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

IN THE MATTER OF THE AMENDED) Cause No. 535
APPLICATION OF WHITING OIL AND GAS)
CORPORATION FOR AN ORDER TO AMEND) Docket No. 170600335
ORDER NO. 535-369 TO INCLUDE THE)
CARLILE, FORT HAYES, AND CODELL) Type: SPACING
FORMATIONS IN AN ESTABLISHED 960-ACRE)
DRILLING AND SPACING UNIT AND)
ESTABLISHING WELL LOCATION RULES)
APPLICABLE TO THE DRILLING AND)
PRODUCING OF WELLS FROM THE CARLILE,)
FORT HAYES, AND CODELL AND NIOBRARA)
FORMATIONS COVERING CERTAIN LANDS IN)
TOWNSHIP 10 NORTH, RANGE 57 WEST, 6TH)
P.M., WELD COUNTY, COLORADO.)

**REQUEST FOR RECOMMENDATION OF
APPROVAL OF APPLICATION WITHOUT A HEARING**

Whiting Oil and Gas Corporation ("Applicant"), Operator No. 96155, by its attorneys, Welborn Sullivan Meck & Tooley, P.C., requests pursuant to Rule 511.a. of the Rules and Regulations of the Colorado Oil and Gas Conservation Commission for the Director to recommend approval of its April 13, 2017, amended May 5, 2017, verified application ("Application") and the supporting exhibits without a hearing.

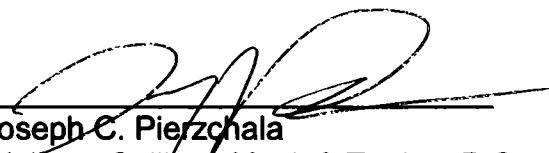
Applicant requests that the above-captioned matter be approved based upon: (i) the merits of the Application, and (ii) Applicant's sworn written testimony verifying sufficient facts along with exhibits that adequately support the relief requested by the Application. To Applicant's information and belief, no protests were timely filed in this matter.

[Remainder of page intentionally left blank]

WHEREFORE, Applicant requests that its request for a recommendation for approval of its Application without a hearing be granted.

DATED this 22nd day of May, 2017

Respectfully submitted,

By: 
Joseph C. Pierzchala
Welborn Sullivan Meck & Tooley, P.C.
Attorneys for Applicant
1125 17th Street, Suite 2200
Denver, CO 80202
(303) 830-2500
jpierzchala@wsmtlaw.com

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

IN THE MATTER OF THE AMENDED)	Cause No. 535
APPLICATION OF WHITING OIL AND GAS)	
CORPORATION FOR AN ORDER TO)	Docket No. 170600335
AMEND ORDER NO. 535-369 TO INCLUDE)	
THE CARLILE, FORT HAYES, AND CODELL)	
FORMATIONS IN AN ESTABLISHED 960-)	
ACRE DRILLING AND SPACING UNIT AND)	
ESTABLISHING WELL LOCATION RULES)	
APPLICABLE TO THE DRILLING AND)	
PRODUCING OF WELLS FROM THE)	
CARLILE, FORT HAYS, AND CODELL AND)	
NIOBRARA FORMATIONS COVERING)	
CERTAIN LANDS IN TOWNSHIP 10 NORTH,)	
RANGE 57 WEST, 6TH P.M., WELD)	
COUNTY, COLORADO.)	

SUMMARY OF RULE 511 WRITTEN TESTIMONY

Whiting Oil and Gas Corporation ("Applicant"), by and through its attorneys, Welborn Sullivan Meck & Tooley, P.C., submits this written testimony and the accompanying Exhibits A, B and C to the Oil and Gas Conservation Commission of the State of Colorado ("Commission") in support of its application for an order amending Order No. 535-369 to include the Carlile, Fort Hays, and Codell Formations an established 960-acre drilling and spacing unit and establishing well location rules applicable to the drilling of wells and producing of oil, gas and associated hydrocarbons from the Carlile, Fort Hays, Codell and Niobrara Formations covering the following lands in Weld County, Colorado ("Application Lands"):

Township 10 North, Range 57 West, 6th P.M.

Section 19: All

Section 30: N½

Based upon work supervised by Mr. Scott McDaniel, Applicant listed in Exhibit A to the Application in this matter the names and addresses of the interested parties and each of those parties was notified as indicated in the Certificate of Mailing filed in this matter. Mr. Scott McDaniel prepared the written land testimony, Exhibit A hereto. Mr. Mark K. Odegard prepared the written geologic testimony, Exhibit B hereto. Mr. Donald F. Koenig prepared the written engineering testimony, Exhibit C hereto. Copies of the affiants' respective resumes are included with their testimony.

Attached to Exhibit A is a map depicting the Application Lands, which also depicts certain lands in the vicinity of the Applications Lands.

As stated in the testimony, several wells have been drilled, tested and completed in the Niobrara and Codell Formations upon lands in the immediate vicinity of the Application Lands, and the Razor #12F-0101A well was completed in the Codell Formation on 960-acre spacing in Sections 1 and 12, Township 10 North, Range 58 West under Order No. 535-507.

The geologic testimony exhibits include: a type log which indicates the Niobrara, Fort Hays, Codell, and Carlile Formations are in contact with each other; a subsea structure map which shows the structural strike is generally Northeast-Southwest across the Application Lands; an isopach of the Niobrara, Fort Hays, Codell, and Carlile Formations in the vicinity of the lands included in this application; and a log cross section of the Niobrara, Fort Hays, Codell, and Carlile Formations showing the continuity of the Formations across the Application Lands.

The engineering exhibits set forth the engineering characteristics of the Niobrara, Fort Hays, Codell, and Carlile reservoirs intended to be drilled and produced by Applicant. Based on reservoir characteristics from certain 960-acre drilling and spacing units that are producing from the Niobrara and Codell Formations, the estimated drilling and completion economics for the Applicant's proposed spacing unit and increased well density would produce favorable economics for the proposed operations. Further, the exhibits support inter-well setbacks of 100 feet based on data from six analogous wells, and, based on four analogous wells, demonstrate that eight wells in a zone will have an estimated drainage area of 60 acres per well, for a total drainage area of less than 960 acres. Finally, the engineering testimony and exhibits describe Whiting's wellbore layout, alternating between producing the "A," "B," "C," benches of the Niobrara Formation, Fort Hays, Codell and Carlile zones. The increased well density is further supported by past testimony provided by Mr. Ralph Nelms in Docket 1309-SP-1149 showing the limited hydraulic fracture pressure communication and calculated short hydraulic fracture half-lengths in the Niobrara Formation.

Based upon this geologic and engineering information, Applicant believes that an order amending Order No. 535-369 to include the Carlile, Fort Hays, and Codell Formations in an established 960-acre drilling and spacing unit will result in economic wells with a favorable return on investment that will allow for efficient drainage and recovery of hydrocarbons from the Niobrara, Fort Hays, Codell, and Carlile Formations without causing waste or injuring correlative rights.

[Remainder of page intentionally left blank]

Dated this 22nd day of May, 2017

Respectfully submitted,

WHITING OIL AND GAS CORPORATION

By:

A handwritten signature in black ink, appearing to read 'JP', is written over a horizontal line.

Joseph C. Pierzchala
Welborn Sullivan Meck & Tooley, P.C.
Attorneys for Applicant
1125 17th Street, Suite 2200
Denver, CO 80202
(303) 830-2500
jpierzchala@wsmtlaw.com

<p align="center">Exhibit A</p> <p align="center">WHITING OIL AND GAS CORPORATION</p> <p align="center">Scott McDaniel</p>	<p align="center">Docket No. 170600335</p> <p align="center">Land Testimony – Rule 511</p> <p align="center">Weld County, Colorado</p>
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Township 10 North, Range 57 West, 6th P.M.

Section 19: All

Section 30: N½

Weld County, Colorado

In support of the Request for Director Approval of the Verified Amended Application of Whiting Oil and Gas Corporation in Cause 535, Docket No. 170600335, and pursuant to Rule 511.b., Scott McDaniel, Regional Land Manager of Whiting Oil and Gas Corporation deposes and states as follows:

I am employed as a Regional Land Manager for Whiting Oil and Gas Corporation ("Whiting"). I have over 28 years of experience as a Landman and have been employed with Whiting since August of 2008 working directly with properties that are the subject of today's hearing.

In support of our Application today, I have prepared one (1) exhibit. The exhibit is attached to my sworn testimony and forms the basis for Whiting's Application to obtain an order to:

- 1) Amend Order No. 535-369 to include the Carlile, Fort Hays and Codell Formations and modify the well location rules applicable to the drilling of wells and producing of oil, gas and associated hydrocarbons from the Niobrara, Carlile, Fort Hays and Codell Formations in an existing 960-acre drilling and spacing unit previously established for the Niobrara Formation covering all of Section 19 and the N½ of Section 30, Township 10 North, Range 57 West, 6th P.M., Weld County, Colorado (the "Application Lands"); and
- 2) Approve up to a total of 32 horizontal wells within the 960-acre drilling and spacing unit comprised of the Application Lands, for the production of oil, gas and associated hydrocarbons from the Niobrara, Carlile, Fort Hays and Codell Formations; and
- 3) Require the productive interval of the wellbore of any permitted wells to be located no closer than 100 feet from the unit boundaries, and no closer than 100 feet from the productive interval of each wellbore be no closer than 100 feet from the treated interval of any other wellbore producing from the Niobrara, Carlile, Fort Hays and Codell Formations, and no closer than 100 feet from a unit boundary unless such boundary abuts or corners lands for which the Commission has not at the time of the drilling permit

application granted the right to locate the treated interval of the wellbore no closer than 100 feet from a unit boundary. If the Commission has not at the time of the drilling permit application granted to the owners of the adjacent or cornering lands the right to locate the treated interval of the wellbore no closer than 100 feet from a unit boundary, then the treated interval of the wellbore shall be located no closer than 300 feet from the unit boundary, without exception being granted by the Director.

Attached Exhibit "A-1" Whiting Leasehold, Existing Spacing Unit Boundaries, Proposed Spacing Unit Boundaries

The attached Exhibit "A-1" is a plat depicting the Application Lands and lands in the vicinity of the Application Lands which have previously had drilling and spacing orders approved by the COGCC for the Niobrara Formation under Order No. 535-179 issued July 9, 2012, Order No. 535-296 issued March 25, 2013, Order No. 535-314 issued May 6, 2013, and Order No. 535-369 issued July 29, 2013. The plat covers an area generally centered 14 miles North and 2 miles East of the town of New Raymer, Colorado. The plat is color coded to show the previously approved COGCC drilling and spacing units, proposed COGCC drilling and spacing units and Whiting leasehold. The lands which are the subject of this application are shown inside the red boundary and are crosshatched in red. Whiting's leasehold is shown in yellow.

Several wells have been drilled, tested and completed in the Niobrara and Codell Formations upon lands in the immediate vicinity of the Application Lands, and the Razor #12F-0101A well was completed in the Codell Formation on 960-acre spacing in Sections 1 and 12, Township 10 North, Range 58 West under Order No. 535-507. Therefore, Whiting believes amending Order 535-369 to include the Carlile, Fort Hays and Codell Formations and modify the well location rules applicable to the drilling of wells and producing of oil, gas and associated hydrocarbons from the Niobrara, Carlile, Fort Hays and Codell Formations will allow development of the Niobrara, Carlile, Fort Hays and Codell Formations to occur, will not promote waste, will not violate correlative rights and will assure the greatest ultimate recovery of oil, gas and associated hydrocarbon substances from the reservoir.

Based upon our examination of relevant records, and under my direction and control, all of the unleased mineral interest owners and mineral lessees within the Application Lands and lands which are contiguous or corner to the Application Lands have received notice of this Application.

To the best of my knowledge and belief, all of the matters set forth herein, my testimony and in the exhibits are true, correct and accurate.

Dated this 19th day of May, 2017



Scott McDaniel
Regional Land Manager

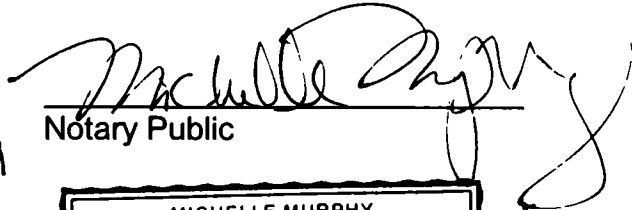
STATE OF COLORADO)
) ss
CITY AND COUNTY OF DENVER)

I, the undersigned Notary Public in and for said County in said State, hereby certify that Scott McDaniel, whose name as Regional Land Manager of Whiting Oil and Gas Corporation, is signed to the foregoing instrument and who is known to me, acknowledged before me on this day that, being informed of the contents of the instrument, executed the same voluntarily for and as the act of said corporation.

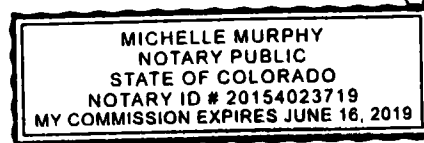
Subscribed and sworn to before me this 19th day of May, 2017.

Witness my hand and official seal

My commission expires 6/16/2019



Notary Public



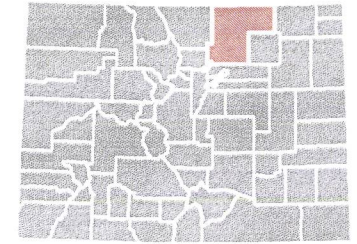
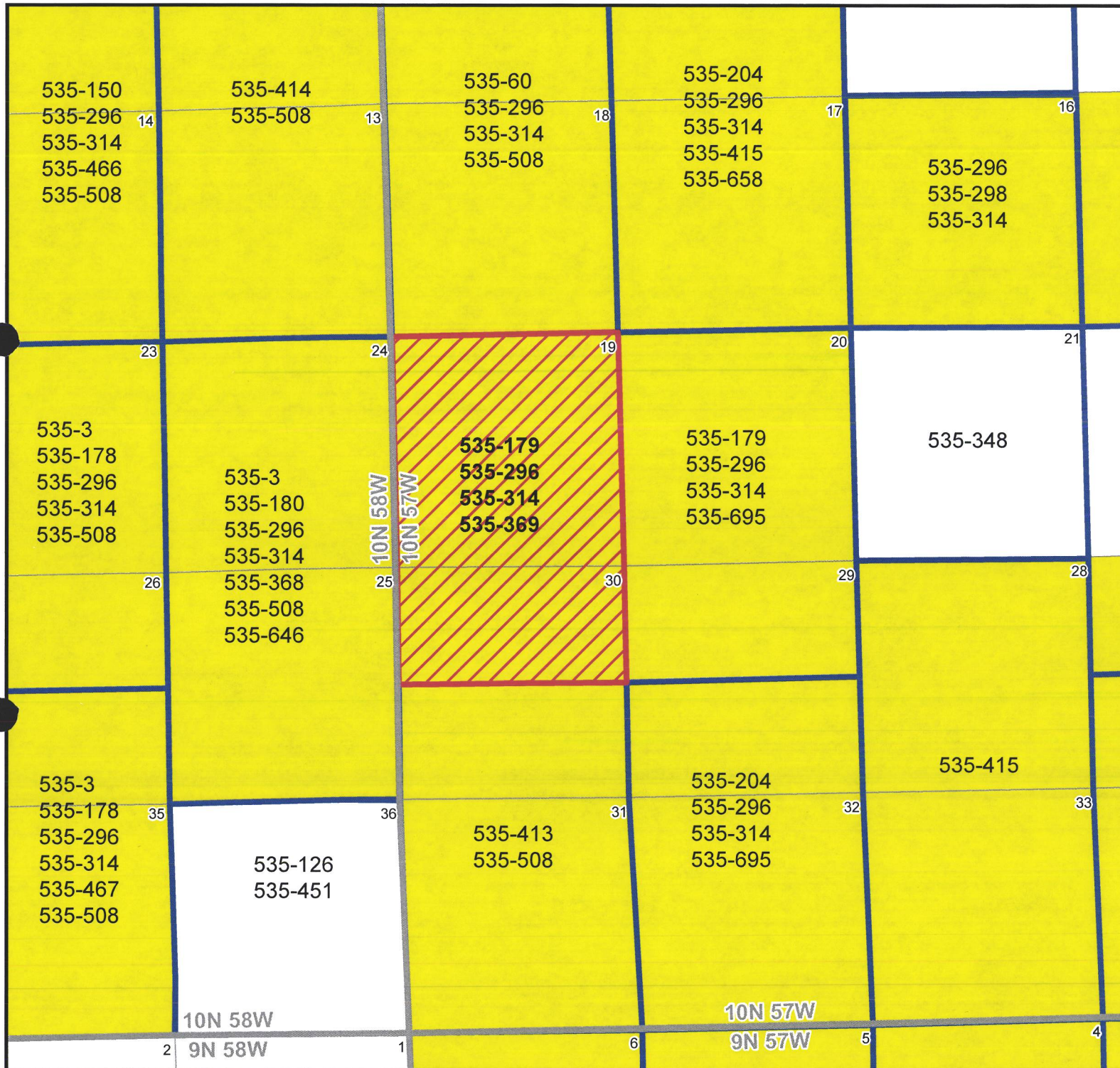


Exhibit "A-1"
Weld County, Colorado

- Application Lands
- Existing Spacing Units

EXPERIENCE

Regional Land Manager

August 11, 2008 to Present

Whiting Oil and Gas Corporation

Confirm land ownership and availability for lease/purchase. Negotiate agreements with land owners for drilling or production rights. Draft and administer contracts including, but not limited to, Joint Operating Agreements, Purchase and Sale Agreements, and Unit Agreements; ensure compliance with government regulations. Lead and direct the work of support staff.

Project Manager

2002 to August 1, 2008

Context Energy Company, Denver, CO

Managed numerous lease acquisition projects for a large lease brokerage firm. I was responsible for managing field personnel, reporting progress to the client, building lease and mineral purchase files, preparing assignments and other legal documents, due diligence reviews and title curative.

Oil and Gas Landman

1999 to 2001

The Meramar Company, Littleton, CO

Managed small lease and right-of-way acquisition projects throughout the Rocky Mountain Region. My responsibilities included title research, lease and right-of-way acquisition, map preparation, lease file management and due diligence reviews.

Land Manager

1997 to 1998

Petrogulf Corporation, Denver, CO

Managed land and lease acquisitions for a very aggressive oil and gas operator in the Rocky Mountain Region. My job description included managing field brokers, coordinating the acquisition of mineral interests and oil and gas leases within a prospect area, working with engineers and geologist on a prospect development basis, and managing lease records.

Oil and Gas Landman

1996 to 1997

Tom Noonan, Gillette, WY

Contract Landman for a Lease Broker in the Powder River Basin. I performed detailed ownership searches and reports in a highly productive coalbed methane play, calculated net revenue interests and purchased oil and gas leases.

Oil and Gas Landman and Project Manager

1994 to 1996

The Meramar Company, Denver, CO

Performed oil and gas lease acquisitions for a small Lease Broker in the Rocky Mountain Region. Managed several small lease acquisition projects in central Kansas and Northwestern Colorado. I performed patent to present grantee/grantor ownership checks and prepared lease status reports for the clients.

Commercial Title Examiner

1991 to 1994

Title Services, Inc., Denver, CO

Prepared title reviews and commitments on commercial property for a large title insurance company. Managed the commercial title department for two years and trained support staff.

Oil and Gas Landman

1983 to 1991

Frontier Land and Exploration, Lakewood, CO

Worked for a large lease brokerage firm managed and owned by my father, John T. McDaniel. Performed ownership and leasehold checks in Southeastern and Southwestern Colorado. Negotiated and purchased oil and gas leases.

EDUCATION

Red Rocks Community College, 1982 to 1983

Golden, CO

Computer Science/Geology GPA: 3.3

Worked towards an Associate of Science Degree in Computer Science with some advanced studies in Geology.

Learned programming in COBOL, FORTRAN, BASIC and RPGII languages. Ran out of money and had to enter the work force before completing my degree

Arapahoe Community College and University of Colorado at Denver, 1981 to 1982

Littleton, CO and Denver, CO

Business GPA: 3.0

Worked on my basic studies with a focus on accounting and geology. Decided to transfer to Red Rocks Community College to focus more on Computer Science.

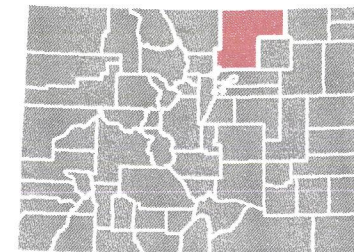


Exhibit "A-1"
Weld County, Colorado

- Application Lands
- Existing Spacing Units

<p align="center">Exhibit B</p> <p align="center">WHITING OIL AND GAS CORPORATION</p> <p align="center">Samuel Z. Scott</p>	<p align="center">Docket No. 170600335</p> <p align="center">Geologic Testimony – Cause 535</p> <p align="center">Weld County, Colorado</p>
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My name is Samuel Z. Scott. I am currently employed as a Senior Geologist with Whiting Oil and Gas Corporation. I have over 10 years' experience in petroleum exploration and I am familiar with the geologic characteristics on the Applications Lands, and the matters set forth in the Docket 170600335 application. A copy of my resume is contained in the exhibit booklet submitted by Whiting.

In support of Whiting's Application in the above referenced docket, I have prepared and am submitting four (4) exhibits. The exhibits are attached to my sworn testimony and form the basis for Whiting's application requesting to:

1. Amend Order No. 535-369 to include the Carlile, Fort Hays, and Codell Formations in the existing drilling and spacing unit in order to efficiently and economically recover oil, gas and associated hydrocarbons from the Carlile, Fort Hays, Codell and Niobrara Formations in the proposed unit.

2. Applicant further requests that the treated interval of each wellbore be no closer than 100 feet from the treated interval of any other wellbore producing from the Carlile, Fort Hays, Codell and/or Niobrara Formations, and no closer than 100 feet from a unit boundary unless such boundary abuts or corners lands for which the Commission has not at the time of the drilling permit application granted the right to locate the treated interval of the wellbore no closer than 100 feet from a unit boundary. If the Commission has not at the time of the drilling permit application granted to the owners of the adjacent or cornering lands the right to locate the treated interval of the wellbore no closer than 100 feet from a unit boundary, then the treated interval of the wellbore shall be located no closer than 300 feet from the unit boundary, without exception being granted by the Director.

3. Applicant requests authority to drill only those wells necessary to determine the well density which allows the most efficient drainage of the Carlile, Fort Hays, Niobrara and Codell Formations, prevents waste, does not adversely affect correlative rights, and assures the greatest ultimate recovery of oil, gas and associated hydrocarbon substances from the Carlile, Fort Hays, Niobrara and Codell Formations. The proposed drilling and spacing unit is not smaller than the maximum area that can be economically and efficiently drained by the authorized wells in such drilling and spacing unit. Applicant further maintains that wells drilled in the above-proposed drilling and spacing units will have no adverse effect on correlative rights of adjacent owners.

Exhibit B-1: TYPE LOG The Niobrara Formation is a late Turonian (89 Ma) to early Campanian (82 Ma) age formation that was deposited during a marine transgression of the Western Interior Cretaceous seaway. It is comprised of three distinct members, the Fort Hays, which is often referred to as the "D" or Lower Chalk, the Smoky Hill, which is comprised of the Niobrara "B" and "C" Chalks and the Beecher Island, which is more commonly known as the "A" Chalk. These members consist of chalk interbedded with silty marlstone laminations. The Niobrara overlies the Codell Formation, which is a fine-grained marine sandstone deposited during a relative low-stand in the Cretaceous seaway. Below the Codell formation the Carlile which consists of a similar lithology to the Codell but with a lower amount of net sand relative to silt and detrital clay. The Carlile formation appears to be hydraulically coupled with the Codell and therefore may contribute minor production to wells completed in the Codell.


Exhibit B-2: SUBSEA STRUCTURE MAP- The asymmetric shape of the Denver Basin is evident in the true vertical structure map on top of the Niobrara. The structural strike is locally oriented NE-SW across the application lands, with an average elevation at the top of the Niobrara of -740 feet below sea level.

Exhibit B-3: GROSS ISOPACH MAP This exhibit represents the gross isopach thickness from the top of the Niobrara formation through the base of the Codell. Across the application lands, the average thickness is 340 feet.

Exhibit B-4: CROSS SECTION- This cross section represents the vertical distribution of chalk benches within the Niobrara, commonly referred to as the A, B & C chinks as well as the Fort Hays member of the Niobrara and the Codell/Carlile. The datum for the cross section is the top of the Niobrara. The Niobrara and Codell/Carlile formations are ubiquitous across the application lands and share a common source of supply. The log curves represented on the cross section include spontaneous potential (SP), gamma ray (GR) and deep resistivity (ILD).

