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Potential for Future Water Flood Projects in Wyoming

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POTENTIAL FOR FUTURE WATER FLOOD PROJECTS IN WYOMING

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Introduction

Wyoming, perhaps more than any other state, is dependent on revenues generated from the development and sales of minerals within its borders and has a vested interest in ensuring that its resources are properly and efficiently exploited. Maximizing the efficiency of oil and gas production in Wyoming is one of the primary goals of the Enhanced Oil Recovery Institute (EORI). Potential methods or practices that can improve or enhance the recovery efficiency of oil and gas production in the state are of paramount interest. Likewise, those policies or practices that hinder such efforts are also important to discuss.

Wyoming has nearly one billion barrels of proved oil reserves, a significant portion of which is still on primary production. Assessing the potential for secondary recovery from current oil fields is always a daunting task and requires evaluations regarding whether any given field will respond favorably to secondary recovery efforts.

This paper makes general assumptions regarding the feasibility of using a water flood to enhance oil recovery in a field based on publicly available data. The conclusions resulting from these assumptions are meant to be a guideline for the potential of future water flooding and are not meant to provide detailed evaluations of any given field's ultimate recovery.

Assumptions

For the purposes of this paper, only fields that are presently on primary production were examined. One of the basic assumptions for estimating future reserves is that, in general, if secondary recovery is employed in a field it can produce about the same reserves as that from primary production. This assumption is based on the reservoir and fluid properties of most of the target fields. Furthermore, for the sake of simplicity and ease of documentation, the current cumulative production from a field still on primary production is the number used to estimate its potential reserves under secondary recovery.

Production data are taken from records at the Wyoming Oil and Gas Conservation Commission (WOGCC) except in those cases where more accurate numbers are available from other published documentation (Wyoming Geological Association Symposia). Cumulative production numbers available from the WOGCC go back to the beginning of 1978 and production prior to that date requires reviewing copies of individual monthly production records on file. Some published field studies contain cumulative production values dating back to original production dates and were used when available.

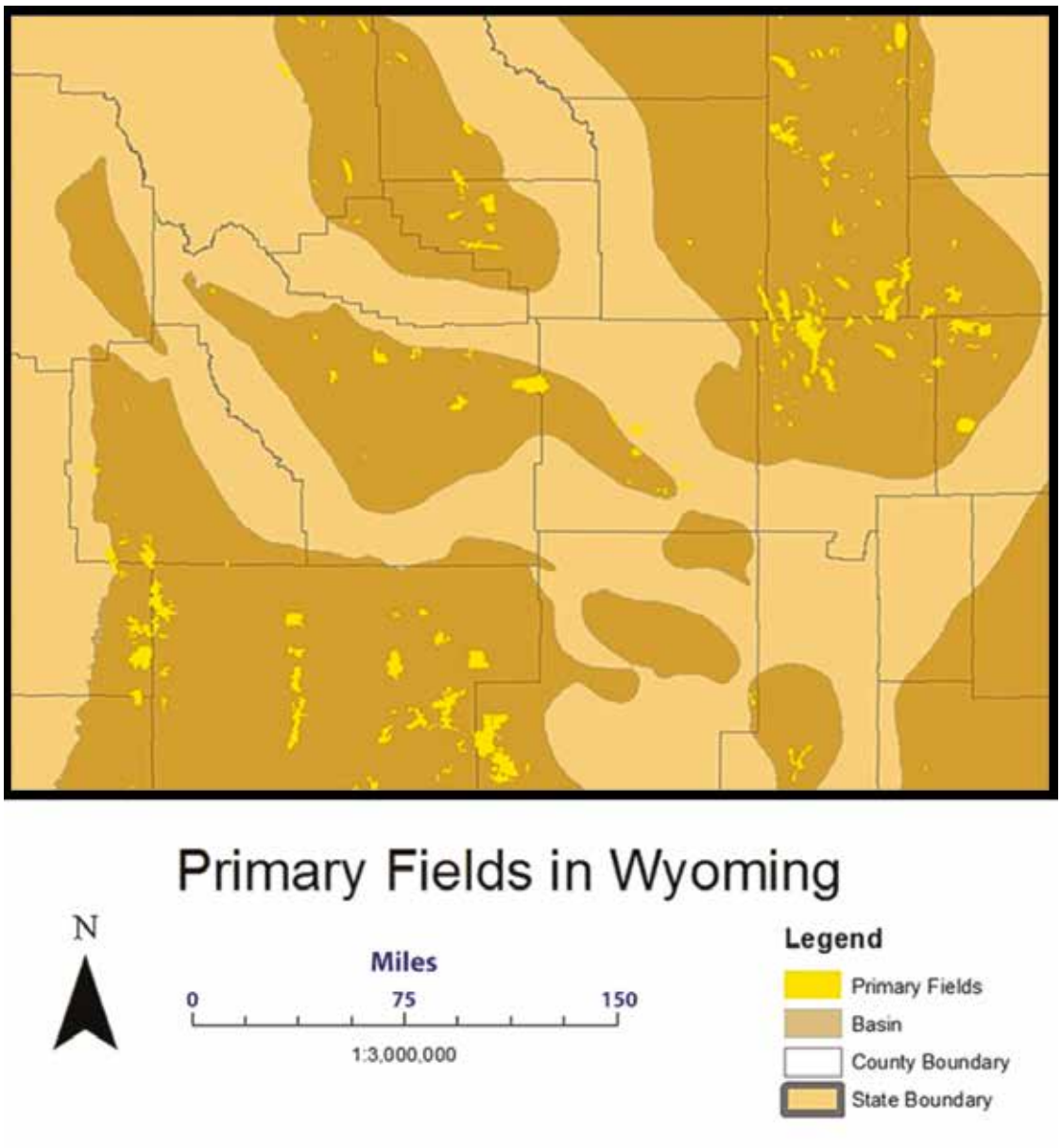
Not every field that is still on primary production will have a significant response to an induced water flood. Oil fields that are

