The Bakken Explorers

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Petroleum News Bakken

The Bakken Explorers,
an annual publication
from Petroleum News Bakken


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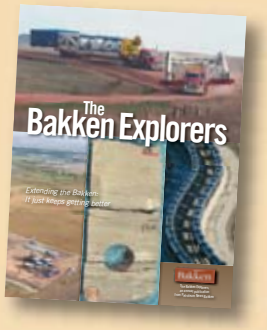

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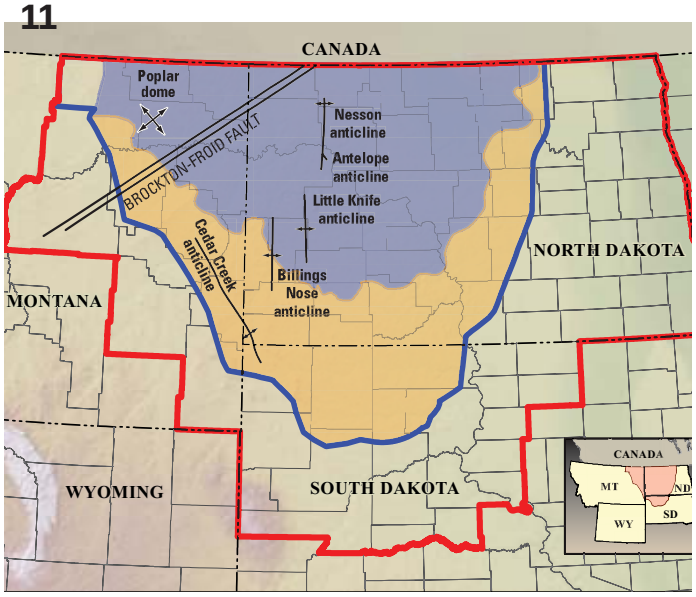

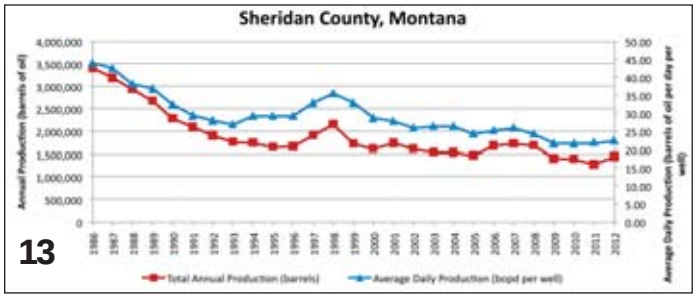

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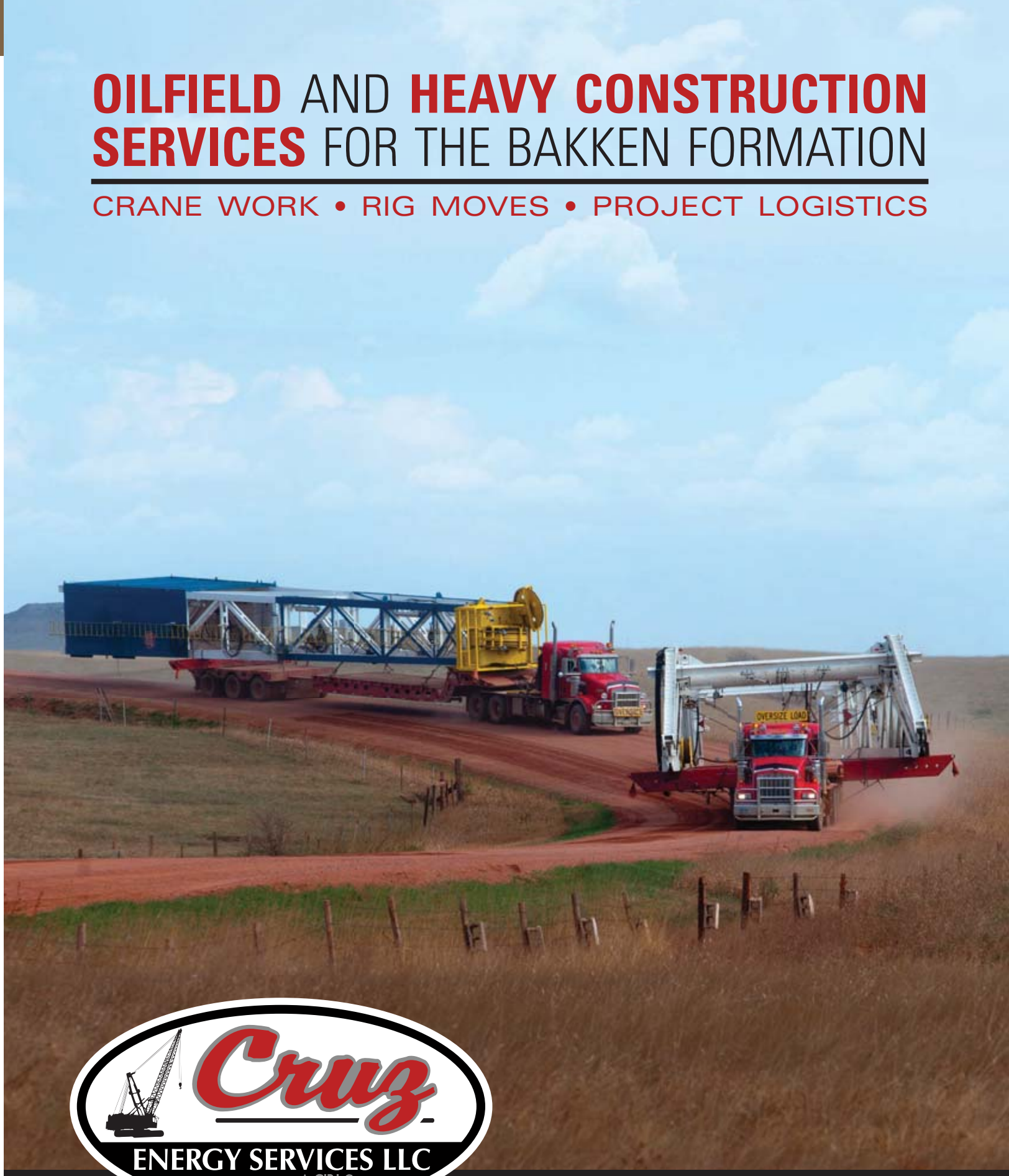

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Thank you Bakken explorers for securing future production

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First annual Bakken Explorers magazine features exploration leaders

Welcome to the first annual edition of The Bakken Explorers magazine, brought to you by Petroleum News Bakken, a weekly newspaper that covers oil and gas activity in the Bakken petroleum system of the Williston Basin.

It will be the can-do attitudes of the basin's explorers that continue to break the technological, geological and economic barriers, keeping the Bakken's oil and gas production growing, and then stable, for decades to come.

KAY CASHMAN

Our only regret is that we were not able, for various reasons, to feature all the explorers in this first issue, but we did get the "greats," such as Slawson Exploration, Continental Resources and Whiting Petroleum.

MARTI REEVE

The first criteria we used to qualify the selected companies was that the information had to be backed by public disclosure, either well completion filings with government agencies or statements made by the company or its partners in conjunction with stock market reports.

Most importantly, however, explorers had to be working to extend the Bakken petroleum system's recoverable oil reserves in one or more of three ways:

1. Exploring laterally by testing the fringe of the known productive Bakken petroleum system;

2. Exploring vertically by evaluating relatively unproduced formations or formation zones in the Bakken system, such as the upper Bakken shale member and the second, third and fourth benches of the Three Forks; or

3. Looking to increase producible reserves by developing and utilizing new technology — preferably technology used in combination with 1 and 2 above.

Nominations for E&P companies for next year's magazine — and, of course, for potential articles in Petroleum News Bakken — are always welcome. They should be sent to Kay Cashman at publisher@petroleumnewsbakken.com or Mike Ellerd at mellerd@petroleumnews-bakken.com.

Photos and other possible art for the next edition of The Bakken Explorers should be sent to Marti Reeve at mreeve@petroleumnews.com.

Finally, thank you to the advertisers who helped support the magazine this year, with the intention of saluting those E&P companies helping to ensure the future of the oil industry in the Williston Basin.

Cheers,
Kay Cashman, publisher & executive editor
Marti Reeve, special publications director

USGS doubles the oil

Latest assessment: Bakken petroleum system holds mean 7.38B barrels of oil, 6.75 tcf gas

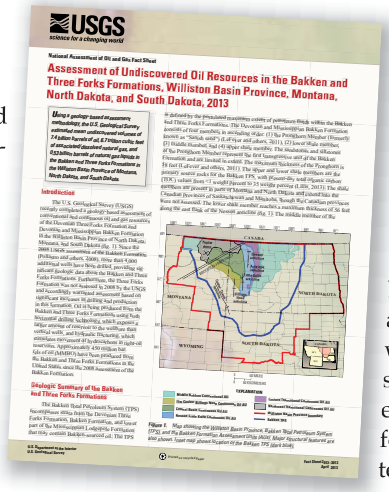
By RAY TYSON
For Petroleum News Bakken

Industry representatives polled more than a year ago by Petroleum News accurately predicted that the federal government would end up at least doubling the amount of crude oil that could be technically recovered from the U.S. portion of the Bakken petroleum system.

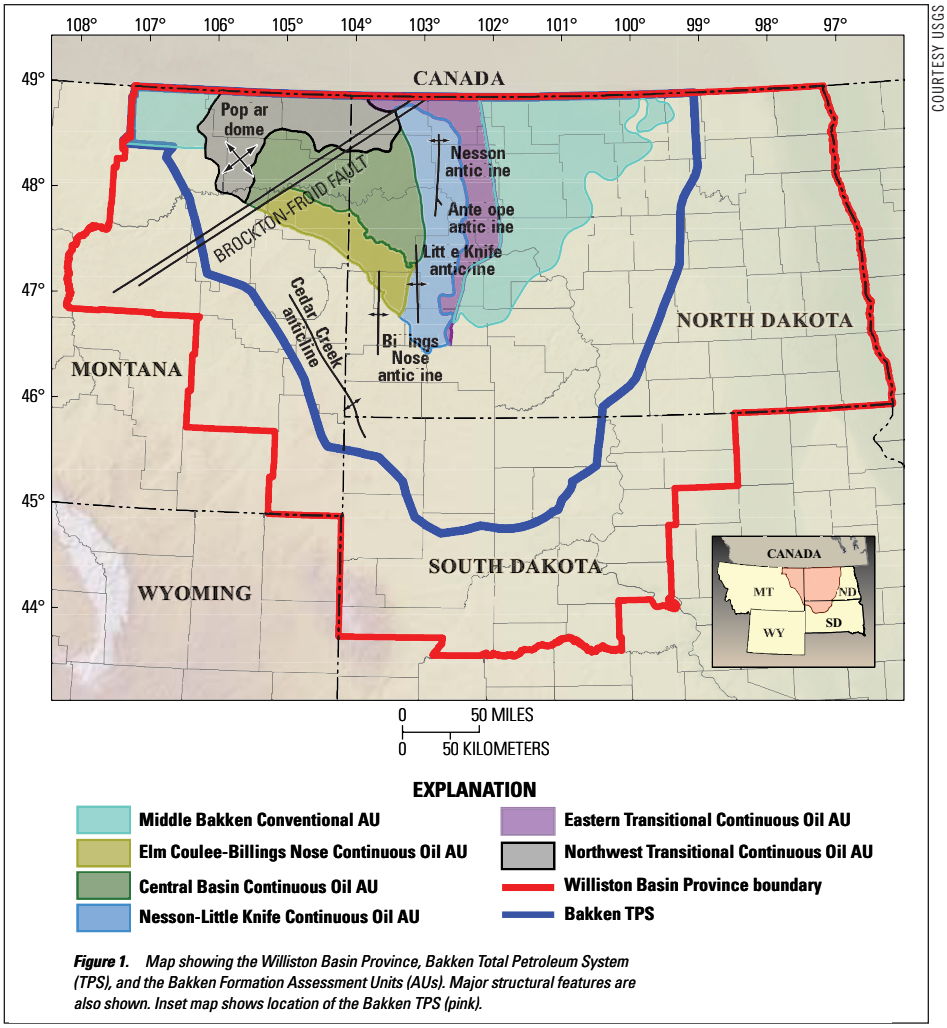
That's largely because the 2008 study conducted by the U.S. Geological Survey did not include crude oil estimates for the Three Forks formation, which many believe to be as prolific as the Bakken formation. And that's how it shakes out in the long-awaited, updated USGS study released April 30 by the U.S. Department of the Interior.

USGS now believes the entire Bakken petroleum system, including the Three Forks, holds a mean 7.38 billion barrels of undiscovered, technically recoverable oil, compared to a mean 3.65 billion barrels estimated in the 2008 study. Estimates range from a low of 4.42 billion barrels to a high of 11.43 billion barrels.

Of the 7.38 billion barrel mean, 3.73 billion barrels is attached to the Three Forks, meaning the 3.65 billion barrels attributed to the Bakken in the 2008 study remains unchanged in the revised study five years later. The USGS is now saying the Bakken and Three Forks formations hold roughly the same amount of technically recoverable oil.


USGS
Assessment of Undiscovered Oil Resources in the Bakken and Three Forks Formations, Williston Basin Province, Montana, North Dakota, and South Dakota, 2013

USGS also calculated that the Bakken petroleum system contains nearly three times more recoverable gas than originally thought — a mean of 6.7 trillion cubic feet of natural gas and 530 million barrels of gas liquids. Gas estimates range from 3.43-11.25 trillion cubic feet and 230-to 950 million barrels of gas liquids, with the increases due primarily to the inclusion of the Three Forks formation.



COURTESY USGS

Figure 1. *Map showing the Williston Basin Province, Bakken Total Petroleum System (TPS), and the Bakken Formation Assessment Units (AUs). Major structural features are also shown. Inset map shows location of the Bakken TPS (pink).*

Three Forks is expansive

Three Forks is a thicker and more extensive horizon than the Bakken, extending further east across North Dakota, further west into Montana and as far south as South Dakota. However, only about 5 percent of the formation is said to have been tested, compared with 14-33 percent in some of the better-known parts of the Bakken.

The Interior Department noted that since its 2008 assessment, more than 4,000 wells have been drilled in the Williston Basin, providing updated subsurface geologic data that helped in updating the study.

"Previously, very little data existed on the Three Forks formation and it was generally thought to be unproductive," the agency said in a press release. "However, new drilling resulted in a new understanding of the reservoir and its resource potential."

PNB polls industry

Industry representatives interviewed by Petroleum News in early April 2012 at the Bakken Investors Conference in Minot, N.D., agreed the USGS would have to at the minimum double its esti-

mated oil recovery to around 8 billion barrels.

"That's what I'm hearing based on new data that's come in on the wells that have been drilled," Laura Erickson, an industry consultant and head of Williston, N.D.-based Plains Energy Technical Resources LLC, said on the conference sidelines.

"I think there are a lot of people who think that is reasonable," said Terry D. Hildestad, former president and chief executive officer of MDU Resources.

"I've seen people coming up with even larger numbers," added Kathleen Neset, president of Neset Consulting and widely known as the "Godfather of the Bakken."

Closer to 11 billion barrels

On learning of USGS' latest oil recovery estimates, Ron Ness, president of the North Dakota Petroleum Council Petroleum Council, told attendees at the 21st Williston Basin Petroleum Conference in Regina, Sask., on May 1 that he believes the actual number is closer to the USGS' high estimate of 11 billion barrels.

"That's a big number. It's double what it was before," he said of USGS mean assessment. "But I think as an industry, and most of the North Dakota prognosticators that you see, think it's probably on the low

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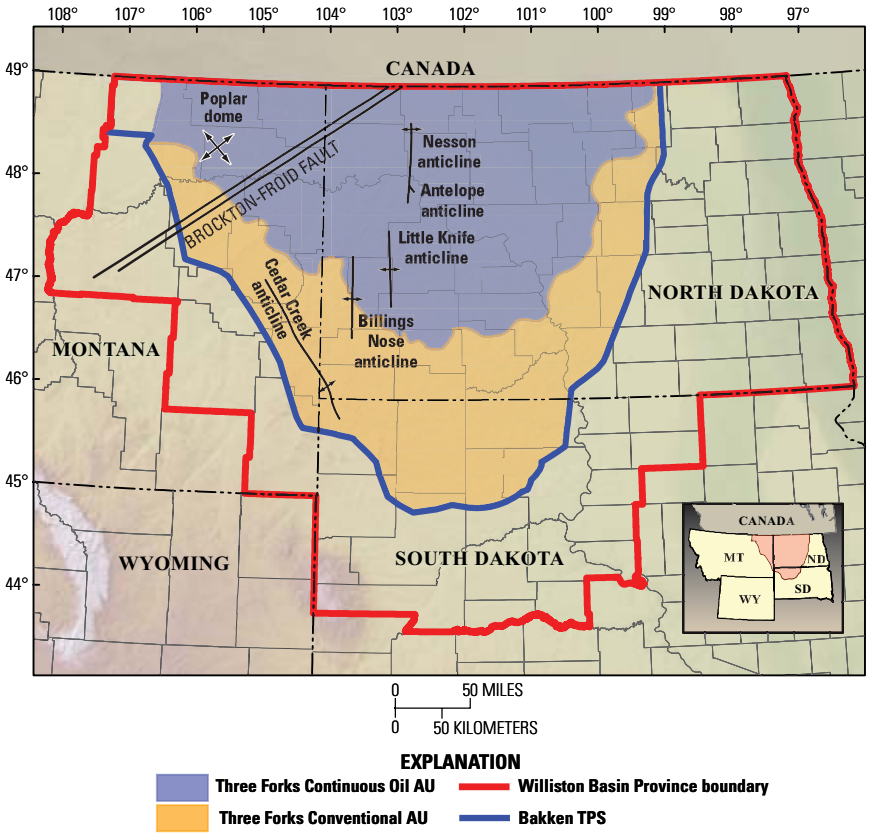


COURTESY USGS

Figure 2. *Location of the Three Forks Formation Assessment Units (AUs) in the Williston Basin Province. Inset map shows location of the Bakken TPS (pink).*

Movement in Sheridan County

Oil and gas drilling split between Bakken, non-Bakken; TAQA most active operator

By MIKE ELLERD

For Petroleum News Bakken

Most of the non-Bakken production in Sheridan County comes from the Ratcliffe formation, while nearly all of the unconventional production is from horizontal wells targeting the Bakken formation, although there has been some recent Three Forks activity in the county.

Within the Bakken petroleum system, Sheridan County, Montana's most northeastern county bordering both North Dakota and Saskatchewan, tends to stay off of most people's radar. However, Sheridan has seen its share of oil and gas activity over the years, and activity in the county, both conventional and unconventional, continues today, drawing little attention.

Montana Board of Oil and Gas Conservation, MBOGC, records indicate that approximately 1,150 wells have been drilled in Sheridan County dating back to the early 1950s. As of mid-July 2013, there were fewer than 200 producing wells in the county, approximately half of those vertical wells producing from such formations as the Ratcliffe, Red River, Nisku, Winnipegosis, Mission Canyon, Duperow and Nesson Zone.

Most of the non-Bakken production in Sheridan County comes from the Ratcliffe formation while nearly all of the unconventional production is from horizontal wells targeting the Bakken formation, although there has been some recent Three

continued on next page

USGS ASSESSMENT *continued from page 11*

side. …"

In fact, Bakken resource estimates have varied widely dating back to the 1950s. And USGS latest estimates would be considered ultra-conservative compared to some industry projections, most notably those compiled by E&P independent Continental Resources, a major producer and largest leaseholder in the Williston Basin.

Continental's robust estimate

Since 2010, Continental has believed at least 24 billion barrels of oil equivalent could be recovered from the Bakken system, based on a 3.5-4 percent recovery rate from an estimated 577 billion barrels of in-place resource. (See articles on pages 21 and 56 with updated estimates from Continental.)

But that 24 billion boe recovery projection is likely to be increased dramatically in the near future. Last summer the company increased its in-place resource estimate from 577-to 903 barrels, a whopping 56 percent increase. The 326 billion barrel in-place increase was based primarily on numerous oil-saturated core samples taken at various locations, deep within the Three Forks formation.

