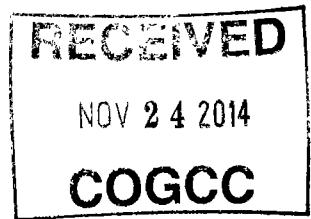




02235956

11.24.14

## **511 DOCUMENTS**



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

|                                     |   |                         |
|-------------------------------------|---|-------------------------|
| IN THE MATTER OF THE PROMULGATION   | ) | CAUSE NO. 421           |
| AND ESTABLISHMENT OF FIELD RULES TO | ) |                         |
| GOVERN OPERATIONS FOR THE CODELL    | ) | DOCKET NO. 1412-SP-2217 |
| FORMATION, HEREFORD FIELD, WELD     | ) |                         |
| COUNTY, COLORADO                    | ) |                         |

REQUEST FOR RECOMMENDATION OF  
APPROVAL OF APPLICATION WITHOUT A HEARING

Anadarko E&P Onshore LLC ("Applicant"), by and through its undersigned attorneys, hereby 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 October 16, 2014 verified application ("Application") and the supporting exhibits without a hearing.

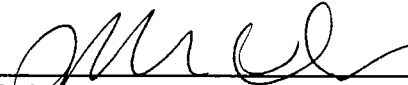
Applicant requests that the above-captioned matter be approved based upon: (i) the merits of the Application, and (ii) Applicant's sworn written testimony verifying sufficient facts along with exhibits that adequately support the relief requested in the Application. To Applicant's information and belief,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

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

DATED this 24<sup>th</sup> day of November, 2014.

Respectfully submitted,

ANADARKO E&P ONSHORE LLC

By:   
Robert A. Willis  
Jillian Fulcher  
Beatty & Wozniak, P.C.  
Attorneys for Applicant  
216 16<sup>th</sup> Street, Suite 1100  
Denver, Colorado 80202  
(303) 407-4499



**Cause Nos. 421 & 535, Docket No. 1410-SP-2217**

# **Anadarko Petroleum Corporation**

## **Jason Rayburn – Land Testimony** Cause 535, Docket No. 1412-SP-2217

*Request to establish an approximate 1,298.98-acre drilling and spacing unit for Sections 13 (small lots located in Colorado), 24 and 25, Township 12 North, Range 64 West, 6<sup>th</sup> P.M., and authorize one horizontal well within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell Formation*

My name is Jason Rayburn, and I am currently employed as a Landman for Anadarko Petroleum Corporation (“Anadarko”). I graduated from the University of Oklahoma in 2008 with a Bachelor of Science in Business Administration with an emphasis in Energy Management. I have over 8 years of experience in petroleum land management and administrative areas of the oil and gas business. I am familiar with the lands subject to, and the matters set forth in the October 16, 2014, verified 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 the basis for the Application requesting to establish an approximate 1,298.98-acre drilling and spacing unit for Sections 13 (small lots located in Colorado), 24 and 25, Township 12 North, Range 64 West, 6<sup>th</sup> P.M. (the “Application Lands”), and authorize one horizontal well within the proposed unit, for production of oil, gas and associated hydrocarbons from the Codell Formation.

1. Exhibit No. L-1

Exhibit No. L-1 is an overhead map which shows the location of the Application Lands within Weld County, Colorado.

2. Exhibit No. L-2

Exhibit No. L-2 is a map which demonstrates Anadarko’s mineral interest in the Application Lands.

*Testimony and Conclusions*

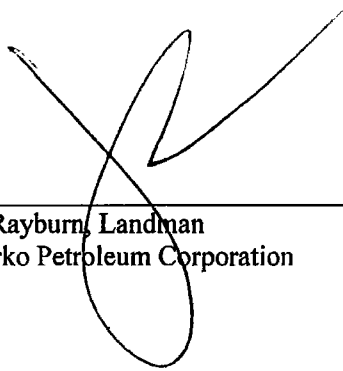
Anadarko owns substantial mineral interests within the approximate 1,298.98-acre drilling and spacing unit proposed for the Application Lands.

Based on the examination of relevant contracts and records, the interested parties (owners within the proposed drilling and spacing unit) have been duly served with the Application and associated Notice of Hearing. Further, as of the date of this testimony, Anadarko 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, correct and accurate.



DATED this 24<sup>th</sup> day of November, 2014.

  
\_\_\_\_\_  
Jason Rayburn, Landman  
Anadarko Petroleum Corporation

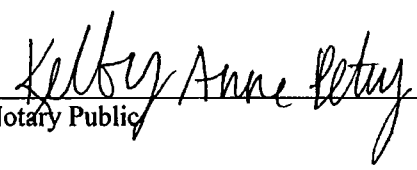
VERIFICATION

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

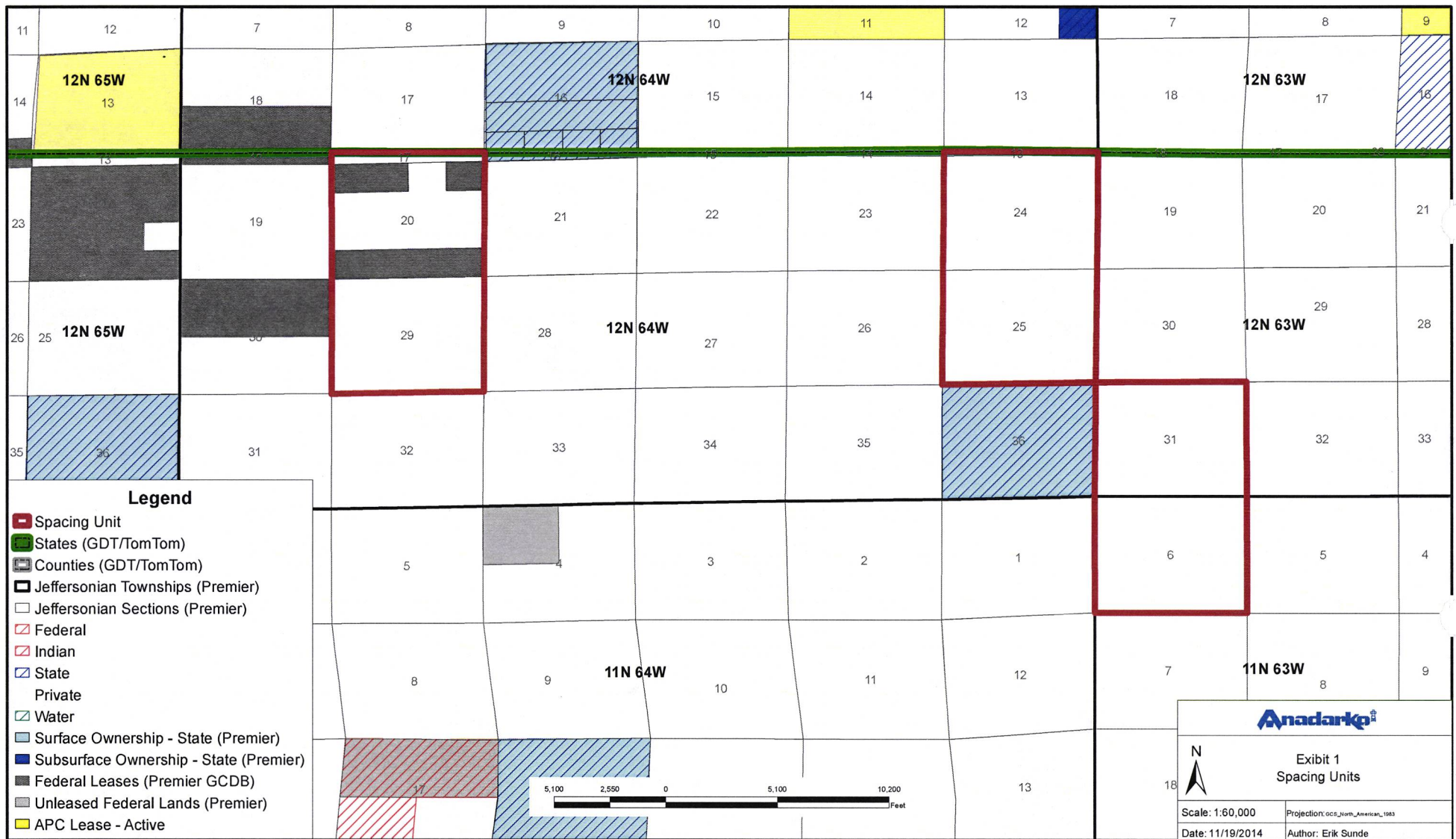
The foregoing instrument was subscribed and sworn to before me this 24<sup>th</sup> day of November, 2014, by Jason Rayburn, Landman for Anadarko Petroleum Corporation.

Witness my hand and official seal.

My commission expires: 9/9/17.

  
\_\_\_\_\_  
Notary Public

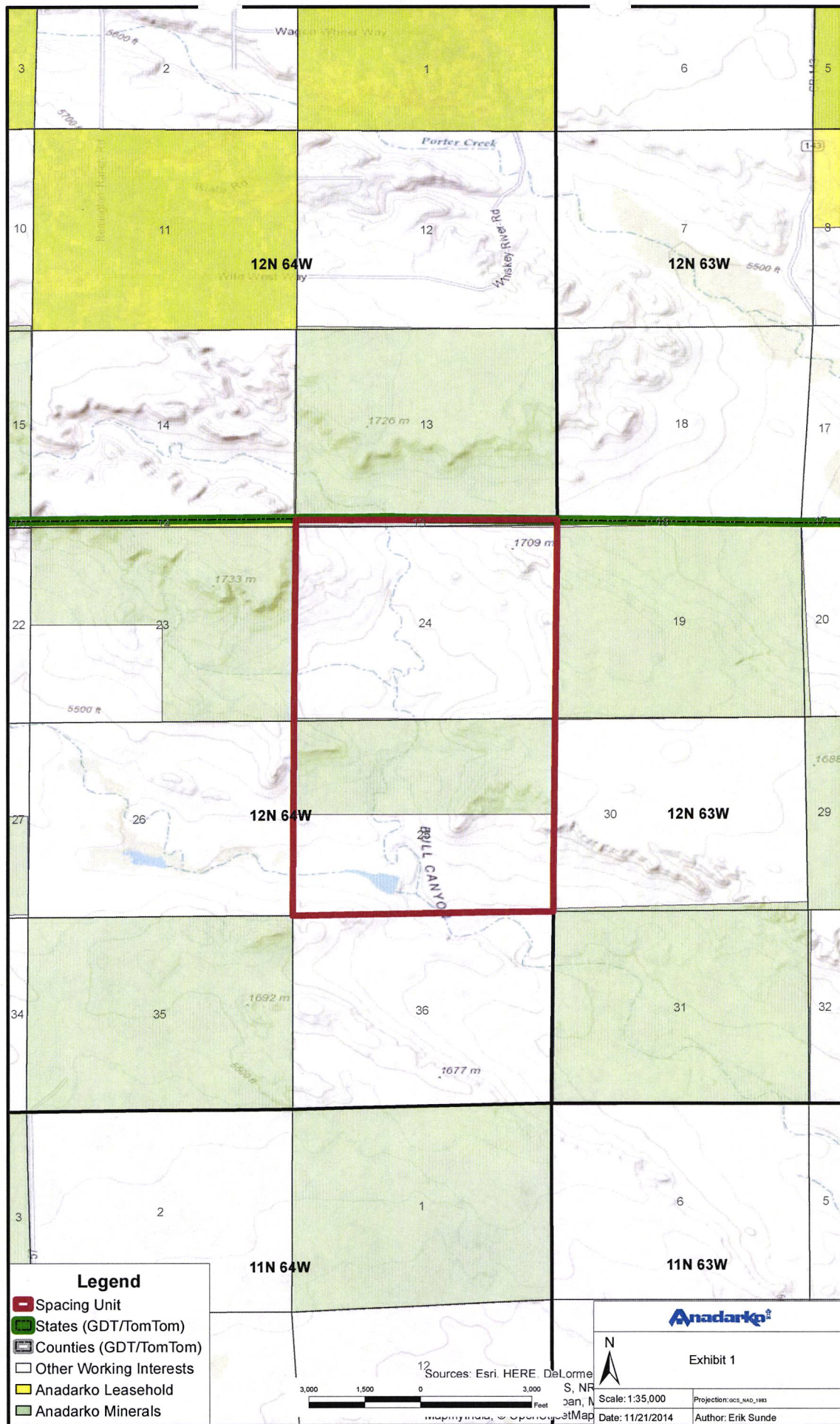
KELBY ANNE PETRY  
NOTARY PUBLIC  
STATE OF COLORADO  
NOTARY ID 20134056601  
MY COMMISSION EXPIRES 09/09/2017



For internal information only. Depicted information is subjective and its accuracy has not been verified. Printed or saved versions may be outdated. Depictions and information are intended to be confidential, and may be subject to legal restrictions or protections.

