WolfBone Play Evolution, Southern Delaware Basin: Geologic Concept Modifications That Have Enhanced Economic Success*

Bill Fairhurst¹, Mary Lisbeth Hanson¹, Frank Reid¹, and Nick Pieracacos¹

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Abstract

The WolfBone play is an emerging unconventional oil resource. Exploration and development have been a systematic evolution from geologic concept to drilling, evaluation, and revision of targets. Originally, Wolfcamp sandstone reservoirs below and Third Bone Spring sandstone reservoirs above the Wolfcampian shale source section were targeted. Current drilling and production are focused on the 1000-ft-thick, oil-rich, unconventional Wolfcamp shale.

The Wolfcamp is an ideal heterogenetic resource consisting of quartz, carbonate, and kerogen. Exploration and field development will be successful over a large area. However, the geologic and economic sweet spot is limited to the basin floor. In this setting quartz and kerogen accumulated in the quiet deep basin interrupted by episodic deposition of shelf to basin-floor carbonate debris flows that settled basinward of the deceleration boundary. These depositional processes resulted in compositional and grain-size heterogeneities and accumulation of the thick organic-rich targets.

During maturation large volumes of oil were sealed in place (108 MMBOIP per section). Expansion from kerogen to oil in a sealed system resulted in overpressure and abundant fracturing that has resulted in enhanced productivity. Individual wells have flowed 45 MBO from 11,000 ft prior to initiating artificial lift, which is atypical of Permian Basin reservoirs. Farther into the basin and upslope these conditions do not exist and are outside the economic sweet spot. Basinward, the unit is consistently thick; however, there is more shale, and the section is starved of siltstones and carbonates. Upslope, the unit thins and is more gas-prone. In these slope environments the mixture of coarser-grained shelf carbonates and sandstones breached the system, providing migration pathways which have limited productivity and lower ultimate economic recoveries.
Since 2009, this play has been developed with vertical wells comingling the oil resource with conventional reservoirs. Interpretation of imaging logs has identified the primary fracture orientation and zones with conjugate fractures systems. Integration with production logs has optimized horizontal target identification, and horizontal drilling has begun. The Leonardian Avalon sweet spots occur at similar depositional setting as the Wolfcampian resource and the same geographic position in this portion of the basin. The Avalon is estimated to have 103 MMBOIP per section.

References


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WolfBone Play Evolution, Southern Delaware Basin: Geologic Concept Modifications That Have Enhanced Economic Success

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Most active US basin with 433 rigs (Delaware Basin: 214), Hz Rigs: ~35%(1)

Total Resource in place per section: 108 Mmboe
- Horizontal Development:
  - Alternative Wolfcamp development strategy modeled
  - 3rd Bone Spring development

Upside Potential
- Horizontal resource in Avalon Shale
  - Avalon Shale - 105 MMboe in place per section
- Delaware Sands - ongoing vertical & horizontal exploitation
- Vertical drilling targeting deeper gas zones

(1) Source: RigData, TPH. Hz % includes horizontal and directional rigs. As of September 30, 2011, or most recent data available.
Production from the Permian System

Summary
- Permian system comprised of multiple basins:
  - Delaware Basin
  - Central Basin Platform
  - Midland Basin
- Development progression:
  - Early production from shallow formations on the basin edges
  - Transition to deeper deposits in the central Delaware (Avalon, Bone Spring, & Wolfcamp)
- Recent basin revitalization:
  - Comingled vertical completions
  - Modern horizontal drilling and completion technologies

Permian Basin Structure
- Deeper
- Shallower

Permian Basin Cross Section

Delaware Basin Deposition

- 2 depositional systems in place
  - Deep submarine channels running off the NW Shelf and Central Basin Platform
  - Periods of influx of carbonate debris
- 3rd process in generation of organics in the photic zone across the entire basin as debris settled
  - Mostly organics settling in the deep basin; carbonates mainly deposited on the Shelf and on the Slope

Wolfbone Industry Activity

Source: HPDI and Eagle data. Producing wells.
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<th>DELAWARE BASIN</th>
<th>PERIOD</th>
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Bone Spring Type Log Section

Gamma Ray, API

0 75 150

Porosity, %

30 20 10 0 -10

Bone Spring Hoban Sand

Bone Spring A Sand

Bone Spring C Sand

Full logs available on VDR

© Eagle Oil & Gas, Co., 2012
Hz Bone Spring IP Bubble Map

All completions >1,000 boe/d are less than 12 mo. old

Wells completed as Wolfbone producers after 1/1/2009 - Hoban, Wolfbone fields
Hz Bone Spring IP Bubble Map

All completions >1,000 boe/d are less than 12 mo. old

Wells completed as Wolfbone producers after 1/1/2009 - Hoban, Wolfbone fields.

