



02109795

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

**RECEIVED**

NOV 17 2009

**COGCC**

IN THE MATTER OF THE PROMULGATION  
AND ESTABLISHMENT OF FIELD RULES TO  
GOVERN OPERATIONS IN THE SULPHUR  
CREEK FIELD, RIO BLANCO COUNTY,  
COLORADO

CAUSE NO. 527

DOCKET NO: 0911-AW-05

**REQUEST FOR DIRECTOR APPROVAL OF APPLICATION ON THE**  
**MERITS OF A VERIFIED APPLICATION AND SUPPORTING EXHIBITS**

By Verified Application ("Verified Application") filed with the Colorado Oil and Gas Conservation Commission ("COGCC") on July 7, 2009, Williams Production RMT Company ("Applicant") by and through its attorneys, Beatty & Wozniak, L.P., requested that the COGCC permit optional ten acre density drilling for certain described lands for the Williams Fork and Iles Formations (including the Sego member of the Iles Formation of the Mesaverde Group. The Verified Application has not been contested. Pursuant to Rule 511.a., Applicant hereby requests that the Director recommend approval of the Verified Application on the basis of the merits and the supporting exhibits.

**BACKGROUND AND STATUS OF THE APPLICATION**

1. Applicant owns a leasehold interest in the Application Lands as described in its verified application.
2. Approval of the Verified Application will allow gas and associated hydrocarbon substances from the Williams Fork and Iles Formations (including the Sego member of the Iles Formation to be developed and will not result in violation of correlative rights and will prevent waste.
3. Applicant requests that notice be taken of the testimony and evidence presented in the Application which resulted in the Commission's Orders 527-1 and 527-4.

### VERIFIED STATEMENT

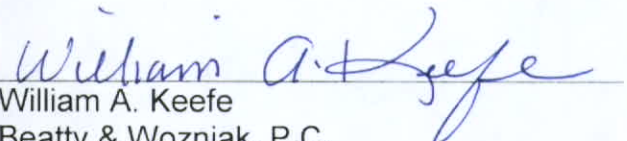
Attached are the verified statements of Maxwell Faith, Landman for Applicant, Eric C. Stenberg, Senior Staff Geoscientist of Applicant and Gabriel J. D'Arthenay Senior Petroleum Engineer of Applicant submitted in support of this request for the Director to recommend approval of the Verified Application on the basis of the merits and the supporting exhibits.

DATED: November 17th, 2009.

Respectfully submitted,

WILLIAMS PRODUCTION RMT COMPANY

By:



William A. Keefe

Beatty & Wozniak, P.C.

216 Sixteenth Street, Suite 1100

Denver, Colorado 80202-5115

Telephone No.: (303) 407-4475

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NOV 17 2009

DOJGCC

*WILLIAMS PRODUCTION RMT  
COMPANY*

Cause No. 527  
Docket No. 0911-AW-05  
Williams Production RMT Company



STATE OF COLORADO

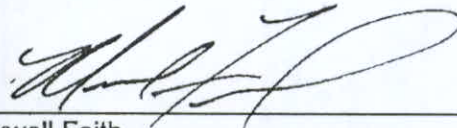
CITY AND COUNTY OF DENVER

)  
) ss.  
)

Verified Statement of Maxwell Faith

In support of the request for Director approval of the Verified Application of Williams Production RMT Company in Cause No. 527, DOCKET NO. 0911-AW-05, pursuant to Rule 511.b, Maxwell Faith, Landman of Williams Production RMT Company, upon oath, deposes and states as follows:

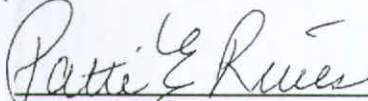
- a. I am currently employed as a Landman of Williams Production RMT Company. I have been and am presently responsible for and have knowledge of the land position related to the Application Lands.
- b. Attached is a copy of my resume prepared by me. Attached are Exhibits C-1 and C-2 which were prepared by Eric Stenberg. I have reviewed these exhibits, and to the best of my knowledge and belief, the exhibits are correct and accurate as of the date of this Verified Statement.
- c. Exhibit C-1 is a plat of Williams' Ryan Gulch prospect situated in Rio Blanco County, Colorado. Ryan Gulch is located in Townships 1 through 4 South, Ranges 97 through 99 West. Only a small portion of the prospect is being considered in this application and the application lands are shaded in pink. The application lands in Ryan Gulch area are entirely Federal Oil & Gas Leases and a majority of which are under federal-owned surface estate. Exhibit C-2 is a plat of the application lands, shaded in pink, with other lands in the proximate area already approved for 10-acre density for Williams Fork, Iles, and Sego shaded in blue. Williams owns a leasehold interest in all the application lands shaded in pink, Williams also holds a leasehold interest in the lands surrounding the application lands shaded in yellow. Williams has focused mainly on developing the Williams Fork, Iles, and Sego Formations in the Ryan Gulch area. Allowing well density on a 1 well per 10 acre basis would enable Williams to develop our assets of the Ryan Gulch area in an economic matter, while simultaneously protecting our correlative rights from leases surrounding it.
- d. I have not been advised of and am not aware of any protests to this Verified Application.
- e. The parties identified on the Exhibit A to the Verified Application are the parties entitled to notice under the rules of the COGCC.



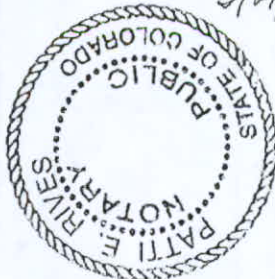
Maxwell Faith

Subscribed to and sworn to before me this 17<sup>th</sup> day of November, 2009 by Maxwell Faith, Landman of Williams Production RMT Company.

My Commission expires: 5/21/2011

  
Notary Public

Address: 1515 Arapahoe St. Jwr 3 #1000  
Denver CO 80202





**MAXWELL G. FAITH**  
Williams Production RMT Company  
1515 Arapahoe Street - Tower 3, Suite 1000  
Denver, CO 80202  
maxwell.faith@williams.com

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**EXPERIENCE**

**Williams Production RMT Company**

**Denver, CO**

**Landman**

**December 2007 - Present**

Responsible for all land related functions in an assigned areas, provide land support to all disciplines of asset team for annual drilling program, including review of drilling title opinions, perform necessary curative; conduct written and verbal communications with third parties to obtain well participation decisions, preparation and negotiation of joint operating agreements, farmout agreements, acreage trades/swaps with third parties, negotiation of lease terms and all other typical oil and gas land related agreements. Interaction with internal drilling operations and planning groups as well as interaction with outside third party operators and partners, organize and supervise efforts of outside lease brokers, contract Landmen and title attorneys.

**Strata Oil & Gas Company, LLC**

**Denver, CO**

**Independent Landman**

**May 2005 - December 2007**

Worked in numerous counties in Colorado, New Mexico, Washington and Wyoming performing cursory and curative title searches. Negotiated and prepared oil and gas leases and surface-use agreements for mineral and surface owners. Performed due diligence for client acquisitions. Prepared abstracts of title from county records for drilling title opinions.

**Fitzsimmons, LLC**

**Gillette, WY**

**Independent Landman**

**April 2004 - May 2005**

Worked in various counties in Colorado and Wyoming negotiating and preparing oil and gas leases and surface-use agreements for mineral and surface owners. Conducted research to secure title for leases in title companies and in county records.

**E & G Energy**

**Shelby County, TX**

**Landman**

**February - March 2004**

Worked with lease and right-of-way brokers in Texas, processed title for mineral and property owners with oil and gas landmen.

**Enterprise Leasing**

**Washington, DC**

**Management Trainee**

**November 2002 - January 2004**

Involved in Management Training program focusing on all aspects of a managerial position. Responsible for daily operation of car rental branch, including contract underwriting, inside sales to customers and outside sales to local businesses, marketing to client accounts, and customer service.

**EDUCATION**

**Tulane University**

**New Orleans, LA**

Bachelor of Arts in Communications

**May 2002**

Minor in Business

**PROFESSIONAL ASSOCIATIONS**

American Association of Professional Landmen

Denver Association of Petroleum Landmen

- Ryan Gulch Prospect
- Application Lands
- Lands previously approved for 10-acre density Order No. 527-1,4

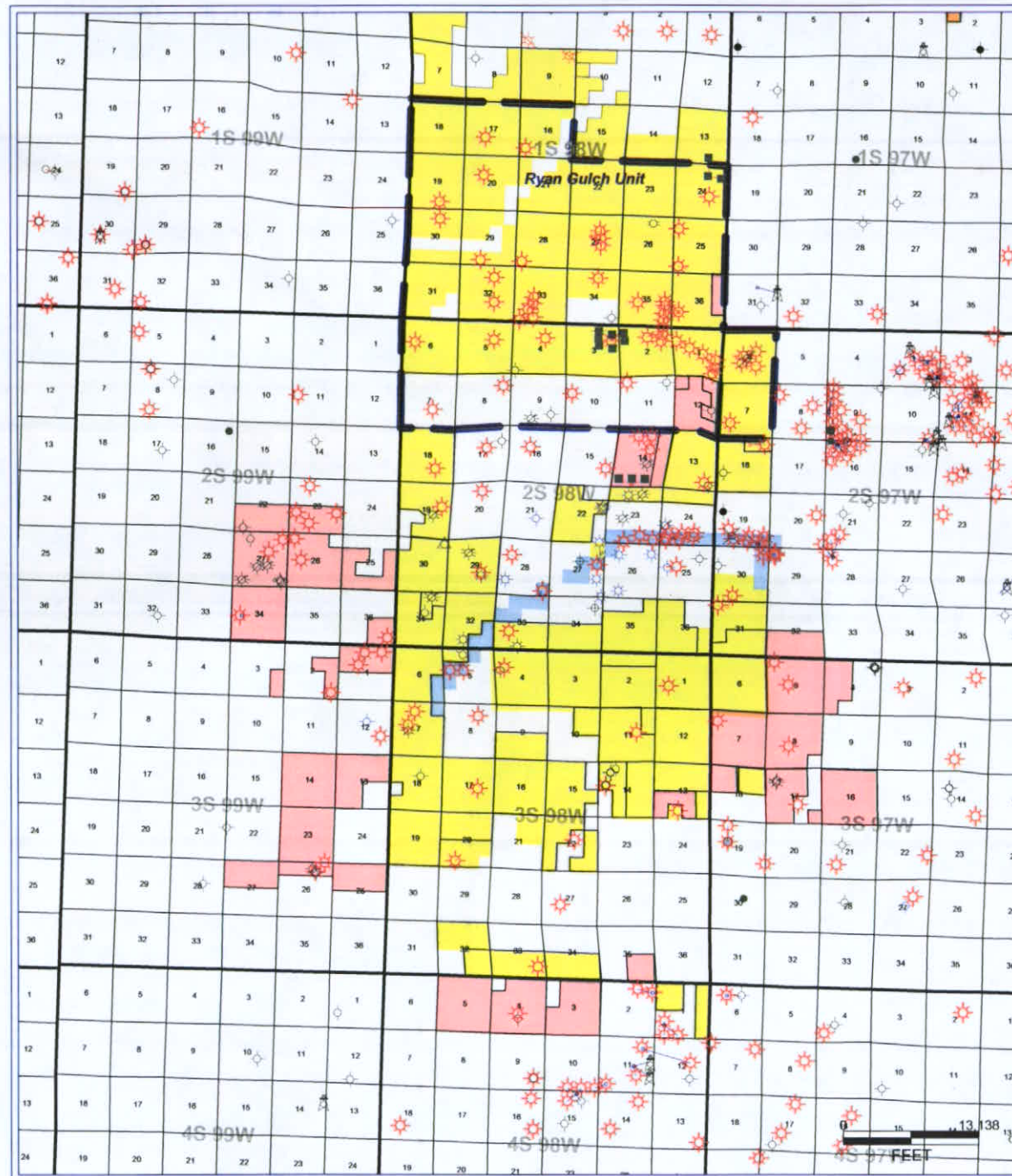


Exhibit C-1



- Application Lands
- Lands previously approved for 10-acre density Order No. 527-1,4

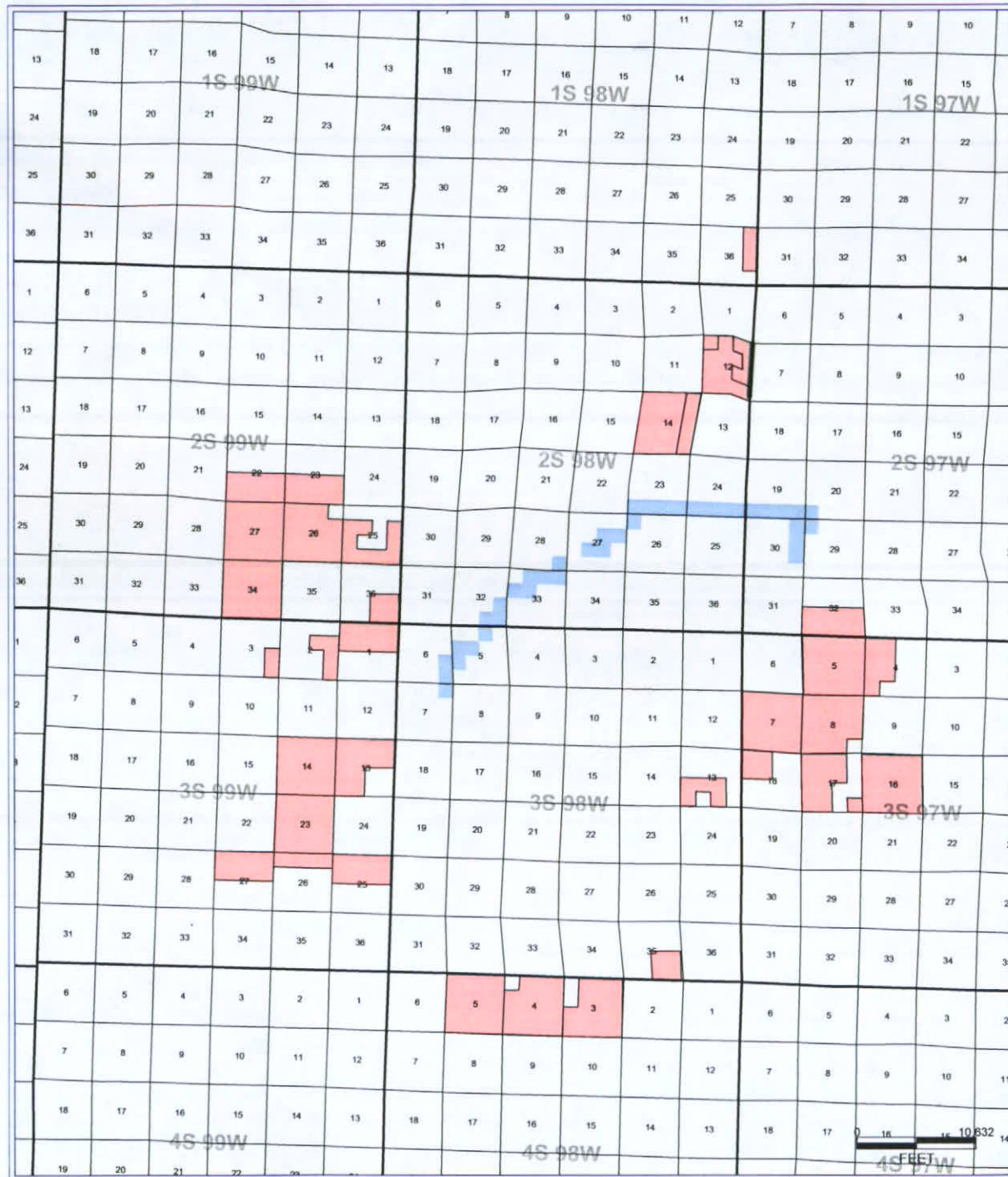


Exhibit C-2



STATE OF COLORADO

)

) ss.