on a natural water drive or those that have recovery factors over 20% were excluded.

Potential Candidates for Secondary Recovery

Based on data at the WOGCC as of June 2018, there are 513 reservoirs spread across 397 different oil fields that are still on primary production and are considered potential candidates for secondary recovery. This number excludes 38 reservoirs that are on natural water drive as well as an additional 86 reservoirs that have recovery factors over 20%. These 397 oilfields have already produced more than 465 million barrels of oil (MMBO).

To be realistically conservative, these oil fields were further winnowed by eliminating those with a Gas Oil Ratio (GOR) of greater than



10,000 cubic feet/barrel or those that have produced an average of less than 20,000 BO/well, unless access to additional zones warrant consideration of such wells. This procedure reduced the candidate fields from 397 to 241. Cumulative production from these 241 fields is over 328 MMBO.

Potential tax revenue to Wyoming from these fields if they produced an additional 328 MMBO from secondary recovery, would amount to over $2.25 billion. This figure assumes a conservative $55/BO crude price over the life of the water floods and an average total tax rate (property, ad valorem, and severance) of 12.5%.

Significance of Candidate Fields to Wyoming Production

For the year 2017, the 241 candidate fields produced at a rate of 30,729 BOPD with total annual production of 11.2 MMBO. This amount represented about 18% of the state's production that year.

Despite the significance of these numbers, it is important to note that the per well production from these fields averages just 6.3 BOPD. In fact, 1,258 of the wells in these target fields are producing less than 1 BOPD, yet each borehole represents an important and sometimes critical access point to the oil reserves remaining in the ground.

It is critical that these boreholes remain intact and capable of being utilized if these remaining reserves are to be recovered. Any policy or practice that forces boreholes to be plugged and abandoned prior to a thorough assessment of the potential for additional hydrocarbon recovery is counterproductive to Wyoming.

Challenges to Implementing New Secondary Recovery Projects

Implementing new secondary recovery efforts requires capital investment. Geological and engineering studies need to be conducted to fully understand a reservoir prior to initiating a water flood. Proper placement of injection and recovery wells may require workovers of existing wells and possibly the drilling of new ones. Suitable sources of water for injection need to be identified. Injection pumps, flowlines, tank batteries, treatment facilities, and a host of other considerations need to be planned and financed.