Continental has yet to officially increase its recovery estimates. However, a 3.5 percent recovery rate on 903 billion boe would boost the company's official 24 billion boe yield to 32 billion, while 4 percent would yield 36 billion boe and 5 percent, 45 billion boe.

Continental is so sure of its expectations for the Williston Basin that last October it announced a highly ambitious goal of tripling production and reserves by year-end 2017, with the Bakken taking the lead role in the effort.

The "geological foundation" that "underpins" the USGS' updated assessment was specifically provided by the North Dakota Geological Survey, North Dakota Industrial Commission, Montana Board of Oil and Gas, and multiple industry groups working in the region, according to the Interior Department.

"This new information and data allowed USGS to develop a more robust geologic model and understanding of the petroleum system of the Bakken and Three Forks formations," the agency said.

Estimates are conservative

Meanwhile, Lynn Helms, director of the North Dakota Department of Minerals Resources, DMR, welcomed the USGS update though conceded the numbers were probably conservative.

"Assessments like these are typically more conservative because technology changes so rapidly," he said. "We agree with the range of numbers and think the high estimate of 11 billion barrels is a reasonable target as technology and exploration of the Three Forks continues."

Helms said the USGS assessment gives state and counties, as well as operators, a better idea of what to expect from development.

"This will assist in further planning of all the necessary components of oil and gas development, from regulation to roads and housing," he added.

Study is significant

North Dakota state geologist Ed Murphy acknowledged the significance of including the Three Forks in the study.

"This assessment shows the importance of the Three Forks development, something that companies are just beginning to explore," he said. "This is an evolving oil play, and we will continue to evaluate the results as more wells are drilled into the deeper Three Forks benches."

In 2008, DMR released its own assessment of the Bakken system at 2.1 billion barrels, followed by a 2010 assessment of the top 50 feet of the Three Forks at 1.87 billion barrels, for a total of technically recoverable oil just shy of 4 billion barrels.

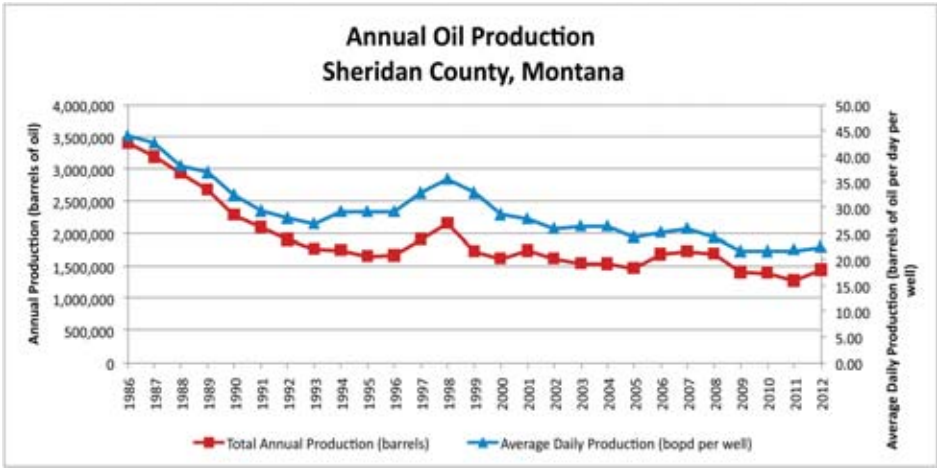
However, the department said it has no plans to update its 2010 assessment, but has been collecting "pertinent data" should state policy makers feel an update is needed.

Editor's note: The full USGS report can be found here: http://pubs.usgs.gov/fs/2013/3013/

Contact Ray Tyson at rtyson@petroleumnews.com

Forks activity in the county.

While annual production in Sheridan County has generally declined since 1986, the first year for which MBOGC has annual production data (see graph), there was an upswing in production in the mid- to late-1990s followed by a less pronounced decline. Although production has fluctuated somewhat since 2000, annual production has been hovering at about 1.5 million barrels. Average production per well through 2012 is some 20 barrels of oil per day. Through April 2013, the most recent month for which MBOGC has finished compiling production data, Sheridan County has produced a total of 529,700 barrels of oil in 2013. Average production in the county has recently been increasing, and through April the county averaged 26.76 bopd per well in 2013.



TAQA North USA

The most aggressive operator in Sheridan County over the last two years is Calgary-based TAQA North USA Inc., which began North American operations when its parent company, Abu Dhabi National Energy Co., acquired Northrock Resources Ltd. in 2007. TAQA North has since continued expanding its North American operations in Canada as well as Montana and North Dakota.

Over the past 24 months, TAQA North USA has brought 16 wells on production in Sheridan County, all horizontal Bakken wells. Initial production, IP, rates for those 16 wells range from a low of 8 bopd to a high of 347 bopd with an average IP of 79.88 bopd.

TAQA North has 71 producing wells in Sheridan County and in April those wells produced a total of 50,488 barrels, averaging 30.65 bopd per well. While most of the company's Sheridan wells, 45 of the 71, are non-Bakken, its 26 Bakken wells accounted for 36,399 barrels or 72 percent of the company's April production, with production averaging 64.31 bopd.

Most of TAQA's Sheridan County wells are in the Flat Lake field just below the Canadian border in the far northeast region of the county.

Three Forks activity

There are only two wells in the MBOGC database identified as targeting the Three Forks formation in Sheridan County, one operated by Whiting Oil and Gas and the other by Marathon Oil. Whit-

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SHERIDAN COUNTY *continued from page 13*

ing's Gronlie Farms 31-25TFH in the Elm Coulee, Northeast field in the southeast region of the county went on production in August 2012 and through May 2013 had produced 17,008 barrels, averaging 65.67 bopd. That well had an IP of 130 bopd.

Marathon's Sheridan County Three Forks well, the Dave Clark 21-13H, has also been producing in the Elm Coulee, Northeast field since August 2012, and through April produced a total of 10,843 barrels of oil. The number of producing days is not available for this well in the MBOGC database, but the Dave Clark 21-13H did have an IP of 159 bopd.

Other recent activity

In addition to its Three Forks well, Marathon has drilled and brought on production five Bakken wells in Sheridan County since February 2012, all in the Elm Coulee, Northeast field. The IP rates for those five wells ranged from 53 to 254 bopd with an average IP of 158.2 bopd.

Whiting has one other producing well in Sheridan County in addition to its Three Forks well, the Nyby 1-6 well, a Bakken well in the Katy Lake, North field in east-central Sheridan County. The Nyby 1-6 is a vertical, Red River well, and since production began in January 1986, the well produced a total 395,947 barrels of oil through May 2013 with a daily production average of 42.98 bopd.

Other operators bringing Bakken formation wells on production in Sheridan County in the last two years include Samson Resources, Sinclair Oil and Gas, Southwestern Energy, and Vaalco Energy (USA).

Samson drilled and brought on production two wells in the county in June 2012, both targeting the Bakken formation. Those two wells had IPs of 67 and 149 bopd. These are the only two producing wells that Samson has in Sheridan County, and both are in the Elm Coulee, Northeast field.

Sinclair's Chisholm 1-3H well went on production in January 2013 with an IP of 160 bopd, and through May 2013 that well produced a total of 8,780 barrels of oil over 81 days of pumping for a daily average of 108.40 bopd. This well is in the Elm Coulee, Northeast field and is the only producing well that Sinclair has in Sheridan County.

Southwestern Energy's Bedwell 33-52 1-1H well in the Elm Coulee, Northeast field went on production in September 2012 with an IP of 171 bopd and through April 2013 produced 9,352 barrels with a daily average of 52.83 bopd. This is Southwestern Energy's only producing well in the county.

Vaalco Energy's Bolke 07-01H wildcat well began producing in February 2013 and had an IP of 22 bopd. Total production data for the Vaalco well are not yet available in the MBOGC database. This is the only producing well that Vaalco has in Sheridan County.

Non-Bakken activity

In addition to the recent Bakken and Three Forks activity in Sheridan County, four wells tapping other formations have gone on production in the last 24 months. Vess Oil Corp. brought its Federal 1-5H horizontal Ratcliffe well on production in September 2012. That Ratcliffe well had an IP of 400 bopd and through April 2013 produced a total of 13,948 barrels with an average of 65.18 bopd. Vess has five producing wells in the county, all in the Dwyer and Rush fields in the east-central and southeast areas of the county, respectively.

Omimex Canada brought its Ostby 3-34 well on production in December 2011. The Ostby is a vertical well targeting the Mission Canyon formation. That well had an IP of 180 barrels, and through May 2013 produced 18,974 barrels of oil with an average of 36.14 bopd. Omimex has four other vertical Mission Canyon wells in Sheridan County, the first of which went on production in November 2005. Together, those four other Omimex wells produced 446,019 barrels of oil over 8,974 days of production through May 2013, for a collective average of 49.70 bopd from the Mission Canyon. All of these Omimex wells are in the Anvil, North field in the southeast region of the county.

Prima Exploration's Stringer 2-14-1B directional well in Katy Lake field in Sheridan County was originally drilled as a Nesson Zone conventional well in 1986 by Gulf Oil. Through January 2003 that well produced 80,323 barrels over 4,458 days of production for an average of 18.02 bopd. The well was later deepened to the Ratcliffe, but MBOGC records show no production from the Ratcliffe. In 2012 a lateral was drilled into the Red River formation and had an IP of 37 bopd when it went back on production in December 2012. Since then, the well has produced 531 barrels over 25 days of production for an average of 21.24 bopd. The well was pumped for 10 days in May 2013 and produced no oil but did produce 124 barrels of water.

Prima has another Stringer well in Sheridan County, the Stringer 1-14-1B also in the Katy Lake field. That well was also originally drilled by Gulf Oil as a Red River well in 1979 but didn't go on production until 1986. Between January 1986 and July 2012, the well produced an impressive 1,149,929 barrels of oil from the Red River formation over 8,815 days of pumping for average production of 130.45 bopd. The well was recompleted as a Nesson Zone well in 2012, and since going back on production from the Nesson Zone in August 2012, the well has produced only 170 barrels over 84 days of pumping for an average of 2.02 bopd.

Prima has four other producing wells in Sheridan County, all vertical and located in the Raymond and Divide fields in the central region of the county.

The only other operator to complete a well in Sheridan County in the last 24 months was Northern Oil Production Inc., which completed its Tange 4 well, a directional Winnipegosis formation well in the Outlook field in the northwest region of the county. That well began producing in June 2012, and while the MBOGC database indicates an IP of 0 barrels, the well produced a total of 1,790 barrels through April 2013 with an average production of 7.43 bopd. Northern Oil Production has eight other producing wells in the county.

Other Sheridan activity

Numerous other operators have drilled and completed wells in Sheridan County that continue to produce oil. Other active operators in the county include Petro-Hunt, SM Energy, Continental Resources, Kodiak Oil and Gas, Bluebonnet Energy Corp., Newfield Production, Linn Operating and Earthstone Energy.

While there are producing wells scattered across the entire county, most of the activity in Sheridan County is centered in the Flat Lake field in the far northeast corner. The latest MBOGC records indicate that a total of 22,506,542 barrels of oil have been produced from the Flat Lake field since the field was discovered in 1964.

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SLAWSON EXPLORATION

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Slawson Exploration approaching 40 years as a leader exploring new horizons using innovative technologies

By MIKE ELLERD
For Petroleum News Bakken

Talk to anyone who knows anything about exploration for oil in the Williston Basin and the name Slawson will invariably come up. Since drilling its first well in the Williston Basin in the 1970s, Slawson Exploration has become an industry leader in exploring new frontiers and has developed a reputation as an innovative and aggressive company not afraid to venture into new territory, both geologically and technologically, in its quest to develop oil.

In fact, in a recent conversation with Petroleum News Bakken, one North Dakota state official said that Slawson's science projects seem to always make money while another referred to Slawson as the "ultimate explorer."

In the Williston Basin, Slawson has pioneered exploration in the upper Bakken shale and the False Bakken along the outer fringes of the Bakken petroleum system.

Slawson has also been a leader in developing innovative drilling and completion techniques, as well as a frontrunner in using those new technologies to produce oil from various petroleum pools over its nearly 40-year history in the basin.

On its website, Slawson Exploration refers to itself as "an aggressive exploration firm" that "focuses on risk-reduction technological advantages in time-tested, prolific geologic provinces, delivering greater returns for investors." Throughout its history, the company has employed a variety of advanced exploration techniques to drill more than 3,500 wells in 10 western states, including two-dimensional seismic/stratigraphic analysis in the early 1980s; resource horizontal drilling beginning in the late 1980s; large-scale, three-dimensional amplitude versus offset or AVO in gas basins in California in the 1990s; and more recently, record-setting staged hydraulic fracturing in oil plays throughout the Rocky Mountain region.

Slawson Exploration is a privately held, family-operated oil and gas exploration company founded in 1957 by geologist Don-

ald C. Slawson. The company is based in Wichita, Kan., with regional offices in Denver, Oklahoma City, and Houston. Donald Slawson's son Todd is the president and chief executive officer of Slawson Exploration and Todd's brother Craig is the company's vice president for exploration.

Early history

Donald Slawson, operating as Donald C. Slawson, Oil Producer, began drilling conventional wells into the Red River formation in Roosevelt County, Mont., in the mid 1970s. He continued exploring other conventional plays throughout the 1980s, including the Ratcliffe and Mission Canyon formations of the Madison Group in both Montana and North Dakota. In 1989, Donald C. Slawson, Oil Producer, formally became Slawson Exploration and continued conventional development in the Madison Group.

Slawson's first venture in horizontal drilling in the Bakken dates as far back 1989 when the company drilled its Sidewinder 1-7 horizontal well into the Bakken formation in the Ash Coulee field in Billings County, N.D. That well, tested in early February of 1990, set a record at the time with an initial production rate, IP, of 1,362 barrels of oil per day.

However, it was not until directional drilling and hydraulic fracturing technologies advanced in the mid- to late 2000s that Slawson really picked up speed in the Williston Basin and has gone on to drill hundreds of horizontal Bakken wells in both North Dakota and Montana.

Upper Bakken shale innovator

Although not the first company to drill into the upper Bakken shale, Slawson was one of the first to successfully drill horizontally and produce oil from the upper shale. John Fair, president of PetroShale (US) Inc., one of Slawson's non-operating partners in the Williston Basin upper shale prospects, told Petroleum News Bakken in October 2012 that Slawson first began drilling the upper shale in the late 1980s and early 1990s when it drilled a series of un-stimulated, short-lateral wells in the Ash Coulee-Billings Nose area in southwest North Dakota in an attempt to intercept large fractures. While the wells did have high IPs, production quickly fell, and the wells did not have large expected ultimate recoveries, or EURs.

Slawson then drilled a horizontal upper shale well in the Mondak area that straddles the two states south of Elm Coulee. That well initially produced in the range of 120 barrels per day, which was considered "ho hum," Fair said. However, the well continued to produce, and Slawson noted that the production soon went hyperbolic and was producing with a very low decline. Once the well "hit curve," according to Fair, it declined at an annual rate of only 1 percent. The production curve showed the well, which was un-stimulated and completed on a very short lateral, will ultimately produce about 750,000 barrels.

Between 1994 and 2007, Slawson continued to drill un-stimulated wells into the upper Bakken shale in the area. According to Fair, EURs for those wells averaged 730,000 barrels and did not behave like middle Bakken wells in that they had low IPs, went hyperbolic very quickly, and had very low declines.

North Dakota Industrial Commission, or NDIC, records indicate that in 2007 and 2008, Slawson drilled two wells in the upper shale in the Squaw Gap field in southwest McKenzie County near the Montana border with IPs of 479 and 216 bopd. Through April 2013 the two wells have cumulative productions of 175,349 and 92,725 barrels, respectively.

Farther west in the Squaw Gap field adjacent to the Montana border, Slawson drilled six additional wells which were on confidential status as of the end of June 2013.

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Then in September 2012 PetroShale announced successful test results from four stimulated horizontal test wells that Slawson had drilled into the upper shale in the Elm Coulee field in Richland County, Mont., just across the border from the Squaw Gap field in North Dakota. This region approaches the outer fringes of the Bakken petroleum system, and according to Fair, is an area where the middle Bakken, from which most of the oil in the Williston Basin is produced, becomes very tight and begins to pinch out, where the lower Bakken has already pinched out, and where the Lodgepole and Three Forks are also very tight.

As a result, Fair said, the upper shale is "world class" source rock with no place for the oil to go. In the September 2012 announcement, PetroShale said that early type-curves on those wells resulted in EURs analogous to those 730,000 barrel EURs from un-stimulated wells that Slawson had drilled between 1994 and 2007.

Beating drilling pitfalls

Drilling horizontally into shales, the primary source rock for oil, presents a variety of challenges and can be risky, and not everyone is willing to run those risks. Slawson, however, is a notable exception.

In May 2012, Vice President Craig Slawson told Petroleum News Bakken that "Nobody in their right mind would target, would drill into, the upper or lower Bakken shale," but added that "we aren't right minded."

Julie LeFever, director of the North Dakota Geological Survey's core library, told Petroleum News Bakken in October 2012 that one of the problems with drilling the upper Bakken shale is that the shale is unstable and collapses. However, she added that Slawson proved that not only it is possible to successfully drill in the upper shale, but it can be done while keeping costs down.

Jim Halvorson, a petroleum geologist with the Montana Board of Oil and Gas Conservation says that it's almost impossible to drill and frack a two-mile long lateral in the upper shale for the same reason LeFever gave. So there is an advantage, Halvorson says, to drilling shorter laterals and to drilling those shorter laterals from a single vertical borehole, which is what Slawson has been doing.

But fracking multilateral wells in the upper shale is another challenge, according to Halvorson, causing many operators to go back to single laterals. However, Slawson, true to form, appears to have also solved that problem. Fair says Slawson has been experimenting with one-mile, dual-lateral wells in the upper shale with costs in the range of $7 million to $8 million.

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SLAWSON *continued from page 17*

Board records indicate that Slawson recently drilled a dual-lateral well with one sidetrack in the upper shale in the Elm Coulee field. Since January 2013, that well has produced a total of 11,125 barrels over 69 days of production for an average of 284 barrels of oil per day.

Slawson, Northern Oil and Gas

PetroShale isn't the only non-operator partnering with Slawson in the upper shale. Northern Oil and Gas has aligned with Slawson in development of the upper shale in Richland County in its Big Sky prospect, and in March 2013, Northern Oil announced that as a result of Slawson's innovations, Northern Oil's Big Sky prospect had become the company's area of highest internal rate of return.

Northern's Chief Executive Officer Michael Reger said at the time that Slawson was drilling short laterals of approximately 5,000 feet on 640-acre spacing units and completing the wells with 20-stage sliding sleeves and white sand. Reger said those wells have EURs in the range of 350,000 to 400,000 barrels, and a cost per well of approximately $5 million.

First in the False Bakken

Not only has Slawson been a pioneer in exploring the upper shale, but it is also believed to be the first to successfully drill and complete a producing well in the False Bakken. The False Bakken is an organic-rich limestone interval near the bottom of the Lodgepole formation along the southern flanks of the Bakken petroleum system that can appear very similar to the upper shale, hence the name "False" Bakken.

In June 2013, the Montana board approved a request by Slawson to make permanent a 640-acre spacing unit in Richland County for the production of oil and gas from a well the company had recently completed. While the well's target formation is formally identified in records as the Lodgepole formation, Halvorson says the well is, in fact, a False Bakken well.

The well began producing in August of 2012 and through April 30 has yielded a total of 12,946 barrels over a total of 219 days of production for a daily average of 59 bopd. Halvorson says that, as far as he knows, it is the only well ever completed in, and producing from, the False Bakken.

Slawson's other activities

While Slawson has been an innovator in vertical and lateral exploration of the Bakken petroleum system, much of the company's Williston Basin operations are focused on the middle Bakken.