CITY AND COUNTY OF DENVER

)

Verified Statement of Eric C. Stenborg

In support of the request for Director approval of the Verified Application of Williams Production RMT Company in Cause No. 527, Docket No. 0911-AW-05, pursuant to Rule 511.b, Eric C. Stenberg, Sr. Staff Geoscientist of Williams Production RMT Company, upon oath, deposes and states as follows:

- a. I am currently employed as a Sr. Staff Geoscientist for Williams Production RMT Company. I have been and am presently responsible for and have knowledge of the geologic characteristics of the Williams Fork, Iles, and Sego Formations underlying the Application Lands.
- b. I have not previously testified as an expert witness in petroleum geology matters before Hearing Officers of the COGCC. My resume is attached as **Exhibit B-1** and I have 27 years of geologic experience in the Oil and Gas industry. Attached Exhibits B-1 through B-10 were either prepared or compiled by me. I have reviewed each of those exhibits, and to the best of my knowledge and belief, each of those exhibits is correct and accurate as of the date of this Verified Statement.
- c. **Exhibit B-2**  
Exhibit B-2 is a type log for the Mesaverde Group. The well in Exhibit B-2 is located in Section 14, Township 2S, Range 98W and is situated on application lands. The well name is the Federal RG 32-14-298.

The Mesaverde Group is Upper Cretaceous in age and consists of, from youngest to oldest, the Williams Fork, Iles, and Sego Formations. This application requests 10-acre spacing for all of these formations.

The Williams Fork Formation is comprised of sandstones, shales, and coals deposited in an upper to lower coastal plain setting. The lower 400 feet of the Williams Fork Formation is a coal bearing member commonly known as the Cameo Coal Interval. The sandstones in the Williams Fork Formation are fluvial in origin and were deposited in meandering to braided stream depositional environments.

Shown on this type log is the Top of Gas Saturation. This is the point below which sands that are perforated will produce essentially water-free



gas. The productive sandstones throughout the Williams Fork Formation are laterally discontinuous and naturally fractured, and have microdarcy permeability and porosities ranging from 6% to 10%. Gross productive interval ranges from 2000' to 3000'. Because of the tight nature of these sands, they will not produce economic volumes of gas unless they are fracture stimulated.

The Iles formation consists of three members; the Rollins Sandstone, and the Cozzette and Corcoran members.

The Rollins Sandstone was deposited in a shoreline environment and is laterally continuous except where faulted. This sandstone, which is about 100' thick, is generally not a target in the application lands due to its tendency to produce high volumes of water. However, where trapping conditions are suitable it can produce in isolated areas. Porosity ranges between 6% and 12% and permeability is in the microdarcy range.

The Cozzette Member is an interval of approximately 220' thick and consists of interbedded sandstones and shales with some thin coals and carbonaceous shales. The very top sandstone of the member appears to be of marine shoreline origin similar to the Rollins but much thinner. It is not usually targeted because like the Rollins it is prone to produce water. The remaining sandstones within the Cozzette Member are targets and are thought to have been deposited in lower coastal plain fluvial meandering streams with possible tidal influences. From observations of many electric logs in the application area, the sandstones appear to be discontinuous as would be expected from sandstones deposited in channel environments. Porosity ranges between 6% and 10% and permeability is in the microdarcy range.

The Corcoran Member is approximately 360' thick and consists of interbedded sandstones and shales with some thin coals and carbonaceous shales. The sandstones of this member are very similar to the fluvial, discontinuous sandstones of the overlying Cozzette Member.

The Sego Formation consists of two intervals, the Upper Sego and Lower Sego Sandstones. The Upper Sego is approximately 240' thick, while the Lower Sego is about 150' thick. Like the Cozzette and Corcoran members, these sandstones are thought to have been deposited in a lower coastal plain environment with possible tidal influences. The predominant depositional environment is thought to be meandering streams. As in the Cozzette and Corcoran members, observations of electric logs suggest that these sandstones are discontinuous in nature. However, in some places within the application lands the sandstones in the Upper Sego can be quite thick. It is thought that these thick



sandstones represent amalgamated or stacked channel sands that have questionable reservoir continuity between adjacent sandstones. Porosity ranges between 6% to 10% and permeability is in the microdarcy range. In this area the Lower Sego sandstone is the oldest sandstone of the Mesaverde Group, and overlies the first marine shale tongue of the Mancos Group.

d. **Exhibit B-3**

Exhibit B-3 is an index map showing the location of three stratigraphic cross-sections in this application. Cross-sections A-A' and B-B' cover the west and east parts (respectively) of the application lands, and cross-section C-C' is a local cross-section of two wells approximately 740' apart.

e. **Exhibit B-4**

Exhibit B-4 is stratigraphic cross-section A-A' that runs through the western portion of the application lands. This section includes two wells spaced 6.6 miles apart. This section shows that all of the formations under consideration for 10 acre spacing are present in this area. In addition, the numerous sands and variable nature of the channel sand development in the Williams Fork, Cameo, Cozzette, Corcoran, and Sego intervals is displayed.

f. **Exhibit B-5**

Exhibit B-5 is stratigraphic cross-section B-B', which spans across the eastern portions of the application lands. Two wells are shown that are spaced 5.1 miles apart. As in the previous exhibit, this section shows that all of the formations under consideration for 10 acre spacing are present in this area. Again, the numerous sands and variable nature of the channel sand development in the Williams Fork, Cameo, Cozzette, Corcoran, and Sego intervals is displayed.

g. **Exhibit B-6**

Exhibit B-6 is stratigraphic cross-section C-C' of just the Williams Fork interval between two closely spaced wells in the application area. These two wells are spaced 740' apart which compares to an average distance of 660' between wells on 10 acre spacing. The purpose of this exhibit is to demonstrate the poor continuity of most of the sandstones within this interval, especially of the numerous thin sandstones. It also demonstrates that significant reserves would likely be bypassed with a well spacing larger than 10 acres.

h. **Exhibit B-7**

Exhibit B-7 is a photograph of the Williams Fork outcrop northeast of Grand Junction, near Cameo, Colorado, approximately 45 miles south



of the application lands. The sediments visible in this outcrop are very similar to the lower portion of the productive Williams Fork section in the application lands area. In the bottom of the photograph, we can see the laterally continuous marine Rollins Sandstone which defines the base of the Williams Fork Formation. The reddish colored sediments just above the Rollins define the Cameo member and the middle and upper portions of the photograph show a significant section of the sands and shales of the remaining Williams Fork Formation. The primary purpose of this photograph is to show the discontinuous nature of the channel sands and their approximate dimensions. Two hypothetical 10-acre wells spaced 660ft apart are shown intersecting different sandstones separated by shales. A study of this particular outcrop was performed by Dr. Rex Cole of Mesa State. Dr. Cole and his students physically measured the widths of 137 of the sand bodies shown in this photograph and the results of their work are outlined in Exhibit B-8.

i. **Exhibit B-8**

Exhibit B-8 shows the frequency of different Williams Fork sand body widths in outcrop and their cumulative frequency. The graph shows that 80% of the measured sand bodies have widths of less than 750 ft and that over 60% of the sand bodies have widths less than 500 ft. The average width of the 137 sand bodies measured in the study is 682 ft. For reference, 10-acre density is equivalent to wells that are 660 feet apart. Again, this study shows that significant reserves would likely be bypassed with a well spacing larger than 10 acres.

j. **Exhibit B-9**

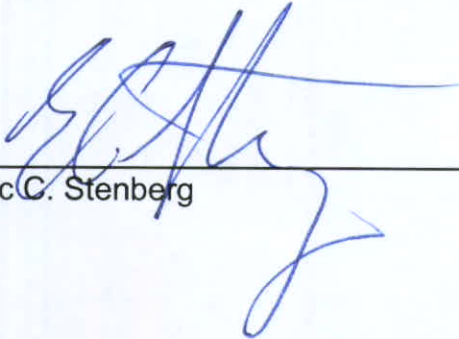
Exhibit B-9 is a sketch of a portion of the Williams Fork outcrop on the west side of Rifle Gap, on the eastern margin of the Piceance Basin. This diagram shows two sands in the same stratigraphic horizon with two hypothetical 10-acre wells, spaced 660 ft apart. This figure shows that nearby sand bodies in the same stratigraphic horizon are in fact, different sands.

k. **Exhibit B-10**

Exhibit B-10 is a stratigraphic cross-section of the Iles-Sego interval between the same two closely spaced wells (740' apart) shown in Exhibit B-6. The purpose of this exhibit is to demonstrate the limited continuity of most of the productive channel sands within this interval, especially of the thinner sands. Note also that the Rollins and uppermost Cozzette sandstones *are* continuous due to their marine origin. As noted above, these two continuous sands are not often completed due to high water cut. As in the Williams Fork-Cameo interval, this cross-section demonstrates that significant reserves would likely be bypassed with a well spacing larger than 10 acres.

I. **Summary**

The nature of the depositional environments and the associated limited extents of individual sand channel reservoirs within the Williams Fork, Iles, and Sego Formations justify 10-acre well density in order to minimize bypassed reserves.

  
\_\_\_\_\_  
Eric C. Stenberg

Subscribed to and sworn to before me this 5th day of November, 2009 by Eric C. Stenberg, Sr. Staff Geoscientist for Williams Production RMT Company.

My Commission expires: 5/21/2011



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

Address: 1515 Arapahoe St.  
Lower 3, #1600  
Denver CO 80202



## Eric C. Stenberg

Williams Production RMT  
1515 Arapahoe Street, Tower 3, Suite 1000  
Denver, Colorado 80202  
(303) 606-4057  
eric.stenberg@williams.com

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### Professional Experience:

- |                              |   |                  |
|------------------------------|---|------------------|
| Aug 2008<br>to Current       | Williams Production RMT<br><b>Sr. Staff Geoscientist, Piceance Highlands Asset Team</b>   | Denver, Colorado |
|                              | <ul style="list-style-type: none"><li>• Responsible for all Mesaverde geologic operations in Williams-operated Ryan Gulch field area in the northern Piceance Basin, Colorado.</li><li>• Duties require an understanding of the stratigraphy, structure, and reservoir qualities of the Williams Fork, Iles, and Sego formations.</li><li>• Other duties include well planning, monitoring drilling wells and well logging, and the identification of pay intervals for well completions.</li></ul> |                  |
| Sep 2003<br>to Aug 2008      | Williams Production RMT<br><b>Powder River Basin Geological Supervisor</b>  | Denver, Colorado |
|                              | <ul style="list-style-type: none"><li>• In addition to all of the geologic duties described below, supervised one geologist and one geotechnician.</li></ul>  |                  |
| March 2002<br>to Sep 2003    | Williams Production RMT<br><b>Senior Staff Geoscientist</b>   | Denver, Colorado |
|                              | <ul style="list-style-type: none"><li>• Responsible for the geologic operations of one-half of Williams' CBM development in the Powder River Basin, Wyoming.</li><li>• Mapped numerous Fort Union coals over a large area.</li><li>• Proposed up to 250 CBM wells per year, and monitored the subsequent drilling of these wells. Also monitored the drilling of 100-200 3rd party CBM wells per year.</li><li>• Experienced with coal coring and gas content/isotherm analysis.</li></ul>          |                  |
| August 2000<br>to March 2002 | CMS Oil & Gas<br><b>Senior Geologist</b>  | Denver, Colorado |
|                              | <ul style="list-style-type: none"><li>• Managed all geological operations of CMS's coalbed methane drilling program in the Powder River Basin, Wyoming.</li><li>• Involved in drilling approximately 350 CBM wells.</li><li>• Responsible for selecting all new CBM locations for CMS.</li><li>• Supervised two field and one office personnel.</li><li>• Prepared geologic exhibits and testified for WOGCC hearings.</li></ul>  |                  |

**Exhibit B-1**

**Cause No. 527**

**Docket No. 0911-AW-05**



- August 1997 to August 2000      Lance Oil & Gas/Western Gas Resources      Denver, Colorado  
**Geologist**
- Studied Lewis and Almond sandstone potential in the Sand Wash Basin. Recommended a successful Lewis development program. In addition, along with another geologist created and sold two exploratory Lewis prospects.
  - Conducted regional CBM studies and generated prospects in the Piceance, Sandwash, and Forest City basins.
  - Evaluated approximately \$15 MM of acreage acquisitions and trades in the PRB CBM play.
- Jan 1987 to August 1997      Martens & Peck Opr. Co. / American Oil and Gas      Denver, Colorado  
**Senior Geologist**
- Conducted regional exploration studies in various Rocky Mountain basins for prospect generation and speculative acreage buying purposes. These basins included the Piceance, Paradox, Powder River, and Williston Basins.
  - Prepared geologic maps and cross-sections in the Powder River Basin CBM play. Did wellsite geology and field supervision for the drilling of approximately 100 CBM wells.
- April 1986 to January 1987      Various Companies      Denver, Colorado  
**Consulting Geologist**
- Worked on several development projects for clients in Colorado, Montana, and North Dakota.
- January 1982 to January 1986      Petro-Lewis Corporation      Denver, Colorado and Lubbock, Texas  
**Development Geologist**
- Responsibilities included 35 fields in the Rocky Mountain Region and the Permian Basin.
  - Analyzed fields for step-out drilling and recompletion potential.
  - Generated prospects which resulted in drilling two commercial oil wells and one commercial gas well.
- Education:**      Colorado School of Mines      Golden, Colorado  
**BSc. Geological Engineering**      1981

**Professional Affiliations:**

- American Association of Petroleum Geologists
- Rocky Mountain Association of Geologists
- Wyoming Board of Professional Geologists

**Exhibit B-1****Cause No. 527****Docket No. 0911-AW-05**

Type Log for the Mesaverde Group,  
Ryan Gulch Field Area, Rio Blanco County, Colorado

0510312790000

Williams  
Federal RG  
32-14-238

Twn-Rgn-Sec : 72S R8W S14



Tertiary

Ft. Union Fm.