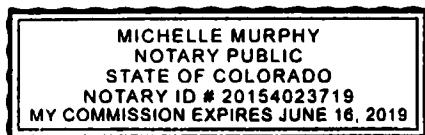
Based upon geologic information available the proposed drilling and spacing units will allow efficient drainage of the Niobrara and Codell/Carlile Formations, will prevent waste, will not adversely affect correlative rights and will assure the greatest ultimate recovery of gas and associated hydrocarbons.

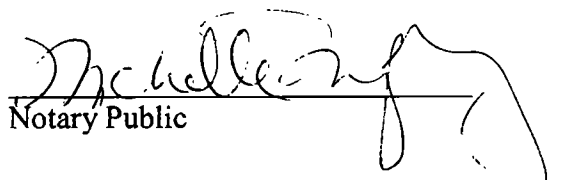
Geology Exhibits B-1, B-2, B-3, and B-4 were prepared by me and to the best of my knowledge; all of the matters set forth are true, correct, and accurate.


Samuel Z. Scott
Senior Geologist

BEFORE ME, the undersigned, on this day personally appeared Mr. Samuel Z. Scott in his capacity as a Senior Geologist for Whiting Petroleum Corporation and its wholly owned subsidiary Whiting Oil and Gas Corporation.

GIVEN UNDER MY HAND AND SEAL OF OFFICE this 16th day of May 2017.




Notary Public
My Commission Expires 6/18/2019

Sam.Scott@whiting.com

(817) 304-4516
2629 W 35th Ave ,Denver, CO 80211

WORK EXPERIENCE

Senior Geologist 03/2017-Present
Whiting Petroleum Corp.-Central Rockies Team Denver, CO

- *Lead geologist for development of Whiting's Redtail Assets.
- *Generator of new exploration opportunities in the greater DJ Basin

Senior Geologist 01/2014-03/2017
Whiting Petroleum Corp.-Northern Rockies Team Denver, CO

- *Lead geologist for Whiting's Sanish Bakken/Three Forks Asset.
- *Developed Section-Based Mapping method for evaluation of irregular geometries associated with horizontal wells.
- *Delineated Exploration Prospects in the Madison Misson Canyon Fm.

Senior Geologist 2/2012-01/2014
Whiting Petroleum Corp.-Gulf Coast Team Denver, CO

- *Lead geologist working on emerging exploration play in the Brown Dense of Northern Louisiana. Worked closely with team members on all aspects of well selection, data gathering, analysis, permitting, and execution.
- *Responsible for steering exploration horizontal well in zone using real time data.
- *Presented to outside companies once a decision was made to exit the play and sell.

Senior Geologist 12/2011-02/2012
Occidental Petroleum, Inc.-CA Growth Team Bakersfield, CA

- * Lead geologist on specialized team focused on unlocking the Monterey Shale oil resource play. Worked closely with completions engineers, reservoir engineers, and petrophysicists to develop completion strategy for nanodarcy permeability rock.
- *Construct basin scale Petrel models for mapping of TOC, maturity, and overpressure.
- *Plan, supervise, and execute drilling of deep wells targeting generating shales.
- *Develop workflows to better constrain mechanical stratigraphy and stress state.

Senior Geologist 07/2010-12/2011
Occidental of Elk Hills-Shale Asset Team Bakersfield, CA

- *Lead Geologist for OXY's 29R Structure. AFE'd and supervised drilling of 25 new shale wells. Designed and supervised drilling and stimulation of 1st horizontal shale completion in OXY's Kern County discovery area.
- *Updated STOOIP Petrel models for 29R and 14Z areas. Mentored junior geologists.
- *Part of multidisciplinary team supervising outsourced dual perm simulation.

Senior Geologist 01/2010-07/2010
Occidental of Elk Hills-Gunslinger RMT Bakersfield, CA

*Built Petrel model for OXY's Kern County discovery. Worked closely with reservoir simulators for STOOIP estimation and forecasting.
*Generate AFEs and new drilling locations.

Staff Geologist 04/2007-12/2009
Occidental Permian- South RMT Houston, TX

*Construct STOOIP Petrel Models for OXY Permian in San Andres, Grayburg and Wolfcamp assets (CRCU, Rhodes Cowden, NCU, South Cowden).
* Mentor junior geologists.
*Initiate and supervised core description and building of sequence stratigraphic framework for OXY's North Cowden Grayburg field.

Geoscience Intern 05/2006-08/2006
OXY Permian-Integrated Reservoir Management Houston, TX

*Constructed full-field porosity model for the Fullerton San Andres Unit using PETREL. Calculated permeability from transforms, oil saturations, and STOOIP.

Research Assistant 01/2005-04/2006
Bureau of Economic Geology-RCRL Austin, TX

*Measured section and mapped throughout study area in Last Chance Canyon, NM.
*Acquired ground based LIDAR, transferred field mapping, and modeled clinoforms.

TA (teaching assistant) 08/2004-12/2004
University of Texas at Austin Austin, TX

*Instructed introductory level paleontology labs. Grade exams and coursework.

Geotech 02/2004-06/2004
Approach Resources, Inc. Fort Worth, TX

*Imported digital logs, reservoir pressure tests and calibrated and straightened raster logs. Performed basic log quality control in the field, and prepared cross sections.

Open-Hole Wireline Logging Engineer 06/2001-02/2003
Halliburton Energy Services Bakersfield, CA

*Gained operational and theoretical knowledge of wireline tools. Performed log quality control for a major client.

EDUCATION

The University of Texas Jackson School of Geosciences
M.S. Geological Sciences
Advisor: Dr. Charles Kerans

Austin, TX
2004-2007
G.P.A.-3.78

The Colorado College
B.A Geology
Advisor: Dr. Paul Myrow

Colorado Springs, CO
1997-2001
G.P.A.-3.14

Halliburton Fort Worth Learning Center
Basic L & P Field Engineer I

Fort Worth, TX
08/2001-11/2001

THESIS TOPIC - Along-Strike Variability of Clinothems in a Mixed Carbonate Siliciclastic Ramp Setting: Last Chance Canyon, NM

SKILLS AND PROFICIENCIES

- *Software: Petra, Geographix, Powerlog, Interactive Petrophysics, Openworks, Petrel, GOCAD, basic UNIX proficiency, Lowis, DSS, OFM and Microsoft Office suite.
- *Specialized: Petrel expert, Carbonate Petrographic Techniques, Outcrop field work
- *Operations: Wireline log interpretation and environmental tool response.
- *Language: Conversational Spanish language skill.
- *Interpersonal/Communication: Effective speaker and writer.

PROFESSIONAL AFFILIATIONS

- *AAPG, SEPM, GSA, RMAG

PUBLICATIONS AND PRESENTATIONS

- *RMAG Hot Plays Forum 2015- 20 minute oral presentation
- *RMAG Hot Plays Core Workshop – ½ day workshop
- *OXY CA Shale Forum 2012—30 minute oral presentation
- *WTGS annual meeting 2009—30 minute oral presentation
- *OXY West Texas Carbonate Field Trip 2007, 2008, and 2009-Co-Leader
- *RCRL annual meeting 2007—30 minute oral
- *RCRL annual meeting 2005—30 minute oral
- *RCRL field trip 2005—Led day of field trip in thesis area
- *AAPG annual meeting 2005—Morning Poster Session
- *Occidental Intern Presentation 2006—3 presentations to diverse audiences
- *WTGS annual meeting 2006—30 minute oral presentation

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 WHITING OIL & GAS CORP.
TERRACE 36-32M
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KB : 4,905
 TD : 6,928

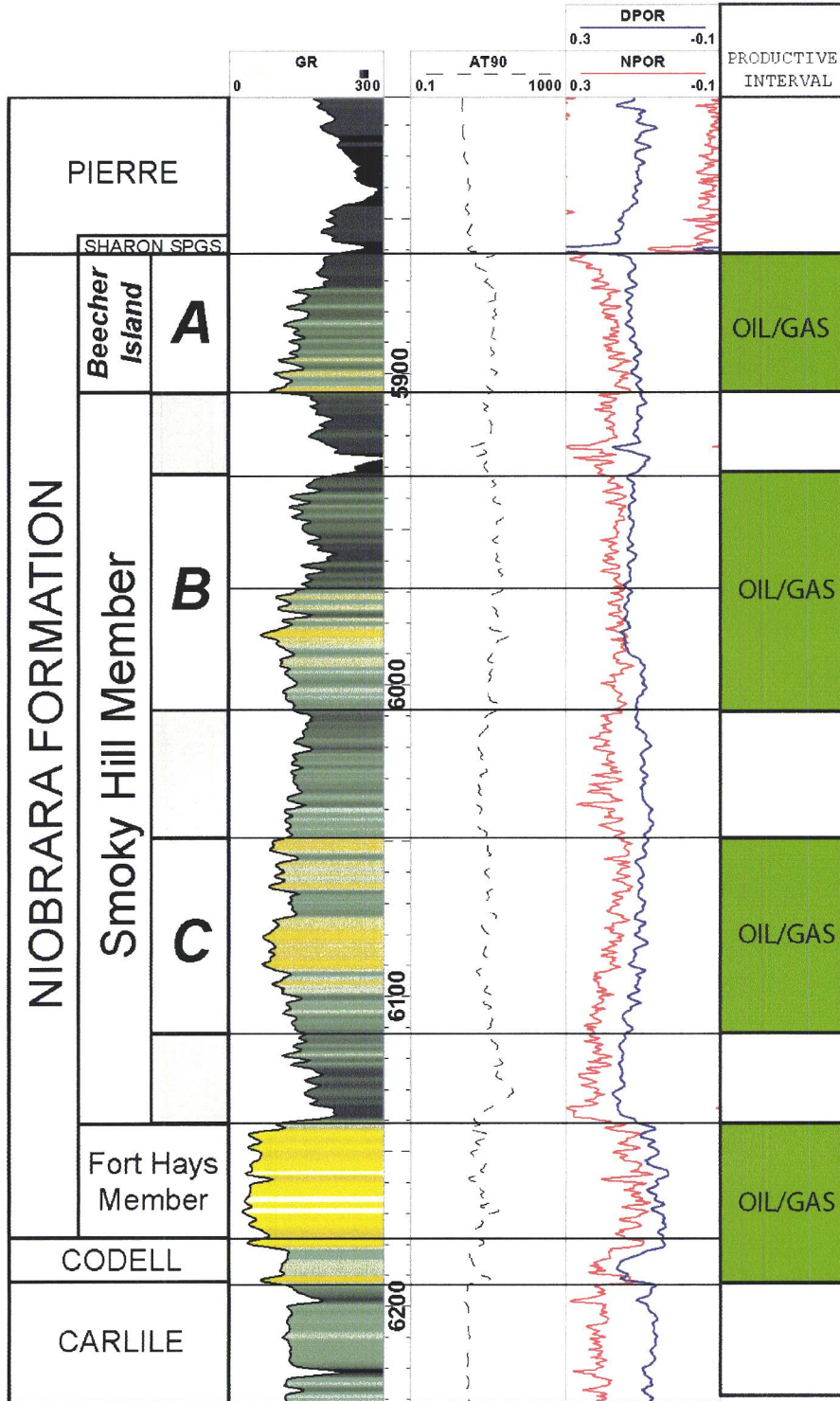
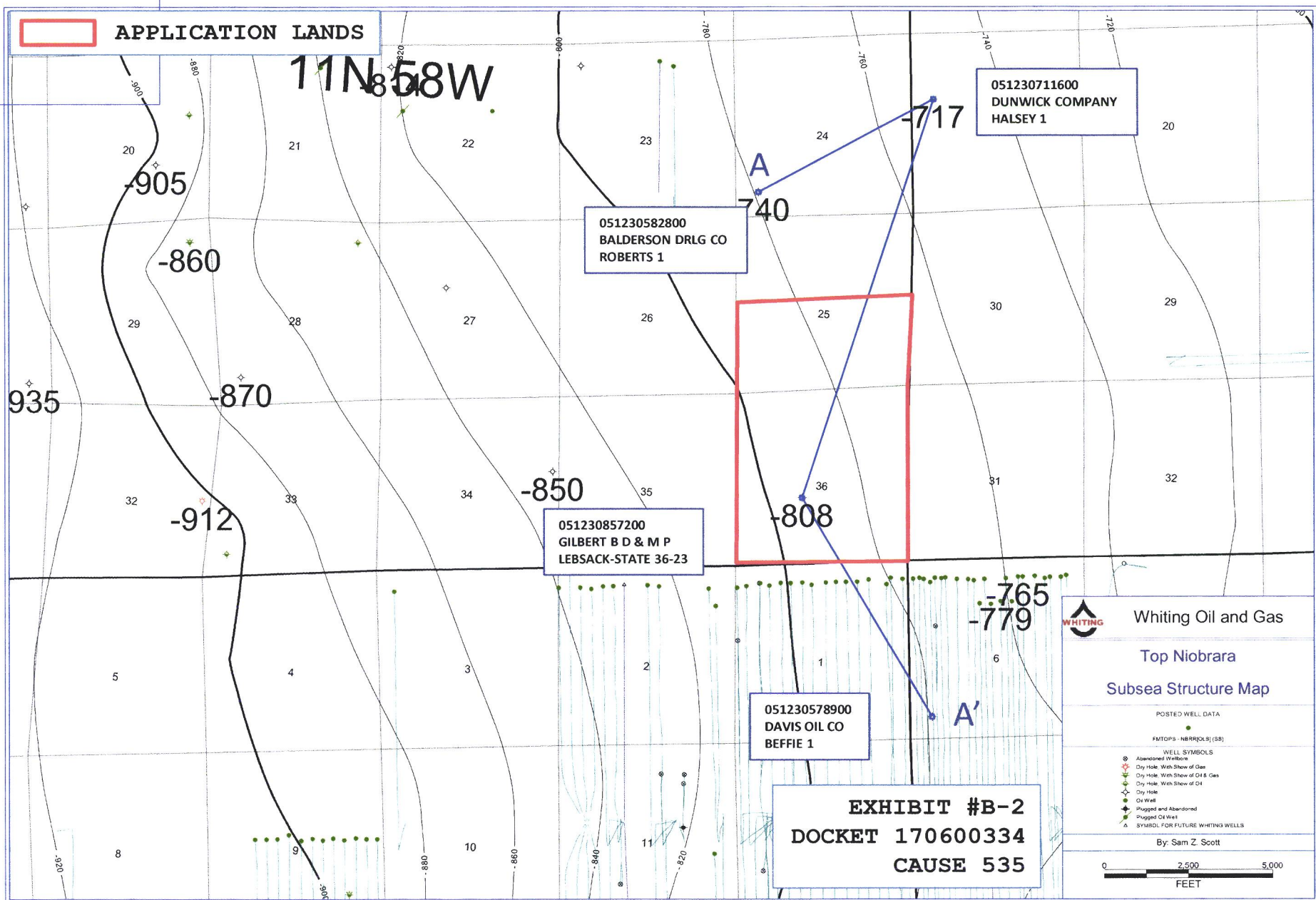
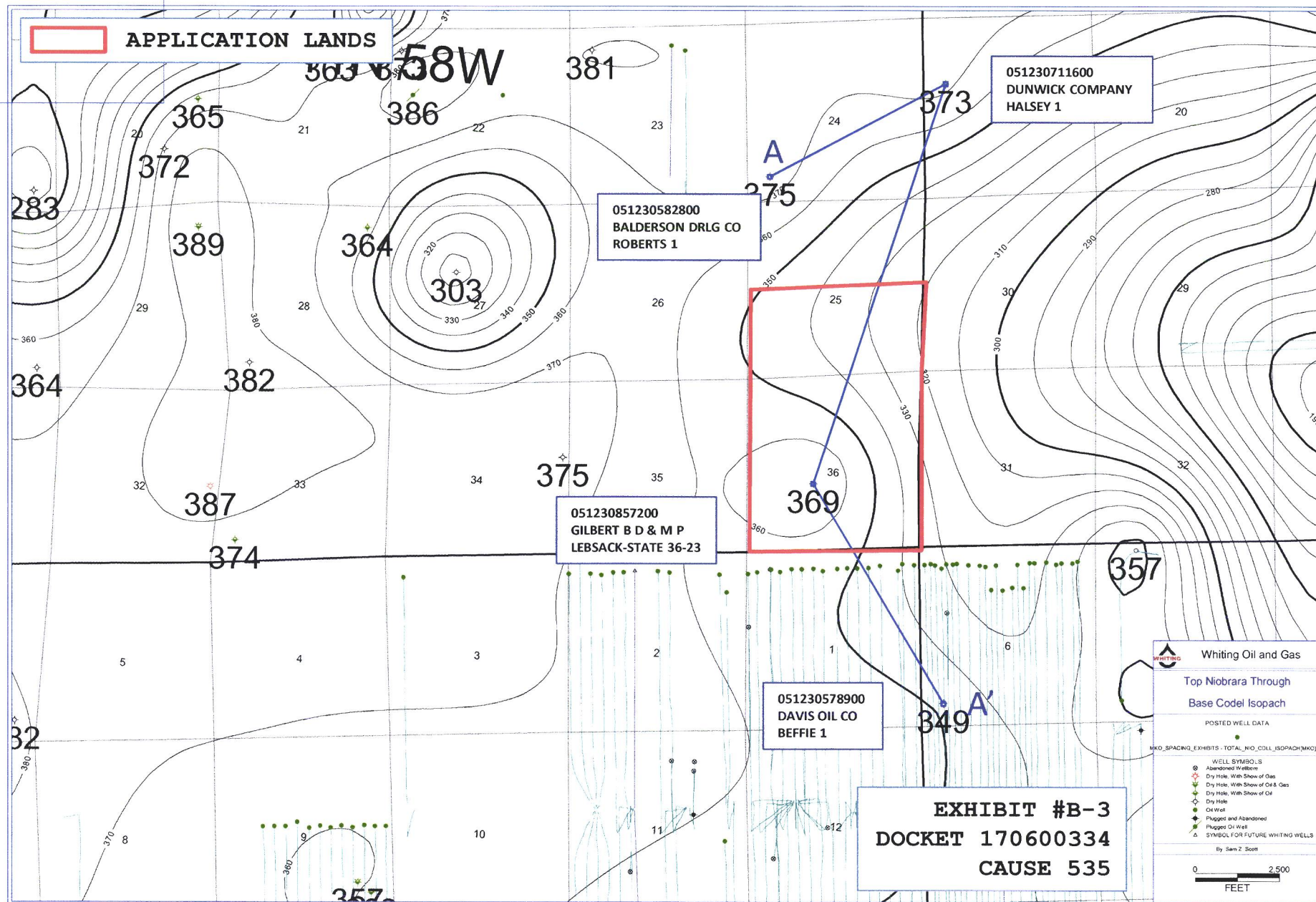


EXHIBIT #B-1
 DOCKET 170600334
 CAUSE 535





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BALDERSON DRLG CO
ROBERTS 1
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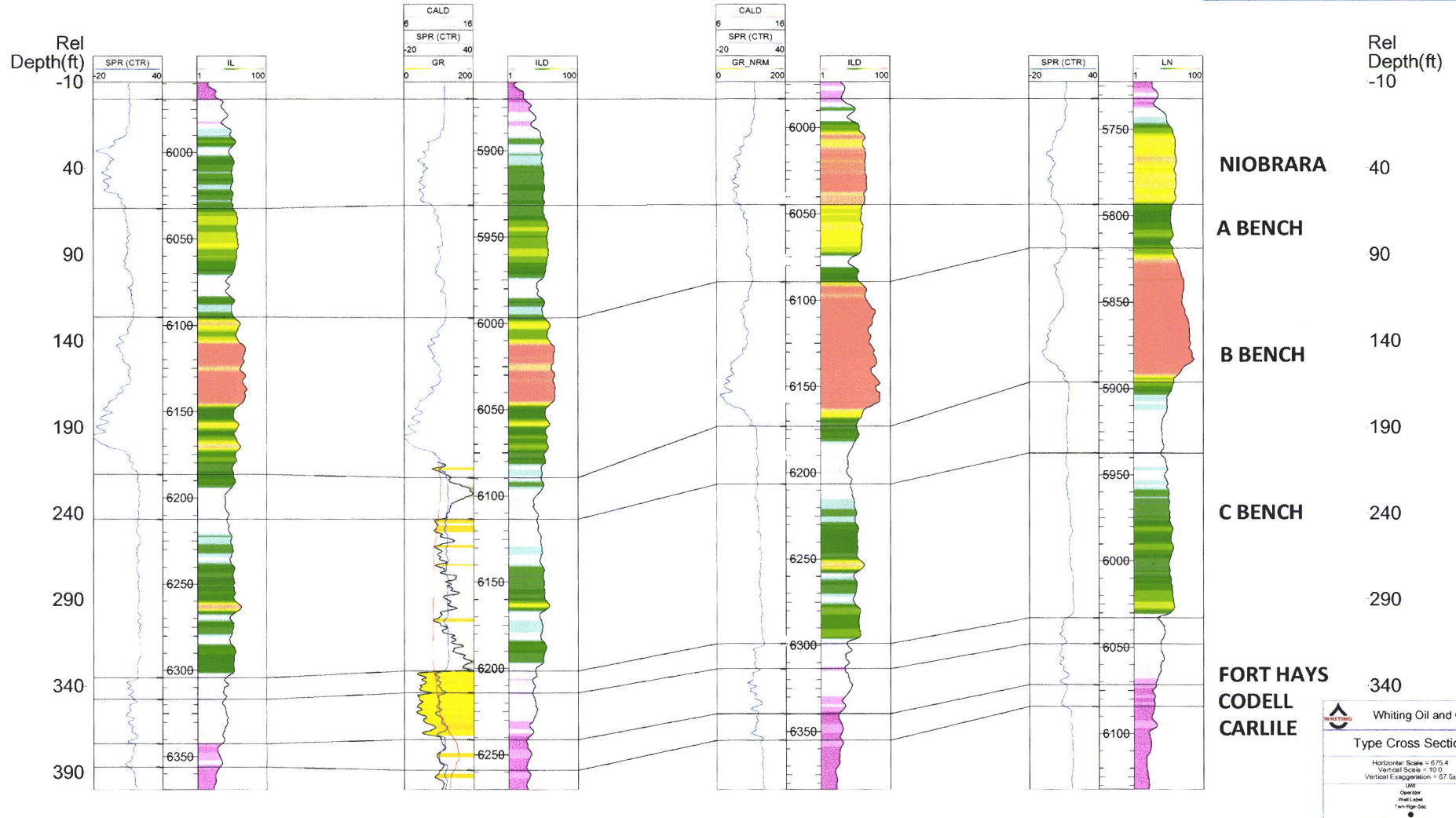
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DUNWICK COMPANY
HALSEY 1
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051230857200
GILBERT B D & M P
LEBSACK-STATE 36-23
T11N R58W S36

051230578900
DAVIS OIL CO
BEFFIE 1
T10N R57W S6

A'

EXHIBIT #B-4
DOCKET 170600334
CAUSE 535



Sam.Scott@whiting.com

(817) 304-4516

2629 W 35th Ave ,Denver, CO 80211

WORK EXPERIENCE

- Senior Geologist** **03/2017-Present**
Whiting Petroleum Corp.-Central Rockies Team **Denver, CO**
*Lead geologist for development of Whiting's Redtail Assets.
*Generator of new exploration opportunities in the greater DJ Basin
- Senior Geologist** **01/2014-03/2017**
Whiting Petroleum Corp.-Northern Rockies Team **Denver, CO**
*Lead geologist for Whiting's Sanish Bakken/Three Forks Asset.
*Developed Section-Based Mapping method for evaluation of irregular geometries associated with horizontal wells.
*Delineated Exploration Prospects in the Madison Misson Canyon Fm.
- Senior Geologist** **2/2012-01/2014**
Whiting Petroleum Corp.-Gulf Coast Team **Denver, CO**
*Lead geologist working on emerging exploration play in the Brown Dense of Northern Louisiana. Worked closely with team members on all aspects of well selection, data gathering, analysis, permitting, and execution.
*Responsible for steering exploration horizontal well in zone using real time data.
*Presented to outside companies once a decision was made to exit the play and sell.
- Senior Geologist** **12/2011-02/2012**
Occidental Petroleum, Inc.-CA Growth Team **Bakersfield, CA**
* Lead geologist on specialized team focused on unlocking the Monterey Shale oil resource play. Worked closely with completions engineers, reservoir engineers, and petrophysicists to develop completion strategy for nanodarcy permeability rock.
*Construct basin scale Petrel models for mapping of TOC, maturity, and overpressure.
*Plan, supervise, and execute drilling of deep wells targeting generating shales.
*Develop workflows to better constrain mechanical stratigraphy and stress state.
- Senior Geologist** **07/2010-12/2011**
Occidental of Elk Hills-Shale Asset Team **Bakersfield, CA**
*Lead Geologist for OXY's 29R Structure. AFE'd and supervised drilling of 25 new shale wells. Designed and supervised drilling and stimulation of 1st horizontal shale completion in OXY's Kern County discovery area.
*Updated STOOIP Petrel models for 29R and 14Z areas. Mentored junior geologists.
*Part of multidisciplinary team supervising outsourced dual perm simulation.
- Senior Geologist** **01/2010-07/2010**
Occidental of Elk Hills-Gunslinger RMT **Bakersfield, CA**

- *Built Petrel model for OXY's Kern County discovery. Worked closely with reservoir simulators for STOOIP estimation and forecasting.
- *Generate AFEs and new drilling locations.