As of the end of June 2013, NDIC records show Slawson as having a total of 176 wells in the state on active status, 71 still on confidential status, eight listed as currently being drilled, and another seven with permitted drill locations. MBOGC records indicate that as of the end of June, Slawson had 65 producing wells in Montana, 11 of which are upper shale wells, and one is the False Bakken well.

Slawson ranked 12th among the top 50 oil producers in North Dakota as of April 2013, producing a total of 527,901 barrels during the month from wells it operates for a daily average of 17,597 barrels according to NDIC records. In Montana, Slawson was the fourth largest oil producer from wells it operates in April 2013 with a total of 81,041 barrels produced during the month for a daily average of 2,701.4 barrels.

Contact Mike Ellerd at mellerd@bresnan.net

Apache evaluates far western Bakken fringe

By KAY CASHMAN
Petroleum News Bakken


G. STEVEN FARRIS

Two companies lead the pack in western fringe exploration of the Williston Basin's Bakken petroleum system — Marathon Oil and TAQA North USA, which have been drilling wells in the eastern half of Sheridan County, west of North Dakota's Divide County (see story on page 12). Even farther west, in Daniels County, Mont., the lead explorer, and the only E&P company of any size in the area, is Apache Corp., doing business as Apache Western Exploration.

The big independent announced it had picked up 300,000 net acres in Daniels County in June 2012, subsequently drilling five wells and then pulling its people and equipment out of the area in January 2013.

The main newspaper in the county, the Daniels County Leader, reported Jan. 31, "Apache employees have said that it will be six months or so before they return. We were told, 'This is a science project and remember there have been other successful oil fields developed over a period of years, not months.'"

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TELEPHONE: (713) 296-6000 • **WEBSITE:** www.apachecorp.com

An Apache spokesman told Petroleum News Bakken in mid-July 2013 that the company was still evaluating data.

Ahead of the pack

When Apache first announced its entry into Daniels County, its executives said the newly acquired acreage held 35 vertical wells, all of which were "oil saturated."

Houston-based Apache acquired its Montana assets from Shale Exploration LLC, a PR savvy firm headquartered in Fort Worth, Texas, with three other U.S. offices, including Scobey, Mont., the county seat of Daniels.

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APACHE *continued from page 19*

Dubbed the Jayhawk prospect by Shale Exploration, it was hard to determine which partner (Shale Exploration retained 100,000 acres of the 400,000-acre prospect) was more upbeat about the potential of the acreage, which they estimated had "more than 1,900 potential" drilling locations with a "potential resource of 1 billion barrels of oil."

Apache, never a company to dally when there's drilling to be done and money to be made, planned to drill "up to five wells" in 2012.

JOHN BEDINGFIELD

"That program will run through the end of the year, and assuming success, we'll continue on into 2013," company vice president for exploration and new ventures, John Bedingfield, said June 15 at Apache's 2012 Investor Day.

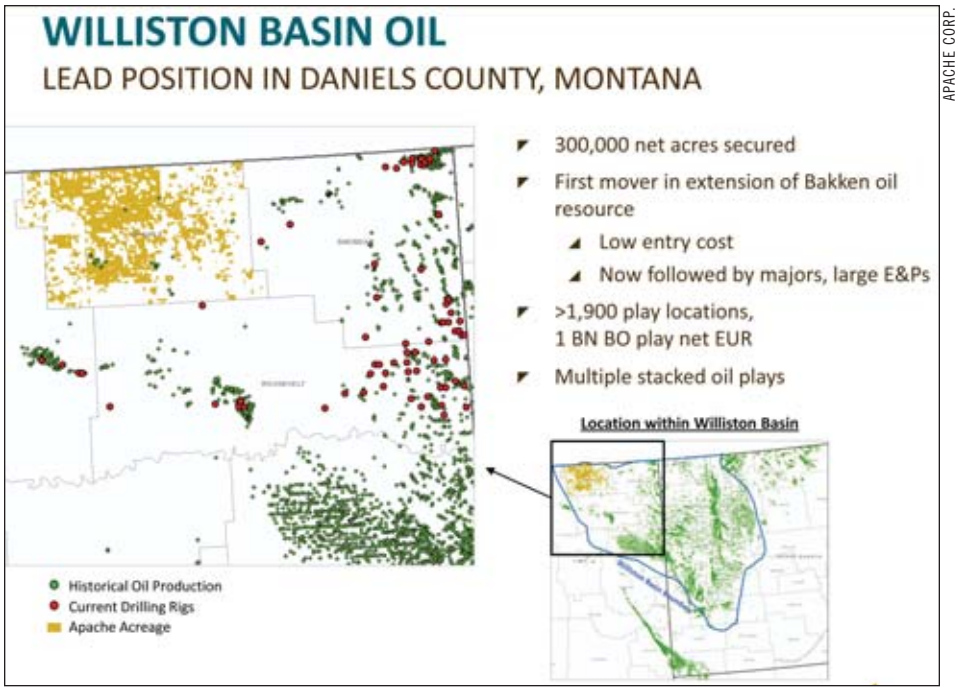
The announcement was the first time Apache officials talked about Daniels County publicly, giving the company what Bedingfield referred to as a "first-mover" advantage, with "low entry costs."

Pointing to the Elm Coulee field on a map ("Williston Basin Oil, Lead Position in Daniels County, Montana"), Bedingfield told investors, Elm Coulee's "got a billion barrels of oil from the Bakken. … There's no Three Forks at that location. The red dots … represent where industry is currently drilling, and what you can see is that industry is moving in this direction and certainly … has been quite active in Canada, as well."

But Petroleum News Bakken could only locate one of the 30 or so rigs purportedly drilling in Sheridan County, directly to the east of Daniels; only three of the 30 or so rigs in Roosevelt County to the south and east of Daniels; and one in the unnamed Valley County to the west where Apache's map showed four. According to Oil Patch Hotline's June 14, 2012 Montana rig report those were the only oil and gas rigs working in the area at the time.

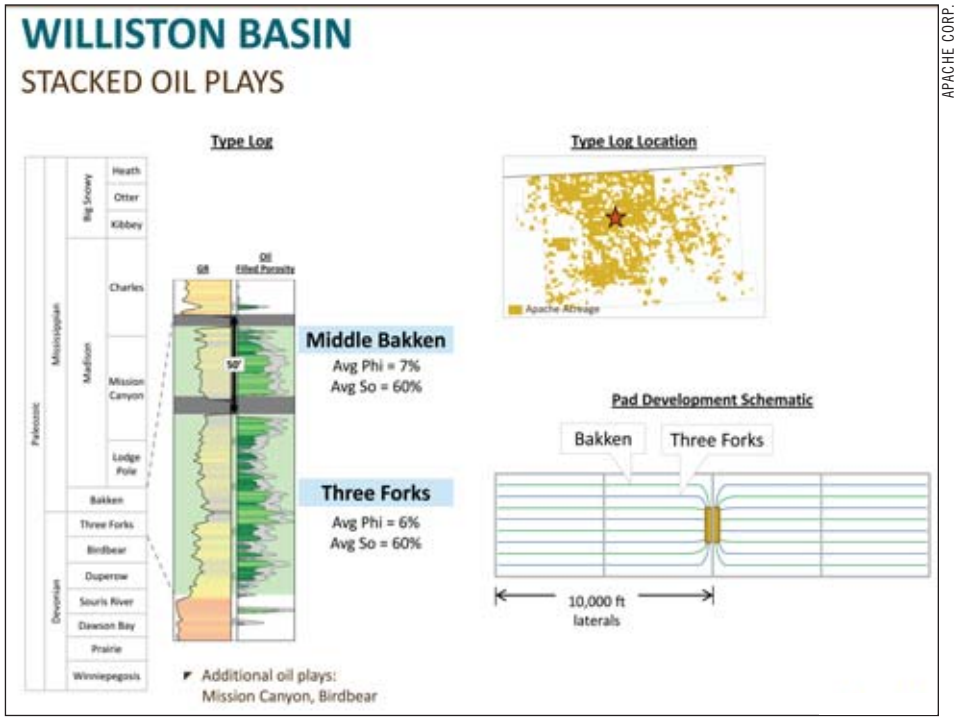
When asked about the discrepancy Apache spokesman Bill Mintz said July 24, as this magazine was going to press, that "IHS data shows 76 wells spud in those three counties in the first half of 2012."

One of the things Bedingfield was very pleased with was that he expected the wells to be less expensive — $7.5 million versus about $10 million in the heart of the Bakken in western North Dakota — because the Bakken petroleum system was at a shallower depth in Daniels County than



APACHE CORP.

The red dots in this map supposedly refer to "current drilling rigs," but according to Oil Patch Hotline's June 14, 2012 Montana rig report, there was only one rig operating in Sheridan County at the time; three in Roosevelt County; and one in Valley County (directly west of Roosevelt and Daniels). Today, the July 13, 2013 edition of Oil Patch Hotline shows two rigs in Roosevelt County and none in Sheridan, Valley or Daniels.



APACHE CORP.

farther east.

Although Apache was initially focusing on the middle Bakken and the upper Three Forks zones, Bedingfield said "there are a number of other plays throughout … the Madison section above us, Lodgepole and others. … And below in the Devonian, there's other Devonian plays, the Birdbear, for example, which also has oil pay."

One drilling pad, he says, should be able to access four square miles with 16 wells — "eight Bakken and eight Three Forks wells, at basically 10,000 foot laterals."

In a slide that looked at a cross section of Apache acreage, the reservoirs were "fully matured and definitely in the oil window, with the lighter colors representing higher oil saturation. The two grey bands or the

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CONTINENTAL RESOURCES

Continental: Bakken much bigger than previously thought

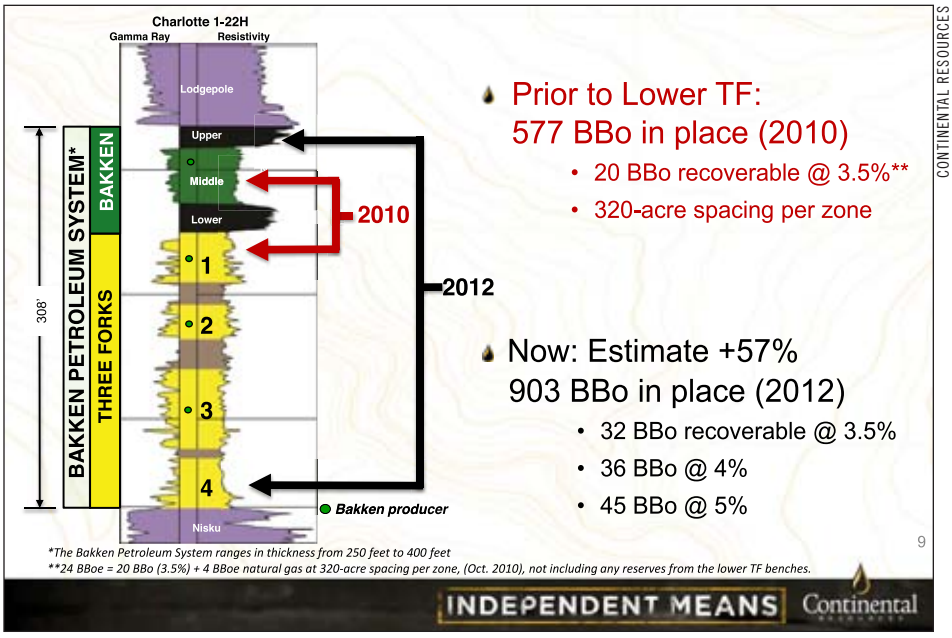
Wide, rich, deep — multiple formations, advanced techniques, higher reservoir pressures — optimism for recoverable reserves

By STEVE SUTHERLIN
For Petroleum News Bakken

Continental Resources is contemplating skyward adjustments of recoverable reserves estimates in the Bakken petroleum system based on a massive revision in the company's oil in-place estimate. The company plans to make revisions of its recoverable reserves estimates in late 2013 at soonest, once it completes extensive productivity testing of the lower benches of the Three Forks formation.

HAROLD HAMM

Three Forks, which lies below the Bakken formation, is the reason Continental's in-place estimates spiked sharply upward. If Continental is right about Three Forks, the Bakken petroleum system is vastly richer per acre and more cost effective to drill than previously thought.



CONTINENTAL RESOURCES

So far, as Continental delves into the deeper benches of the Three Forks, its case is getting stronger.

In 2011 and 2012 Continental — noting production success in the upper Three Forks — conducted a well-coring program to find out where the oil saturation ended. What it found raised its optimism about

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the oil saturation of all four levels of the Three Forks formation.

"What we found was it didn't end," Warren Henry, Continental's vice president of investor relations, said during his presentation to the Global Hunter Securities GHS 100 Energy Conference June 25, 2013 in Chicago. "It went all the way down to the Nisku (bottom cap)."

FREDERICK BOTT

Based largely on core samples from its current 20-well exploration program Continental thinks seven layers of the Bakken petroleum system have much in common.

The company views the Bakken as an integrated, high-pressured petroleum system, top to bottom, compared to the former theory that the deeper Three Forks "was sort of a halo of oil" pushed down into that interval based on the pressure in the middle Bakken, Winston Frederick Bott, Continental's president and chief operating officer, said in a Feb. 28, 2013 conference call with industry analysts.

"We now feel it's all one cell and it's all very, very similar pressure," he added. "And therefore, the recovery factors are going to be much more an important factor for us to determine."

From top to bottom, the cell actually extends from the Lodgepole just above the upper Bakken shale member downward through the middle Bakken dolomite unit and lower Bakken shale to the "Nisku" just below the fourth bench of the Three Forks, Henry said.

Technology, testing — key catalysts

Continental's aggressive progress in the Bakken is driven by increasing knowledge of the production capabilities of the petroleum system, combined with leaps in technology and subsequent economies.

Henry said "the key catalyst" for Continental right now is the on-going well productivity and density tests, which will carry into next year and help establish how much resource can be recovered from the Bakken petroleum system.

However, Henry said, "probably the most important catalyst" for the company during the past several months in the Bakken has been the company's continuing move to pad drilling.

The move from four wells per pad to as many as 12 saves the company time and money, he said.

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FLASH — upper Bakken shale

In a new development, Continental is targeting the upper Bakken shale in far southeastern McKenzie County. To date, just a few companies have been able to successfully produce from the actual Bakken shale source rock, with Slawson Exploration in the lead.

Continental submitted an application to the North Dakota Industrial Commission to drill, complete and produce up to four wells in each existing 1,280-acre spacing unit in the Charlie Bob-Bakken pool.

Currently, almost all oil from the Bakken play is produced from the middle Bakken. The middle Bakken is sandwiched between the shale layers that generated the oil which feeds the reservoirs in the Bakken system.

In its application, Continental put ultimate recoveries for the proposed upper Bakken shale wells at 246,000 barrels of oil and 323 million cubic feet of gas, with an estimated initial production, or IP, rate of 420 barrels of oil per day, and a gas-to-oil ratio of 1,300 cubic feet of gas per barrel of oil.

Continental's application appears to be the first mention in public or company financial records of Continental's targeting the upper Bakken shale member.

However, it fits with the high pressure theory — that the various layers making up the Bakken petroleum system are encased and under "very, very similar" high pressure, meaning a lot more oil than currently estimated by the company may ultimately be recovered from the massive system.

In addition to oil saturation, "high pressure greatly increases the odds that I'm going to have producible reserves," Warren Henry, Continental's vice president of investor relations, said in a May 6, 2012, interview with Petroleum News Bakken.

Dueling oil in-place estimates

Continental is the largest acreage holder in the Bakken, ending 2012 with a lease position of 1,140,000 net acres primarily in North Dakota. The company also leads the pack in fanning the expansion of expectations for the Bakken.

However, despite the recent boost to the company's oil in-place estimates, Continental's most recently stated estimate of

recoverable reserves — 24 billion boe — has not been correspondingly adjusted.

Henry noted that a 3.5 percent recovery rate on 903 billion barrels of in-place oil would "pump" the 24 billion barrels up to 32 billion barrels.

"If we were able to increase the recoveries with technology, it could be 4 or 5 percent (and) could double the recoverable oil," he said.

When announced in October 2010, 24 billion boe was five times larger than the 4.3 billion boe published by the USGS in April 2008.

In the 2008 study the USGS did not include crude oil estimates for the Three Forks formation.

An updated USGS study released April 30 by the U.S. Department of the Interior says the entire Bakken petroleum system, including the Three Forks, holds a mean 7.38 billion barrels of undiscovered, technically recoverable oil, compared to a mean 3.65 billion barrels estimated in the 2008 study. Estimates range from a low of 4.42 billion barrels to a high of 11.43 billion barrels.

Of the 7.38 billion barrel mean, 3.73 billion barrels is attached to the Three Forks, meaning the 3.65 billion barrels attributed to the Bakken in the 2008 study remains unchanged in the revised study five years later.

Three Forks far flung

Three Forks is a thicker and more extensive formation than the Bakken, extending farther east across North Dakota, farther west into Montana and as far south as South Dakota. However, only about 5 percent of the formation is said to have been tested, compared with 14-33 percent in some of the better-known parts of the Bakken.

The Interior Department said that since its 2008 assessment, upwards of 4,000 wells have been drilled in the Williston Basin, providing updated subsurface geologic data that helped in updating the study.

"Previously, very little data existed on the Three Forks formation and it was generally thought to be unproductive," the agency said in a press release. "However, new drilling resulted in a new understanding of the reservoir and its resource potential."

In mid-2008, Continental was the first company to drill a horizontal well into the first bench, or upper Three Forks, a variable tight oil reservoir consisting of green and pinkish-tan carbonate mudstone, as well as shale but with no organic content.

The first bench, or upper Three Forks reservoir, lies about 20 feet below the lower Bakken shale member, which until recently was where all Three Forks production came from.

Technology enhances harvest

Continental said it prefers to grow organically rather than by acquisition, saying on its website that it relies on advanced technology in harvesting oil and natural gas to build shareholder value.

"Our technical staff has internally generated substantially all of the opportunities for the investment of our capital."

The company's operating strategy in the Bakken focuses on three major technologies — horizontal drilling, hydraulic fracture stimulation or fracking, and a proprietary multiwell pad drilling technique the company calls ECO-Pad.

In addition to reducing costs, the company said its ECO-Pad system taps more of a reservoir's resources while reducing environmental impact due to a reduced operational footprint per well.

Continental's aggressive progress in the Bakken is driven by increasing knowledge of the production capabilities of the petroleum system, combined with leaps in technology and subsequent economies.

Shift to acquisition mode

Continental's organic growth model seems to have served it well so far, but as the playing field in the Bakken becomes more crowded, Continental has stepped up its focus on acquisitions.

"We continue to increase our concentration in high-value, high-growth, crude oil assets, especially in the Bakken," said Harold Hamm, Continental chairman and chief executive officer. "We are growing the value of our Bakken assets through strategic acquisitions, exploration, and the expanded use of pad drilling, which should improve efficiencies and translate into even better rates of return."

Continental saw its year-end 2012 proved reserves across all of its properties jump 54 percent to 785 million barrels of oil equivalent. Likewise, total annual production rocketed 58 percent from 2011 levels to 35.7 million boe.

Of the 785 million boe in total year-end proved reserves, three-quarters or 564 million boe are situated in the Bakken petroleum system. And that's almost double the proved reserves in the play at the end of 2011, the company reported.

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Crescent Point bullish on unitization, waterflooding

Canada's largest Bakken producer using enhanced oil recovery to boost recoverable oil; unitization key

By KAY CASHMAN
Petroleum News Bakken

Calgary-based Crescent Point Energy, a trailblazer in the use of horizontal drilling and multistage fracturing to commercialize Saskatchewan's tight-oil plays, is working on twin-pronged objectives — waterflooding and unitization — to increase recoverable reserves in its U.S. and Canada Williston Basin Bakken petroleum system assets.

Waterflooding, an enhanced oil recovery technique, functions best over an entire pool rather than on individual wells. But the owners must reach a unitization agreement before a major project can move forward — hence the dual objectives.

After a lapse of many years, the sudden surge of light oil drilling has revived the prospect of unitizations, driven by a Petroleum Technology Alliance Canada study estimating that improved water management could boost Western Canada's oil reserves by 1 billion barrels.