Upper Cretaceous

MESAVERDE GROUP

WILLIAMS FORK FORMATION

ILES  
FORMATION

SEGO  
FORMATION

Top Gas Saturation

CAMEO COAL INTERVAL

ROLLINS SANDSTONE

COZZETTE MEMBER

CORCORAN MEMBER

UPPER SEGO SANDSTONE

LOWER SEGO SANDSTONE

Mancos Group

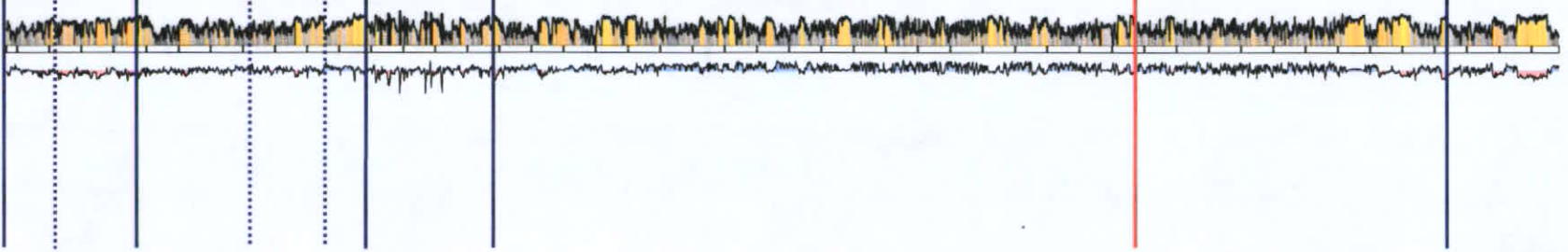


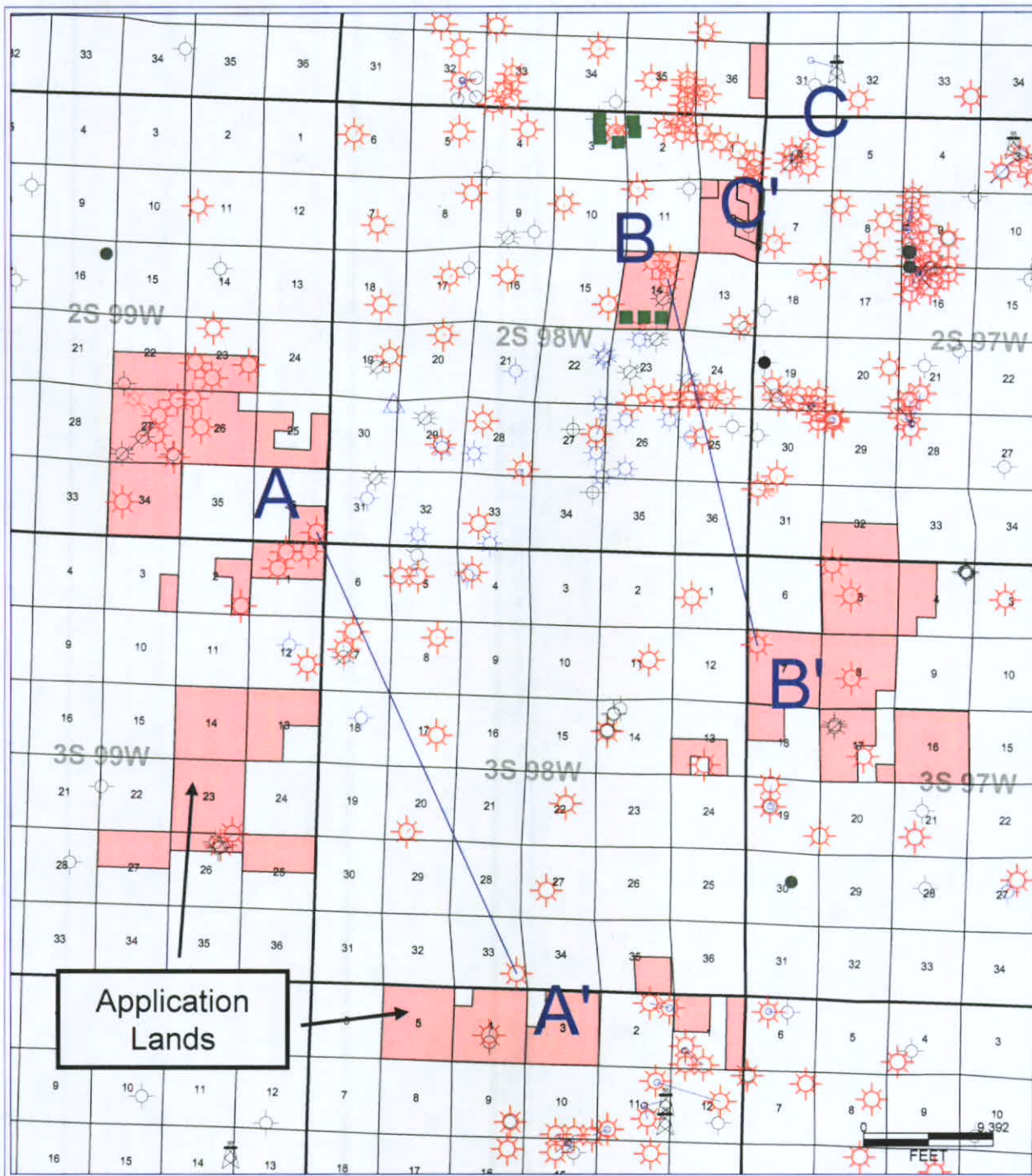
Exhibit B-2

Cause No. 527

Docket No. 0911-AW-05



# Cross-Section Index Map



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**Exhibit B-3**  
**Cause No. 527**  
**Docket No. 0911-AW-05**



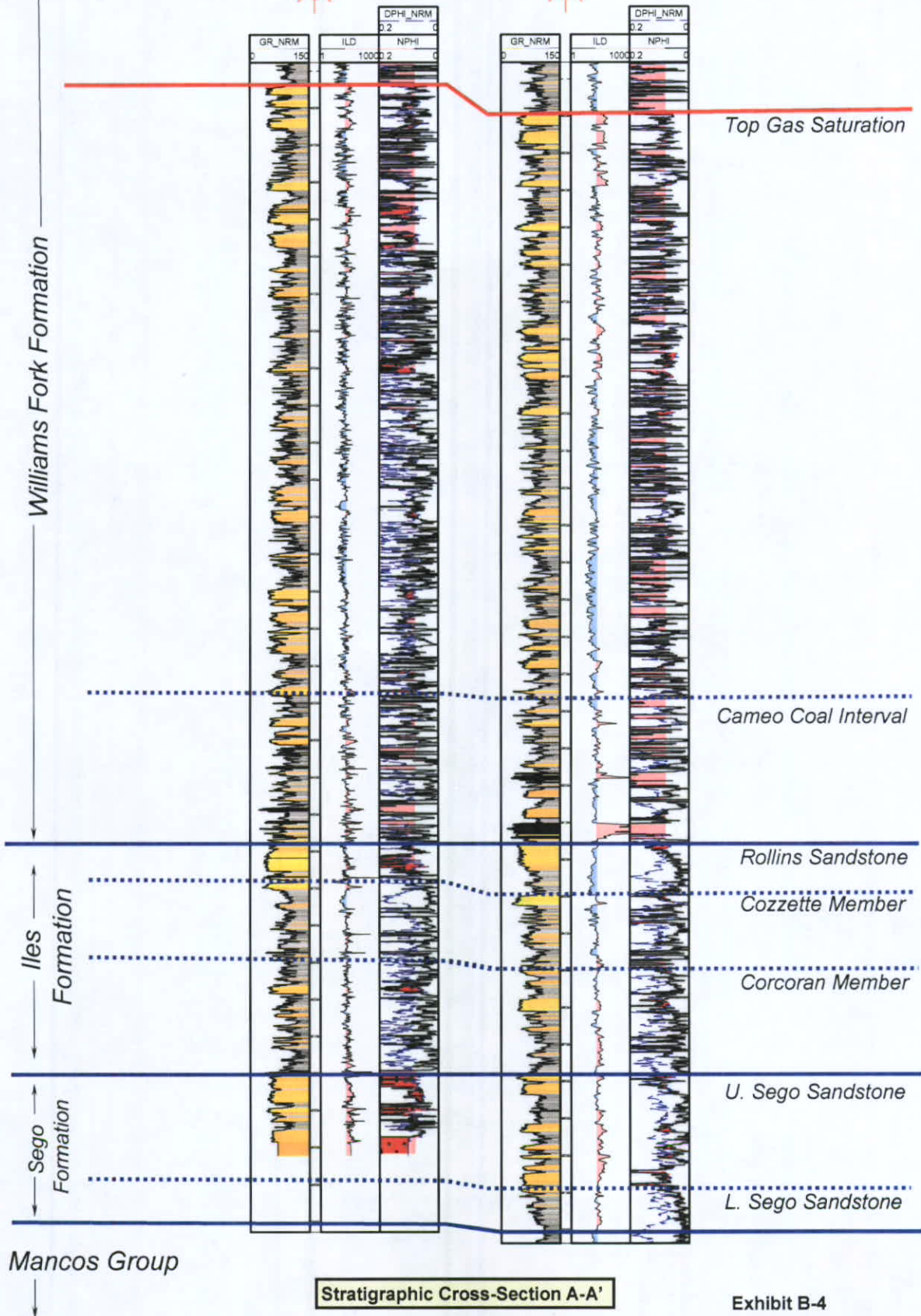
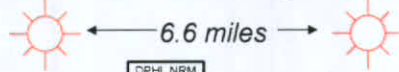
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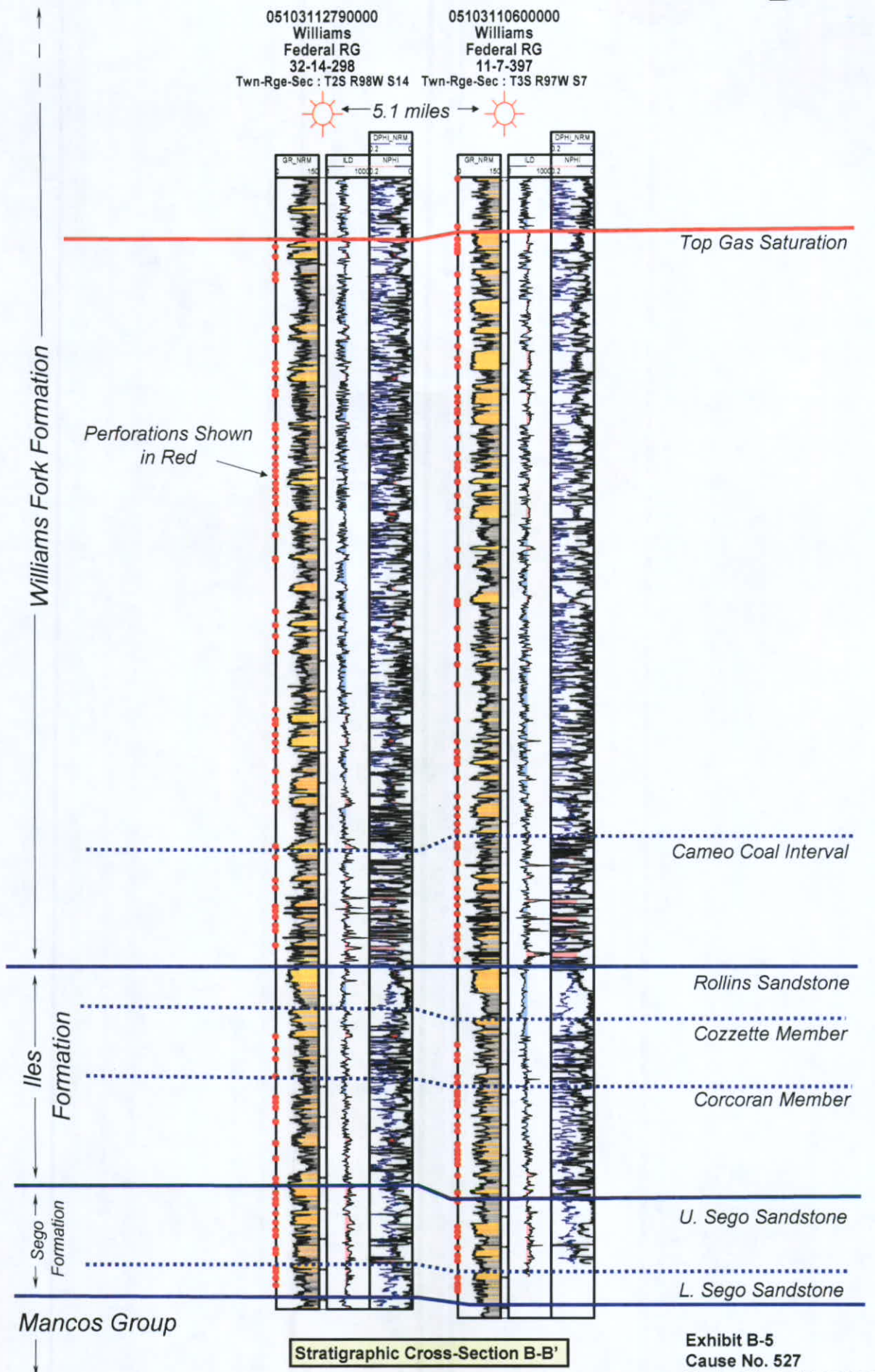
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CSG EXPLORATION CO  
GOVT  
398-33-4

Twn-Rge-Sec : T2S R99W S36 Twn-Rge-Sec : T3S R98W S33



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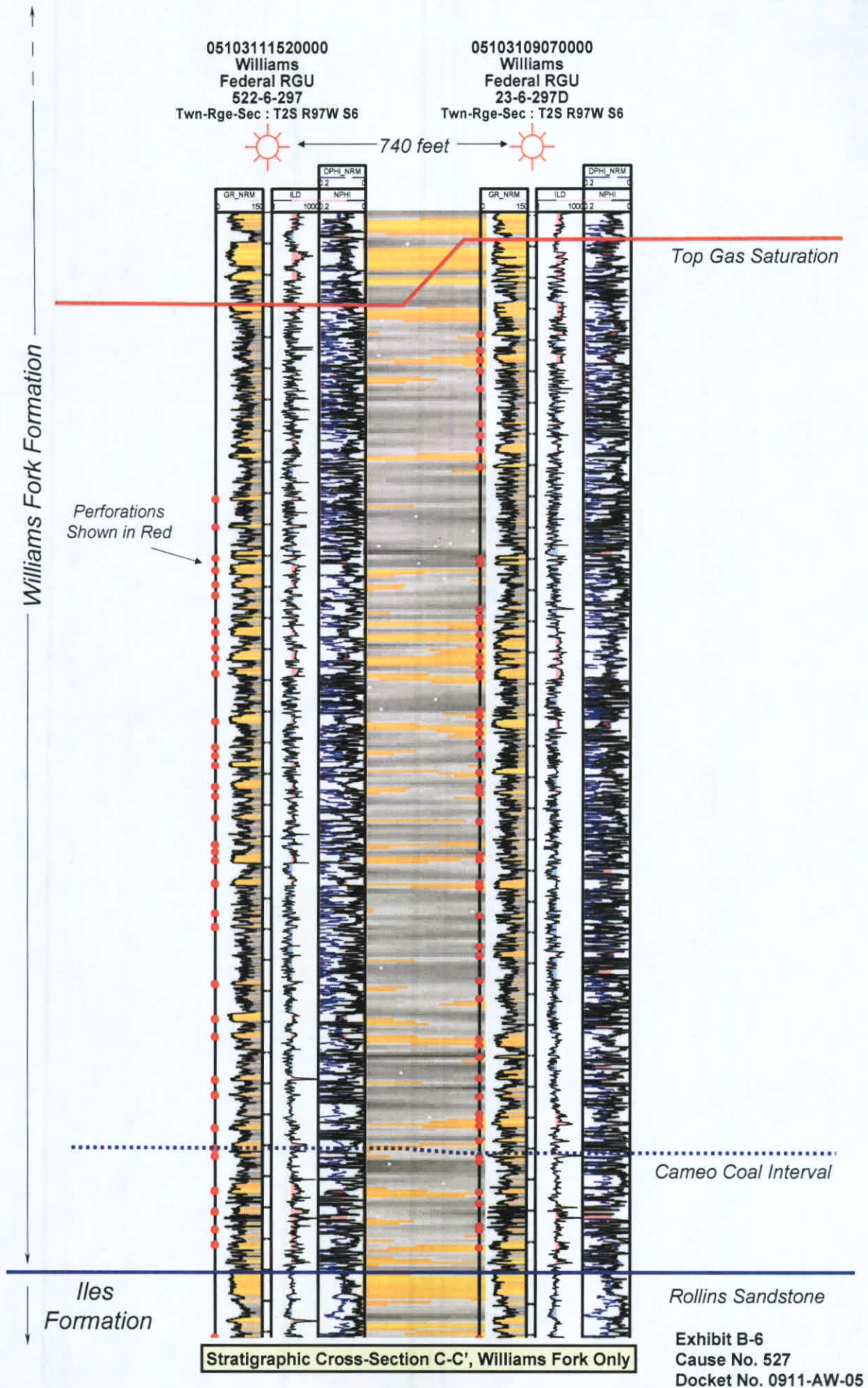
B'





