Exploration of the Alberta Bakken: A Resource Play Mosaic in the Making?

A Brief Tour Through The School of Rock

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The Warm-Up Act

AN EMERGING LIGHT OIL RESOURCE PLAY

A number of oil and gas companies on both sides of the Canada-United States border have recently focused intensely on an emerging light oil resource play known as the Alberta Bakken. We estimate industry expenditures on land acquisition, joint venture arrangements, exploration work, and drilling of approximately $0.5 billion to date.

The industry’s interest is centred on the southern extent of the Alberta Basin, which straddles northwest Montana and southern Alberta. To date, Canadian operators have licensed 23 wells, 21 of which are classified as new field wildcat locations, with 16 wells spud and 10 rigs released from location so far. On the U.S. side, industry has similarly licensed 24 wells, 22 of which were classified as wildcats, with 15 already spud and 13 rigs released to date.

WHAT DOES INDUSTRY SEE?

The purpose of this report is to ask and attempt to answer the following simple questions:

- What are the factors that have drawn industry to the specific area of southern Alberta and northwest Montana?
- What are the factors that argue in favour of the play’s success?
- What are the risks and challenges that should also be considered?

The common market adage about the play is that nothing will be known until the drilling confirms or condemns the area. While in an ultimate sense this is true, we also see this as an incomplete viewpoint and believe there is much more that we can understand now as industry stands on the leading edge of its efforts to assess and appraise the play.

We have met with numerous management teams and industry sources to investigate the play. In effect, we have attempted to construct the mosaic of technical and industry factors that argue in favour of the Alberta Bakken. Hand in hand with the vast potential of the mosaic – and given that, like rock ‘n’ roll, exploration can be a vicious game – we have similarly attempted to highlight the challenges that go along with exploration of a new play, with consideration to technical and economic hurdles that must be monitored and overcome.

WHAT DOES THE MOSAIC LOOK LIKE?

We have identified 16 factors that we view as bullish indicators for the potential success of the Alberta Bakken play, which comprise 12 technical items and four industry considerations.

Technical factors in favour of the play:

1. source rock;
2. extensive hydrocarbon saturation;
3. in the oil window;
4. overpressure;
5. fracture enhancement;
6. reservoir;
7. formation penetrations;
8. log, core, cutting, and drill stem test analyses;
9. historical production precedents;
10. recent perforation and test sample;
11. recent production data; and
12. regionalization.

Industry factors that support the play:
1. land acquisition activity;
2. multiple parties;
3. multiple drilling licenses; and

WHAT IS THE POTENTIAL?

One participant in the play, Rosetta Resources Inc., has noted resource in place of 13-15 mmbbl per section with overpressured, movable, high-quality light oil conditions confirmed through its exploration to date in Montana. Given the performance of industry in the Williston Basin’s Bakken play, investors have good reason to be excited, due to the size of the Alberta Basin Bakken area of interest in southern Alberta and northwest Montana. In our view, the area has material regional extent with an estimated 175 km (110 mi) north-south, and 55 km (35 mi) east-west fairway. While we do not think we are at point where it is appropriate to trumpet the potential size of the resource in place, given the early-stage nature of industry’s progress so far, the math is easily doable and implies vast potential in the multiples of billions of barrels. The extent of the oil in place is subject to many risk factors such as formation thickness. More importantly, the question of whether or not the resources are recoverable and producible at economic rates does remain to be answered. It is premature to peg type curves onto the play, in our view, and potential does not take you to the top of the charts, but we do believe the mosaic offers good justification for industry’s interest in the area to date.

WHO HAS EXPOSURE TO THE PLAY?

This report contains detailed mapping of the key landholders in the region, which includes 34 key owners in Canada and 10 in the United States. Below is a list of the identifiable company participants on both sides of the border – 15 in Alberta and 12 in Montana – for which we have further investigated in this report. We provide research coverage for eight.

Canadian-side participants:
- Crescent Point Energy Corp.*
- Canadian Natural Resources Limited*
- Encana Corporation*
- ExxonMobil Canada Ltd. (private)
- Murphy Oil Corporation*
- Nexen Inc.*
- Shell Canada Limited (private)
- Argosy Energy Inc.
• Blacksteel Energy Inc.
• Bowood Energy Inc.
• DeeThree Exploration Ltd.
• Legacy Oil + Gas Inc.*
• Pace Oil & Gas Ltd.
• PetroSpirit Resources Ltd. (private)
• Wild Stream Exploration Inc.*

U.S.-side participants:
• Anschutz Exploration Corporation (private)
• Newfield Exploration Company
• Quicksilver Resources Inc.
• Rosetta Resources Inc.
• Abraxas Petroleum Corporation
• Arkanova Energy Corporation
• American Eagle Energy Inc.
• Compton Petroleum Corporation*
• Mountainview Energy Ltd.
• Passport Energy Ltd.
• Primary Petroleum Corporation
• Stone Energy Corporation

WHAT SHOULD INVESTORS LOOK FOR?

We aim to monitor industry as it attempts to properly science the play, from assessment and appraisal, through to development. Of the 44 key owners identified, 14 operators have licensed locations and nine have actually drilled and rig released wells so far. Over the next 12 months, look for specific operator confirmations of overpressure, movable oil, and rock amenability to mechanical stimulation, along with the establishment and definition of attractive reservoir characteristics. Ultimately, it does come down to the ability to produce. We estimate initial 90-day rates in the 100 to 225-plus boe/d range are required for cost of capital returns, relative to low case well costs of $2.5 million and high case costs of $4.5 million-plus.

TUNE IN AND TURN IT UP

There are many forms of rock, in both geological and musical respects. All things being equal, we prefer hard rock to soft rock. The oil and gas business is more commonly focused on softer rocks, but make no mistake, we like good rock when we see it – and hear it. Our quest is to see if industry can turn up the volume from the rock of the Alberta Bakken play, and we like what we hear so far. Welcome to our brief tour through the School of Rock.

* Currently covered by Scotia Capital Equity Research.
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START ME UP

The Bakken crude oil play of the Williston Basin in both the United States and Canada has become very well known, and continually better understood and exploited in recent years. In the United States, production currently stands at 380,000 boe/d,\(^1\) while the Canadian side of the border presently offers 70,000 boe/d. The U.S. Geological Survey (USGS) was caused to increase its assessment of technically recoverable oil in 2008 to a range of 3.0 billion to 4.3 billion barrels on the U.S. side of the border, an assessment that increased 25 times versus its 1995 analysis.\(^2\) The ultimate potential of the various play components on both sides of the 49th parallel may prove higher yet in the years ahead. In fact, retiring U.S. Senator Byron Dorgan of North Dakota called upon the USGS to re-examine its assessment of technically recoverable oil,\(^3\) and U.S. oilman Harold Hamm of Continental Resources Inc. recently suggested the ultimate recovery is more likely to be in the order of 20 billion barrels in Montana and North Dakota alone.\(^4\)

DOWN IN A HOLE

Several factors have coalesced over the past decade-plus to increase recoveries from the Bakken play and other tight oil plays in North America. Chief among them was a more effective application of horizontal drilling and completions techniques. Specifically, the previously available technologies of horizontal drilling, well bore segmentation, and hydraulic formation stimulation have combined to create what is now otherwise known as horizontal multi-stage fracturing, a recovery technique that continues to evolve positively with the benefits from industry learning and refinement.

54-40 (OR FIGHT)

While the Bakken play is most commonly associated with the Williston Basin, the Bakken in a broad sense is actually a pervasive source rock for the entire Western Canadian Sedimentary Basin. It may confuse the issue, but it should be noted that the Western Canadian Sedimentary Basin in this regard encompasses the Williston Basin as well as the Alberta Basin. Students of history (and of rock) will recall an early American concept of Manifest Destiny, which argued through an associated slogan of “Fifty-Four Forty or Fight” that the United States was to rightly acquire the lands of Canada up to the 54th parallel, or 54° 40’, to be specific. While this obviously did not come to pass (the number 1812 may come to mind for some now, as it did then), there is an element of destiny with respect to how the Bakken formation, and its equivalents, were created on a geologic time scale.

Exhibit 1, sourced from the National Energy Board of Canada and adapted from the Geological Survey of Canada, shows the Lower, Middle, and Upper depositional units of the Bakken formation, which spans the Western Canadian Sedimentary Basin. The depositional units, broadly shown, reach from the Dakotas in the United States right up through Western Canada and as far north as the Yukon and Northwest Territories, in the range of 43° latitude to 62° latitude, and effectively straddle the modern-day Canada–U.S. border.

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3 "Dorgan asks agency to re-evaluate Bakken," *Bismarck Tribune*, December 29, 2010.
Exhibit 1: Bakken Play Area and Depositional Units

A BOY NAMED SUE ... AND A PLAY NAMED BAKKEN (OR EXSHAW?)

In North Dakota, northeast Montana, Manitoba, Saskatchewan, and southeast Alberta, the Bakken formation of the Williston Basin may be composed of up to three distinct members:

1. black mudstone upper member,
2. gray mudstone/sandstone middle member, and
3. black mudstone lower member.\(^5\)

Atop the Bakken in the Williston Basin typically lies the Lodgepole, while below the Bakken, the Three Forks is generally present.

Moving further west and north, in the balance of Alberta and northeast British Columbia, along with northwest Montana, the formation industry now commonly refers to as the Alberta Bakken is technically named the Exshaw formation. Centred in the Alberta Basin, the Exshaw is more appropriately characterized as a geologic time-equivalent formation to the Bakken formation proper of the Williston Basin. The Exshaw formation can be characterized as a black shale, which may be composed of the following:

1. black shale upper member,
2. siltstone middle member, and
3. black shale lower member.\(^6\)

West of the Sweet Grass Arch, and atop the Exshaw formation, the Banff (equivalent to Lodgepole in the Williston Basin) is a second formation that can be rich in organic content and that is characterized as a basal, black shale.\(^7\) Overlying the basal Banff shale, the Banff is composed of Banff carbonate cycles, while the Big Valley (equivalent to Three Forks in the Williston Basin) underlies the Exshaw.

Exhibit 2 shows the correlation and distinction of these formations postulated by Mark Smith and Marc Bustin, with a key demarcation line between the two being the Sweet Grass Arch, which runs roughly north-south along the Alberta-Saskatchewan border for reference purposes.


\(^{6}\) Ibid.

\(^{7}\) Ibid.
Exhibit 2: Distribution of Bakken and Exshaw Formations


LAY IT DOWN

The analysis conducted by Smith and Bustin argues the following:

“The Late Devonian and Early Mississippian Bakken and Exshaw formations are a continuum of regionally correlated, organic rich (up to 35% total organic carbon), black shale source rocks covering much of the Western Canadian Sedimentary Basin.”

Exhibit 3 shows how the various formations correlate to one another to be considered geologic equivalents. In this report, the geologic terms for the Williston Basin (Lodgepole, Bakken, and Three Forks) and its equivalents (Banff, Exshaw, and Big Valley) will be used interchangeably with the broad sense of Alberta Bakken, focused on these formations in the Alberta Basin.

8 Ibid.
Exhibit 4 further shows the burial history of an example of the Williston Basin at 16-36-1-18W2, versus history for 16-29-1-11W4, which is on the eastern edge of the Alberta Bakken in the vicinity of a feature known as the Kevin Sunburst Dome. It is not in the sweet spot of industry’s interest in the Exshaw but provides an indicative representation nonetheless. The burial history of 8-17-53-21W4 in the Alberta Basin is also shown for reference purposes, but is further north of industry’s current focus in southern Alberta.
“Most rock journalism is people who can’t write, interviewing people who can’t talk, for people who can’t read.”

– Frank Zappa

DAZED AND CONFUSED

The two formations are often described as equivalents, but does the Exshaw equal the Bakken? The depositional histories are similar, while the burial histories and timing are different, so the formations described are correlated rather than identical. At the same time, it should be noted that, in combination, as part of the Devonian-Mississippian petroleum system, the Bakken and Exshaw formations have commonalities and acted as very important hydrocarbon source rocks as oil migrated from these layers into ultimately what are some very notable reservoirs and trends in the Western Canadian Sedimentary Basin. Exhibit 5 identifies these postulated migration paths that sourced modern-day hydrocarbon pools and accumulations.