Crescent Point, the largest Bakken producer in the Williston Basin in Canada, is eagerly awaiting a decision by the Saskatchewan government to allow the province's first "unitization" in 20 years, opening the door for multiple owners in pools to create single operating units, requiring each to contribute to capital and operating costs, while sharing in the profits based on their stakes.

In late March, Neil Smith, Crescent Point's chief operating officer, said company management was optimistic that government approval would occur sometime before the end of September for the first unit and be followed by three more over the next two years. (In late 2012, the government of Saskatchewan issued a permit approving Crescent Point's application for a waterflood unit in the Lower Shaunavon resource play, a milestone in the company's efforts.)

Waterflooding getting results

Crescent Point has been expanding its waterflood programs in the Bakken, Shaunavon and Viking plays of Western Canada and its trials are already yielding positive results.

By the end of March the company had converted five producing Viewfield Bakken wells in Saskatchewan to water injection, raising the total to 46 wells and reported that production results were surpassing its expectations.

Company President Scott Saxberg forecast that 40,000 barrels of oil per day of Crescent Point's anticipated 100,000 barrels a day in 2013 will be affected by waterflooding.

"There is easily 25,000 barrels per day of long-term waterfloods that we have within our company already from legacy assets," he told a conference call at the end of March. "On the Bakken side it is probably going to push close to 10,000 barrels per day and on the Shaunavon side probably 5,000 barrels per day."

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Increasing number of fracs

In the Saskatchewan Bakken, Crescent Point has also re-entered wells that were originally completed with eight-stage and 16-stage cemented liners and increased them to 25-stage and 30-stage completions.

The results have allowed the company to identify 90 wells in the play as candidates for the process.

Based on the initial success, Crescent Point plans to drill six more two-mile horizontal wells in 2013, on top of the four already completed, and is confident they can be drilled for about half the cost of similar wells drilled across the border in North Dakota.

100% drilling success

In the Bakken-dominated southeast Saskatchewan and southwest Manitoba region, Crescent Point participated in drilling 106 (87 net) wells and one net water source well in the first quarter 2013, reporting a 100 percent success rate.

Of the oil wells, 80 (72 net) were drilled in the Saskatchewan Bakken light oil resource play.

During the second quarter, the complete results from which were not available July 1, 2013, the company participated in drilling 26 (15 net) horizontal wells in conventional zones, several of which it said significantly exceeded initial production rate expectations.

Crescent Point announced a target for 2013 of 169 net wells in the Saskatchewan Bakken, with a budget set at C$490 million including expenditures on land, seismic and facilities.

U.S. wells

In the United States, 67 (30 net) wells were drilled by Crescent Point in the January-March period, 14 (3.2 net) in North Dakota targeting the middle Bakken and upper Three Forks members, and depending on commodity prices three times that number

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Viewfield Bakken

Crescent Point has been drilling wells in this light oil reservoir for more than five years. With a "large multi-year, low-risk drilling inventory" and the" continuous expansion" of its waterflood program, the company says this resource play is still in the early stages of development.

Manitoba Bakken

Through low-cost drilling, this "large oil-in-place pool" provides Crescent Point with "steady, high-net-back production." The company plans "over time" to continue to increase recovery factors in the play.

Flat Lake Bakken

This "large oil-in-place, light oil pool" gives Crescent Point exposure to the North Dakota portion of the Williston Basin, but on the Canadian side of the border , "which means we've been able to capitalize on lower service costs and higher rates of return," the company says.

North Dakota Bakken/Three Forks

Crescent Point entered this "large oil-in-place play" in 2010, "quickly amassing a large land base" and securing contracts with service providers. "Focused on long-term development of the play" company executives say "there is long-term upside in this emerging area, through increased recovery factors and reduced costs."

CRESCENT POINT *continued from page 24*

could be drilled in the final three quarters of the year.

Production growth

Crescent Point's average daily production company-wide grew from about 275 barrels of oil equivalent in its first year of business in 2001 to exceed 117,000 barrels by the first quarter of 2013.

In addition to its Bakken petroleum system assets in the Williston Basin of Canada and the U.S., Crescent Point operates assets in Utah's Unita Basin, Saskatchewan's Shaunavon medium oil resource play, Alberta's Beaverhill Lake emerging light oil resource play, Alberta's Viking light oil resource play, and Alberta's Bakken, where the company is conducting high-impact exploration for both conventional and unconventional oil.

The largest chunks of its 2013 capex budget of $1.5 billion are being directed at three premier plays: the Viewfield Bakken in Saskatchewan; the Bakken and Three Forks formations in North Dakota's Bakken petroleum system; and the Unita Basin in Utah.

Contact Kay Cashman at publisher@petroleumnews.com

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Continental has two major exploration-appraisal programs planned for 2013. It's testing productivity of the lower Three Forks benches with a 14-well program at locations across the play. In addition, the company has initiated the first of four increased density pilot programs that will involve multiple wells in the middle Bakken and the first three benches of the Three Forks zone, to test the appropriate density for full development. Successful results from these programs would prove commercial productivity and could significantly impact future reserve bookings, the company said.

Continental said it expects to begin reporting results from new lower-bench productivity tests quarterly over the next 12-to-18 months.

"(Last year) was a good year for Continental. We completed the move of our headquarters to Oklahoma City, and we increased our focus by selling mature properties and redeploying capital to higher growth-rate assets," said Rick Bott, Continental president and chief operating officer.

"We have expanded our land position, increased production, increased proved reserves, embarked on an ambitious exploration-appraisal program, retooled our marketing efforts, secured capital to fund our ongoing growth, and continued to build our leadership and technical staff."

Contact Steve Sutherlin at stevepna@hotmail.com

Whiting looks to exploit more zones

Evaluating other Williston Basin geologic targets in and outside of the Bakken petroleum system, increasing well density

By KAY CASHMAN
Petroleum News Bakken

Whiting Petroleum's field strategy in the Williston Basin is to look for two types of development opportunities: one, new zones to exploit in and outside of the Bakken petroleum system, and; two, increasing the density of wells on existing production.


JAMES VOLKER

Whiting had record production during the 2013 first quarter, averaging 89,135 barrels of oil equivalent per day company-wide, a 10 percent increase over first quarter 2012 production of 80,747 boe per day, and a 4 percent increase over the fourth quarter 2012 average of 86,055 boe per day.

"And we're on track to post a year-over-year production gain of between 12 percent and 16 percent," James Volker, Whiting's chairman and chief executive officer, said in a first-quarter conference call with industry analysts in late April.

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Whiting Petroleum Corp.
TOP EXECUTIVE: James Volker, chairman and chief executive officer
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Seventy-four percent of Whiting's total production comes from the company's core Rocky Mountain region, with more than 60 percent of the total coming directly from the Bakken and Three Forks plays in the Williston Basin. In April 2013, the most recent month reported by the North Dakota Department of Minerals, Whiting-operated Bakken wells produced an average of 68,815.4 barrels of oil per day, making Whiting the second largest Bakken system oil producer in the state.


MARK WILLIAMS

Part of the company's success in the Williston Basin can be attributed to a slew of successful projects, starting with drilling at its Sanish, Pronghorn, Hidden Bench and Tarpon fields that continue to "underpin" its healthy production increases, per Volker.

One of its most interesting recent vertical exploratory efforts is Whiting's plan to test an untapped and highly prospective oil formation within the Bakken petroleum system known as the lower Bakken silt.

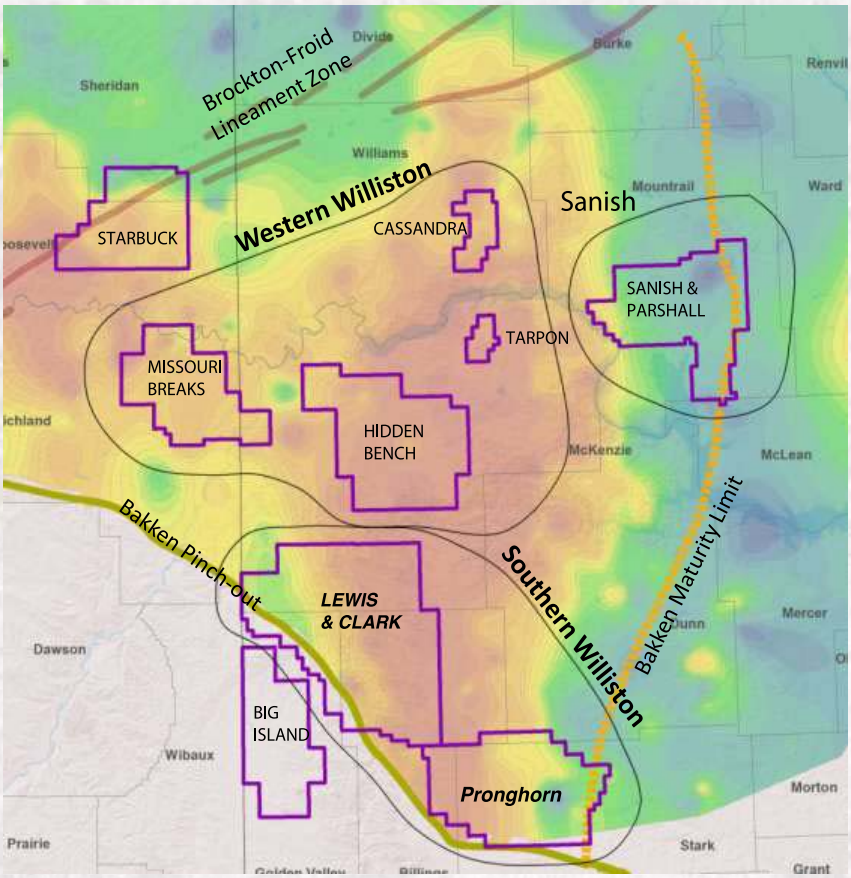
Sandwiched between the non-producing lower Bakken shale and the Pronghorn sand, the lower Bakken silt is right above the Three Forks formation (see Hidden Bench information in adjacent chart titled "Williston Basin Primary and Prospective Drilling Plan by Area").

Whiting says the silt is situated in the central portion of the Williston Basin, and according to Volker is "primarily present" at the company's Hidden Bench prospect in North Dakota's McKenzie County.

Whiting said it identified the zone through extensive core sampling, which "demonstrated high oil in place and may significantly increase reserves in this area."

The company is so confident about transforming the silt into production that it plans to invest millions of dollars "bracketing" the formation with as many as eight wells above and seven wells below the silt. The wells, to be drilled on 160-acre spacing, might even improve current production from the middle Bakken zone, the company said in discussing first quarter 2013 results.

continued on page 28



Field	Target	Gross Acres	Net Acres
Sanish / Parshall	Middle Bakken / Three Forks	174,466	82,400
Pronghorn	Pronghorn Sand	196,822	128,080
Lewis & Clark	Three Forks	199,660	134,114
Hidden Bench	Middle Bakken / Three Forks	47,958	28,832
Tarpon	Middle Bakken / Three Forks	8,805	6,258
Starbuck	Middle Bakken / Three Forks / Red River	105,664	91,228
Missouri Breaks	Middle Bakken / Three Forks	95,803	65,481
Cassandra	Middle Bakken / Three Forks	30,347	13,883
Big Island	Red River	176,900	125,530
Other ND & Montana		75,377	28,719
		1,111,802	704,525 (1)

(1) As of 3/31/13, Whiting's total acreage cost in 704,525 net acres is approximately $371 million, or $526 per net acre.

WHITING *continued from page 26*

Previous 'silt' drilling failed

Whiting said it previously attempted to drill into the lower Bakken silt but ran into difficulties when the drill bit got stuck in the formation.

"So our approach here is essentially to drill both above it in the middle Bakken and below it in the Three Forks and essentially frack simultaneously to develop this zone," Mark Williams, Whiting's senior vice president of exploration and development, told analysts March 4, 2013, at the Raymond James Institutional Investors Conference in Orlando, Fla.

"It represents a tremendous resource for us as we go forward in developing this," he added, explaining Whiting's field strategy for the basin.

Most Bakken petroleum system oil in the Williston Basin is currently produced from the middle Bakken tight oil reservoir, consisting of sandstone, siltstone, dolomite and mudstone sandwiched between two zones of shale, the most common source rock for petroleum, as well as the upper bench of Three Forks formation, another non-shale, tight reservoir, made up of silty dolostone, clay-rich dolostones, red beds and anhydrites.

Well-density projects

In 2013 Whiting is conducting pilot well density programs at Pronghorn and Hidden Bench fields, along with its flagship Sanish field in Mountrail County, N.D., in an effort to strengthen production.

Sanish, one of the first middle Bakken discoveries in the basin, alone represents nearly 40 percent of Whiting's total production; by spacing wells closer together, the company believes it may be able to boost the oil recovery rate 15-17 percent from its current 10-11 percent.

If successful at Sanish, the company said, it could add an additional three middle Bakken locations per 1,280-acre spacing unit. The company also plans to refracture several wells in the field in 2013.

At Pronghorn, Whiting plans to drill six Pronghorn sand wells per 1,280-acre spacing unit, which is up from the company's initial plan of three wells per spacing unit.

A noted explorer and powerhouse in the Williston Basin, Whiting is generally credited with discovery of the productive Pronghorn sand zone in southern North Dakota at the company's Pronghorn prospect in Stark County. The zone lies above the Three Forks and below the lower Bakken silt.

"At Hidden Bench … we have the opportunity not only to do higher (well) density, but to develop that lower Bakken Silt zone," Williams said.

"If successful this would add over 116 net locations at Pronghorn and over an additional 160 net locations at Hidden Bench," Volker said

Pronghorn's 'exceptional' results

Production from Whiting's Pronghorn and Lewis & Clark prospects, located in in the southern Williston Basin and encompassing 396,482 gross (262,194 net) acres, averaged 13,800 boe per day in the first quarter, a whopping 52 percent increase over the 9,055 boe per day rate in 2012's first quarter.

Whiting said it had "exceptional" drilling results in the fourth quarter 2012, including eight wells with 24-hour initial production rates exceeding 2,000 boe per day.

Production from the Western Williston Basin, which includes Hidden Bench, Tarpon, Missouri Breaks and Cassandra, averaged 6,520 boe per day in the first quarter, representing a 27 percent increase over the 5,120 boe per day average rate in the fourth quarter of 2012. The area encompasses a total of 182,913 gross (114,454 net) acres.

Whiting said Tarpon produced the third highest well flow rate (Federal 21-4-3H) in the history of the Williston Basin — 6,879 boe per day (4,971 barrels of oil) during its first 24 hours of production in December 2012 from the middle Bakken interval. The company has also begun pad drilling at Tarpon with immediate plans to drill three wells off each pad.

Of note at Missouri Breaks during the first quarter was the Miller 34-8-1H in the middle Bakken formation flowing at 1,475 boe per day, "our best rate to date in the field," the company said. Whiting holds 95,803 gross (65,481 net) acres in the prospect, located in Richland County, Mont., and McKenzie County, N.D.

The first well drilled in the eastern portion of Missouri Breaks, the Amber Elizabeth 9-4H in the middle Bakken, flowed 1,315 boe in its first day of production in October.

Sanish output keeps rising

Net production from Whiting's legacy Sanish field averaged 31,081 boe per day in 2012, a whopping 40 percent increase over 2011 levels, the company reported.

First-quarter 2013 net production from Sanish alone contributed an average 33,300 boe per day, a hefty 16 percent jump from the 28,790 boe per day average recorded in 2012's first quarter.

Sanish output now represents 37 percent of Whiting's entire production.

Whiting noted the completion of the Fladeland 14-33H in an April conference call, a well that was completed in the middle Bakken flowing 3,220 boe per day in its first 24 hours of production. The well's 7,279-foot lateral was fracked in a total of 22 stages.

What about Three Forks lower benches?

Whiting Petroleum doesn't see eye-to-eye with fellow Bakken producer Continental Resources when it comes to the possible far-reaching significance of Continental's successful production test from the first-ever horizontal well completed in the third bench of the Three Forks.

continued on page 30

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WHITING *continued from page 28*

Continental believes the Charlotte 3-22H, in North Dakota's McKenzie County, is an important step in assessing the productivity of the lower Three Forks reservoirs.

Charlotte 3-22H is the first of 14 wells that will test three benches of the Three Forks and could lead to a substantial increase in the amount of oil Continental thinks can be recovered from the giant Bakken petroleum system.

"So they've drilled their well and it's looking pretty positive there," James T. Brown, Whiting's president and chief operating office, told analysts at the Dec. 5, 2012, Wells Fargo Securities Energy, MLP and Pipeline conference in New York.

However, because the well is situated in the most oil prolific area of the Williston Basin, coupled with its own drilling experiences, Whiting concludes that Continental's lofty expectations for the lower Three Forks are probably limited to the middle portion of the basin.

"We have tried it farther out on the edge of the basin," Brown said. "I can't say that we were real enthused with it." He said Whiting even drilled a horizontal well into the first bench of the Three Forks on its southwest Hidden Bench property.

"We did not find the encouragement we needed," Brown added.

It's Whiting's view that the oil originates in the lower Bakken shale and was forced down into the Three Forks. The Charlotte 3-22H happens to be in a deep portion of the basin, where the oil flows hotter and under higher pressure than other areas, and where more oil is generated from the shale than any other portion of the Bakken.

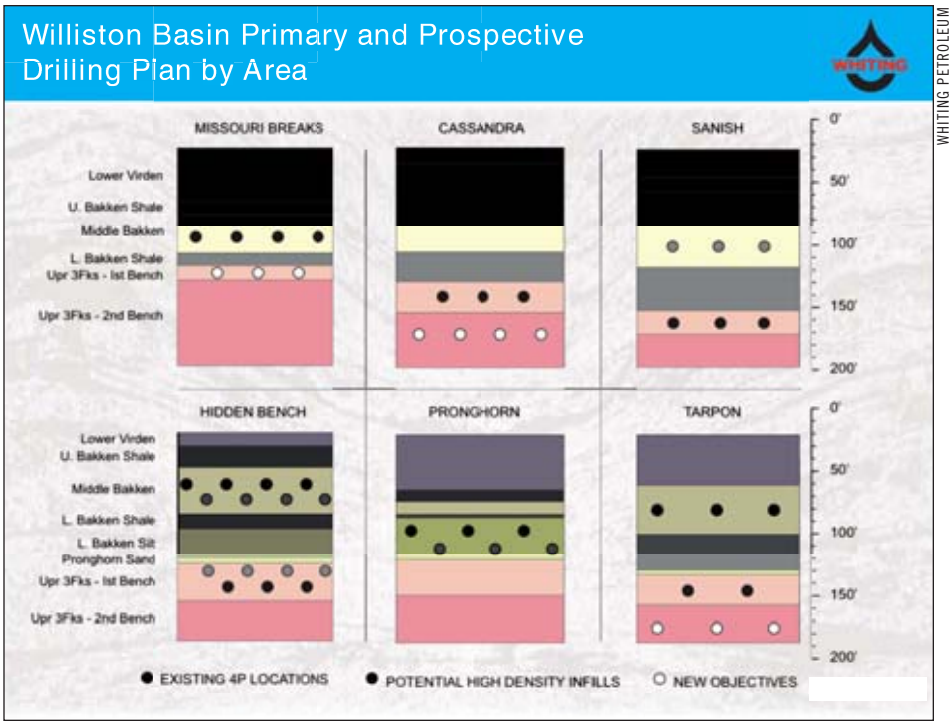
"In Whiting's opinion, it's not going to work everywhere, but it definitely could work out in the middle part of the basin," Brown said.

Nevertheless, "We're going to be keeping an eye on what they do because it could become something. And we wish them all the luck in the world."

Tapping the Red River

In its evaluation of another petroleum system in the Williston Basin, Whiting identified more than 50 vertical Red River prospects at its Big Island play, consisting of 172,464 gross (122,389 net) acres in Golden Valley County, N.D., and Wibaux County, Mont.

Additional 3-D seismic is being shot on the northwest portion of Big Island to identify any more prospect locations, the company said, noting that estimated ultimate recoveries for wells range from 200,000 boe to 300,000 boe. And the wells have estimated completion costs per well of just $5-$5.5 million.