Staff Geologist **04/2007-12/2009**
Occidental Permian- South RMT **Houston, TX**

- *Construct STOOIP Petrel Models for OXY Permian in San Andres, Grayburg and Wolfcamp assets (CRCU, Rhodes Cowden, NCU, South Cowden).
- * Mentor junior geologists.
- *Initiate and supervised core description and building of sequence stratigraphic framework for OXY's North Cowden Grayburg field.

Geoscience Intern **05/2006-08/2006**
OXY Permian-Integrated Reservoir Management **Houston, TX**
 *Constructed full-field porosity model for the Fullerton San Andres Unit using PETREL. Calculated permeability from transforms, oil saturations, and STOOIP.

Research Assistant **01/2005-04/2006**
Bureau of Economic Geology-RCRL **Austin, TX**
 *Measured section and mapped throughout study area in Last Chance Canyon, NM.
 *Acquired ground based LIDAR, transferred field mapping, and modeled clinoforms.

TA (teaching assistant) **08/2004-12/2004**
University of Texas at Austin **Austin, TX**
 *Instructed introductory level paleontology labs. Grade exams and coursework.

Geotech **02/2004-06/2004**
Approach Resources, Inc. **Fort Worth, TX**
 *Imported digital logs, reservoir pressure tests and calibrated and straightened raster logs. Performed basic log quality control in the field, and prepared cross sections.

Open-Hole Wireline Logging Engineer **06/2001-02/2003**
Halliburton Energy Services **Bakersfield, CA**
 *Gained operational and theoretical knowledge of wireline tools. Performed log quality control for a major client.

EDUCATION

The University of Texas Jackson School of Geosciences
M.S. Geological Sciences
Advisor: Dr. Charles Kerans

Austin, TX
2004-2007
G.P.A.-3.78

The Colorado College
B.A Geology
Advisor: Dr. Paul Myrow

Colorado Springs, CO
1997-2001
G.P.A.-3.14

Halliburton Fort Worth Learning Center
Basic L & P Field Engineer I

Fort Worth, TX
08/2001-11/2001

THESIS TOPIC - Along-Strike Variability of Clinothems in a Mixed Carbonate Siliciclastic Ramp Setting: Last Chance Canyon, NM

SKILLS AND PROFICIENCIES

- *Software: Petra, Geographix, Powerlog, Interactive Petrophysics, Openworks, Petrel, GOCAD, basic UNIX proficiency, Lowis, DSS, OFM and Microsoft Office suite.
- *Specialized: Petrel expert, Carbonate Petrographic Techniques, Outcrop field work
- *Operations: Wireline log interpretation and environmental tool response.
- *Language: Conversational Spanish language skill.
- *Interpersonal/Communication: Effective speaker and writer.

PROFESSIONAL AFFILIATIONS

- *AAPG, SEPM, GSA, RMAG

PUBLICATIONS AND PRESENTATIONS

- *RMAG Hot Plays Forum 2015- 20 minute oral presentation
- *RMAG Hot Plays Core Workshop – ½ day workshop
- *OXY CA Shale Forum 2012—30 minute oral presentation
- *WTGS annual meeting 2009—30 minute oral presentation
- *OXY West Texas Carbonate Field Trip 2007, 2008, and 2009-Co-Leader
- *RCRL annual meeting 2007—30 minute oral
- *RCRL annual meeting 2005—30 minute oral
- *RCRL field trip 2005—Led day of field trip in thesis area
- *AAPG annual meeting 2005—Morning Poster Session
- *Occidental Intern Presentation 2006—3 presentations to diverse audiences
- *WTGS annual meeting 2006—30 minute oral presentation

<p align="center">Exhibit C</p> <p align="center">WHITING OIL AND GAS CORPORATION</p> <p align="center">Donald F. Koenig</p>	<p align="center">Docket No. 170600335</p> <p align="center">Engineering Testimony – Rule 511</p> <p align="center">Weld County, Colorado</p>
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ENGINEERING TESTIMONY

Township 10 North, Range 57 West, 6th P.M.

Section 19: All

Section 30: N½

My name is Donald F. Koenig. I am currently employed as a Reservoir Engineering Manager with Whiting Oil and Gas Corporation ("Whiting"). I have over 19 years of experience in reservoir engineering and am familiar with the reservoir engineering characteristics on the lands addressed in this testimony, and the matters set forth in Docket 170600335. A copy of my resume is attached to this testimony.

In support of Whiting's application (the "Application") in the above referenced docket, I have prepared and am submitting E-1 through E-8. The exhibits are attached to my sworn testimony and form the basis for Whiting's Application to gain approval to drill and complete on increased well density up to 32 wells in the requested 960-acre drilling and spacing unit for the Niobrara and Codell Formations covering the following lands ("Application Lands"):

Township 10 North, Range 57 West, 6th P.M.

Section 19: All

Section 30: N½

Exhibit E-1a presents the Niobrara/Codell/Fort Hayes formation reservoir characteristics and a volumetric calculation showing the estimated oil recovery from increased density wells drilled on 960-acre spacing on the Application Lands. I have broken out the Niobrara "A", "B", "C" and Fort Hays/Codell zone characteristics. There is an estimated 74 MMBO in this 960 acre spacing unit, of which Whiting hopes to recover up to 12% of the oil in place.

Exhibit E-2a presents the calculated drainage areas and estimates the drainage width for FOUR analogous Niobrara wells located in Township 10 North- Range 57 West. The average drainage for these four wells of various lateral lengths is 60 acres with a corresponding drainage width of 264 ft. The wells produce from the Niobrara "B" and Niobrara "C". Production is similar from Codell/Fort Hayes and Niobrara "A" wells located just to the West of these wells.

Exhibit E-2b demonstrates the economics for the same four analogous Niobrara wells. With a Rate of Return ("ROR") around 13%, Return on Investment ("ROI") of 1.52

and average payout of 5.61 years, the area has been economic. The economics were run at a 50 \$/BBL oil price.

Exhibit E-3 analyzes the economics for an average well in a 960-acre spacing unit with up to 32 wells. Again the economics are good for a 50 \$/BBL price with a ROR of 35% and ROI of 1.97. The Estimated Ultimate Recovery ("EUR") for this case was derived from the EUR calculated on Exhibit E-1 using an average 12% recovery factor on the four zones in the Niobrara and Fort Hays/Codell.

Exhibits E-4 contains the decline curves for four analogous Niobrara wells in Exhibit E-2a and b.

Exhibit E-5 contains the results from RTA analysis for six horizontal Niobrara wells. Rate Transient Analysis demonstrates an estimated frac half-length of 84 feet and only 19 microdarcies of permeability. The hydraulic fracture half-length calculated from rate transient analyses, together with downhole pressure data from offset wells indicates that less than a 100 foot setback is sufficient. According to our findings, some waste is inevitable with 100 foot setbacks, but it is less than that created by the state-wide 600 foot setback.

Exhibit E-6 represents a half spacing unit depiction of the wellbore layout for these spacing units with Whiting alternating between producing the "A," "B," "C," and Fort Hays Codell zones. Whiting believes that each of the four zones will act as separate reservoirs. Due to Bentonites and other low permeability areas located between the zones in the Niobrara, the fracs do not grow into other zones. Both daily downhole pressure monitoring and post-frac tracer data has shown that there is not communication between zones.

Exhibit E-7 details oil, gas and water analysis for wells located on trend with the four analogous wells.

Exhibit E-8 shows data from a frac tracer survey that we took when we frac'd a vertical Niobrara "B" well, the Razor 26J-2633L. The well-log shows that the frac is contained in the Niobrara "B" while that the Niobrara "A" and "C" are separate zones.

Findings from the engineering analyses presented in Exhibits E-1, E-2a and b, E-3, E-4, E-5, E-6, E-7 and E-8 are summarized below:

- (1) Offset wells have cumulatively produced between 40 and 117 MBO per well with an average EUR of 208 MBO from a single well drilled into a spacing unit. An average EUR of 267 MBO is expected for 960 acre spacing unit well with up to eight wells per zone. The total amount of oil in place in the Niobrara is 74 MMBO per 960 acre spacing unit.
- (2) The four analogous wells presented in Exhibit 2a and b had an average EUR of 208 MBO and an estimated drainage area of 60 acres per well. The EURs

presented in Exhibits 1 and the economics in Exhibit 3 take into account better fracture technology. It also shows that when multiplied by eight wells per zone, the wells should drain less than 960 acres. Exhibit 8 gives an example of the frac not growing into the other zones; it stays contained in the Niobrara "B".

- (3) The 960 spacing unit case presented in the Economics Exhibits (E3) provided acceptable economics and will efficiently drain the Niobrara.
- (4) Past testimony provide by Mr. Ralph Nelms and updated here has shown very limited hydraulic fracture pressure communication, and calculated short hydraulic fracture half-lengths in the Niobrara formation.

The proposed increased density drilling program on 960-acre on the Application Lands is designed to protect correlative rights and prevent waste by utilizing Reservoir Engineering evaluation tools including but not limited to RTA analysis, geo-mechanical and numerical simulation modeling.

Engineering Exhibits E-1, E-2a and b, E-3, E-4, E-5, E-6, E-7 and E-8 were prepared by me and to the best of my knowledge, all of the matters set forth are true, correct, and accurate.

Dated this 15th day of May, 2017.


Donald F. Koenig

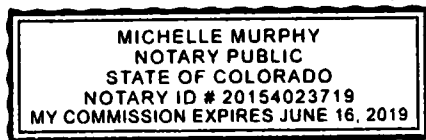
STATE OF COLORADO)
) ss.
CITY AND COUNTY OF DENVER)

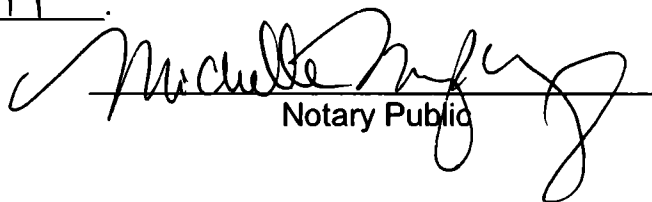
I, the undersigned Notary Public in and for said County in said State, hereby certify that Donald F. Koenig, whose name as Reservoir Engineering Manager of Whiting Oil and Gas Corporation, is signed to the foregoing instrument and who is known to me, acknowledged before me on this day that, being informed of the contents of the instrument, executed the same voluntarily for and as the act of said corporation.

Subscribed and sworn before me this 15th day of May, 2017.

Witness my hand and official seal

My commission expires 6/16/2019.




Notary Public

DONALD F. KOENIG

788 Mueller Drive
Highlands Ranch, CO 80129

PROFESSIONAL EXPERIENCE

WHITING PETROLEUM CORPORATION, Denver, Colorado <i>Senior Reservoir Engineer.</i>	2013 to present
EOG RESOURCES INC., Denver, CO <i>Reservoir Engineering Advisor</i>	2005-2013
MARATHON OIL COMPANY, Houston, TX <i>Advanced Reservoir Engineer</i>	2003-2005
MARATHON OIL COMPANY, Oklahoma City, OK <i>Reservoir Engineer II</i>	2000-2003
MARATHON OIL COMPANY, Tyler, TX <i>Reservoir Engineer I</i>	1997-2000

EDUCATION:

Montana Tech	B.S.	Petroleum Engineering	1997
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VOLUMETRICS INCREASED DENSITY- 960 acre Spacing Unit						
Niobrara Formation Reservoir Parameter Description	A-Zone	B-Zone	C-Zone	Fort Hays/Codell/Carlile	Average/Total	Units
Depth (True Vertical Depth Below Ground Level)	5,570	5,620	5,740	5,810		feet
Porosity	0.13	0.13	0.11	0.13	0.12	fraction
Swi (Initial Water Saturation Percent of Pore Space)	0.35	0.35	0.35	0.35	0.35	fraction
Net Pay Thickness	32	55	58	19	164	feet
Initial Reservoir Pressure	2,700	2,750	2,800	2,835	2,800	psi
Initial Reservoir Temperature	230	230	230	230	230	deg F
Gas Oil Ratio (Initial)	460	460	460	460	460	cubic feet/stock tank barrel
Oil Gravity	34.9	34.9	34.9	34.9	34.9	deg API
Gas Gravity	0.921	0.921	0.921	0.921	0.921	Air = 1.0
Initial Formation Volume Factor						
Calculated from Standing's Correlation	1.32	1.32	1.32	1.32	1.32	reservoir bbls/stock tank barrel
Number Of Wells	8	8	8	8		
Recovery Factor						
Used for Whiting 120-acre calculations	12%	12%	10%	14%	12%	% of volumetric oil In place
Drainage Area For Spacing Unit	960	960	960	960		acres
OOIP = 7758 X AREA X H x 0.12 x (1-0.35) / 1.32 (960 acres) (estimated)	15,256,460	26,222,040	23,398,128	8,710,118	73,586,746	stock tank barrels
EUR = OOIP x RF (960 acres estimated)	1,830,775	3,146,645	2,339,813	1,219,417	8,536,649	stock tank barrels
EUR for horizontal wells/zone in 960 acre spacing unit (estimated)	228,847	393,331	292,477	152,427	266,770	stock tank barrels per well
Drainage area for each of 8 horizontal wells/zone drilling on 960-acre spacing					160	acres per well
EUR (stock tank barrels per acre ft) (estimated)	59.6	59.6	42.0	66.9		stock tank barrels/acre-ft
EQUATIONS USED:						
OOIP = 7758 X AREA X HEIGHT X POROSITY X (1-Swi)/Boi (stock tank barrels)						
EUR = OOIP X RF (stock tank barrels)						
OOIP = Original Oil In place (stock tank barrels)						
EUR = Estimated Ultimate Oil Recovery (stock tank barrels)						
AREA = (acres) HEIGHT = NET PAY (feet)						
POROSITY = Fraction of Total Rock Volume (fraction)						
Swi = Initial Water Saturation (fraction)						
RF = Recovery Factor of OOIP (fraction)						
Boi = Initial Oil Formation Volume Factor (reservoir barrels / stock tank barrels)						

Exhibit E-1
Docket 170600335
Cause No. 535

Redtail Horsetail Drainage Calculations

	Units	Horsetail 30F-1941	Horsetail 30F-1942	Horsetail 30F-1947	Horsetail 30F-1948
Niobrara Zone		C	B	C	B
Porosity	fraction	0.11	0.13	0.11	0.13
Initial Water Saturation	fraction	0.35	0.35	0.35	0.35
Net Pay Thickness	feet	58	55	58	55
Initial Reservoir Pressure	psi	2,700	2,750	2,750	2,750
Initial Reservoir Temperature	deg F	230	230	225	225
Gas Oil Ratio (Initial)	scf/bbl	460	460	460	460
Oil Gravity	deg API	34.9	34.9	34.9	34.9
Gas Gravity	Air = 1.0	0.921	0.921	0.921	0.921
Initial Formation Volume Factor					
Standing's Correlation	res. bbls/stock tank bbls	1.32	1.32	1.32	1.32
OOIP/acre	stock tank barrels	24,373	27,315	24,373	27,315
Recovery Factor	%	14%	14%	12%	12%
Estimated EUR	stock tank barrels	163,171	320,680	60,271	286,100
Estimated Drainage Area	acres	48	84	21	87
Spacing Unit Length	ft	7,920	7,920	7,920	7,920
Calculated Drainage Width	ft	263	461	113	480

Average EUR	207,556	BO
Average Drainage Area	60	acres
Average Drainage Width	264	FT

Redtail Horsetail Economics

Exhibit E-2b

Niobrara Formation Drilling and Completion Economics

Drilling and Completion Costs:	\$4.00	MM
Oil Price:	\$50	/bbl
Gas Price:	\$3.00	/Mcf
Operating Expenses Monthly:	\$10,000	/month
Operating Expenses \$/MCF:	\$0.50	/Mcf
Working Interest:	100%	
Net Revenue Interest:	80%	
State Severance Oil:	5%	
State Severance Gas:	5%	
County Ad Valorem:	4.95%	
Gas Shrink	0.9	

	Units	Horsetail 30F-1941	Horsetail 30F-1942	Horsetail 30F-1947	Horsetail 30F-1948
IP:	BOPD	400	466	363	193
Gross EUR Oil	MBO	163	321	60	286
Gross EUR Gas	MMCF	133	487	73	146
Net EUR Oil	MBO	131	257	48	229
Net EUR Gas	MMCF	106	390	58	117
NPV 10%	M\$	-1,105	2,094	-2,496	1,418
DCFROR	%	1%	30%	0%	22%
ROI		1.01	2.47	0.34	2.25
Projected Life or Payout	Years	8.65	2.86	7.42	3.51

Average EUR	208	MBO
Average DCFROR	13%	
Undiscounted ROI	1.52	
Payout	5.61	Years

Exhibit E-3

Niobrara Formation 960-acre Spacing Drilling and Completion Economics

Drilling and Completion Costs:	\$4.00	MM
Oil Price:	\$50	/bbl
Gas Price:	\$3.00	/Mcf
Operating Expenses Monthly:	\$10,000	/month
Operating Expenses \$/MCF:	\$0.50	/Mcf
Working Interest:	100%	
Net Revenue Interest:	80%	
State Severance Oil:	5%	
State Severance Gas:	5%	
County Ad Valorem:	4.95%	
Gas Shrink	0.9	
Initial Gas Oil Ratio:	550	scf/stb
Final Gas Oil Ratio:	2500	scf/stb
Initial Oil Rate:	11,552	barrels of oil per month
IP:	380	BOPD
Gross EUR Oil	267	MBO
Gross EUR Gas	606	MMCF
Net EUR Oil	213	MBO
Net EUR Gas	485	MMCF

Un-risked Economics:

Economics shown below are for each individual well assuming 32 horizontal wells are drilled in a 1280-acre spacing unit:

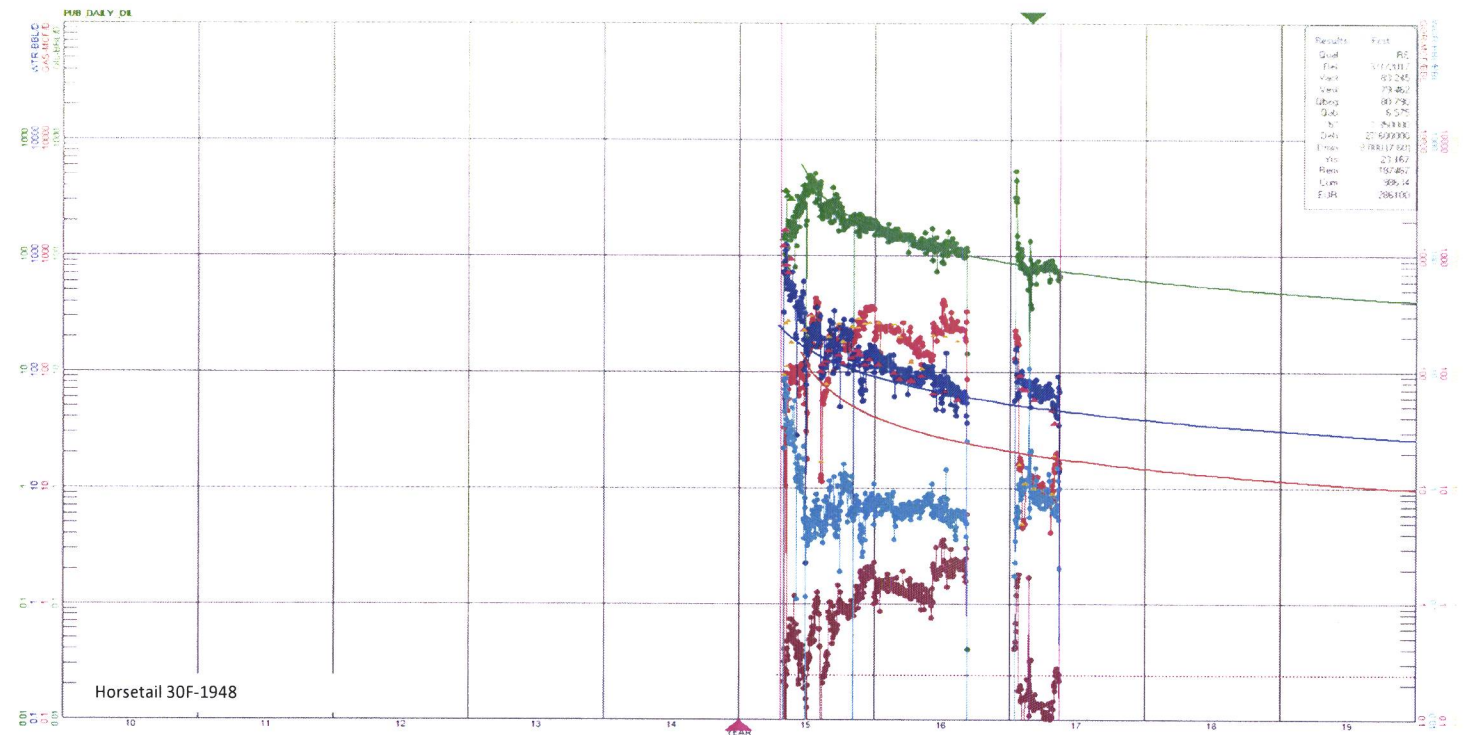
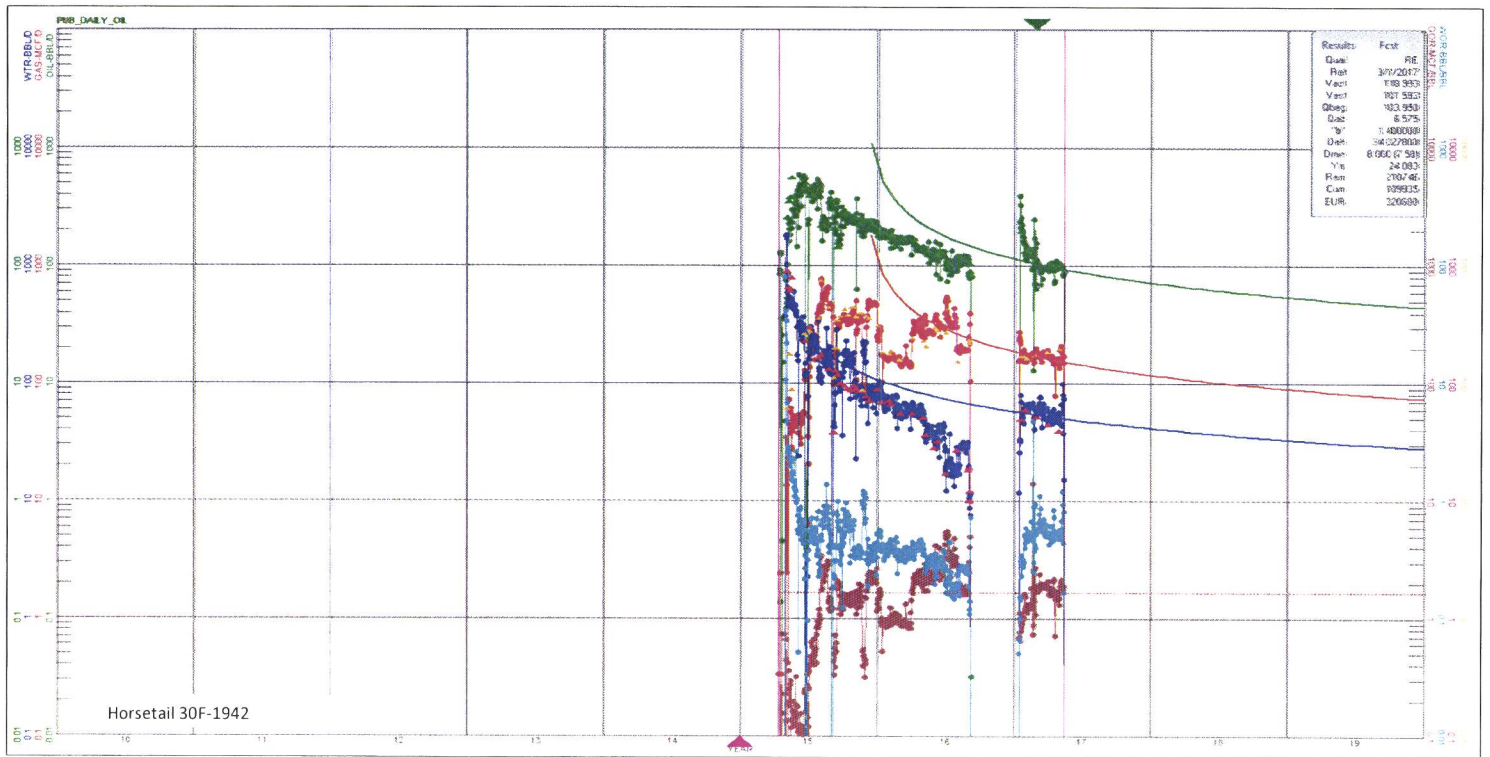
Un-risked Gross EUR Oil:	267	MBO
Un-risked Gross EUR Gas:	606	MMCF
NPV 10	1972.94	M\$
DCFROR	35%	
ROI	1.97	
Payout	1.79	Years