C

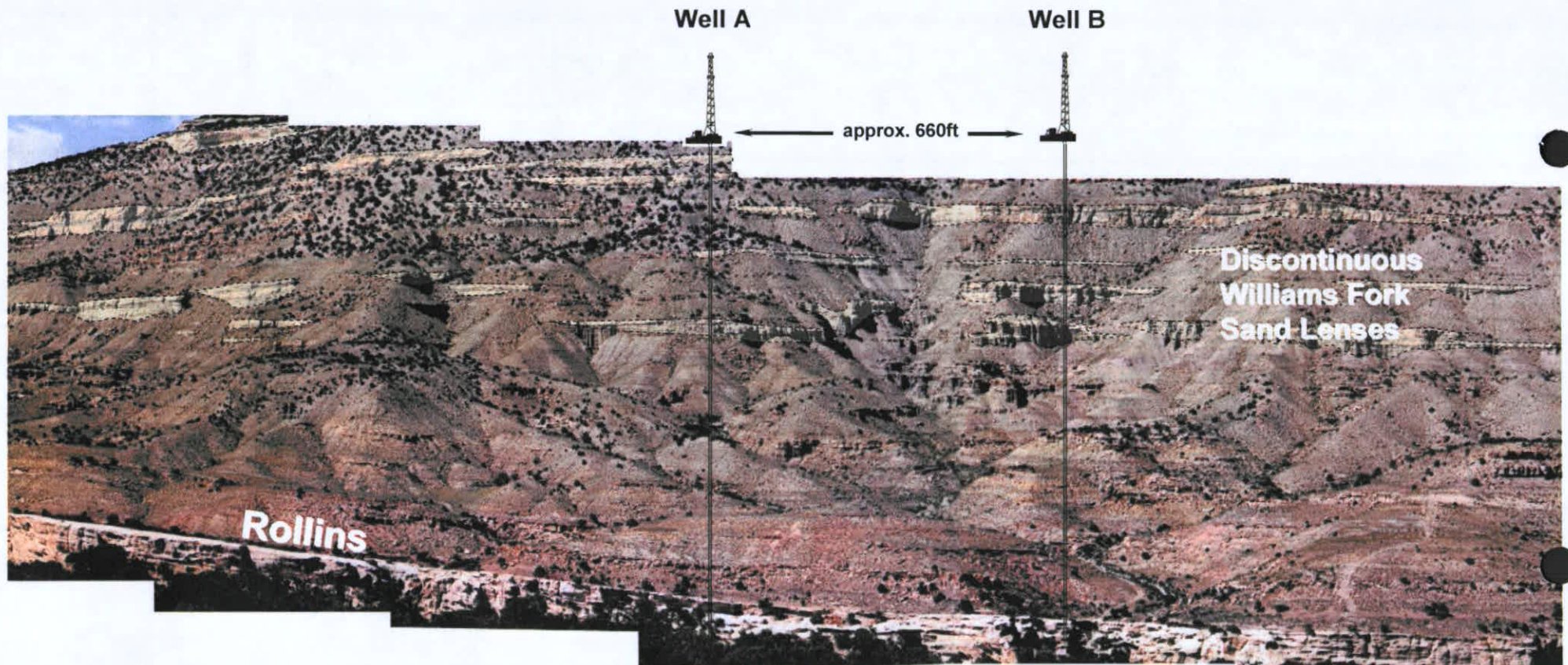
C'





# Mesaverde Outcrop, Coal Canyon Near Cameo, Colorado

Williams Fork Sandstone Bodies With Hypothetical 10-acre wells



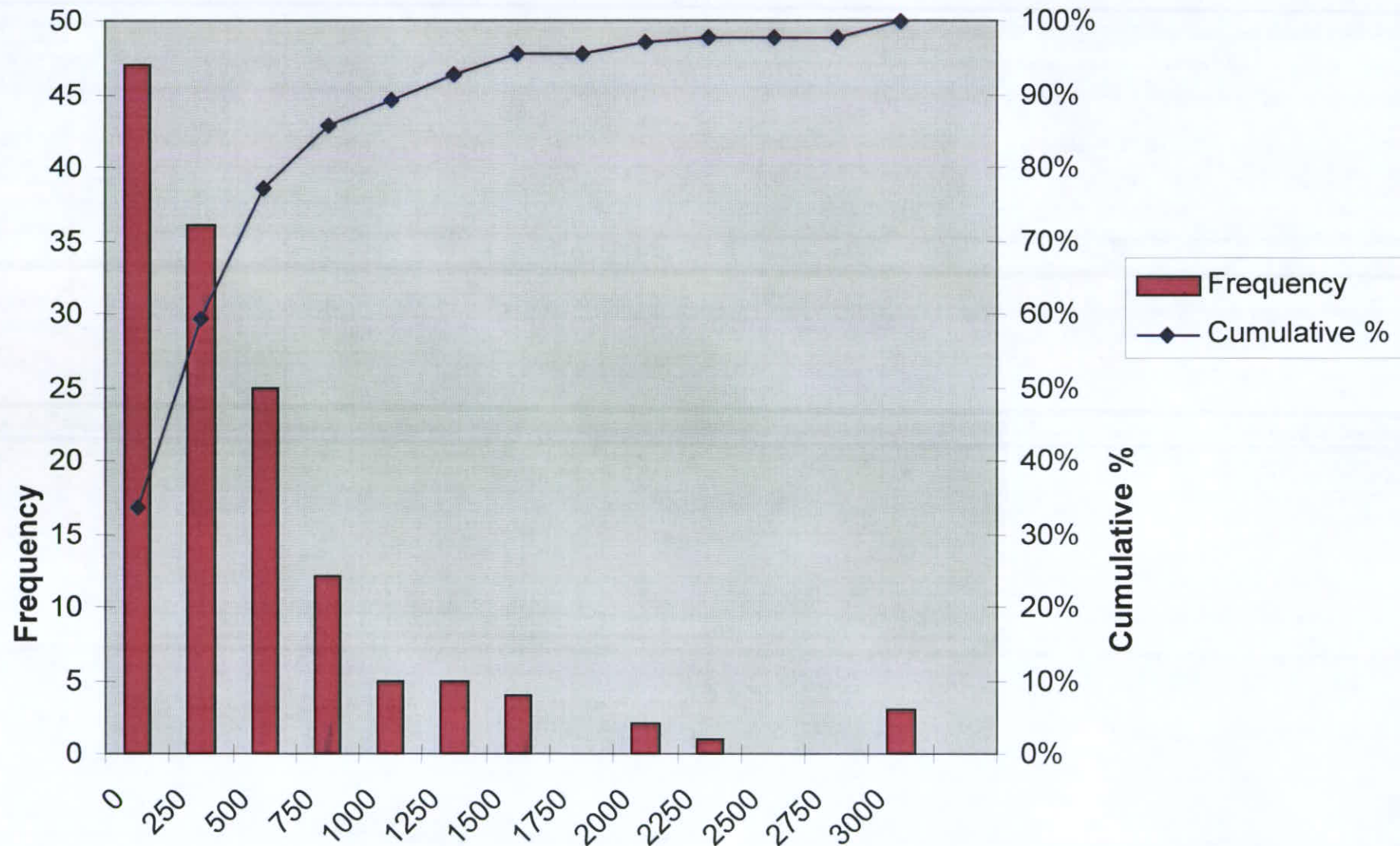
Approximately 45 miles south of 10 acre spacing application lands, very similar lower Williams Fork section to that in the application area.

Outcrop study of excellent exposures near Cameo, Colorado was undertaken to gather data on Williams Fork and Cameo sand body extents

Exhibit B-7  
Cause No. 527  
Docket No. 0911-AW-05



## Williams Fork Outcrop Sand Body Sizes

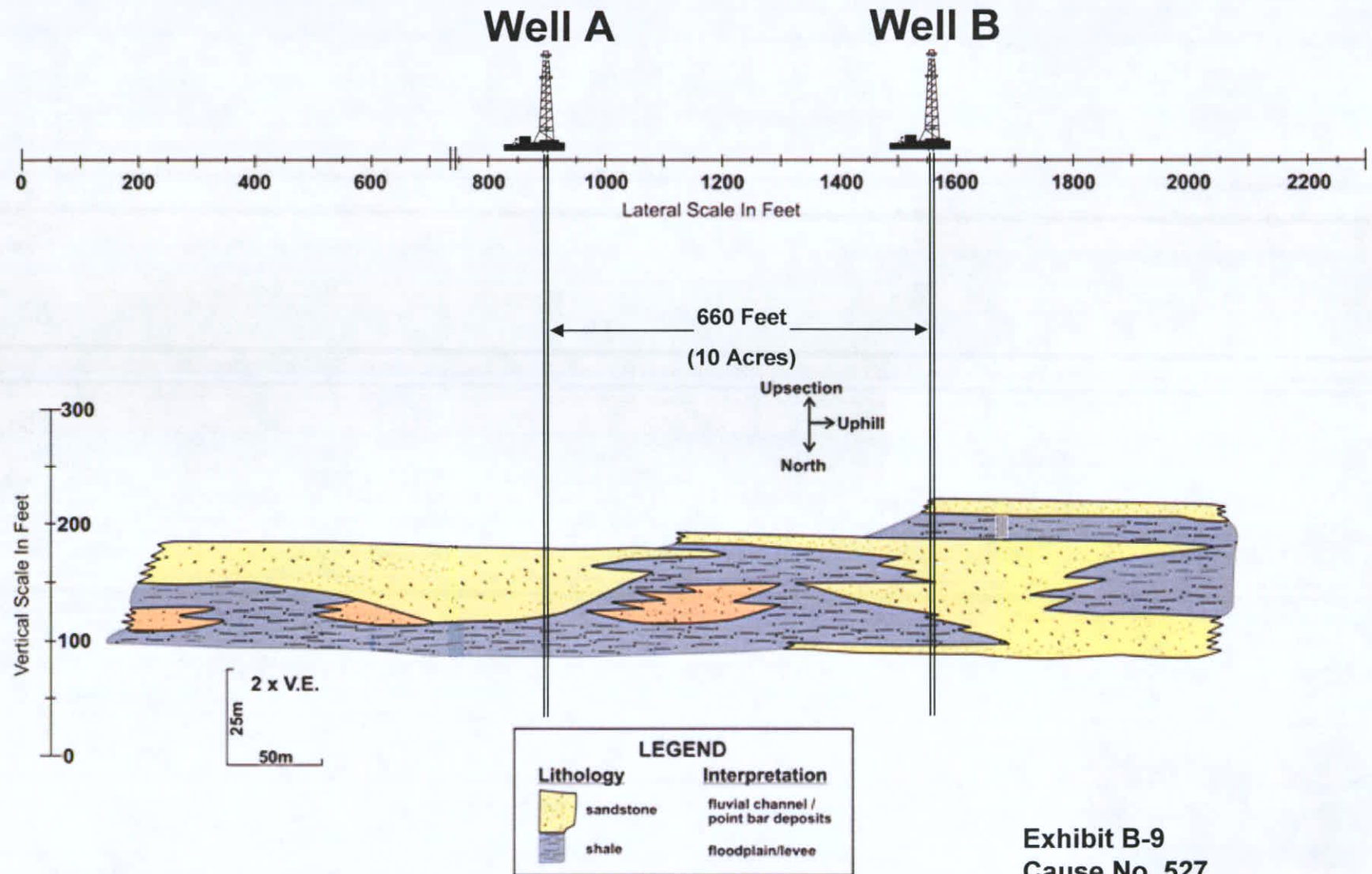


**Average Extents of 137 Sand Bodies=682 ft**

**Exhibit B-8  
Cause No. 527  
Docket No. 0911-AW-05**

# Williams Fork Sandstone Bodies With Hypothetical 10-Acre Wells

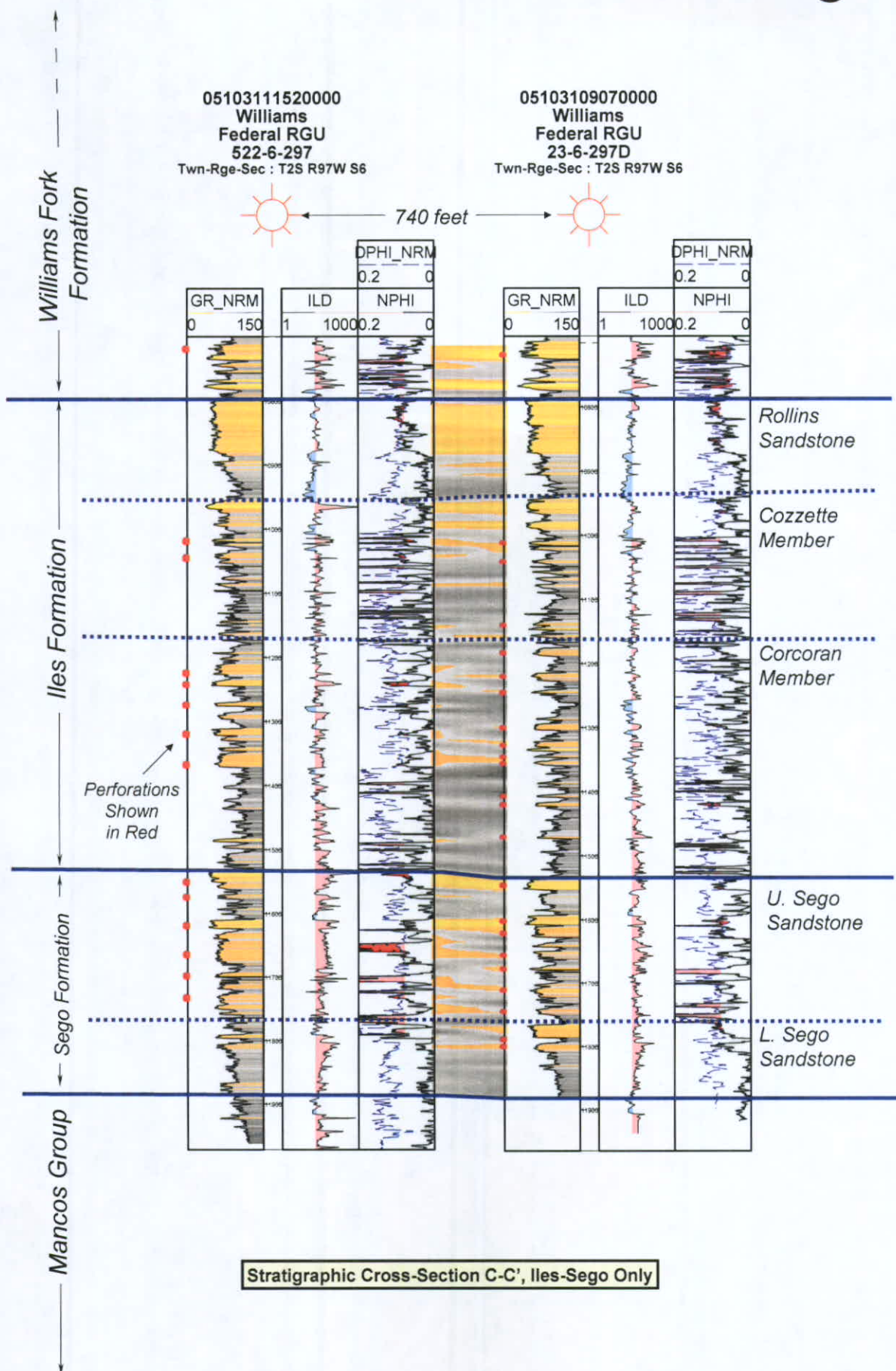
Eastern Margin of Piceance Basin - Mesaverde Outcrop at Rifle Gap (near Rifle, Colorado)



Outcrop of lens 8, west side of Rifle Gap, modified from Lorenz, 1982 (Pg. 28, Fig. 12).