WHITING PETROLEUM

But another largely untested lower Red River D zone, which might be suited for horizontal drilling, could be a "major game-changer" for the company.

In the last half of 2013, Whiting plans to drill what it believes will be the first horizontal well to enter the lower Red River D zone. If successful, the addition of horizontal wells, which significantly increase wellbore exposure to oil, could dramatically change the production dynamics of the play, the company indicated.

Whiting characterizes Red River as one of the oldest known but least understood geological trends in the Williston Basin. The company holds large acreage positions in several counties the trend crosses in eastern Montana and western North Dakota.

"We're nine for 10 on drilling Red River bumps — traditional bumps found with 3-D seismic," Volker told analysts at an April 15 conference in New York hosted by the Independent Petroleum Association of America, IPAA.

"So there's the great economics, quick payouts here in around 12 months — and then three-to-one, four-to-one, on your money," he added.

Bakken-like 'porosity highlights'

Interesting anomalies have appeared in Whiting's extensive 3-D seismic studies — Bakken-like horizontal "porosity highlights" in the Lower Red River "D" zone at Big Island.

"It's very similar to drilling in a lower porosity zone like the Bakken," Volker explained. "It really would allow us to go horizontal in areas that essentially show up on our 3-D, sort of between the porosity indications that are seen on the 3-D."

He added: "With these large acreage positions that we hold here, they may turn into a horizontal play as well as a vertical play. If that happens, it's a major game-changer for Whiting and some of the other producers in the area."

However, the massive Bakken shale formation itself, a world-class unconventional play being developed with horizontal wells, does not exist in the Big Island prospect, said Williams.

And though the underlying Three Forks formation is present, he added, it's not a prospective reservoir without the Bakken "to charge it."

Other operators have successfully drilled into the Red River B zone in the southern Williston Basin.

Starbuck, Missouri Breaks and another Whiting prospect, Lewis & Clark, are prospective in the B and C zones with both vertical and horizontal wells, Williams said, adding the company would be testing them later in 2013.

Contact Kay Cashman at publisher@petroleumnews.com

Exploring vertically, laterally in Bakken

MDU subsidiary Fidelity evaluating upper Bakken shale and southern limits of Three Forks

By KAY CASHMAN
Petroleum News Bakken


KENT WELLS

While Fidelity Exploration & Production Co.'s 2012 exploration in Richland County, Mont. was initially focused on the Three Forks formation, drilling data shifted efforts to the upper Bakken shale, eventually making Fidelity the second Williston Basin operator to produce oil from actual shale with horizontal wells and hydraulic fracturing. The upper Bakken shale is the source of much of the oil in the tight sand reservoirs of the Bakken petroleum system.

Executives from Fidelity, a MDU Resources subsidiary with roots dating back to the late 1920s (Fidelity Oil Group), said the lower initial production rates from the shale were offset by lower decline rates when compared to Fidelity's middle Bakken and Three Forks wells.

COMPANY NAME: Fidelity Exploration & Production Co.
PARENT COMPANY: MDU Resources Group
TOP BAKKEN EXECUTIVE: Kent Wells, president, CEO of Fidelity
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BAKKEN HEADQUARTERS: 2010 Montana Ave, Glendive, MT 59330
TELEPHONE: (406) 359-7360 • **WEBSITE:** www.fidelityepco.com

Under the leadership of President and Chief Executive Officer Kent Wells the company continues to work to crack the code in the upper Bakken zone where completion techniques perfected in the middle Bakken have not been as successful in the shale and where drillers have issues with wellbore stability that limit

continued on page 32


FIDELITY EXPLORATION & PRODUCTION


FIDELITY EXPLORATION & PRODUCTION

FIDELITY *continued from page 31*

the length of horizontal legs.

Two of the upper Bakken wells drilled by Fidelity in 2012 are expected to be re-completed in 2013, and at least two more wells drilled, pending the expected second quarter completion of in-house studies designed to solve both issues.

The first upper Bakken well drilled by the company was the Edam 15-22H in southeastern Richland County, which it calls an "upper Bakken/False Bakken oil well," because a portion of the bit path cut into the False Bakken. While most of the well's lateral cut through the upper Bakken with a small portion of the path going through the Scallion member, the lateral finished in the False Bakken. The Scallion member is a thin limestone interval that separates the Lodgepole formation from the upper shale zone of the Bakken formation.

With an initial oil production rate of 22 barrels, the Edam 15-22H went online in July 2012 and through May 2013 had been on production for 208 days, yielding a total of 2,778 barrels of oil for an average daily production of 13.60 bpd.

The upper Bakken/False Bakken well has also produced 115 thousand cubic feet of natural gas for an average daily production of 0.55 mcf.

Shale activity continues

Fidelity continues to explore and develop the upper Bakken shale.

According to Montana Board of Oil and Gas Conservation records, as of May 2013 Fidelity had four upper Bakken wells in production, all in the Elm Coulee field in Richland County.

The wells went on production between September 2012 and April 2013. Average daily oil production from these four upper Bakken wells ranged from 20.67 to 121.46 bpd. Together they have produced 41,969 barrels of oil over 632 individual producing days for collective daily averages of 66.41 bpd.

Focusing on North Dakota

Despite its interest in the upper Bakken in Richland County, the E&P arm of MDU Resources is focusing the majority of its production efforts in North Dakota's Bakken play this year, following promising well results in Stark and Mountrail counties in 2012. As of the end of June 2013, it had three rigs working in the two counties.

With net North Dakota oil production at 7,000-bpd at the end of December 2012, Fidelity was ranked as the No. 22 producer from the Bakken petroleum system by wells operated. In April, output had reached 7,400 bpd.

About half of the $400 million the company planned to spend in 2013 was slated for the Williston Basin, with the majority aimed at bringing prospects into production in North Dakota.

Testing lateral limit

Fidelity has also been testing the lateral limits of the Bakken petroleum system to the south in North Dakota's Stark County, where the company has 40 Three Forks targets lined up for drilling.

In Mountrail County, Fidelity has another 40 wells planned in the middle Bakken.

Contact Kay Cashman at publisher@petroleumnews.com

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Ceramic proppant pays off big for Halcon

Modified completion techniques boost initial production rates on latest wells; efficiencies drive costs lower

By STEVE SUTHERLIN

For Petroleum News Bakken

Halcon Resources Corp. is finding success in the Williston Basin as the company carries out a drilling and completion modification program.

Halcon adopted the use of ceramic proppant in its Fort Berthold area wells, the company said in a June operational update, and the well results beat out any prior wells done in the area by Halcon or its predecessors.

Ceramic proppant costs more than sand, and Halcon is using high volumes of it. The company said it has increased proppant volume per lateral foot. For Halcon, it seems, the ceramics are earning their keep, juicing production at a rate that will justify the cost.

Halcon recently drilled and completed a ceramic-fracked Bakken well in Fort Berthold which produced 90 percent oil at an initial rate of 3,060 barrels of oil equivalent per day — the highest initial production rate of any Halcon-owned well in the Bakken formation.

Halcon said it also had increased stage density in its latest wells, employing simultaneous fracks or zipper fracks. It is utilizing plug and perf on completions.

Pricey materials aside, the company actually expects to lower its cost per well this year.

Halcon expects well costs in Fort Berthold to decrease by approximately 10 percent to $9 million by the end of the year, "through efficiencies related to pad drilling operations, implementation of centralized production facilities and continued optimization of completion techniques."

Halcon is in transition to batch pad drilling. The record Fort Berthold well was the first well drilled on a two-well pad, the company said.

Bakken and Three Forks improved

Halcon's three most recently completed Bakken wells in Fort Berthold had an average initial production rate of 2,648 boepd, a 38 percent gain over similar wells completed by the company in the first quarter of 2013 using the previous completion method.

Four second quarter Three Forks wells drilled in Fort Berthold had an average initial production rate of 2,094 boepd, 77 percent better than all other Three Forks wells completed by Halcon in the area during the first quarter of 2013.

Halcon is testing 660 foot spacing for Bakken wells in Fort Berthold. The testing will involve surface and downhole microseismic with results expected by the end of 2013.

In the Marmon area, the average initial production rate for the two most recently completed Bakken wells is 91 percent above the average initial production rate for previous company operated Bakken wells in the area. Halcon said it expects an average ultimate recovery from the wells of 462,000 barrels of oil equivalent, which is more than 40 percent higher than that of company owned Bakken wells drilled using the previous completion method in Marmon.

NAME OF COMPANY: HRC Operating (formerly G3 Operating)
PARENT COMPANYY: Halcon Resources
TOP BAKKEN EXECUTIVE: John Wright, vice president operations, Bakken/Three Forks
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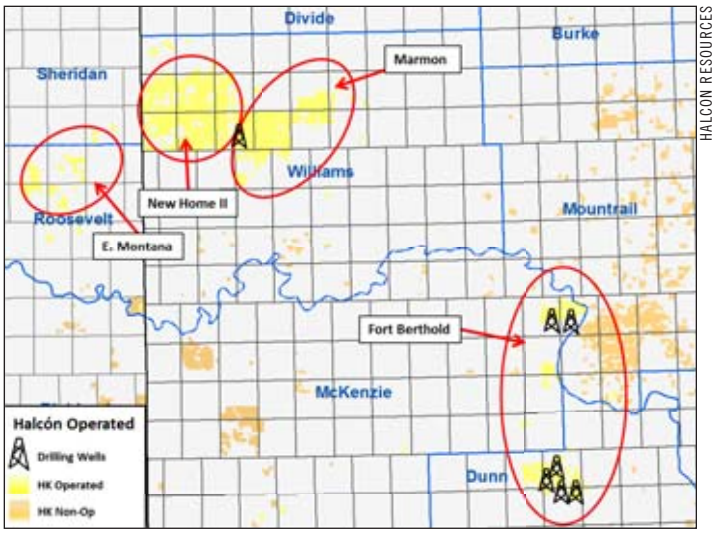
TELEPHONE: (303) 297-2028 • **WEBSITE:** halconresources.com



HALCON RESOURCES

The company said it was operating eight rigs on its 135,000 net acre position in the Williston Basin, 75 percent of which is held by production, "which allows the company the flexibility to focus on operational improvements."

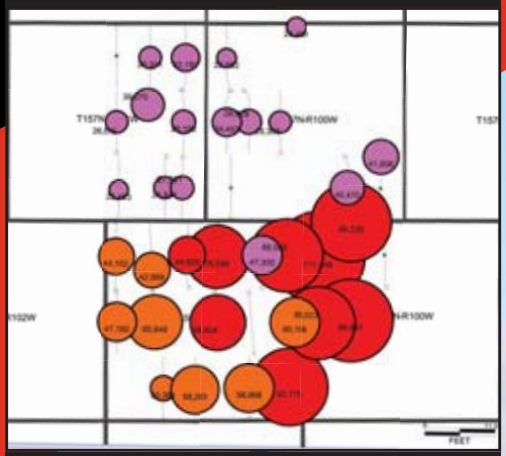
Halcon set its 2013 drilling and completion budget at $475 million.

Aggressive acquisition

Halcon expects to close in July on an acquisition of 19,500 net operated acres in Williams County from Denver-based Resolute Energy for $75 million. Halcon is buying Resolute's working interest. Current production from the acreage is approximately 900 to

continued on page 36

180 Day Cumulative Oil Production Comparison



- 35# X-link gel, sliding sleeves, with sand or ceramic ~31,000 BO per 180 days
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Petroleum News
Bakken

page 11 Interior's Ken Salazar to resign; Byron Dorgan possible successor

Vol. 1, No. 19 • www.PetroleumNewsBakken.com | A semi-monthly newspaper for industry and government | January 20, 2013

Construction nearing completion

To meet increasing demand for electricity by member cooperatives in northwest North Dakota, Basin Electric is building a natural gas-fired peaking station northwest of Williston near a natural gas processing plant. Construction on the $64-million Phase I portion of the project began in June, and commercial operation of the first of three 45-megawatt units is set for April. Wanzek Construction is the project's general contractor.

Denbury transactions strengthen ConocoPhillips, Exxon in Bakken

E&P independent Denbury Resources has managed to vastly broaden its enhanced oil recovery, EOR, program in the Rockies and Texas through separate billion dollar deals with ConocoPhillips and ExxonMobil. But the transactions also greatly strengthen the Bakken portfolios of these two big companies.

One deal allows Conoco to focus more investment dollars in the region, while the other significantly expands Exxon's acreage position and production in the unconventional oil play.

Denbury is the largest combined oil and natural gas operator in both Mississippi and Montana, and owns the largest reserves of CO2 used for tertiary oil recovery east of the Mississippi River.

Under terms of the latest deal, announced Jan. 15, Denbury

see DENBURY DEALS page 10

Seaway launches new era

The Seaway Crude Oil Pipeline Co. has taken the biggest step so far toward reducing transportation bottlenecks between the U.S. Midwest and the Gulf Coast, setting the stage for significant changes by mid-2014 that will bring relief to Bakken producers.

The 50-50 joint venture by affiliates of Enbridge and Enterprise Products Partners has completed a reversal of 500 miles of the Seaway system, increasing the flow between Cushing, Okla., and Houston to 400,000 barrels per day from 150,000 bpd.

The partnership is now targeting 850,000 bpd by the first quarter of 2014 when it introduces a new twin line parallel to

see SEAWAY PROGRESS page 17

Rail could be headed downhill

A rise in oil shipments by rail out of Western Canada to 120,000 barrels per day from 70,000 bpd in fall 2011 may be short-lived said a research note by Calgary-based investment bank Peters & Co.

It said the economic justification underpinning the increase could start to fade over the next two years as new pipelines start operations to the U.S. Gulf Coast and Eastern Canada.

The report said the use of rail to transport crude from Western Canada will have a "longer term function" of serving refineries in Eastern Canada that are not currently connected by pipelines to producing fields.

"But the economics will become marginalized for the

see RAIL FUTURE page 17

GOVERNMENT

'Wake-up call'

North Dakota experiences first crude oil production decline in 19 months

By RAY TYSON
Petroleum News Bakken

North Dakota has now recorded back-to-back months in which the massive Bakken petroleum system has failed to live up to production expectations.

Reasons behind lackluster performances in October and especially in November have led the state's top oil man, Lynn Helms, to issue a "wake-up call" for those who believed the good times would continue unabated.

"We've gotten very used to the increase in production, almost regardless of what was happening out there," Helms, director of the Department of Mineral Resources, said in a Jan. 11 conference call.

For the first time in 19 months, North Dakota's oil production declined in November, the most recent month for which production statistics are available. Output fell 2.2 percent, from an average 749,212 barrels per day in October to 733,078 bpd in November.

"Our expectation was for a 2-to 3 percent increase," Helms conceded.

LYNN HELMS

Storm blamed for slowdown

Winter storm Brutus was blamed for most of the

see PRODUCTION DECLINE page 18

MOVING HYDROCARBONS

Takeaway to beat output

North Dakota oil takeaway capacity continues to grow; gas takeaway catching up

By MIKE ELLERD
For Petroleum News Bakken

The latest North Dakota crude oil takeaway and production statistics and projections indicate that not only is takeaway capacity staying ahead of production, but with anticipated infrastructure growth, takeaway capacity is projected to stay far ahead of oil output in years to come. That's per two key state energy agencies — the North Dakota Pipeline Authority and the Oil and Gas Division, under the Department of Minerals.

Pipeline Authority Director Justin Kringstad estimates that the combined pipeline and rail takeaway capacity for North Dakota crude oil will reach 1,538,000 barrels per day by the end of 2013, and by the end 2016 that total capacity is projected to reach 2,123,000 bpd.

In comparison, the latest North Dakota crude production estimates presented to the North Dakota House Appropriations Committee on Jan. 10 by Oil and Gas Division Director Lynn Helms, indicate a maximum possible future production of 1,600,000 bpd which could be reached

JUSTIN KRINGSTAD

see TAKEAWAY CAPACITY page 19

LAND & LEASING

Shore zone makes auction

One-third of ND oil leases are in disputed water line area of Missouri River

By MIKE ELLERD
For Petroleum News Bakken

Over one-third of the acres nominated for North Dakota's Feb. 5 lease auction are in the disputed "shore zone" between the high and low water lines of the Missouri River in Dunn County. The Trust Lands Minerals Management Division has posted auction nominations totaling 27,356 acres in nine western North Dakota counties, and not only is that total below the 10-year average for the February lease auction, it would be even further below average were it not for 9,820 shore zone acres that were recently delineated in a state-commissioned survey.

DREW COMBS

Shore zone dispute

In 2008, the North Dakota Land Board commissioned a survey to establish the ordinary high water mark of the Missouri and Yellowstone rivers to determine the acreage between those high and low water lines, which under North Dakota law would be considered sovereign land belonging to the state. With the survey now complete, Trust Lands is putting the leases up for sale. A total of 9,900 acres were nominated in Dunn County, all but 80 of which are in the shore zone. Those shore zone tracts are all odd-sized tracts ranging from 161 to 1.61 acres and averaging 93.4 acres.

Who actually owns the shore zone acreage,

see 'SHORE ZONE' page 12

HALCON *continued from page 34*

950 boepd, Halcon said.

The transaction increases Halcon's holdings in the Williston Basin to approximately 155,000 net acres.

In June Halcon transferred all active assets to HRC Operating LLC from G3 Operating LLC.

HRC Operating is an indirect, wholly owned subsidiary of Halcon Resources Corp.

G3 Operating was acquired by Halcon as part of Halcon's acquisition of GeoResources in 2012. The transfers are part of an internal reorganization and simplification effort by Halcon to apply its brand to all of the company's remaining subsidiaries, the company said.

All active assets formerly identified as G3 Operating are now identified as HRC Operating, both in North Dakota and Montana. The transition was done through a blanket name change.

Contact Steve Sutherlin at stevepna@hotmail.com

APACHE *continued from page 20*

grey band at the top and the one sort of in the upper middle represents the two Bakken shales. They are mature in this area. We put a lot of time and effort into (determining) that. … We have great saturations in our reservoirs. And the reservoirs here, they're a little bit siltier. It actually has slightly better porosities than we've seen elsewhere and the facies are, I think quite amenable to very good production rates," Bedingfield said.

"So we do think this is a great location. It's very similar to the Rough Rider field, I believe, on the eastern side, and also a little bit to Elm Coulee to the south, although our pay … in this part of play is significantly larger than at Elm Coulee."

Pleased with first well

In early November 2012, Apache Chairman and Chief Executive Officer G. Steven Farris said he was pleased with what he had seen from the first well drilled in the company's Daniels County acreage.

"As we continue to build and execute our global pipeline of exploration activity we're testing two wells (in two new plays for Apache) — one in the Williston Basin and one in the Mississippi Lime. The good news is we've had good oil shows from the logs in the formations that we were targeting," he said.

"We're currently in the completion phase of our initial wells in each of these plays and we'll be experimenting with our frack designs to give us optional results," Farris said, noting that in Daniels County "there have been some other operators … not right next door … that have announced pretty good results. I mean, the play is moving that way (northwest), so hopefully, it moves all our way. We're going to find out here."

As this annual edition of The Bakken Explorers magazine goes to press Apache is preparing for its second quarter conference call on Aug. 1, where an announcement about its Montana well results is possible, as it will be six months since Apache employees told Daniels County residents they would return in six months.

Editor's note: Three of the slides Apache used in its June 2012 Investor Day presentation about Daniels County can be found here: http://bit.ly/123oZGJ

Contact Kay Cashman at publisher@petroleumnews.com

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KODIAK OIL & GAS CORP.

Kodiak focused on communication theory

Fracking boosts nearby producing wells; will revise completion procedures to raise output, recoverable reserves

By STEVE SUTHERLIN
For Petroleum News Bakken

Kodiak Oil & Gas Corp. has observed evidence of "communication" between Bakken wells during fracture stimulation and it said it will revise well-completion procedures to strengthen production of nearby wells and increase recoverable reserves.

"With this approach we are seeing a positive response from the shut-in wells once they are returned to production, which leads us to believe that we are initiating new fractures into the old well bores and finding new reserves," Lynn Peterson, Kodiak's chairman and chief executive officer, said during a March 1 conference on year-end 2012 financial and operating results.

"As a result of that, we decided to revise our completion procedures," he said.