In addition to surface and subsurface equipment, some reservoirs are not compatible with commonly used and available injection waters. In such cases, fluid compatibility studies need to be conducted and corresponding treatment facilities may need to be constructed to ensure that the injection water does not adversely affect the reservoir and hinder recovery efficiency.

The need for capital investments is acute. If financial burdens reduce a company's capital to the point that it cannot effectively conduct the necessary work to initiate an effective water flood then the project may never be implemented or may be conducted under less than ideal conditions. It is important that any oil or gas recovery method is conducted in the most effective manner to maximize the recovery efficiency.

Impact of the Oil & Gas Industry on Wyoming Employment

According to the 2015 economic report by the American Petroleum Institute, the oil and gas industry had the following impact on employment in Wyoming:

- Direct: 30,983 jobs within the oil & gas industry in Wyoming
- Indirect: 8,201 jobs within the supply chain and part of the oil & gas industry
- Induced: 18,318 jobs resulting from the household spending earned from direct and indirect industry employment
- Total 57,502 jobs affected by the oil and gas industry in Wyoming
- Contributed 22.7% of Wyoming GDP (2nd highest in the nation after Oklahoma (27.3%))
- Wyoming labor force in 2016 was 302,300
- 50 largest employers in the state employed 37,624 people in 2016
- The number of direct and indirect oil-industry-related jobs (39,184) is larger than the number of jobs provided by the top 50 employers in the state

Summary

- 241 fields are good candidates for secondary recovery projects in the state
- Primary production from these 241 fields in 2017 represented 18% of the total annual production in the state
- Secondary recovery from these fields has the potential to generate approximately 328 MMBO in new reserves
- State severance, ad valorem, and property tax revenue from these water flood projects could result in at least $2.25 billion
- New jobs will be created
- Application of future tertiary production in these same fields would result in additional reserves
- It is critical that boreholes within these fields be evaluated and preserved for access to the reserves remaining within

The selection process utilized for this paper is understandably simplistic and generalized. It is meant to provide a guideline on the magnitude of the number of fields that are good candidates for secondary recovery and of the reserves expected from initiating new water flood projects in Wyoming. This paper was never intended to provide a definitive amount to either candidate fields or expected reserves.

As with any such endeavor, generalities used in the assessment process result in a lack of detail. There are undoubtedly fields that may be viable candidates for a water flood but were excluded due to factors such as the way data are reported or due to the fact that the criteria used are inadequate to account for all the variables and situations that are present. As an example, a field with many wells and multiple pay zones has commingled production. This field may have an isolated reservoir that produced the bulk of the oil and would respond well to secondary recovery but when the average production per well is calculated on a field basis the cumulative production per well fails to meet the criterion of 20,000 BO per well. Additionally, a field may have been subjected to a water flood and is therefore eliminated from the list even though closer scrutiny would reveal that a different and economically attractive pay zone within the field was not flooded.

In the final assessment, there are ample candidates for future water flooding projects in Wyoming. The candidate oil fields contain significant reserves that can be extracted

economically at minimal risk and should be attractive to any number of operators. Maintaining access to boreholes that can be utilized for a water flood is critical to any future improved or enhanced oil recovery projects.

References

American Petroleum Institute, 2015, Economic impacts of the natural Gas and Oil Industry on the U.S. Economy in 2015

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www.careerinfonet.org/state

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Wyoming Geological Association various field reports, Oil and Gas Field Symposia

Wyoming Oil and Gas Conservation Commission,
wogcc.wyo.gov

APPENDIX

Average Recovery Factors based on published field reports

Reservoir	RF High	RF Low	RF Average
Shannon	16.6	13.2	14.9
Muddy	15.5	0.5	7.5
Phosphoria	17.0	0.2	7.0
Turner	17.5	0.2	6.6
Frontier	12.7	0.1	3.5
Dakota	16.4	0.05	3.3
Fort Union	7.6	0.01	3.2
Nugget	1.8	1.8	1.8
Mesaverde	1.8	0.1	1.1
Lance	0.6	0.1	0.4
Minnelusa	No Data	No Data	No Data
Cloverly	No Data	No Data	No Data