For questions regarding appropriate use, contact the GSC (x62900).

Path: L:\SharedData\Denver\RockiesLand\GIS\Projects\Wattenberg\mxd\ResolutionExhibit\_December\_Hearing\_Area1.mxd







## **Thomas. A. Berkman – Geologic Testimony**

### **Docket Numbers:**

*1412-SP-2216*

*1412-SP-2217*

*1412-SP-2219*

My name is Tom Berkman and I am currently employed as a Senior Project Geological Advisor for Anadarko Petroleum in Denver. I graduated from Colorado College in Colorado Springs with a B.A. Degree in Geology, and from Oregon State University in Corvallis, OR with an M.S. in Geoscience. I have over 27 years of experience in the oil and gas industry. I am familiar with the land subject to and the matters set forth in the October 16, 2014 verified Applications filed herein. My resume/cv is attached to this submission. See APPENDIX.

In support of the above-docketed Applications, I am submitting 5 exhibits. The exhibits are attached to my sworn testimony and form the basis of the Applications requesting an order to establish 3 - approximate 1280 acre drilling and spacing units for the Codell sandstone and/or Niobrara shale. They also authorize the drilling of 1 - horizontal well per spacing unit for the production of oil, gas and associated hydrocarbons.

### **Exhibit G-1**

Exhibit G-1 is a Type Log of the Upper Cretaceous stratigraphy of the northern D-J Basin. The Niobrara Formation consists of 2 informal members, the Smokey Hill shale, and the Fort Hayes limestone, which directly overlies the Codell. The Pierre Shale overlies the Niobrara. The Carlisle shale is present below the Codell sandstone.

### **Exhibit G-2**

Exhibit G-2 is a structure map on the top of the Codell/base Niobrara showing the proposed drilling and spacing units. The map shows the structure dipping gently to the west at approximately 50 ft / mile across the proposed units.

### **Exhibit G-3**

Exhibit G-3 is a net pay isopach map of the Codell sandstone. Thickness of the Codell ranges from 16 ft in the south part of the map to approximately 20 ft along the Colorado – Wyoming border.

### **Exhibit G-4**

Exhibit G-4 is a net pay isopach map of the Niobrara shale. Thickness of the Niobrara net pay ranges from less than 135 ft in the west to approximately 145 ft along the east portion of the map.

## Exhibit G-5

Exhibit G-5 is a west to east stratigraphic cross-section across the proposed drilling and spacing units, hung on the top of the Codell sandstone. It is evident that the Codell sandstone and Niobrara shale exists under the Application Lands.

### ***Conclusions***

The Codell sandstone consists of a very fine-grained laminated sandstone, interbedded with bioturbated sands and silts which were deposited in a marine setting during the Cretaceous Western Interior Seaway. This tight sandstone has been producing oil and gas in the DJ Basin for dozens of years, and exists under all of the drilling and spacing units proposed in the Applications.

The Niobrara consists of 2 informal members, the Smoky Hill shale member and the Fort Hayes limestone member, deposited during a major marine transgression in the Cretaceous Western Interior Seaway. The Niobrara is a self-sourced resource play that is present throughout much of the Rocky Mountain region.

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

**VERIFICATION**

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

Tom Berkman

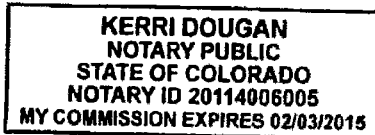
Thomas A. Berkman  
Sr. Project Geological Advisor  
Anadarko Petroleum

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

The foregoing instrument was subscribed and sworn to before me this 20<sup>th</sup> day of November, 2014, by Thomas A. Berkman, Sr. Project Geological Advisor for Anadarko Petroleum.

Witness my hand and official seal.

My commission expires: 02/03/2015



Notary Public Kerri Dougan



Colorado Oil and Gas Conservation Commission Hearings  
December 15th, 2014

# Docket #'s

|                     |                              |
|---------------------|------------------------------|
| <i>1412-SP-2216</i> | <i>Niobrara</i>              |
| <i>1412-SP-2217</i> | <i>Codell</i>                |
| <i>1412-SP-2219</i> | <i>Codell &amp; Niobrara</i> |

## Geological Exhibits

Tom Berkman  
Sr Project Geological Advisor  
Anadarko Petroleum  
Denver, CO

# Upper Cretaceous Type Log Northern DJ Basin

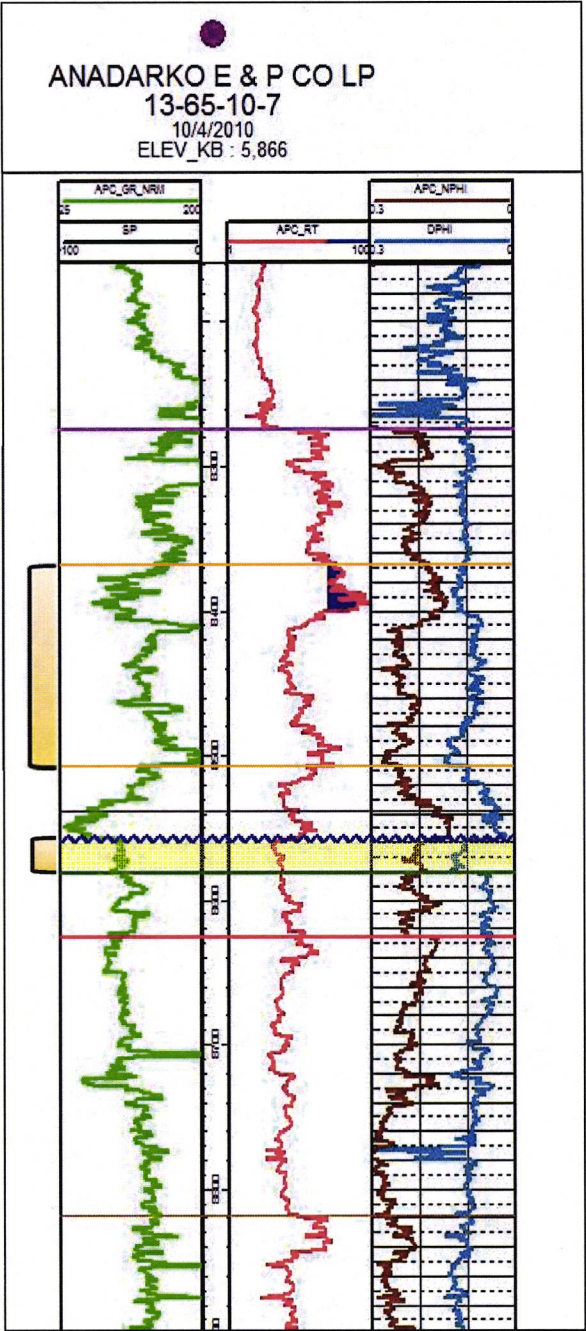
Upper Cretaceous

Niobrara

Greenhorn

Niobrara 'H'

Codell 'H'



Pierre Shale

Smoky Hill Shale  
Member

Ft Hayes Ls

**Codell Ss**

Carlise Sh

Limestone mbr

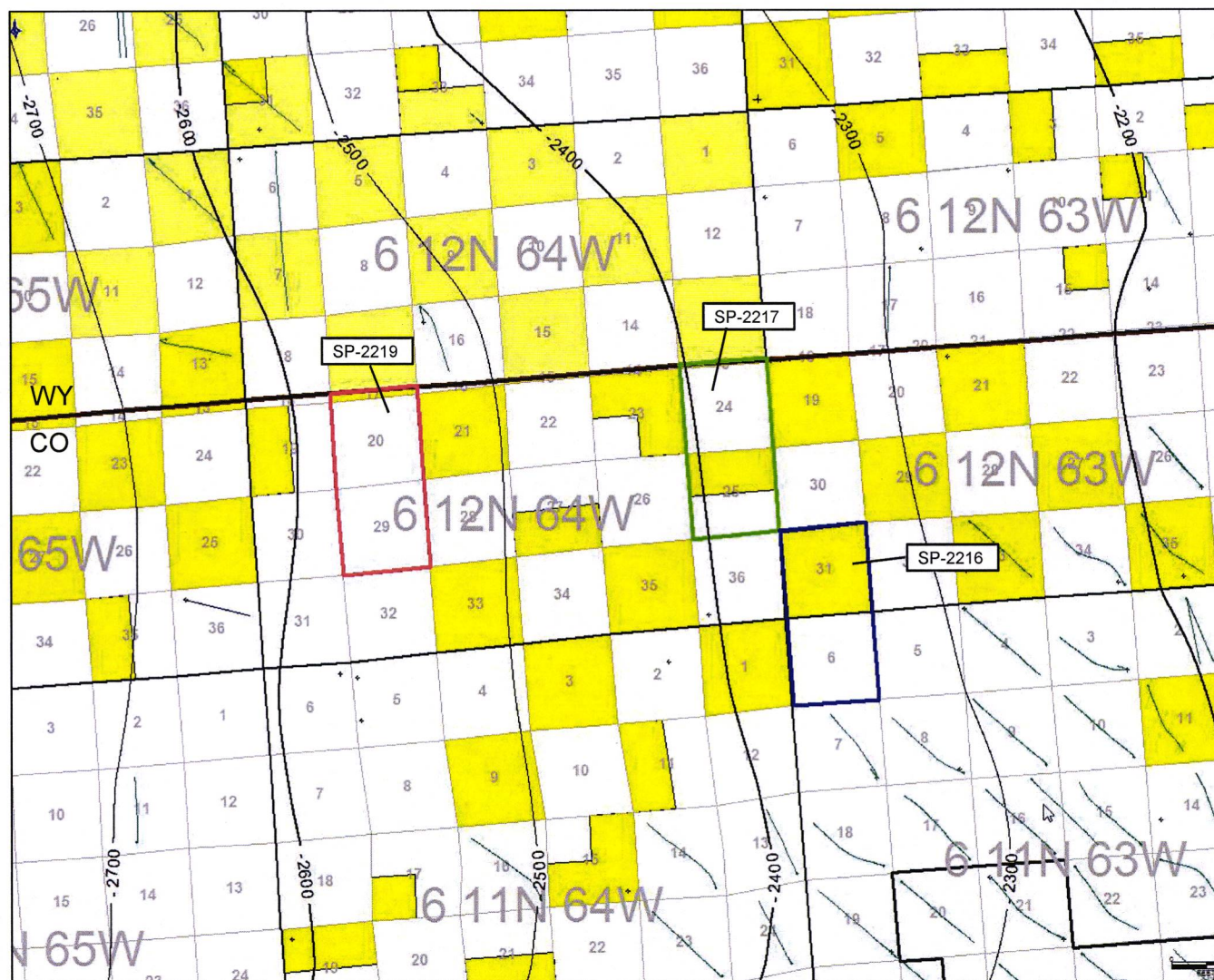
## Geological Exhibit 1 Dockets:

|              |                   |
|--------------|-------------------|
| 1412-SP-2216 | Niobrara          |
| 1412-SP-2217 | Codell            |
| 1412-SP-2219 | Codell & Niobrara |



# Top Codell (Base Niobrara) Structure Map (ss)

Geological Exhibit 2 Dockets:



- 1412-SP-2216 Niobrara
- 1412-SP-2217 Codell
- 1412-SP-2219 Codell & Niobrara

Anadarko Petroleum

## Northern DJ Basin

Top Codell Structure Map

Codell Spacing Applications

- WELL SYMBOLS
- AFE's
  - DRY & ABANDON WITH OIL SHOWS
  - DRY AND ABANDON
  - Dry Hole
  - Junked and Abandoned
  - Microseismic Monitor Well
  - OIL WELL
  - PLUGGED & ABANDONED
  - Waiting on Permit
  - PILOT HOLE
  - SERVICE WELL
  - SPUD-A
  - AT-TD

