

**FORSPAN ASSESSMENT MODEL FOR CONTINUOUS  
ACCUMULATIONS--BASIC INPUT DATA FORM (NOGA, Version 9, 2-10-03)**

**IDENTIFICATION INFORMATION**

Assessment Geologist:	R.M. Pollastro	Date:	18-Mar-08
Region:	North America	Number:	5
Province:	Williston Basin	Number:	5031
Total Petroleum System:	Bakken-Lodgepole	Number:	503101
Assessment Unit:	Eastern Expulsion Threshold	Number:	50310164
Based on Data as of:			
Notes from Assessor:			

**CHARACTERISTICS OF ASSESSMENT UNIT**

**Assessment-unit type:** Oil (<20,000 cfg/bo) or Gas (≥20,000 cfg/bo), incl. disc. & pot. additions Oil

**What is the minimum total recovery per cell?** 0.002 (mmbo for oil A.U.; bcfg for gas A.U.)

Number of tested cells: 21

Number of tested cells with total recovery per cell ≥ minimum: 14

Established (discovered cells): X Hypothetical (no cells):           

Median total recovery per cell (for cells ≥ min.): (mmbo for oil A.U.; bcfg for gas A.U.)

1st 3rd discovered	<u>0.005</u>	2nd 3rd	<u>0.19</u>	3rd 3rd	<u>0.385</u>
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**Assessment-Unit Probabilities:**

<u>Attribute</u>	<u>Probability of occurrence (0-1.0)</u>	
1. <b>CHARGE:</b> Adequate petroleum charge for an untested cell with total recovery ≥ minimum.		<u>1.0</u>
2. <b>ROCKS:</b> Adequate reservoirs, traps, seals for an untested cell with total recovery ≥ minimum.		<u>1.0</u>
3. <b>TIMING:</b> Favorable geologic timing for an untested cell with total recovery ≥ minimum.		<u>1.0</u>
<b>Assessment-Unit GEOLOGIC Probability</b> (Product of 1, 2, and 3):		<u>1.0</u>

**NO. OF UNTESTED CELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES**

1. Total assessment-unit area (acres): (uncertainty of a fixed value)

calculated mean	<u>1,940,000</u>	minimum	<u>1,843,000</u>	mode	<u>1,940,000</u>	maximum	<u>2,037,000</u>
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2. Area per cell of untested cells having potential for additions to reserves (acres): (values are inherently variable)

calculated mean	<u>400</u>	minimum	<u>80</u>	mode	<u>320</u>	maximum	<u>800</u>
uncertainty of mean:	minimum	<u>300</u>	maximum	<u>500</u>			

3. Percentage of total assessment-unit area that is untested (%): (uncertainty of a fixed value)

calculated mean	<u>99.6</u>	minimum	<u>99.4</u>	mode	<u>99.6</u>	maximum	<u>99.7</u>
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**NO. OF UNTESTED CELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES  
(Continued)**

4. Percentage of untested assessment-unit area that has potential for additions to reserves (%):  
( a necessary criterion is that total recovery per cell  $\geq$  minimum; uncertainty of a fixed value)

calculated mean 83.7      minimum 70      mode 85      maximum 96

Geologic evidence for estimates:

Recent discoveries in Parshall area has multiple favorable geologic factors including 1) intersected by lineament; 2) wrench faulting allowing both vertical fracturing and compression component to assist in the development of horizontal fractures; 3) good matrix porosity in upper Middle Member; and 4) area in early maturity stage where conversion to bitumen and bitumen to oil may produce horizontal microfractures

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**TOTAL RECOVERY PER CELL**

Total recovery per cell for untested cells having potential for additions to reserves:  
(values are inherently variable; mmbo for oil A.U.; bcfg for gas A.U.)

calculated mean 0.25      minimum 0.002      median 0.12      maximum 5

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**AVERAGE COPRODUCT RATIOS FOR UNTESTED CELLS, TO ASSESS COPRODUCTS**

(uncertainty of fixed but unknown values)

<u>Oil assessment unit:</u>	minimum	mode	maximum
Gas/oil ratio (cfg/bo)	<u>240</u>	<u>320</u>	<u>960</u>
NGL/gas ratio (bnql/mmcf)	<u>40</u>	<u>80</u>	<u>120</u>
<u>Gas assessment unit:</u>			
Liquids/gas ratio (bliq/mmcf)	<u>                    </u>	<u>                    </u>	<u>                    </u>

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**SELECTED ANCILLARY DATA FOR UNTESTED CELLS**

(values are inherently variable)

<u>Oil assessment unit:</u>		minimum	mode	maximum
API gravity of oil (degrees)		<u>34</u>	<u>41</u>	<u>50</u>
Sulfur content of oil (%)		<u>0.01</u>	<u>0.1</u>	<u>1</u>
Depth (m) of water (if applicable)		<u>                    </u>	<u>                    </u>	<u>                    </u>