(University of Oklahoma, University of Wyoming, University of Colorado, Colorado School of Mines, Wyoming Geological Association)

Candidate Oilfields for Secondary Recovery Efforts

(Primary Production; <20% RF; <10,000 GOR; > 20,000 BO/well)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
AFRICAN SWALLOW	2000	MUDDY	2	1,269,039
ALLEMAND	1987	MUDDY	1	118,672
ALICIA	1985	MUDDY	5	218,329
ALLISON	1985	MINNELUSA	1	128,240
AMOS DRAW	1982	MUDDY	39	2,771,213
ANSCHUTZ RANCH EAST	1982	NUGGET	5	2,233,474
ARCHIBALD	1975	FRONTIER	2	530,150
AVERY DRAW	1985	DAKOTA	1	156,424
AVERY DRAW	1985	FRONTIER	1	283,843
BAILEY DOME	1944	NUGGET	3	1,150,339
BAIRD PEAK	1964	CURTIS	1	125,620
BARBER CREEK WEST	1962	PARKMAN	2	844,334

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
BARBER CREEK WEST	1962	FERGUSON	1	59,113
BARTON	1956	LAKOTA	27	112,454
BASIN	1965	TURNER	1	240,357
BATES CREEK	1954	FRONTIER	1	73,491
BERTHA	1955	MUDDY	2	350,841
BESSIE BOTTOM	1983	NUGGET	1	208,534
BETHLEHEM	1973	MUDDY	4	331,841
BIG CAT	1998	SUSSEX	1	54,498
BIG CAT	1998	SHANNON	3	45,509
BIG HOLLOW	1938	MUDDY	8	70,940
BLACK ROCK DRAW	1982	PARKMAN	1	165,702
BLACK THUNDER	1953	MUDDY	5	1,363,433
BLIZZARD	1986	MUDDY	1	148,830
BLIZZARD	1986	DAKOTA	1	93,072
BLUE HILL	1988	FRONTIER	1	184,675
BOBCAT CREEK	1980	FRONTIER	2	230,069
BOGGY CREEK	1971	MUDDY	8	478,605
BOGGY CREEK	1971	TURNER	15	1,078,497
BOULDER GULCH	1981	CODY	4	98,684
BOX CREEK	1955	MUDDY	1	132,886
BRISLAWN	1988	MINNELUSA	1	169,300
BROOKS DRAW	1982	TURNER	10	399,537
BROOKS DRAW	1982	MUDDY	2	69,535
BROSA DRAW	1989	MINNELUSA	1	406,202
BROWNING	1969	BROWNING	1	375,613
BUCK DRAW	1974	DAKOTA	1	205,091
BUCK DRAW	1974	FRONTIER	1	433,272
BUFF	1970	MUDDY	11	830,806
BURNT WAGON	1976	FRONTIER	4	277,289
BUTTE	1980	TURNER	1	50,797
BUTTE DRAW	2010	MINNELUSA	7	1,672,460
BYRON SOUTHEAST	1955	PHOSPHORIA	1	144,121
CAMP CREEK NW	2006	MINNELUSA	2	97,128
CARR CREEK	1985	MINNELUSA	1	529,438
CARTER	1969	TURNER	1	138,732

