Emerging Plays
Dallas Petroleum Club
April 21, 2017
Some Things Old, Something New
Powder River Basin

*Cretaceous sands and shales*
Powder River Basin Resource Plays
Top targets for permits approved in the past 180 days. Source: DrillingInfo
Top targets for hz permits granted in the past 180 days. Source DrillingInfo
Top Operators Planning Activity

Top targets for permits granted in the past 180 days. Source: DrillingInfo
Lower Cretaceous PRB Resource Plays

Source: USGS
Upper Cretaceous PRB Resource Plays

Source: USGS

4/22/2017
February BLM Sale

- Wyoming State Office of the BLM’s February lease sale attracted bonuses of $129 million, the highest amount of revenue and most acreage sold (183,000 acres) in the past four years.

- The sale’s top per-acre bid of $16,500 was made by Durango-based Peak Powder River Resources LLC for a 317-acre lease in southwestern Campbell County.

- Peak Powder River paid $19.9 million for seven parcels at the sale covering 3,557 acres in Campbell and Johnson counties, an average of $5,609 per acre.

- The sale’s top overall bid of $18.1 million ($12,002 per acre) was made by Navigation Powder River LLC of Houston for 1,511-acre lease in Campbell County.
March Wyoming State Lease Sale

• Colorado-based **Peak Powder River Acquisitions LLC** made high bids totaling $7.2 million for two parcels covering 1,120 acres in Campbell and Converse counties, an average of $6,500 an acre.

• **Titan Exploration LLC** paid $6.4 million for six parcels comprising 1,679 acres in Campbell, Converse and Johnson counties, an average of $3,830 an acre.

• **Navigation Powder River LLC**, Houston, acquired eight parcels covering 2,838 acres in Campbell, Converse, Natrona and Johnson counties for high bids totaling $4.2 million, an average of $1,475 per acre.

• The sale’s top per-acre bid of $15,001 was made by **Navigation** for Parcel 121, a 40-acre lease in Campbell County.

• Denver independent **Anschutz Exploration Corp** won four parcels taking in 1,315 acres in Campbell and Converse counties for high bids totaling $3.4 million, an average of $2,592 an acre.
Drilling and completion costs are expected to range from $6 million to $7.5 million per well.

Average EURs trending 500,000 to 900,000 bbls of oil equivalent per well.

200 development locations (35 in Teapot, 55 in Parkman and 110 in Turner) can work at $50 oil price.
Chesapeake Energy

- PRB will receive 10% of CHK’s 2017 capex budget.
- CHK will run 2 rigs this year.
- Breakevens are $35-$45 per bbl.
• Turner D&C cost is $5 million/well.

• In late 2015, EOG proposed developing 1,500 wells during a 10-year period on 100 multi-well pads in its Greater Crossbow Oil & Gas Project in southern Campbell and northern Converse counties.

• EOG completed 3 wells in 4Q 2016 with average 30-day initial production rates per well of 2,155 boe/d, or 1,810 bo/d, 135 b/d of NGLs and 1.3 million cu ft daily of natural gas.
• **ConocoPhillips** has been granted drilling permits for 24 horizontal tests of Frontier or Shannon in township 48n-77w.

• Denver independent **Wold Energy Partners LLC** has scheduled eight extended-reach horizontal exploratory tests on a common drillpad in 39n-75w, northwestern Converse County. The Frontier, Mowry and Niobrara formations will be tested with two wells each. The remaining two tests will target Dakota and Shannon. Total measured depths are between 20,000 and 24,000 feet for the wells.

• **Ballard Petroleum Holdings** in mid-2015 completed its 44-15TH Dilts in 42n-73w, initially flowing 2,009 bbls of oil, 4.1 million cu ft of gas and 205 bbls of water per day. Production is from a horizontal Turner interval at 11,330-14,971 ft, following fracture stimulation in 32 stages.
San Andres

Horizontal play on the Permian Basin’s Northwest Shelf and Central Basin Platform
Historical San Andres Production

Source: DrillingInfo, RPSEA
## San Andres Horizontal Permits

<table>
<thead>
<tr>
<th>OPERATOR</th>
<th>Hz San Andres Permits</th>
</tr>
</thead>
<tbody>
<tr>
<td>RING ENERGY, INC.</td>
<td>25</td>
</tr>
<tr>
<td>STEWARD ENERGY II, LLC</td>
<td>18</td>
</tr>
<tr>
<td>RILEY EXPLORATION OPG CO, LLC</td>
<td>15</td>
</tr>
<tr>
<td>KINDER MORGAN PRODUCTION CO LLC</td>
<td>14</td>
</tr>
<tr>
<td>SHERIDAN PRODUCTION COMPANY, LLC</td>
<td>11</td>
</tr>
</tbody>
</table>

Hz San Andres permits granted in last 180 days. Source: DrillingInfo
• Today certain San Andres hz wells target the transition zone below the oil/water contact.

• Transition zones extend below what was traditionally considered to be the oil/water contact, and also extend laterally past the traditional field boundaries.

• Numerous San Andres fields exhibit large transition zones.

• Initial production can be immediate, though typically as reservoir pressure is reduced the oil cuts increase.
Transition Zone Theories:
• Dewatering: water is pumped out of the reservoir and disposed of, not reinjected.

• Depressuring: the water removal stimulates production by reducing reservoir pressure to below the bubblepoint. The expanding gas drives oil production.

