Horizontal Development of the San Andres Formation, Platang Field, Yoakum County, by John Worrall and Mike Hanagan, Manzano Energy Partners.

Statistics and Development Timeline

Horizontal Development of the Platang San Andres Field

- Acquired 6500 Acres in 2012 with No existing Production.
- Drilled Two Pilot Holes in 2013. Installed an SWD system. Acquired 10,454 more acres.
- Late 2014 Began a One Rig Development Program and drilled 33 wells back to back. Released the rig in early 2016. Drilled one more in mid 2016 for a total of 36. Generally started a frac job or spudded a well every Monday for 15 months.
- EUR is 315 MBOE for One Mile laterals and 490 MBOE for 1.5 Mile Laterals
- August (8/22-8/28 week) 2016 Production: 4853 BOPD + 5890 MCFGPD + 25,880 BWPD (16% Oil Cut) (5245 BOEPD at a 15:1 conversion)
- Project has 42.4 MMBOE Recoverable Reserves. 101 Locations. (Has Already Produced > 2 MMBO)
- Avg. Lifting Costs for June-August 2016 was $7.69 per gross barrel
- Total All In D/C plus Operating Costs are $14/gross barrel and $18.5 per net barrel
- Sold Effective August 1, 2016 to Steward Energy for $225 Million.

  16,954 Contiguous Net Acres. 36 Wells, 5245 Gross Producing BOEPD, 3680 Net BOEPD to Sale Interest
  $61,140 per net producing barrel, or
  PDP PV10 of $132.2 MM + $12 MM for infrastructure + $4613 per net acre.
TALK OUTLINE

- **INTRODUCTION**

- **Pre-Drilling Information**
  - 10 Former Vertical Wells on the Lease Block
  - Adjacent Analog Field, the West Brahaney Unit

- **Pilot Log Information Gathered**

- **Mapping of the San Andres Reservoir**
  - Structure Mapping
  - Isopach Mapping

- **Horizontal Development**
  - Drilling & Completion (Methods, Costs and Optimizations)
  - Production Data (Type Curves and EURS)

- **CONCLUSIONS**

- **NORTH YOAKUM UPDATE (Time Permitting)**
Geology and Engineering

Geological Overview

- Manzano’s Platang field is located on the north end of the Central Basin Platform
- The San Andres dolomite is just one of many Platform candidates for horizontal technology.
Geologic Overview

Geologic Field Study
Approx. 45 miles wide by 30 miles tall
(>1,300 square miles)
in Yoakum County, TX / Lea County, NM area
Pre-Drilling (2013) Observations:
1) 10 Vertical Tests of Oil in San Andres on the Lease Block (1950s-1980s)
2) Avg IP: 22 BOPD, 58 BWPD (10 wells, 28% Oil Cut)
4) Actual=18.3 MBO, 190 MBW, 5 wells (9% OC)
4) No current SA production on the block

Opportunity:
Apply Modern Horizontal Drilling & Completion Technology to Profitably Extract Reserves

Cumulative Gas Vol in Red
Cumulative Oil Vol in Green
Cumulative Water Vol in Blue

Geologic Target Area: Pre-Drilling Observations
KEY POINTS

Pi Marker at 5129
Top A Zone 5190
Top Porosity 5299 (70’ in) – equivalent to the Slaughter or Chambliss zone in Tx (P-1 zone NM)
Bottom log 5325 still in the zone with 18% porosity. Total of 84 ft >4% porosity.

_calculates Productive_
Sw = 11 to 32% across porosities ranging up to 18%, with mudlog shows throughout.

_Vertical Wells not at all economic, even with a 41,000# frac job._

Decisions: Drill thru the Lower Brahaney (5500’). Must drill horizontally and must complete with significant frac jobs. Will produce lots of water and must prepare to deal with it.
Analog Production:

Waterflood – Walsh Petroleum West Brahaney Unit

- First drilled in 1954, began injection in 1965
- Historical estimates and data available in the unitization report

**West Brahaney Unit**

- Secondary Oil: 10.6 MMBO
- Primary Oil: 5.5 MMBO
- Total Oil thru March 2015: 16.1 MMBO
- Secondary to Primary Ratio: 1.9 to 1
- Recovery Per Acre: 2.7 MBO/acre
- Recovery Per Section: 1,717 MBO/section

**Primary Oil Decline estimated at 16%**

- Monthly Production (MBO) vs Year for West Brahaney Unit with oil and primary oil forecast lines.
Fina West Brahaney Unit (WBU) #211 Sec. 541. Type Log Section.

Core Data 5110-5130, Avg K=.02md, Avg Porosity=1.45%, Avg So=0%, Avg Sw=84% (8 cores)

Nodular Anhydrite, Bedded Anhydritic Dolomite
Probable Supratidal Environment, Ramp Setting
Fina WBU #211 Sec. 541. Upper Chambliss “A” Dolomite

5189-5209, Avg K=.87md, Avg Porosity=6.6%, Avg So=23.8%, Avg Sw=21.8% (20 cores).

Massive Tan Dolomite with anhydrite cement and nodules, some anhydrite cemented burrows. Intertidal.
Fina WBU #211 Sec. 541. Chambliss “A” Dolomite. Main Pay. Walsh Lateral Target.

Avg $K = 17.98$md, Avg Porosity= 15.0%, Avg So = 21.5%, Avg Sw = 44.3 (17 cores). This interval had been waterflooded for 28 years when these cores were taken. In 1960, adjacent wells produced 80% oil cut.