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
CHEYENNE RIDGE	1982	MUDDY	1	31,266
CHICKEN CREEK	1983	NUGGET	2	1,044,386
CLARETON SOUTHWEST	1969	MUDDY	2	35,194
CLEARWATER	1993	MINNELUSA	1	91,113
COLE NORTHEAST	1983	FRONTIER	3	412,054
COLLETT CREEK	1989	BIG HORN	2	957,427
COON CREEK	1953	FRONTIER	4	172,641
CORNEY	1980	TEAPOT	3	228,116
CORONA	1986	MINNELUSA	1	92,575
CORRAL CREEK	1962	MINNELUSA	2	749,456
CROSSBOW	2010	TURNER	31	7,127,857
CROSSBOW	2010	PARKMAN	25	3,644,413
DALE NORTH	1984	J SAND	1	67,616
DEEN DRAW EAST	2010	MINNELUSA	6	3,013,067
DEEP DRAW	1957	MINNELUSA	2	1,384,778
DEER CREEK	1950	MUDDY	1	205,768
DEMOTT DRAW	1984	MINNELUSA	1	71,876
DENNELL DRAW	1982	TURNER	1	67,555
DERRICK DRAW	1989	MUDDY	1	6,532,780
DESERT SPRINGS WEST	1959	ALMOND	23	2,006,509
DEWEY DOME	1936	SUNDANCE	8	27,729
DILLINGER RANCH EAST	1979	MOWRY	2	212,979
DILTS	1980	PARKMAN	2	212,635
DOGIE	1954	MUDDY	4	51,411
DOUGLAS SOUTH	1946	PARKMAN	4	195,519
DRY FORK	1970	SHANNON	2	241,581
DRY FORK	1970	PARKMAN	5	1,400,451
DRY PINEY	1957	NUGGET	9	15,545,194
DUBOIS	1946	PHOSPHORIA	3	306,653
DUCK CREEK	1967	MUDDY	2	346,750
DUTTON CREEK	1927	MUDDY	3	354,679
EAST DRAW	1987	MUDDY	1	57,364
EAST FORK	1985	DAKOTA	1	83,230
ENOS CREEK	1923	CURTIS	1	185,887
FAIRWAY	1994	CODELL	5	1,070,094

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
FELIX	1982	MUDDY	11	866,353
FENTON	1972	MUDDY	2	476,402
FERRIS EAST	1919	CHUGWATER	1	442,421
FINLEY DRAW	1982	FRONTIER	16	3,908,357
FINLEY DRAW	1982	SHANNON	6	962,984
FIVE MILE	1952	MUDDY	16	972,759
FIVE MILE	1952	FRONTIER	4	402,594
FLAT TOP	1961	LANCE	2	86,632
FLAT TOP	1961	TEAPOT	22	2,917,520
FOURTEEN MILE	1952	MUDDY-DAKOTA	4	153,475
FOURTEEN MILE	1952	PHOSPHORIA	4	121,956
FREEDOM	1998	PHOSPHORIA	1	37,242
FRISBY SOUTH	1972	PHOSPHORIA	27	7,571,540
FRISBY SOUTH	1972	ERVAY	1	147,461
FROG CREEK	1972	MUDDY	15	1,200,092
G.P. DOME	1920	NIOBRARA	2	63,028
GEARY NORTH	1968	MUDDY-DAKOTA	1	59,277
GEORGE RANCH	1961	MUDDY	4	537,633
GEORGE RANCH	1961	DAKOTA	2	74,711
GIBSON DRAW	1970	MUDDY-TURNER	8	642,273
GLASSER DRAW	1983	MUDDY-TURNER	1	66,101
GOOSE EGG	1975	PHOSPHORIA	4	142,523
GOVERNMENT BRIDGE	1956	CODY	13	1,946,674
GOVERNMENT BRIDGE	1956	MUDDY	1	194,575
GRAHAM RESERVOIR	1983	FRONTIER	1	215,459
GRAHAM RESERVOIR	1983	MUDDY-DAKOTA	1	544,941
GREASEWOOD WEST	2002	DAKOTA	2	104,027
GREAT DIVIDE	1978	LEWIS	2	376,003
GREYBULL WEST	1952	TORCHLIGHT	1	46,526
GUN	1983	J SAND	1	24,548
HA CREEK	1974	MUDDY	36	1,078,534
HA CREEK	1974	DAKOTA	3	174,282
HAND CREEK	1983	PHOSPHORIA	2	174,542
HARPER DRAW	1998	MUDDY	2	79,281
HAY RESERVOIR	1977	LEWIS	52	2,859,283