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Gamma Ray, API

0 150

Porosity, %

0 -10

Bone Spring Hoban Sand

Bone Spring A Sand

Bone Spring C Sand

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Plugging Water-Bearing Zones Improves Profits

Pistola #1 Case History
- Eagle’s 2nd Wolfbone completion
- Well initially flowed >1,000 bblw/d
- Leveled out ~150 bblw/d
- Re-entered wellbore and cement squeezed Middle Wolfcamp Sands C&D
- Re-completed Middle and Upper Wolfcamp shales and 3rd Bone Spring Sands
- **Well IP’d > 450 bopd following intervention**

Pistola #1 Production History

City of Pecos 15 #1 Case History
- Eagle’s 6th Wolfbone completion
- Well initially flowed >1,200 bblw/d
- Decreased to ~600 bblw/d over 30 days
- Re-entered wellbore and cement squeezed Middle Wolfcamp Sands C
- Re-completed Middle and Upper Wolfcamp shales and 3rd Bone Spring Sands
- **WOR cut in half to ~1.5 from 3+ vastly improving economics**
Production Logs = Precision Completions

Production Logs Used to Identify Target Intervals

- Eagle has run production logs in 9 Wolfbone wells
- Tool has multiple sensors to identify contributing intervals:
  - Spinner with dual-axis caliper
  - Pressure and temperature sensors
  - Digital Entry Flowview Imaging Tool (DEFT)
    - Water measurement
  - Gas Holdup Optical Sensing Tool (GHOST)
    - Gas measurement

Relative Flow Contribution by Member\(^{(1)}\)

- Total Hydrocarbon (boe)
- Water

<table>
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<th>Member</th>
<th>Wells</th>
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<tr>
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</tr>
<tr>
<td>2nd BS Shale Lwr</td>
<td>3</td>
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<tr>
<td>3rd BS Sands</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>Mid Wolfcamp Shale A</td>
<td>8</td>
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<tr>
<td>Mid Wolfcamp Sands D</td>
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</tr>
</tbody>
</table>

Previously Drilled Hz Target

Current Hz Target Monroe 39 #2H

Water-bearing zones No longer completed

Current Wolfbone Targets

Full logs available in VDR

\(^{(1)}\) Eagle has run production logs in 9 Wolfbone wells.

Tool has multiple sensors to identify contributing intervals:

- Spinner with dual-axis caliper
- Pressure and temperature sensors
- Digital Entry Flowview Imaging Tool (DEFT)
  - Water measurement
- Gas Holdup Optical Sensing Tool (GHOST)
  - Gas measurement

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Focusing the Effort

Continued improvements lead to targeted completions

Most recent wells completed consistently with excellent results
IP’s Trending Upward as Completions Improve

~5% IP increase with every subsequent completion

Average = 148 bbl/d

**North Wells**

**South Wells**

NOTE: Eagle operated Wolfbone completions.

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Honoring Recent Data

Recent well data; supports type curve IP

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RIVERFORD EXPLORATION, LLC WOLFBONE WELLS
RATE : CUM (BO)

Monthly Sales Volumes (BO)

y = 10000e^{-2.05x}
R² = 0.795

y = 3196.1e^{1.05x}
R² = 0.3441

y = 3851.5e^{-3.05x}
R² = 0.7128

y = 1700e^{3.05x}
R² = 0.39

© Riverford Exploration, LLC, 2012
BELL 213-A2 ("TYPE WELL"), RATE: CUM (BO)

\[ y = 5046.1e^{-0.05x} \]

\[ R^2 = 0.5546 \]
MONROE 28 #1 ("HIGH-SIDE WELL")
RATE : CUM (BO)

$y = 10000e^{-0.05x}$
$R^2 = -0.807$
Wolfcamp - The Source of the Delaware’s Success

Wolfcamp Geologic Characterization

- Ideal mineralogy and grain-size distribution to behave as both a source rock and a reservoir
- 108 MMboe in-place per square mile
- Approximately 1,000’ thick
  - 2-5% TOC
  - 50-90% quartz & carbonate, 10% clay
- 0.7 psi/ft pressure gradient
  - From in-situ hydrocarbon generation & storage
  - Higher production rates
  - Shallower declines
- Carbonate debris flows were the primary target
  - Conventional Wolfcamp production
- Industry now targeting the source rock
  - Modern D&C techniques
Wolfberry vs. Wolfbone

