USGS
science for a changing world

Input-Form Data for the U.S. Geological Survey Assessment of the Mississippian Barnett Shale of the Bend Arch–Fort Worth Basin Province, 2015

By Kristen R. Marra, Ronald R. Charpentier, Christopher J. Schenk, Michael D. Lewan, Heidi M. Leathers-Miller, Timothy R. Klett, Stephanie B. Gaswirth, Phuong A. Le, Tracey J. Mercier, Janet K. Pitman, and Marilyn E. Tennyson

Open-File Report 2016–1097

U.S. Department of the Interior
U.S. Geological Survey

U.S. Department of the Interior
SALLY JEWELL, Secretary

U.S. Geological Survey
Suzette M. Kimball, Director

U.S. Geological Survey, Reston, Virginia: 2016

Suggested citation:
Marra, K.R., Charpentier, R.R., Schenk, C.J., Lewan, M.D., Leathers-Miller, H.M., Klett, T.R., Gaswirth, S.B., Le, P.A., Mercier, T.J., Pitman, J.K., and Tennyson, M.E., 2016, Input-form data for the U.S. Geological Survey assessment of the Mississippian Barnett Shale of the Bend Arch–Fort Worth Basin Province, 2015: U.S. Geological Survey Open-File Report 2016-1097, 31 p., http://dx.doi.org/10.3133/ofr20161097.

ISSN 2331-1258 (online)

Contents

Tables

Input-Form Data for the U.S. Geological Survey Assessment of the Mississippian Barnett Shale of the Bend Arch–Fort Worth Basin Province, 2015

By Kristen R. Marra, Ronald R. Charpentier, Christopher J. Schenk, Michael D. Lewan, Heidi M. Leathers-Miller, Timothy R. Klett, Stephanie B. Gaswirth, Phuong A. Le, Tracey J. Mercier, Janet K. Pitman, and Marilyn E. Tennyson

Introduction

In 2015, the U.S. Geological Survey (USGS) released an updated assessment of undiscovered, technically recoverable shale gas and shale oil resources of the Mississippian Barnett Shale in north-central Texas (Marra and others, 2015). The Barnett Shale was assessed using the standard continuous (unconventional) methodology established by the USGS for two assessment units (AUs): (1) Barnett Continuous Gas AU, and (2) Barnett Mixed Continuous Gas and Oil AU. A third assessment unit, the Western Barnett Continuous Oil AU, was also defined but was not quantitatively assessed because of limited data within the extent of the AU. The purpose of this report is to provide supplemental documentation of the quantitative input parameters applied in the Barnett Shale assessment.

Assessment Methodology

The USGS uses two distinct peer-reviewed methodologies to assess for conventional and continuous resource accumulations. While both methodologies result in probabilistic estimates of undiscovered petroleum resources, each require specific input parameters. Conventional resources are defined where oil or natural gas is buoyant upon water and where petroleum resources have migrated into structural and (or) stratigraphic traps. The primary input data are related to the numbers and sizes of undiscovered conventional accumulations (Klett and others, 2005). In contrast, a continuous resource accumulation is defined as oil and (or) natural gas that has been generated from a thermally mature source rock and has remained within or adjacent to the source rock. The continuous resource assessment methodology is primarily focused on the uncertainties regarding the average drainage area of wells and the average estimated ultimate recoveries (EURs) of wells, as well as the projection of future success ratios (Charpentier and Cook, 2012). These methodologies are summarized in more detail in multiple published reports (Klett and Charpentier, 2003; Crovelli, 2005; Klett and Schmoker, 2005; Klett and others, 2005; Schmoker, 2005; Schmoker and Klett, 2005; Charpentier and Cook, 2012).

For the Barnett Shale assessment, the statistically based summary input data form for continuous resources was used for both quantitatively assessed AUs to document the descriptive information used in the resource calculation for each defined assessment unit (Charpentier and Cook, 2012). For the Barnett Mixed Continuous Oil and Gas AU, a modification was made to

the continuous input data form for "sweet spot" areas to incorporate both oil and gas production within the AU (line 4 on the form), as the assessment unit type was characterized as both gas and oil. A "sweet spot" is generally defined as an area with favorable geologic characteristics for petroleum resource production, including an adequate thermal history, gas content, and matrix rock properties. In this case, the percentage of untested assessment-unit area in sweet spots (given in percent) was modified to represent the percent of undrilled wells that could potentially be oil wells (also given in percent). Subsequently, the section for estimated ultimate recovery distributions per well in sweet spot areas (lines 5a and 5b) and nonsweet spot areas (lines 6a and 6b) was changed to reflect the future success ratio and average EUR distributions for oil wells and for gas wells, respectively. In addition, data for the coproduct ratios and ancillary data section were provided for both oil and gas wells.