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
HAYBARN	1981	FORT UNION	8	687,843
HENRY SOUTH	1985	DAKOTA	4	742,410
HILDA	1987	MINNELUSA	2	687,843
HINES	1971	MUDDY	2	307,708
HIRSCH	1986	MUDDY	1	106,118
HOGSBACK	1955	FRONTIER	113	9,005,678
HORNBUCKLE	1984	Frontier	1	48,748
HORNE BROTHERS	1951	SUNDANCE	2	396,306
HORNE BROTHERS	1951	MORRISON	1	88,751
HOWARD RANCH	1961	LANCE	1	30,809
HUGHIE DRAW	1987	MINNELUSA	1	127,569
IRON CREEK	1917	CLOVERLY	12	34,565
IRON CREEK	1917	FRONTIER	6	7,800
JEWEL	1960	MINNELUSA	1	976,872
JIGGS THOMPSON	1961	MUDDY	23	458,852
JIGGS THOMPSON NORTH	1993	TURNER	2	21,523
KARA	1955	WALL CREEK	6	114,951
KEYTON ROAD	1976	MUDDY	1	77,058
KIRBY DRAW	1954	FRONTIER	2	553,439
KIRBY DRAW SOUTH	2006	FRONTIER	3	186,805
KITTY	1965	MUDDY	146	22,936,289
KOHLER	1970	PHOSPHORIA	1	101,009
KREJCI	1960	MOWRY	2	122,342
LAMB	1913	MADISON	3	357,741
LEBAR	1962	TEAPOT	1	52,522
LEE DRAW	1981	MINNELUSA	1	74,347
LEGACY	1989	DAKOTA	1	334,777
LEIMSER	1965	DAKOTA	1	93,949
LEIMSER	1965	LEO	2	93,949
LIGHTNING CREEK	1949	FIRST SUNDANCE	5	731,236
LIGHTNING CREEK	1949	MUDDY	18	407,231
LINCOLN ROAD	1977	DAKOTA	26	3,634,255
LINDBERG EAST	1985	J SAND	1	320,992
LITTLE GRASS CREEK	1917	PHOSPHORIA	2	263,834
LITTLE MEDICINE BOW	1953	SUNDANCE	4	117,884

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
LITTLE MEDICINE BOW	1953	MUDDY	3	89,803
LIZARD HEAD	1995	NIOBRARA	1	74,745
LIZARD HEAD	1995	FRONTIER	1	52,906
LOST CABIN	1957	WIND RIVER	7	577,813
MARNIE	1982	MINNELUSA	1	849,596
MARSHALL	1967	PHOSPHORIA	5	1,053,040
MARY DRAW	1982	PARKMAN	14	2,388,684
MARY DRAW	1982	TURNER	8	2,036,156
MCCREERY	1983	MINNELUSA	4	663,030
MEETEETSE	1955	PHOSPHORIA	1	161,725
MIDDLE DOME	1963	PHOSPHORIA	2	274,421
MIDDLE MOUNTAIN	1952	FRONTIER	1	58,292
MIDWAY	1931	MUDDY-DAKOTA	3	402,345
MISSOURI	1987	MINNELUSA	1	109,563
MITCHELL BREAKS	1998	MINNELUSA	1	147,975
MOORCROFT	1887	MINNELUSA	1	232,615
MOORCROFT EAST	1984	MUDDY	6	149,312
MOORE	1984	FRONTIER	1	420,122
MORSE	1971	MINNELUSA	1	693,724
MOSEBAR DRAW	2000	MINNELUSA	1	108,709
MUSH CREEK WEST	1949	NEWCASTLE	23	4,223,057
NAPIER ROAD	1982	PARKMAN	1	75,084
NEIBER DOME	1948	FRONTIER	3	42,532
NETA	1985	MINNELUSA	1	700,294
NIGHT CREEK	1985	TURNER	1	78,525
NINEMILE	1981	FRONTIER	1	73,051
NUTCRACKER	1988	MUDDY	4	159,531
OGALALLA HILLS	1985	FRONTIER	1	117,636
OLDS	1975	BUTLER	15	114,194
OLDS	1975	LAKOTA	12	188,934
OLMSTEAD	1964	MUDDY	1	72,681
ORMSBY ROAD	1991	MUDDY	1	31,375
ORPHA	1985	FRONTIER	5	757,386
OSAGE	1919	MUDDY / NEWCASTLE	200	32,241,979
OVERLAND	1970	NIOBRARA	3	124,541