Wolfbone has Superior Reservoir Properties

- Depth and Pressure → Greater Reservoir Energy
  - Wolfbone is highly overpressured (~ 0.7 psi/ft)
  - Wolfbone is ~ 2,000’ deeper
  - **Wolfbone up to 2x Wolfberry pressure**
- Thicker vertical section leads to additional upside
  - Both completed over 1,250’ interval
  - Wolfbone has 2,000’ additional potential
- Substantial upside in the Delaware Basin
  - Uphole potential in Delaware Sands
  - Hz development

Wolfbone Well Count is Quickly Growing

Equivalent Geologic Age

Wolfcamp Unit in Common
Wolfbone... the Delaware’s Wolfberry... only Better

Industry Bringing Midland Basin Technology to the Delaware

- Industry has increased Wolfberry EUR over time by comingling more zones
- Activity significantly increased with improved results (now > 700 wells/year)
- Deeper, overpressured Delaware yielding superior Wolfbone EUR vs. Wolfberry
- Wolfbone wells flow 3-6 months before pump (20+ Mbo)

Wolfbone (Delaware) | Wolfberry (Midland)
--- | ---
**Primary Zones** | 3rd Bone Spring to Wolfcamp
| Upr Spraberry to Wolfcamp
--- | ---
**Additional Zones** | Delaware Sands, Avalon Shale, Deeper zones
| Non-traditional shale/silt zones and Deeper Zones
| (Strawn, Atoka, Mississipian)
--- | ---
**EUR (Mboe)** | 240
| 165
--- | ---
**% Liquids (%)** | > 80%
| ~ 65%
--- | ---
**Depth (feet)** | 11,000 - 12,500
| 7,500 - 11,000
--- | ---
**Spacing (acres)** | 40 acres
| 40 acres (current), testing on 20
| 1 well will HBP 160 acres
--- | ---

**Strat Column**

---

Wolfberry Evolution Through Technology

| EUR (Mboe) | <50 | 100 | 150 | 165 |
| Wells/Pct | -150 | -150 | -400 | >700 |

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(1) Chart adapted from Pioneer Natural Resources.
(2) Approximate yearly average.
Wolfbone Type Curve (vs. Wolfberry)

- **Wolfbone Data**:
  - Wellhead EUR (Mboe): 240
  - Oil EUR (Mbbl): 180
  - Gas EUR (MMcf): 359
  - % Oil: 75%
  - 24-hour Oil IP (bbl/d): 200
  - 24-hour Gas IP (Mcf/d): 400
  - Hyperbolic Exponent: 0.4
  - 1st Year Decline: 43%
  - Terminal Decline: 10%

- **Wolfberry**:
  - Wellhead EUR (Mboe): 141
  - Oil EUR (Mbbl): 105
  - Gas EUR (MMcf): 211
  - % Oil: 75%
  - 24-hour Oil IP (bbl/d): 80
  - 24-hour Gas IP (Mcf/d): 160
  - Hyperbolic Exponent: 1.5
  - 1st Year Decline: 59%
  - Terminal Decline: 6%

**GOR (scf/stb): 2,000**

(1) 2009+ vintage Wolfberry completions.

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Wolfbone 30-Day IP Bubble Map

NOTE: Wells completed as Wolfbone producers after 1/1/2009 - Hoban, Hoban South, Wolfbone fields.

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Fairhurst, Bill; Hanson, Mary Lisbeth; Reid, Frank; and Pieracacos, Nick
* Courtesy of Carrollton Minerals Partners

## Avalon
- ~800’ thick.
- 105 MMboe in-place per sq. mile

<table>
<thead>
<tr>
<th>Period</th>
<th>Unit</th>
<th>~ Depth</th>
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<td>Guadalupian</td>
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<td>8,800</td>
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<td>Cherry Canyon</td>
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<td>Brushy Canyon</td>
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**Stacked pay Verticals producing in 3rd Bone - Wolfcamp series**

Wolfbone Vertical –
- ~1200’ thick.
- 108 MMboe in-place per sq. mile

© Carrollton Minerals Partners, 2012
Going Sideways to Get Ahead

Horizontals in the Delaware

- Operators have been developing the 3rd Bone Spring with horizontal wells
  - Capture more acreage than vertical wells
  - More stimulated rock volume leads to higher rates
  - Larger drainage area leads to greater ultimate recovery
- Thick sections perfect for horizontal development
  - 2+ laterals per unit (Bone Spring, Wolfcamp, Avalon)
  - More laterals increase recovery factor per section