Conclusion: Project Economics are Favorable

Exhibit E-3

Docket 170600335

Cause No. 535



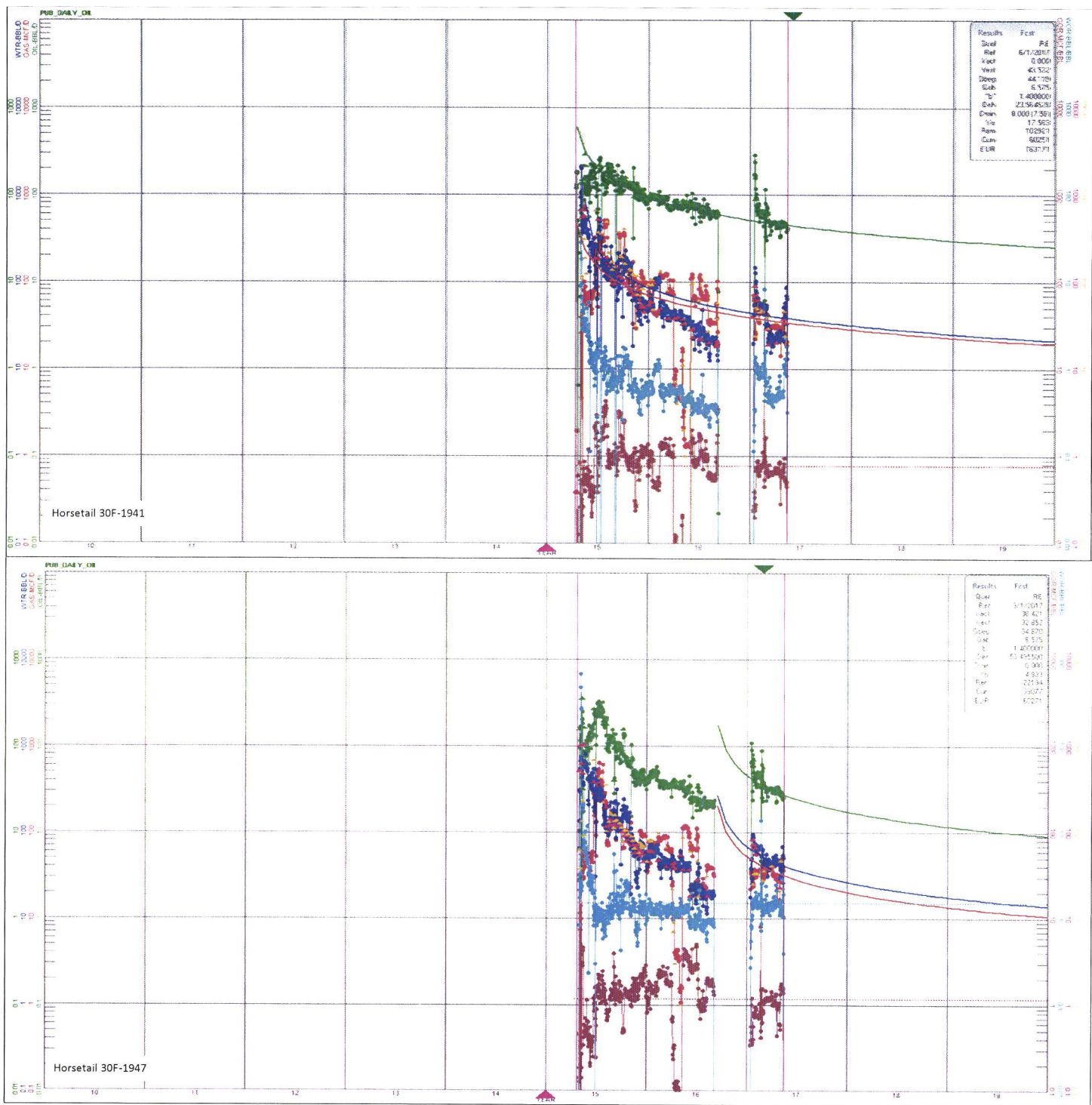
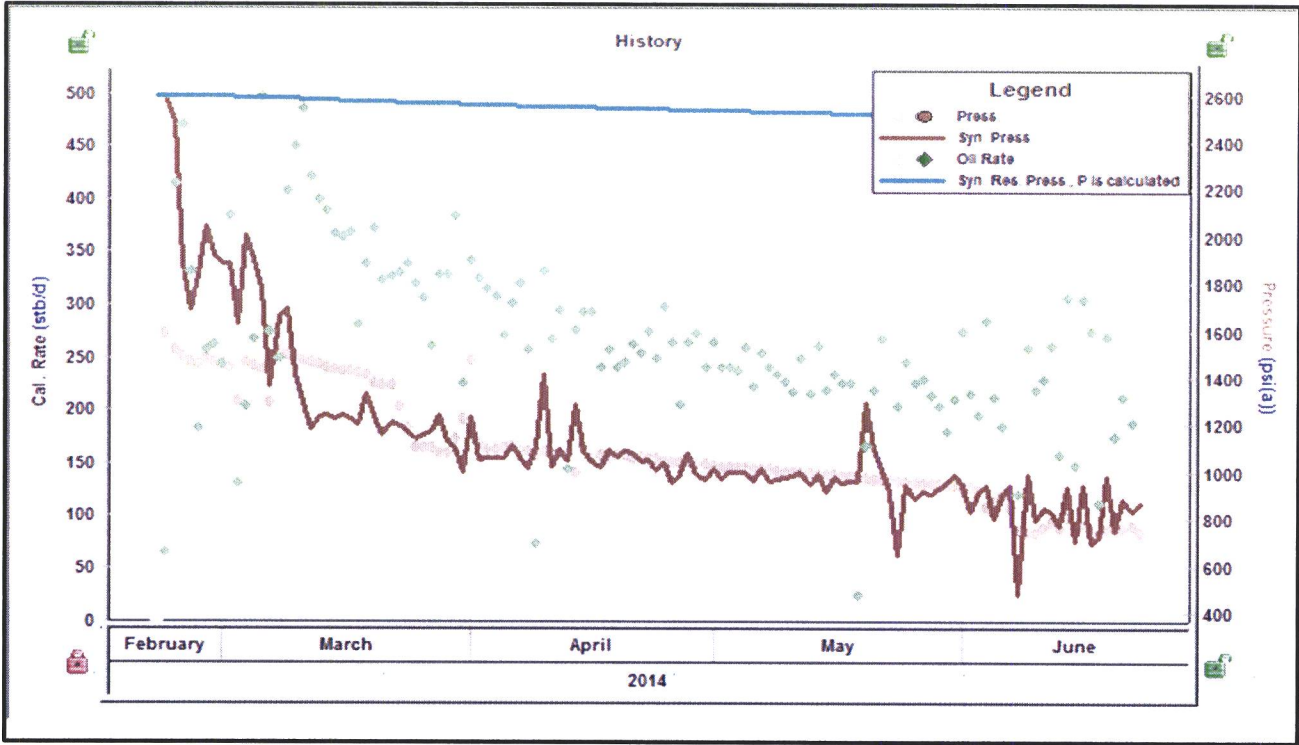
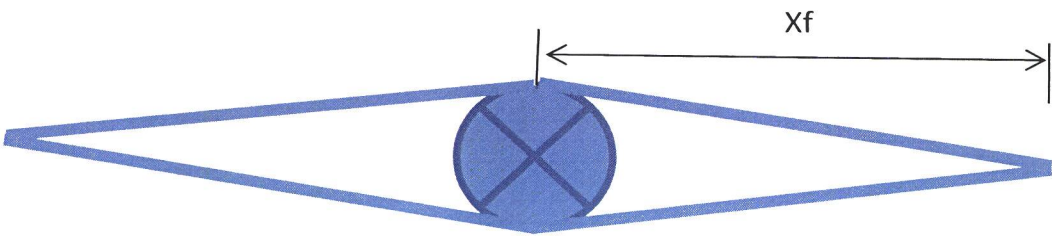


Exhibit E-4b
Docket 170600335
Cause No. 535

Whiting Niobara B RTA Results

RTA Indicates that Frac Half Lengths average 85 ft and the permeabilty to Oil is only 19 MicroDarcies

Well Name	Drilling Unit	Well Location	Oil Permeability MicroDarcies	Xf ft
Wildhorse 16-13H	640	SEC 16 T9N R59W	17	50
Two Mile 22-13H	640	SEC 22 T11N R57W	17	85
Horsetail 18-0733H	960	SEC 18 T10N R57W	12	105
Wolf 35-2623H	960	SEC 35 T10N R59W	3	100
Horsetail 16-1610BH	640	SEC 16 T10N R57W	24	70
Horsetail 07-611H	960	SEC 18 T10N R57W	40	95
			19	84



1280 Acre Well Layout

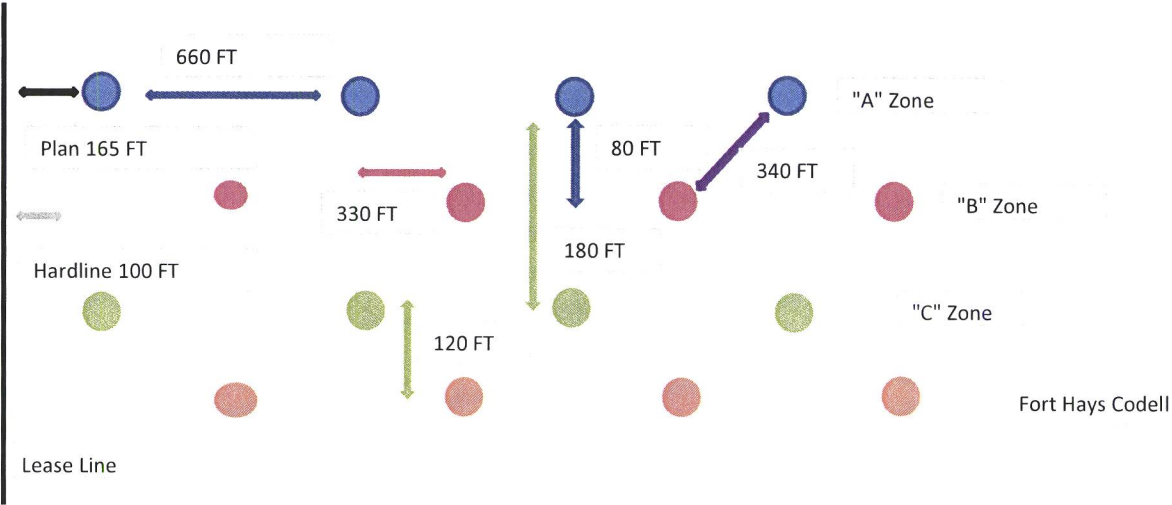



Exhibit E-6
Docket 170600335
Cause No. 535




TECHNOLOGY LABORATORY, INC.
CENTRE PROFESSIONAL PARK
1612 Centre Avenue
Fort Collins, Colorado 80526
(970) 499-1414

CERTIFICATE OF ANALYSIS

Whiting Petroleum Corp. 1700 Broadway Denver, CO 80290-2300		Sampled Received	12/18/13 12/19/13
Sample ID: Horseshall 07-0611B	Project No.	Redtail Field	
Laboratory ID: A9549-01	Matrix	Water	


CAS Number	Parameter	Result	Units	MDL	Method	Date Analyzed
N/A	Specific Gravity	1.0038			ASTM D1298	12/23/13
N/A	Resistivity	6.2793	Ohm Meters @ 68 °F		EPA-120.1	12/23/13
N/A	pH	7.1	Units		EPA-150.1	12/23/13
N/A	Total Dissolved Solids (TDS)	35270	mg/L	5	EPA-160.1	12/23/13
16887-00-6	Chloride	14243	mg/L	1	EPA-300.1	12/23/13
18785-72-3	Sulfate	20.0	mg/L	0.05	EPA-300.1	12/23/13
71-52-3	Bicarbonate	927	mg/L	1	EPA-310.2	12/23/13
97328-76-2	Carbonate (CO3)	< 1.0	mg/L	1	EPA-310.2	12/23/13
7440-39-3	Dissolved Barium	20.5	mg/L	0.01	EPA-60.108	12/23/13
7440-42-8	Dissolved Boron	20.2	mg/L	0.006	EPA-60.108	12/23/13
7440-70-2	Dissolved Calcium	190	mg/L	0.1	EPA-60.108	12/23/13
7439-89-6	Dissolved Iron	14.2	mg/L	0.007	EPA-60.108	12/23/13
7439-95-4	Dissolved Magnesium	35.5	mg/L	0.02	EPA-60.108	12/23/13
7440-09-7	Dissolved Potassium	19.2	mg/L	0.1	EPA-60.108	12/23/13
7440-23-5	Dissolved Sodium	8899	mg/L	0.01	EPA-60.108	12/23/13
7704-94-6	Dissolved Zirconium	6.077	mg/L	0.01	EPA-60.108	12/23/13



TECHNOLOGY LABORATORY, INC.

The results contained in this report
relate only to those items tested.

Page 1 of 3

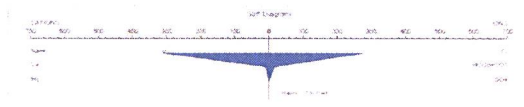


TECHNOLOGY LABORATORY, INC.
CENTRE PROFESSIONAL PARK
1612 Centre Avenue
Fort Collins, Colorado 80526
(970) 499-1414


CERTIFICATE OF ANALYSIS

Whiting Petroleum Corp. 1700 Broadway Denver, CO 80290-2300		Sampled Received	01/28/14 01/28/14
Sample ID: Razzo 27 K-Pan	Project No.	Plowman	
Laboratory ID: A9756-01	Matrix	Water	

CAS Number	Parameter	Result	Units	MDL	Method	Date Analyzed
N/A	Specific Gravity	1.01			ASTM D1298	02/04/14
N/A	Resistivity	6.326	Ohm Meters @ 68 °F		EPA-120.1	02/04/14
N/A	pH	6.9	Units		EPA-150.1	02/04/14
N/A	Total Dissolved Solids (TDS)	41043	mg/L	5	EPA-160.1	02/04/14
16887-00-6	Chloride	9193	mg/L	1	EPA-300.1	02/04/14
18785-72-3	Sulfate	< 0.05	mg/L	0.05	EPA-300.1	02/04/14
71-52-3	Bicarbonate	677	mg/L	1	EPA-310.2	02/04/14
97328-76-2	Carbonate (CO3)	< 1.0	mg/L	1	EPA-310.2	02/04/14
7440-39-3	Dissolved Barium	21.6	mg/L	0.01	EPA-60.108	02/04/14
7440-42-8	Dissolved Boron	18.3	mg/L	0.006	EPA-60.108	02/04/14
7440-70-2	Dissolved Calcium	191	mg/L	0.1	EPA-60.108	02/04/14
7439-89-6	Dissolved Iron	0.223	mg/L	0.007	EPA-60.108	02/04/14
7439-95-4	Dissolved Magnesium	32.6	mg/L	0.02	EPA-60.108	02/04/14
7440-09-7	Dissolved Potassium	17.6	mg/L	0.1	EPA-60.108	02/04/14
7440-23-5	Dissolved Sodium	7111	mg/L	0.01	EPA-60.108	02/04/14
7704-94-6	Dissolved Zirconium	6.117	mg/L	0.01	EPA-60.108	02/04/14



TDS Diagram



TECHNOLOGY LABORATORY, INC.

The results contained in this report
relate only to those items tested.

Page 1 of 3

Estimation of Frac Height Growth using Tracer Data

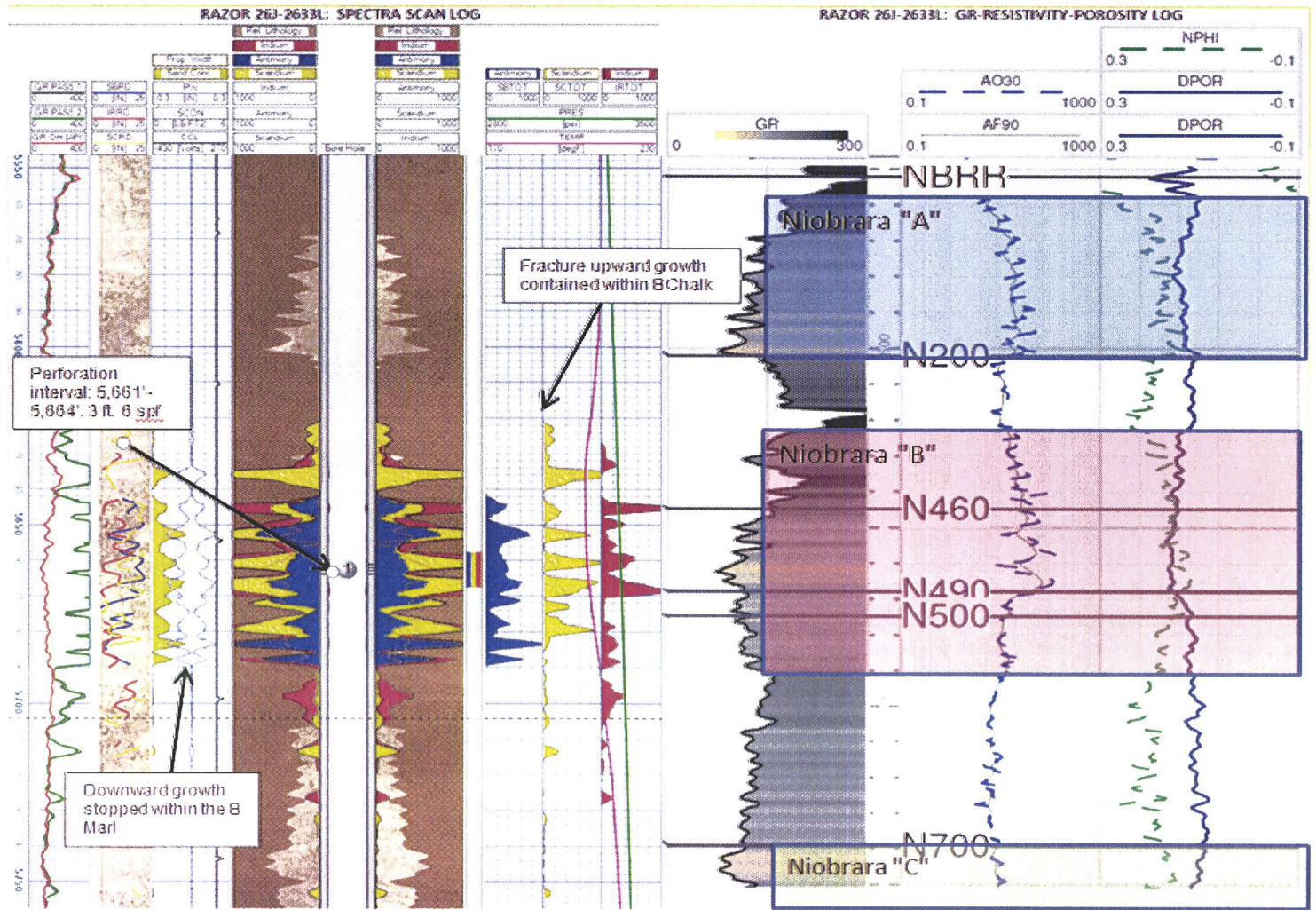


Exhibit E-8 •
Docket 170600335
Cause No. 535

ORIGINAL

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



IN THE MATTER OF THE AMENDED)
APPLICATION OF WHITING OIL AND GAS)
CORPORATION FOR AN ORDER TO)
AMEND ORDER NO. 535-369 TO INCLUDE)
THE CARLILE, FORT HAYES, AND CODELL)
FORMATIONS IN AN ESTABLISHED 960-)
ACRE DRILLING AND SPACING UNIT AND)
ESTABLISHING WELL LOCATION RULES)
APPLICABLE TO THE DRILLING AND)
PRODUCING OF WELLS FROM THE)
CARLILE, FORT HAYES, AND CODELL AND)
NIOBRARA FORMATIONS COVERING)
CERTAIN LANDS IN TOWNSHIP 10 NORTH,)
RANGE 57 WEST, 6TH P.M., WELD)
COUNTY, COLORADO.)

Cause No. 535

Docket No. 170600335

Type: SPACING AND
INCREASED DENSITY

SUBMISSION OF SUPPLEMENTAL RULE 511 MATERIALS

Whiting Oil and Gas Corporation ("Applicant"), Operator No. 96155, by its attorneys, Welborn Sullivan Meck & Tooley, P.C., in support of the captioned Application, submits the following supplemental Engineering Testimony supporting efficient and economic development of the Niobrara, Fort Hays, Codell, and Carlile Formations for production of oil, gas, and associated hydrocarbons within the Application Lands.

Dated: June 30, 2017

Respectfully submitted,

WHITING OIL AND GAS CORPORATION

By: 

Joseph C. Pierzchala

Geoffrey W. Storm

Welborn Sullivan Meck & Tooley, P.C.

Attorneys for Applicant

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Denver, CO 80202

(303) 830-2500

jpierzchala@wsmtlaw.com

gstorm@wsmtlaw.com

<p align="center">Exhibit C</p> <p align="center">WHITING OIL AND GAS CORPORATION</p> <p align="center">Donald F. Koenig</p>	<p align="center">Docket No. 170600335</p> <p align="center">Engineering Testimony – Rule 511</p> <p align="center">Weld County, Colorado</p>
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ENGINEERING TESTIMONY

Township 10 North, Range 57 West, 6th P.M.

Section 19: All

Section 30: N½

My name is Donald F. Koenig. I am currently employed as a Reservoir Engineering Manager with Whiting Oil and Gas Corporation ("Whiting"). I have over 19 years of experience in reservoir engineering and am familiar with the reservoir engineering characteristics on the lands addressed in this testimony, and the matters set forth in Docket No. 170600335. A copy of my resume is attached to this testimony.

In support of Whiting's application (the "Application") in the above referenced docket, I have prepared and am submitting E-1 through E-8. The exhibits are attached to my sworn testimony and form the basis for Whiting's Application to gain approval to drill and complete on increased well density up to 32 wells in the requested 960-acre drilling and spacing unit for the Niobrara, Fort Hays, Codell, and Carlile Formations covering the following lands ("Application Lands"):

Township 10 North, Range 57 West, 6th P.M.

Section 19: All

Section 30: N½

Exhibit E-1a presents the Niobrara and Fort Hays/Codell/Carlile Formation reservoir characteristics and a volumetric calculation showing the estimated oil recovery from increased density wells drilled on 960-acre spacing on the Application Lands. I have broken out the Niobrara "A", "B", "C" and Fort Hays/Codell/Carlile zone characteristics. There is an estimated 74 MMBO in this 960-acre spacing unit, of which Whiting hopes to recover up to 12% of the oil in place.

Exhibit E-2aA presents the calculated drainage areas and estimates the drainage width for eight analogous Niobrara wells located in Township 10 North, Ranges 57 through 59 West. The average drainage for these eight wells of various lateral lengths is 70 acres with a corresponding drainage width of 382 ft. The wells produce from the Niobrara "A", "B", and "C".

Exhibit E-2aB presents the calculated drainage areas and estimates the drainage width for eight analogous Codell wells located in Township 10 North, Range 58 West. The average drainage for these eight wells of various lateral lengths is 108 acres with a corresponding drainage width of 592 ft.