By: T. Beckman

0 10,000  
FEET



Proposed Codell &  
Niobrara Spacing Units



Proposed Codell  
Spacing Units



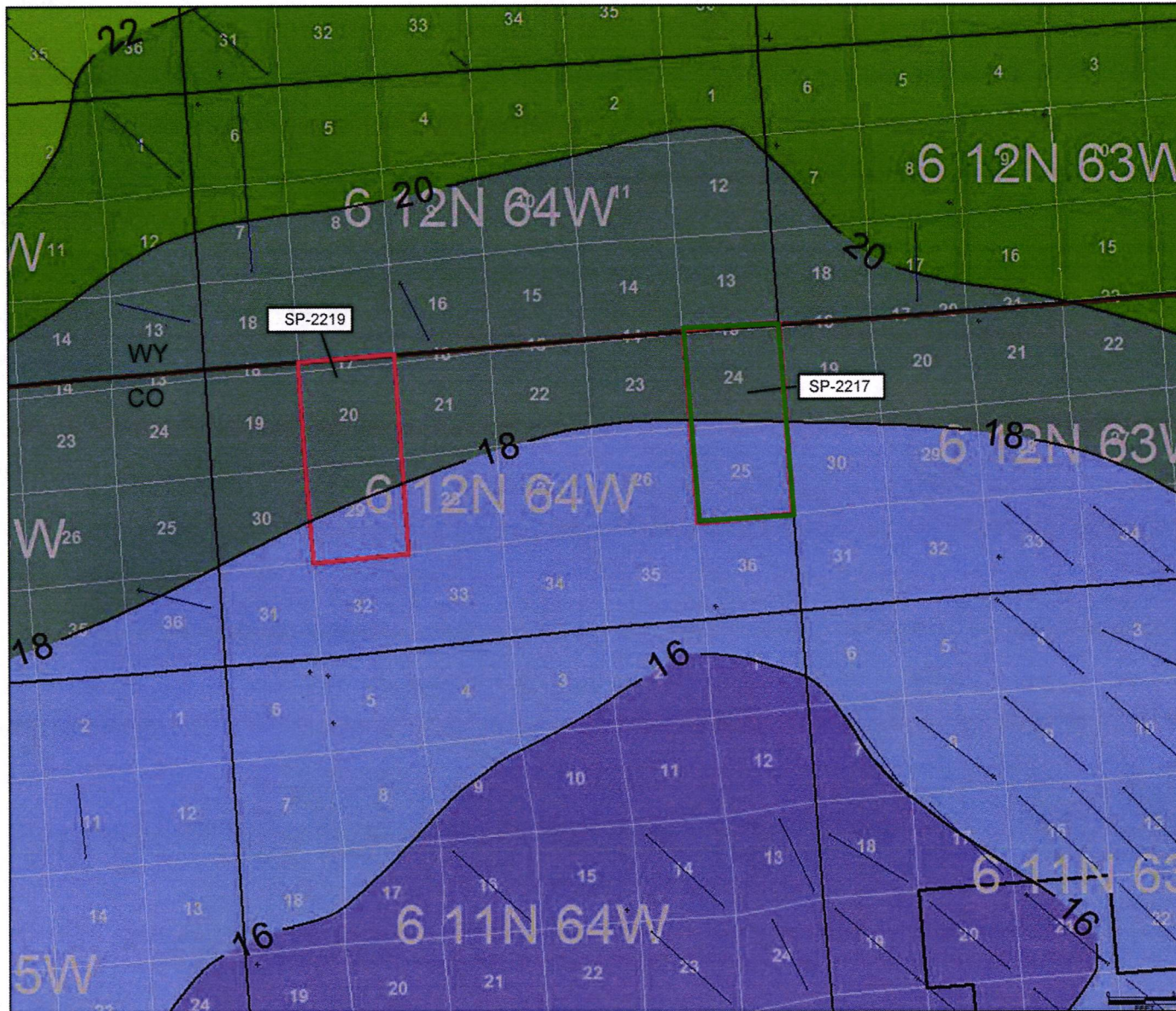
Proposed Niobrara  
Spacing Units





# Codell Net Pay Isopach Map (ft)

Geological Exhibit 3 Dockets:



1412-SP-2217 Codell

1412-SP-2219 Codell & Niobrara

Anadarko Petroleum

Northern DJ Basin

Codell Net Pay Isopach  
Codell Spacing Applications

- WELL SYMBOLS
- AFE's
  - DRY & ABANDON WITH OIL SHOWS
  - DRY AND ABANDON
  - Dry Hole
  - Junked and Abandoned
  - Microseismic Monitor Well
  - OIL WELL
  - PLUGGED & ABANDONED
  - Waiting on Permit
  - PILOT HOLE
  - SERVICE WELL
  - SPUD-A
  - AT-TD

By: T. Berkman

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FEET



Proposed Codell &  
Niobrara Spacing Units



Proposed Codell  
Spacing Units



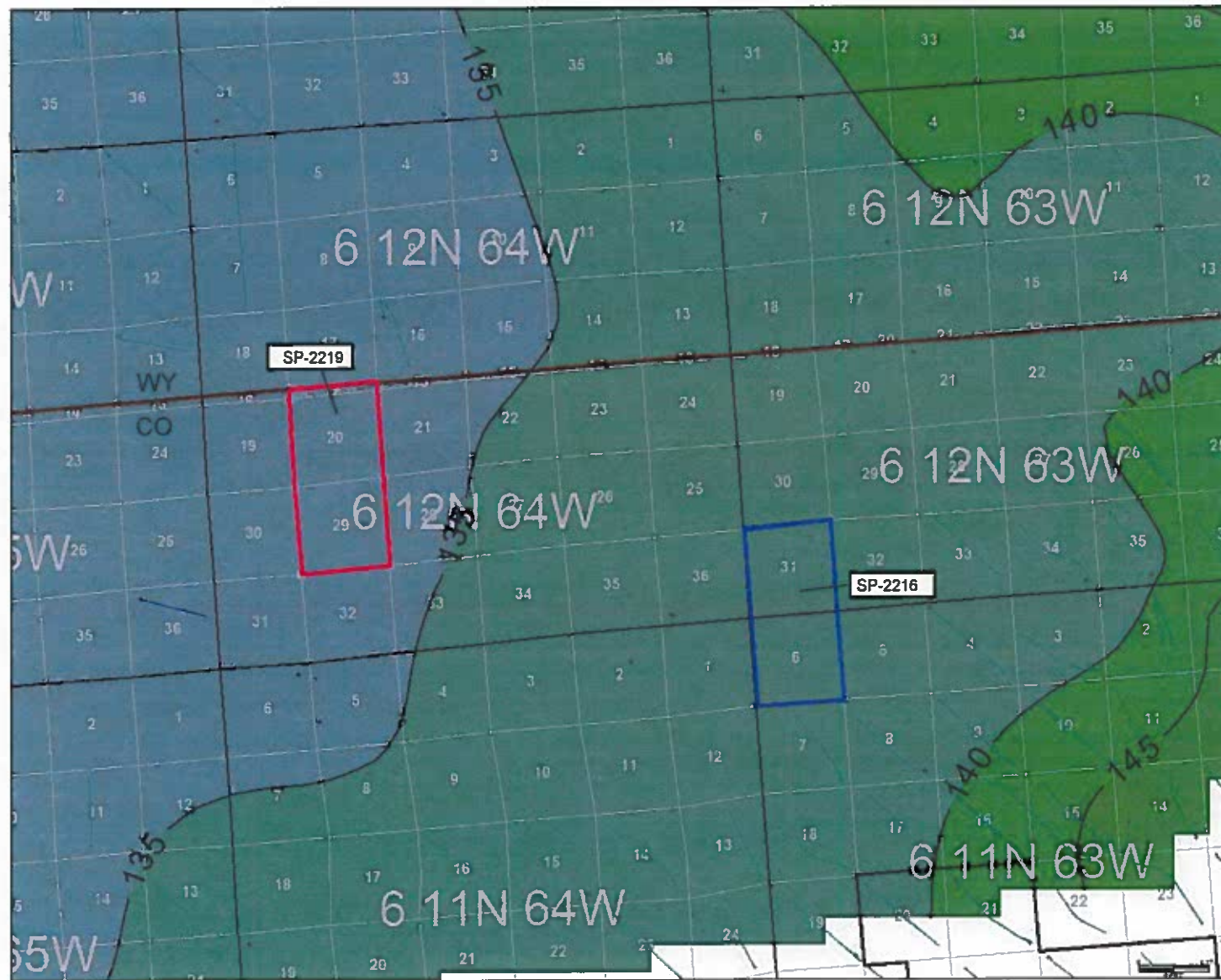


# Niobrara Net Pay Isopach Map (ft)

Geological Exhibit 4 Dockets:

1412-SP-2216 Niobrara

1412-SP-2219 Codell & Niobrara



Anadarko Petroleum

Northern DJ Basin

Niobrara Net Pay Isopach

Codell - Niobrara Spacing Applications

December 15th, 2014

WELL SYMBOLS  
 DRY & ABANDON WITH OIL SHOWS  
 DRY AND ABANDON  
 Dry Hole  
 Microseismic Monitor Well  
 OIL WELL  
 PLUGGED AND ABANDON OIL WELL  
 PILOT HOLE  
 SERVICE WELL

By J. Gorman

0 10,000  
 FEET



Proposed Codell &  
 Niobrara Spacing Units



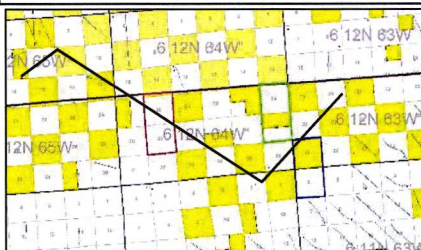
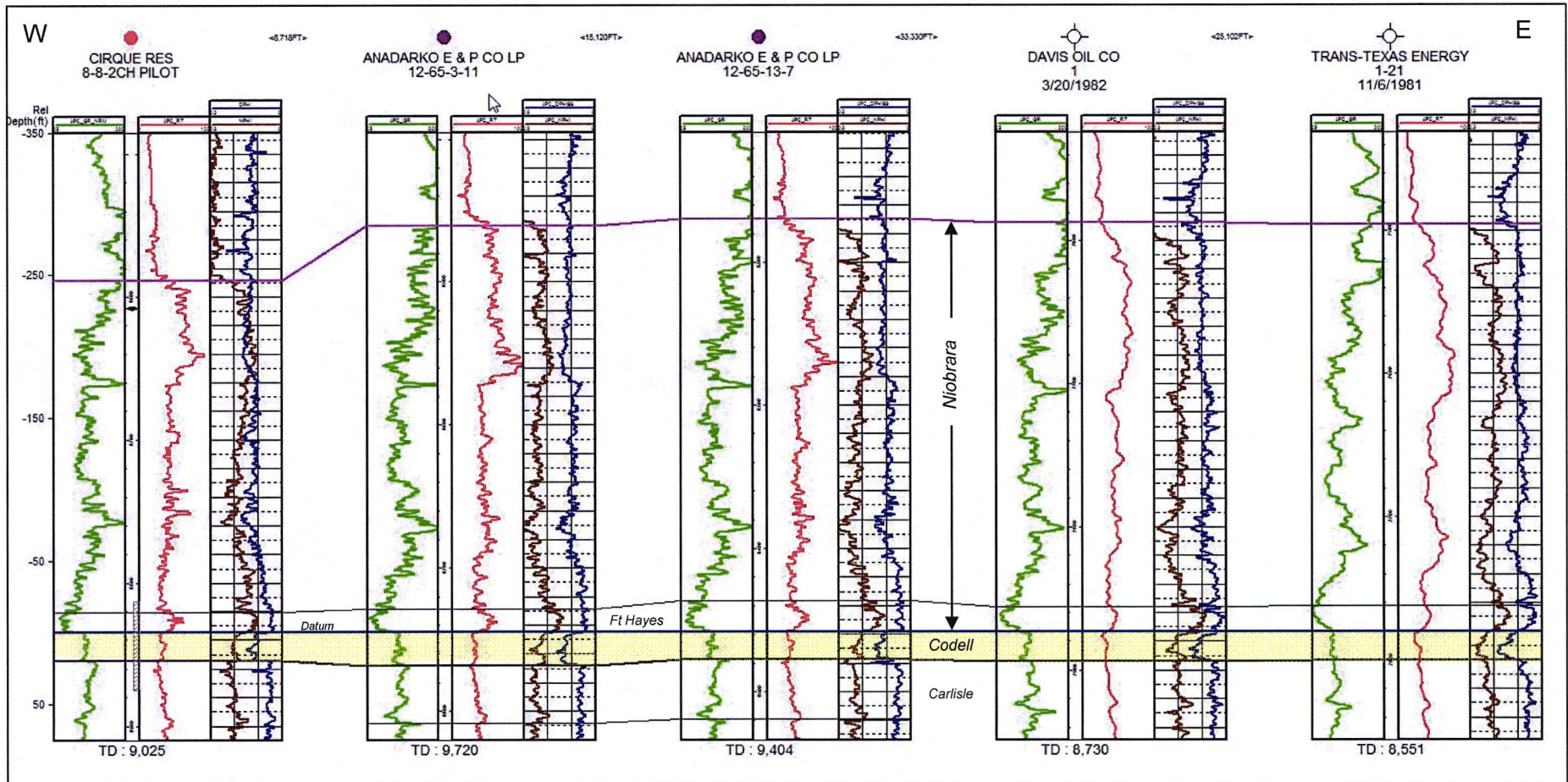
Proposed Niobrara  
 Spacing Units



# Geological Exhibit 5 Dockets:

1412-SP-2216 Niobrara  
1412-SP-2217 Codell  
1412-SP-2219 Codell & Niobrara

## Codell - Niobrara Stratigraphic Cross Section



Location Map



## THOMAS A. BERKMAN

Anadarko Petroleum  
1099 18<sup>th</sup> St  
Denver, CO 80202  
(720) 929-6237  
E-mail: [Thomas.Berkman@anadarko.com](mailto:Thomas.Berkman@anadarko.com)

464 Sylvester Way  
Highlands Ranch, CO 80129  
(303) 975-6331  
E-mail: [TBerk51289@aol.com](mailto:TBerk51289@aol.com)

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### CAREER SUMMARY

Skilled development and near-field exploration geoscientist with 27 years industry experience. Proven track record of finding, appraising, and developing oil and gas reserves both domestically and abroad. Comfortable with workstation mapping and 3D interpretation using Petra, Landmark and Geoframe platforms.