Horizontal Wells consistently Outperform Vertical

- Vertical to Horizontal EUR factor:
  - Bakken 3 - 5x
  - Eagle Ford 5 - 7x
  - Granite Wash 4 - 5x
  - Miss Lime 3 - 4x
  - Niobrara 6 - 8x
  - Wolfcamp (Midland) 5 - 6x
  - Wolfcamp (Delaware) 3x

Average ~ 5x

Vertical vs. Horizontal Drainage Area

- Vertical Well = 40 Ac
- Horizontal Well = 160 Ac

Source: CHK IR presentation. TPH internal research.

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The Bone Spring package exists across much of the Delaware Basin though different members are more prevalent in specific areas.
The Avalon Shale is present throughout the Delaware basin and is currently being pursued as an unconventional play in the Northern half.
What is the Avalon Shale?

The Avalon Shale is the stratigraphic interval between the top of the Bone Spring Formation & the 1st Bone Spring Sand.

**Basin Geology**

- Bounded by carbonate shelves & platforms
  - North: Northwest Shelf
  - East: Central Basin Platform
  - South: Marathon Fold Belt
  - West: Diablo Platform
- Bone Spring stratigraphy varies across the Delaware Basin
  - NW Shelf: predominantly carbonate
  - Slope: 1st/2nd/3rd sandstones developing in the lower part of the interval
- Deep Basin → Avalon Shale
  - “Shale” development within the upper 1st Carbonate section
  - Organic-rich siltstone and carbonate debris flow
  - Unconventional, continuous accumulation
  - 900 - 1,000’ gross thickness
Avalon Shale Net Isopach

Summary

- Map Parameters
  - Ft > 12% Density Porosity
  - GR > 75 Units
  - Resistivity > 20 ohm-m
  - From 600 data points
- Isopach is concentric from basin edges
- Porosity thick coincides with Bone Spring thick above basin low
- Primarily Pelagic deposition

Structure

- Regional Structure dips east at 100’ per mile
- 6,000’ deep in W. Eddy to 10,000’ deep in Lea County
- Lea County has more structural nosing and dip reversals than Eddy
- Axial low of basin trends N-S through Lea and Loving Counties
- GOR varies with depth with oily production in deeper basin

Source: Net isopach map and summary bullets from John Worrall (Geologist and Partner, Bold Energy II, LLC and Manzano Energy Partners), and Chad Kronkosky (Reservoir Engineer, Bold Energy II, LLC).
Eagle Avalon Shale Isopach

105 MMboe in-place per square mile across Eagle position

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Texas Avalon / Bone Spring Production Increasing

Production growth expected to continue recent momentum given industry focus on liquids and public statements from operators

Cumulative Production 96 MMboe

- Gas
- Oil
- Well Count

Source: HPDI. Includes vertical and horizontal wells with a target reservoir of Bone Spring or Avalon (HPDI does not currently distinguish between the zones) in the following counties: Reeves, Loving, Ward, Pecos, Winkler

First Avalon Shale Horizontal Producer
Chesapeake PLU Pierce Canyon 17-1H
First Production: January 2009
Peak Rate: 656 boe/d

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Eagle Oil & Gas

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Turbidite Channel Cross-Section
The Permian is the Premier US Oil Basin

Multi-Zone Vertical and Hz Development Potential

- **Wolfbone**
  - Commingled vertical wells that capture oil-rich 3rd Bone Spring and Wolfcamp over a 1,250’ interval
  - Overpressured analog to Wolfberry in the Midland Basin
  - High-liquid content provides superior economics
  - 108 MMboe in-place per square mile

- **Wolfcamp**
  - Horizontal drilling has begun in TX and Eddy, NM
  - Thick interval provides multi-lateral potential

- **3rd Bone Spring**
  - Substantial nearby horizontal drilling

- **Avalon Shale**
  - Up to 1,000’ gross thickness across the basin
  - Laterally extensive & continuous across Reeves, Co.
  - 105 MMboe in-place per square mile

- **Delaware Sands (Brushy, Cherry, and Bell Canyon)**
  - Vertical & horizontal exploitation of the 3,000 - 3,500’ thick interval with dozens of potential pays