Further, some theories advance the notion that the Exshaw, from geochemistry and biomarker perspectives as well as the regionally extensive nature of the formation, may potentially be the source rock responsible for the modern-day oil sands deposits of Alberta. The purpose of this report is to concentrate on industry’s interest in the Alberta Bakken resource potential of southern Alberta and northern Montana, but the migration analysis and theories underscore that these are prolific source rocks, which themselves have become of greater interest for unconventional exploration and exploitation rather than the more traditional migration chase for hydrocarbons in conventional accumulations.

SEE ME, FEEL ME

While the burial history of the Banff and Exshaw formations generally places the formation at depth, given structural elements of the Western Canadian Sedimentary Basin as it approaches the disturbed belt of the Rocky Mountain region, there are three observable outcrops in Alberta, the most famous of which is likely the Jura Creek Canyon area, located just north of the Trans-Canada Highway between Calgary and Banff, Alberta, as the Rocky Mountains rise up from the Great Plains. Exhibit 6 shows the Exshaw type section at Jura Creek, which clearly features the siltstone member and the black shale member.

Exhibit 6: Core and Outcrop Samples Sites in Alberta for the Banff and Exshaw Formations

The work of the ERCB/AGS analysis indicates 16 core sample sites in Alberta of the Banff and Exshaw formations with 72 samples taken, in addition to the three outcrop sites with 59 samples taken. There are varying components of data and inferences that can be made from these samples, but in our estimation, the analysis helps confirm the pervasive nature of the source rock and its prospective nature for hydrocarbon exploitation under the right conditions.

WHEREFORE AND WHY

“It’s difficult to get started – when it comes to dealing with an unknown quantity, people are reluctant to trust their own opinion. It helps if two or three people give you a boost.”

— Lyle Lovett

Given these source rocks are pervasive from the Dakotas of the United States all the way through to the northern territories of Canada, what are the conditions and interpretations that have emerged to suggest that, as formations, the Bakken/Exshaw continuum may prove productive beyond its current unconventional sweet spot of development centred in the Williston Basin? Two areas have received notable attention of late. The most prominent is in southern Alberta and northwest Montana, while the Horn River Basin of northeast British Columbia has also come to light.

We are Alberta (and Montana) bound in the next section, but shall deal with Horn River first, as the information with respect to the Bakken/Exshaw play on this front is fairly limited at this stage. While Horn River is not the focus of this report (see our August 2010 Oil & Gas Spotlight: Horn River Shale report for further details about this natural gas shale play), it is important to note that Quicksilver Resources Inc. indicated the following in 2010:

- Drilled three wells into the Muskwa and one well into the Klua.
- Each well intersected the Bakken/Exshaw in 50 to 60 ft intervals.
- Logs indicate oil saturation in the formation.
- Sidewall core samples show significant mobile oil saturation (11%-34% of pore volume).

Anecdotally, we understand other operators may have also intersected the Bakken/Exshaw formation with similar observations in the Horn River area without official comment. Quicksilver has one further horizontal now drilled into the play but the well is not expected to be completed until summer 2011.

Given the widespread extent of the Bakken and Exshaw formations, it is also insightful to understand where the conditions are favourable for the existence of petroleum system maturation. Exhibit 7 shows the interpretation of mature Devonian-Mississippian oil windows in the green shade, which in Canada roughly correlates with the Bakken play of southeast Saskatchewan, along with an extensive north-south path through Alberta and northeast British Columbia.

There is a significant window of opportunity in Western Canada with respect to the potential for overpressured and mature petroleum generation to exist. As exploration on this front continues, there may be other areas that show potential, such as in Horn River, but our attention now turns more specifically to southern Alberta and northwest Montana.

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11 Oil saturation equals the reservoir oil volume divided by the pore volume (Source: Encyclopaedia of Petroleum Science & Engineering, 2003).
Exhibit 7: Devonian-Mississippian Petroleum System and Hydrocarbon Maturity Windows

MORE THAN A FEELING – TECHNICAL ARGUMENTS IN FAVOUR OF THE PLAY

Over the course of the past two years, we estimate industry in both southern Alberta and northwest Montana have collectively invested $0.5 billion into the play in land and exploration expenditures to date. The intent of this report is to better understand the mosaic of data and technical factors that have driven management teams to focus on this specific area. In this respect, we ask, What are the reasons the play could work and what current data point towards its potential success?

1. Source Rock

The previous discussion has demonstrated the extensive presence of source rock, which is a basic, but also essential, starting point in the exploration for new resource plays.

2. Extensive Hydrocarbon Saturation

Through the area, our analysis indicates there is significant and widespread hydrocarbon saturation, which in many cases is a thickness measured in the hundreds of metres, with the Banff, Exshaw, and Big Valley taken into combination. In this respect, we view the area as supportive of a continuous petroleum system. For reference, the following quotation from Stephen Sonnenberg and Aris Pramudito, describing the Williston Basin, in our view also largely applies to the Alberta “Bakken” analog:

“A continuous accumulation is a hydrocarbon accumulation that has some or all of the following characteristics: pervasive hydrocarbon charge throughout a large area; no well defined oil- or gas-water contact; diffuse boundaries; commonly abnormally pressured; a large in place resource volume but a low recovery factor; little water production; geologically controlled sweet spots; reservoirs commonly in close proximity to mature source rocks; reservoirs with very low matrix permeabilities; and water occurring updip from hydrocarbons. The Bakken petroleum system meets all these characteristics.”

3. In the Oil Window

The area in southern Alberta and northwest Montana that is of greatest interest to industry is bounded by the disturbed belt, or over-thrust activity, created by the Rocky Mountains to the west, the Sweet Grass Arch and Kevin Sunburst Dome to the east, the Vulcan Low to the north, with a southern extent somewhat in question as it moves deeper into Montana.

In general, the burial depth and burial temperature created by the disturbed belt increases the likelihood of natural gas generation, as opposed to oil generation, as evidenced by local natural gas production along the Rockies and its eastern slope foothills region (and operators would also likely encounter materially higher drilling costs as a result). Broadly, to the east, the play also exhibits a likely decrease in oil generation and maturation levels from the Banff-Big Valley interval. Exhibit 8 demonstrates this through the work of U.S. Geological Survey members Debra Higley and Michael Lewan and their analysis of vitrinite reflectance values, which show the areas in southern Alberta prospective for the various phases of maturation for both oil and natural gas, in the context of the burial history at maximum depth approximately 60 million years ago, as the hydrocarbon was generated.

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13 A measure of the thermal maturity of organic matter. This analytical method was developed to rank the maturity of coals and is now used in other rocks to determine whether they have generated hydrocarbons or could be effective source rocks. The reflectivity of at least 30 individual grains of vitrinite from a rock sample is measured under a microscope. The measurement is given in units of reflectance, % R0, with typical values ranging from 0% R0 to 3% R0. Values for gas-generating source rocks typically exceeded 1.5% (Source: Schlumberger Oilfield Glossary).

“I’m the artist formally known as Beck. I have a genius wig. When I put that wig on, then the true genius emerges. I don’t have enough hair to be a genius. I think you have to have hair going everywhere.”

– Beck

Similarly, Exhibit 9 further shows the Geological Survey of Canada’s interpretation for Western Canada, based on the indication of present-day maturation levels, and generally agrees with the work of the U.S. Geological Survey’s members with respect to southern Alberta, with slightly greater maturity given the passage of time.

We view industry’s attention as appropriately directed towards southern Alberta and northwest Montana given it is fair to say the area is in the oil window.
Exhibit 9: Vitrinite Isoreflectance Contours for Exshaw–Bakken Formations and Equivalent Strata

Figure 4. Vitrinite isoreflectance (%Ro) map for late Devonian to early Carboniferous 'Exshaw-Bakken group' and equivalent strata (see text for explanation of stratigraphic units) in the WCSB.

Source: ©2002 Geological Survey of Canada (Calgary); Scotia Capital.
4. Overpressure

The conditions for overpressure exist in the fairway, given source rock that was buried deep within the oil-generation window and had tight rocks above and below that constrained the migration of oil updip. The presence of these constraints isolates the accumulation and allows pressure build-up, in our view. Analysis by Stephan Nordeng on the Bakken petroleum system articulates this point from a Williston Basin perspective:

“Overlying and underlying rocks that are sufficiently thick, widespread and impermeable so as to isolate the accumulation (i.e., Bakken Formation, Three Forks Formation, and the Lodgepole Formation).”

5. Fracture Enhancement

- **Geopressure and micro-fractures.** There is geopressure present in much of the area that industry has pursued, evidenced by overpressure in formation well penetrations. Further, there is overpressure above and below the Exshaw, which is a commonality with components of the Bakken play of the Williston Basin. The overpressure can locally fracture the rock through the conversion of source rock to hydrocarbon and is theorized to be present in the Exshaw, and evidenced by the 100/10-30-008-23W4/00 well (discussed in greater detail on pages 23 and 25), which demonstrates 15 kPa per metre versus normal pressure of approximately 10 kPa per metre for southern Alberta. The presence of these micro-fractures would argue for enhanced permeability and ability to produce hydrocarbons and is a critical piece to the technical arguments that could support the play.

- **Tectonic activity.** The area of industry focus in southern Alberta and northern Montana is near the disturbed belt represented by the Rocky Mountains. Upon the mountain-building event, compressive action occurred on a regional basis, which helped to create thrust faulting and a regional stress regime. The maximum principal stress is orientated in a northeast to southwest direction. This allows one to predict that vertical fracture planes would be parallel to this maximum principal stress. Therefore, we expect operators will generally want to drill obliquely or perpendicularly to this orientation (i.e., versus the $S_{\text{Hmax}}$ trajectories in Exhibit 10). The play is also bounded by the Vulcan Low to the north and the Sweet Grass Arch to the east.

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16 Pressure increases predictably with depth in areas of normal pressure. The normal hydrostatic pressure gradient for freshwater is 0.433 psi/ft, or 9.792 kPa/m, and 0.465 psi/ft for water with 100,000 ppm total dissolved solids (a typical Gulf Coast water), or 10.516 kPa/m. Deviations from normal pressure are described as high or low pressure (Source: Schlumberger Oilfield Glossary). Note that water salinity of 100,000 ppm relates to the Gulf Coast and does not typically occur in Western Canada until greater depths than those in question in the Alberta Bakken play, such that 9.8 kPa/m is a better approximate benchmark for normal pressure.


18 Ibid.
**Extensional faulting.** In the period after the mountain-building event occurred, the sedimentary rocks effectively relaxed, where it is theorized that extensional faulting occurred. In this respect, there are arguments in favour of more localized creation of natural fractures. Dependent on the proximity of these extensional fractures, this could foster a stronger regional potential to produce than from non-naturally fractured rock. Specifically, extensional faulting could result in enhanced fracturing and therefore permeability of the reservoir rock. An analysis by Sophie Lemieux of the Southern Alberta Lithospheric Transect (SALT) suggests the following:

“Thus, the two fault geometries imaged on the SALT data lead to the interpretation that a widespread extensional event must have occurred during the Late Cretaceous tectonic evolution of the WCSB in southern Alberta.”

Exhibit 11 shows a sampling grid from the Geological Survey of Canada, which from a broad perspective, highlights where the SALT seismic lines analyzed by Lemieux are located in a regional sense.

![Exhibit 11: Aeromagnetic Anomalies and Crustal Domains of Southern Alberta and Northern Montana](image)

Exhibit 12 provides a view of extensional faulting in southern Alberta, and more specifically in the Fort MacLeod and Lethbridge areas near the Blood reserve.