Drilling depth (m)

minimum	F75	mode	F25	maximum
<u>2130</u>	<u>                    </u>	<u>2895</u>	<u>                    </u>	<u>3200</u>

Gas assessment unit:

		minimum	mode	maximum
Inert-gas content (%)		<u>                    </u>	<u>                    </u>	<u>                    </u>
CO <sub>2</sub> content (%)		<u>                    </u>	<u>                    </u>	<u>                    </u>
Hydrogen sulfide content (%)		<u>                    </u>	<u>                    </u>	<u>                    </u>
Heating value (BTU)		<u>                    </u>	<u>                    </u>	<u>                    </u>
Depth (m) of water (if applicable)		<u>                    </u>	<u>                    </u>	<u>                    </u>

Drilling depth (m)

minimum	F75	mode	F25	maximum
<u>                    </u>				

Success ratios:

	calculated mean	minimum	mode	maximum
Future success ratio (%)	<u>84</u>	<u>70</u>	<u>85</u>	<u>96</u>

Historic success ratio, tested cells (%) 67

Completion practices:

- |  |                  |
|--|------------------|
| 1. Typical well-completion practices (conventional, open hole, open cavity, other) | <u>open hole</u> |
| 2. Fraction of wells drilled that are typically stimulated                         | <u>1</u>         |
| 3. Predominant type of stimulation (none, frac, acid, other)                       | <u>frac</u>      |
| 4. Fraction of wells drilled that are horizontal                                   | <u>0.9</u>       |
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**ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES**  
**Surface Allocations** (uncertainty of a fixed value)

1. <u>North Dakota</u>	represents	<u>100</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>100</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
2. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
3. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
4. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
5. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
6. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

7. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

8. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

9. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

10. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

11. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

12. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

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**ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS**  
**Surface Allocations** (uncertainty of a fixed value)

1. <u>Federal Lands</u>	represents	<u>3.63</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>3</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
2. <u>Private Lands</u>	represents	<u>67.13</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>68</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
3. <u>Tribal Lands</u>	represents	<u>20.61</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>21</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
4. <u>Other Lands</u>	represents	<u>6.68</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>6</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
5. <u>ND State Lands</u>	represents	<u>1.95</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>2</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
6. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

7. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

8. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

9. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

10. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

11. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

12. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

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**ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS**  
**Surface Allocations** (uncertainty of a fixed value)

1. <u>Bureau of Land Management (BLM)</u>	represents	<u>0.02</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>0</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
2. <u>BLM Wilderness Areas (BLMW)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
3. <u>BLM Roadless Areas (BLMR)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
4. <u>National Park Service (NPS)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
5. <u>NPS Wilderness Areas (NPSW)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
6. <u>NPS Protected Withdrawals (NPSP)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

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7. <u>US Forest Service (FS)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
8. <u>USFS Wilderness Areas (FSW)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
9. <u>USFS Roadless Areas (FSR)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
10. <u>USFS Protected Withdrawals (FSP)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
11. <u>US Fish and Wildlife Service (FWS)</u>	_____	represents	1.97	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		2	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
12. <u>USFWS Wilderness Areas (FWSW)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____

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<u>13. USFWS Protected Withdrawals (FWSP)</u>	represents	<u>          </u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>Gas in gas assessment unit:</u>			
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>14. Wilderness Study Areas (WS)</u>	represents	<u>          </u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>Gas in gas assessment unit:</u>			
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>15. Department of Energy (DOE)</u>	represents	<u>          </u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>Gas in gas assessment unit:</u>			
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>16. Department of Defense (DOD)</u>	represents	<u>  1.57  </u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	<u>          </u>	<u>      1      </u>	<u>          </u>
<u>Gas in gas assessment unit:</u>			
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>17. Bureau of Reclamation (BOR)</u>	represents	<u>  0.07  </u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	<u>          </u>	<u>      0      </u>	<u>          </u>
<u>Gas in gas assessment unit:</u>			
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>18. Tennessee Valley Authority (TVA)</u>	represents	<u>          </u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>
<u>Gas in gas assessment unit:</u>			
Volume % in entity	<u>          </u>	<u>          </u>	<u>          </u>

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19. Other Federal represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

20. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

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**ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS**  
**Surface Allocations** (uncertainty of a fixed value)

1. <u>Northeastern Glaciated Plains (NEGP)</u>	represents	<u>16.53</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>20</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
2. <u>Northern Glaciated Plains (NGPL)</u>	represents	<u>53.70</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>60</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
3. <u>Northwestern Great Plains (NWGP)</u>	represents	<u>29.77</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	<u>20</u>	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
4. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
5. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
6. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

7. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

8. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

9. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

10. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

11. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

12. \_\_\_\_\_ represents \_\_\_\_\_ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

Gas in gas assessment unit:  
Volume % in entity \_\_\_\_\_

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