### PROFESSIONAL EXPERIENCE

- |              |  |
|--------------|--|
| 2004-Present | <p><b>Anadarko Petroleum, Denver, CO</b><br/><b>Sr Project Geologic Advisor - Rockies</b></p> <ul style="list-style-type: none"><li>• Currently geoscientist for northern DJ Basin. Worked many of the important hydrocarbon-producing Laramide basins in Wyoming and Colorado for 8 yrs. Proposed and drilled exploration and development wells, both horizontal and vertical, and recommended data acquisition and development plans, land purchases, and spacing requirements with team.</li><li>• Proposed and drilled 3 exploitation wells for Gunnison Field, Garden Banks, Deepwater GoM. GB668#10 came in with over 350' TVT of pay and proved up additional 125 bcf recoverable in main reservoir. Well maintaining production for 1.5 years of 50 MMCF/D and 4000 BOPD, making it one of the biggest wells in Anadarko's portfolio.</li><li>• Generated 3 new low-risk, high-reward step-out exploration prospect opportunities in East Breaks, Deepwater GoM, providing 40 MMBOE reserve potential in structural traps adjacent to Nansen Field. Shackleton Prospect drilled in 2008 resulted in booking 15 MMBOE net to company.</li><li>• Mentor for Associate Geologists</li></ul> |
| 1999-2004    | <p><b>BP Exploration and Production Inc., &amp; Vastar Resources, Inc., Houston, TX</b><br/><b>Principal Geologist – Deepwater GoM</b></p> <ul style="list-style-type: none"><li>• Interpreted multiple 3-D data volumes and mapped 5 pay zones to construct net pay maps and develop reservoir architecture for productive deepwater systems in Mississippi Canyon and Garden Banks areas, deepwater GoM. Integrated well and seismic data for reservoir description and time-depth conversion.</li><li>• Project Geologist responsible for planning drilling locations, generating prognoses, and expectations for 2001 - 10 well development program at Horn Mountain Field. Program results met or exceeded predrill expectations and completed without any geologic sidetracks. Field currently producing at sustained rate of 70,000 bopd.</li><li>• Evaluation of Kings Peak Field led to decision by management to retain under-performing, over-capitalized asset. Mapped 7 productive and potential horizons and</li></ul>   |

generated subsalt exploration play and 3 unrecognized development well locations. Appointed Kings Peak Project Manager for MM\$107 2-well development program.

1990-1999

**ARCO INTERNATIONAL OIL & GAS CO., ARCO OIL & GAS CO., TX & CA  
Staff Geologist**

- Project Geologist for delineation drilling of 8-10 TCF gas discovery in Bolivia foldbelt.
- Implemented program for 6 diverse exploration blocks in Ecuador, Peru, and Bolivia, an area encompassing 14 million acres.
- Project Geologist for ARCO Middle East, reservoir description for plan of development and directed appraisal drilling of Al Rayyan Field. Directed geosteering of 5 medium-radius horizontal wells in Arab Fm carbonate reservoirs, resulting in 37,000 BOPD initial production.
- Responsible for exploration discovery in 1995 adding 4.2 MMBO in economic reserves adjacent to Placerita Field in Ventura Basin, California.
- As Development Geologist in multi-disciplinary teams, implemented, expanded and monitored several development projects resulting in 50% increase in oil production from turbidite reservoirs in San Joaquin and Ventura Basins, California over a 5 year period.
- Expert witness testimony during Los Angeles County property tax appeal resulting in a 3 \$MM finding for ARCO in 1995.

1982-1985  
1988

**PHOENIX GEOPHYSICS, INC., Denver, CO  
Geophysicist-Project Supervisor**

- Recognized and solved all technical and logistical problems to ensure steady production of geophysical data acquisition in hydrocarbon and geothermal exploration. Directed field-client operations. Managed crew finances, payroll, and weekly expense and production reports.
- Rejoined Phoenix in 1988 in capacity of Project Supervisor for 4 month, long-distance remote time-series survey in Japan.

1988

**OREGON STATE UNIVERSITY, Corvallis, OR          Teaching Assistant**

- Taught 45 students per quarter basic geology for 2 quarters during graduate school. In charge of all class and lab preparation.

1981  
(Summer)

**UNITED STATES BUREAU OF MINES          Physical Science Technician**

- Geological mapping of mines and surface exposures, geochemical sampling for precious and base metals, and performing helicopter reconnaissance in White Mountains of eastern California.

## **EDUCATION**

- 1986-1990      **Oregon State University**, Corvallis, OR
- M.S. in Geoscience, 1990. Major: stratigraphy, sedimentology. Minor: tectonics, geophysics.
- 1978 - 1982      **Colorado College**, Colorado Springs, CO
- B.A. Degree in Geology, 1982.
- 1990 - present      Numerous industry, technical and financial schools and seminars

## **PUBLICATIONS**

- Smith, K., Bottjer, R., Sterling, R., Nowak, H., and Berkman, T.A., 2015, (in press) Codell Sandstone, Northern DJ Basin, Wyoming and Colorado: Reservoir Characteristics in a Tight Oil Play: AAPG abstract, 2015 Annual Meeting, Denver, CO
- Ellis, L., Berkman, T.A., Uchytel, S., and Dzou, L., 2007, Integration of mud gas isotope logging (MGIL) with field appraisal at Horn Mountain Field, deepwater Gulf of Mexico: *Journal of Petroleum Science & Engineering*
- Berkman, T.A., Ellis, L., and Grass, D., 2002, Integration of mud gas isotope data with field appraisal at Horn Mountain Field, deepwater Gulf of Mexico: (Abst.) AAPG National Conv., Houston, TX
- He, Z., and Berkman, T.A., 1999, Interactive charge modeling of the Qatar Arch petroleum systems: (Abst.) AAPG Hedberg Conference "Multi-Dimensional Basin Modeling".
- Berkman, T.A., 1996, Structure and hydrocarbon exploration in the transpressive basins of southern California: AAPG Field Conference Guidebook 73, field trip contributor and author.
- Berkman, T.A., 1994, Placerita oilfield - A case study of steamflooding a complexly stratified reservoir: *The Pacific Petroleum Geologist*, AAPG Pacific Section. no.4
- Werner, K.S., Graven, E.P., Berkman, T.A., and Parker, M.J., 1991, Direction of maximum horizontal compression in northwestern Oregon as determined by borehole breakouts: *Tectonics*, v. 10, no. 5
- Berkman, T.A., 1991, Timing of structural growth at Northwest Stevens Field as evidenced by Stevens channel geometries: (Abst.) AAPG Bull. v. 75/2 p. 357
- Berkman, T.A., Niem, A.R., and Farr, L., 1991, Depositional environments, tectonic setting, and diagenesis of the gas-producing Eocene Cowlitz Formation, northern Oregon Coast Range: (Abst.) SEPM 1991 Meeting on Tectonics and Sedimentation
- Jackson, R.A., Berkman, T.A., and Dahleen, W.K., 1991, A depositional setting for the Mist Gas Field reservoir sands: (Abst.) AAPG Bull. v. 75/2 p. 368
- Moore, G.W., Berkman, T.A., and Sidlauskas, F.J., 1990, Geographic map of the Circum - Pacific region, Arctic sheet, Circum-Pacific Council for Energy and Mineral Resources (available through AAPG)

## **PROFESSIONAL ACTIVITIES**

- Wyoming Licensed Professional Geologist #3675
- Texas Licensed Professional Geologist #2688
- Active member – Rocky Mountain Association of Geologists
- Active member - National AAPG



**Cause No. 535, Docket Nos. 1412-SP-2217, 2216 and 2219**



## **Anadarko Petroleum Corporation**

### **Emily Boecking – Engineering Testimony**

Cause 535, Docket Nos. 1412-SP-2217, 2216 and 2219

*Request to establish four approximate 1,280-acre drilling and spacing units, and authorize one horizontal well within the proposed units, for production of oil, gas and associated hydrocarbons from the Codell and/or Niobrara Formations*

My name is Emily Boecking, and I am currently employed as a Reservoir Engineer for Anadarko Petroleum Corporation (“Anadarko”). I graduated from the Duke University in 2007 with a Bachelor of Science in Mechanical Engineering. I have over 7 years of experience in the oil and gas industry of which 5 years have spent as a reservoir engineer. I am familiar with the lands subject to, and the matters set forth in the October 16, 2014, verified applications (the “Applications”) filed herein. My resume/c.v. is attached to this submission. See Appendix.

In support of the Applications, I am submitting five exhibits. The exhibits are attached to my sworn testimony and form the basis for the Applications requesting to establish an approximate 1,280-acre drilling and spacing units for the below-described lands (the “Application Lands”), and authorize one horizontal well within the proposed units, for production of oil, gas and associated hydrocarbons from the Codell and/or Niobrara Formations:

#### ***Docket No. 1412-SP-2217, Codell Formation***

##### Township 12 North, Range 64 West, 6<sup>th</sup> P.M.

Section 13: Lots 1 through 4 (approximately 18.98 acres),  
being that portion lying within the state of  
Colorado  
Section 24: All  
Section 25: All

#### ***Docket No. 1412-SP-2216, Niobrara Formation***

##### Township 12 North, Range 63 West, 6<sup>th</sup> P.M.

Section 31: Lot 1 (39.82 acres), Lot 2 (40.10 acres), Lot 3  
(40.38 acres), Lot 4 (40.66 acres), E $\frac{1}{2}$ W $\frac{1}{2}$ , E $\frac{1}{2}$   
[All]

##### Township 11 North, Range 63 West, 6<sup>th</sup> P.M.

Section 6: Lot 1 (40.49 acres), Lot 2 (40.35 acres), Lot 3  
(40.21 acres), Lot 4 (40.86 acres), Lot 5 (40.78  
acres), Lot 6 (40.78 acres), Lot 7 (40.76 acres),  
SE $\frac{1}{4}$ NW $\frac{1}{4}$ , S $\frac{1}{2}$ NE $\frac{1}{4}$ , E $\frac{1}{2}$ SW $\frac{1}{4}$ , SE $\frac{1}{4}$  [All]

***Docket No. 1412-SP-2219, Codell and Niobrara Formations***

Township 12 North, Range 64 West, 6<sup>th</sup> P.M.

|             |   |
|-------------|---|
| Section 17: | Lots 1 through 4 (approximately 57.99 acres),<br>being that portion lying within the state of<br>Colorado |
| Section 20: | All   |
| Section 29: | All   |

1. Exhibit No. E-1

Exhibit No. E-1 is a table showing reservoir drainage area calculations for current producing wells in the Northern DJ Basin closest offsetting the proposed units. Wells included in this table are producing from the Codell formation with production for 5 months or more and have horizontal completed lateral lengths ranging from 8,500' - 9,500'.

2. Exhibit No. E-2

Exhibit No. E-2 shows the decline curves used to extrapolate estimated ultimate recovery for use in the drainage area calculations for the Codell.

3. Exhibit No. E-3

Exhibit No. E-3 is a table showing reservoir drainage area calculations and Joshi effective vertical drainage radii for current producing wells in the Northern DJ Basin closest offsetting the proposed units. Wells included in this table are producing from the Niobrara formation with production for 12 months or more and have horizontal completed lateral lengths ranging from 3,400' - 5,800'.