**Exhibit 12: Extensional Faulting on the Southern Alberta Lithospheric Transect and Fault Geometries Example**


- **Fracture enhancement caveats.** It should be noted that tectonic and extensional faulting are not expected to affect all areas, but if an operator is close to a fault plane, then it could, as a more localized aid, enhance fractures. What is not completely known is how widespread the fracturing is, what the spacing of the fracture planes is, and what contribution these features may make to rock permeability.
6. Reservoir Question

The application of horizontal drilling and multistage fracture treatment by industry to hydrocarbon exploration and development has arguably expanded the notion of what reservoir rock is over the past decade. Whereas reservoir rock was previously largely governed by naturally occurring porosity and permeability, and shale rocks were typically viewed as source rocks rather than reservoir, the technological unlocking of shale can result in situations where the shale itself is a reservoir, source rock, and trap.20 Today’s drilling and completions technology, in combination with the qualities a shale source rock can offer (i.e., thermally mature organic matter in an overpressure condition with the potential for natural fractures or fracture amenability), means that fracture enhancement can be mechanically induced. As an analog, it is theorized that Slave Point production from the Horn River Basin area in northeast British Columbia was sourced from the Evie and Muskwa shales, which are equivalent to the Duvernay formation in Alberta. The Evie, Muskwa, and Duvernay shales themselves have become the target of very active industry exploration and development in recent years. With these concepts transferred back to the Alberta Bakken, the potential for today’s technology to unlock light oil shale source rock is real, in our view, and could be further enhanced by access to greater permeable and porous rock through interbedded siltstones and sandstones, contained within a closed petroleum system. In the North Dakota Bakken, the middle Bakken, with its silt, sand, and carbonate sequence that has low permeability and porosity, has proved to be the main zone of interest. Among the American operators in the Alberta Bakken play, Newfield Exploration Company and Rosetta Resources Inc. refer to reservoir contained within the Bakken petroleum system, which includes the upper Wabamun, the Exshaw, and portions of the lower Banff. Further drilling is required to isolate key areas of potential productivity.

7. Formation Penetrations

Our mapping of the Exshaw in southern Alberta and northwest Montana includes an assessment of all the well penetrations through the formation to date. From Townships T1 to T15 and Range 1-15W4 on the Canadian side, there are an estimated 268 wells by industry penetrating the Banff-Big Valley interval over 180 square townships. Within the fairway (defined by shows, production), there are 119 observable wells, approximately 76 of which have a show in the Banff-Big Valley interval. While this is a very sparse level of drilling density at 1.5 wells per township, it is not an undrilled area.

On the Montana side, in the vicinity of the Blackfeet Reservation, from observable data, it is estimated the drilling density is lower, with approximately 15 penetrations witnessed over Townships T32N to 37N and Ranges R5W to R13W. This is an even sparser level of drilling at an implied density of 0.3 wells per township. Again, a minimally explored area, but not entirely untested.

Importantly, from an exploration perspective, we note the overall well control is very limited, in our view, compared with the Williston Basin upon the emergence of its Bakken play, and implies a higher level of risk, of which investors should remain well cognizant. It should be kept in mind that within the spectrum of risk, the Alberta Bakken is still high-risk, new field wildcat territory versus much of the Williston Basin Bakken, which is more in the delineation, development, and exploitation phases. Yet, hand in hand with risk, the prize could also offer material rewards.

8. Log, Core, Cutting, and Drill Stem Test Analyses

Analysis of well logs helps allow for mapping of the potential play fairway area, with the caveat that there is not a lot of data. What the logs do show are localized thicks (thick Banff-Big Valley intervals), as shown by isopach maps. The question is, Will these provide localized sweet spots? Drilling to date is testing this idea, with locations by key players that appear to be on and off of identifiable thicks. Drilling off the thicks could represent an effort by larger companies to establish a more regionalized suite of contingent resources or may simply be premised on interpretations (such as seismic) not available to outsiders.

Our mapping from the perspective of log evaluations in Montana consisted of reviews of the Bakken/Three Forks (U.S. equivalent to Exshaw in Canadian nomenclature, interpreted as the interval between the Mississippian Lodgepole Limestone/Dolomite and the Devonian Potlatch Limestone). Of the 180 logs analyzed, 29 penetrated the Bakken/Three Forks interval. Most logs were a combination of either SP/Resistivity or GR/Neutron with a mudlog description. The SP/Resistivity was not of high quality, given the reviewable data available. In order to establish an estimate for total organic carbon content (TOC), cores, cuttings, etc. would be required from the intervals.

In western Montana, south of the Blackfeet Reservation area of industry focus, Primary Petroleum Corporation noted in November 2010 that its evaluation of the Bakken core indicated TOC in excess of 14% from the Bakken, along with oil staining and fluorescence from well cuttings in the area. Primary Petroleum noted the cuttings and core evaluations were accessed through the Montana Board of Oil and Gas in Billings, and the USGS in Denver.

In Alberta, the 100/10-30-008-23W4/00 well (discussed further in Historical Production Precedents on page 25) was cored in the Banff formation and demonstrated permeability in the ranges from 0.06 mD to 0.43 mD while porosity averaged 2%.21 While this is only one dataset, the low permeability and porous nature of the rock highlights the need for horizontal drilling and multistage fracture treatment applications to unlock the play, as traditional vertical well intersections have generally not proven able to access enough productive rock.

Exhibit 13 shows log analysis of Alberta well location 100/02-16-003-21W4/00, with the Exshaw and Stettler formations highlighted for reference, indicative of hydrocarbon presence. Further, the well provides a good example of drill stem test (DST) data, which are obtained when the well operators unload fluid from the test recovery and measure the length of the drill pipe that contains oil. The diameter of the drill pipe used to recover the oil is understood, as is the time the tool was open. The data suggest approximately 30 barrels of oil entered the pipe over a two-hour timeframe. One could then infer 360 barrels as achievable over a 24-hour period, which from a production standpoint, should be reduced to a fraction thereof. Based on practice, actual deliverability over an extended period of time would be closer to 100 bbl/d, in our view. While there is extrapolation in this exercise, to be sure, we view such examples of DST data in Alberta that we have analyzed as positive factors. We did not interpret any drill stem tests for the Montana wells.

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21 The darcy (D) is a standard unit of measure of permeability. One darcy describes the permeability of a porous medium through which the passage of one cubic centimetre of fluid having one centipoise of viscosity flowing in one second under a pressure differential of one atmosphere where the porous medium has a cross-sectional area of one square centimetre and a length of one centimetre. A millidarcy (mD) is one thousandth of a darcy and is a commonly used unit for reservoir rocks (Source: Schlumberger Oilfield Glossary).
Exhibit 13: Exshaw and Stettler Well Log Analysis and Drill Stem Test Example

DST #9
1785-1820m
rec’d 315m clean oil,
85m oil cut mud,
Oil 34.4° API
Water 17,161 ppm

Source: Scotia Waterous; Scotia Capital.
9. Historical Production Precedents

In 1979, a well (located at 100/10-30-008-23W4/00) was drilled as a new field wildcat by Kaiser Oil Ltd. The well ticket notes high pressure was encountered at approximately 2,000 metres, with severe high pressure noted at 2,140 metres and a true vertical well depth of 2,390 metres. The well was brought on in 1979, with first-month (time-on adjusted) production capability of 355 boe/d, and first-year average production of 117 boe/d, which was 94% crude oil, with the balance natural gas. The well continues to pump oil at modest rates under the operatorship of Indra Oil & Gas Ltd. and has cumulative production of 244 mbbl of oil and 0.7 bcf of natural gas, for a total of 256 mboe total (see Exhibit 14).

The productive formation is listed as the Stettler, which in the view of some industry participants is effectively Big Valley, based on reviews of offsetting cores, with a formation top at approximately 2,235 metres, underlying the formation tops of the Banff at approximately 1,900 metres and the Bakken/Exshaw at approximately 2,150–2,220 metres. It is theorized the well may have drilled through a fault and/or encountered natural fractures, which enabled the cumulative production witnessed to date. While the result was not repeated, the well offers encouragement from the standpoint of pressure, in that it was producible, fracture enhancements likely exist, and there was effectively no water (47 bbl cumulative).

There are other production precedent examples, such as from the Banff formation, featured in Exhibit 15, which show cumulative production ranges from 1,000 bbl to 33,000 bbl. In our view, these wells are indicative of good oil presence but were limited by the vertical drilling and completions technology of the day.
The 06-18-009-24W4 well, which produced approximately 33,000 bbl out of the Banff formation, offers a good historical show of production from the Banff, in our view. Further, the completion records for the well indicate the well kicked upon drilling out of the stage collar, which required the operations to mud-up to an 11 lb per gallon mud weight, which implies approximately 13 kPa/m of pressure. Oil flowed from the well with initial pressure of 10.4 kPa/m, which, while lower, is still regarded as overpressured relative to interpretation of the local window of over- versus under-pressured formation in the region. We view these oil shows and pressure examples as incremental positive indicators and note that the Banff wells featured cover a wide area of investigation.

10. Recent Perforation Test and Sample

Bowood Energy Inc. recently perforated and sampled a well, previously drilled by Anderson Exploration Ltd. in 1980, which it now operates as a Bow Island shallow natural gas well. The well (located at 100/02-16-003-21W4/00) was drilled as a new field wildcat exploration well to a total depth of 2,555 metres and intersected the Exshaw formation top at 1,800 metres. The well is also one of the furthest eastern data points and is notable for a DST in 1980 that was over a large interval and tested 34° API oil quality. In its June 2010 test, Bowood conducted 5 metres worth of perforation intervals, more specifically in the Exshaw shale and siltstone, versus the 1980 test that was over a wider interval. The Bowood test sampled oil from formation with 33° API oil quality, shown in Exhibit 16.

11. Recent Production Data

The well that kicked off the play in earnest in Canada was drilled under the land broker identifier of Antelope Land Services at the well location of 100/14-07-001-21W4/00, which is known as the Del Bonita area of Alberta, just north of the Alberta-Montana border. The well was initially drilled...
under a land broker identifier because its ultimate operator, Crescent Point Energy Corp., wished to remain anonymous as it endeavoured to further increase its acreage position in the play. Drilling commenced July 24, 2010, and the rig was released off the location August 25, 2010.

From public provincial data, the well produced 140.8 m$^3$ of crude oil, 40.1 m$^3$ of water, and 32.4 e3m$^3$ of natural gas in the month of November, which comprised full-month volumes with the on-stream and off-stream time proportions unknown. At a minimum, the well suggests 36 boe/d of production, if it were on-stream over the entirety of November. The actual productivity of the well could be higher, given the percentage time it was on for the month is unknown (i.e., 720 hours through the month is the theoretical maximum time on), but is highly likely less than 100% and could be well south of this, plus the type and effectiveness of the well-completion technology applied is also unknown.

We interpret these rates as a minimum level and view it as very positive that crude oil was encountered, despite the need for further context with respect to the water component, because the return of completions load fluid to surface upon initial production can complicate interpretation. We note that the emergence of new resource plays is typically exemplified by a period of experimentation with respect to drilling orientation, and to completion and production techniques, such that one well result does not make or break a play but instead adds to industry’s mosaic of data.

12. Regionalization

The geological characteristics that could make the play work span a wide area, with industry testing in a regional setting that is approximately 175 km (110 mi) north-south, and 55 km (35 mi) east-west. While this could result in sweet spots with more local extent, we view the sheer size of the area as a positive from an exploration perspective as industry tests different concepts.

FOUR STRONG WINDS – INDUSTRY FACTORS IN FAVOUR OF THE PLAY

In addition to the technical factors discussed, we note the following developments among industry participants in the area over the past couple of years that suggest the dedication of real land and exploration budgetary dollars, along with significant technical time commitment and interest.

1. Land Acquisition Activity

The Alberta land system allows for a very transparent post view of land sale bonuses paid to the province of Alberta to acquire the right to drill on Crown land. Land acquisition activity picked up in Canada in early 2010, and Exhibit 17 shows a time series analysis by month of the land sales that were awarded. Note that our analysis takes a wide view of land activity in southern Alberta (from townships T1 to T15, and ranges R9W4 to R1W5). In reality the ultimate play fairway we expect industry to establish, with preferred overpressured conditions and appropriate exposure to the oil window, is a subset of this area, perhaps half to two-thirds the size we have evaluated. Our total dollar and acreage figures considered are therefore somewhat overstated, while our average prices per acre understated versus the areas of greatest bidding intensity reflected by our Prices Paid Heat Map, as well as versus maximum industry prices paid per acre.

Exhibit 18 further shows the land sale activity mapped by price, with lands shown in price brackets of:

- <$100/acre = 40% of total land and 3% of total prices paid;
- >$100 and <$500 = 34% of total land and 25% of total prices paid;
- >$500 and <$1,000 = 15% of total land and 33% of total prices paid; and
- >$1,000 = 11% of total land and 39% of total prices paid.
Exhibit 17: 2010 Southern Alberta Basin Crown Land Sales – Purchases by Month

Source: GeoScout; Scotia Capital.