Exhibit B-9  
Cause No. 527  
Docket No. 0911-AW-05





STATE OF COLORADO

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) SS.

CITY AND COUNTY OF DENVER

)

Verified Statement of Gabriel J. D'Arthenay

In support of the request for Director approval of the Verified Application of Williams Production RMT Company in Cause No. 527, DOCKET NO. 0911-AW-05, pursuant to Rule 511.b, Gabriel J. D'Arthenay, Senior Petroleum Engineer of Williams Production RMT Company, upon oath, deposes and states as follows:

- a. I am currently employed as a Senior Petroleum Engineer of Williams Production RMT Company. I have been and am presently responsible for and have knowledge of the land position related to Engineering.

- b. Attached is a copy of my resume attached as Exhibit A-21. Attached Exhibits A-1 through A-21 were prepared by me or under my direction and control. I have reviewed each of those exhibits, and to the best of my knowledge and belief, each of those exhibits is correct and accurate as of the date of this Verified Statement.

- c. Exhibit A-1
- Two 160 acre tract areas in Grand Valley and Rulison fields were drilled on 10-acre density as the first pilot areas in 2001-2002. These areas were chosen due to the staggered development on 40-acre and 20-acre density and the high cumulative production of gas. This area would have the highest likelihood of any observed depletion within each field. 8 producing wells existed and 8 new 10-acre wells were drilled in each 160-acre pilot. A total of 219 individual sand bodies were tested within the 16 new 10-acre wells which were composed of bottom hole pressure build ups and infection falloff testing. 14 fracturing treatments on 4 wells were monitored from adjacent well bores using microseismic instrumentation which provided a created fracture geometry and direction of the treatments. In addition, 4 production logs and 4 formation micro imager (FMI) logs were run on those same wells.

- d. Exhibit A-2
- From the FMI log, natural fracture and drilling induced fracture direction can be obtained (1<sup>st</sup> and 2<sup>nd</sup> row of rose plots). Also from the microseismic monitoring of the fracture treatments, a fracture direction can be measured (3<sup>rd</sup> row of rose plots). Both forms of independent measurement agree and confirm the fracture orientation within each pilot



area. This measurement will become very important to the optimization of the bottom hole well placement in 10-acre density development.

e. Exhibit A-3

Each 160-acre pilot area is shown with full 10-acre development. The 10-acre wells were drilled with no consideration of fracture orientation. Note the two wells (GM 443-33, RWF 434-20) in each field that are on direct orientation (based off of microseismic and FMI data) with the older parent wells. These two "orientation wells" were the poorer performers of the 10-acre pilot wells and measured more depletion. All other 10-acre wells, including those as close as 300-ft from the parent well but off fracture orientation, performed at field average.

f. Exhibit A-4

This is a geological log representation of one of the Rulison 10-acre pilot wells that had every completed sand body individually tested for reservoir pressure. This was done on 8 total wells. Each sand was perforated (pink dots) and tested prior to performing the fracturing treatment (black line connecting the perforations) – this was repeated for each frac interval. Most of the pressure measurements (blue numbers) fall within the natural progression of increasing reservoir pressure with depth. Three sands (red numbers) showed some partial depletion and didn't fall within the other tests.

g. Exhibit A-5

This is a geological log representation of another Rulison 10-acre pilot well in which one sand per frac interval was tested with a bottom hole pressure build-up and also a injection fall-off test. This was done on 8 total wells. Both testing methods were performed on the same sand to validate the injection fall-off testing analysis which was performed on majority of the sands in the pilot. Each sand tested was chosen to be the most correlative to offset producing wells and had the highest likelihood of depletion in the well bore. All the pressure tests in this well were shown to be near virgin reservoir pressure.

h. Exhibit A-6

The first table represents a summary of the pressure testing that has been performed in the Grand Valley field pilot area. 95 tests were completed on the new 10-acre pilot wells. 78 of the 95 tests (82%) were measured and shown to have no depletion (virgin pressure or more than 85% of virgin pressure). If you eliminate the "orientation wells" pressure tests, due to the fact that wells would not be placed on direct orientation in the future, the percentage of no depletion sands increase to 88%. This illustrates that majority of the sand bodies completed within 10-acre wells have no or limited depletion.



The second table represents a summary of the pressure testing that has been performed in the Rulison field pilot area. 124 tests were completed on the new 10-acre pilot wells. 109 of the 124 tests (88%) were measured and shown to have no depletion (virgin pressure or more than 85% of virgin pressure). If you eliminate the "orientation wells" pressure tests, due to the fact that wells would not be placed on direct orientation in the future, the percentage of no depletion sands increase to 94%. This illustrates that majority of the sand bodies completed within 10-acre wells have no or limited depletion.

j. Exhibit A-7

Minimal depletion was measured throughout the sixteen 10-acre pilot wells. More depletion was observed when wells are on exact fracture orientation with older parent wells. Pressure test results confirm the geological model. Even with some pressure reduction, 10-acre density wells will produce substantial incremental gas reserves.

k. Exhibit A-8

This graph represents average monthly production of all wells within the Rulison field that are normalized back to the same first production day. The production data is broken out into 40-acre (red line), 20-acre (blue line), and newer 10-acre wells (green line). Note that the new 10-acre wells (104 wells) are better performers than the older 40-acre parent wells and as good as the 20-acre development wells. Again these 3 production graphs confirm the success and need of 10-acre density development to maximize gas in place recovery.

l. Exhibit A-9

This graph represents average monthly production of all wells within the Parachute field that are normalized back to the same first production day. The production data is broken out into 40-acre (red line), 20-acre (blue line), and newer 10-acre wells (green line). Note that the new 10-acre wells (123 wells) are better performers than the older 40-acre parent wells and as good as the 20-acre development wells.

m. Exhibit A-10

This graph represents average monthly production of all wells within the Grand Valley field that are normalized back to the same first production day. The production data is broken out into 40-acre (red line), 20-acre (blue line), and newer 10-acre wells (green line). Note that the new 10-acre wells (135 wells) are better performers than the older 40-acre parent wells and as good as the 20-acre development wells.

n. Exhibit A-11

This exhibit builds on the graph shown in Exhibit A-10 by comparing the original 10-acre pilot in the Grand Valley Field with and



adjacent and recent 10-acre development. This graph illustrates that when bottom-hole locations are placed optimally (via the new 10-acre development in Section 3), 10-acre wells will perform optimally. Therefore, reservoir depletion and performance can be optimized if development occurs on 10-acre density from the onset with optimally placed bottom-hole locations.

n. Exhibit A-12

This exhibit shows multiple Gas-In-Place (GIP) calculations for different independent research reports and from internal Williams analysis. An analysis was performed at the time of the 10-acre pilots which is noted by the "2002 Williams Analysis" values. An average GIP for a given 640-acre section was calculated for each of Williams three fields. The bottom portion of the exhibit shows the gas recovery factors based on the calculated GIP and using the average estimated ultimate recovery (EUR) for each field. Going from 40-acre to 20-acre to 10-acre development improves the average recovery factors from 19% to 79%. Limiting development to 20-acre density would leave over 60% of the GIP in the reservoir.

o. Exhibit A-13

With early 10-acre density drilling approved development, we can take advantage of one rig move to a location to develop wells within reach which means less rig moves and re-disturbance of pads. This also will lessen the likelihood for well problems during drilling operations; stuck pipe, sidetracking, and well control issues due to possible pressure variations between individual sand bodies. Early 10-acre approval will also increase the fracture stimulation effectiveness of all targeted pay sands which can be compromised if differing pressured sands are encountered during completions. Approval will allow the ability to optimally place bottom hole locations that will in turn minimize well interference and maximize ultimate recovery of gas-in-place. Community and environmental benefits would also be realized also with lessening operational time per well location and reduce prolonged road traffic.

p. Exhibit A-14

To summarize the data and results reviewed thus far, 10-acre development is the optimal development from a geologic, reservoir, production, and environmental standpoint.

q. Exhibit A-15

This exhibit states Williams' intent to commingle the Williams Fork, Iles and Sego formations in a single wellbore on 10-acre density. The exhibit explains the reasoning behind commingling and states the fact that it is the most economic method of development which is supported by exhibit's A-16 through A-18.

r. Exhibit A-16

The purpose of this exhibit is to illustrate the economic viability of the Ryan Gulch Field. Due to higher elevations of this leasehold, total well costs are greater than typically associated with the Rulison, Parachute, and Grand Valley Fields. However, with current capital and LOE assumptions, as well as commodity pricing, the calculated rate of return exceeds Williams' internal hurdle rate. With 10-acre development, costs are expected to decrease due to fewer rig moves and more optimal completions logistics.

s. Exhibit A-17

This exhibit shows the economic assumptions used for the Iles and Sego.

t. Exhibit A-18

The purpose of this exhibit is to show that a standalone well drilled to the Iles and Sego is uneconomic. The most economic approach is to drill a well to the base of the Sego and commingle the Williams Fork, Iles and Sego.

u. Exhibit A-19

This exhibit illustrates the normalized production results of all 2008 Ryan Gulch wells. Again, the purpose of this exhibit is to illustrate the economic viability of this field.

v. Exhibit A-20

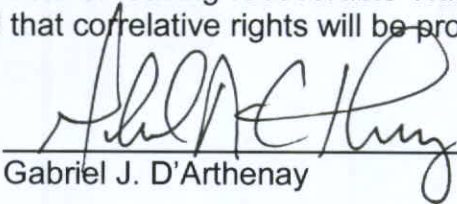
This exhibit illustrates recent FMI data taken at the Ryan Gulch Field. The results are very similar to those shown in Exhibit A-2. From the FMI log, natural fracture and drilling induced fracture direction can be obtained. This measurement will become very important to the optimization of the bottom hole well placement in 10-acre density development.

w. Exhibit A-21

Attached is a copy of my resume.



It is my expert opinion that to maximize the ultimate recovery of gas in place in Williams Fork Formation underlying the Application Lands, ten (10) acre density drilling should be permitted and that by granting the Verified Application the waste of leaving recoverable Williams Fork gas in place will be avoided and that correlative rights will be protected.

  
\_\_\_\_\_  
Gabriel J. D'Arthenay

Subscribed to and sworn to before me this 4<sup>th</sup> day of November, 2009 by Gabriel J. D'Arthenay, Senior Petroleum Engineer of Williams Production RMT Company.

My Commission expires: 10/22/10



Susan A. Bethea  
\_\_\_\_\_  
Notary Public

Address: \_\_\_\_\_  
\_\_\_\_\_

*Susan A. Bethea  
Notary Public, State of Colorado  
1515 Arapahoe Street, Tower 3, #1000  
Denver, CO 80202  
My Commission Expires: 10/22/10*

9192 Roadrunner St.  
Littleton, CO 80129

(303) 284-5328  
giznig@hotmail.com

## Gabriel J. D'Arthenay

### Education

1997-2001      COLORADO SCHOOL OF MINES      Golden, CO

- Bachelor of Science in Petroleum Engineering
- 3.5/4.0 GPA in Petroleum Engineering
- Fluent in Spanish
- Dean's List - Fall Semester 2000-2001

### Experience

Summer 2000 & 2001      CENTER LINE DATA      Wheat Ridge, CO

**Digitizing Assistant**

- Scanning and grid identification
- Digitizing various types of well logs
- Well log analysis

Summer 2000      CALPINE NATURAL GAS      Denver, CO

**Research Assistant**

- Well log analysis of California gas fields

1997-2000      COLORADO SCHOOL OF MINES      Golden, CO

**Research Assistant**

- Computer drafting of geological maps
- Construction of geological cross-sections
- Core analysis

Jan 2002 - Mar 2005      WILLIAMS PRODUCTION RMT COMPANY      Gillette, WY

**Production Engineer (Powder River Basin)**

- Assist in the drilling and completion of Coalbed Natural Gas wells
- Implement various artificial lift systems (ESP's, Rod Pumps and Progressing Cavity Pumps)
- Evaluate interference test data to measure reservoir permeability and connectivity
- Use bottom-hole pressure data and core analysis to evaluate performance of wells
- Monitor production and work with operations group to identify workover candidates
- Write procedures for and supervise liner installations, cleanouts, fish jobs, perforating and stimulations
- Various regulatory work with the BLM, Wyoming Oil and Gas Conservation Commission and the U.S. Forest Service
- Assist in the planning of Federal Plans Of Development
- Experience with design of gas gathering systems (pressure drops, line friction calculations and capacity) and compression facilities
- Created procedures and guidelines for gas measurement and calibration as per Williams requirements and policies

Exhibit A-18  
Cause: 527  
Docket#: 0911-AW-05



- Work on power contracts and power line capacity requests
- Track lease operating costs
- Create AFEs for various projects
- Public relations work through field tours and open forums

Mar 2005 - Dec 2006 WILLIAMS PRODUCTION RMT COMPANY

Denver, CO

**Reservoir Engineer (Powder River Basin)**

- Perform decline curve analysis and reserves estimates in *OGRE*
- Initiate compression requests by utilizing production forecasts and working with Gas Management Team
- Determine where proved reserves can be added
- Assist team in preparing year end reserves estimates and also work with reserves auditors to ensure that reported reserves are within audit tolerance
- Assist team with annual budget planning
- Evaluate BLM drainage cases
- Run economic analyses for operated and non-operated properties
- Analyze AFE distributions and make recommendations based on economics
- Monitor production and assist field team in identifying workover candidates
- Monitor non-operated activities and maintain good working relationships with partners
- Provide engineering support to Williams' Tax group regarding sales tax audits
- Assist Williams' E&P International group with evaluation of potential international E&P opportunities

Dec 2006 - Current WILLIAMS PRODUCTION RMT COMPANY

Denver, CO

**Completions Engineer (Piceance Basin)**

- Design and optimize limited entry slickwater fracs for tight gas completions
- Experience with CO2 and gel fracs
- Schedule completions and optimize use of equipment especially through rough winter months
- Optimize production through quarterly well reviews with field staff and identify workover opportunities and efficient artificial lift methods
- Assist in the planning of Federal Plans Of Development
- Create AFEs for various projects
- Track costs to stay within company metrics
- Support A&D group with lease evaluations and potential acreage acquisitions
- Support exploration team with operations on wildcat wells in news areas of interest

**Technical Skills**

- Computer Skills: Object-oriented programming in *Visual Basic 6.0* and *LabView 5.0* languages; *Microsoft Office* suite, *Crystal Ball* and *MiniTab*
- Simulation Programs: *Eclipse* and *Vertex*

Exhibit A-18  
Cause: 527  
Docket#: 0911-AW-05

- Forecasting and Economics Software: *OGRE 2.3*
- Gathering System Design: Fekete *F.A.S.T. Piper*
- Evaluation Software: Landmark *Dynamic Surveillance System (DSS)* and *DIMS*; Ferguson Beauregard *CBManager* automation (SCADA) software
- Drafting: Experience with *Canvas 2.5-7.0* and *AutoCAD* software
- Field Session: Summer 2000, worked on geological and engineering based projects for two weeks in Massedona, Colorado. Visited Chevron gas field and studied CO<sub>2</sub> injection and other recovery methods
- Project Teamwork: Designed waterflood for Lone Cedar Field (Campbell County, Wyoming)
- Web Page Design- Experience with *DreamWeaver* web page design program

#### Continuing Education

- **Well Control School** (January 20-21, 2005)
- **Coalbed Methane Geology and Engineering: Well Completions and Production, New Analyses of Field Data and Best Practices** (November 2-3, 2005)
- **Coalbed Methane Engineering Methods** (March 14-15, 2006)
- **GOHFER Frac School** (March 19-21, 2007)
- **Southwestern Petroleum Short Course Gas Well Deliquification Workshop** (2007 & 2008)
- **SPE ATW Tight Gas Completions: Technology Applications and Best Practices** (December 12-14, 2007) (Speaker)