• Bypassed pay: horizontal legs access trapped pockets of oil.

Residual Zone Efforts:
• EOR using alternating carbon dioxide and water injections.
# San Andres Comparison

## San Andres v. The Shales
Applying unconventional techniques to a conventional reservoir

<table>
<thead>
<tr>
<th></th>
<th>San Andres</th>
<th>Unconventional</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth</strong></td>
<td>4,500–5,500 feet</td>
<td>8,000–12,000 feet</td>
</tr>
<tr>
<td><strong>Development Cost</strong></td>
<td>$2.0MM - $2.5MM</td>
<td>$6.0MM - $9.0MM</td>
</tr>
<tr>
<td><strong>Drilling Days</strong></td>
<td>8-10 Days</td>
<td>20-30 Days</td>
</tr>
<tr>
<td><strong>Completion Size</strong></td>
<td>200–500 lbs/ft</td>
<td>2,000–3,000 lbs/ft</td>
</tr>
<tr>
<td><strong>F&amp;D Cost</strong></td>
<td>$4.50 - $8.50 / bo</td>
<td>$5.00 - $12.00 / bo</td>
</tr>
<tr>
<td><strong>Permeability</strong></td>
<td>Millidarcies</td>
<td>Nanodarcies</td>
</tr>
</tbody>
</table>

Source: Monadnock Resources, DUG Permian 2017

4/22/2017
Wellbore Schematic - Horizontal

Drilling Metrics:

- Drill 12 1/4" vertical hole to 2,500. Set 9 5/8" casing → 1 Day
- Drill 8 3/4" vertical to 4,600’ MD and TVD → <1 Day
- Drill 8 3/4” curve at 10 DLS to 90 degrees at 5,650’ MD and 5,250’ TVD → 1 Day
- Drill lateral from 5,650’ MD to +10,000’ MD → 2.5 Days
- Run 5 1/2” casing to surface (plug and perf completion)

Source: Monadnock Resources, DUG Permian 2017
Ring Energy

- Ring’s 42,852 gross acre position is in Andrews and Gaines Counties.

- 238 gross potential horizontal locations.

- SWD infrastructure in place to facilitate a horizontal drilling program.

- Just purchased 33,000 undeveloped acres in Gaines County for $16.6 million.

Source: Ring Energy
• San Andres EURs are 300 to 450 Mboe

• Fracs are evolving. Now at 12-16 stages per 1 mile lateral. Jobs are 600,000 to 1.5 million lbs of proppant.

60,000 net operated acres
- Ideally situated adjacent to the Basin’s most prolific fields

Infrastructure build out
- 90,000 bbls/d permitted SWD capacity from 3 wells
- 30+ mile produced water gathering and transport system currently being built out

Actively Drilling, Delineating & Derisking
- Encouraged by early results throughout the position
Tampico-Misantla Basins

Upper Jurassic shales
Tampico-Misantla Basin

- Discovered in 1962, Amatitlán field has produced ~ 175,000 bbls of light oil with peak production of 650 bbl/d in 2005.

- LUKOIL and Canadian junior Renaissance Oil Corp. will spend $60 million to develop the 56,800-acre block.

- The partners plans to re-establish production in Chicontepec formation and to commercialize the Upper Jurassic shale formations.

Source: Dan Jarvie
Generalized Stratigraphic Column

Bossier, Haynesville, Smackover age equivalents
Major source rocks in Deepwater Gulf of Mexico

<table>
<thead>
<tr>
<th>Upper Jurassic</th>
<th>Tithonian</th>
<th>Pimienta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kimmeridgian</td>
<td>Taman</td>
<td>Chipoco</td>
</tr>
<tr>
<td>Oxfordian</td>
<td>Santiago</td>
<td>Zuloaga</td>
</tr>
</tbody>
</table>
Gross And Net Thickness

Source: Dan Jarvie, Jarvie and Maende, 2016
Comparison Of Petroleum Generation Potentials

Source: Dan Jarvie, Jarvie and Maende, 2016
### Comparison To An Established Reservoir

<table>
<thead>
<tr>
<th>Location</th>
<th>Rock Type</th>
<th>Age</th>
<th>Thickness</th>
<th>Original TOC</th>
<th>Porosity</th>
<th>Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pimienta, Taman, Santiago</td>
<td>Marine carbonate</td>
<td>Upper Jurassic</td>
<td>500 – 1,000 ft</td>
<td>~ 5%</td>
<td>~ 7%</td>
<td>~ 1 microDarcy</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>Marine Carbonate</td>
<td>Cretaceous</td>
<td>200 – 250 ft</td>
<td>~ 5%</td>
<td>~ 7%</td>
<td>~ 1 microDarcy</td>
</tr>
</tbody>
</table>

Source: Dan Jarvie, Jarvie and Maende, 2016
Challenges To Unconventional Development

- Contract terms: Amatitlán is a currently a service contract with Pemex that should soon migrate to an E&P license. That timing is not certain.
- Taxes and royalties: still need to be worked out.
- Well costs: unconventional drilling is just beginning in Mexico, so early wells may carry high well costs.
- First movers: there will be many challenges of developing the supply chain, dealing with communities and operating under new regulations that have not been tested yet.
- Economics and politics: the price of oil and Mexico’s 2018 Election are both wildcards.
Thank you.

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