Eagle Development is Proving Many Zones

- Eagle currently produces 1,888 boe/d from 28 wells
  - 24 vertical wells commingling production across 3rd Bone Spring members and Upper Wolfcamp members
  - 4 horizontal wells drilled into the 3rd Bone Spring Sands

- Eagle is currently drilling their first horizontal Wolfcamp well in the Upper Wolfcamp Shale B member
  - Excellent results to date with >100’ flares during drilling with 12.6 ppg mud
  - Over 100 bbl oil returned to pit while drilling lateral
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Recent Nearby Industry Results

- **Avalon Shale**
  - Chesapeake Ross Ranch Federal 6-1H
  - IP rate: 1,528 boe/d

- **Bone Spring**
  - Apache Bullhead 55-1-41 H
  - IP rate: 835 boe/d

- **Bone Spring**
  - Chesapeake Johnson 1-86
  - 30-day rate: 920 boe/d

- **Wolfcamp**
  - J. Cleo Thompson Terrill State
  - 30-day rate: 549 boe/d

- **Delaware**
  - Devon Colonel Drake 24 1H
  - 30-day rate: 518 boe/d

- **Bone Spring**
  - Anadarko Monroe 34-220
  - 30-day rate: 1,345 boe/d

- **Bone Spring**
  - Cimarex Terrill State
  - 30-day rate: 1,226 boe/d

- **Wolfbone**
  - J. Cleo Thompson Perry State 40
  - 30-day rate: 708 boe/d

Source: HPDI, Corporate IR Presentations.
Eagle Operated Wolfbone Production

Total Current Net Production: 1,780 boe/d (2,404 boe/d gross) (1)

Includes 17 operated wells

Source: Company Data
(1) Production Data as of 9/30/11.
Wolfbone Drilling Curves

<table>
<thead>
<tr>
<th>Well</th>
<th>Spud</th>
<th>TVD (ft)</th>
<th>Spud-to-TD</th>
<th>Spud-to-RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheldon #1</td>
<td>12/28/2009</td>
<td>12,685</td>
<td>37</td>
<td>39</td>
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<td>Pistola #1</td>
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<tr>
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<td>35</td>
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<tr>
<td>Balamorhea Ranch</td>
<td>6/18/2010</td>
<td>12,500</td>
<td>31</td>
<td>34</td>
</tr>
<tr>
<td>Capps #1</td>
<td>8/4/2010</td>
<td>12,084</td>
<td>30</td>
<td>33</td>
</tr>
<tr>
<td>City of Pecos 15 #1</td>
<td>9/17/2010</td>
<td>12,206</td>
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<td>27</td>
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<tr>
<td>Monroe 28 #1</td>
<td>10/21/2010</td>
<td>12,250</td>
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<td>31</td>
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<tr>
<td>Pecos Bill 203 #1</td>
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<tr>
<td>Monroe 39 #1</td>
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<td>31</td>
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<tr>
<td>Capps #2</td>
<td>3/7/2011</td>
<td>11,405</td>
<td>29</td>
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</table>

<table>
<thead>
<tr>
<th>Well</th>
<th>Spud</th>
<th>TVD (ft)</th>
<th>Spud-to-TD</th>
<th>Spud-to-RR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wyatt Earp #1</td>
<td>3/7/2011</td>
<td>11,582</td>
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<td>34</td>
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<tr>
<td>Culley 27 #1</td>
<td>3/18/2011</td>
<td>12,655</td>
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<td>42</td>
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<tr>
<td>Bell #3</td>
<td>3/19/2011</td>
<td>11,407</td>
<td>25</td>
<td>27</td>
</tr>
<tr>
<td>Doc Holliday 34 #1</td>
<td>4/3/2011</td>
<td>11,600</td>
<td>25</td>
<td>34</td>
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<tr>
<td>Leslie 11 #1</td>
<td>4/30/2011</td>
<td>12,700</td>
<td>37</td>
<td>39</td>
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<tr>
<td>City of Pecos 16 #1</td>
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<td>Billy the Kid 31 #1</td>
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<td>Bell #4</td>
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<td>Monroe 39 #2H</td>
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<td>33</td>
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<td>Planned Vt</td>
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<tr>
<td>Planned Hz</td>
<td>15,500</td>
<td>45</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>

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Drilling a single vertical well allows an operator to book the following:

- **1 PDP**
- **8 PUD**
- **16 Probable**
- **56 Possible**

80 total 3P locations

Using a “fence post” development technique allows an operator to quickly prove an entire field.