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Based on the observations Kodiak decided to temporarily shut down all producing wells within the immediate vicinity of new wells being completed, saying the gains outweigh the temporary production delays.

Company officials believe that by staggering fractures, the benches may communicate better and open up the entire interval.

Kodiak is testing its well communication theory in two pilot

KODIAK OIL & GAS CORP.

projects using tight well spacing, Smokey and Polar. The pilots will consume about a third of the 2013 drilling budget. In each pilot the company plans to drill six wells in the middle Bakken and six wells in the Three Forks.

However, Kodiak said it will not test the lower bench of the Three Forks even though Kodiak believes its Polar, Smokey and Koala prospects have lower bench potential.

Peterson is content for now to watch how drilling the lower bench goes for his competitors.

LYNN PETERSON

"We want to see what the results are before we go spending any capital," Peterson said of the third bench. "But we're very comfortable with the first two benches."

Kodiak said it's important to test the concept throughout an entire 1,280-acre drilling unit.

Wells in the middle Bakken will be 800 to 850 feet apart, with vertical spacing between the middle Bakken and upper Three Forks about 70 feet apart. Spacing between the upper Three Forks and middle Three Forks is about 50 feet.

Completion operations at Polar are scheduled for mid-year. Smokey will see full development after the Polar project.

Systematic

On Kodiak's Polar block in Williams County a dozen wells are to be drilled and completed within a single 1,280-acre spacing unit. They will be fracked, then brought on line together.

The sudden surge of oil will need gathering pipelines, Peterson said at the Dec. 5 Wells Fargo Securities Energy, MLP and Pipeline conference in New York.

"We've got to be prepared to handle 15,000-to 20,000 barrels in a pretty short time frame in order to move all this properly," he said. "This is going to be a fun test for us. We think it will really start to show us what this play's potential is."

In the Smokey prospect south of Polar in McKenzie County, wells will not be brought on stream at the same time. At Smokey — also a 12-well test with tight well spacing on a 1,280-acre unit — drilling and fracking was already under way in 2012.

"So we're going to see if there is a difference in production as

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KODIAK *continued from page 39*

we frack them over time versus fracking them all together," Peterson said. "So there's a little bit of science going into this thing, in trying to figure out what we've got here."

He added: "It is important that we do this work in the early stages of our development program in order to gain information to help us best drain the reservoirs."

Per well cost down

Kodiak's well costs in the deepest, most operationally expensive portion of the Bakken have dropped to $10-$10.5 million from $11.5-$12 million per well, the company said.

Kodiak is drilling wells much faster than a year ago due to efficiencies built into the system, Peterson said. A well that once took 35-38 days to drill now takes 20-23 days, with some wells taking less than 20 days to drill.

Crew quality has improved, Peterson said, adding that more wells are being drilled and completed per pad.

Kodiak recently took delivery of a seventh operated drilling rig.

The rig was mobilized to the Smokey project area in McKenzie County, where it will commence drilling a four-well pad, the company said.

Expansion by acquisition

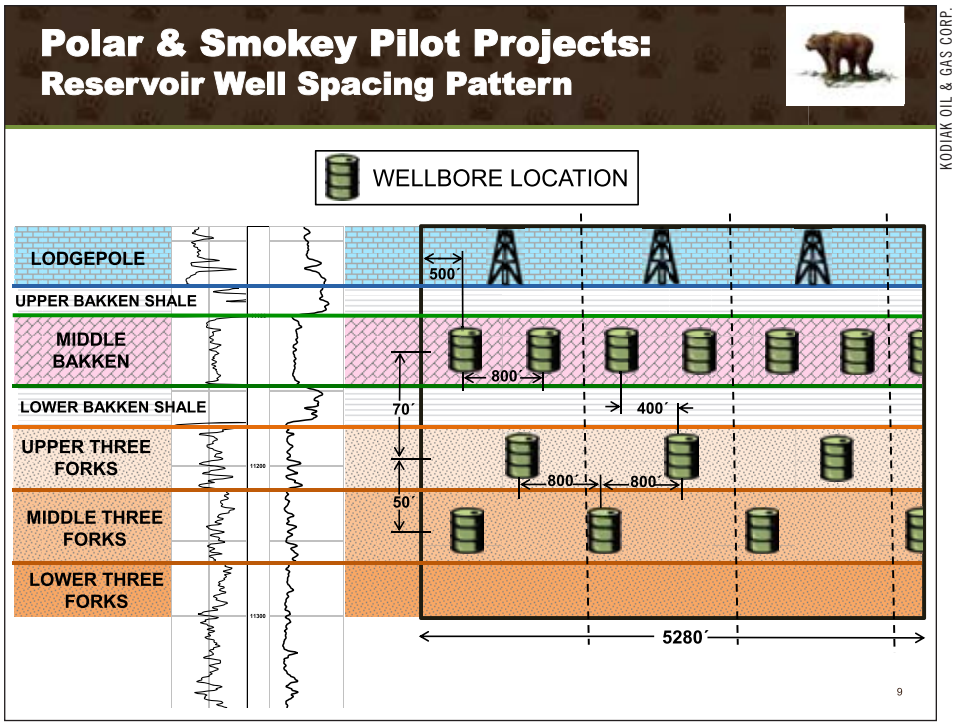
Kodiak, which is focused on the Bakken petroleum system of the Williston Basin, is multiplying its acreage and production in the basin under a purchase and sales agreement reached with Liberty Resources, a small private E&P company, also based in Denver, Colo.

Kodiak is paying $660 million in cash for the assets — 5,700 boe equivalent production per day and 42,000 net acres in North Dakota's Williams and McKenzie counties.

"The proposed acquisition's characteristics adhere to our stated strategy of identifying and acquiring reduced-risk, contiguous leasehold in our immediate core areas," Peterson said.

The acquisition, announced June 3, would raise Kodiak's land position 27 percent to 196,000 acres from 154,000 acres, and would boost production by 23 percent to about 30,000 boepd from 24,300 boepd.

The acquired leasehold includes 35 controlled drilling spacing units, based on 1,280-acre spacing, and is 90 percent held by production. The southern Williams County lands, about 14,000 net acres, are adjacent to Kodiak's core Polar area. An additional 25,000 net acres — called "Ursid" — are situated in McKenzie County to the west of the company's Koala and Smokey areas.



KODIAK OIL & GAS CORP.

A long runway of growth

"The increase in our inventory of future drilling locations provides the company with a longer runway of sustainable growth," Peterson said.

"As we continue our down-spacing work in our Koala and Smokey areas, we would expect the number of locations to increase significantly."

Peterson said Kodiak also would benefit from increased cash flow from the additional production, as well as proved reserves included in the deal.

"As the acquired lands are largely held by production, we can methodically develop the leasehold on a schedule that best fits our capital expenditures and drilling program," he said.

Kodiak said it would finance the $660 million acquisition by tapping its revolving credit facility.

Competition heats up

Like every major play, consolidation continues in the Bakken, "though a lot of good packages have been purchased already," Peterson said, explaining that ExxonMobil, Hess, Statoil and other large companies have contributed to the land scarcity, as they expand their positions in the Bakken.

When Kodiak entered the Williston basin of North Dakota and Montana in 2004, it was a small independent hoping to cash in on the rich promise of the region. The company has grown rapidly from a pure explorer of the Bakken with a $6 million annual budget in 2005 into an E&P with a $775 million capital budget for 2013, all allocated to the Williston Basin. The company's final budget for 2012 was adjusted to $750 million.

Of the preliminary $775 million budgeted for 2013, $600 million is allocated for the drilling and completing of 75 gross (61 net) operated wells; $140 million to non-operated drilling and completion activities for 14 net wells; and $35 million for other items including water disposal systems, well connections, and acreage acquisitions.

Peterson wants to reduce well costs further.

"While we modeled nearly $10 million per well for drilling and completions costs in our 2013 (budget), we expect to achieve lower well costs as we move through 2013," Peterson said.

The 2013 drilling program is designed to provide flexibility in identifying suitable well locations and in the timing and size of capital investment, the company said.

In the Bakken, it seems the only thing that doesn't change is change. A bit of flexibility in a company's drilling program makes sense.

Contact Steve Sutherlin at stevepna@hotmail.com

Second fiddle makes sweet music

EOG likes Eagle Ford best, but Bakken next in line; well spacing and waterflooding in tool basket

By STEVE SUTHERLIN

For Petroleum News Bakken

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One year ago EOG Resources Inc. thought Bakken production was on the wane but due to the magic of downspacing — and its success in non-core areas — the company is singing Bakken's praises once again.

"We're considerably more optimistic about the next 10 years of this play than we were a year ago," EOG CEO Mark Papa said during a first-quarter earnings call in early May.

Strong results from the Bakken petroleum system in the U.S. Williston Basin and from the Eagle Ford in south Texas prompted EOG to raise its liquids growth target for the year by three percentage points, to 33 percent.

MARK PAPA

Houston-based EOG has made no secret of the fact that it prefers the Eagle Ford over the Bakken.

"The Eagle Ford continues to be our 800-pound gorilla in terms of crude oil growth, and we still believe our position is the largest domestic net oil discovery in 40 years and generates the highest direct (after tax rate of return) of any current large hydrocarbon play," Papa said.

BILL THOMAS

Come together

EOG predicted Bakken production would fall in 2012 and it pulled rigs from the play.

Today, however, EOG is drafting charts that show an upward trajectory. Downspacing is the key ingredient in a mix of new practices EOG is deploying in the Bakken.

Downspacing has proven to both accelerate and expand recovery.

At EOG's Parshall field in Mountrail County, N.D., 320-acre spacing has shown higher initial production rates from the newer infill wells. At the same time, downspacing has improved recovery from the initial wells. The synergies have accelerated the return on 320-acre spacing as compared to the company's previous spacing — a well every 640 acres.

The three wells drilled at 320-acre spacing — Wayzetta 156-3329H, 124-3334H and 157-2835H — produced 1,393 barrels per day, 992 bpd and 1,083 bpd with 600 thousand cubic feet per day, 300 mcf per day and 300 mcf per day of associated rich natural gas.

The company plans to test 160-acre spacing on its core acreage and implement downspacing on its nearby Bakken Lite acreage, sometime later in the year.

Also testing waterflooding

Another test EOG is doing is a waterflood pilot project it began in mid-April to enhance oil recovery at Parshall. EOG expects to have results by the end of the year.

Waterflooding, if successful, would heap an extra spoon of sugar on a projected 4 percent boost to recovery rates at Parshall.

According to Papa, EOG's Parshall field recovery rate estimates were at 8 percent, but downspacing boosted estimates to 12 percent.

EOG President Bill Thomas said the company is seeing positive results from 160-acre downspaced wells. He added that EOG has completed its first two wells on 160-acre spacings in the Parshall field, and those wells, Wayzetta 022-1509H and Wayzetta 149-1509H, tested at maximum rates of 1,185 and 1,265 bpd, respectively.

"In 2012, we completed 28 net wells in the Parshall field and Antelope areas with a successful 320-acre downspacing program," Thomas said.

"In 2013, we plan to complete 46 net wells in these same two areas."

The company's focus in 2013, Thomas said, will be to further downspace to 160 acres in both the Bakken and Three Forks pay intervals, as well as continue to improve frack efficiency, and to optimize the recovery factor of each play. If 160-acre downspacing proves successful, Thomas said, it will allow EOG to accelerate its development program in 2014 and beyond. Overall, EOG is planning to complete 53 net Bakken/Three Forks wells in 2013.

"The takeaway from our Bakken/Three Forks asset is the wells are getting better with continued success in downspacing," Thomas said. "The number of potential locations is growing and this provides us many years of high ROR investment opportunity in the play."

Breaking up is good to do

Thomas said that advanced fracking technology was another

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EOG RESOURCES *continued from page 41*

major component in the company's technical arsenal that was proving effective in boosting output.

"New frack technology is improving our wells in every area of the Bakken/Three Forks," Thomas said during a Feb. 14 conference call. "In some cases the new frack technology used in our 320-acre downspacing in the Parshall core has resulted in a 30 to 70 percent improvement in cumulative production over the original offset wells on a per foot of treated lateral basis."

As an example, Thomas cited the company's Wayzetta 156-3329H, a 320-acre downspaced well completed in 2012 which had a cumulative production of 330,000 barrels of oil in the first 320 days. That well, Thomas said, was steadily producing at a rate of more than 800 barrels of oil per day.

"Our Bakken and Three Forks drilling results during the fourth quarter were outstanding and our 2013 program should be one of our strongest in many years," Thomas said. "While most of the industry Bakken/Three Forks results are trending downward, EOG results are moving in the opposite direction. In other words, our wells are getting better."

Overall, EOG's gross Bakken/Three Forks production at year end 2012 was 62,100 barrels of oil equivalent per day, up from the gross production of 56,400 boepd at the end of 2011. EOG also indicated that its average estimated ultimate recovery, independent of lateral length, was 544,000 barrels of oil per well, while the North Dakota Bakken EUR average is 338,000 barrels.

Happy Trails

Venturing out from its Bakken core area has also paid off for EOG. Some 25 miles to the southwest, in the Antelope Extension, five new wells have confirmed the potential of both the upper Three Forks and the middle Bakken units.

In the Diamond Point/Stateline area of western North Dakota and eastern Montana, EOG completed seven wells with initial production rates between 540 and 1,100 bpd.

The results added 200 drilling locations to the region, according to EOG.

One of the top reasons to anticipate growth in 2013, Thomas said, "is that our drilling program is directed to the Parshall core and Antelope Extension areas, which are some of the best acreage blocks in the play." He said a recently completed Three Forks well in the Antelope Extension, the Hawkeye 102-2501H, is producing 2,945 bpd. Another recently completed Antelope Extension well, the Hawkeye 01-2501H, a Bakken formation well, is producing 2,444 bpd.

Working on the railroad

EOG has made investments to increase Bakken production, but new production won't add to cash flow unless it has a cost-effective path to market. The company expects railroad tankers to continue to ease the shortage of pipeline capacity out of the Bakken to refineries.

EOG is investing in rail — a new crude-by-rail facility in St. James, La. — that is ramping up to handle 50,000 bpd in summer and 70,000 bpd by the end of the year.

The new facility allows EOG to deliver Bakken crude to either St. James or Cushing, Okla. It received its first shipment of Bakken crude in mid-April, allowing EOG to capture a $15 per barrel advantage from Light Louisiana Crude prices.

"Based on current differentials, the best (net present value) for our rail tanker fleet is to move our EOG Bakken oil to St. James and sell our Eagle Ford in the Houston and Corpus Christi markets," Papa said.

The need for rail to move crude from Midcontinent fields will likely persist, even if plans for expanding pipeline links from the Bakken to the Gulf Coast are realized, Papa told a Colorado conference.

He said rail will still be used five years from now to deliver Bakken crude to all three Lower 48 coasts — the Gulf, East and West — but that the current advantage of Louisiana Light Sweet, LLS, crude prices in the Houston market could evaporate within 18 months.

The differential for LLS stood at $21 a barrel over West Texas Intermediate in February.

Papa said there will always be the "advantage of a price lift" somewhere in the United States that will generate a "pretty fat margin."

However, he said there are no guarantees that the LLS margin will extend into 2014-15, and that perhaps in the future EOG will deliver Bakken crude to other regions and less to the Gulf Coast.

Railroad facilities are not the only infrastructure plays EOG is funding. The company is saving money with its new fracking sand plant in Wisconsin, which cuts about $500,000 off the cost of each well.

Room to grow

EOG, in a Nov. 28 presentation, said the company projects an increase of 2 million barrels of oil a day from new U.S. tight and shale oil production by 2015. The U.S. Energy Information Administration forecast in June named 2 million boe per day as a high case scenario.

"Our projection is over the four-year period from 2011 to 2015," Papa said, "U.S. oil volumes are going to grow by 2 million barrels a day from shale oil and we stand by that. Where's the growth coming from over this four-year period? It's coming from only two plays, and it's two plays EOG found, and two plays that EOG has major positions in," Papa said.

"One is the Eagle Ford," He said. "We're the dominant player (there) … and the second one is the Bakken, which is more of a mature play."

He described the rest of the horizontal plays in the United States as "contributory … but negligible."

"The third play (is) the Permian — that's the Wolfcamp, the Leonard and everything else," he said, adding that there had "been lots of press" about the Permian Basin, "lots of ink, but it's not that big in size."

The plays that make a difference, the Bakken and Eagle Ford, are the black oil plays — not the combo plays, he said.

"Show me the money"

EOG capital expenditure for 2013 will focus on the Eagle Ford and Bakken plays. "EOG's demonstrated ability to organically grow crude oil volumes should lead to strong 2013 returns," Papa said in a Feb. 13 press release.

"Until other commodity prices strengthen, we are directing EOG's capex dollars almost exclusively toward crude oil exploration and development. Leading with our Eagle Ford and North Dakota operations, EOG is well positioned to achieve its game plan, while identifying strategic marketing advances that will further strengthen our position."

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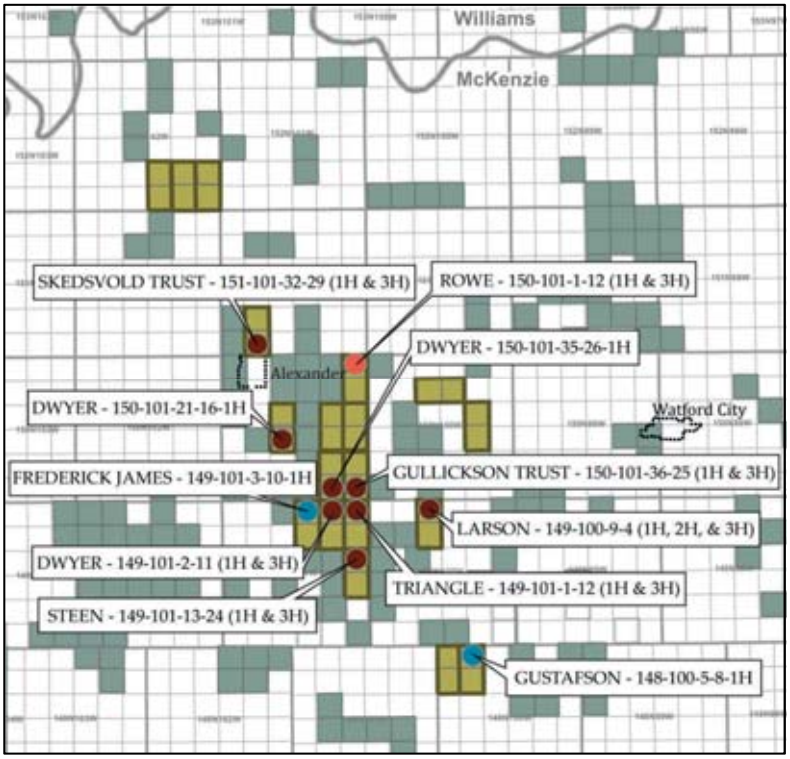
TRIANGLE PETROLEUM

MCKENZIE COUNTY – CORE AREA



DETAILS

- ~22,000 net acres; 50% operated
- Completion: plug and perf, 100% ceramic
- Drilling Inventory: 114 operated locations
- Currently operating 3 drilling rigs
- 54 permits approved or submitted

Average McKenzie County AFE ($mm) FY'14	
Min	$11.2
Max	$12.2
Average	$11.5

KEY HIGHLIGHTS

- 17 gross operated wells producing and 2 wells waiting on completion
- Planned artificial lift conversion from gas lift to rod pump complete

Triangle pushing innovative technology

Approaching Bakken fringe with caution, but testing remote and hybrid fracking, stronger and lighter proppants

By KAY CASHMAN
Petroleum News Bakken

Although Denver-based Triangle Petroleum has an acreage position in Montana that is on the northwestern flank of the Williston Basin, adjacent to the Elm Coulee field, the company is going to keep an eye on what larger companies are doing in the region before it initiates its own drilling program.

But Triangle does qualify as an explorer because of its focus on technology in the Bakken petroleum system.

Downspacing tests conducted by Triangle in the first quarter of 2013 indicate the potential for densities of up to six to eight middle Bakken and two to four upper Three Forks wells per 1,280-acre spacing unit in the company's McKenzie County core area. That core area is in one of the deepest areas of the Williston Basin.