4. Exhibit No. E-4

Exhibit No. E-4 shows the horizontal well drainage area calculation for a well with a 9,000' completed lateral length producing from the Niobrara using the Joshi method.

5. Exhibit No. E-5

Exhibit No. E-5 shows the decline curves used to extrapolate estimated ultimate recovery for use in the drainage area and Joshi effective vertical drainage radii calculations for the Niobrara.

***Testimony and Conclusions***

Anadarko believes that drilling and completed horizontal wells in the Codell and/or Niobrara Formations underlying the Application Lands is the most efficient and economic method to develop the resource potential for these formations.

The calculated drainage areas for the wells drilling in the Codell Formation offsetting the Application Lands, with 8,500' - 9,500' laterals, range from 90 to 259 acres. Therefore the calculated drainage area supports the initial drilling of one horizontal well for the Codell Formation underlying the Application Lands.

The calculated Joshi effective vertical drainage radius for the wells drilling in the Niobrara Formation offsetting the Application Lands, with 3,400'-5,800' laterals, averages 354 feet. The estimated





Colorado Oil and Gas Conservation Commission Hearings  
December 15<sup>th</sup>, 2014

# Docket #'s

|                     |                              |
|---------------------|------------------------------|
| <i>1412-SP-2216</i> | <i>Niobrara</i>              |
| <i>1412-SP-2217</i> | <i>Codell</i>                |
| <i>1412-SP-2219</i> | <i>Codell &amp; Niobrara</i> |

## Engineering Exhibits

Emily Boecking  
Sr Reservoir Engineer  
Anadarko Petroleum  
Denver, CO

Exhibit E-1: Drainage Area Calculation

Codell Horizontal Well Drainage Area Calculation

| API No         | Lease    | Well No   | Reservoir | Operator      | Section | Township | Range | Cumulative Oil (bbl) | EUR Oil (bbl) | Completed Interval | Average Porosity (phi, %) | Water Saturation (Sw, %) | Thickness (h, ft) | Drainage Area (acres) |
|----------------|----------|-----------|-----------|---------------|---------|----------|-------|----------------------|---------------|--------------------|---------------------------|--------------------------|-------------------|-----------------------|
| 49021210120000 | JUBILEE  | 103-0433H | Codell    | EOG Resources | 4       | 13 N     | 65 W  | 147,397              | 361,853       | 9,313              | 12                        | 50                       | 24                | 259                   |
| 49021210560000 | JUBILEE  | 513-0820H | Codell    | EOG Resources | 8       | 13 N     | 65 W  | 89,657               | 290,784       | 9,401              | 12                        | 51                       | 22                | 229                   |
| 49021210610000 | JUBILEE  | 584-1705H | Codell    | EOG Resources | 17      | 13 N     | 65 W  | 56,053               | 188,114       | 9,400              | 12                        | 51                       | 23                | 141                   |
| 49021210600000 | JUBILEE  | 586-1705H | Codell    | EOG Resources | 17      | 13 N     | 65 W  | 53,217               | 159,399       | 9,086              | 12                        | 51                       | 23                | 120                   |
| 49021210880000 | JUBILEE  | 611-0706H | Codell    | EOG Resources | 7       | 13 N     | 65 W  | 44,558               | 115,541       | 8,511              | 12                        | 51                       | 22                | 90                    |
| 49021209670000 | REDSTONE | 2-1-1CH   | Codell    | EOG Resources | 2       | 13 N     | 65 W  | 67,142               | 179,494       | 9,467              | 12                        | 50                       | 24                | 128                   |
| 49021210150000 | WINDY    | 504-1806H | Codell    | EOG Resources | 18      | 13 N     | 64 W  | 103,736              | 251,420       | 9,116              | 12                        | 53                       | 22                | 201                   |

Average Drainage Area: 167 Acres

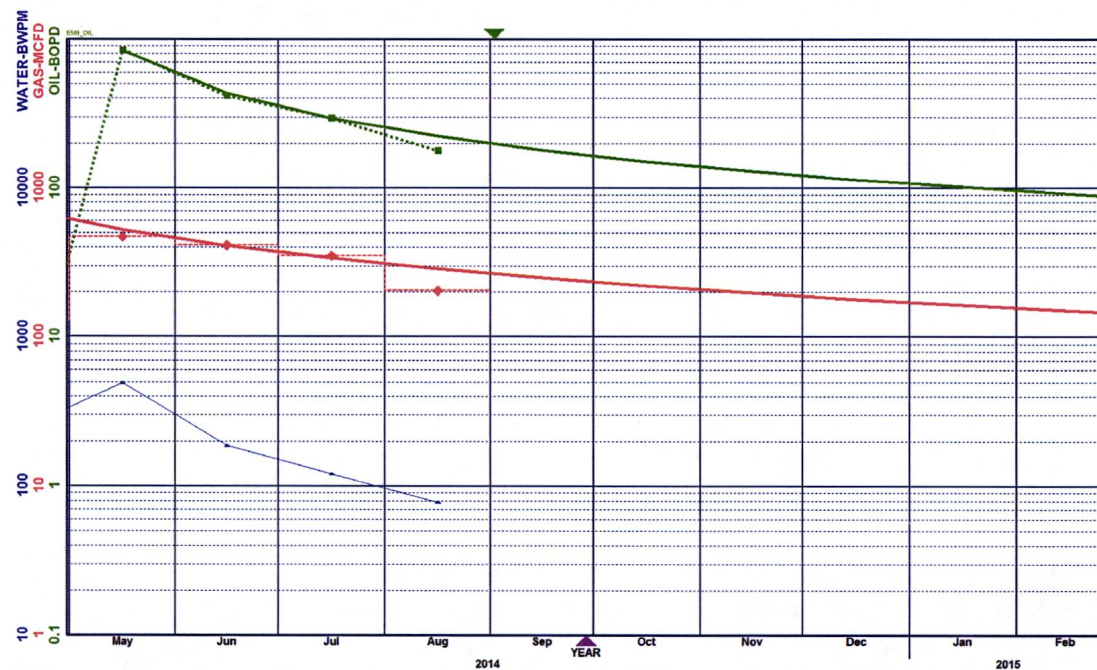
Drainage area equation:  $Area = \frac{EUR*B_o}{7758*h*phi*(1-S_w)*R_F}$

$B_o = 1.4$

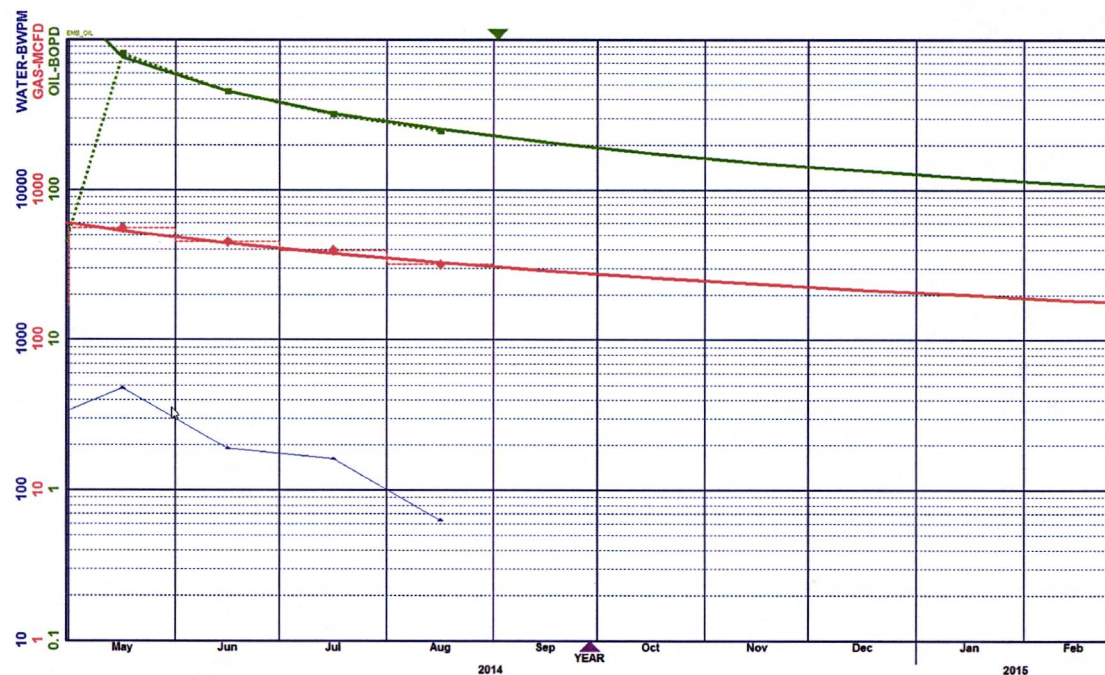
$R_F = 18\%$

## Exhibit E-2: Decline Curve Analysis

|                   |         |
|-------------------|---------|
| Jubilee 586-1705H |         |
| 49021210600000    |         |
| Codell            |         |
| EOG Resources     |         |
| 17 13N 65W        |         |
| Cum Oil (BO)      | 53,217  |
| Cum Gas (MMCF)    | 47,976  |
| EUR Oil (BO)      | 159,399 |
| EUR Gas (MMCF)    | 242,746 |



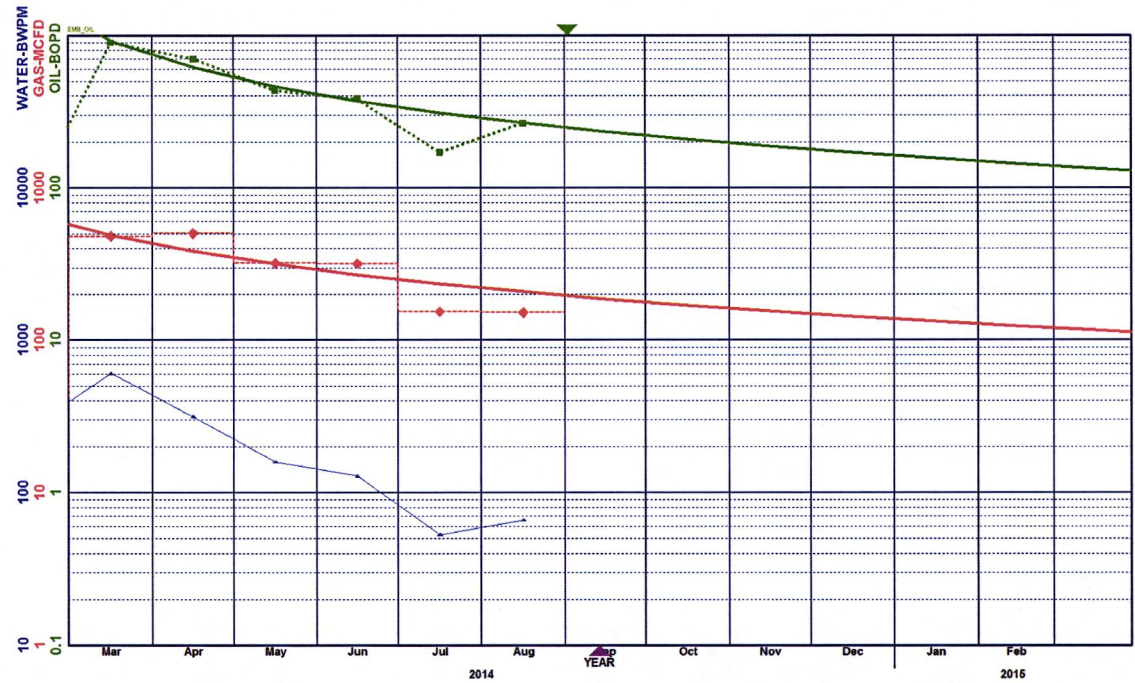
|                   |         |
|-------------------|---------|
| Jubilee 584-1705H |         |
| 49021210610000    |         |
| Codell            |         |
| EOG Resources     |         |
| 17 13N 65W        |         |
| Cum Oil (BO)      | 56,053  |
| Cum Gas (MMCF)    | 57,887  |
| EUR Oil (BO)      | 188,114 |
| EUR Gas (MMCF)    | 312,571 |