#### Affiliations

- Member of the Society of Petroleum Engineers (1997-Current)
- Education Chairman for Powder River Basin SPE Chapter (2003-2005)
- Social Chair for the Society of Petroleum Engineers Young Professionals (2006-2007)
- Program Chair for the Society of Petroleum Engineers Young Professionals (2007-Current)



## 10-Acre Pilot Summary

	<u>Grand Valley</u>	<u>Rulison</u>	<u>Total</u>
Acres:	160	160	320
Existing Wells: (20-Acre Well Density)	8	8	16
Wells Drilled: (10-Acre Well Density)	8	8	16
Pressure Tests: 219 (Individual Sands)	95	124	
Microseismic Monitored Hydraulic Fracs:	6	8	14

Other Tests: 4 Production Logs, 7 RFT tests, 4 FMI logs



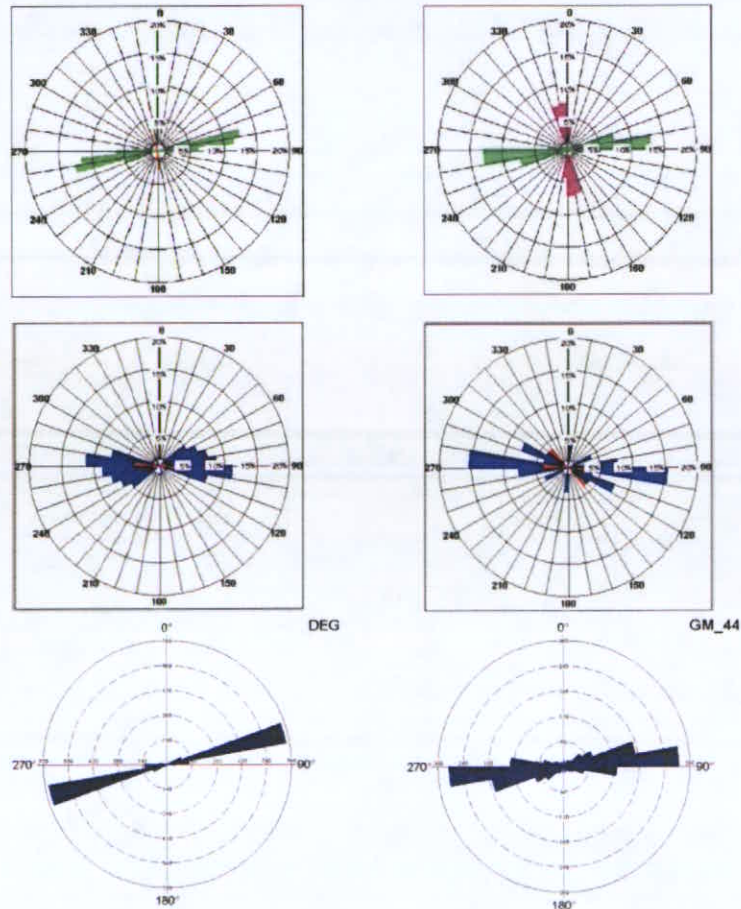
Exhibit: A-1

Cause: 527

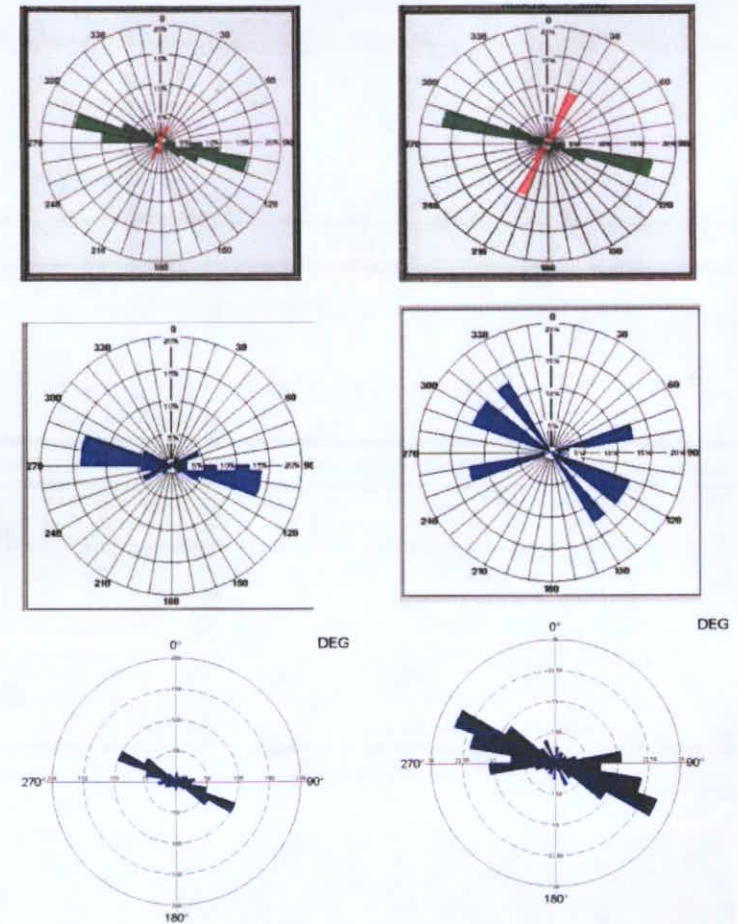
Docket #: 0911-AW-05

# FMI and Microseismic Results

## Grand Valley



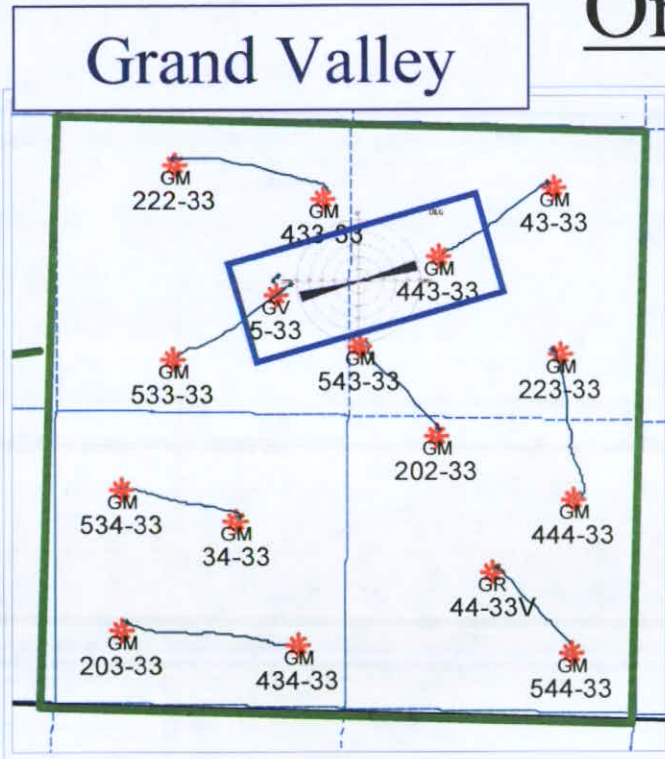
## Rulison



FMI and Microseismic confirm both hydraulic and natural fracture orientations are approximately the same



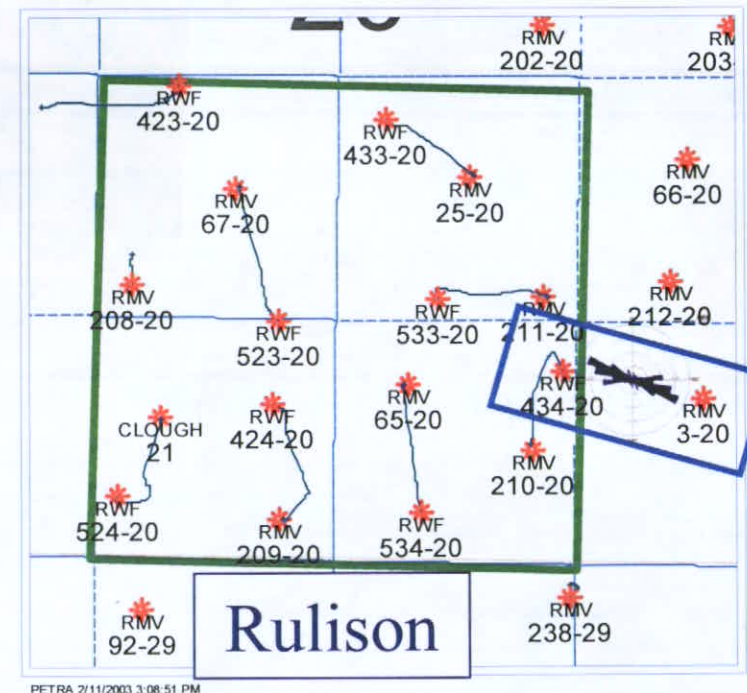
# Orientation is Critical



One well in each pilot was on direct fracture orientation to a parent well.

(GM 443-33 and RWF 434-20)

- Those 2 wells on exact orientation were poorer performers and measured significant depletion
- All other 10-Acre wells (including those as close as 300 feet off orientation) performed at field average



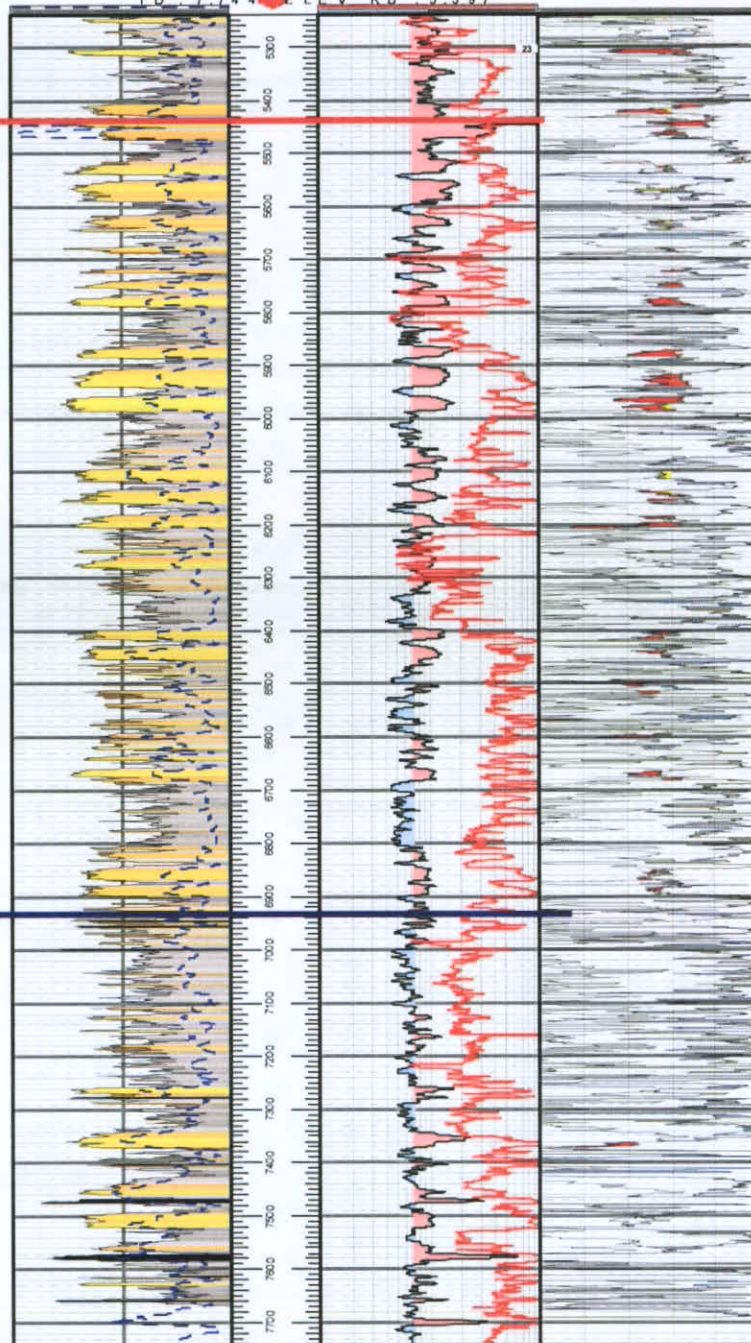
# Pore Pressure Tests – All Sands Completed

R W F 4 3 3 - 2 0  
T 6 S R 9 4 W S 2 0  
T D : 7 - 7 4 4 E L E V K B : 5 . 3 9 7

Top Gas Saturation

WILLIAMS FORK FORMATION

CAMEO FM TOP



## Reservoir Pressure Results (Every sand tested that was completed)

- 2,516 psi – No Depletion
- 2,520 psi – No Depletion
- 2,522 psi – No Depletion
- 2,580 psi – No Depletion
- 2,597 psi – No Depletion
- 3,226 psi – No Depletion
- 3,297 psi – No Depletion
- 3,336 psi – No Depletion
- 2,931 psi – No Depletion
- 3,428 psi – No Depletion
- 1,987 psi – Partial Depletion
- 1,566 psi – Partial Depletion
- 3,242 psi – No Depletion
- 3,263 psi – No Depletion
- 2,793 psi – Partial Depletion
- 3,232 psi – No Depletion
- 3,020 psi – No Depletion
- 3,531 psi – No Depletion
- Bad Test
- 4,104 psi – No Depletion
- 4,050 psi – No Depletion
- 4,123 psi – No Depletion
- 4,141 psi – No Depletion
- 4,534 psi – No Depletion
- 4,788 psi – No Depletion
- 4,813 psi – No Depletion
- 5,110 psi – No Depletion
- 5,234 psi – No Depletion
- 4,905 psi – No Depletion