Source: GeoScout; Scotia Capital.
Exhibit 19 shows the total land sale activity in 2010, with July the high month for the amount of land acquired at 111,000 acres, the amount of dollars paid at $64 million, and for the average price per acre paid at $575.

Overall, industry acquired 492,000 acres in 2010, at a total cost of $170 million and an average price of $452 per acre. Relative to all of the land sale bonuses paid by industry to the Province of Alberta in 2010, these sales represented 7.2% of the total proceeds. Exhibit 20 shows the cumulative acres acquired and dollars paid for acreage in southern Alberta in 2010. With year-to-date 2011 land sales factored in, we estimate these figures increase by approximately 50,000 acres and $25 million.
There are also other avenues where significant acreage was accessed over the past year, and select non-Crown freehold and farm-in areas potentially remain available, which are discussed in greater detail in the next section, *Good Ol’ Hockey Game – An Overview of the Canadian Side*. In terms of major deals, the following are notable:

- Crescent Point Energy Corp. acquired Darian Resources in July 2010, which is assumed to be a significant portion of its 1.0 million-plus net acres amassed to date, and is an example of a material-sized farm-in deal in southern Alberta, where the company assumed Darian’s obligations to lands held by Encana Corporation.

- Murphy Oil Corporation and Bowood Energy Inc. accessed significant land exposure in southern Alberta through deals with the Blood First Nation in September 2010.

- Anschutz Exploration Corporation, Newfield Exploration Company, and Rosetta Resources Inc. all entered into material-sized farm-in deals with the Blackfeet Nation of northwest Montana, which leased almost all of its reservation lands.

2. Multiple Parties

Several players are involved in Exshaw exploration at present, in both Canada and the United States. In Canada, the entities range from multi-national (Shell), to U.S. independent (Murphy), to prominent capitalization companies (Crescent Point, Nexen), to smaller entities with excellent land positions (Bowood, DeeThree). Similarly, in the United States, there are U.S. independents (Rosetta, Newfield, Quicksilver), as well as prominent private companies (Anschutz) and smaller capitalization landholders (Primary). We take the presence of companies with varying capitalization sizes, backgrounds, and origins as an important sign that, while it does not offer validation in itself, it does confirm exploration intrigue from multiple technical teams and shareholder bases.

3. Multiple Drilling Licences

Currently a total of 23 wells have been licensed on the Canadian side of the border in Alberta, while 24 wells have been licensed on the American side of the border in Montana. The bulk of these wells have been classified as new field wildcat exploration wells. The level of licensing is significant, given there has not been much in the way of exploration in the region for many years.

4. Bakken-Experienced Operators

The operators in Canada include Crescent Point, which is the largest operator of Bakken production in Canada, along with Legacy, which was one of the first entrants to achieve proof of concept in horizontal drilling and multistage fracture treatment of the Bakken play in Canada. Similarly, Newfield, Anschutz, and Abraxas are notable participants in the Williston Basin and Bakken play in the United States.
Good Ol’ Hockey Game –
An Overview of the Canadian Side

THE BLOOD TRIBE

“Ohsokayisskoohso’p.”
– Kainai Phraseology for “We Ultimately Determine Our Own Path”

The Blood Tribe, also known as the Kainai, are part of the Blackfoot Confederacy, or Niitsitapi, which means “original people” and, in addition to the Blood, includes the North Peigan and Siksika of Canada, along with the South Peigan of Montana. All of these First Nations shared common culture and language and heritage with a history that dates back thousands of years and used to span an area from as far south as the Yellowstone River in Montana to as far north as modern-day Edmonton, bounded by the Rocky Mountains on the west and the Cypress Hills to the east. While the Blood Tribe’s land position is vastly smaller than what it used to be, it represents the single largest First Nation territory in all of Canada, and with a population of approximately 10,000 people. The Blood lands are also massive in the context of industry’s exploration interest in the region and the tribe is therefore a key player (see Exhibits 30 and 31). The importance of the Blood in this regard is highlighted by agreements entered into with Bowood Energy Inc. and Murphy Oil Corporation in 2010, which are discussed in greater detail in the next section, A Canadian (Railroad) Trilogy (And Then Some).

THE MCINTYRE RANCH

The McIntyre Ranch was established in 1894 through a land purchase by Billy McIntyre from the Alberta Railway and Irrigation Company and pre-dates the formation of the Province of Alberta in 1905. The ranch was acquired by its current owners, the Thrall family, in 1947, and includes 87 sections (56,000 acres) of ranching land, which represents one of the largest deeded properties in Canada. The ranch is located in Townships T2-T4 and Ranges R21-R23W4, which is 50 km (30 mi) south of Lethbridge, situated on the Milk River Ridge in Cardston County. Per its public disclosures, the McIntyre Ranching Co. Ltd. owns approximately 81 sections (52,000 acres) of mineral title within the ranch itself, along with an incremental 72 sections (46,000 acres) outside the boundaries of the ranch proper. The area is sparsely drilled, and is partially leased out to Bowood Energy Inc., but it is sizable and therefore likely to be a frequent target of oil & gas land professionals and companies. It should be noted that should increased development on McIntyre interests occur, it is possible there could be environmental considerations per the noted grassland and environmental protection areas in Exhibit 21 (circa 1996).

24 All information for the McIntyre Ranch sourced from www.mcintyreranch.com.
FREEHOLD LAND

Two operators, Crescent Point Energy Corp. and DeeThree Exploration Ltd., have extensive farm-in acreage on Encana Corporation acreage. The Encana lands are notable from the standpoint that much of the land ties back to one of its predecessor companies, PanCanadian Petroleum Limited. PanCanadian was previously part of the Canadian Pacific conglomerate, and was afforded the freehold land associated with railway rights inherited from Canadian Pacific Railway. It is important to note that: (1) Encana is the most prominent landholder in southern Alberta; (2) a significant portion of Encana’s acreage was farmed out, and farm-in participants typically have obligations to meet, plus specific royalty arrangements payable back to Encana upon development success. Per its 2010 Investor Day disclosures, Encana noted it has farmed out 1.7 million acres in its Clearwater Business Unit, which includes its southern Alberta freehold lands. Through *The Globe and Mail*, Encana recently commented broadly on farm-out activities, and the article noted royalty rates in the range of 30% to 38%.<sup>25</sup> While these percentages are high relative to average life-of-well Alberta Crown rates expected, we caution the rates appeared to be a generalization. Farm-in agreements can be complex and require context, and in reality we would not be surprised to see sliding scale royalties sensitive to well productivity and commodity prices that might result in lower average rates payable. Further details on the Encana lands are noted in the next section, *A Canadian (Railroad) Trilogy (And Then Some)*.

CROWN LAND

Crown land sales since the start of 2010 in the Province of Alberta amount to plus or minus 0.5 million acres, dependent on one’s view of where the trend acreage truly exists. A number of industry participants have noted that the speed with which the land was tied up, between Crown sales and other avenues, was much quicker than the land rush in most other resource plays in Canada over the past decade, and have tempered expectations with respect to the prospect of further significant parcels from the Crown. In effect, much of the play has been tied up. The important feature to note, in our view, is that drilling on Crown land is available to benefit from the Alberta royalty regime, which is advantageous based on the measured depth of wells.

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A Canadian (Railroad) Trilogy (And Then Some)

CRESCE NT POINT ENERGY CORP.

Listed: TSX-CPG
Coverage: 1-Sector Outperform; 12-month target $49.00 (Patrick Bryden, CFA)

Crescent Point announced on September 20, 2010, that it had acquired private producer Darian Resources, adding approximately 1 million net acres of land presumed to be prospective for the Bakken/Three Forks formation equivalents in southern Alberta, 900 bce/d of production, and 3.6 mmbce of 2P reserves. Darian had a farm-in agreement that provided it access to lands in the southern Alberta region; it entered into Companies’ Creditors Arrangement Act (CCAA) protection in early 2010, and was acquired by Crescent Point on July 5. Total consideration for the acquisition amounted to $96 million, composed of $69 million in cash and acquired debt, with the remainder paid in Crescent Point shares. As we understand it, the Darian lands comprised approximately 985,000 net acres of farm-in lands that access Encana Corporation freehold lands with an agreement expiration of December 31, 2011, and five-year lease terms for earned lands (note that the Encana disclosures on the next page suggest expiration at the end of 2013).26 We are not aware of any amendments or specifics with respect to Crescent Point disclosures but the acreage represents a vast amount of land and, in our view, Crescent Point’s ability to earn the acreage is materially stronger than that of a smaller private entity. Crescent Point’s timing was exceptional from the standpoint that the original farm-in was effectively conceived in pursuit of shallower natural gas horizons, while the opportunity to acquire Darian emerged early on in the formation of the deeper Alberta Bakken light oil play mosaic.

Crescent Point has also added land in the southern Alberta region through brokers over the last year at Crown land sales (approximately 100 sections, perhaps more) and now, in combination with the acquisition, holds over 1 million net acres in the area. Crescent Point’s disclosure is not specific with respect to the precise acreage total and location at this stage. The company intended to spend $10 million in Q4/10 and $25 million in 2011 on the properties, drilling a total of 19 net wells. Specific 2011 plans include 14 net development and exploration wells. As noted, Crescent Point drilled the first horizontal well into the play with its Del Bonita well at 100/14-07-001-21W4/00, with preliminary production referenced previously. Horizontal wells have also been licensed and drilled at Reagan and licensed at Barons in Alberta.

Crescent Point’s entry into the play through Darian and additional land purchases is notable from the standpoint that it is the most prominent operator in the Williston Basin’s Bakken play in Canada, and it also tends to be an aggressive mover on emerging resource plays, as witnessed in the Bakken and Lower Shaunavon plays of Saskatchewan. We view management’s interest in the area as very positive, in conjunction with its efforts to appropriately condition the market to the early and exploratory nature of the area at present.

- Wells licensed: 5
- Wells drilled: 5

Canadian Natural Resources Limited

**Listed: TSX & NYSE-CNQ**
**Coverage: 2-Sector Perform; 12-month target $44.00 (Mark Polak, CFA)**

Canadian Natural is one of Canada’s largest producers and holds some oil and gas production and land in southern Alberta. To our knowledge, the company has not focused on the play in its disclosures, but given its large capitalization stature in the Canadian energy sector, its presence in the area is noteworthy.

Encana Corporation

**Listed: TSX & NYSE-ECA**
**Coverage: 2-Sector Perform; 12-month target US$34.00 (Mark Polak, CFA)**

Per the discussion earlier on freehold land, Encana is a dominant acreage holder in southern Alberta. At present, Encana appears content to monitor the activities of the companies that have farmed in on its land. Encana is also a prominent participant in the Horn River Basin natural gas shale play of northeast British Columbia and in the longer term, as per the information noted on the Exshaw in this region by Quicksilver Resources, might have transferable insights between these two plays with respect to oil exploration. Given the nature of much of its ownership position in southern Alberta, as legacy freehold rights, Encana is in an enviable position to collect royalty payments from successful farm-in participants or have acreage ultimately revert to it. It is also afforded the luxury to watch and learn from other participants, given its expiry issues on average are not the same as traditional Crown landholders.

Encana’s current stance on the area is as follows:

- Owns approximately 1,800 net sections of CPR legacy fee lands in southern Alberta.
- 90% of these lands are joint ventured with two separate oil and gas producers.
- The joint venture lands show prospective plays in the Banff/Lodgepole, Exshaw/Bakken, and Wabamun formations.
- The joint venture agreements will reach the end of their terms in 2013.
- The joint venture partners will retain the spacing unit of the producing zone in which a successful well has been drilled.
- Royalties on Encana fee lands are based on a sliding scale, with a minimum of 4% and a maximum of 40%.