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
PARNELL DRAW	1973	MUDDY	1	128,064
PATRICK DRAW NORTH	1961	ALMOND	8	657,522
PAYNE	1969	MUDDY	2	94,796
PAYNE	1969	NIOBRARA	10	161,069
PHEASANT	1965	MINNELUSA	2	1,097,774
PHILLIPS CREEK	1980	FRONTIER	5	1,504,771
PHILLIPS CREEK	1980	SHANNON	1	385,998
PHOENIX	1985	MUDDY	2	222,530
PIETRA	1994	ALMOND	1	26,114
PILOT BUTTE	1916	CODY	7	634,751
PILOT BUTTE	1916	PHOSPHORIA	10	4,376,291
PINE LODGE	1960	LEO	1	211,890
PINE TREE	1976	SHANNON	54	10,171,803
PINE TREE	1976	FRONTIER	13	1,010,169
PINEDALE	1956	LANCE	3047	51,259,648
PLEASANTDALE	1975	PARKMAN	9	1,385,754
POISON DRAW	1972	TECKLA	51	7,695,131
POISON DRAW	1972	TEAPOT	3	40,886
POISON SPIDER WEST	1948	FRONTIER	2	756,548
POISON SPIDER WEST	1948	MORRISON	3	634,519
POISON SPRING CREEK	1958	MUDDY	1	326,303
POLO	1978	MUDDY	2	37,700
POPO AGIE	1974	PHOSPHORIA	1	44,321
POPSKULL	1989	MUDDY	2	366,803
PORCUPINE	1969	SUSSEX	32	2,126,043
POWELL	1954	SUSSEX-PARKMAN	4	311,587
PREP	1963	MUDDY	1	500,222
PUMPKIN CREEK	1969	SUSSEX	1	100,914
R W CREEK	1981	MUDDY	6	309,877
RAILROAD BEND	1990	MINNELUSA	1	257,732
RANKIN	1954	MUDDY	1	34,480
RATTLESNAKE	1968	PHOSPHORIA	21	7,399,016
RAWHIDE	1953	PHOSPHORIA	4	151,289
RECLUSE SOUTHEAST	1969	MUDDY	3	597,012
RED BIRD	1964	1-2 LEO	1	35,490

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
RED BIRD	1964	LEO	2	59,617
REX LAKE	1923	DAKOTA-MUDDY-LAKOTA	9	807,514
ROAD HOLLOW	1981	BIG HORN	3	2,029,460
ROBIN	1971	ALMOND	1	277,029
ROCKY POINT	1961	MUDDY	6	3,000,000
ROSE CREEK	1957	PHOSPHORIA	2	280,194
ROSS (009)	1983	FRONTIER	1	112,746
ROSS (009)	1983	DAKOTA	1	61,328
SALT CREEK WEST	1917	WALL CREEK	11	505,658
SAND CREEK NORTH	1986	FRONTIER	1	112,381
SAWGRASS	1988	MINNELUSA	2	376,146
SAWMILL DRAW	1983	PARKMAN	1	79,851
S-BAR	1969	MUDDY	1	490,255
SCHOOL CREEK	1981	TURNER	13	1,599,194
SCRIBNER	1986	MINNELUSA	2	127,135
SHEEP CREEK	1935	PHOSPHORIA	5	351,719
SHEEP POINT	1957	PHOSPHORIA	6	875,882
SHELDON	1925	FRONTIER	4	114,524
SHELDON	1927	NUGGET	4	2,548,478
SHELL DRAW	1985	MUDDY	3	191,720
SHERWOOD	1954	SHANNON	2	209,664
SIERRA MADRE	1981	SHANNON	21	997,333
SIEVERS	1975	SHANNON	1	116,281
SIMPSON NORTH	1988	MINNELUSA	1	502,985
SMITH DRAW	1985	DAKOTA	2	20,630
SNYDER CREEK	1954	MUDDY	6	416,939
SOUTH FORK	1947	PHOSPHORIA	2	1,513,010
SPAAR CREEK	2002	MINNELUSA	1	95,706
SPEARHEAD RANCH	1973	FRONTIER	10	6,255,325
SPOTTED HORSE	1972	MUDDY	5	520,257
SPRINGEN NORTH	1990	MUDDY	3	136,617
STAGE STOP	1966	LEWIS	1	945,509
STORE	1969	MUDDY	3	1,029,273
SULPHUR CREEK	1942	ASPEN	1	20,366
SWAN	1970	DAKOTA	6	1,111,101