ROLLINS MEMBER

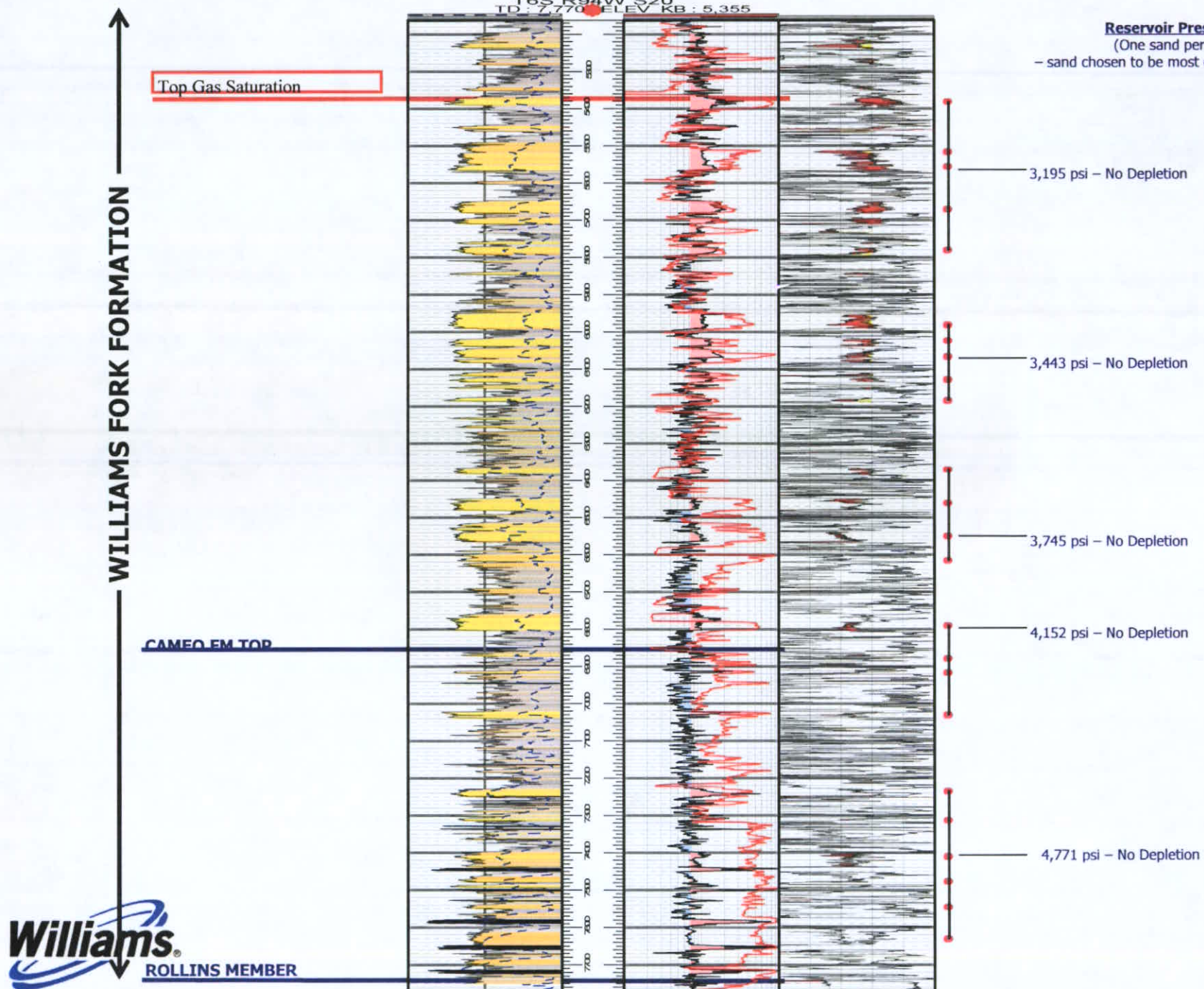
Exhibit: A-4

Cause: 527

Docket #: 0911-AW-05



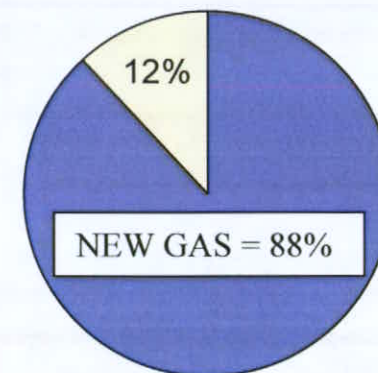
# Pore Pressure Tests – One Sand Per Frac Stage



## Grand Valley Pressure Testing Summary

Type of Test	# of Tests	No Depletion	Partially Depleted
20-acre Pilot Pressure Tests	7	6 86%	1 14%
Total 10-acre Pilot Pressure Tests	95	78 82%	17 18%
10-acre Pilot Pressure Tests (Without "Orientation Well")	75	66 88%	9 12%

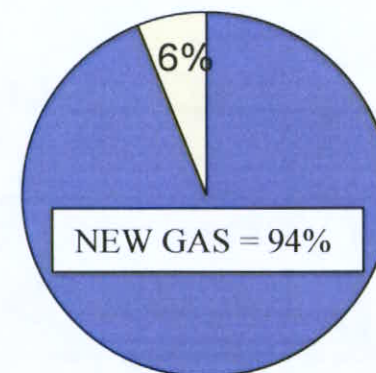
Grand Valley Reserves



## Rulison Pressure Testing Summary

Type of Test	# of Tests	No Depletion	Partially Depleted
20-acre Pilot Pressure Tests	7	7 100%	0 0%
Total 10-acre Pilot Pressure Tests	124	109 88%	15 12%
10-acre Pilot Pressure Tests (Without "Orientation Well")	98	92 94%	6 6%

Rulison Reserves



**No Depletion:** Virgin Reservoir Pressure or slightly less than virgin reservoir pressure (gas is not being effectively produced from offset wells)



Exhibit: A-6

Cause: 527

Docket #: 0911-AW-05



## Pressure Test Summary

- Minimal amount of depletion measured
- More depletion seen when wells are on exact orientation with old parent wells
- Pressure test results confirm the geologic model
- Even with some pressure reduction, 10-acre density wells will produce substantial incremental gas reserves.