ExxonMobil Canada Ltd. (Private)

ExxonMobil Canada holds a significant amount of legacy acreage in the region. The land does not include holdings of Imperial Oil Limited (3-Sector Underperform; 12-month target $40.00; Mark Polak, CFA) but, as we understand it, if ExxonMobil Canada were to pursue further land interests in the area, it would do so under an area of mutual interest arrangement with Imperial. The acreage held by ExxonMobil Canada is generally further to the west, and may therefore be more prone to deeper gas than the oil window industry has pursued to the east of its acreage.
MURPHY OIL CORPORATION

**Listed: NYSE-MUR**  
**Coverage: 2-Sector Perform; 12-month target US$75.00 (Mark Polak, CFA)**

Murphy announced a major farm-in arrangement with the Blood Tribe in September 2010 that provided 129,280 acres of land prospective for the Exshaw/Bakken with a five-year drilling rights lease agreement and a minimum 16-well drilling commitment. The Murphy-Blood lands represent approximately 36% of the reservation. More recent Murphy corporate presentation materials indicate its land position has increased since that announcement, with 150,000 net acres total noted in its public disclosures. We believe the opportunity to form an arrangement with the Blood was likely hotly pursued by industry, and the selection of Murphy by the tribe is therefore positive, in our view. We believe Murphy may have added further acreage, and management has indicated it plans to drill six wells in 2010 to test concepts on the acreage. It should be noted that management has commented it also intends to evaluate the potential of the Second White Speckled Shale (also well known as the Second White Specks). The first well Murphy proposes to drill on the Blood lands is located at 100/15-21-004-25W4, which is in close proximity to a well drilled in 1982 by Gulf Canada at 100/14-21-004-25W4 on an Exshaw thick estimated to be 24 metres. Murphy has also licensed two wells closer to the Alberta-Montana border, on non-Blood Tribe lands in the Reagan area.

- Wells licensed: 4

NEXEN INC.

**Listed: TSX & NYSE-NXY**  
**Coverage: 2-Sector Perform; 12-month target $24.00 (Mark Polak, CFA)**

Nexen is a recent entrant into the fairway in Canada through Alberta Crown land sales. Management hinted at its entrance into a new resource play in Alberta recently; notably, its presence is now known through a well licensed in the Keho area. Like Encana and Quicksilver Resources, Nexen is also a prominent participant in the Horn River Basin.

- Wells licensed: 1

SHELL CANADA LIMITED (PRIVATE)

Shell Canada is believed to have acquired acreage in Crown land sales, potentially through multiple land brokers, and has licensed four wells into the play at the Del Bonita area near the Alberta-Montana border. It should also be noted that Shell has a long history in southern Alberta with extensive deep foothills natural gas experience, specifically in the Waterton area in the southwest corner of Alberta, and may therefore have some incremental technical perspectives versus more recent entrants to the region.

- Wells licensed: 4
ARGOSY ENERGY INC.

*Listed: TSXV-GSY*

Argosy has 35 sections of land it views as prospective for Banff, Exshaw, and Big Valley potential in the Claresholm area to the north of the Blood Tribe reservation. The company has stepped its efforts up quickly, with one horizontal drilled in Q4/10 and two horizontal wells planned for Q1/11. Management has noted expectations for 150 boe/d initial production rates from the play area at well costs of $3 million.

- **Wells licensed:** 3
- **Wells drilled:** 1

BLACKSTEEL ENERGY INC.

*Listed: TSXV-BEY*

Blacksteel holds 2,560 acres in the Del Bonita border area of Alberta. Management has indicated it interprets the play as dolomitic siltstone sequence with up to 30 metres of gross oil play, anticipated porosity of 3% to 9%, and permeability of 0.1 to 10 mD. Its acreage is within close proximity of Rosetta, Crescent Point, and Shell Canada well locations. The company plans to drill one vertical well through the Bakken, with the ability to kick out to a horizontal at a later date, and complete technical review work for a total cost of $1.0 million to $1.2 million. Management also intends to consider partners as well as an increased land position.

BOWOOD ENERGY INC.

*Listed: TSXV-BWD*

Bwood is notable within the Canadian side of the play in that it was early to the concept and has announced a major farm-in agreement with the Blood Tribe. The gross land position is 118,000 acres, or 100,000 acres on a net basis. The company acquired 22,000 acres of freehold land in 2007, along with additional Crown land, and 60,640 acres through an agreement with the Blood Tribe. As noted, the Blood lands are very significant in size, are sparsely drilled, and the Bowood Blood lands represent approximately 17% of the reservation. The company paid approximately $230/acre to attain its Blood acreage position, with one drill required in years one and two, followed by two wells per year in years three through five, all to the first of 1,000 metres depth or 5 metres into the Devonian as minimum drilling depths. Royalties are structured similarly to Alberta royalties; with a 10% minimum, the tribe can elect to participate straight up for 20% or is entitled to a 20% working interest upon Bowood’s recovery of 200% of total capital costs.

Bwood has in turn formed a joint venture and strategic farm-out arrangement with Legacy Oil + Gas Inc. on its Blood and non-Blood acreage, whereby Legacy can earn 50% of all Bowood lands, part of which has already occurred through an equalization for $8 million net to Bowood on 33,280 acres, and the balance of which is through farm-in on 83,840 acres. Legacy is initially committed to drill two horizontals, with one well expected to spud by the end of March and the second by the end of August. Legacy pays 80% of each well to earn 50% in eight sections of farm-out lands and has a rolling option to continue drilling past the second well.
We view Bowood’s relationship with the Blood as an intangible but also very valuable feature of the business. There is no doubt in our minds the Blood lands were hotly pursued by industry; that a company the size of Bowood was chosen is therefore a noteworthy achievement and endorsement, in our view. We also view the decision to invite Legacy into its opportunity set as a positive development in that Legacy is an experienced and well-regarded team, with significant Bakken experience in the Williston Basin. Legacy is also of a size where the potential exposure to the play versus its company size is appropriately geared to offer good appreciation potential upon success, and should therefore help ensure it is motivated and focused to achieve proof of concept. In our view, Bowood has one of the most advanced interpretations of the factors that could make the play work.

- Wells licensed: surface and licensing underway for two wells with Legacy

DEETHREE EXPLORATION LTD.

*Listed: TSXV-DTX*

The company has an extensive farm-in on Encana lands in the Lethbridge area, which was initially focused on natural gas exploration but has also shifted towards oil exploration with the balance of industry in the area. Management has successfully run prior companies that include Dual Exploration Inc. and Devlan Exploration Inc., both of which were sold to Cyries Energy Inc. With respect to Encana farm-in lands, DeeThree clearly has one of the larger acreage positions potentially exposed to the Alberta Bakken on the Canadian side of the play. DeeThree is also notable in that its lands are believed to effectively be in the middle of much of the Crescent Point acreage.

- Wells licensed: 1 (plus one Nisku Arcs well licence)

LEGACY OIL + GAS INC.

*Listed: TSX-LEG*

*Coverage: 1-Sector Outperform; 12-month target $17.00 (Jason Bouvier, CFA)*

Legacy is led by Trent Yanko, who previously served as President & CEO of Mission Oil & Gas Inc. Mission was notable as a first mover in the Canadian side of the Williston Basin Bakken play. In particular, Mission was on the leading edge of the early application of horizontal drilling and multistage fracture completions technology in the Bakken proper. Legacy maintains 310,000 net acres in the Canadian and American sides of the Williston Basin Bakken play and, notably, also formed a joint venture and farm-in arrangement with Bowood Energy Inc. (the details of Legacy and Bowood’s arrangement are noted in the Bowood section). Given the past success of the management team in the Williston Basin Bakken play, we view its interest in southern Alberta and relationship with Bowood positively.

- Wells licensed: surface and licensing underway for two wells with Bowood
PACE OIL & GAS LTD.

*Listed: TSX-PCE*

Pace maintains a fairly large and relatively contiguous acreage position in the area of T11 to T15 and R16 to R19W4. The company is more focused on glauconite channel plays at present, and management has not disclosed any assessment of potentially prospective lands in the area for the Alberta Bakken play. The company’s land expiry issues in the area are minimal, though, and management therefore has the ability to monitor industry activities and evaluate the Alberta Bakken potential of its acreage at a measured pace.

PETROSPIRIT RESOURCES LTD. (PRIVATE)

PetroSpirit has wells licensed in the Reagan area of Alberta along the border with Montana. The company has already rig-released two wells, while a third was spud in late January. The company executed a farm-in arrangement with Gryphon Petroleum Corp. for 12 sections of land, subject to farm-in terms. The drilling includes three vertical tests, and management plans to stand pat at three with seven-inch casing set in the wells in order to potentially enable kickoff into horizontal drilling at a later date. Management has noted several horizons of interest, with faulting present in its Reagan area acreage. Management also notes the structural activity in the area, with regional principal stress orientation dominated from the thrust sheets to the west and the potential intrusive rock, as possible positive factors for fracture enhancement of the rock in the play fairway. Given the company is private and does not appear to have near-term land expiry issues, management has stated it intends to monitor industry learning in the play activity as it further evaluates its three vertical locations and acreage for future development.

- Wells licensed: 3
- Wells drilled: 2

WILD STREAM EXPLORATION INC.

*Listed: TSXV-WSX*

*Coverage: 1-Sector Outperform; 12-month target $15.25 (William Lee, P.Eng.)*

The company maintains a relatively smaller acreage exposure to the play along the Alberta side of the Alberta-Montana border. The company is more focused on other light oil resource plays, predominantly at Shaunavon in southwest Saskatchewan, the Dodsland Viking play in Saskatchewan, and at Garrington in the Cardium. It maintains approximately 12,800 net acres but is less active on this land than its other light oil focus areas.
Are You Ready for Some Football?
An Overview of the American Side

THE BLACKFEET RESERVATION

The Blackfeet Reservation is located in the northwest corner of Montana to the east of Glacier National Park, is 1.5 million acres in size and, like the Blood Tribe, by virtue of its location the Blackfeet Nation is positioned as a major player in the renewed exploration of the region.27 The land within the Blackfeet Reservation is approximately 42% owned tribally, while 31% is held by allottees,28 and the 27% balance is held by fee owners.29 The Alberta Basin extends from Canada into northwest Montana, similarly bounded by the disturbed belt of the Rocky Mountains to the west and the Sweet Grass Arch to the east. The area has a long history of hydrocarbon exploration that dates back to the 19th century. The 170+ mmbbl Cutbank field, discovered in 1926, is productive from several sands and is by far the largest area accumulation to date: approximately one-quarter of it is located on Blackfeet lands, with the balance off the reservation (see Exhibit 22).30

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28 The U.S. federal government began the policy of allotting American Indian land as early as 1788. Several treaties with Indian tribes included provisions that stated land would be divided among individual tribal members. After 1871, however, Congress declared that no further treaties would be made and all future dealings with Indian nations would be conducted through legislation. In 1934, the Wheeler-Howard Act (also known as the Indian Reorganization Act) was passed ending the process of allotment on Indian lands in the contiguous United States (Source: Indian Land Tenure Foundation).
29 Ibid.
30 Ibid.
Over the past 10 years, the reservation has seen very limited drilling activity, mainly limited to the Cutbank field. Exhibit 23 shows a generalized view of the stratigraphy as it transitions from the Williston Basin at the east to the Alberta Basin at the west. While an extremely long and simplified cross-section, it illustrates the continuum between these two centres of the Bakken and its Exshaw equivalent source rock.

Blackfeet Nation-sponsored geological evaluations note the presence of the “Bakken” equivalent rock in the Mississippian-Devonian, with the existence of source rock, and that the area is thermally mature, with porosity in the Devonian unknown.

The 1982 Indian Mineral Development Act effectively governs the agreements that the Blackfeet Tribal Business Council is free to form with any industry parties it chooses to invite to work on its lands. Next we discuss the recent ventures industry has formed with the Blackfeet to pursue the Alberta “Bakken” play, which are dominated by Anschutz Exploration Corporation, Newfield Exploration Company, and Rosetta Resources Inc., with negotiations in part facilitated by Indian Affairs, Department of Energy and Mineral Development. Exhibit 24 provides the land interests of the key participants on the Blackfeet Reservation with recent drilling and licensing activity noted.