Exhibit E-2bA demonstrates the economics for the same four analogous Niobrara wells. With a Rate of Return ("ROR") around 19%, Return on Investment ("ROI") of 1.42 and average payout of 7 years, the area has been economic. The economics were run at a 50 \$/BBL oil price.

Exhibit E-2bB demonstrates the economics for the same eight analogous Codell wells. With a Rate of Return ("ROR") around 10%, Return on Investment ("ROI") of 0.88 and average payout of 8 years, the area has been barely economic. The economics were run at a 50 \$/BBL oil price.

Exhibit E-3 analyzes the economics for an average well in a 960-acre spacing unit with up to 32 wells. Again the economics are good for a 50 \$/BBL price with a ROR of 35% and ROI of 1.97. The Estimated Ultimate Recovery ("EUR") for this case was derived from the EUR calculated on Exhibit E-1 using an average 12% recovery factor on the four zones in the Niobrara and Fort Hays/Codell.

Exhibits E-4 contains the decline curves for the eight analogous Niobrara wells in Exhibits E-2aA and E-2bA and the decline curves for the eight analogous Codell wells in Exhibits E-2aB and E-2bB.

Exhibit E-5 contains the results from RTA analysis for six horizontal Niobrara wells. Rate Transient Analysis demonstrates an estimated frac half-length of 84 feet and only 19 microdarcies of permeability. The hydraulic fracture half-length calculated from rate transient analyses, together with downhole pressure data from offset wells indicates that less than a 100 foot setback is sufficient. According to our findings, some waste is inevitable with 100 foot setbacks, but it is less than that created by the state-wide 600 foot setback.

Exhibit E-6 represents a half spacing unit depiction of the wellbore layout for these spacing units with Whiting alternating between producing the "A," "B," "C," and Fort Hays Codell zones. Whiting believes that each of the four zones will act as separate reservoirs. Due to Bentonites and other low permeability areas located between the zones in the Niobrara, the fracs do not grow into other zones. Both daily downhole pressure monitoring and post-frac tracer data has shown that there is not communication between zones.

Exhibit E-7 details oil, gas and water analysis for wells located on trend with the four analogous wells.

Exhibit E-8 shows data from a frac tracer survey that we took when we frac'd a vertical Niobrara "B" well, the Razor 26J-2633L. The well-log shows that the frac is contained in the Niobrara "B" while that the Niobrara "A" and "C" are separate zones.

Findings from the engineering analyses presented in Exhibits E-1, E-2a and b, E-3, E-4, E-5, E-6, E-7 and E-8 are summarized below:

- (1) Offset Niobrara Formation wells have cumulatively produced between 60 and 336 MBO per well with an average EUR of 206 MBO from a single Niobrara well. Offset Codell Formation wells have cumulatively produced between 81 and 279 MBO per well with an average and EUR of 146 MBO from a single Codell well drilled into a spacing unit. An average EUR of 266 MBO is expected for 960-acre spacing unit well with up to eight wells per zone. The total amount of oil in place in the Niobrara A, B, C zones and Fort Hays/Codell/Carlile Formations is 74 MMBO per 960-acre spacing unit.
- (2) The eight analogous Niobrara wells presented in Exhibits E-2aA and E-2bA had an average EUR of 206 MBO and an estimated drainage area of 70 acres per well. The eight analogous Codell wells presented in Exhibit E-2aB and E-2bB had an average EUR of 146 MBO and an estimated drainage area of 108 acres per well. The EURs presented in Exhibits 1 and the economics in Exhibit 3 take into account better fracture technology. It also shows that when multiplied by eight wells per zone, the wells should drain less than 960 acres. Exhibit 8 gives an example of the frac not growing into the other zones; it stays contained in the Niobrara "B".
- (3) The 960-acre spacing unit case presented in the Economics Exhibits (E3) provided acceptable economics and will efficiently drain the Niobrara.
- (4) Past testimony provide by Mr. Ralph Nelms and updated here has shown very limited hydraulic fracture pressure communication, and calculated short hydraulic fracture half-lengths in the Niobrara formation.

The proposed increased density drilling program on 960-acre on the Application Lands is designed to protect correlative rights and prevent waste by utilizing Reservoir Engineering evaluation tools including but not limited to RTA analysis, geo-mechanical and numerical simulation modeling.

Engineering Exhibits E-1, E-2, E-3, E-4, E-5, E-6, E-7 and E-8 were prepared by me and to the best of my knowledge, all of the matters set forth are true, correct, and accurate.

Dated this th27 day of June, 2017.


Donald F. Koenig

VOLUMETRICS INCREASED DENSITY- 960 acre Spacing Unit						
Niobrara Formation Reservoir Parameter Description	A-Zone	B-Zone	C-Zone	Fort Hays/Codell/Carlile	Average/Total	Units
Depth (True Vertical Depth Below Ground Level)	5,570	5,620	5,740	5,810		feet
Porosity	0.13	0.13	0.11	0.13	0.12	fraction
Swi (Initial Water Saturation Percent of Pore Space)	0.35	0.35	0.35	0.35	0.35	fraction
Net Pay Thickness	32	55	58	19	164	feet
Initial Reservoir Pressure	2,700	2,750	2,800	2,835	2,800	psi
Initial Reservoir Temperature	230	230	230	230	230	deg F
Gas Oil Ratio (Initial)	460	460	460	460	460	cubic feet/stock tank barrel
Oil Gravity	34.9	34.9	34.9	34.9	34.9	deg API
Gas Gravity	0.921	0.921	0.921	0.921	0.921	Air = 1.0
Initial Formation Volume Factor						
Calculated from Standing's Correlation	1.32	1.32	1.32	1.32	1.32	reservoir bbls/stock tank barrel
Number Of Wells	8	8	8	8		
Recovery Factor						
Used for Whiting 120-acre calculations	12%	12%	10%	14%	12%	% of volumetric oil in place
Drainage Area For Spacing Unit	960	960	960	960		acres
OOIP = 7758 x 960 x H x 0.10 x (1-0.35) / 1.32 (960 acres) (estimated)	15,256,460	26,222,040	23,398,128	8,710,118	73,586,746	stock tank barrels
EUR = OOIP x RF 960 acres estimated)	1,830,775	3,146,645	2,339,813	1,219,417	8,536,649	stock tank barrels
EUR for horizontal wells/zone in 1280 acre spacing unit (estimated)	228,847	393,331	292,477	152,427	266,770	stock tank barrels per well
Drainage area for each of 8 horizontal wells/zone drilling on 960-acre spacing					160	acres per well
EUR (stock tank barrels per acre ft) (estimated)	59.6	59.6	42.0	66.9		stock tank barrels/acre-ft
EQUATIONS USED:						
OOIP = 7758 X AREA X HEIGHT X POROSITY X (1-Swi)/Boi (stock tank barrels)						
EUR = OOIP X RF (stock tank barrels)						
OOIP = Original Oil In place (stock tank barrels)						
EUR = Estimated Ultimate Oil Recovery (stock tank barrels)						
AREA = (acres) HEIGHT = NET PAY (feet)						
POROSITY = Fraction of Total Rock Volume (fraction)						
Swi = Initial Water Saturation (fraction)						
RF = Recovery Factor of OOIP (fraction)						
Boi = Initial Oil Formation Volume Factor (reservoir barrels / stock tank barrels)						

Exhibit E-1
Docket 170600335
Cause No. 535

Redtail Horsetail Drainage Calculations

	Units	Horsetail 30F-1941	Horsetail 30F-1942	Horsetail 30F-1947	Horsetail 30F-1948	Razor 10E-0302	Razor FED 30K-3105	Razor FED 30K-3107	Wolf 35-2613
Zone		C	B	C	B	B	B	A	B
Porosity	fraction	0.11	0.13	0.11	0.13	0.13	0.13	0.13	0.13
Initial Water Saturation	fraction	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Net Pay Thickness	feet	58	55	58	55	55	55	32	55
Initial Reservoir Pressure	psi	2,700	2,750	2,750	2,750	2,750	2,750	2,700	2,750
Initial Reservoir Temperature	deg F	230	230	225	225	230	230	225	230
Gas Oil Ratio (Initial)	scf/bbl	460	460	460	460	460	460	460	460
Oil Gravity	deg API	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9
Gas Gravity	Air = 1.0	0.921	0.921	0.921	0.921	0.921	0.921	0.921	0.921
Initial Formation Volume Factor									
Standing's Correlation	res. bbls/stock tank bbls	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
OOIP/acre	stock tank barrels	24,373	27,315	24,373	27,315	27,315	27,315	15,892	27,315
Recovery Factor	%	12%	12%	12%	12%	12%	12%	12%	12%
Estimated EUR	stock tank barrels	163,171	320,680	60,271	286,100	132,141	336,613	196,517	159329
Estimated Drainage Area	acres	56	98	21	87	40	103	103	49
Spacing Unit Length	ft	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920
Calculated Drainage Width	ft	307	538	113	480	222	565	567	267

Average EUR 206,853 **BO**
Average Drainage Area 70 **acres**
Average Drainage Width 382 **FT**

Redtail Horsetail Drainage Calculations

	Units	RAZOR 11F- 0206B	RAZOR 11G- 0210B	RAZOR 12F- 0106B	RAZOR FED 30K-310B	RAZOR FEDERAL 12F- 1304B	RAZOR FEDERAL 12F- 1301A	RAZOR 12F- 0101A	RAZOR 25B- 2551
Zone		Codell	Codell	Codell	Codell	Codell	Codell	Codell	Codell
Porosity	fraction	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Initial Water Saturation	fraction	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Net Pay Thickness	feet	19	19	19	19	19	19	19	19
Initial Reservoir Pressure	psi	2,700	2,750	2,750	2,700	2,750	2,750	2,700	2,750
Initial Reservoir Temperature	deg F	240	240	240	240	240	240	240	240
Gas Oil Ratio (Initial)	scf/bbl	460	460	460	460	460	460	460	460
Oil Gravity	deg API	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9
Gas Gravity	Air = 1.0	0.921	0.921	0.921	0.921	0.921	0.921	0.921	0.921
Initial Formation Volume Factor									
Standing's Correlation	res. bbls/stock tank bbls	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
OOIP/acre	stock tank barrels	9,073	9,073	9,073	9,073	9,073	9,073	9,073	9,073
Recovery Factor	%	15%	15%	15%	15%	15%	15%	15%	15%
Estimated EUR	stock tank barrels	114,125	138,039	111,020	278,933	95,450	105,013	80,624	248,529
Estimated Drainage Area	acres	84	101	82	205	70	77	59	183
Spacing Unit Length	ft	7,920	7,920	7,920	7,920	7,920	7,920	7,920	7,920
Calculated Drainage Width	ft	461	558	449	1,127	386	424	326	1,004

Average EUR 146,467 BO
 Average Drainage Area 108 acres
 Average Drainage Width 592 FT

Redtail Horsetail Economics

Exhibit E-2bA

Niobrara Formation Drilling and Completion Economics

Drilling and Completion Costs:	\$4.00	MM
Oil Price:	\$50	/bbl
Gas Price:	\$3.00	/Mcf
Operating Expenses Monthly:	\$10,000	/month
Operating Expenses \$/MCF:	\$0.50	/Mcf
Working Interest:	100%	
Net Revenue Interest:	80%	
State Severance Oil:	5%	
State Severance Gas:	5%	
County Ad Valorem:	4.95%	
Gas Shrink	0.9	

	Units	Horsetail 30F- 1941	Horsetail 30F- 1942	Horsetail 30F- 1947	Horsetail 30F- 1948	Razor 10E- 0302	Razor FED 30K-3105	Razor FED 30K-3107	Wolf 35-2613
IP:	BOPD	400	466	363	193	435	519	562	448
Gross EUR Oil	MBO	163	321	60	286	132	197	336	159
Gross EUR Gas	MMCF	133	487	73	146	230	733	448	294
Net EUR Oil	MBO	131	257	48	229	106	158	269	127
Net EUR Gas	MMCF	106	390	58	117	184	586	358	235
NPV 10%	M\$	-1,105	2,094	-2,496	1,418	-1,350	35	3,206	-806
DCFROR	%	1%	30%	0%	22%	0%	11%	86%	0%
ROI		1.01	2.47	0.34	2.25	0.77	1.23	2.36	0.94
Projected Life or Payout	Years	8.65	2.86	7.42	3.51	11.92	4.62	1.14	14

Average EUR 207 MBO
 Average DCFROR 19%
 Undiscounted ROI 1.42
 Payout 7 Years

Exhibit E-2bA

Docket

170600335

Cause No. 535

Redtail Horsetail Economics

Exhibit E-2bB

Niobrara Formation Drilling and Completion Economics

Drilling and Completion Costs:	\$4.00	MM
Oil Price:	\$50	/bbl
Gas Price:	\$3.00	/Mcf
Operating Expenses Monthly:	\$10,000	/month
Operating Expenses \$/MCF:	\$0.50	/Mcf
Working Interest:	100%	
Net Revenue Interest:	80%	
State Severance Oil:	5%	
State Severance Gas:	5%	
County Ad Valorem:	4.95%	
Gas Shrink	0.9	

	Units	RAZOR 11F- 0206B	RAZOR 11G- 0210B	RAZOR 12F- 0106B	RAZOR FED 30K-310B	RAZOR FEDERAL 12F- 1304B	RAZOR FEDERAL 12F- 1301A	RAZOR 12F- 0101A	RAZOR 25B- 2551
IP:	BOPD	289	447	289	549	252	237	280	676
Gross EUR Oil	MBO	114	138	111	279	95	105	81	249
Gross EUR Gas	MMCF	230	197	196	202	116	113	126	285
Net EUR Oil	MBO	91	110	89	223	76	84	64	199
Net EUR Gas	MMCF	184	158	156	161	93	90	100	228
NPV 10%	M\$	-1,786	-1,268	-1,851	1,896	-2,182	-1,971	-2,473	1,203
DCFROR	%	0%	0%	0%	47%	0%	0%	0%	32%
ROI		0.63	0.79	0.61	1.88	0.51	0.57	0.42	1.64
Projected Life or Payout	Years	10.00	12.25	9.67	1.61	8.25	9.17	6.92	2.21

Average EUR 146 MBO
 Average DCFROR 10%
 Undiscounted ROI 0.88
 Payout 8 Years

Exhibit E-2bB

Docket

170600335

Cause No. 535

Exhibit E-3

Niobrara Formation 960-acre Spacing Drilling and Completion Economics

Drilling and Completion Costs:	\$4.00	MM
Oil Price:	\$50	/bbl
Gas Price:	\$3.00	/Mcf
Operating Expenses Monthly:	\$10,000	/month
Operating Expenses \$/MCF:	\$0.50	/Mcf
Working Interest:	100%	
Net Revenue Interest:	80%	
State Severance Oil:	5%	
State Severance Gas:	5%	
County Ad Valorem:	4.95%	
Gas Shrink	0.9	
Initial Gas Oil Ratio:	550	scf/stb
Final Gas Oil Ratio:	2500	scf/stb
Initial Oil Rate:	11,552	barrels of oil per month
IP:	380	BOPD
Gross EUR Oil	267	MBO
Gross EUR Gas	606	MMCF
Net EUR Oil	213	MBO
Net EUR Gas	485	MMCF

Un-risked Economics:

Economics shown below are for each individual well assuming 32 horizontal wells are drilled in a 1280-acre spacing unit:

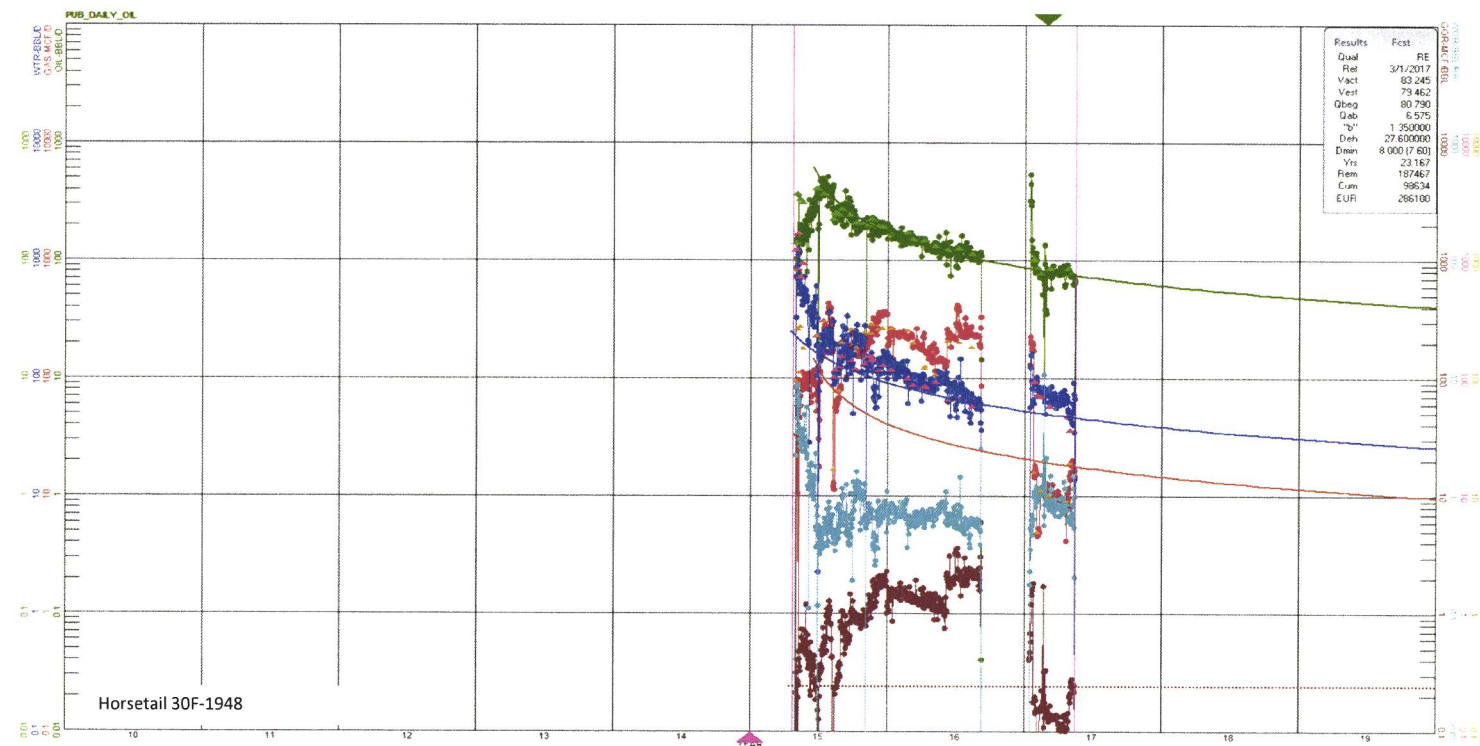
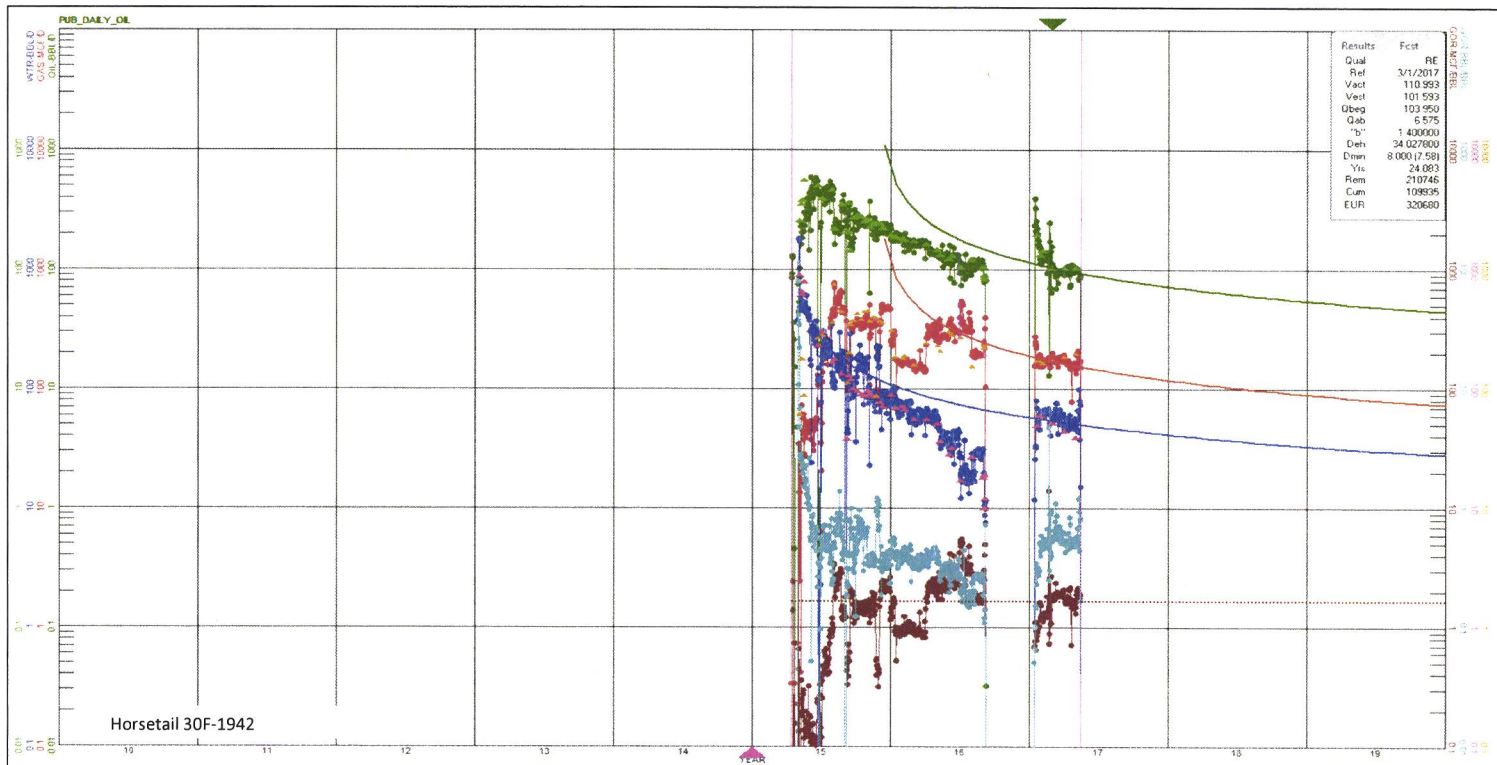
Un-risked Gross EUR Oil:	267	MBO
Un-risked Gross EUR Gas:	606	MMCF
NPV 10	1972.94	M\$
DCFROR	35%	
ROI	1.97	
Payout	1.79	Years