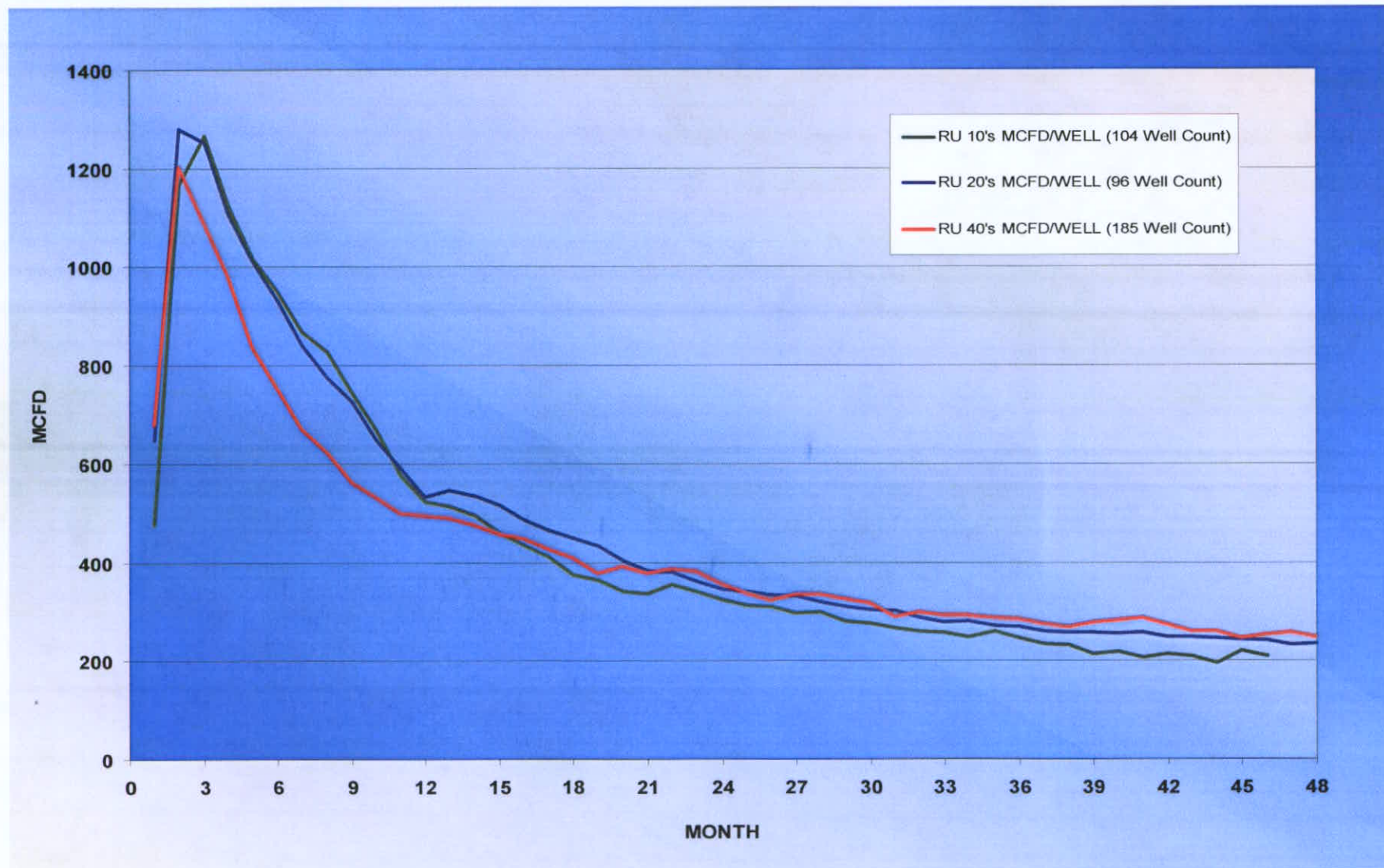


Exhibit: A-7

Cause: 527

Docket #: 0911-AW-05

# Rulison Average Monthly Production Comparison





# Parachute Average Monthly Production Comparison

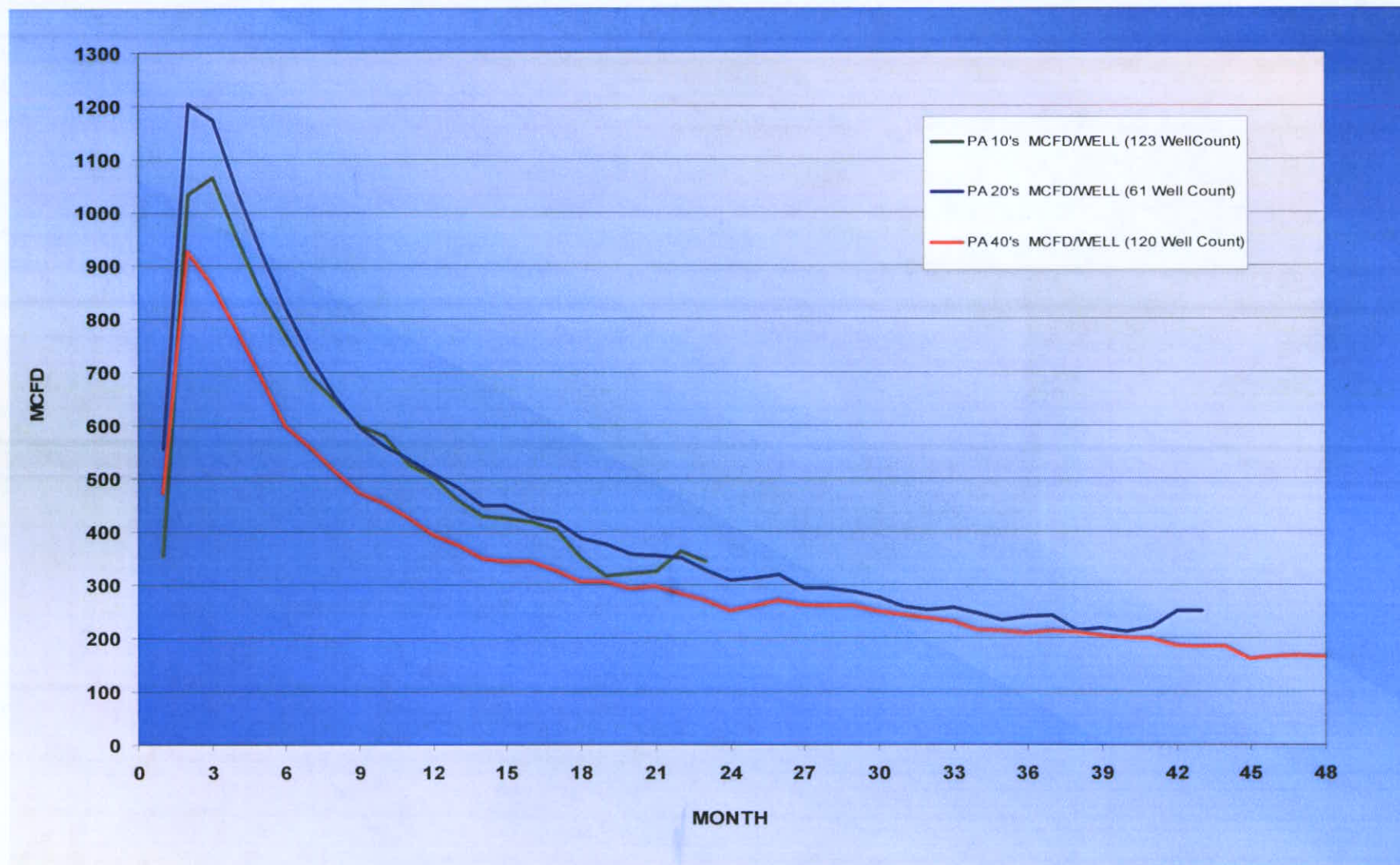


Exhibit: A-9

Cause: 527

Docket #: 0911-AW-05

# Grand Valley Average Monthly Production Comparison

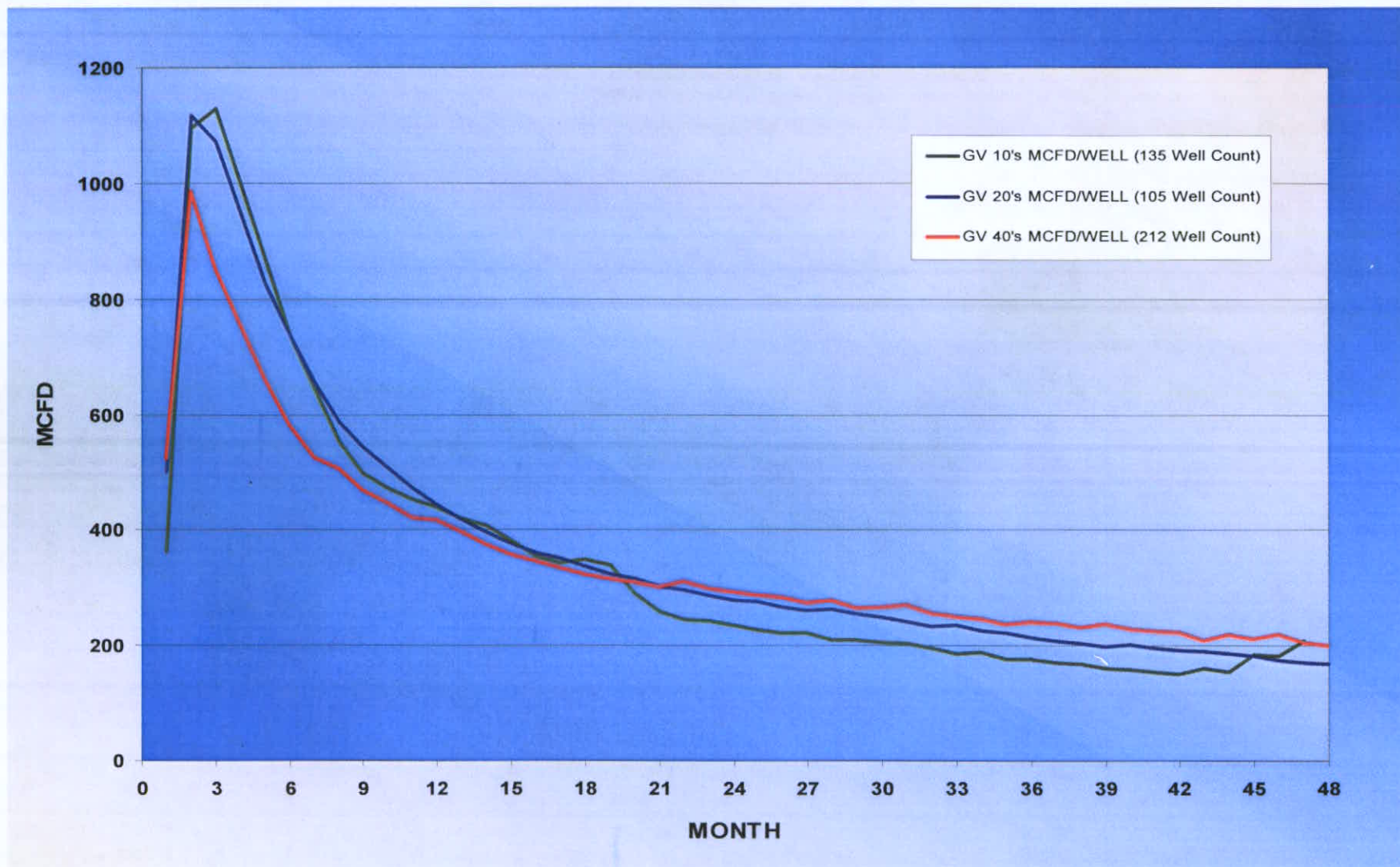


Exhibit: A-10

Cause: 527

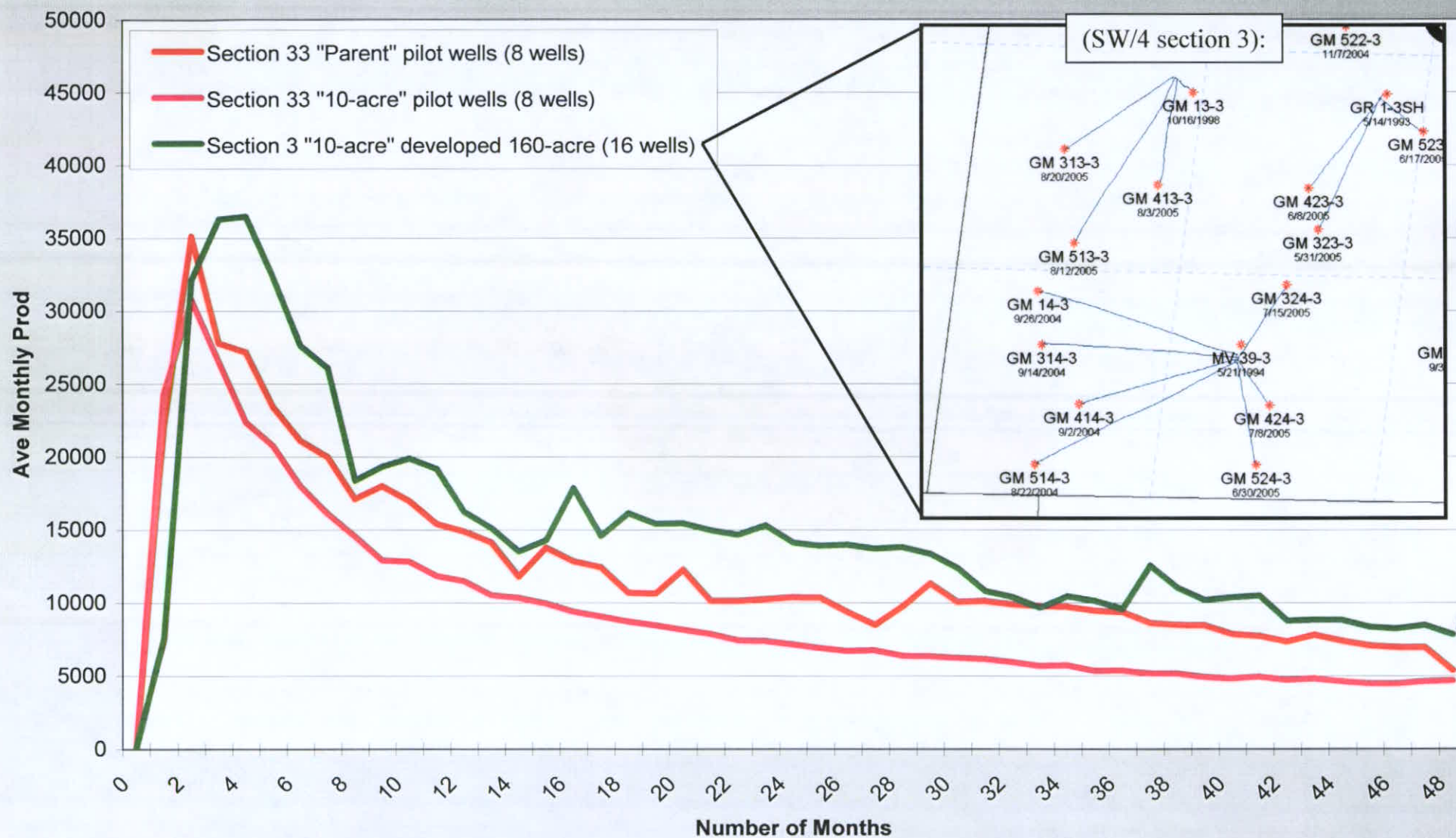
Docket #: 0911-AW-05





# Adjacent 160-acre in Grand Valley Field

## Average Monthly Production with "Optimal" Well Placement



# Summary Of Gas In Place And Recoverable Gas

## Field Average GIP

### GAS IN PLACE PER 640 ACRES-WILLIAMS FORK

USGS 1987 Report	110.9 BCF	} Independent Research Reports
MWX Project - Rulison	120.9 BCF	
GRI 1999 Report	70 – 170 BCF	

Barrett 1995 GIP Analysis	87.0 BCF	Grand Valley/Parachute
93 Well Survey	122.0 BCF	Rulison

Grand Valley 2002 Analysis	105.0 BCF
Parachute 2002 Analysis	120.0 BCF
Rulison 2002 Analysis	135.0 BCF

### Recovery Factors at Different Well Densities

Well Density	Grand Valley @1.30 BCF/Well	Parachute @1.40 BCF/Well	Rulison @1.60 BCF/Well
640 Acres	1%	1%	1%
320 Acres	2%	2%	2%
160 Acres	5%	5%	5%
80 Acres	10%	9%	10%
40 Acres	20%	19%	19%
20 Acres	40%	37%	38%
10 Acres*	79%	75%	76%

\* Application Density

## Pilot Area GIP

### GAS IN PLACE PER 160 ACRES - WILLIAMS FORK

Grand Valley	26.3 BCF
Rulison	33.8 BCF

Grand Valley Pilot:

EUR From Parent Wells (20-Acre Density):

**11.3 BCF (43% Recovery)**

EUR From 10-Acre Wells (10-Acre Density):

**8.7 BCF + 11.3 BCF = 20.1 BCF (76% Recovery)**

Rulison Pilot:

EUR From Parent Wells (20-Acre Density):

**12.1 BCF (36% Recovery)**

EUR From 10-Acre Wells (10-Acre Density):

**10.2 BCF + 12.1 BCF = 22.3 BCF (66% Recovery)**



Exhibit: A-12

Cause: 527

Docket #: 0911-AW-05



# Benefits of Early 10-acre Density Drilling Approved Development

## Drilling

- Take advantage of one rig move to a location to develop 10-acre wells within reach. Less \$\$'s for rig moves and re-disturbance of pads.
- Lessening the likelihood for well problems during drilling operations; stuck pipe, sidetracking, well control issues due to possible pressure variations between individual sand bodies.

## Completions

- Increase the fracture stimulation effectiveness of all targeted pay sands which can be compromised if differing pressured sands are encountered during completions.
- Cost effective to complete multiple wells on one pad at the same time.



Exhibit: A-13

Cause: 527

Docket #: 0911-AW-05

# Benefits of Early 10-acre Density Drilling Approved Development (cont.)

## Reservoir

- Ability to optimally place bottom hole locations that will in turn minimize well interference and maximize ultimate recovery of gas-in-place.

## Community

- Lessens the assured return and re-disturbance of a well pad over and over for 40, 20, and 10-acre development.
- Would lessen operational time per well location and reduce prolonged road traffic.



Exhibit: A-13 (cont.)

Cause: 527

Docket #: 0911-AW-05



# Engineering Summary

- Pressure testing and production analysis confirms geological model
- Unique opportunity to analyze an area with staggered time development (40's, 20's, and 10's)
- Bottom hole well placement very important to minimize interference
- Proven new gas recoveries on 10-acre development
- Minimize community impact – one time development



Exhibit: A-14

Cause: 527

Docket #: 0911-AW-05

## Commingling Williams Fork with Iles and Sego

- It is our intent to drill wells, in which Williams has deep rights, to the Iles and Sego formations. Williams has already adopted the practice of commingling the Iles and Sego formations with the Williams Fork formation in the Piceance Basin. The results have been successful and Williams believes that commingling these different horizons in a single wellbore is the most economic and efficient method.
- The economics which are shown in the attached exhibits show that drilling a stand alone Iles and Sego well is uneconomic. The incremental cost to drill and complete the Iles and Sego in a commingled Williams Fork wellbore is the most economic and efficient development scenario.
- The Iles and Sego formations are stimulated similarly to the Williams Fork during completion. Discontinuous sand bodies are present and limited entry hydraulic fracture design is implemented. Hydraulic fracture simulators have shown that fracture half lengths during a typical treatment are not propagating more than 600 feet.



Exhibit: A-15

Cause: 527

Docket #: 0911-AW-05



## Summary of Well Economics – Ryan Gulch

### Assumptions:

Commingled Iles, Sego and Williams Fork well

Estimated Ultimate Recovery: 1.59 Bcf (Range: 0.8 – 2.2 Bcf)

Total Capital Cost/Well: \$3,300,000

Monthly Operating Cost/Well: \$3,500

Working Interest: 51%

Net Revenue Interest: 44.625%

Tailgate Pricing: \$3.52 (Oct 2009)

### Economic Calculations:

After Tax Payout: 4.8 Years

After Tax Rate-of-Return: Exceeds Williams' internal hurdle rate

After Tax Return-on-Investment: 1.66



Exhibit: A-16

Cause: 527

Docket #: 0911-AW-05

# Ryan Gulch Field – Summary of Well Economics for Iles & Sego

## Assumptions:

- Estimated Iles Only Ultimate Recovery: 0.4 Bcf (25% total well based on % sand in wellbore for Williams Fork/Iles/Sego wells in the Ryan Gulch field)
- Capital: Iles stand alone Drill and Complete/well: \$2,600,000  
Iles additional to Williams Fork Drill and Complete/well: \$730,000
- Monthly Operating Cost/Well: \$3500/well/month
- Working Interest: 51%
- Net Revenue Interest: 44.625%
- Tailgate Pricing: \$3.52 (Oct 2009)



Exhibit: A-17

Cause: 527

Docket #: 0911-AW-05



## **Iles/Sego Economic Calculations:**

### **Iles, Sego Formations Stand Alone Well**

After-Tax Payout: Well does not payout

After-Tax Present Value (Discounted 10%): Negative

After-Tax Rate-of-Return: Zero

### **Iles, Sego Addition to Williams Fork Formation**

After-Tax Payout: 3.27 Years

After-Tax Present Value (Discounted 10%): Positive

After-Tax Rate-of-Return: Exceeds Williams' Internal Hurdle Rate

After Tax Return-on-Investment: 1.54



Exhibit: A-18

Cause: 527

Docket #: 0911-AW-05

Ryan Gulch Unit - 2008 Program  
(Normalized Curve)

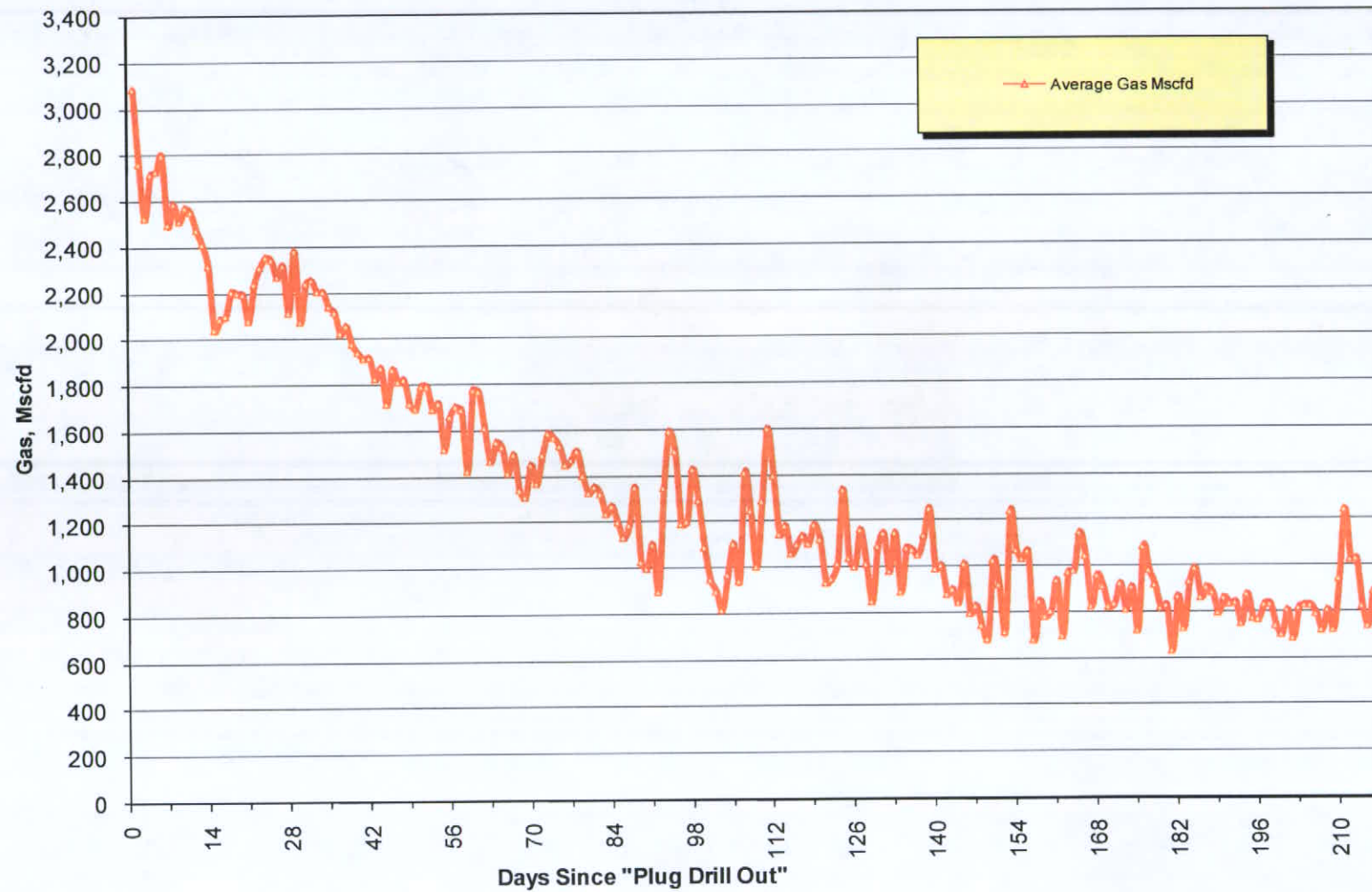


Exhibit: A-19

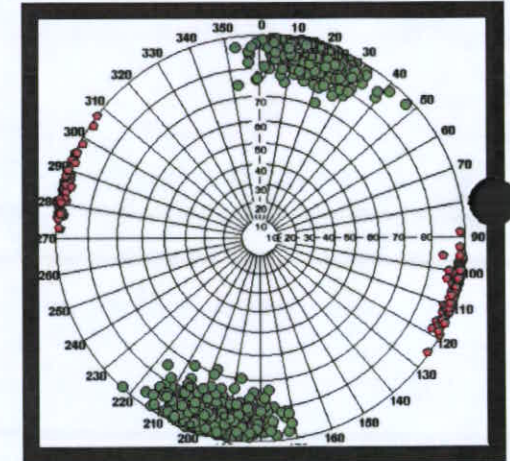
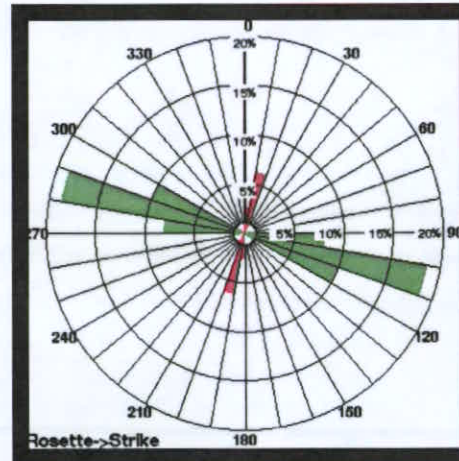
Cause: 527

Docket #: 0911-AW-05



# Ryan Gulch FMI Results

Drilling Induced  
Fractures



Natural Formation  
Fractures