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31 Ibid.
32 Ibid.
33 Ibid.
34 Ibid.
STATE, FEDERAL, AND PRIVATE LANDS

Outside of the reservation, land in the potential fairway is a mix of state land, freehold land, and federal land managed by the Bureau of Land Management (known as the BLM). Montana state lands offer a 12-month royalty holiday on new wells, which results in a 0.76% top-line royalty payment, after which lessees are required to pay a royalty of 16.67% in conjunction with a production tax of 9.25%. Federal and state income taxes also apply but can typically be materially mitigated by deductions. Exhibits 25 and 26 show both the public land ownership of the state and the tracts nominated for bidding in the March 1, 2011, open auction of state leases, both of which highlight nomination activity in northwest Montana.

Acreage is also available through private mineral owners and through the BLM for federal lands. There did not appear to be any material BLM land sale activity in the Alberta Bakken trend area in 2010 or for 2011 based on lease sale information and maps reviewed. The Blackfeet Reservation and private mineral lands appear to be the key avenues of land access for the Alberta Bakken trend in Montana.

Exhibit 25: Major Public Land Ownership of Montana

Source: State of Montana, Department of Natural Resources and Conservation.

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35 36.25.210, Montana State Law.
36 15.36.204, Montana State Law.
Exhibit 26: Montana Minerals Management Bureau March 1, 2011, Oil and Gas Lease Sale

STATE OF MONTANA  MARCH 1, 2011 SALE
PRELIMINARY MAP - ALL TRACTS

Source: State of Montana, Department of Natural Resources and Conservation; Scotia Capital.
An American Trilogy (And Then Some)

ANSCHUTZ EXPLORATION CORPORATION (PRIVATE)

Anschutz has leased a material portion of the western portion of the Blackfeet Reservation, and is believed to be mainly focused on the Cretaceous Cone Member of the Marias River Shale, which, based on locality, may also be categorized as part of the Second White Specks, Greenhorn, and Belle Fourche units.37 A generalized west-to-east schematic of play types in Exhibit 27 shows the thickness of the Cretaceous interval on the west side of the Blackfeet Reservation along the disturbed belt.

Exhibit 27: Blackfeet Reservation Play Types

In addition to its Cretaceous exploration interest, Anschutz has drilled one well and licensed two additional wells that are deeper, with terminal formations in the Potlatch, Bakken, and Three Forks. The 1-4 White Calf well was spud in December 2009, with the rig released in February 2010; results to date are unknown. Anschutz has also licensed two additional locations, 1-26 Pine Ridge in September 2010 and 1-3 White Calf in October 2010. Exhibit 28 features a seismic and area focus map with respect to its Cretaceous initiatives, as well as an interpretation of the seismic for the 1-4 White Calf well.

Limited data are available with respect to the company, given it is private, but Anschutz was a recent seller of Marcellus acreage, in which is was an early entrant, and has history in the North Dakota Williston Basin Bakken, which are attributes we view positively with respect to its early interest in exploration of the Blackfeet lands in the Alberta Basin.

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NEWFIELD EXPLORATION COMPANY

Listed: NYSE-NFX

The company entered into an initial agreement with the Blackfeet Nation towards the end of 2009 to hold 156,000 acres, and has increased its position since then, with the requirement to drill a minimum of one deep test per year and commercialize development by 2014. This is the largest oil exploration agreement signed by the Blackfeet to date.\(^\text{38}\) Newfield currently holds 280,000 net acres in the region. The company plans to employ both vertical and horizontal wells to delineate the lands, with the Bakken expected to be encountered at true vertical depth in the range of 9,100–10,100 ft.\(^\text{39}\) The Peacemaker 1-5H is a horizontal test approximately half a mile to the southeast of Rosetta Resources Inc.’s Tribal Gunsight well. There is market speculation about the success of these two wells but no formal data yet. Management did recently confirm all of its wells have hit oil and one horizontal is on production with a second awaiting completion.

- Wells licensed: 10
- Wells drilled: 5

\(^{38}\) Ibid.
\(^{39}\) Ibid.
QUICKSILVER RESOURCES INC.

Listed: NYSE-KWK

In terms of public disclosures, we noted previously that Quicksilver provided insights into indications of mobile oil in the Exshaw in its Horn River Basin acreage of northeast British Columbia. With respect to northwest Montana, the company holds 119,000 net acres held by production, which are to the east to the bulk of the activity focused on the Blackfeet Reservation. Quicksilver’s land is held by legacy production previously owned by Unocal, and therefore has minimal near-term land expiry issues. Management has noted that it therefore has the benefit of awaiting the results of industry’s exploration in the region. Quicksilver is also a participant in an area of mutual interest in the region that is 300,000 net acres in size. Very recent disclosures from Quicksilver have characterized its land position as 175,000 net acres.

ROSETTA RESOURCES INC.

Listed: Nasdaq-ROSE

Rosetta is led by Randy Limbacher, who was previously President, Exploration and Production – Americas for ConocoPhillips. Rosetta has been involved in exploration of the Alberta Bakken in northwest Montana since 2008. The company maintains 300,000 acres, mainly focused on the Blackfeet Reservation. The main target of Rosetta’s exploration efforts appears to be the Bakken-equivalent Exshaw, and its disclosures also emphasize “oil saturated and overpressured Banff, Bakken, and Three Forks intervals, and an oil-saturated Nisku section.” In its public disclosures, Rosetta’s description of the play specifically includes the following:

- focused on the area as a Williston Basin, Devonian oil shale analog;
- true vertical depths range from 4,500 to 7,300 ft;
- confirmed overpressured reservoirs;
- confirmed movable, high-quality oil; and
- confirmed resource in place of 13–15 mmboe per section.

Rosetta has employed seismic data from the Blackfeet and Indian Affairs, Department of Energy and Mineral Development, in its exploration program. An interpretive cross-section of the Landslide Butte area is shown in Exhibit 29, along with reservation seismic lines and Bakken/Exshaw penetrations with the Landslide and Gunsight areas highlighted.\(^{40}\)

\(^{40}\) Ibid.
To date, management has drilled six wells, two of which are viewed to be on strike, 28 miles apart, and one well that is viewed to be eight miles downdip. The company is now into the early phase of a multi-well vertical delineation program to further assess the prospects of the region.

- Wells licensed: 10
- Wells drilled: 6

**ABRAXAS PETROLEUM CORPORATION**

**Listed: Nasdaq-AXAS**

Abraxas has indicated ownership of over 10,000 net acres in the Alberta Bakken of northwest Montana. There are no locations or capital for the area included in its 2011 budget, but the company intends to add to its land position. Abraxas is notable for its operated and non-operated presence in the Bakken/Three Forks play of the Williston Basin in both eastern Montana and North Dakota. The Alberta Bakken leases are owned in the Glacier and Toole counties with five- to 10-year lease terms.
ARKANOVA ENERGY CORPORATION

Listed: OTCBB-AKVA

Arkanova maintains acreage in Glacier and Pondera counties prospective for the Alberta Bakken. The company announced in January 2011 that, through its wholly owned subsidiary Provident Energy of Montana, LLC, its 5,900 foot vertical depth Tribal-Max 1-2817 well, drilled for a primary horizontal target in the Lower Cut Bank sand at a 3,300 feet depth, confirmed the presence of Bakken/Three Forks at depth on its Glacier county acreage. The company expects to follow up the well with Tribal Max 2-2818 horizontally into the Bakken/Three Forks.

- Wells licensed: 1
- Wells drilled: 1

AMERICAN EAGLE ENERGY INC.

Listed: OTCBB-AMZG

The company maintains acreage in the Glacier and Toole counties of Montana. The leasehold lands include 75,000 acres, with ownership interests in the 33% to 50% range. Management disclosures indicate key formations of interest include the Banff, Bakken, and Three Forks. The company is also focused on Bakken interests at Hardy in Saskatchewan and in North Dakota, with prior management experience from the Elm Coulee field development in the Williston Basin.

COMPTON PETROLEUM CORPORATION

Listed: TSX-CMT

Coverage: 2-Sector Perform; 12-month target $0.50 (Jason Bouvier, CFA)

In recent corporate presentations, Compton noted it has approximately 79,000 net acres in northwest Montana. The acreage is located at T18 to 22N, R3 to 6 W, and the land tenure is good, with no material expiries until 2017. The company has noted it has held discussions with third parties as it attempts to determine if it will explore the acreage through drilling, invite in a joint venture partner, or monetize the asset. Compton also maintains fairly extensive landholdings throughout southern Alberta, which might offer some further exposure as the trend’s exploration develops further.

MOUNTAINVIEW ENERGY LTD.

Listed: TSXV-MVW

Mountainview is based in Montana but TSX Venture listed. It has operatorship over 74,000 net acres in Pondera county of northwest Montana potentially exposed to the Alberta Bakken trend. The lands are further south than the bulk of industry’s activity in Glacier county to the north. Management plans to monitor industry activity, further evaluate its lands, and also maintain a few smaller parcels of acreage in the region on the Montana side of the border.
PASSPORT ENERGY LTD.

Listed: CNSX-PPO

Passport is Alberta-based but its assets are focused in northwest Montana and southeast Saskatchewan. Passport acquired a 60% interest in oil and gas leases in the Sweet Grass Arch for a net land position of approximately 26,000 acres in the Toole and Pondera counties of Montana. The acreage position is further to the south and east of industry’s primary area of focus in northwest Montana. Through 2010 and 2011, the company intends to spend approximately $3 million with an eight-well program based on acquired seismic data, and notes both natural gas potential and Bakken oil potential in the Sweet Grass Arch region.

PRIMARY PETROLEUM CORPORATION

Listed: TSXV-PIE

Primary is a Canada-based and -listed company that has extensive land in northwest Montana with over 200,000 net acres. The acreage is held in an area of interest identified by management to the south of the Blackfeet Reservation. As the trend moves south, deeper into Montana, it is less well established how far the Exshaw/Bakken formations extend and what the pressure conditions may be. As noted earlier, Primary Petroleum has evaluated Bakken core from its area of interest, which indicated total organic carbon content (TOC) in excess of 14%. Management has also analyzed and commented on oil staining and fluorescence from well cuttings in the area. Primary’s review of cuttings and core evaluations were accessed through the Montana Board of Oil and Gas in Billings and the USGS in Denver.

STONE ENERGY CORPORATION

Listed: NYSE-SGY

Stone’s exposure to the play is through a 35% working interest in acreage held by Newfield Exploration Company. The company has indicated 35,000 net acres of exposure to the trend, with evaluation of drilling results underway.
Come Together – What the Entire Play Looks Like

Exhibit 30 is an isopach map that interprets the thickness of the interval from the base of the Lodgepole to the top of the Three Forks (and equivalents) in both northwest Montana and southern Alberta. The interpretation is based on the analysis of well penetrations into the formation, logs, cores, drill stem tests, and other geological interpretations. Exhibit 31 also includes isopach analysis with landholders shown.

Source: Scotia Waterous; Scotia Capital.
Exhibit 31: Landholders Map of Alberta Bakken

Source: Scotia Waterous; Scotia Capital.
The Roughest Neck Around – The Drilling Has Started

To the end of January 2011, 23 wells have been licensed on the Canadian side of the border, with 10 rig released, 21 of which were classified as new field wildcat locations. To date, 16 of these wells have been spud, and 10 have been rig released. In addition to the 23 wells discussed, we also note two further wells as, in our evaluation, Nisku Arcs targets and one Second White Specks location.

On the Montana side of the border, 24 wells have been licensed, 22 of which were classified as wildcat wells. To date, 15 of these wells have spud, and we estimate 13 have been rig released.