Summary Data-Input Forms for Assessment

The data-input forms for the two quantitatively assessed Barnett Shale AUs are provided in tables 1 and 2.

References Cited

Charpentier, R.R., and Cook, T.A., 2012, Improved USGS methodology for assessing continuous petroleum resources, version 2.0: U.S. Geological Survey Data Series 547, 22 p.

Crovelli, R.A., 2005, Analytical resource method for continuous petroleum accumulations—The ACCESS assessment methodology, chap. 22 *of* USGS Southwestern Wyoming Province Assessment Team, Petroleum systems and geologic assessment of the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–B, 10 p.

Klett, T.R., and Charpentier, R.R., 2003, FORSPAN Model users guide: U.S. Geological Survey Open-File Report 2003–354, 37 p.

Klett, T.R., and Schmoker, J.W., 2005, Input-data form and operational procedure for the assessment of continuous accumulations, 2002, chap. 18 *of* USGS Southwestern Wyoming Province Assessment Team, Petroleum systems and geologic assessment of the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, 8 p.

Klett, T.R., Schmoker, J.W., and Charpentier, R.R., 2005, U.S. Geological Survey input-data form and operational procedure for the assessment of conventional petroleum accumulations, chap. 20 *of* USGS Southwestern Wyoming Province Assessment Team, Petroleum systems and geologic assessment of the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Digital Data Series DDS–69–D, 7 p.

Marra, K.R., Charpentier, R.R., Schenk, C.J., Lewan, M.D., Leathers-Miller, H.M., Klett, T.R., Gaswirth, S.B., Le, P.A., Mercier, T.J., Pitman, J.K., and Tennyson, M.E., 2015, Assessment of undiscovered shale gas and shale oil resources in the Mississippian Barnett Shale, Bend Arch–Fort Worth Basin Province, north-central Texas: U.S. Geological Survey Fact Sheet 2015–3078, 2 p.

Schmoker, J.W., 2005, U.S. Geological Survey assessment concepts for continuous petroleum accumulations, chap. 13 *of* USGS Southwestern Wyoming Province Assessment Team, Petroleum systems and geologic assessment of the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Data Series DDS–69–D, 7 p.

Schmoker, J.W., and Klett, T.R., 2005, U.S. Geological Survey assessment concepts for conventional petroleum accumulations, chap. 19 *of* USGS Southwestern Wyoming Province Assessment Team, Petroleum systems and geologic assessment of the Southwestern Wyoming Province, Wyoming, Colorado, and Utah: U.S. Geological Survey Data Series DDS–69–D, 6 p.

ISSN 2331-1258 (online)
http://dx.doi.org/10.3133/ofr20161097

Table 1. (following 13 pages) Input parameters for the Barnett Continuous Gas Assessment Unit (50450161), Bend Arch–Fort Worth Basin Province. [bcfg, billion cubic feet of gas; mmcfg, million cubic feet of gas, cfg, cubic feet of gas; mmbo, million barrels of oil; bo, barrel of oil, bliq, barrel of liquid; bngl, barrel of natural gas liquids; m, meters; AU, assessment unit; EUR, estimated ultimate recovery]

USGS U.S. PETROLEUM RESOURCES ASSESSMENT
INPUT DATA FORM FOR CONTINUOUS ACCUMULATIONS (version 1.3, April 29, 2015)

IDENTIFICATION INFORMATION

Assessment Geologist:	K.R. Marra	Date:	8/26/2015
Region:	North America	Number:	5
Province:	Bend Arch-Fort Worth Basin	Number:	5045
Total Petroleum System:	Barnett-Paleozoic	Number:	504501
Assessment Unit:	Barnett Continuous Gas	Number:	50450161
Based on Data as of:	IHS (2015)		
Notes from Assessor:			

CHARACTERISTICS OF ASSESSMENT UNIT

Assessment-unit type: oil (<20,000 cfg/bo) ____ gas (>20,000 cfg/bo) X
heavy oil (<10 API) ____

Well type: vertical ____ horizontal X

Major reservoir type (Choose one.):
shale X low-permeability clastics ____
coal ____ low-permeability carbonates ____
diatomite ____

Minimum EUR per well 0.02 (mmbo for oil AU; bcfg for gas AU)

Number of tested wells: 18,922
Number of tested wells with EUR > minimum: 16,577
Historic success ratio, tested wells (%) 88

Assessment-Unit Probability:
What is the probability that at least one well within the AU will have production capacity of at least the minimum EUR? 1.0