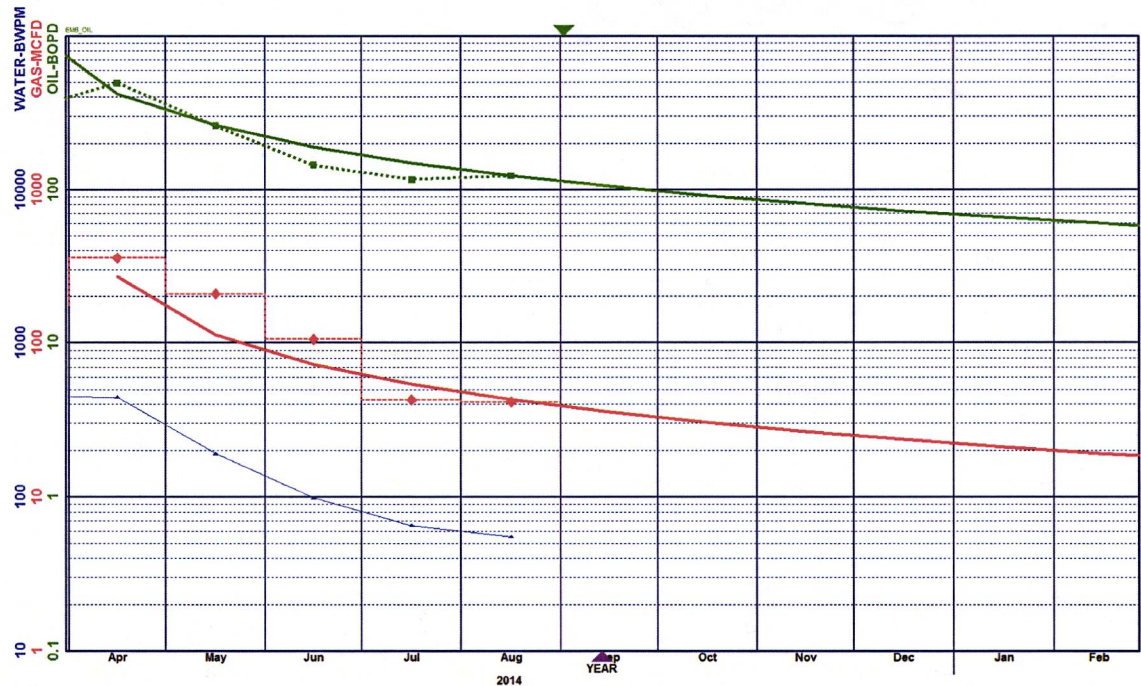


## Exhibit E-2: Decline Curve Analysis

|                   |         |
|-------------------|---------|
| Jubilee 513-0820H |         |
| 49021210560000    |         |
| Codell            |         |
| EOG Resources     |         |
| 8 13N 65W         |         |
| Cum Oil (BO)      | 89,657  |
| Cum Gas (MMCF)    | 60,165  |
| EUR Oil (BO)      | 290,784 |
| EUR Gas (MMCF)    | 244,086 |



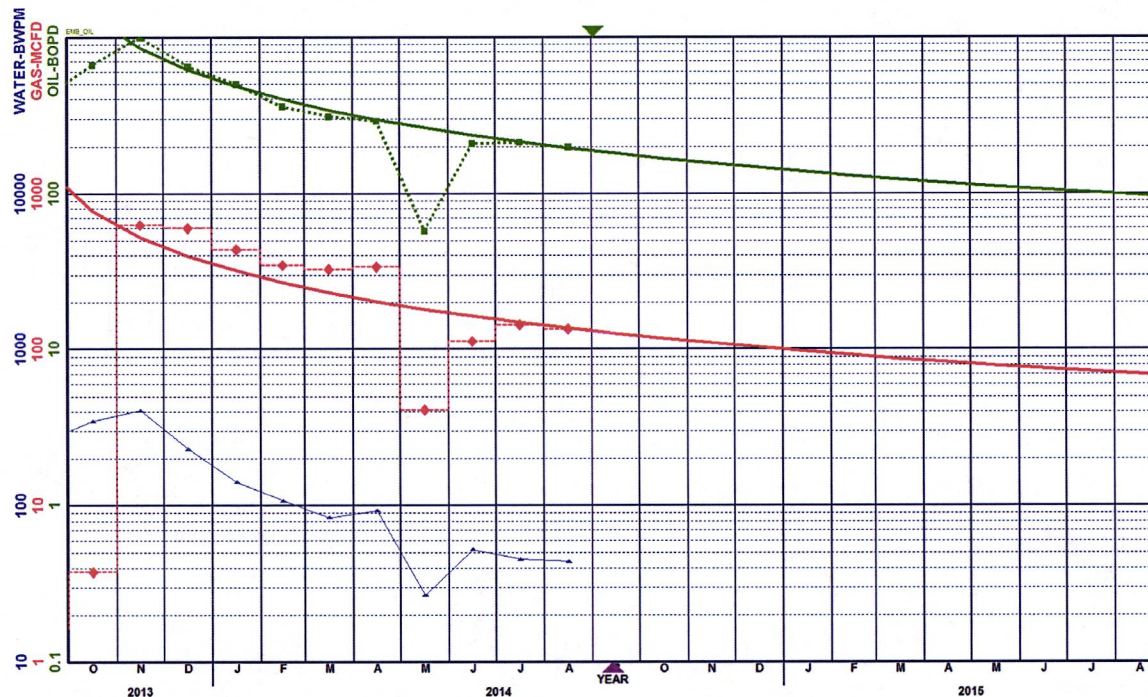
|                   |         |
|-------------------|---------|
| Jubilee 611-0706H |         |
| 49021210880000    |         |
| Codell            |         |
| EOG Resources     |         |
| 7 13N 65W         |         |
| Cum Oil (BO)      | 44,558  |
| Cum Gas (MMCF)    | 28,312  |
| EUR Oil (BO)      | 115,541 |
| EUR Gas (MMCF)    | 47,830  |





## Exhibit E-2: Decline Curve Analysis

|                   |         |
|-------------------|---------|
| Jubilee 103-0433H |         |
| 49021210120000    |         |
| Codell            |         |
| EOG Resources     |         |
| 4 13N 65W         |         |
| Cum Oil (BO)      | 147,397 |
| Cum Gas (MMCF)    | 94,451  |
| EUR Oil (BO)      | 361,853 |
| EUR Gas (MMCF)    | 247,262 |



|                 |         |
|-----------------|---------|
| Windy 504-1806H |         |
| 49021210150000  |         |
| Codell          |         |
| EOG Resources   |         |
| 18 13N 64W      |         |
| Cum Oil (BO)    | 103,736 |
| Cum Gas (MMCF)  | 85,456  |
| EUR Oil (BO)    | 251,420 |
| EUR Gas (MMCF)  | 274,291 |

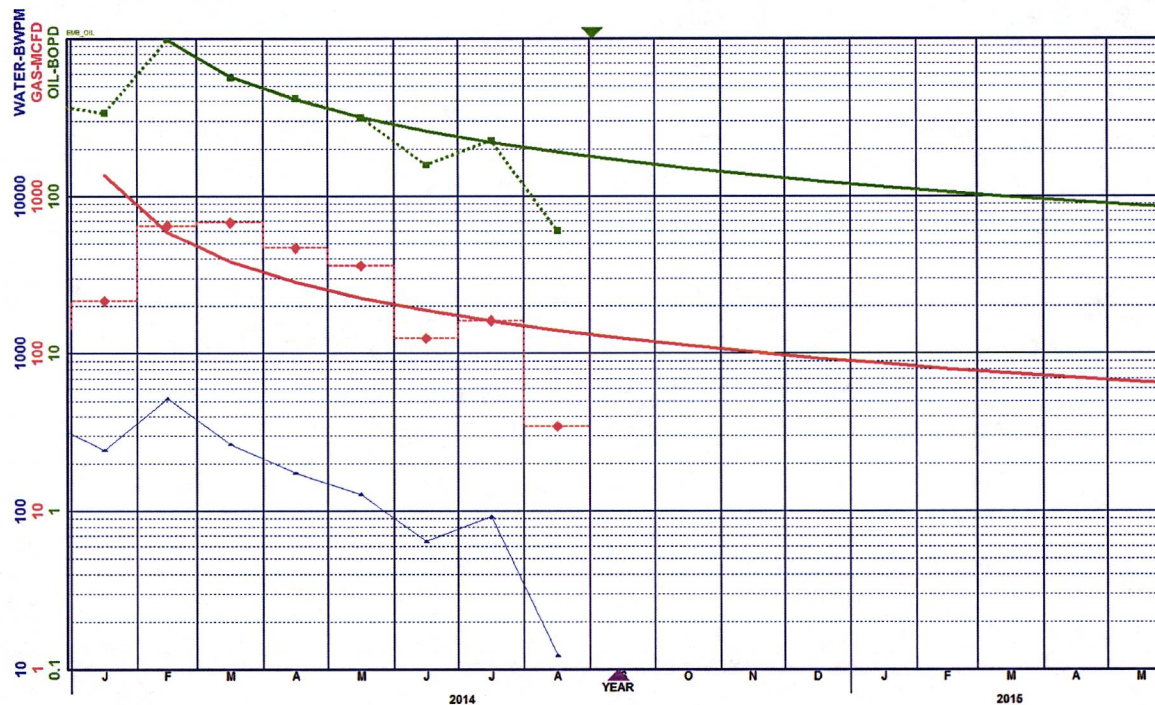
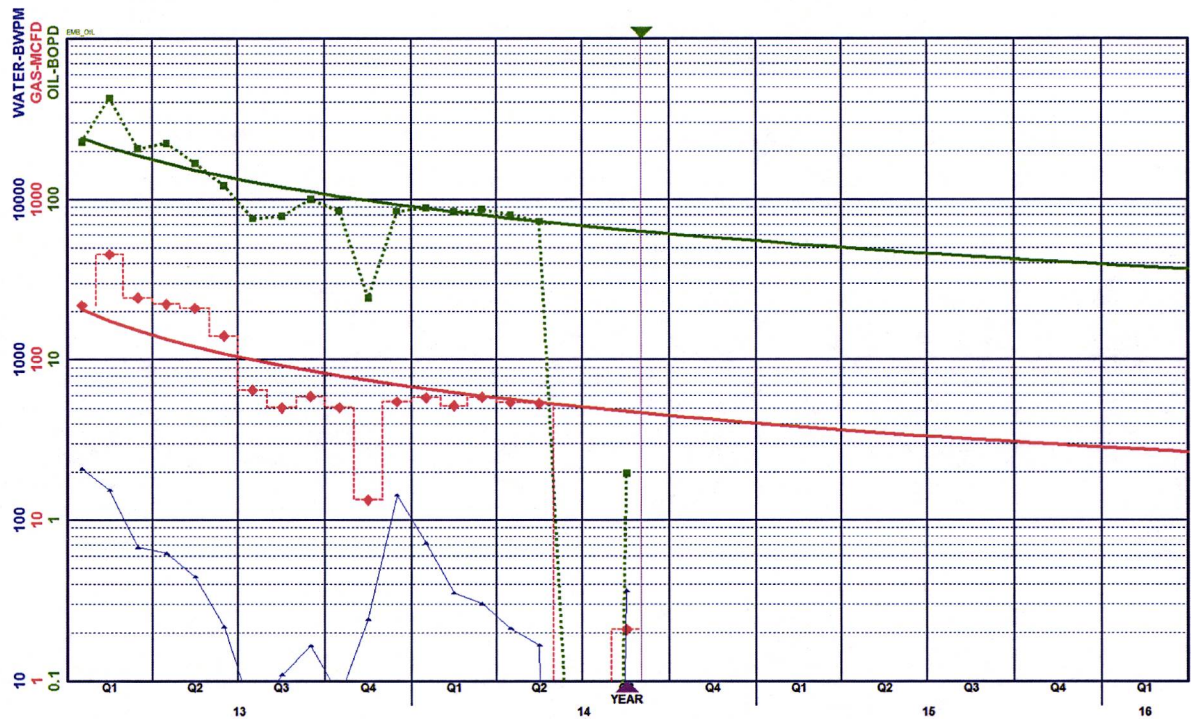




Exhibit E-2: Decline Curve Analysis

|                   |         |
|-------------------|---------|
| Redstone 2-1-1 CH |         |
| 49021209670000    |         |
| Codell            |         |
| EOG Resources     |         |
| 2 13N 65W         |         |
| Cum Oil (BO)      | 67142   |
| Cum Gas (MMCF)    | 61,843  |
| EUR Oil (BO)      | 179,494 |
| EUR Gas (MMCF)    | 192,085 |