Exhibit 32 shows the progress of key operators in the United States, while Exhibit 33 shows the same for the Canadian side of the border. Exhibit 30 provides a detailed overview of the various operators in terms of licence, spud, and rig release dates.
Exhibit 33: Alberta Bakken Well Licensing and Drilling Activity – Province of Alberta

- **Crescent Point**
  - License Date: Mar-10
  - Spud Date: May-10
  - Rig Release Date: Jun-10

- **Shell Canada**
  - License Date: 10-Aug-10
  - Spud Date: 30-Aug-10
  - Rig Release Date: 19-Sep-10

- **Murphy**
  - License Date: 07-Jan-11
  - Spud Date: 17-Jan-11
  - Rig Release Date: 27-Jan-11

- **Argosy**
  - License Date: 21-Jul-10
  - Spud Date: 10-Aug-10
  - Rig Release Date: 30-Aug-10

- **Petrospirit**
  - License Date: 19-Oct-10
  - Spud Date: 29-Oct-10
  - Rig Release Date: 08-Nov-10

- **Other Canada**
  - License Date: May-10
  - Spud Date: Jun-10
  - Rig Release Date: Jul-10

Source: Bowood Energy Inc; Scotia Capital.
## Exhibit 34: Alberta Bakken Well Licensing and Drilling Activity

<table>
<thead>
<tr>
<th>WELL LOCATION</th>
<th>WELL NAME</th>
<th>OPERATOR</th>
<th>CLASS</th>
<th>TYPE</th>
<th>MD (M)</th>
<th>Term FM</th>
<th>License Date</th>
<th>Spud Date</th>
<th>Rig Release Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>NE SW 28 32N 8W</td>
<td>TRIBAL MAX 1-2817</td>
<td>ARKANOVIA</td>
<td>V</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>NW NW 5 33N 6W</td>
<td>1-5H PEACENAKER</td>
<td>NEWFIELD</td>
<td>WILDCAT</td>
<td>HZ</td>
<td>2,794</td>
<td>BAKKEN</td>
<td>16-Mar-10</td>
<td>09-Apr-10</td>
<td>20-May-10</td>
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<tr>
<td>SE SW 9 33N 7W</td>
<td>1-9-16H OLD WEST</td>
<td>NEWFIELD</td>
<td>WILDCAT</td>
<td>HZ</td>
<td>2,853</td>
<td>BAKKEN</td>
<td>06-May-10</td>
<td>25-May-10</td>
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<td>NW NE 11 33N 7W</td>
<td>1-11H SHERIFF</td>
<td>NEWFIELD</td>
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<td>HZ</td>
<td>2,860</td>
<td>BAKKEN</td>
<td>06-May-10</td>
<td>26-May-10</td>
<td>03-Sep-10</td>
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<tr>
<td>SE SW 8 33N 8W</td>
<td>1-8 TRIBAL LULU PARR</td>
<td>NEWFIELD</td>
<td>WILDCAT</td>
<td>V</td>
<td>2,438</td>
<td>BAKKEN</td>
<td>26-May-10</td>
<td>11-Sep-10</td>
<td>17-Oct-10</td>
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<tr>
<td>NW NE 21 35N 9W</td>
<td>1-21 TRIBAL SACRED PIPE</td>
<td>NEWFIELD</td>
<td>WILDCAT</td>
<td>V</td>
<td>2,810</td>
<td>BAKKEN</td>
<td>18-Jun-10</td>
<td>21-Oct-10</td>
<td>09-Nov-10</td>
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<tr>
<td>NW NE 9 32N 9W</td>
<td>1-9 TRIBAL CUMBERLAND</td>
<td>NEWFIELD</td>
<td>WILDCAT</td>
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<td>2,870</td>
<td>BAKKEN</td>
<td>28-Jun-10</td>
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<tr>
<td>NW NW 7 36N 9W</td>
<td>07-4H TRIBAL RIVERBEND W</td>
<td>ROSETTA</td>
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<td>HZ</td>
<td>2,789</td>
<td>SOURIS RIVER</td>
<td>11-Jul-09</td>
<td>25-Aug-09</td>
<td>08-Sep-09</td>
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<td>NW NW 7 36N 9W</td>
<td>29-13H TRIBAL BIG ROCK</td>
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<td>WILDCAT</td>
<td>HZ</td>
<td>2,773</td>
<td>SOURIS RIVER</td>
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<td>27-Sep-10</td>
<td>20-Nov-10</td>
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<td>SE SE 21 37N 7W</td>
<td>21-12H RUMNEY TRIBAL</td>
<td>ROSETTA</td>
<td>WILDCAT</td>
<td>HZ</td>
<td>3,061</td>
<td>BAKKEN</td>
<td>18-Jun-10</td>
<td>09-Nov-10</td>
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<tr>
<td>SE SE 21 37N 7W</td>
<td>21-12H BIG TEX</td>
<td>ROSETTA</td>
<td>WILDCAT</td>
<td>HZ</td>
<td>3,061</td>
<td>CAMBRIAN</td>
<td>15-Nov-10</td>
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<td>SW SW SW 12 37N 9W</td>
<td>12-13H TRIBAL GUNVISION</td>
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<td>HZ</td>
<td>2,754</td>
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<td>28-Nov-09</td>
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<tr>
<td>NW NW SW 3 36N 7W</td>
<td>350-B-35-04 BRANDY/OLD</td>
<td>ROSETTA</td>
<td>WILDCAT</td>
<td>V</td>
<td>2,211</td>
<td>BAKKEN</td>
<td>08-Sep-10</td>
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<td>NW NW 7 36N 6W</td>
<td>3006-19-01 GAGE</td>
<td>ROSETTA</td>
<td>DEV</td>
<td>V</td>
<td>1,561</td>
<td>BAKKEN</td>
<td>08-Sep-10</td>
<td>16-Oct-10</td>
<td>20-Dec-10</td>
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<td>NW NW 7 36N 6W</td>
<td>12-15V TRIBAL GUNVISION S</td>
<td>ROSETTA</td>
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<td>V</td>
<td>1,823</td>
<td>BAKKEN</td>
<td>20-Oct-10</td>
<td>10-Nov-10</td>
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<td>3207-22-12 GLACIER FARMS</td>
<td>ROSETTA</td>
<td>WILDCAT</td>
<td>V</td>
<td>1,676</td>
<td>SOURIS RIVER</td>
<td>17-Dec-10</td>
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<td>SE SW 7 34N 6W</td>
<td>3406-07-14 TURVEY</td>
<td>ROSETTA</td>
<td>WILDCAT</td>
<td>V</td>
<td>1,676</td>
<td>SOURIS RIVER</td>
<td>17-Dec-10</td>
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</tr>
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</table>

### Exhibit 34: Alberta Bakken Well Licensing and Drilling Activity (cont’d)

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<thead>
<tr>
<th>ALBERTA</th>
<th>23 WELLS (10 RR)</th>
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<td>100/02-31-010-25W4/00</td>
<td>ARGOSY GRANUM 3-31-10-25 ARGOSY OD V 2,535 WABAMUN 24-Sep-10 29-Sep-10 14-Oct-10</td>
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<tr>
<td>100/02-35-010-26W4/00</td>
<td>ARGOSY DD AMELIA 15-35-10-26 ARGOSY NPW DD 2,612 WABAMUN 22-Dec-10 -- --</td>
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<td>100/02-24-011-26W4/00</td>
<td>ARGOSY GRANUM 2-24-11-26 ARGOSY NPW HZ 3,694 WABAMUN 20-Jan-11 21-Jan-11 --</td>
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<td>100/02-24-002-25W4/00</td>
<td>CCRLE AETNA 16-24-2-25 CANADIAN COASTAL NPW V 2,770 EXSHAW 06-Aug-10 17-Aug-10 05-Sep-10</td>
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<td>100/14-07-001-21W4/00</td>
<td>ANTELOPE HZ DELBON 14-7-1-21 CRESCENT POINT NFV HZ 3,166 WABAMUN 09-Jul-10 24-Jul-10 25-Aug-10</td>
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<td>100/03-08-001-18W4/00</td>
<td>ANTELOPE HZ SUNBURST 3-8-1-18 CRESCENT POINT* NFV HZ 2,895 EXSHAW 23-Sep-10 03-Oct-10 29-Oct-10</td>
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<td>CPEC REAGAN 15-1-2-20 CRESCENT POINT NPW HZ 3,019 WABAMUN 05-Nov-10 11-Nov-10 30-Nov-10</td>
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<td>100/13-35-012-24W4/00</td>
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<tr>
<td>100/13-28-011-24W4/00</td>
<td>NEXEN KEHO 13-28-11-24 NEXEN NPW HZ 4,020 WABAMUN 20-Dec-10 -- --</td>
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<td>PETROSPIRIT REAGAN 1-23-1-20 PETROSPIRIT NFV V 1,471 STETTLER 26-Nov-10 04-Dec-10 20-Dec-10</td>
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<td>100/10-20-001-22W4/00</td>
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<tr>
<td>100/04-13-002-22W4/00</td>
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<td>100/02-28-001-23W4/00</td>
<td>SCL DELBON 02-28-1-23 SHELL CANADA NFV V 4,496 BIG VALLEY 17-Nov-10 -- --</td>
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**Nisku Arcs Wells:**

102/04-32-003-17W4/00 | D3EXP FERGUSON 4-32-3-17 DEETHREE NPW V 1,442 LEDUC 12-Jan-11 -- -- |

**Second White Specks Wells:**

100/16-03-011-20W4/00 | CROCOTTA IRONSP 16-3-11-20 CROCOTTA NPW V 1,664 IRETON 03-Dec-10 11-Dec-10 30-Dec-10 |

100/16-28-011-28W4/00 | PARA MONTY PARAMOUNT REN V 2,520 SECOND WS 03-Feb-11 -- -- |

* Crescent Point assumed to be operator.

What I Got – Acreage Holders and Exposure Levels

Exhibit 35 shows the acreage positions of the various companies in the play that have interests in southern Alberta and northwest Montana. The chart features corporate-disclosed prospective land amounts. Given the early-stage nature of industry attention in the region, it should be noted that land acquisition activity still features competitive considerations that have prompted many to hold land parcels in land broker names in order to obscure corporate identities. Some businesses, such as Shell, are expected to confirm larger land positions over time, given recent well licences identified.

Exhibit 36 places the amount of acreage held, without judgement in terms of how prospective the land is ultimately expected to be, in context of the enterprise value of each company. Exhibit 37 further shows the relationship between the enterprise value and land position of each entity in the play with smaller enterprise value businesses broken out in the top right corner of the chart for reference.
Exhibit 36: Alberta Bakken Acreage Exposure per Million Dollars of Enterprise Value

Notes:
* Land position subject to confirmation.
** Represents Encana freehold lands not currently farmed-out or joint ventured (10% of 1,800 net section total southern Alberta freehold lands).
*** Land position currently unknown.
**** Enterprise values of private companies not available.

Source: Company reports; Scotia Capital estimates.

Exhibit 37: Alberta Bakken Known Acreage Holders Relative to Company Size

Source: Company reports; Scotia Capital estimates.
Showdown at Big Sky – Economic Considerations

Given the Williston Basin has a number of different light oil resource play components in various stages of exploration, delineation, and development, a number of areas can be used as analogs for potential well economics. In our view, it is premature to extrapolate to a type curve, given the absence of dependable initial production rates and production data on both sides of the border. Instead, we view it as more appropriate to attempt to back into the kind of initial production rates and recoveries required for break-even returns at our long-term price deck assumptions and an assumed average well cost. Exhibits 38 and 39 assume a typical Bakken type curve, with a mid-case successful well cost of $3.5 million, and Alberta Crown royalties based on a well depth of 2,000 metres and horizontal length of 1,500 metres. Under these parameters, we view the following initial production rates and recoveries as early hurdles for industry with Alberta Crown and Montana State lands to clear, though they could eventually see relaxation with improved costs should large-scale development occur. It should also be noted the economic circumstances of many operators are unique given specifics related to farm-in, joint venture, or tribal arrangements.

Exhibit 38: Implied Initial Production Rates Required to Earn Cost of Capital Under Assumed Well Costs

<table>
<thead>
<tr>
<th>Well Profile</th>
<th>Mid Case</th>
<th>Low Case</th>
<th>High Case</th>
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<tr>
<td>Depth</td>
<td>meters</td>
<td>2,000</td>
<td>2,000</td>
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<tr>
<td>Horizontal Length</td>
<td>meters</td>
<td>1,500</td>
<td>1,500</td>
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<tr>
<td>Fracture Stages</td>
<td>stages</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Successful Well Costs</td>
<td>$mm</td>
<td>$3.5</td>
<td>$2.5</td>
</tr>
<tr>
<td>Cost of Capital 90 Day Rates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alberta Crown</td>
<td>boe/d</td>
<td>145</td>
<td>100</td>
</tr>
<tr>
<td>Montana State</td>
<td>boe/d</td>
<td>177</td>
<td>126</td>
</tr>
<tr>
<td>Implied Recoveries</td>
<td>mboe</td>
<td>118</td>
<td>81</td>
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<tr>
<td>Alberta Crown</td>
<td>mboe</td>
<td>144</td>
<td>103</td>
</tr>
<tr>
<td>Montana State</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: Production and reserves quoted prior to royalties (i.e., gross); drilling grossed up 15% for dry hole costs; and total well costs grossed up 15% for infrastructure. Estimates are based on flat US$85/bbl WTI crude oil and US$6/mcf Nymex natural gas, and a 9% after-tax weighted average cost of capital.