NUMBER OF UNDRILLED WELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES

1. Productive area of accumulation (acres): (triangular)

calculated mean 6,473,000 minimum 6,000,000 mode 6,419,000 maximum 7,000,000

2. Uncertainty about average drainage area of wells (acres): (triangular)

calculated mean 100 minimum 60 mode 100 maximum 140

3. Percentage of total assessment-unit area that is untested (%): (triangular)

calculated mean 73 minimum 65 mode 73 maximum 80

4. Percentage of untested assessment-unit area in sweet spots (%): (triangular)

calculated mean 28 minimum 15 mode 30 maximum 40

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ESTIMATED ULTIMATE RECOVERY (EUR) PER WELL

SWEET SPOTS

5a. Future success ratio (%): (triangular)

calculated mean 89 minimum 85 mode 90 maximum 92

5b. Uncertainty about average EUR (mmbo for oil; bcfg for gas): (shifted truncated lognormal)

calculated mean 2.034 minimum 1 median 2 maximum 3

NON-SWEET SPOTS

6a. Future success ratio (%): (triangular)

calculated mean 73 minimum 60 mode 75 maximum 85

6b. Uncertainty about average EUR (mmbo for oil; bcfg for gas): (shifted truncated lognormal)

calculated mean 0.956 minimum 0.5 median 0.9 maximum 2

UNCERTAINTY ABOUT AVERAGE COPRODUCT RATIOS FOR UNTESTED WELLS
(triangular)

	minimum	mode	maximum
Oil assessment unit:			
Gas/oil ratio (cfg/bo)			
NGL/gas ratio (bngl/mmcfg)			
Gas assessment unit:			
Liquids/gas ratio (bliq/mmcfg)	0.5	1.3	2

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

SELECTED ANCILLARY DATA FOR UNTESTED WELLS
(no specified distribution type)

Oil assessment unit:	minimum		median		maximum
API gravity of oil (degrees)					
Sulfur content of oil (%)					
Depth (m) of water (if applicable)					
Drilling depth (m)	minimum	F75	median	F25	maximum

Gas assessment unit:	minimum		median		maximum
Inert-gas content (%)	0.50		2.50		20.00
CO_2 content (%)	0.10		1.00		5.00
Hydrogen sulfide content (%)	0.00		0.00		0.00
Heating value (BTU)					
Depth (m) of water (if applicable)					
Drilling depth (m)	minimum	F75	median	F25	maximum
	700		1900		3000

Completion practices:

1.	Typical well-completion practices (conventional, open hole, open cavity, other)	conventional
2.	Fraction of wells drilled that are typically stimulated	1
3.	Predominant type of stimulation (none, frac, acid, other)	frac
4.	Historic fraction of wells drilled that are horizontal	0.72

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES
Surface Allocations

1. Texas

Onshore: 100 area % of the AU
100 mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

2. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

3. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

4. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

5. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES
(continued)

6. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

7. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

8. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

9. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

10. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO PROVINCES
Surface Allocations

1. Number: 5045 Name: Bend Arch-Forth Worth Basin

Onshore: 99.62 area % of the AU
100.00 mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

2. Number: 5049 Name: Gulf Coast Mesozoic

Onshore: 0.38 area % of the AU
0.00 mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

3. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

4. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

5. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO PROVINCES
(continued)

6. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

7. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

8. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

9. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

10. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS
Surface Allocations

1. Federal Lands — is 2.95 % of the AREA of the AU
   mean VOLUME % in entity 1.5

2. Private Lands — is 0.01 % of the AREA of the AU
   mean VOLUME % in entity 0

3. Tribal Lands — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

4. Other Lands — is 96.88 % of the AREA of the AU
   mean VOLUME % in entity 98.33

5. Texas State Lands — is 0.17 % of the AREA of the AU
   mean VOLUME % in entity 0.17

6. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

7. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

8. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

9. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

10. _____ — is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS
(continued)

11. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

12. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

13. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

14. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

15. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

16. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

17. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

18. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

19. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

20. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
Surface Allocations

1. Bureau of Land Management (BLM) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

2. BLM Wilderness Areas (BLMW) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

3. BLM Roadless Areas (BLMR) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

4. National Park Service (NPS) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

5. NPS Wilderness Areas (NPSW) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

6. NPS Protected Withdrawals (NPSP) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

7. US Forest Service (FS) is 0.31 % of the AREA of the AU
   mean VOLUME % in entity 0.5

8. USFS Wilderness Areas (FSW) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

9. USFS Roadless Areas (FSR) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

10. USFS Protected Withdrawals (FSP) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
(continued)

11. US Fish and Wildlife Service (FWS) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

12. USFWS Wilderness Areas (FWSW) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

13. USFWS Protected Withdrawals (FWSP) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

14. Wilderness Study Areas (WS) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

15. Department of Energy (DOE) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

16. Department of Defense (DOD) is 2.63 % of the AREA of the AU
    mean VOLUME % in entity 1

17. Bureau of Reclamation (BOR) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

18. Tennessee Valley Authority (TVA) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

19. Other Federal is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

20. _____ is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

Assessment Unit (name, no.)
Barnett Continuous Gas, 50450161

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
Surface Allocations

1. Blackland Prairies (BLPR) is 0.17 % of the AREA of the AU
   mean VOLUME % in entity 0.00

2. Cross Timbers and Prairie (CRTP) is 83.85 % of the AREA of the AU
   mean VOLUME % in entity 95.00

3. Edwards Plateau (EDPT) is 15.99 % of the AREA of the AU
   mean VOLUME % in entity 5.00

4. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

5. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

6. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

7. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

8. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

9. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

10. _____ is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
(continued)

11. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

12. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

13. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

14. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

15. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

16. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

17. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

18. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

19. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

20. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

Table 2. (following 13 pages) Input parameters for the Barnett Mixed Continuous Gas and Oil Assessment Unit (50450162), Bend Arch–Fort Worth Basin Province. [bcfg, billion cubic feet of gas; mmcfg, million cubic feet of gas, cfg, cubic feet of gas; mmbo, million barrels of oil; bo, barrel of oil, bliq, barrel of liquid; bngl, barrel of natural gas liquids; m, meters; AU, assessment unit; EUR, estimated ultimate recovery]

USGS U.S. PETROLEUM RESOURCES ASSESSMENT
INPUT DATA FORM FOR MIXED CONTINUOUS ACCUMULATIONS (version 1.0, September 1, 2015)

IDENTIFICATION INFORMATION

Assessment Geologist:	K.R. Marra	Date:	9/2/2015
Region:	North America	Number:	5
Province:	Bend Arch-Fort Worth Basin	Number:	5045
Total Petroleum System:	Barnett-Paleozoic	Number:	504501
Assessment Unit:	Barnett Mixed Continuous Gas and Oil	Number:	50450162
Based on Data as of:	IHS (2015)		

Notes from Assessor:

CHARACTERISTICS OF ASSESSMENT UNIT

Assessment-unit type: oil (<20,000 cfg/bo) X gas (>20,000 cfg/bo) X
heavy oil (<10 API)

Well type: vertical horizontal X

Major reservoir type (Choose one.):
shale X low-permeability clastics
coal low-permeability carbonates
diatomite

Minimum EUR per well 0.002 MMl (mmbo for oil AU; bcfg for gas AU)

Number of tested wells: 3448
Number of tested wells with EUR > minimum: 2350
Historic success ratio, tested wells (%) 68

Assessment-Unit Probability:
What is the probability that at least one well within the AU will have production capacity of at least the minimum EUR? 1.0

NUMBER OF UNDRILLED WELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES

1. Productive area of accumulation (acres): (triangular)

calculated mean 2,019,000 minimum 1,700,000 mode 2,057,000 maximum 2,300,000

2. Uncertainty about average drainage area of wells (acres): (triangular)

calculated mean 100 minimum 60 mode 100 maximum 140

3. Percentage of total assessment-unit area that is untested (%): (triangular)

calculated mean 84 minimum 75 mode 85 maximum 92

4. Percentage of untested wells that are oil wells (%): (triangular)

calculated mean 60 minimum 40 mode 65 maximum 75

Assessment Unit (name, no.)
Barnett Mixed Continuous Gas and Oil, 50450162

ESTIMATED ULTIMATE RECOVERY (EUR) PER WELL

OIL WELLS

5a. Future success ratio (%): (triangular)

calculated mean	minimum	mode	maximum
47	30	45	65

5b. Uncertainty about average EUR (mmbo for oil): (shifted truncated lognormal)

calculated mean	minimum	median	maximum
0.036	0.02	0.035	0.05

GAS WELLS

6a. Future success ratio (%): (triangular)

calculated mean	minimum	mode	maximum
47	30	45	65

6b. Uncertainty about average EUR (bcfg for gas): (shifted truncated lognormal)

calculated mean	minimum	median	maximum
1.017	0.5	1	1.5

UNCERTAINTY ABOUT AVERAGE COPRODUCT RATIOS FOR UNTESTED WELLS

(triangular)

	minimum	mode	maximum
Oil assessment unit:			
Gas/oil ratio (cfg/bo)	7500	8400	8600
NGL/gas ratio (bngl/mmcfg)	15	30	45
Gas assessment unit:			
Liquids/gas ratio (bliq/mmcfg)	15	22	30