## Exhibit E-3: Drainage Area Calculation

### Niobrara Horizontal Well Drainage Area Calculation

| API No         | Lease     | Well No     | Reservoir | Operator                             | Section | Town<br>ship | Range | Cumulative<br>Oil (bbl) | EUR Oil<br>(bbl) | Completed<br>Interval | Average<br>Porosity<br>(phi, %) | Water<br>Saturation<br>(Sw, %) | Thickness<br>(h, ft) | Drainage Area<br>(acres) | Joshi Effective<br>Vertical Drainage<br>Radius (feet) |
|----------------|-----------|-------------|-----------|--------------------------------------|---------|--------------|-------|-------------------------|------------------|-----------------------|---------------------------------|--------------------------------|----------------------|--------------------------|---|
| 49021206490000 | ATCHISON  | 13-65-35-4H | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 35      | 13 N         | 65 W  | 24,606                  | 39,412           | 5,713                 | 10                              | 45                             | 133                  | 34                       | 124   |
| 49021206650000 | ATCHISON  | 12-65-13-4H | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 13      | 12 N         | 65 W  | 26,133                  | 42,770           | 3,851                 | 10                              | 45                             | 134                  | 36                       | 189   |
| 49021207500000 | PATRIOT   | 1-19H       | Niobrara  | EOG RESOURCES INCORPORATED           | 19      | 14 N         | 64 W  | 23,966                  | 45,662           | 4,216                 | 9                               | 45                             | 146                  | 37                       | 179   |
| 49021206810000 | ATCHISON  | 12-65-1-4H  | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 1       | 12 N         | 65 W  | 38,857                  | 54,231           | 5,748                 | 10                              | 45                             | 134                  | 46                       | 167   |
| 49021206630000 | STATE     | 13-64-16-4H | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 16      | 13 N         | 64 W  | 38,833                  | 69,099           | 5,480                 | 10                              | 45                             | 136                  | 58                       | 218   |
| 49021207610000 | MARLIN    | 12-65-3-4H  | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 3       | 12 N         | 65 W  | 49,696                  | 80,101           | 4,203                 | 10                              | 45                             | 134                  | 64                       | 297   |
| 49021206520000 | SHATTO    | 13-65-10-4H | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 10      | 13 N         | 65 W  | 57,880                  | 93,268           | 5,225                 | 10                              | 45                             | 132                  | 77                       | 294   |
| 49021208720000 | JUBILEE   | 69-04H      | Niobrara  | EOG RESOURCES INCORPORATED           | 4       | 13 N         | 65 W  | 71,574                  | 113,263          | 3,540                 | 10                              | 45                             | 136                  | 91                       | 463   |
| 49021209810000 | BIG SANDY | 7-33H       | Niobrara  | EOG RESOURCES INCORPORATED           | 33      | 14 N         | 65 W  | 42,153                  | 139,739          | 3,541                 | 10                              | 45                             | 136                  | 113                      | 557   |
| 49021207560000 | MARLIN    | 12-65-3-2H  | Niobrara  | ANADARKO E & P COMPANY LIMITED PRTNR | 3       | 12 N         | 65 W  | 88,634                  | 144,389          | 4,407                 | 10                              | 45                             | 134                  | 117                      | 493   |
| 49021209800000 | JUBILEE   | 30-07H      | Niobrara  | EOG RESOURCES INCORPORATED           | 7       | 13 N         | 65 W  | 56,422                  | 152,245          | 3,836                 | 10                              | 45                             | 133                  | 123                      | 567   |
| 49021208750000 | WINDY     | 01-18H      | Niobrara  | EOG RESOURCES INCORPORATED           | 18      | 13 N         | 64 W  | 68,721                  | 163,414          | 3,401                 | 9                               | 45                             | 132                  | 144                      | 699   |
|                |           |             |           | <b>AVERAGE</b>                       |         |              |       |                         | <b>94,799</b>    | <b>4,430</b>          | <b>10</b>                       | <b>45</b>                      | <b>135</b>           | <b>78</b>                | <b>354</b>  |

$$\text{Drainage area equation: } Area = \frac{EUR * B_o}{7758 * h * \phi * (1 - S_w) * R_F}$$

$$B_o = 1.4$$

$$R_F = 3\%$$

# Exhibit E-4: Estimated Drainage for Proposed 9000' Niobrara Horizontal Well

## Horizontal Well Drainage Area Joshi Method

$r$  = effective drainage radius from vertical well, ft

$L$  = lateral length, ft

$A$  = drainage area for horizontal well

$$A = \frac{\pi r^2 + 2rL}{43560}$$

$$r = 354 \text{ ft}$$

$$L = 9,000 \text{ ft}$$

$$A = 155 \text{ acres}$$

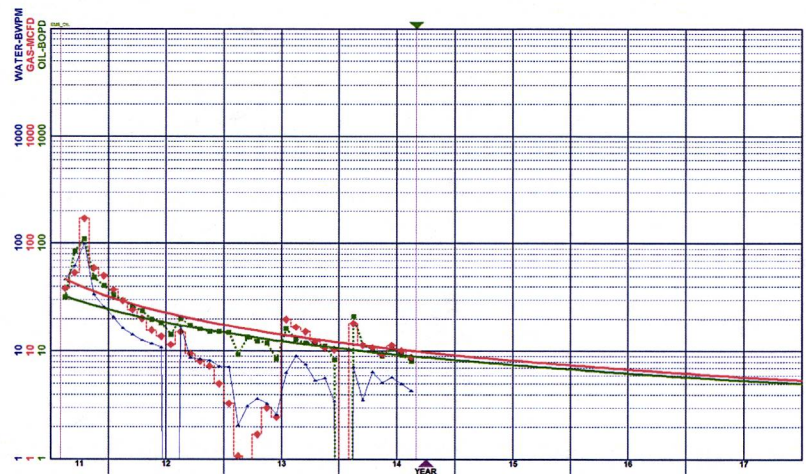
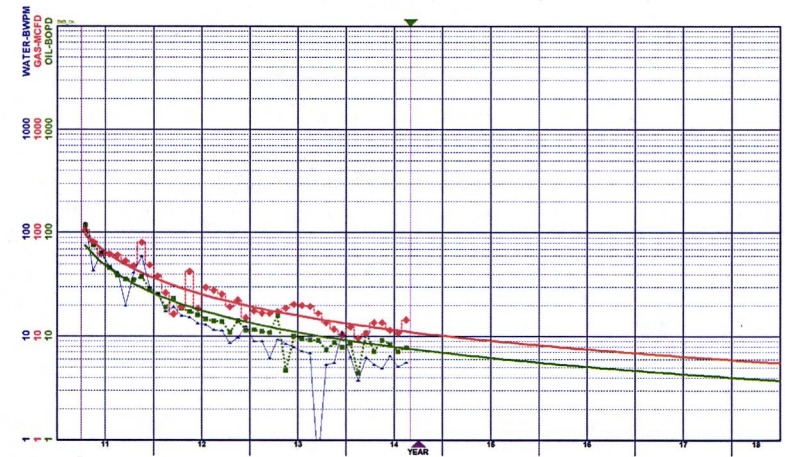
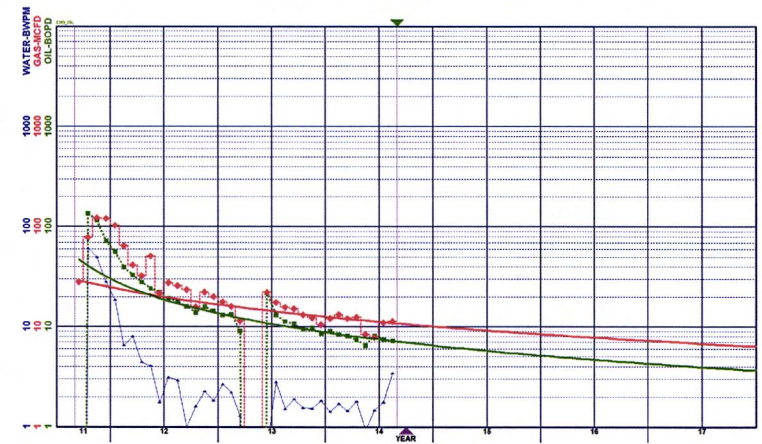


## Exhibit E-5: Decline Curve Analysis

|              |                                     |
|--------------|-------------------------------------|
|              | ATCHISON 13-65-35-4H                |
|              | 49021206490000                      |
|              | Niobrara                            |
|              | ANADARKO E & P COMPANY LIMITED PRTR |
|              | 35 13 N 65 W                        |
| Cum Oil (BO) | 24,606                              |
| EUR Oil (BO) | 39,412                              |

|              |                                     |
|--------------|-------------------------------------|
|              | ATCHISON 12-65-13-4H                |
|              | 49021206650000                      |
|              | Niobrara                            |
|              | ANADARKO E & P COMPANY LIMITED PRTR |
|              | 13 12 N 65 W                        |
| Cum Oil (BO) | 26,133                              |
| EUR Oil (BO) | 42,770                              |

|              |                            |
|--------------|----------------------------|
|              | PATRIOT 1-19H              |
|              | 49021207500000             |
|              | Niobrara                   |
|              | EOG RESOURCES INCORPORATED |
|              | 19 14 N 64 W               |
| Cum Oil (BO) | 23,966                     |
| EUR Oil (BO) | 45,662                     |



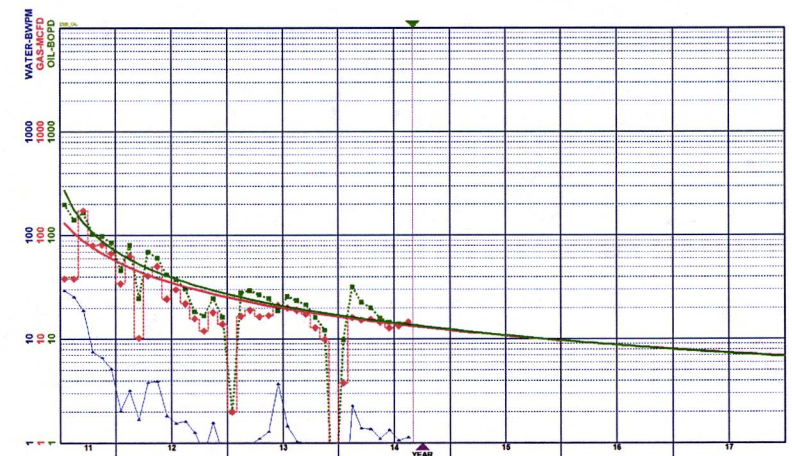
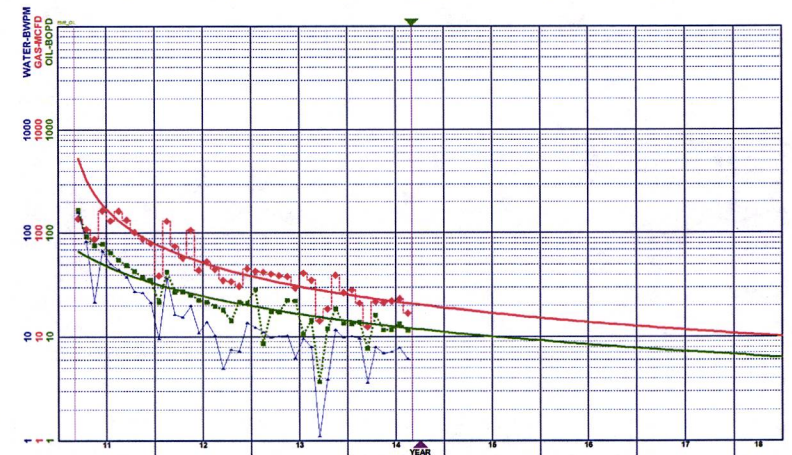
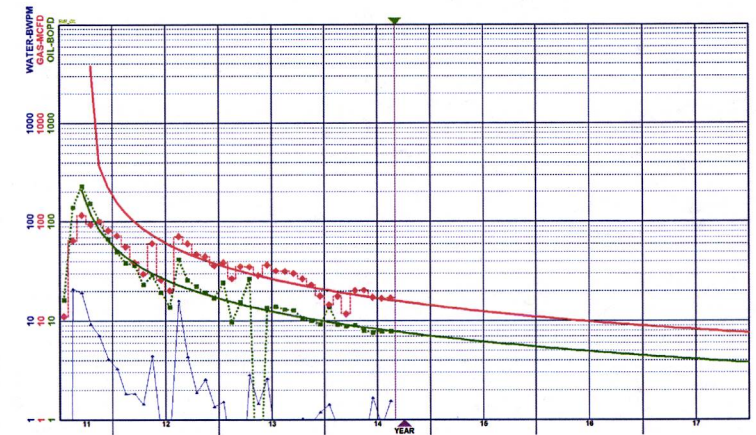