Source: Scotia Capital estimates.

Exhibit 39: Cost of Capital Initial Production Rates and Ultimate Recoveries
Rock ’N’ Roll Is a Vicious Game – Potential Risks

The mosaic of information at this stage appears favourable to us for the Banff-Exshaw-Big Valley interval to support the emergence of a new resource play in southern Alberta and northwest Montana. The current reasons for caution, however, must be considered.

WELL CONTROL RISK

With limited well control, exploration and delineation drilling could reveal sweet spots, but the play could also be smaller than it appears due to various considerations (such as low permeability, inability or difficulty executing formation stimulation with current completion techniques).

Note the early nature of the play indicates overpressure from data in Alberta, and from Rosetta Resources in Montana, but there is a significant amount of territory in between, for which more drilling data are required to better establish key technical parameters of the region.

UNCONVENTIONAL VERSUS CONVENTIONAL RISK

There is expected to be an updip component to the play, which ultimately is likely to turn the prospective fairway from unconventional conditions to a more conventional geological environment at depth. The eastern limit requires better definition, given it is expected to be shallower, with thinner intervals of interest, loss of overpressure, and less maturity in oil generation. Operators may drill wet or dry wells as a result.

FRACTURE NETWORK RISK

The mosaic of technical information includes three important factors that point towards the potential for good permeability, which would be positive with respect to the ability to produce. The specific nature of the fracture network does need to be better defined, though, and the key question is whether these attributes are pervasive or localized. What Stephen Sonnenberg and Aris Pramudito have written about the Williston Basin Bakken also applies to the Alberta Bakken, in our view:

“Many of the reservoirs in the Bakken petroleum system have low permeability. Productive areas or sweet spots are localized areas of improved reservoir permeability through natural fracturing or development of matrix permeability or a combination of both.”

From the perspective of natural fractures, the questions ultimately drive at (1) how many there are, (2) what the spacing is, and (3) how connective they are. From a mechanical stimulation perspective, the questions relate to how amenable or brittle the rock is to multistage fracture treatment, and to what degree this can foster greater connectivity of pre-existing natural fractures.

RESERVOIR/PRODUCTIVITY RISK

The application of horizontal drilling and multistage fracture technology to unconventional resources has arguably enhanced how industry defines what reservoir rock is versus traditional source rock. Regardless, what industry aims to find in the Alberta Bakken play is hydrocarbon saturated rock that is overpressured and amenable to mechanical stimulation. The key questions are: is the rock fractured enough, and can it produce? In our view, this needs to be answered through drilling and will be an important determinant of not only production potential, but also the manner in which production declines with resultant implications for potential recovery rates and economics.

MECHANICAL RISK

As with any play, there could be drilling and completions challenges. We do not expect the region to suffer from any unique technical drilling risks, but this will need to be monitored, and industry will be dealing with overpressured rock, which requires greater care than conventional operations. On the completions side, we do not anticipate the formation will be overly complex in terms of fracture treatment and fracture fluid amenability but, as with most plays, a period of experimentation will be required to establish this, which will in all likelihood result in variable results early on, in our view.

ECONOMIC RISK

The combination of the following factors may serve as impediments to successful per-well economics relative to the rates and recoveries ultimately achieved by drilling participants in the region.

- **Drilling and completions costs.** Drilling and completions costs are likely to vary by drilling depth and complexity but are estimated to be in the range of $2.5 million to $4.5 million per successful well.
- **Access to services.** Given the early-stage nature of the activity in the region, drilling rigs and completion costs may come at a higher price for the first movers, and the quality of labour crews may also prove to be an issue.
- **Royalties.** The drilling on Crown land is eligible to benefit from the Alberta royalty regime, which can be advantageous based on the measured depth of wells. The Montana state lands can also benefit from the 12-month new well royalty holiday. The terms of the Blackfeet royalty arrangements are not known at this time, while the Blood Tribe and freehold Encana royalty arrangements are referenced previously. We view the royalties as generally fairly progressive but, in all cases, the royalties are an item relative to initial rates, production type curves, and recoveries that industry will need to factor into the equation versus total well costs and associated economics.
- **Infrastructure.** Given the sparsely drilled nature of the area, local infrastructure is limited, which we would expect to result in trucking in the interim and to require greenfield infrastructure builds should scalable development ensue. This feature is somewhat less advantageous than brownfield resource plays in areas with excess infrastructure capacity from prior legacy local production development.

INDUSTRY LEARNING CURVE AND MARKET EXPECTATION RISK

Most resource plays develop through a learning curve that requires time to establish how the wells should be drilled (i.e., orientation, drill bit technology, geo-steering, mud weights, horizontal lengths), how the wells should be completed (fluids, proppants, tonnage, number of fracture stages), and how the wells should be produced. We note that it can take a number of wells into an area before definitive conclusions can be drawn, and the news flow from southern Alberta and northwest Montana will therefore require context as the market learns of well-by-well results. We view the following statement from Randy Limbacher, President & CEO of Rosetta Resources, as an appropriate approach for the entire play on both sides of the border:

> “Like the early days of the analog play in the Williston Basin, we are committed to doing the essential science that these plays require, which takes time.”

> **Rosetta Resources Inc., Second Quarter 2010 Results.**
OTHER FORMATION RISK (AND OPPORTUNITY)

The key target of industry at this stage is the Exshaw, but perhaps the Banff or the Big Valley may offer better potential. There are other formations that could prove to be of equal or greater interest, such as the Second White Specks, on which Murphy is also focused through its Blood Tribe acreage. Similarly, Anschutz exploration initiatives appear to be focused on the Cretaceous Cone Member of the Marias River Shale, which, based on locality, may also be categorized as part of the Second White Specks, Greenhorn, and Belle Fourche units.

EXPLORATION RISK

It should be emphasized that, while we believe the mosaic of information appears very positive and points towards good potential for the Alberta Bakken to prove successful in general, it is still early in the exploration phase and there is much to prove yet. Investors should keep in mind that a mosaic does not make for exact science and that exploration, like rock ’n’ roll, can be a vicious game.
Long May You Run – What to Watch For

What milestones should be awaited and how should these be interpreted? In our view, industry and the investment community will rightly pay attention to the drilling initiatives now underway, in aggregate, and should monitor the extent to which wells can be successfully completed and proved to be productive and economic. Productive horizontal wells in the heart of the fairway from the likes of Crescent Point, Nexen, Murphy, and Shell on the Canadian side, and from Newfield, Rosetta, and Anschutz on the American side, would be the most bullish factors towards establishment of a commercial resource play and commensurate market attention, in our view.

“In the words of AC/DC: We roll tonight ... to the guitar bite ... and for those about to rock ... I salute you.”

– Dewey Finn (aka Jack Black), School of Rock
Appendix 1: Play List

Start Me Up, The Rolling Stones
Down in a Hole, Alice in Chains
54-40, Canadian alternative rock band
A Boy Named Sue, Johnny Cash
Lay It Down, Aerosmith
Dazed and Confused, Led Zeppelin
See Me, Feel Me, The Who
Wherefore and Why, Gordon Lightfoot
More Than a Feeling, Boston
Naked and Famous, The Presidents of the United States of America
Four Strong Winds, Ian Tyson
Are You Experienced?, Jimi Hendrix
The Hockey Song, Stompin’ Tom Connors
Canadian Railroad Trilogy, Gordon Lightfoot
Share the Land, The Guess Who
Are You Ready for Some Football? Hank Williams Jr.
Little Foothills Heaven, Corb Lund and the Hurtin’ Albertans
An American Trilogy, Elvis Presley
Come Together, The Beatles
Roughest Neck Around, Corb Lund and the Hurtin’ Albertans
What I Got, Sublime
Showdown at Big Sky, Robbie Robertson
Rock N’ Roll Is a Vicious Game, April Wine
Long May You Run, The Stills-Young Band
For Those About to Rock, AC/DC
Stairway to Heaven, Led Zeppelin
## Valuation and Key Risks to Target

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<tr>
<th>Company Name</th>
<th>Valuation Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canadian Natural Resources Limited (CNQ - T)</td>
<td>Valuation: 1.0x our risked 2P+2C NAV less annual dividends</td>
</tr>
<tr>
<td></td>
<td>Key Risks to Target: Commodity prices, timing of projects, and project execution.</td>
</tr>
<tr>
<td>Compton Petroleum Corporation (CMT - T)</td>
<td>Valuation: 0.4x our 2P NAV</td>
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<td></td>
<td>Key Risks to Target: Oil and natural gas prices; Drilling program success</td>
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<tr>
<td>Crescent Point Energy Corp. (CPG - T)</td>
<td>Valuation: 0.9x our 2P NAV plus risked upside.</td>
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<tr>
<td></td>
<td>Key Risks to Target: Crude oil and natural gas prices; CAD/USD exchange rate; drilling program success</td>
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<tr>
<td>Encana Corporation (ECA - N)</td>
<td>Valuation: 1.0x our risked 2P+2C NAV less annual dividends</td>
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<td>Key Risks to Target: Commodity prices, timing of projects, and project execution.</td>
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<td>Imperial Oil Limited (IMO - T)</td>
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<td>Key Risks to Target: Commodity prices, crack spreads, timing of projects, and project execution.</td>
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<td>Legacy Oil + Gas Inc. (LEG - T)</td>
<td>Valuation: 1.1x our 2P NAV plus risked upside.</td>
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<td>Key Risks to Target: Oil and natural gas prices; Drilling program success</td>
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<td>Murphy Oil Corporation (MUR - N)</td>
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<td>Key Risks to Target: Commodity prices, crack spreads, timing of projects, and project execution.</td>
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<td>Nexen Inc. (NXY - T)</td>
<td>Valuation: 0.8x our risked 2P+2C NAV less annual dividends</td>
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<td>Key Risks to Target: Commodity prices, timing of projects, and project execution.</td>
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<tr>
<td>Wild Stream Exploration Inc. (WSX - V)</td>
<td>Valuation: 1.0x our 2P NAV plus risked upside.</td>
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<tr>
<td></td>
<td>Key Risks to Target: Oil and natural gas prices; Drilling program success</td>
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Appendix A: Important Disclosures

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<th>Ticker</th>
<th>Disclosures (see legend below)*</th>
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* **Legend**

**B28**
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The stock is expected to perform approximately in line with the average 12-month total return of the analyst’s coverage universe or an index identified by the analyst that includes, but is not limited to, stocks covered by the analyst.

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The stock is expected to underperform the average 12-month total return of the analyst’s coverage universe or an index identified by the analyst that includes, but is not limited to, stocks covered by the analyst.

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Under Review – The rating has been temporarily placed under review, until sufficient information has been received and assessed by the analyst.

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Low
Low financial and operational risk, high predictability of financial results, low stock volatility.

Medium
Moderate financial and operational risk, moderate predictability of financial results, moderate stock volatility.

High
High financial and/or operational risk, low predictability of financial results, high stock volatility.

Caution Warranted
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Distribution by Ratings and Equity and Equity-Related Financings*

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</tr>
<tr>
<td>2-Sector Perform</td>
<td>50%</td>
<td>46%</td>
</tr>
<tr>
<td>3-Sector Underperform</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>Other Ratings</td>
<td>Percentage Covered</td>
<td>Percentage Undertaken</td>
</tr>
</tbody>
</table>

* As at February 28, 2011.

Source: Scotia Capital.

For the purposes of the ratings distribution disclosure the NASD requires members who use a ratings system with terms different than “buy,” “hold/neutral” and “sell,” to equate their own ratings into these categories. Our 1-Sector Outperform, 2-Sector Perform, and 3-Sector Underperform ratings are based on the criteria above, but for this purpose could be equated to buy, neutral and sell ratings, respectively.