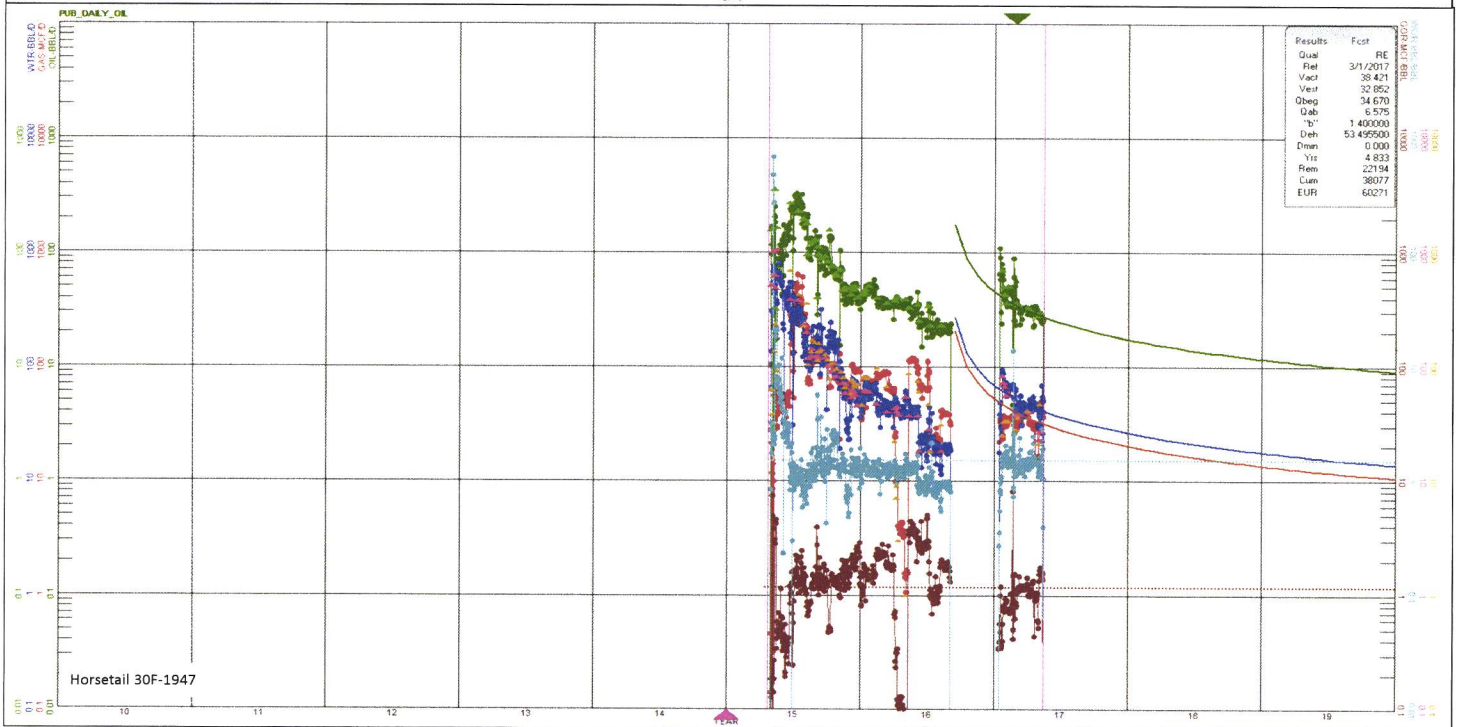
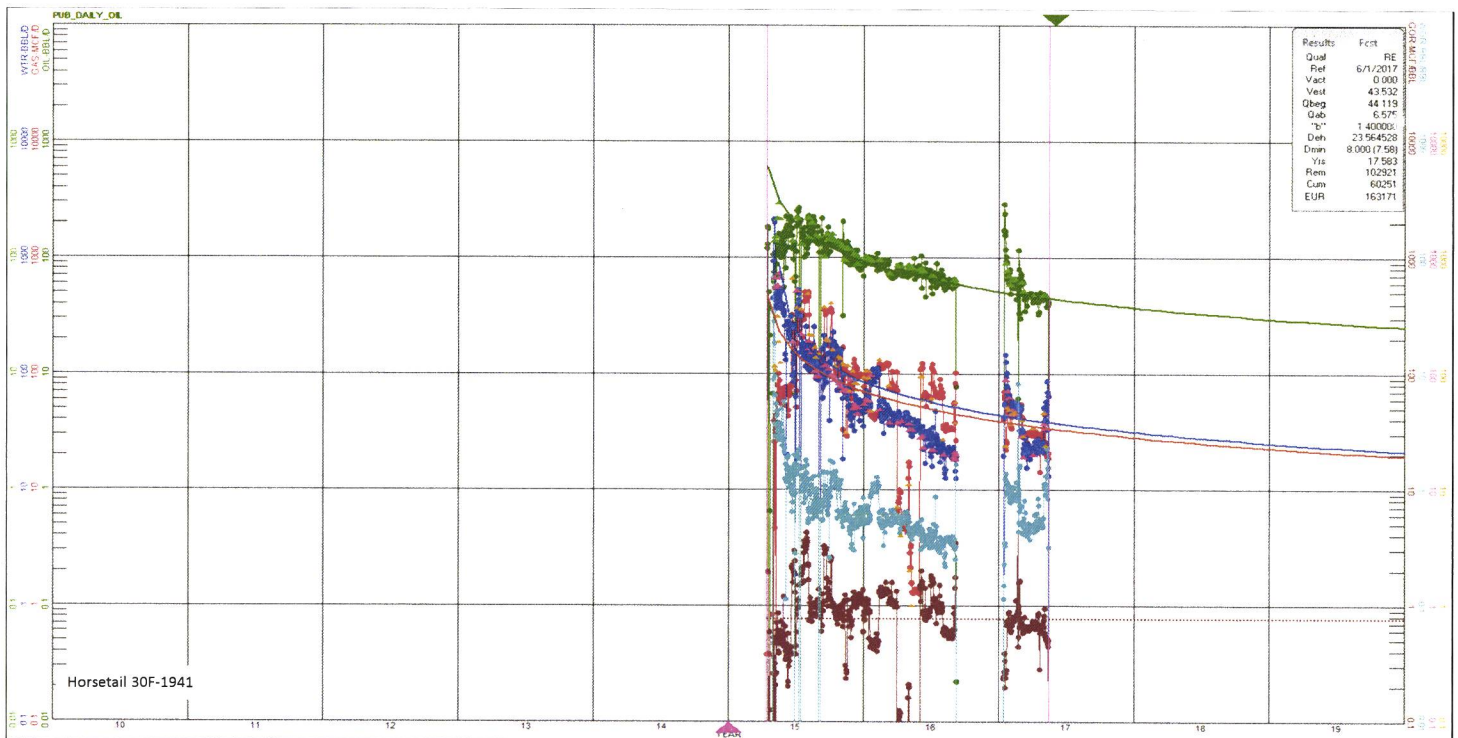
Conclusion: Project Economics are Favorable

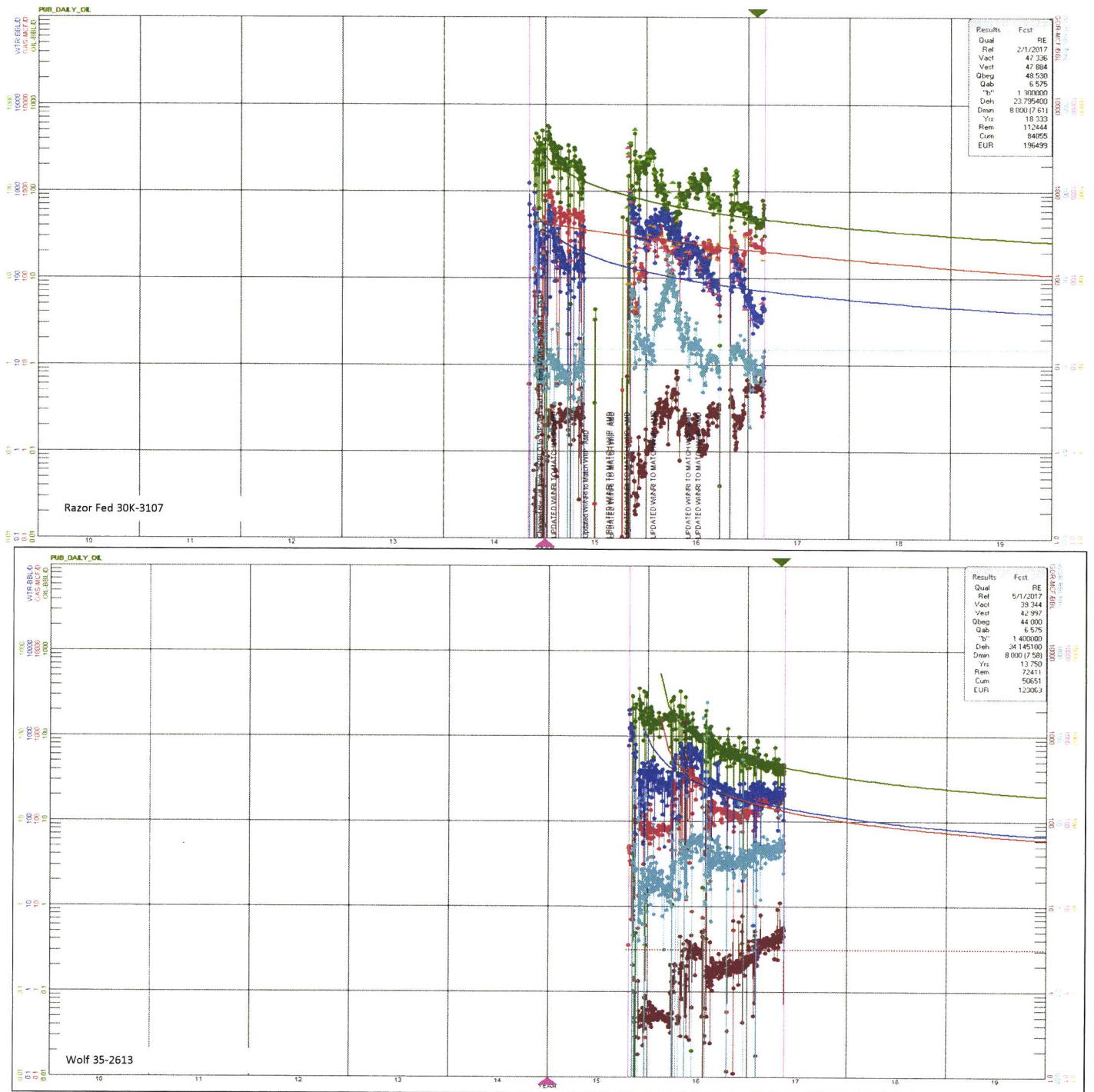
Exhibit E-3

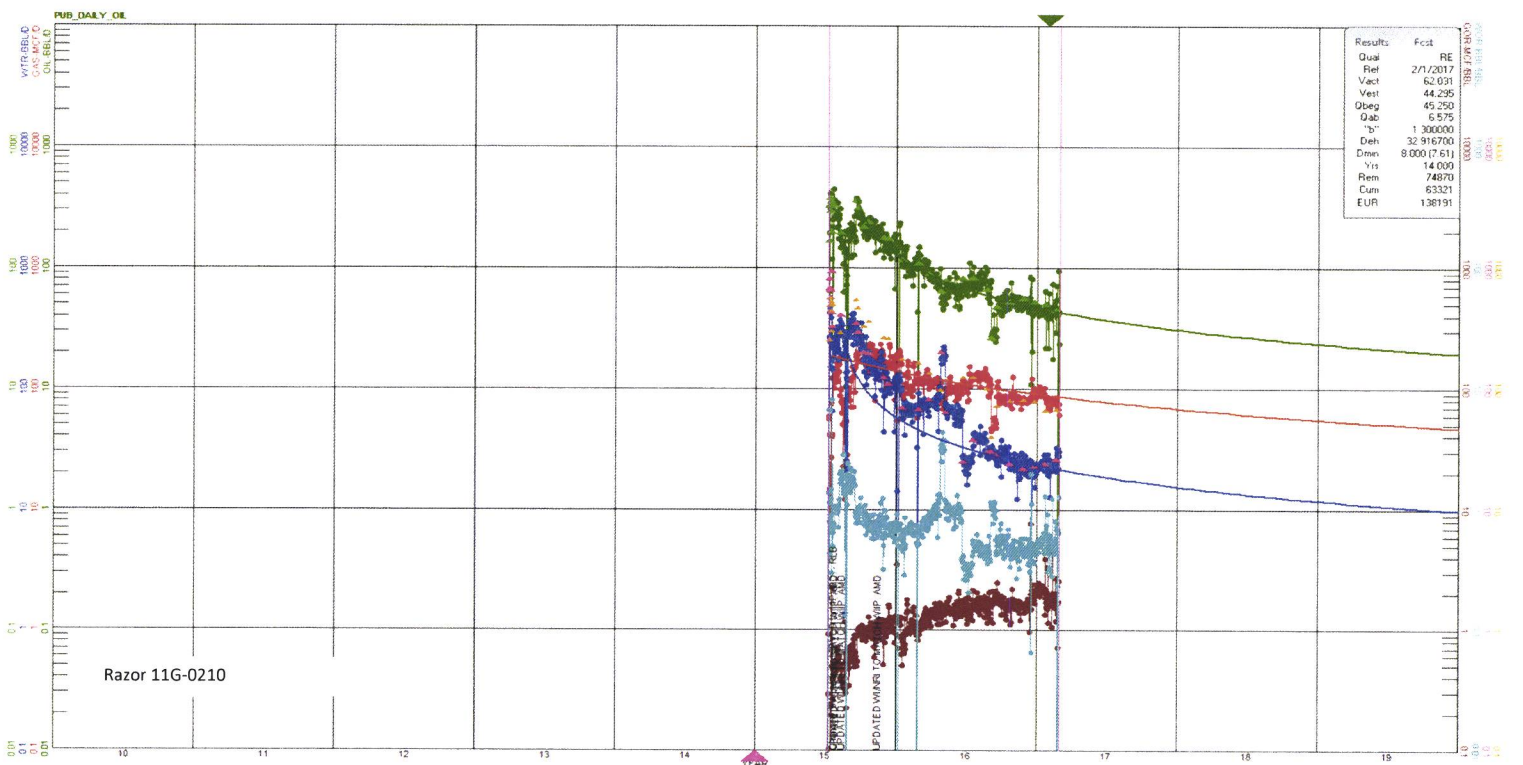
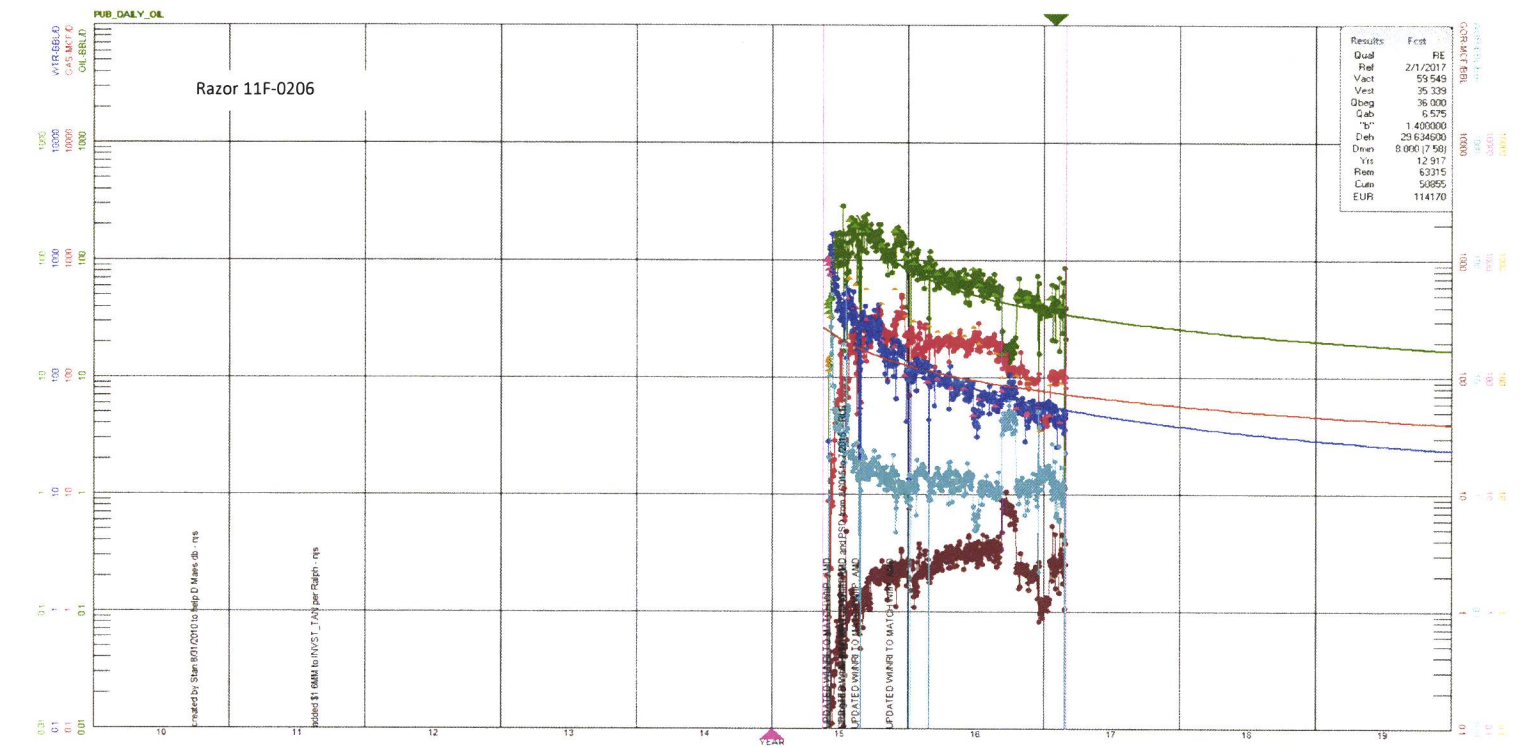
Docket 170600335

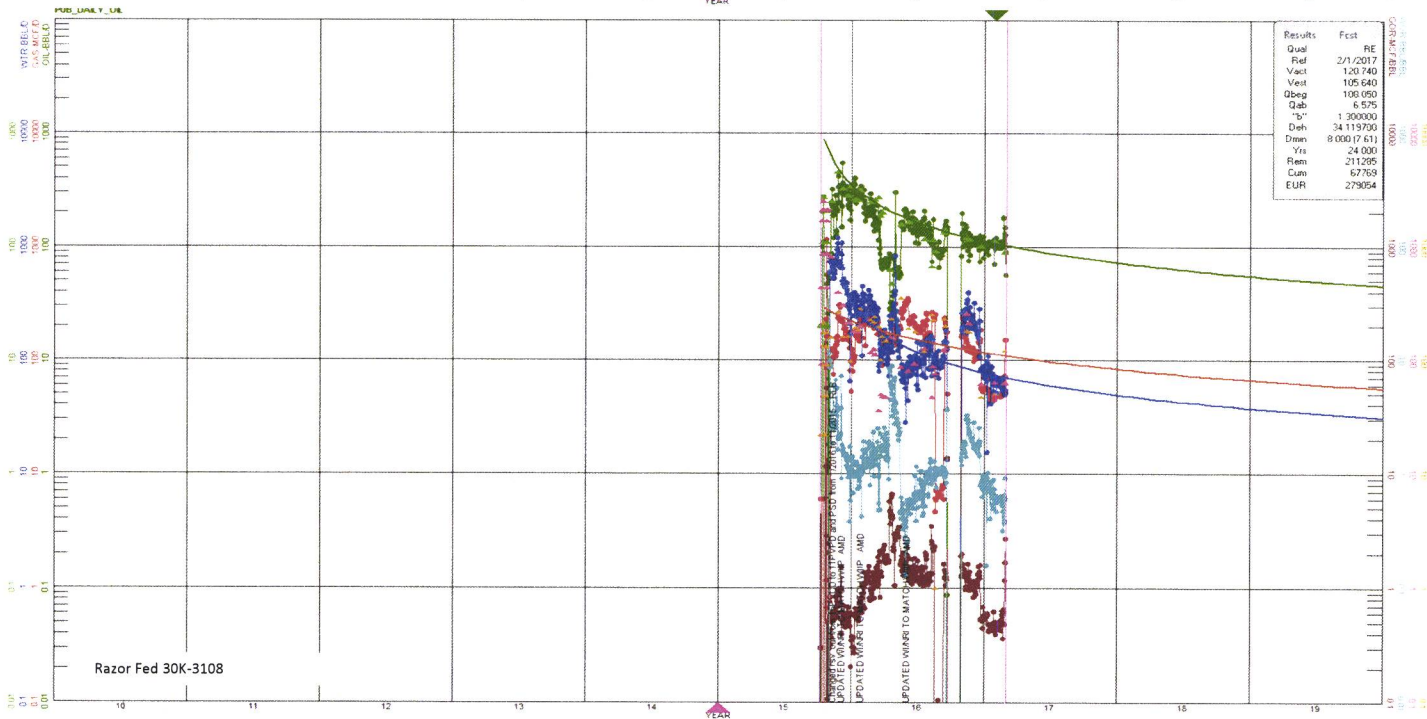
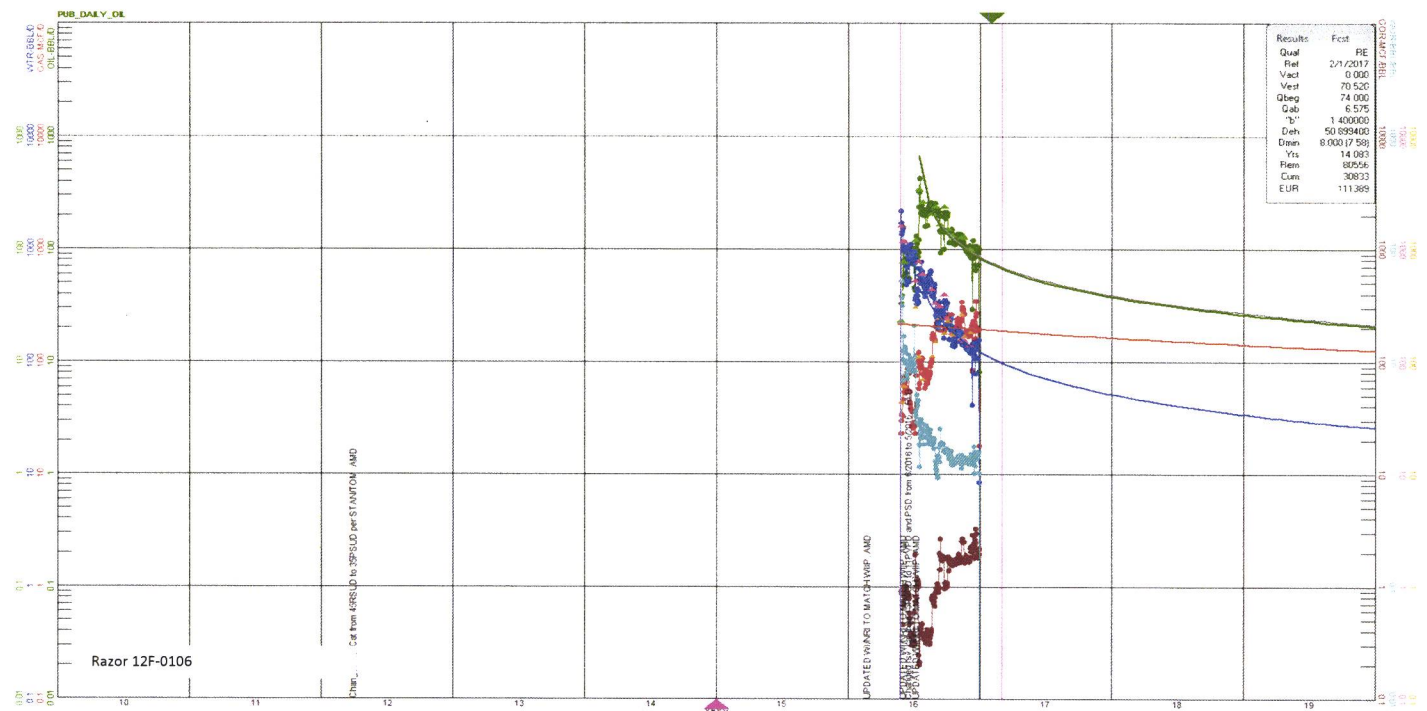
Cause No. 535