## Exhibit E-5: Decline Curve Analysis

|              |  |
|--------------|--|
|              | ATCHISON 12-65-1-4H                    |
|              | 49021206810000                         |
|              | Niobrara                               |
|              | ANADARKO E & P COMPANY LIMITED PARTNER |
|              | 1 12 N 65 W                            |
| Cum Oil (BO) | 38,857                                 |
| EUR Oil (BO) | 54,231                                 |

|              |  |
|--------------|--|
|              | STATE 13-64-16-4H                      |
|              | 49021206630000                         |
|              | Niobrara                               |
|              | ANADARKO E & P COMPANY LIMITED PARTNER |
|              | 16 13 N 64 W                           |
| Cum Oil (BO) | 38,833                                 |
| EUR Oil (BO) | 69,099                                 |

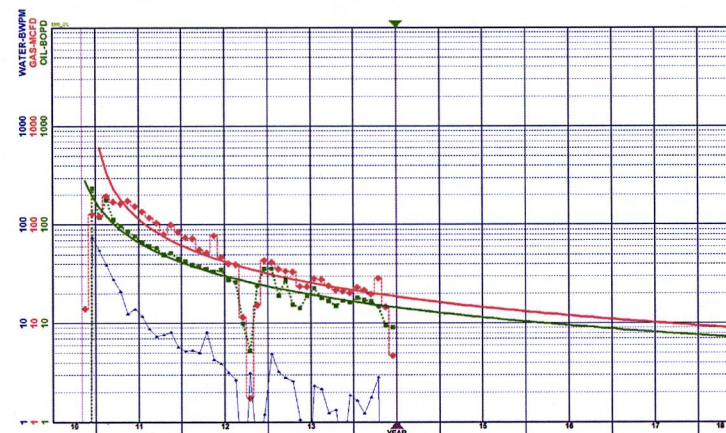
|              |  |
|--------------|--|
|              | MARLIN 12-65-3-4H                      |
|              | 49021207610000                         |
|              | Niobrara                               |
|              | ANADARKO E & P COMPANY LIMITED PARTNER |
|              | 3 12 N 65 W                            |
| Cum Oil (BO) | 49,696                                 |
| EUR Oil (BO) | 80,101                                 |



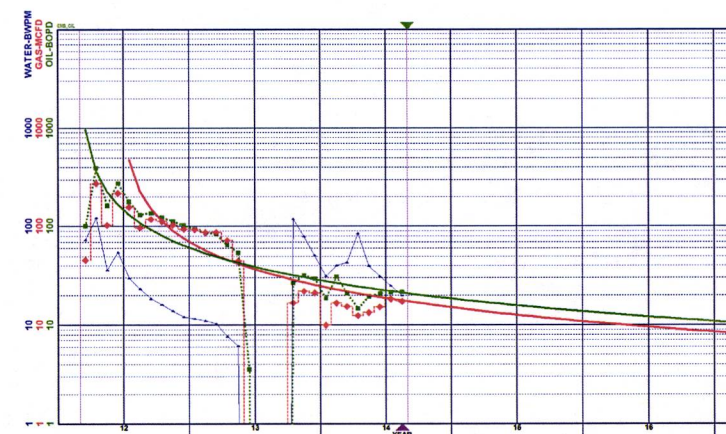


## Exhibit E-5: Decline Curve Analysis

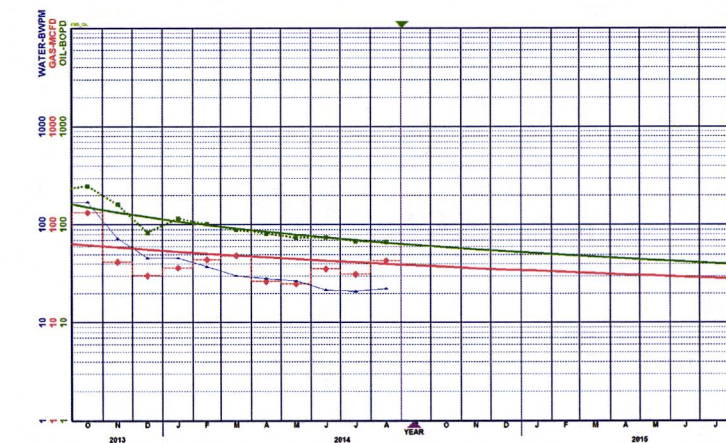
|              |                                     |
|--------------|-------------------------------------|
|              | SHATTO 13-65-10-4H                  |
|              | 49021206520000                      |
|              | Niobrara                            |
|              | ANADARKO E & P COMPANY LIMITED PRTR |
|              | 10 13 N 65 W                        |
| Cum Oil (BO) | 57,880                              |
| EUR Oil (BO) | 93,268                              |



|              |                            |
|--------------|----------------------------|
|              | JUBILEE 69-04H             |
|              | 49021208720000             |
|              | Niobrara                   |
|              | EOG RESOURCES INCORPORATED |
|              | 4 13 N 65 W                |
| Cum Oil (BO) | 71,574                     |
| EUR Oil (BO) | 113,263                    |



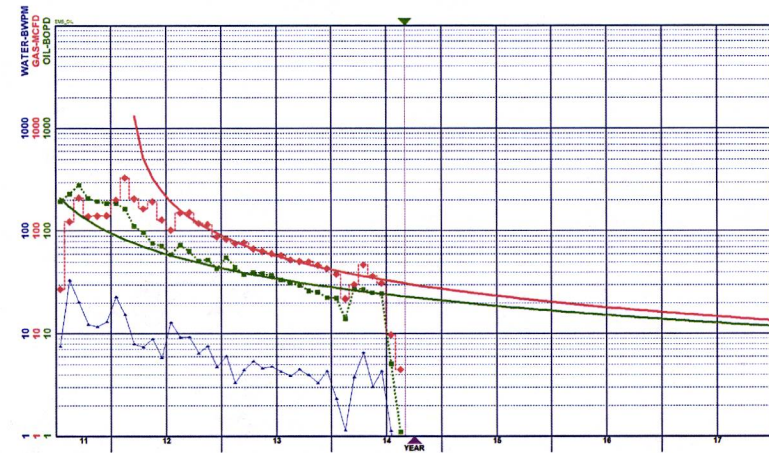
|              |                            |
|--------------|----------------------------|
|              | BIG SANDY 7-33H            |
|              | 49021209810000             |
|              | Niobrara                   |
|              | EOG RESOURCES INCORPORATED |
|              | 33 14 N 65 W               |
| Cum Oil (BO) | 42,153                     |
| EUR Oil (BO) | 139,739                    |



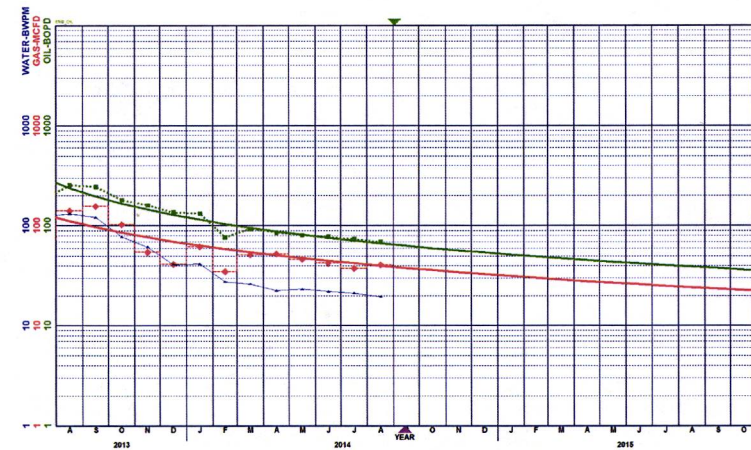


## Exhibit E-5: Decline Curve Analysis

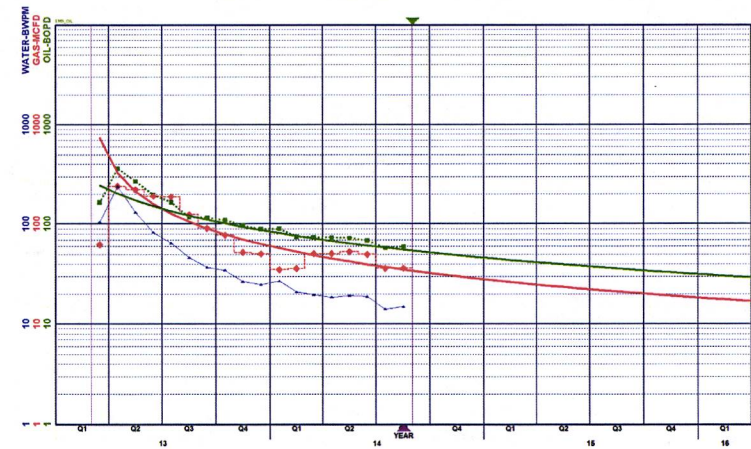
|              |  |
|--------------|--|
|              | MARLIN 12-65-3-2H                      |
|              | 49021207560000                         |
|              | Niobrara                               |
|              | ANADARKO E & P COMPANY LIMITED PARTNER |
|              | 3 12 N 65 W                            |
| Cum Oil (BO) | 88,634                                 |
| EUR Oil (BO) | 144,389                                |



|              |                            |
|--------------|----------------------------|
|              | JUBILEE 30-07H             |
|              | 49021209800000             |
|              | Niobrara                   |
|              | EOG RESOURCES INCORPORATED |
|              | 7 13 N 65 W                |
| Cum Oil (BO) | 56,422                     |
| EUR Oil (BO) | 152,245                    |



|              |                            |
|--------------|----------------------------|
|              | WINDY 01-18H               |
|              | 49021208750000             |
|              | Niobrara                   |
|              | EOG RESOURCES INCORPORATED |
|              | 18 13 N 64 W               |
| Cum Oil (BO) | 68,721                     |
| EUR Oil (BO) | 163,414                    |



## EMILY M. BOECKING

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(720) 929-6390

### EDUCATION

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|   |      |
|---|------|
| <b>Duke University</b> —Durham, North Carolina                      | 2007 |
| B.S.E., Dual Major: Mechanical Engineering & Biomedical Engineering |      |
| <b>Heritage Hall High School</b> —Oklahoma City, Oklahoma           | 2003 |

### WORK EXPERIENCE

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|  |                     |
|--|---------------------|
| <b>Anadarko Petroleum</b> —Denver, Colorado— <i>Senior Reservoir Engineer</i>  | Aug 2013 – Present  |
| Responsible for all reservoir engineering practices for assets in vertical gas field of Wamsutter as well as horizontal exploration and development of Codell and Niobrara in Laramie County, WY. Conducted analysis and economic evaluation for divestiture of company non-operated position in Pinedale/Jonah field. Primary tasks include management of asset budget and portfolio, evaluation of well performance in relation to geologic/reservoir properties as well as completion practices, and technical evaluation of asset field.   |                     |
| <b>Comstock Resources</b> —Frisco, Texas— <i>Corporate Development Engineer</i>  | May 2013 – Aug 2013 |
| Conduct appraisals of oil & gas prospects for potential acquisition consisting of engineering evaluations of reservoir quality, expected ultimate recovery of reserves, and economic value. Determine the potential acquisitions that would best augment current business portfolio as well as the potential divestiture packages of company's current assets that would best benefit overall business model of the company. Work with geoscience, operations, and drilling to provide feedback for optimization of well results and economic return.  |                     |
| <b>Chesapeake Energy</b> —Oklahoma City, Oklahoma— <i>Reservoir Engineer I</i>   | 2010 - 2013         |
| Responsible for all reservoir engineering practices for major company oil & gas assets including horizontal development in the Woodford Shale & Mississippi Lime as well as multi-zone vertical well fields. Analysis methods included decline curve reserve estimations, volumetric calculations, analytical material balance and type curve analysis, well test analysis, and reservoir fluid properties analysis. Performed economic evaluation and optimization for field development and exploration. Coordinated with geoscience, drilling, operations, and land disciplines to optimize project development. Mentored associate reservoir engineers in reservoir engineering practices. |                     |
| <b>Chesapeake Energy</b> —Oklahoma City, Oklahoma— <i>Associate Reservoir Engineer</i>   | 2008 - 2010         |
| Member of the company reservoir Corporate Reserves team charged with creating and evaluating best practices using stochastic methods for booking reserves in compliance with revised SEC reserve booking guidelines. Methods incorporated statistical analysis to meet the standard of reasonable certainty for booking proven undeveloped reserves at distances greater than one legal offset location from existing producing wells in with particular focus in the Barnett Shale, Fayetteville Shale, and Haynesville Shale.  |                     |
| <b>Chesapeake Energy</b> —Lindsey, Oklahoma— <i>Field Engineer</i>   | 2007 - 2008         |
| Worked as an onsite field engineer out of the company field office, overseeing completion and workover procedures including horizontal multi-stage fracture stimulations, uphole vertical well recompletions, and artificial lift installation and repair. Also completed a one month drilling rig rotation observing and learning horizontal drilling practices.  |                     |