SELECTED ANCILLARY DATA FOR UNTESTED WELLS

(no specified distribution type)

Oil wells:	minimum		median		maximum
API gravity of oil (degrees)	35		45		55
Sulfur content of oil (%)	0		0.01		0.1
Depth (m) of water (if applicable)					

Drilling depth (m)	minimum	F75	median	F25	maximum
	1100		1900		3050

Gas wells:	minimum		median		maximum
Inert-gas content (%)	0.50		2.50		20.00
CO_2 content (%)	0.10		1.00		5.00
Hydrogen sulfide content (%)	0.00		0.00		0.00
Heating value (BTU)					
Depth (m) of water (if applicable)					

Drilling depth (m)	minimum	F75	median	F25	maximum
	1100		1900		3050

Completion practices:

1. Typical well-completion practices (conventional, open hole, open cavity, other)	conv
2. Fraction of wells drilled that are typically stimulated	1
3. Predominant type of stimulation (none, frac, acid, other)	frac
4. Historic fraction of wells drilled that are horizontal	0.66

Assessment Unit (name, no.)
Barnett Mixed Continuous Gas and Oil, 50450162

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES
Surface Allocations

1. Texas

Onshore: 100.00 area % of the AU
100.00 mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

2. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

3. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

4. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

5. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES
(continued)

6. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

7. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

8. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

9. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

10. _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

Assessment Unit (name, no.)
Barnett Mixed Continuous Gas and Oil, 50450162

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO PROVINCES
Surface Allocations

1. Number: 5045 Name: Bend Arch-Fort Worth Basin

Onshore: 100.00 area % of the AU
100.00 mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

2. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

3. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

4. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

5. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO PROVINCES
(continued)

6. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

7. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

8. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

9. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

10. Number: _____ Name: _____

Onshore: _____ area % of the AU
_____ mean volume % of the AU

Offshore: _____ area % of the AU
_____ mean volume % of the AU

Assessment Unit (name, no.)
Barnett Mixed Continuous Gas and Oil, 50450162

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS
Surface Allocations

1. Federal Lands — is 4.64 % of the AREA of the AU
   mean VOLUME % in entity 10

2. Private Lands — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

3. Tribal Lands — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

4. Other Lands — is 95.32 % of the AREA of the AU
   mean VOLUME % in entity 89.96

5. Texas State Lands — is 0.04 % of the AREA of the AU
   mean VOLUME % in entity 0.04

6. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

7. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

8. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

9. _____ — is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

10. _____ — is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS
(continued)

11. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

12. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

13. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

14. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

15. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

16. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

17. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

18. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

19. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

20. _____ is _____ % of the AREA of the AU
mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
Surface Allocations

1. Bureau of Land Management (BLM) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

2. BLM Wilderness Areas (BLMW) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

3. BLM Roadless Areas (BLMR) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

4. National Park Service (NPS) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

5. NPS Wilderness Areas (NPSW) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

6. NPS Protected Withdrawals (NPSP) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

7. US Forest Service (FS) is 4.64 % of the AREA of the AU
   mean VOLUME % in entity 10

8. USFS Wilderness Areas (FSW) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

9. USFS Roadless Areas (FSR) is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

10. USFS Protected Withdrawals (FSP) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
(continued)

11. US Fish and Wildlife Service (FWS) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

12. USFWS Wilderness Areas (FWSW) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

13. USFWS Protected Withdrawals (FWSP) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

14. Wilderness Study Areas (WS) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

15. Department of Energy (DOE) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

16. Department of Defense (DOD) is 0.00 % of the AREA of the AU
    mean VOLUME % in entity _____

17. Bureau of Reclamation (BOR) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

18. Tennessee Valley Authority (TVA) is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

19. Other Federal is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

20. _____ is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
Surface Allocations

1. Cross Timbers and Prairie (CRTP) is 84.44 % of the AREA of the AU
   mean VOLUME % in entity 97

2. Rolling Plains (RLPL) is 15.56 % of the AREA of the AU
   mean VOLUME % in entity 3

3. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

4. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

5. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

6. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

7. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

8. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

9. _____ is _____ % of the AREA of the AU
   mean VOLUME % in entity _____

10. _____ is _____ % of the AREA of the AU
    mean VOLUME % in entity _____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
(continued)

11. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

12. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

13. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

14. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

15. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

16. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

17. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

18. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

19. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____

20. _____ is _____ % of the AREA of the AU

mean VOLUME % in entity _____