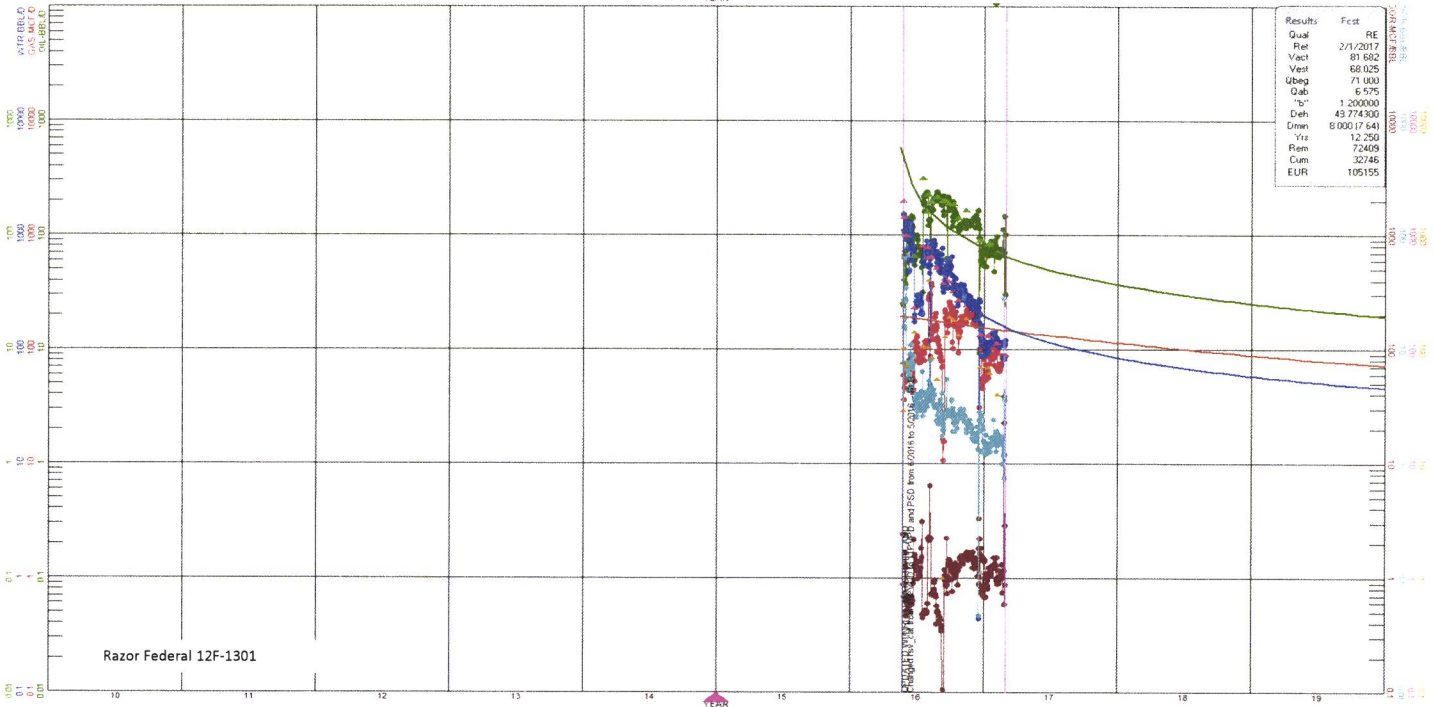
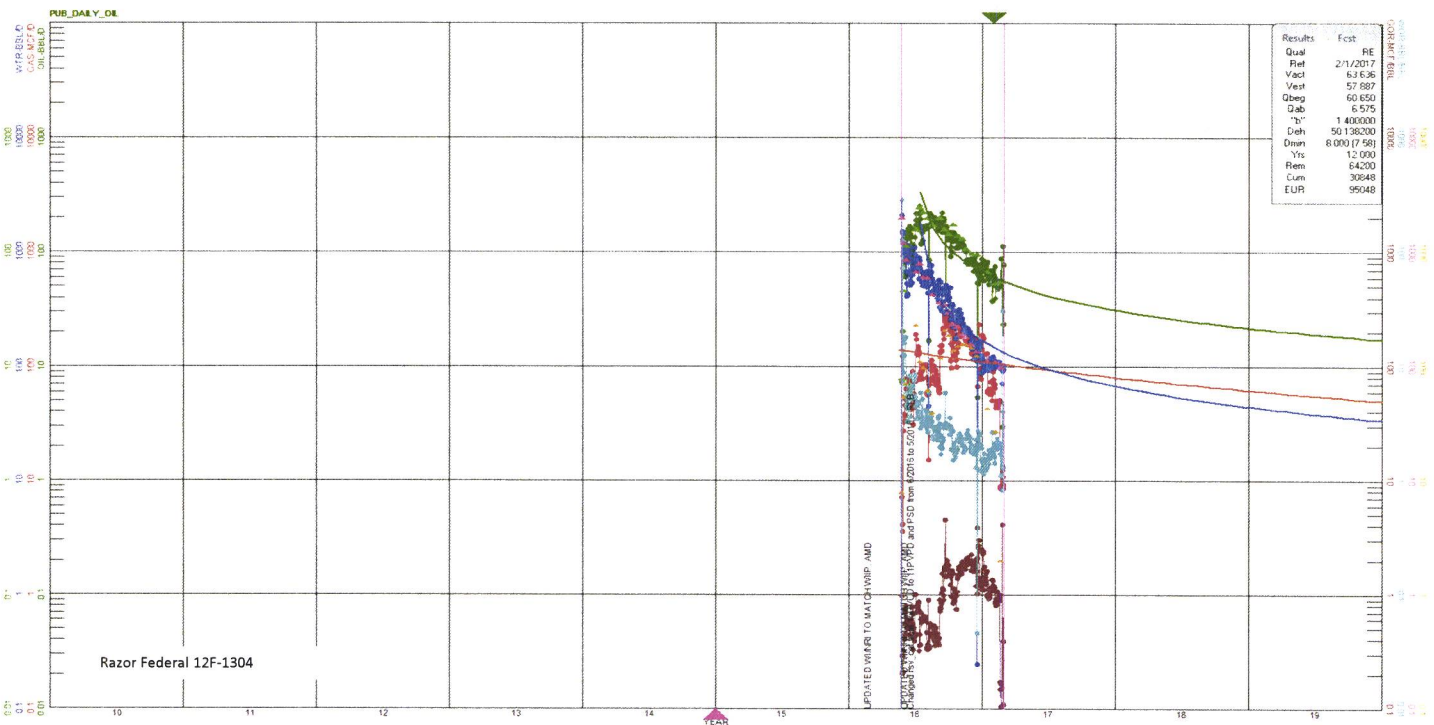


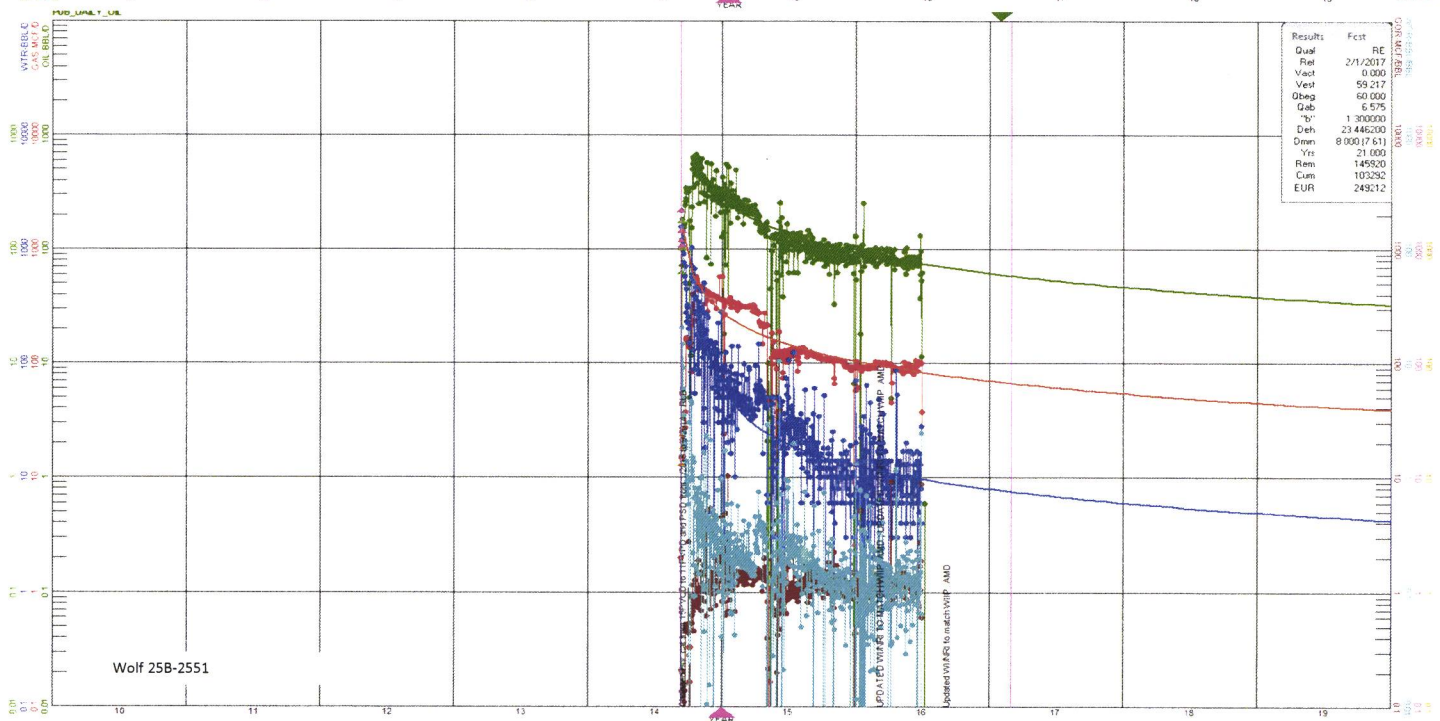
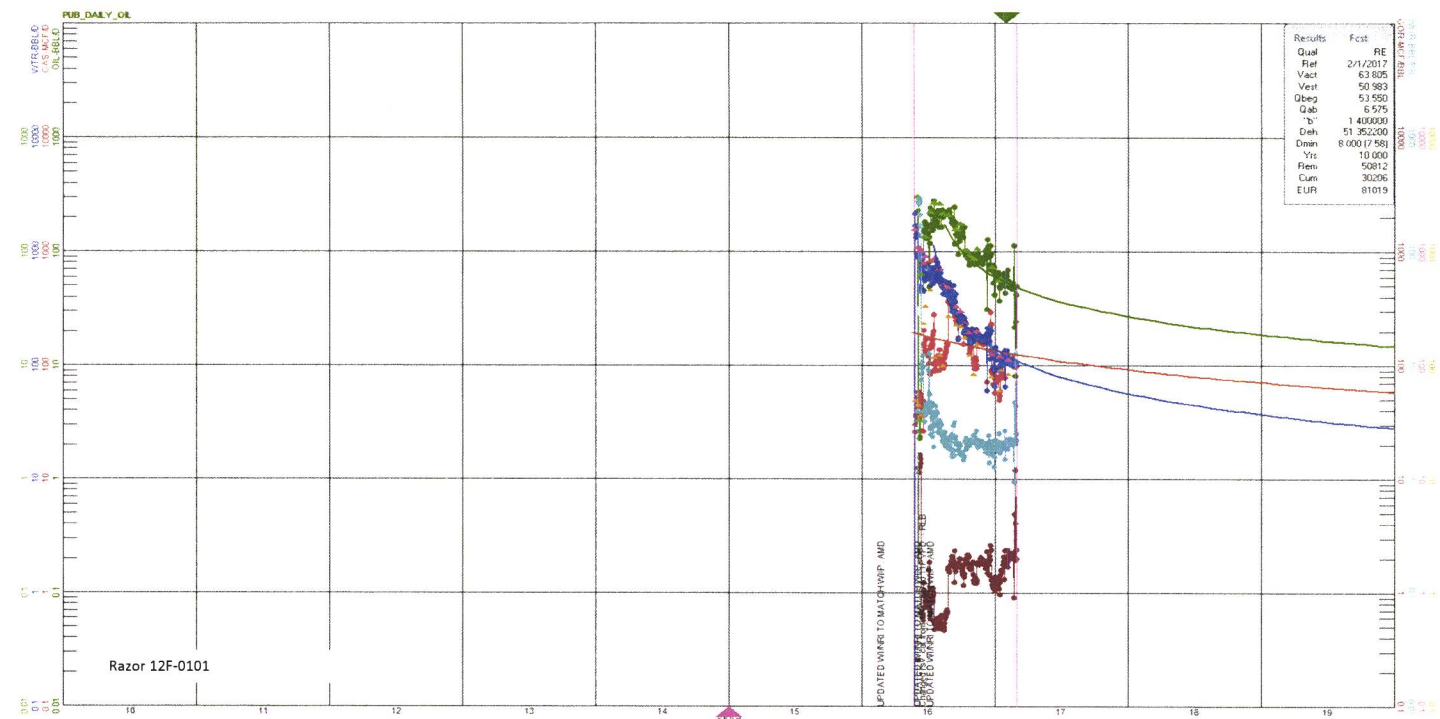








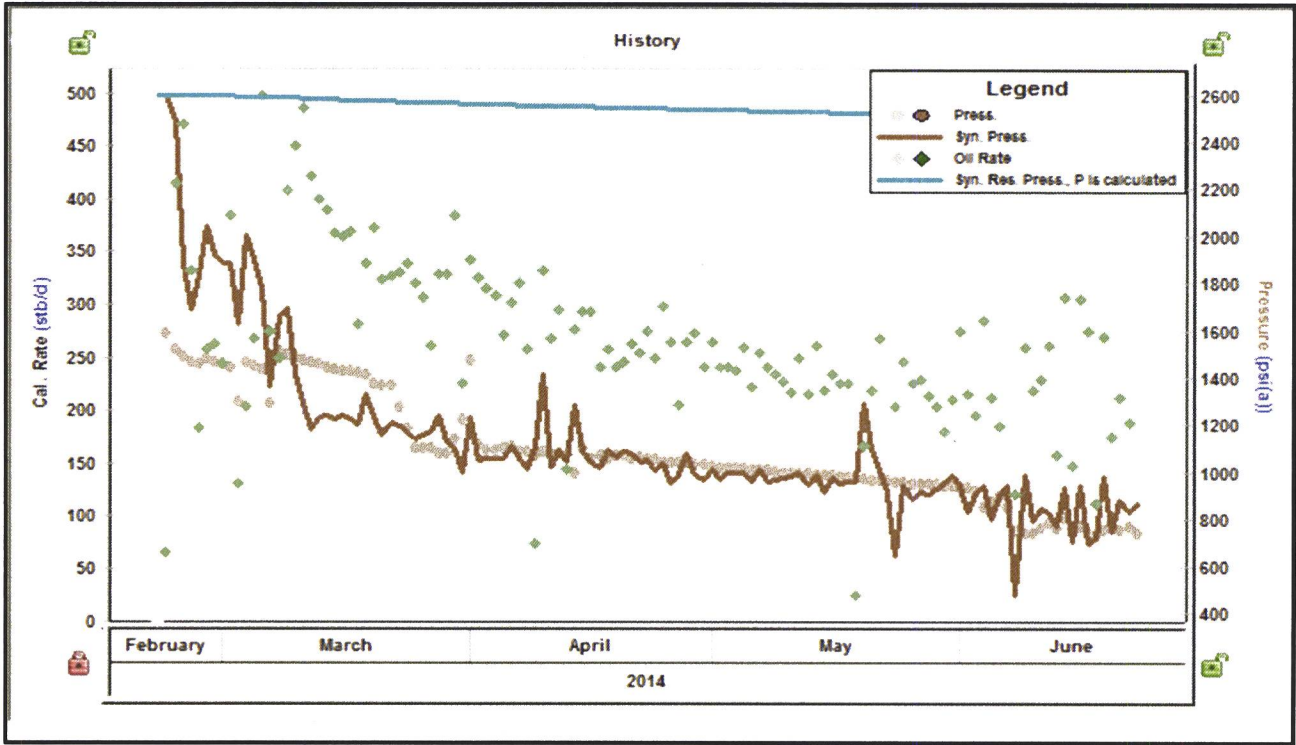
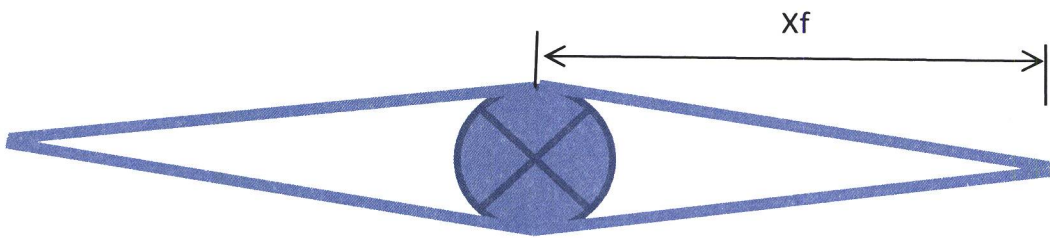




Whiting Niobara B RTA Results

RTA Indicates that Frac Half Lengths average 85 ft and the permeabilty to Oil is only 19 MicroDarcies

Well Name	Drilling Unit	Well Location	Oil Permeability MicroDarcies	Xf ft
Wildhorse 16-13H	640	SEC 16 T9N R59W	17	50
Two Mile 22-13H	640	SEC 22 T11N R57W	17	85
Horsetail 18-0733H	960	SEC 18 T10N R57W	12	105
Wolf 35-2623H	960	SEC 35 T10N R59W	3	100
Horsetail 16-1610BH	640	SEC 16 T10N R57W	24	70
Horsetail 07-611H	960	SEC 18 T10N R57W	40	95
			19	84



1280 Acre Well Layout

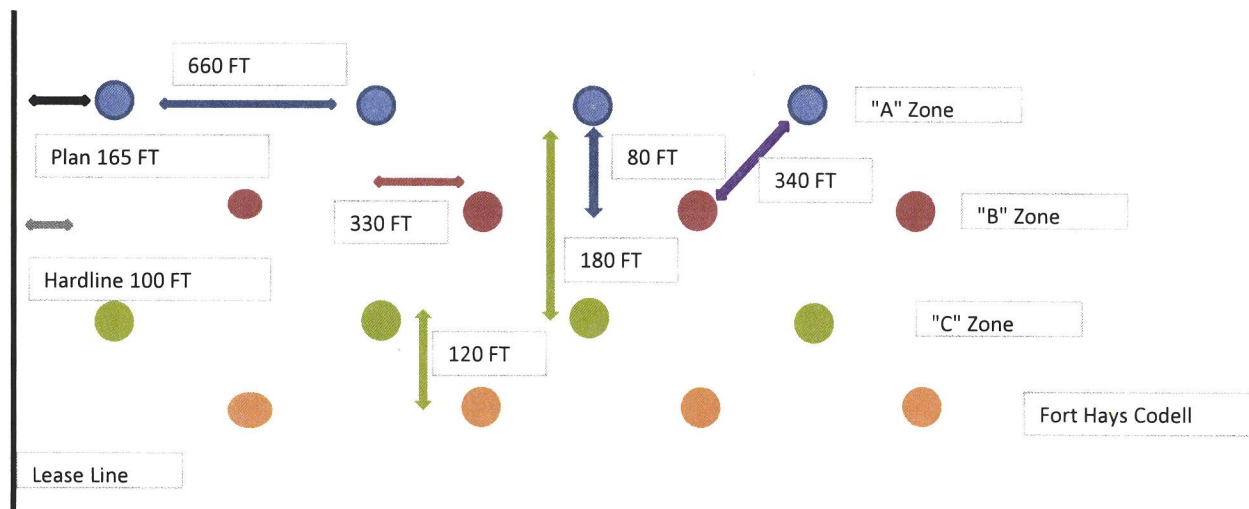


Exhibit E-6
Docket 170600335
Cause No. 535

**TECHNOLOGY LABORATORY, INC.**1012 Centre Avenue
Fort Collins, Colorado 80526
(970) 490-1414**Extended Hydrocarbon Liquid Analysis (DHA)
E & P Tank Information**Whiting Oil & Gas Corp
1700 Broadway
Denver, CO 80290-2300Sampled: 12/18/13
Received: 12/18/13
Analyzed: 12/20/13

Contact: Tom Gibbons

Sample ID: Oil from Separator
Well #: Horizontal 07-0611H
Lab ID: A9547-G1-01
Sampled By: Bill Emery
Analyzed By: Bill EmeryField: Pinnacle Buttes
Cylinder: 150 cc SS
Sample Temperature °F: 132
Sample Pressure (psig): 0
Sampling Method: Water Displacement

COMPONENT	Mole %	Weight %	LV %
Carbon Dioxide	0.000	0.000	0.000
Nitrogen (Air)	0.000	0.000	0.000
Methane	0.000	0.000	0.000
Ethane	0.125	0.036	0.078
Propane	0.000	0.000	0.000
Isobutane	0.000	0.000	0.000
n-Butane	2.190	0.190	0.236
Isopentane	0.000	0.000	0.000
n-Pentane	1.000	0.224	0.279
Cyclopentane	0.000	0.000	0.000
n-Hexane	1.000	0.412	0.500
Cyclohexane	0.000	0.000	0.000
Other n-alkanes	1.214	0.090	0.106
Other isoparaffins	1.000	0.368	0.442
Methylcyclopentane	0.000	0.000	0.000
2,2,4-Trimethylpentane	0.000	0.300	0.360
Benzene	0.000	0.117	0.141
Toluene	0.000	0.156	0.187
Ethylbenzene	0.000	0.131	0.158
Xylenes	0.000	0.172	0.208
C8	3.088	3.343	3.902
C9	3.024	3.330	3.902
C10+	78.222	87.064	78.111
Total	100.000	100.000	100.000

API Gravity (from tank sample): 40.00
Real Vapor Pressure (from tank sample): 8.8

C10+ Average Molecular Weight: 257.0

C10+ specific gravity: 0.871

Analytical Methods: ASTM D-645 ASTM D-6730 DHA

Page 2 of 11

**TECHNOLOGY LABORATORY, INC.****Centre Professional Office Park**1012 Centre Avenue
Fort Collins, Colorado 80526
(970) 490-1414**CERTIFICATE OF ANALYSIS**Whiting Oil & Gas Corp
1700 Broadway
Denver, CO 80290-2300Sampled: 12/10/2013
Received: 12/10/2013
Analyzed: 12/10/2013Sample ID: Horizontal 07-0611H
Sample Point: Separator
Field: Pinnacle
Laboratory ID: A9505-01Cylinder: SS-150
Sample Pressure (psig): 12
Sample Temperature °F: 132

COMPONENT	Mole %	GPM @ 14.696
Oxygen/Nitrogen	0.734	-
CO ₂	2.210	-
Methane	57.398	-
Ethane	15.407	4.100E
Propane	13.454	3.718E
n-Butane	1.676	0.548E
n-Pentane	5.725	1.806E
n-Pentane	1.089	0.398E
n-Pentane	1.311	0.474E
Hexanes Plus	0.951	0.411E
Totals	100.000	11.478E

Gross Wet Real BTU/act at 60°F & 14.696 psia: 1547.29
Gross Dry Real BTU/act at 60°F & 14.696 psia: 1574.69
Relative Density (AIR=1): 0.9608Bill Emery
TECHNOLOGY LABORATORY, INC.

Page 1 of 1

**TECHNOLOGY LABORATORY, INC.**1012 Centre Avenue
Fort Collins, Colorado 80526
(970) 490-1414**Extended Hydrocarbon Liquid Analysis (DHA)
E & P Tank Information**Whiting Oil & Gas Corp
1700 Broadway
Denver, CO 80290-2300Sampled: 12/05/12
Received: 12/05/12
Analyzed: 12/11/12

Contact: Tom Gibbons

Sample ID: Oil from separator
Well #: Razor 12-0141H
Lab ID: A7457-G1-01
Sampled By: Bill Emery
Analyzed By: Bill EmeryField: Pinnacle Buttes
Cylinder: 150 cc SS
Sample Temperature °F: 126
Sample Pressure (psig): 3
Sampling Method: Water Displacement

COMPONENT	Mole %	Weight %	LV %
Carbon Dioxide	0.000	0.000	0.000
Nitrogen (Air)	0.000	0.000	0.000
Methane	0.000	0.000	0.000
Ethane	0.164	0.041	0.082
Propane	2.673	1.046	1.609
Isobutane	0.214	0.104	0.142
n-Butane	0.000	0.000	0.000
Isopentane	0.391	0.237	0.290
n-Pentane	0.729	0.442	0.533
Cyclopentane	0.191	0.107	0.106
n-Hexane	0.000	0.000	0.000
Cyclohexane	0.000	0.000	0.000
Other n-alkanes	0.000	0.000	0.000
Other isoparaffins	2.251	1.951	2.258
Methylcyclopentane	0.000	0.000	0.000
2,2,4-Trimethylpentane	0.000	0.000	0.000
Benzene	0.177	0.117	0.140
Toluene	0.657	0.506	0.644
Ethylbenzene	0.345	0.344	0.300
Xylenes	0.000	0.000	0.000
C8	3.634	3.532	3.538
C9	3.716	3.947	3.955
C10+	79.464	84.421	83.413
Total	100.000	100.000	100.000

API Gravity (from tank sample): 40.00

Real Vapor Pressure (from tank sample): 3.9

Volume of gas per volume of liquid: 0.1471 SCF/bar @ 1770

C10+ Average Molecular Weight: 257.7

C10+ specific gravity: 0.880

Analytical Methods: ASTM D-645 ASTM D-6730 DHA

Page 2 of 88

**TECHNOLOGY LABORATORY, INC.****Centre Professional Office Park**1012 Centre Avenue
Fort Collins, Colorado 80526
(970) 490-1414**CERTIFICATE OF ANALYSIS**Whiting Oil & Gas Corp
1700 Broadway
Denver, CO 80290-2300Sampled: 3/25/2014
Received: 3/25/2014
Analyzed: 3/27/2014Sample ID: Razor 21A
Sample Point: Meter
Field: Pinnacle
Laboratory ID: 81122-01Cylinder: SS-150
Sample Pressure (psig): 7.7
Sample Temperature °F: 60

COMPONENT	Mole %	GPM @ 14.696
Oxygen/Nitrogen	1.151	-
CO ₂	2.681	-
Methane	58.613	-
Ethane	14.660	3.920E
Propane	12.744	3.511E
n-Butane	1.586	0.518E
n-Pentane	5.277	1.663E
n-Pentane	1.011	0.370E
n-Pentane	1.199	0.434E
Hexanes Plus	1.101	0.476E
Totals	100.000	10.895E

Gross Wet Real BTU/act at 60°F & 14.696 psia: 1508.94
Gross Dry Real BTU/act at 60°F & 14.696 psia: 1536.67
Relative Density (AIR=1): 0.9461Bill Emery
TECHNOLOGY LABORATORY, INC.