In a June 10 conference call, Jonathan Samuels, Triangle's president and chief executive officer, said the company ran two separate

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TRIANGLE *continued from page 43*

chemical tracer tests in horizontal Bakken well bores with separations of 450 and 600 feet. Triangle saw no communication between the laterals.

Samuels said he believes production rates in the Williston Basin are going to increase over time, and the possible downspacing to eight to 12 wells per 1,280 acres is one element of that increase.

When the lower benches of the Three Forks are considered, the well density could increase even more, he said.

According to a Triangle press release issued on the same day, the eight to 12 wells per 1,280-acre unit does not include the potential for development of the second and third benches of the Three Forks "as a distinct reservoir."

Samuels said the company is planning two incremental Three Forks tests in 2013.

Remote and hybrid fracking

Triangle is also exploring new ground with its hydraulic fracturing subsidiary Rock Pile Energy Services, which completed what the company calls the first-ever remote frack in which Rock Pile fracked a well by setting up the frack equipment on an adjacent pad and running a high-pressure line to the well that is being fracked. This method avoided the crowding issue of having both drilling and fracking equipment on the same pad and allowed the company to frack one well while the drill rig was drilling the next well on the pad. Triangle said this allowed its Dwyer 150-101-35-26-1H well in McKenzie County's Rawson field to go on production 70 days sooner than would have otherwise been possible.

In addition, Rock Pile fracked 27 of 46 stages of the Rowe 150-101-1-12-3H well, also in the Rawson field, using sleeve-based methods, with the remaining stages fracked using standard plug-and-perf methods. Samuels said using this hybrid of two fracking methods enhances efficiency and production.

And in the deep portion of the basin where the company is drilling in McKenzie County, when a well is down approximately 10,500 feet and out laterally some 10,000 additional feet, "the end of that wellbore is really, really, really far away."

He said that in those situations, using the plug-and-perf method is a long, difficult and expensive process, and if the plugs are not drilled out, restricted flow rigs have to be brought in. "So the hybrid is basically putting sleeves in the toe because there's not a large number of sleeves relative to 100 percent sliding sleeve job. You avoid all the problems of the declining side, all of which can accidentally open up an early stage, and you could lose pieces of well, and there's other issues."

Samuels said there are tradeoffs associated with using the hybrid fracking method, but he added that Rock Pile has become very efficient at employing the method and it's paying off. "I mean, there's tradeoffs — you can spend money, more money and get more oil. The question is: are you getting enough to justify the return on capital. And so I think this is a step in that direction. It saves some time, saved some costs and you're also going to save us time on the backside in terms of the drill outflow. I mean, the well is online for more days in its first 90 days and that means better production profiles that you see on the NDIC report."

Light-weight, ceramic proppant

In addition to its innovative fracking methods, Triangle is also planning to experiment with higher-strength, lighter-weight proppants. Samuels said that, simply put, the pressures at the depths of its wells are higher than the crushing strength of white sand, so Triangle has been using what he described as the "Cadillac" of proppants, a lighter-weight ceramic proppant with a higher cross strength than the pressures the company is experiencing. He said that in an ideal world, "you want your proppant just strong enough to last as long as you need it to, but you don't pay for any more than you need, and so it's testing to find that line."

Samuels said the company will continue looking at proppants to find the one that is best suited for its fracking needs in a continuing effort to enhance efficiency, and added that using light-weight proppant is just one tool available to access reserves at as low a cost as possible.

Production and cost savings

Triangle's average daily production in May 2013 was 4,300 barrels of oil equivalent per day based on a 21-day average, a 23 percent increase over the 3,300 boepd the company was producing at the end of the fourth quarter of 2012. Triangle drilled and completed five gross operated wells in the first quarter using two drill rigs, and is currently operating three full-time drill rigs. A fourth rig is operating on a part-time basis.

The company has set a well cost target of between $10 million and $10.5 million for its McKenzie County wells, and that doesn't account for cost saving associated with Rock Pile and Caliber. Triangle reduced the average number of days from spud to total depth to 27 days in the first quarter of 2013.

Montana acreage

While the northwestern flank of the Williston Basin is primarily undeveloped, permitting and drilling activity by industry continues to converge on Triangle's acreage position.

Benefiting from protracted leasehold terms, the company does not plan on deploying capital to this area over the near term, preferring other operators de-risk the area.

In this part of northeast Montana, Triangle holds approximately 50,000 acres in its Station Prospect in Roosevelt and Sheridan counties.

In a Dec. 10, 2012, conference call, Samuels told analysts, "This is part of our portfolio that gets very little attention, very little value accredited to it. But we're monitoring activity in the area as I'm sure a lot of you are as well and there are some big boys out there sniffing around. You've got Apache (west in Daniels County), Southwestern, Whiting, Samson Resources, all drilling wells, leasing acres and it's going to be something to keep an eye on next year."

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Newfield checking out lower Three Forks benches, Pronghorn

By KAY CASHMAN
Petroleum News Bakken

Newfield Exploration's claim to Bakken explorer status in the Williston Basin is due, first, to its testing of the lower benches of the Three Forks formation within the Bakken petroleum system and, second, to its strides in the application of technology to increase recoveries of oil in place in both the upper Three Forks and middle Bakken members.

The Woodlands, Texas-based independent has been able to accomplish the second while simultaneously lowering its finding and development costs and reducing its surface impacts.


LEE K. BOOTHBY

Because of stellar output from new wells, along with better-than-expected performance from existing wells, Newfield said April 24 that it decided to increase 2013 production estimates for the Williston, where the company is running four drilling rigs.

"We now expect our Williston production to grow 25 percent year-over-year compared to our original target of about 15 percent," Lee K. Boothby, Newfield's chairman, president and chief executive officer, said in the first-quarter conference call.

He said Newfield also expects Williston production to grow about 25 percent year-over-year again in 2014.

The company produced about 9,800 barrels of oil equivalent per day in the first quarter compared to around 8,000 boe a day for the same period in 2012, a nearly 23 percent quarter-over-quarter increase.

11,000-foot laterals

"In the Williston Basin, we delivered some of our best wells to date during the first quarter," Boothby said, assigning credit in large part to increased lateral lengths of about 11,000 feet, along with a reduction in average days to full depth, which was 45 days in 2010, 35 days in 2011, and 25 days in 2012.

During third quarter 2012, a "best-in-class" well was drilled and cased in 18 days, Newfield said.

In its 2012 third-quarter conference call Newfield said completed well costs would continue to reflect efficiency gains, estimating that its 2013 wells could be drilled and completed for about $10 million gross.

In the first quarter 2013 average well costs were $9.8 million, but a well completed in the second quarter was drilled and completed for $8.3 million.

Additional resource potential exists in "deeper benches" of the Three Forks and infill drilling and field testing is under way, the results of which "will be used to plan a future program to exploit the prospective Three Forks-Sanish formation," which presumably includes the Pronghorn member that is now considered the lowest subdivision of the Bakken formation, a sandstone that was formerly called the Sanish.

The Pronghorn lies above the Three Forks.

In its reports to investors, Newfield also said it was running pilots to determine optimal well spacing in the Bakken system.

With a 2013 capital budget of $230 million for the Williston Basin, Newfield expects to drill about 35 operated wells in the middle Bakken and seven wells in the upper Three Forks this year.

With about 96,000 net acres and an inventory of more than 300 ready-to-drill locations in the Bakken and Three Forks formations.

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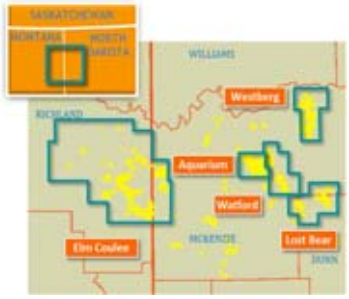
Williston Basin



NET AVG. PRODUCTION (BOEPD)

4Q12 Oil	4Q12 NGLs	4Q12 Gas	1Q13 Oil	1Q13 NGLs	1Q13 Gas
7,760	1,040	1,640	7,320	940	1,540

HIGHLIGHTS:

Our Williston Basin team delivered "best in class" wells in 1Q13. Not only were early production rates near record levels, but well costs showed significant improvements. Including approximately $900k in facilities costs, average well costs during 1Q13 were $9.8 million and a recent well was drilled and completed for $8.3 million.

We were encouraged by the recent successes in the Three Forks formation. Our Sand Creek Federal well had initial production of 3,450 BOEPD (24hr Rate) and averaged 1,077 BOEPD over its first 30 days. We are evaluating the resource potential across our acreage and additional drilling is planned in the 2H13. We will be testing lower benches in 2013

RECENT WELLS

	Formation	WI%	GPI	IP-24hr BOEPD*	30-Day Avg. BOEPD*	60-Day Avg. BOEPD*
Sand Creek Federal	Bakken	41%	10,004	3,405	1,075	–
Sand Creek Federal	Bakken	41%	10,151	3,590	1,139	–
Sand Creek Federal	Three Forks	41%	10,056	3,452	1,077	–
Darlene Federal	Bakken	37%	9,657	2,980	773	637
Darlene Federal	Bakken	37%	9,527	2,559	775	635
Darlene Federal	Three Forks	37%	8,732	1,306	648	531
AVERAGE		**39%**	**9,688**	**2,882**	**915**	**601**

* Gross Production

- Added a 4th operated rig in March 2013
- Operations now focused on SXL wells from common pad locations
- 1Q13 production exceeds original guidance due to better than forecast well performance
  - *Raised 2013 year-over-year production growth estimate to 25% compared to original estimate of 15%.*

NEWFIELD EXPLORATION

Oasis plans lower bench Three Forks well

As output increases, conducts inter-well spacing tests, extensional Three Forks drilling

By KAY CASHMAN
Petroleum News Bakken

In first quarter 2013, Oasis Petroleum cored through the lower benches of the Three Forks formation in the Bakken petroleum system and conducted enhanced log analyses for six pilot test wells that the company is planning to drill into the lower benches.

Oasis Executive Vice President and Chief Operating Officer Taylor Reid said in a May 8 first-quarter earnings conference call that the Houston-based independent is currently analyzing those data, and based on what company officials have seen thus far, Oasis will likely drill its first lower bench well late this year or early in 2014.


TAYLOR REID

According to Reid, Oasis is focusing on optimizing subsurface inter-well spacings — and the corresponding pad arrangement and operation on the surface — in order to most efficiently develop its Williston Basin resources.

"As we have stated previously, an early understanding of the reservoir will promote optimal well spacing and prevent over-capitalization by drilling too many wells in a spacing unit, or by leaving reserves behind by drilling too few," Reid said. "Our work on this front will then lead to best practices for pad development by fitting the subsurface to the surface."

To that end, Reid said Oasis is evaluating optimal spacing efficiencies through three methods: inter-well spacing pilot tests; extensional drilling in the first bench of the Three Forks formation in the Bakken petroleum system; and analysis of other benches of the Three Forks from coring and high-resolution logs.

Reid said that early results from a 2012 spacing test suggest that four wells per reservoir per pad appear to be economic with little interference between wells, and in 2013 the company will test the limits of infill density patterns. "As we drill wells closer together in 2013, we are seeking to achieve the ideal spacing that maximizes the returns per spacing unit."

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In 2013, Reid said, the company will have 22 infill pilot tests spread over its acreages and will be testing up to six wells in the Bakken formation and six wells in the first bench of the Three Forks formation, resulting in densities of up to 12 wells per pad.

In addition, Reid said that the company's Three Forks extensional drilling program in which it drilled step-out wells in both North Dakota and Montana was "very successful," with results similar to Bakken wells in those areas. Because of these positive results, Oasis is planning 15 extensional and step-out tests in 2013. "We think that there is a high probability that the Three Forks is economic across most of our acreage position, and we'll have more well results to share as we approach year end."

As the company continues testing spacing efficiencies, it is simultaneously moving to more and more pad drilling, Reid said. Oasis is currently drilling 60 to 70 percent of its wells on multi-well pads this year, and in 2014 the company's development will be 80-plus percent on pads. Oasis improved its pad designs in 2012, and is now working on surface well configurations and battery designs expected to enhance the company's pad operations moving into 2014.

Chairman and Chief Executive Officer Thomas Nusz said May 8 that Oasis has lowered its weighted average operated well costs from about $10.5 million in the first half of 2012 to $8.4 million in the first quarter of 2013.

Furthermore, he said, first quarter well costs do not include savings the company is realizing from subsidiary Oasis Well Services, which provided an additional $300,000 in savings per well.

The company's average daily production in the first quarter, consisting of 91.5 percent oil, was 30,153 barrels of oil equivalent per day, an increase of 9 percent over the fourth quarter of 2012, and an increase of 71 percent over production in the first quarter of 2012.

Most of the company's first quarter production, some 19,021 boepd, came from its West Williston area in Williams and McKenzie counties in North Dakota and Richland and Roosevelt counties in Montana.

Contact Kay Cashman at publisher@petroleumnews.com

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EOR to improve recovery to more than 25%

Lightstream, formerly PetroBakken, prefers natural gas for enhanced oil recovery; Bakken output levels off

By KAY CASHMAN
Petroleum News Bakken

Lightstream Resources, a frontrunner in successfully tapping the Bakken petroleum system in Saskatchewan, has examined three "tried and true" enhanced oil recovery concepts in the Bakken — waterflooding, natural gas flooding and carbon dioxide flooding — and concluded that CO2 is "probably the best technical solution," Chief Executive Officer John Wright told the investment community at its annual meeting in mid-2012.

Enhanced oil recovery, or EOR, is not a new concept in the development of oil and gas reservoirs, but applying it to tight oil reservoirs is new, Lightstream says.

After laboratory analysis, computer simulations and early field experimentation, Lightstream, formerly known as PetroBakken, believes that natural gas would be "a more effective flooding agent in an EOR scheme as it would sweep the tight Bakken reservoir more efficiently," says an entry on the company's website, noting that Bakken "reserve recovery factors could improve from approximately 15 percent under primary methods to over 25 percent with natural gas as a flooding agent."

Initially, natural gas used in the Calgary-based company's EOR projects will come from its production facilities and is "expected to be recovered and sold at a later date, further enhancing the full cycle economics of EOR."According to Wright, natural gas ranks second and waterflooding is viewed as the least effective.

The most effective is CO2, but because of the "incredibly poor quality" of Bakken rock, injecting fluid is difficult, he said, describing CO2 as a "great fluid to inject into the reservoir and a horrible fluid to run through your facilities, because it forms carbonic acid (which) eats through everything."

Natural gas is cheaper and less corrosive than CO2 and the bulk of the gas can be recovered and sold, enhancing the full-cycle economics of EOR assuming gas prices recover, the company says.

Once primary recovery has taken place in the Bakken, Wright said his company expects to produce only 15 percent-17 percent of the oil-in-place, which he said would have been viewed as a "miracle" 10 years ago. "The flip side of that is we're going to leave 83 percent to 85 percent of the oil behind because we don't have a way to get it out," he said.

Optimization through bilateral evolution

According to Lightstream, its "operational success in the Bakken is largely due" to its "depth of expertise in applying technologies. We are continuously innovating and evolving the efficiency of our horizontal drilling and fracture stimulation methods."

The company developed a drilling and extraction strategy for bilateral wells.

"This dual-leg tactic provides increased exposure to this generally low permeability reservoir. In fact, four bilateral wells will fully develop a section in the Bakken, while eight single laterals are required to achieve the same well density," Lightstream says.

"We have also been able to push the boundaries of the Bakken fairway with the introduction of delayed fracs, and Cleantech fracing solution."

Maturing production and well optimization activities resulted in a leveling off in production from Lightstream's Bakken business unit in southeast Saskatchewan, trimming output to 19,029 barrels of oil equivalent per day in the first quarter from 19,741 boe per day in the final three months of 2012, the company reported.

However, Chief Operating Officer Rene LePrade said "future drilling and optimization of our extensive inventory of existing wells" should mitigate production declines and generate free cash flow from the unit.

First-quarter activities in the Bakken included 15 wells, with 14 brought on production.

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Cardium drilling

Company-wide production for January through March 2013 averaged 49,078 boe per day (82 percent light oil and liquids), an increase of 2,306 boe per day from the opening quarter of 2012.

Lightstream credits most of the growth to the successful execution of a drilling program in the Cardium, a formation that consists of massive sandstone beds separated by shale. Because the Cardium has a higher gas-to-oil ratio than the Saskatchewan Bakken, the company's liquids weighting dropped slightly from a year ago, while temporary facility restrictions on the Cardium unit had a proportionately larger impact on light oil production.

As of March 31, the company had 30 wells waiting for completion and/or brought on production. Wright expects half of that total will come onstream by mid-year.

He said the Cardium should yield 25,000-30,000 boe per day through 2013 and 2014 and could edge over the 30,000-barrel mark for a "very long, extended period of time and make the best use of any infrastructure build-up that we've done, not unlike the Bakken which has turned into a 19,000-20,000 boe per day cash cow for us."

Contact Kay Cashman at publisher@petroleumnews.com

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EVA SLEIRE / STATOIL

Statoil takes long view of Bakken development

Company has long-term business model, with an eye to slow, continuous technology application

By MIKE ELLERD
Petroleum News Bakken

Since acquiring Brigham Oil and Gas in 2011, Norway-based Statoil has been establishing itself as a major player in the U.S. Williston Basin. But with decades of experience in global offshore development, Statoil has a slightly different philosophy when it comes to onshore production. Moving slower rather than faster is part of that philosophy.

London native Stephen Bull is Statoil's vice president overseeing the integration of Brigham into Statoil, and in that role he is very much involved in Statoil's Bakken operations.

Statoil's business model, according to Bull, is to take a longer-term view of onshore production, an approach he describes as somewhat anathema in the onshore world.

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COMPANY WEBSITE: www.bexp3d.com

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continued on page 52

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STATOIL *continued from page 50*

tion going, and then you expect another 20, 30 maybe 40 years of production after that. So we think in terms of decades in our investment horizon."

Bull adds that the slow and continuous application of technology is very important to the company's business model. He says in the early years of North Sea development recovery rates in the Norwegian continental shelf were in the 20 percent range. But through technological advances that provided additional uplift, such as CO2 flooding, those average Norwegian continental shelf recovery rates, he says, are now the highest in the world, averaging 55 percent with some fields yielding up to 70 percent. "In the good old days of petroleum engineering, people wouldn't dream that would ever be possible."

STEPHEN BULL

For the Williston Basin, Bull says Statoil is looking at its assets as a long-term investment and is not in a hurry to drill those assets out. "These are long-term assets and Statoil has always been a long-term sustainable player in whichever area we're in," he says. "Drilling up everything immediately is not what we really want to do."

Bull says Statoil wants to avoid the "super high" production peaks followed by "super high" decline rates that are often seen in onshore production. Instead, he says, Statoil wants to "flatten" those curves over time. "That's important for us because we think we can come back here and probably apply better technology and get more out of the rock than with current methods."

Development, production goals

Statoil's Williston Basin production increased from 21,000 barrels of oil equivalent per day in 2011 to 47,000 boepd in 2012. When Statoil acquired Brigham in 2012, Bull says, Brigham was "on the ramp up," and at one point had as many as 19 rigs operating.

"Doubling production within one year was a testament to the organization," he says. "Right through the middle of integration with a bigger company, and to actually keep those operations going and double it was a pretty amazing feat, it really was, and do that safely as well."

But Statoil is not looking to double production again in 2013. Bull says Statoil has developed its production targets for 2013, and although the company has not yet made those targets public, he said the goal is for a net production increase in 2013, but not to double it.

In 2012, Statoil drilled approximately 150 wells in the Williston Basin, but Bull says that number will be slightly lower in 2013. He expects the rig count to average around 12 for the year, down one rig from the end of 2012.

The slight reduction in drilling activity, he says, is partly due to increased drilling efficiencies.

Much of the increase in drilling efficiency comes from walking drill rigs, Bull says, and Statoil has now moved exclusively to walking rigs in the Williston Basin, completing that transition in 2012. "We spent most of 2012 swapping out those old rigs for the new walking rigs, and we really do see a lot of efficiencies there. It makes a big difference."