Candidate Oilfields for Secondary Recovery Efforts (continued)

Field Name	Year	Primary Reservoir	Wells	Reservoir Cum Oil
T. E. RANCH	1959	DINWOODY-PHOSPHORIA	1	297,134
TAYLOR	1982	FRONTIER	5	1,238,286
TAYLOR RANCH	1986	DAKOTA	3	483,657
THRONE	1971	MUDDY	1	72,788
TICK	1979	PARKMAN	1	51,489
TIMBER CREEK SOUTH	1988	MINNELUSA	1	98,106
TIMBER DRAW	2006	NEWCASTLE	2	47,641
TIPPS	1963	CLOVERLY-LAKOTA	1	275,989
TIPPS	1963	MUDDY	1	173,150
TUIT DRAW	1985	TURNER	16	996,388
TURNERCREST	1986	FRONTIER	1	234,341
TWENTY-ONE MILE BUTTE	1988	PARKMAN	10	861,949
VI BAR RANCH	1988	MUDDY	1	119,296
V-TWO DRAW	1982	SHANNON	1	132,341
V-TWO DRAW	1982	FRONTIER-3	1	117,522
WAGENSEN	1984	MUDDY	1	123,504
WAKEMAN FLATS	1919	WALL CREEK	14	1,029,090
WHISKEY SPRINGS	1988	DAKOTA	3	3,975,790
WHISKEY SPRINGS UNIT	1988	DAKOTA	4	1,789,569
WIDGE NORTH	1991	MUDDY	1	154,646
WIDGE NORTH	1991	MINNELUSA	1	42,863
WILDCAT CREEK	1964	FRONTIER	3	126,678
WILDHORSE CREEK	1982	MUDDY	4	352,324
TOTAL				**328,440,794**

Fields on Primary Production by Basin

Production by Basin	Fields	Production
DJ Basin	5	1,520,950
Greater Green River Basin	15	11,599,338
Green River Basin	11	88,642,479
Laramie Basin	5	1,925,877
Overthrust Belt	5	5,449,261
Powder River Basin	158	181,298,206
Shirley Basin	3	2,249,305

Fields on Primary Production by Basin (continued)

Production by Basin	Fields	Production
Wind River Basin	14	12,284,403
Total	**240**	**328,440,794**

Statistics of Formations on Primary Production

Formation	Fields	Production
Almond	4	2,967,174
Aspen	1	20,366
Bighorn	2	2,986,887
Browning	1	375,613
Butler	1	114,194
Chugwater	1	442,421
Cloverly	2	310,554
Codell	1	1,070,094
Cody	3	2,680,109
Curtis	2	311,507
Dakota	17	13,138,303
Dinwoody-Phosphoria	1	297,134
Ervay	1	147,461
First Sundance	1	731,236
Ferguson	1	59,113
Fort Union	1	365,712
Frontier	35	30,327,366
J Sand	3	413,156
Lakota	2	301,388
Lance	3	51,377,089
Leo	4	711,533
Lewis	3	4,180,795
Madison	1	357,741
Minnelusa	32	16,376,217
Morrison	2	723,270
Mowry	2	335,321
Muddy	73	94,523,656
Nugget	6	22,730,405
Parkman	12	11,305,865
Phosphoria	20	25,344,328

Statistics of Formations on Primary Production

Formation	Fields	Production
Shannon	9	13,236,494
Sundance	3	541,919
Sussex	4	2,593,042
Teapot	4	3,239,044
Teckla	1	7,695,131
Torchlight	1	46,526
Turner	12	13,835,118
Wall Creek	3	1,649,699
Wind River	1	577,813
Total		**328,440,794**

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