Eagle has already proven a large portion of their acreage to 3P.

Only 11 wells required to convert 100% of locations to 3P.
40-Acre Spacing Works in the Wolfbone

Focused Fracture - Capps 214 #1 Case Study

- Bell 213 #1 completed as a “typical” sandstone
  - Unconcentrated frac targeted sand intervals
    - Wolfcamp Upper and Middle A Shales
    - 3rd Bone Spring Sand
    - Not completed in Wolfcamp Upper B Shale
  - Wolfcamp C & D Sands produced excessive water and were plugged
- Capps 214 #1 was completed with a more focused “shale frac”
  - Upper and Middle Wolfcamp Shale
  - Wolfcamp A & B Sand
  - 3rd Bone Spring Sand
  - >2x Bell 213 #1 peak production rate

Same Area - Completely Different Results

Bell/Capps Lease (Southern Area of Eagle Position)

Bell 213 #1 (1)
Peak rate: 202 boe/d

Bell 213 #1 (1)
Peak rate: 202 boe/d

Capps 214 #1
Peak rate: 445 boe/d

NOTE: Bell 213 #1 was completed in the WC Upr and Mid A shales → but not in the best zone, the WC Upr B shale
**Wolfbone 40-acre Case Study** (Bell Lease)

- Bell 213 1, “A” 2, and “A” 3 drilled ~6 months apart
  - 213 1: June 29, 2010
  - 213 “A” 2: Jan 13, 2011
  - 213 “A” 3: May 21, 2011
- No observed interference during completion or production
- Decline rate unaffected by offsetting production
- **40-acre spacing is norm in the Wolfberry (analog)**
  - 20-acre development underway in many areas

---

**Wolfbone Down-Spacing Potential** (Recovery Factor)

- Oil-in-Place per sq mile = 108 MMboe

<table>
<thead>
<tr>
<th>Well Spacing (acres)</th>
<th>40</th>
<th>20</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR/Well (Mboe)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>3.0%</td>
<td>5.9%</td>
<td>11.9%</td>
</tr>
<tr>
<td>225</td>
<td>3.3%</td>
<td>6.7%</td>
<td>13.3%</td>
</tr>
<tr>
<td>250</td>
<td>3.7%</td>
<td>7.4%</td>
<td>14.8%</td>
</tr>
</tbody>
</table>

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Drilling a single horizontal well allows an operator to book the following:

- 1 PDP (4 x 40 Ac)
- 4 PUD (16 x 40 Ac)
- 8 Probable (32 x 40 Ac)
- 28 Possible (112 x 40 Ac)

40 total Hz 3P locations

Horizontal wells are being used to prove fields quickly in North Dakota using the “fence post” development plan.

2009 SEC booking guideline changes made proving reserves with horizontal wells more favorable to operators.

Old method: Only direct lateral offsets

New method: Includes toe+ heel offsets

Eagle is currently completing their first Wolfcamp Shale horizontal well.
Bone Spring Industry Activity

Bone Spring
Concho
Morning Fed. 1H
Test: 700 boe/d

Bone Spring
Chesapeake
Johnson 1-86
30-day: 920 boe/d

Bone Spring
Chesapeake
Crockett 1-26 1H
IP rate: 2,445 boe/d

Bone Spring
Chesapeake
Monroe 1-17 1H
30-day: 1,475 boe/d

Bone Spring
Anadarko
Blacktip Johnson 1-39H
30-day: 920 boe/d

Bone Spring
Cimarex
KHC '33-26'
30-day: 1,226 boe/d

Bone Spring
Cimarex
Davis '33-20'
30-day: 1,293 boe/d

Bone Spring
Cimarex Activity:
7 wells with reported IPs between 560-1,100 boe/d
Avg rate ~856 boe/d

Bone Spring
Devon
Talladega 65 1H
30-day: 1,281 boe/d

Bone Spring
Chesapeake
Monroe 34-220
30-day: 1,345 boe/d

Bone Spring
Anadarko
Blacktip Johnson 1-39H
30-day: 920 boe/d

(1) 3rd Bone Spring horizontal wells listed in HPDI as Phantom field, Wolfcamp reservoir.
Hz Bone Spring IP Rate

15 wells deviating from a standard lognormal distribution were removed from the dataset.
WolfBone Play Evolution, Southern Delaware Basin: Geologic Concept Modifications That Have Enhanced Economic Success

Fairhurst, Bill; Hanson, Mary Lisbeth; Reid, Frank; and Pieracacos, Nick