Pad densities

Statoil's "base case" for pad density, according to Bull, is seven wells per pad in a "four by three" configuration with four wells targeting the Bakken formation and three targeting the Three Forks. How-

ever, Bull says Statoil is looking to increase pad density moving forward and is currently involved in a reservoir and fracture modeling study with Schlumberger looking into well densities and communication between well bores.

"There is a lot of upside in adjusting those densities over time," Bull says. "It shows the level of development the Williston Basin is in. Even though it has been drilling up slowly and surely since the 1950s, we're still in the experimental stage I think — the rest of the players as well — to look at new benches and also looking at increasing the density as well."

Other target formations

Like other companies, Bull says Statoil is also looking at the possibility of targeting other intervals or formations in the basin and not just the middle Bakken and upper Three Forks members of the Bakken petroleum system. He says Statoil will do some experimenting itself, but it will also follow what the rest of the industry is doing and understanding about other horizons.

As he puts it, "We could do a lot of research and science into these things but I think actually putting a well bore through it, fracking it and understanding it and doing the research afterwards is the best way to understand this rock." But exactly what other intervals or formations Statoil might be looking at in the future — "Ask me again in five years," Bull says.

Natural gas task force

Statoil has put together a task force from its research and development team in Houston and operations people both in Austin and Williston to look at how the company can increase its use of natural gas in its Williston Basin operations. Not only is this effort intended to better address flaring, Bull says, but also to cut carbon dioxide emissions. As he notes, "Running a drill rig on diesel fuel puts out a huge amount of CO2."

The task force, Bull says, is looking at how natural gas could be developed on a long-term basis in the basin, including compressing natural gas, not only to run drill rigs but also possibly for lift to increase reservoir recovery.

In addition, he says, it may even be feasible to operate vehicles on compressed natural gas. He says Statoil is currently working with third party consultants and other companies that might want to invest it what the company sees as a "more sustainable business" for the basin.

"We're trying to imagine what this industrialization could look like for the basin for the long-term."

This does not mean to imply that Statoil will get into the CNG business, Bull says, but instead the company will look for those who can get into that market and see how that market can be incentivized in the long-term. "There is a huge possibility, there really is, you've just got to think big of how this business is going to be."

Core area

Statoil presently holds 378,000 net acres in the Williston Basin, 258,000 of which are in North Dakota with the remainder in Montana.

Most of the North Dakota acreage is centered north and south of Williston in Williams and McKenzie counties, and in central Mountrail County. Bull says these are Statoil's core areas in the basin. The acreages there are well connected, which he says is important for gathering systems.

In Montana, Statoil's acreage is concentrated in Richland and Roosevelt counties. Bull says the company wants to hold that acreage, but adds that it is not presently focusing on its Montana assets. "But really we're just looking to drill out the best acreage that we can first, and then we'll come and do the infill over time."

Bud Brigham gets his name back

On April 16 more than 500 Williston Basin wells were transferred from Brigham Oil & Gas to Statoil Oil & Gas.

According to a Statoil spokesperson, "We have finalized all the legal documentation and notifications. I can assure you that takes a while … so now (founder) Bud Brigham can get his name back."

It's just a formality, he said.

Contact Mike Ellerd at mellerd@bresnan.net

OLE JØRGEN BRATLAND / STATOIL

EVA SLEIRE / STATOIL

"Even though it has been drilling up slowly and surely since the 1950s, we're still in the experimental stage I think — the rest of the players as well — to look at new benches and also looking at increasing the density as well."

—Stephen Bull, vice president overseeing the integration of Brigham into Statoil

Working all the angles

WPX combines geological research with optimization of drilling, completions and production

By KAY CASHMAN
Petroleum News Bakken

WPX Energy is increasing its recoverable reserves through technological innovation and a search for the most geologically productive zones in its 84,205 net acres in North Dakota's Williston Basin, a chunk of which lies within the Fort Berthold Indian Reservation.

In mid-2012, having drilled only 10 percent of its potential locations in the Bakken petroleum system, the Tulsa-based company undertook an infill density project in the second half of the year to help better understand its resource.


RALPH HILL

The project, which was also referred to as a science pad, aimed to find the "most geologically productive zones," to "optimize completion designs" and to evaluate ways to increase drilling locations and reserves, WPX President and CEO Ralph Hill said in a third quarter 2012 earnings conference call.

The seven-well program — four in the Bakken and three in the Three Forks — recovered 372 feet of core from the entire Bakken system: "We cored … the upper, the middle, the lower and the Pronghorn (in the Bakken formation). We cored the entire Three Forks formation, all benches, all four benches. We also cored a portion of the Lodgepole and the Birdbear formations. So we have a ton of data that we have that will be coming in. And we had seismic and specialty logs shot obviously during this time," Hill said, noting some of the initial study results would be in in the first quarter of 2013, but that the project would be "long-term" and produce a "ton of data."

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Optimization in all phases

From a technology viewpoint, WPX is focused on optimization in all phases — drilling, completions and production.

Consequently, Hill said in discussing first quarter 2013 results, the company is really hitting its stride in the Bakken, with everything, including estimated ultimate recoveries for wells, getting better.

"Our Bakken oil production increased 50 percent to 11,500 barrels of oil a day in the first quarter. … Our March production averaged 12,500 barrels of oil per day. Our wells continue to perform at or above expectation," he said.

In 2012, WPX drilled 41 gross (27 net) wells in the Bakken, or about 7 percent of its total drilling activities. Of the 31 Bakken wells WPX brought online that year, 28 surpassed performance expectations, with many coming in "significantly higher than our type curves" of 800,000 barrels of oil equivalent for the middle Bakken and 600,000 barrels of oil equivalent for the Three Fork, Hill said.

The top 10 performers included four middle Bakken wells averaging some 38 percent above expectations and six Three Forks wells averaging some 14 percent above expectations.

The company has been successfully experimenting with zipper fracs; thus the majority of its future completions will be done with dual/triple zipper fracs, he said.

Another key to the success of its wells, Hill said, is the use of ceramic proppant rather than just sand; in second quarter 2013 WPX's mix was two-thirds to one-third ceramic to sand.

Although using ceramics adds about $1 million to the cost of a well, Hill said it is a "better performer."

In early 2013, Bryan K. Guderian, senior vice president of operations for WPX, said the company had completed the improvement efforts it began in mid-2012 for the "full well cycle."

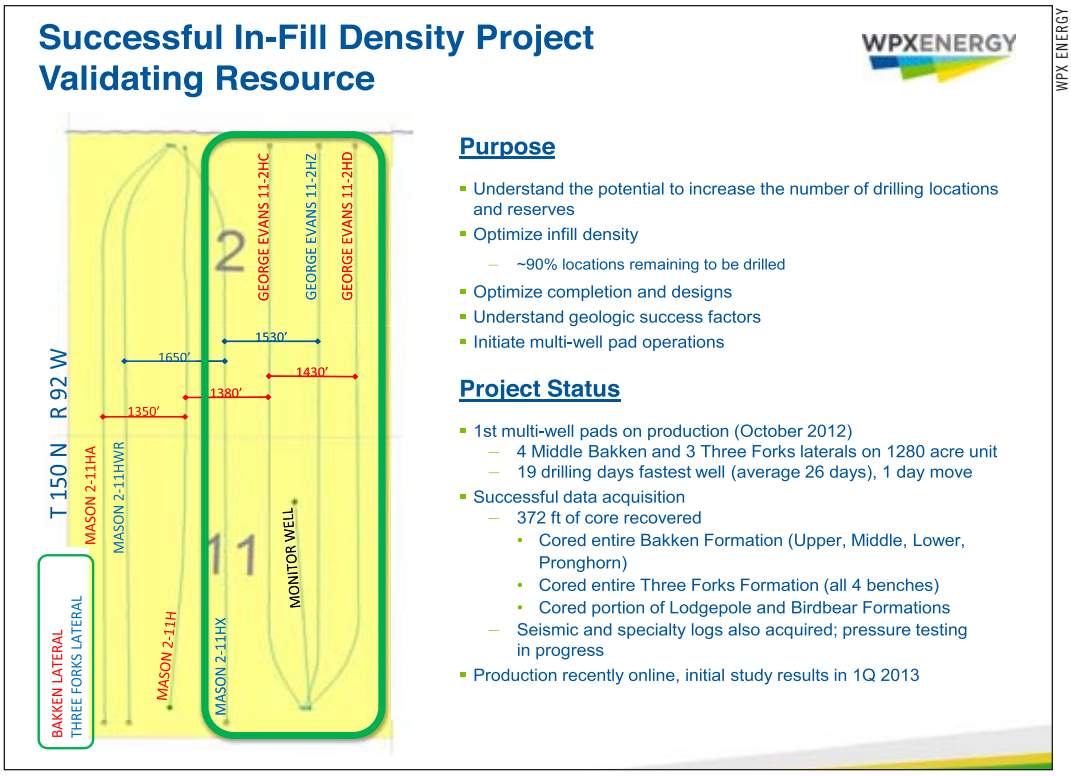
"We've done a number of things on the drilling side, as well as the completion side. I'd say chief among them has been eliminat-

ing or greatly reducing trouble time. We have our new rigs in place. We have changed out a number of critical vendors, predominantly with respect to geosteering, which has helped us to keep our well bores in zone, eliminate shale strikes, which is often the … leading issue around problem wells."

Guderian said WPX had transitioned three of its four rigs to brine drilling, "which allows us to penetrate the well bore more quickly."

On the completion side, the "big change for us middle of last year was going back to plug-in-perf more traditional type operations. …. I think industry, as a whole, and we were no exceptions, had a number of problems with the sleeves and some operators continued to use them. But now that we've transition to pad drilling, we feel like plug-in-perf can be done almost as efficiently as the sliding sleeves and certainly without the risks associated with them."

All the innovations, he said, are "getting traction."



WPX ENERGY

WPX, a wholly owned subsidiary of Williams until late 2011, entered the Williston Basin at the end of 2010 with the $949 million acquisition of Dakota-3 E&P Co.

WPX is slated to invest $370 million in Bakken wells in 2013.

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XTO incorporates lower Three Forks in plans

By KAY CASHMAN
Petroleum News Bakken

As of the end of May 2013, there were only 11 producing oil wells in the lower Three Forks formation within the Bakken petroleum system in the Williston Basin.

One of those wells was drilled by XTO Energy, a subsidiary of ExxonMobil with a 25-year track record of studying and making unconventional resource plays commercial.

Although the company mainly focuses on the prolific middle Bakken member and the first bench of the Three Forks, it also has acreage that it thinks is very prospective for second bench wells and is working to incorporate the zone into its long-term plan for optimization of its Bakken petroleum system assets in the Williston Basin.

XTO's production growth in the basin has been impressive and can be attributed both to acquisitions, such as the $2 billion buy of Denbury Resources North Dakota and Montana Bakken assets, and the drill bit, which includes moving into development phase in 2012 and adding drilling rigs. (As of July 1, 2013, it had 10 rigs in North Dakota, where it operates in eight western counties, and one rig in Montana, where it operates in two northeastern counties.)

In the latest monthly report from the state petroleum offices in North Dakota and Montana, XTO ranked as the seventh largest oil producer from the Bakken petroleum system in North Dakota with an average of 36,836 barrels a day, and No. 3 in Montana, with an average output of 5,739 bopd.

Unlike many of the other oil and gas companies doing business in the Williston Basin, XTO says very little publicly about its activities to increase its recoverable reserves in the Bakken, likely because it is the world's largest publicly traded international oil and gas company, making the Bakken a very small piece of the whole.

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Lower Three Forks zones show promise

By KAY CASHMAN
Petroleum News Bakken

Most Bakken petroleum system oil in the Williston Basin is currently produced from the middle Bakken tight oil reservoir, consisting of an interbedded sequence of siliciclastics and carbonates that is sandwiched between two zones of shale, the most common source rock worldwide for petroleum. There is also some production from the upper bench of Three Forks formation, another non-shale, tight, reservoir, made up of an interbedded sequence of green mudstones and tan silty to sandy dolostones. (Red beds and anhydrites occur in the lower half of the Three Forks — i.e. the third and fourth benches.)

Just how much production comes from the Three Forks is not known because as a formation within the Bakken petroleum system, the upper Three Forks bench is considered part of the Bakken pool, so most E&P companies simply identify production in reports to the appropriate government agencies as Bakken.

Production from the lower benches of the Three Forks is much more closely watched because it is essentially still a science project.

According to Continental Resources' senior vice president of exploration, Jack Stark, as of the end of May 2013 there were only 11 producing wells in the lower benches of Three Forks in the U.S. Williston Basin, meaning second and third benches since none have yet been drilled into the fourth bench.

Five wells have been drilled by other oil and gas companies — EOG Resources, ConocoPhillips, XTO Energy and Zenergy — and six by Continental.

Of the 11 wells, eight are second bench producers with an average initial production, or IP, of 1,695 barrels of oil equivalent per day and a range of 1,031 to 3,150 boe per day.

Three of the 11 wells target the third bench of the Three Forks and produce an average IP of 797 boe a day and a daily range of 465

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THREE FORKS *continued from page 56*

to 1,340 boe.

Stark talked about preliminary results from both private and state models designed to quantify the potential of the lower Three Forks benches in a late May presentation to DUG Bakken and Niobrara conference attendees in Denver, reported by Oil & Gas Investor on June 5.

Recalling a Bakken petroleum system estimate made by Continental in 2010 that predicted ultimate recoverable reserves of 24 billion boe, which excluded the lower Three Forks benches, Stark said an update to include the lower benches would increase the estimate to 32 billion barrels (see chart on page 21).

The revised estimate incorporates lower Three Forks core data and keeps unchanged the 3.5 percent recovery factor used with the previous estimate of reserves based on the middle Bakken and upper Three Forks formation members.

"What is the true recovery factor? We still don't know; we're still estimating it," Stark was quoted as saying in Hart Energy's Oil & Gas Investor. "However, for perspective, every 1 percent in incremental recovery factor translates into an additional 9 billion barrels of estimated ultimate recoverable reserves in the field. It's a remarkably huge field."

Stark said second and third bench performance was consistent with Continental's geologic mode.

"The third bench doesn't have as good reservoir characteristics as the second bench, but they still contain oil and they will deliver."

With anhydrite nodules, the third bench tends to have a little less continuity and greater variability, Stark said, noting the fourth bench was "much more localized" and found more on the west side of the Bakken system versus the east.

Helms upbeat

Continental is not alone in its optimism about the untapped potential of the lower benches of the Three Forks.

When asked what effect the lower benches could have on overall North Dakota oil production during the North Dakota Oil and Gas Division's monthly press conference on June 14, 2013, Director Lynn Helms said that recent modeling suggests that long-term recoveries from the Three Forks could be much higher than initially thought.

Helms said that based on preliminary results from both private and state models, he believes that production curves for the lower benches of the Three Forks formation, which is part of the Bakken petroleum system, will extend out farther than originally estimated. "So in other words, we don't think that the natural production is going to go a lot higher than what the current models say," Helms said. "But we think that the lower benches of the Three Forks are going to result in that peak being really extended. So that instead of hitting a peak and it dropping off, starting to decline in a year or two, we could see a decade of those kind of production numbers."

As Petroleum News Bakken reported earlier in June, the North Dakota Industrial Commission approved a grant of $8 million to the North Dakota Oil and Gas Research Council to help fund a $115 million, three-year project to evaluate exploration and production in the various benches of the Three Forks formation in the Williston Basin. The project, which will focus on exploring Three Forks reserves, determining optimal Bakken pool well densities and optimizing Bakken production, will be conducted in McKenzie County.

Helms said industry is picking up the additional $107 million needed to fund the project.

And while it is very early in terms of how many wells and what the overall potential is going to be, the preliminary results are exciting.

"I just met with a couple of operators last week and they're both looking at deeper Three Forks benches, and industry has got a lot of plans ongoing with regards to infill drilling and development."

According to the Oil & Gas Investor article, Continental is proving incremental reserves from the lower Three Forks in two ways, the first being drilling interference tests that offset exploratory wells.

In its North Dakota Barney unit, where initial wells have been producing from the second and third benches, wells testing for interference will be drilled in the adjacent upper zone, but offsetting by 660 feet.

Continental's second approach, the publication reported, is with its Hawkinson 320-acre pilot density project, which involves testing full development of four zones on 320-acre spacing within a 1,240-acre unit. The pilot provides for drilling 11 new wells near three existing producers — two in the upper Three Forks and one in the middle Bakken — whose combined production is running at running at 800 barrels of oil a day.

Of the 11 wells, seven will be new wells targeting the first three Three Forks zones, as well as the middle Bakken.

The remaining four will be monitor wells, "and we're going to have three of them live every time we do a frac," said Stark.

Stark said the company hopes "to have the project basically all complete and turned on" by November 2013.

To date, Stark said Continental is "very encouraged" by results from the lower benches, which have shown performance characteristics suggesting separation.

"We want to get to the next step and to be able to say with proof positive that we are dealing with incremental reserves, and if there is some communication to be able to say what percent is truly incremental reserves from these zones. So stay tuned," Stark said.

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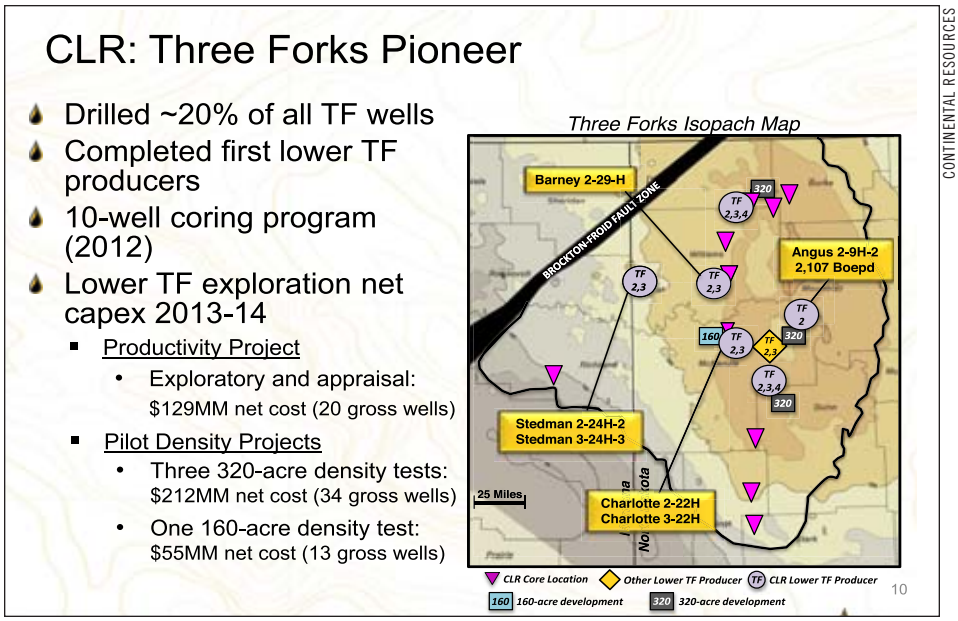

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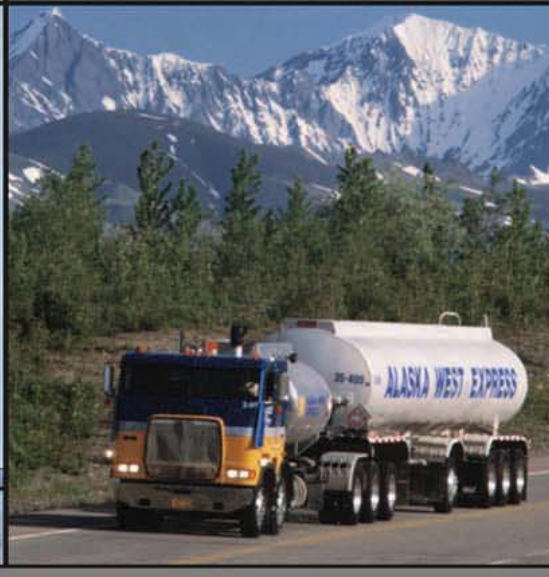

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