Page 1 of 1

Exhibit E-7a

Docket 170600335

Cause No. 535



TECHNOLOGY LABORATORY, INC.
CENTRE PROFESSIONAL PARK
1812 Centre Avenue
Fort Collins, Colorado 80526
(970) 226-1414

CERTIFICATE OF ANALYSIS

Whiting Petroleum Corp
1700 Broadway
Denver CO 80290-2300
Sample ID Horizontal 07 0611H
Laboratory ID A9519-01

Sampled 12/18/13
Received 12/18/13
Project No
Redtail Field
Name Water

CAS Number	Parameter	Result	Units	MDL	Method	Date Analyzed
N/A	Specific Gravity	1.0038			ASTM D1298	12/23/13
N/A	Resistivity	0.2793	Ohm Meters @ 68 °F		EPA-120.1	12/23/13
N/A	pH	7.1	Units		EPA-150.1	12/23/13
N/A	Total Dissolved Solids (TDS)	35270	mg/L	5	EPA-160.1	12/23/13
16887-00-5	Chloride	14243	mg/L	1	EPA-300.1	12/23/13
18785-72-3	Sulfate	20.0	mg/L	0.05	EPA-300.1	12/23/13
71-52-3	Bicarbonate	927	mg/L	1	EPA-310.2	12/23/13
57328-76-2	Carbonate (CO ₃)	< 1.0	mg/L	1	EPA-310.2	12/23/13
7440-39-3	Dissolved Barium	20.5	mg/L	0.01	EPA-60108	12/23/13
7440-42-8	Dissolved Boron	20.2	mg/L	0.006	EPA-60108	12/23/13
7440-70-2	Dissolved Calcium	190	mg/L	0.1	EPA-60108	12/23/13
7439-89-6	Dissolved Iron	14.2	mg/L	0.007	EPA-60108	12/23/13
7439-95-4	Dissolved Magnesium	35.5	mg/L	0.02	EPA-60108	12/23/13
7440-09-7	Dissolved Potassium	19.2	mg/L	0.1	EPA-60108	12/23/13
7440-23-5	Dissolved Sodium	8899	mg/L	0.01	EPA-60108	12/23/13
7704-99-6	Dissolved Zirconium	0.077	mg/L	0.01	EPA-60108	12/23/13

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TECHNOLOGY LABORATORY, INC.

The results shown are in this report
relate only to those items tested

Page 1 of 3

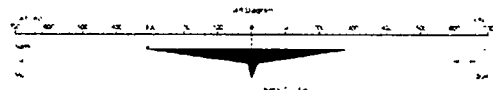


TECHNOLOGY LABORATORY, INC.
CENTRE PROFESSIONAL PARK
1812 Centre Avenue
Fort Collins, CO 80526
(970) 226-1414

CERTIFICATE OF ANALYSIS

Whiting Petroleum Corp
1700 Broadway
Denver CO 80290-2300
Sample ID Horizontal 07 0611H
Laboratory ID A9519-01

CAS Number	Parameter	Result	Units	MDL	Method	Date Analyzed
N/A	Specific Gravity	1.0038			ASTM D1298	12/23/13
N/A	Resistivity	0.2793	Ohm Meters @ 68 °F		EPA-120.1	12/23/13
N/A	pH	7.1	Units		EPA-150.1	12/23/13
N/A	Total Dissolved Solids (TDS)	35270	mg/L	5	EPA-160.1	12/23/13
16887-00-5	Chloride	14243	mg/L	1	EPA-300.1	12/23/13
18785-72-3	Sulfate	20.0	mg/L	0.05	EPA-300.1	12/23/13
71-52-3	Bicarbonate	927	mg/L	1	EPA-310.2	12/23/13
57328-76-2	Carbonate (CO ₃)	< 1.0	mg/L	1	EPA-310.2	12/23/13
7440-39-3	Dissolved Barium	20.5	mg/L	0.01	EPA-60108	12/23/13
7440-42-8	Dissolved Boron	20.2	mg/L	0.006	EPA-60108	12/23/13
7440-70-2	Dissolved Calcium	190	mg/L	0.1	EPA-60108	12/23/13
7439-89-6	Dissolved Iron	14.2	mg/L	0.007	EPA-60108	12/23/13
7439-95-4	Dissolved Magnesium	35.5	mg/L	0.02	EPA-60108	12/23/13
7440-09-7	Dissolved Potassium	19.2	mg/L	0.1	EPA-60108	12/23/13
7440-23-5	Dissolved Sodium	8899	mg/L	0.01	EPA-60108	12/23/13
7704-99-6	Dissolved Zirconium	0.077	mg/L	0.01	EPA-60108	12/23/13



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TECHNOLOGY LABORATORY, INC.

Estimation of Frac Height Growth using Tracer Data

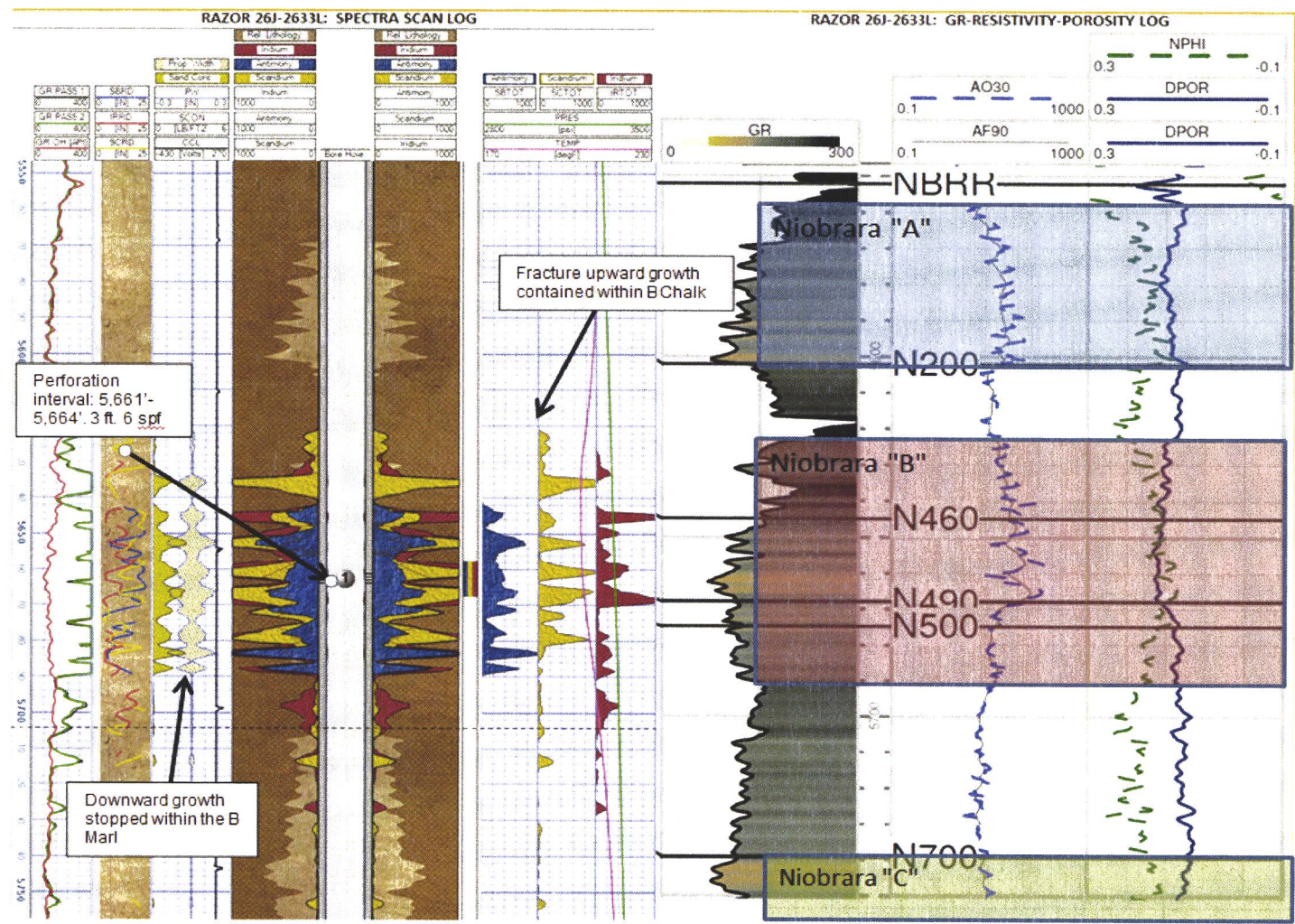


Exhibit E-8
Docket 170600335
Cause No. 535

051233249100
 WHITING OIL & GAS CORP.
TERRACE 36-32M
 T10N R59W S36

KB 4.905
 TD 6.928

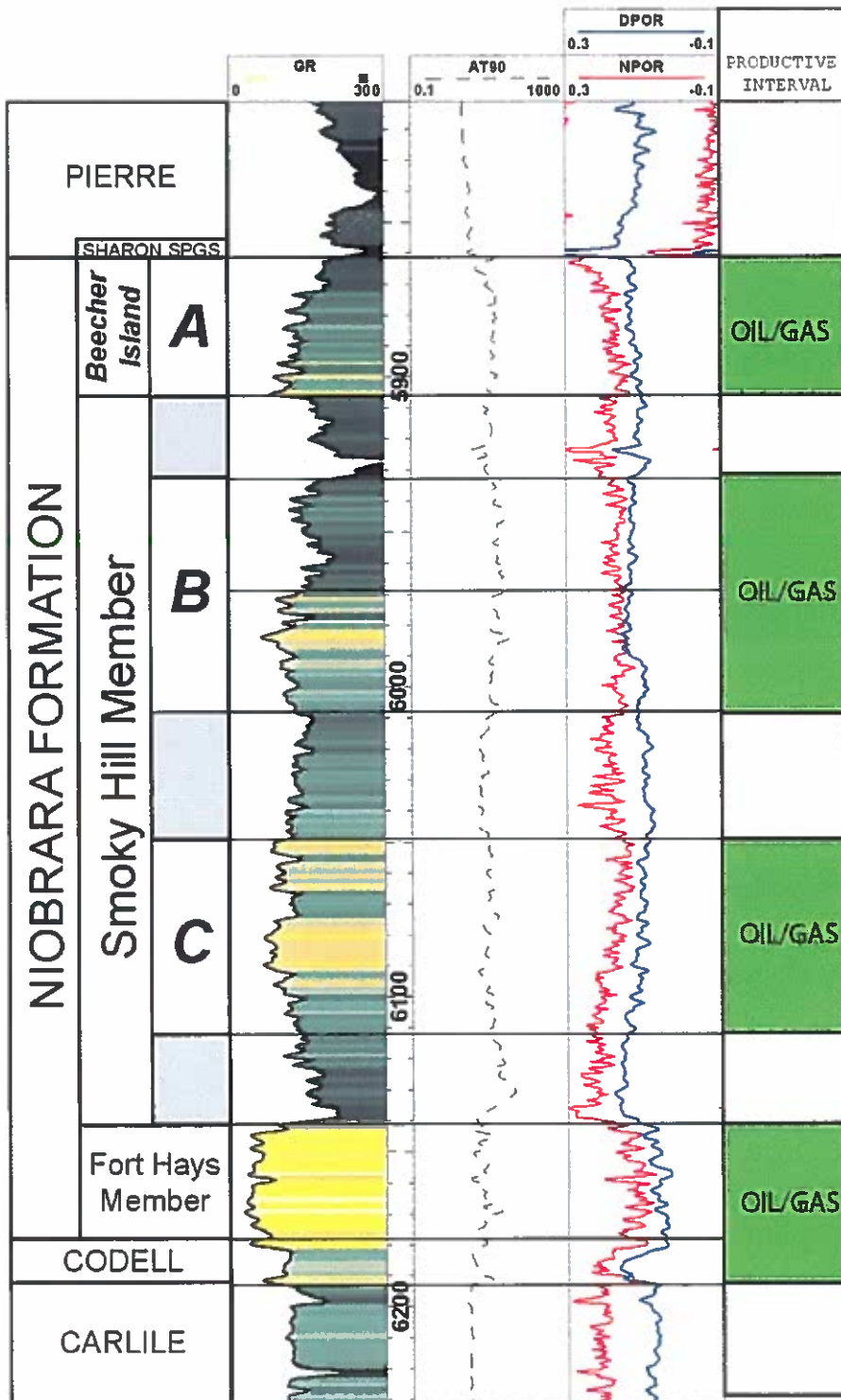
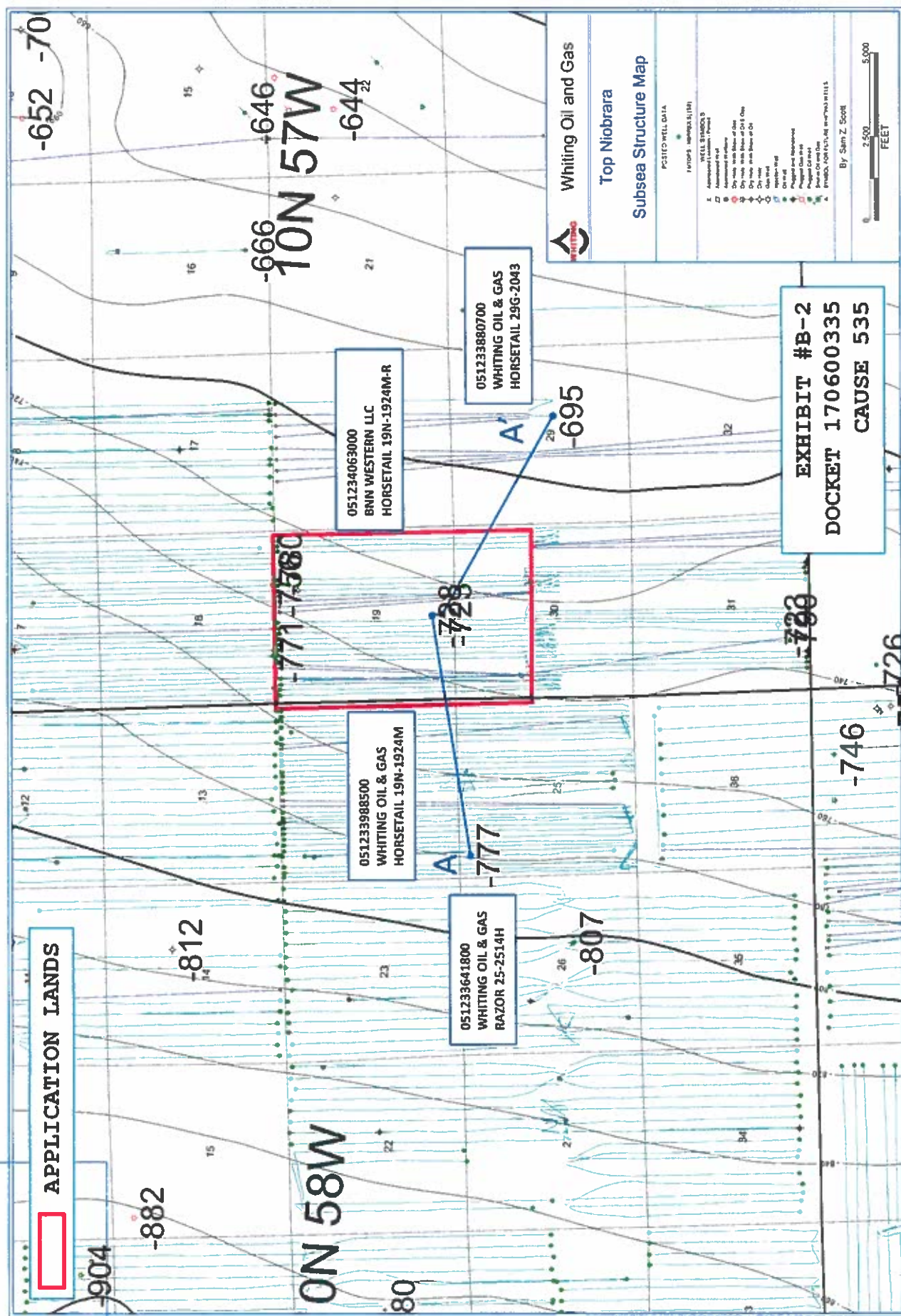


EXHIBIT #B-1
 DOCKET 170600335
 CAUSE 535

170600335



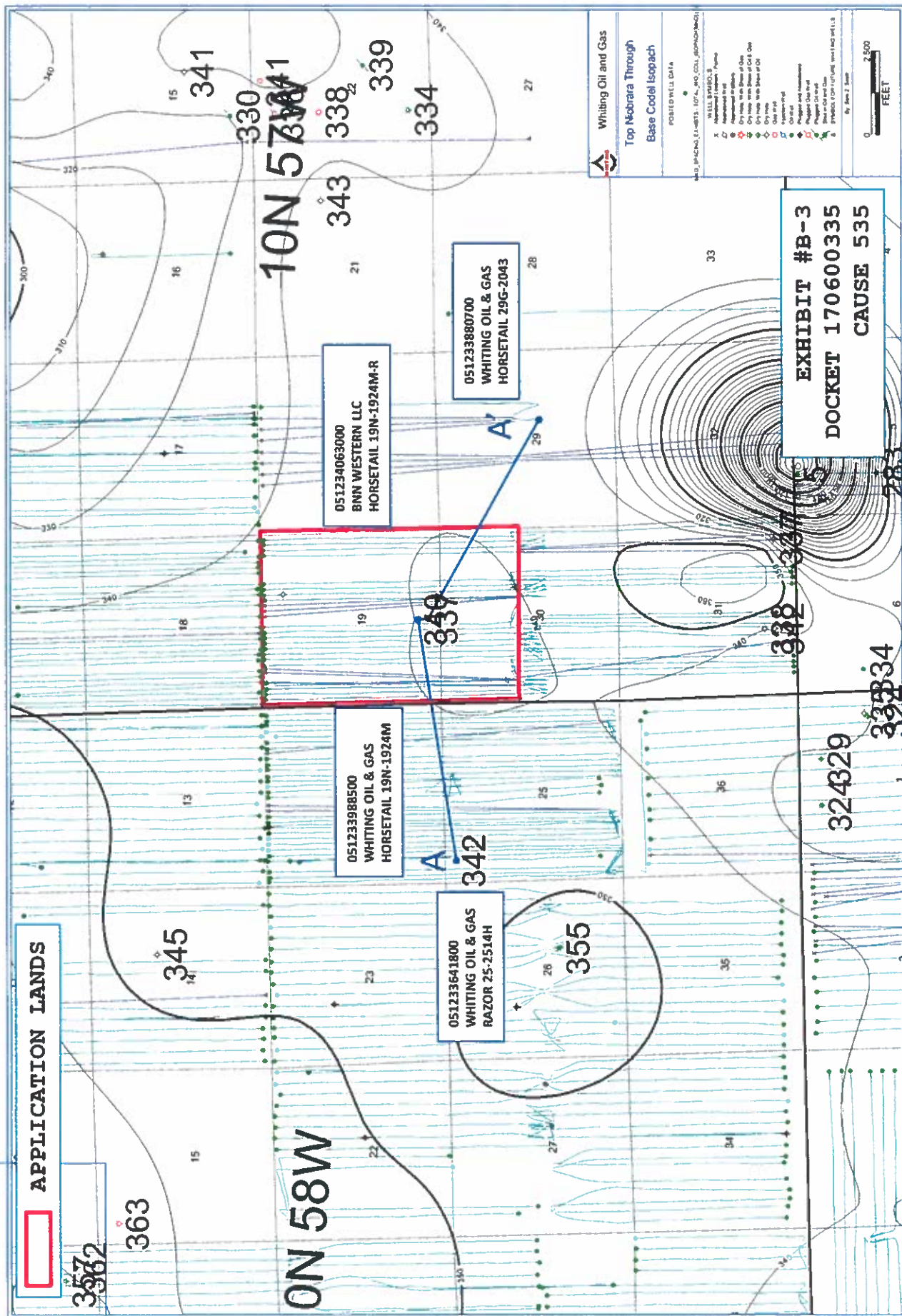


EXHIBIT #B-4

DOCKET 170600335

CAUSE 535

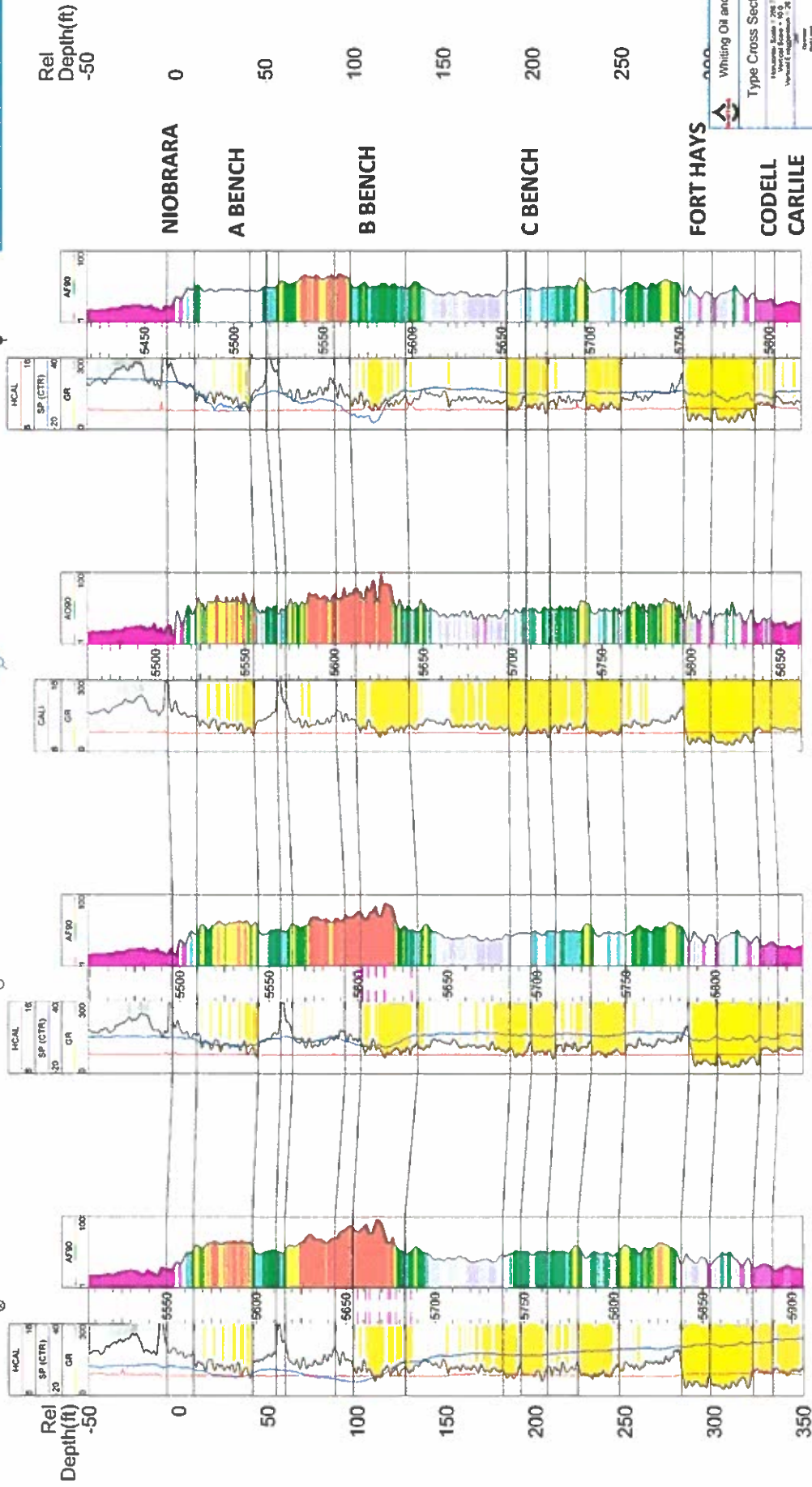
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051233880700
WOGC
HORSETAIL 29G-2043
T10N R57W S29

051234063000
BNN WESTERN LLC
HORSETAIL 19N-1924M-R
T10N R57W S19

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WOGC
HORSETAIL 19N-1924M
T10N R57W S19

051233641800
WHITING OIL & GAS
RAZOR 25-2514H
T10N R58W S25



Whiting Oil and Gas
Type Cross Section
Horizontal Scale = 200'
Vertical Exaggeration = 20:1
Date: 10/1/00
By: [Signature]