Main Interval is massive tan dolomite with anhydrite cement and replacement. This is the main waterflood interval at the West Brahaney Unit.
Massive Tan Dolomite with anhydrite cement and nodules. This is equivalent to the zone in which Manzano drills its laterals.
Geology and Engineering

Manzano Acreage to *West Brahaney Unit*

- **West Brahaney Unit**, 5 spot pattern downspaced by Walsh Petroleum to 20 acre spacing beginning in 1998. Still produces 15,000 BOPM.
  - Walsh’ Flood primarily produces from the 100 ft thick Chambliss (orange) and the upper portion 20 feet of the Brahaney B. In the Cored well, the avg K of the Chambliss was =18 md.
  - Chambliss section in the Platang field (Manzano) is present and on strike with the Walsh acreage. It is the same section but it gets tighter to the west, 1.5 md in the Whatamelon #1 and .04 md in the Broken Spoke on the westernmost side.
  - But Manzano found a thicker overall pay section: 191 ft pay’ in logs and cores, above transitional OWC (Dark Blue).
Pre-Drilling Production Map (2013)
Manzano WhataMelon 519#1 (1st Pilot Log) Sec. 519, Block D, 200 Fsl & Fel, TD 5500 March, 2013 Yoakum County, Tx 218 FT Gross pay column, 191’ Pay >4% FMI shows N80W induced fracture dir.

Chambliss Zone 5198 - 5298 (100 ft thick) Sw Calc= 29-37%. Good Shows, 8 SW cores avg 1.5 md, 10% por., So=27%, Sw=30.6% (Total Fluid=47% oil)

Brahaney Zone 5298-5380 (C top @ 5346) Sw Calc=34-52%, Good Shows, 5 B cores avg .9 md, 10.6% Por, So=21.8, Sw=25.4 (46% of TF) 4 C cores avg 10.1 md, 14.6% Por., So=35.8%, So=32.1%, (53% of total fluid)

Lower Brahaney 5380 top, transitions to more water at 5418. From 5380-5418, Sw=40-45%, Below O/W transition Sw=52-73% Core Data: 1 above = .4 md, So= 35.6, Sw=36, 4 cores below transition avg 2.99 md, 9.3% Por. So=22.4 Sw=77% (TF=23% Oil).

High Perm C Zone Identified Best Perm = Best SO also

Frac 3/4/2014 with 1.0 MM# sand (267#/ft). 1st Oil 3/23/2014. Pk Oil 422 BOPD. 136 BOPD at 180 days. EUR 303 MBO
New Mexico Type Log, 5 mile to the west.

- 1st Oil 4/14/2014
- Pk Oil 389 Bopd. 266 BOPD at 180 days. Current 100 Bopd.
- EUR 304 MBO
- Chambliss is tight but the High Perm C zone is still present.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Porosity</th>
<th>Avg K</th>
<th>So</th>
</tr>
</thead>
<tbody>
<tr>
<td>38’</td>
<td>&gt; 4%</td>
<td>0.04 md</td>
<td>19%</td>
</tr>
<tr>
<td>43.3’</td>
<td>&gt; 4%</td>
<td>0.5 md</td>
<td>53%</td>
</tr>
<tr>
<td>30’</td>
<td>&gt; 4%</td>
<td>0.4 md</td>
<td>31%</td>
</tr>
</tbody>
</table>
Brahaney C Zone Isopach. Target of Manzano Laterals.

Feet Porosity > 6%. 5 ft Contour Intervals. Manzano expanded its lease position where the C zone was present.
Geology and Engineering

Brahaney C Structure. We landed 34 laterals into the top of the C zone using a GR log to KOP.

- Map of the top of the high perm Brahaney C zone. Overall Brahaney structure dips to the southwest.

- Manzano drilled 34 laterals landing them generally 5 to 10 feet into the C zone. Then they followed the structure (usually .5 degrees) up or down.
  - Average permeability of 6.7 md and high of 22 md from 11 sidewall cores from 3 wells
  - Thin sections show the C zone is fine crystalline dolomite with pervasive moldic and intercrystalline porosity
  - Oil saturation is 50% - 53% from two type logs

- Lowest known oil is -1,640’ SSTVD established in the Dog Bar #2H

- Some of Manzano’s best wells were in the NW corner (red contours) of Manzano’s acreage where the Lower Brahaney became more filled with oil as we moved up the Bronco field structure.
Brahaney B/C Net Isopach (ft > 4% porosity)

- Brahaney B/C thickness is typically 80’
- Manzano Platang field acreage contains 35’ to 77’ of Brahaney pay >4% porosity.

Brahaney C High Perm Thin Section

- Smashed Nickle thin section sample with 15.7% porosity and 12.2 md k
- Indicates moldic and intercrystalline porosity
Current Type Curve – 1.0 mile lateral

Peak Daily Oil Production
276 BO on Day 81

329,000 Barrels Oil Estimated Ultimate Reserves

320 Million Cubic Feet Gas Estimated Ultimate Reserves

Net to Working Interest Owners
(after 25% royalty)

- Average Historical MBOE per well: 315
- Average Historical MBOE per well (after 25% royalty): 1,260
- Average D&C Cost per well ($MMs): $2.0
- Average D&C Cost per well (after 25% royalty): $8.0
- D&C Cost per BO: $8.47
- Avg Lifting Cost -- last 3 mos: $10.10
- Total “All-In” Cost per BO: $18.57
483,000 Barrels Oil Estimated Ultimate Reserves

509 Million Cubic Feet Gas Estimated Ultimate Reserves

Type Curve based on 10 wells with at least 9 months of production history

Peak Daily Oil Production 297 BO on Day 56

Confidential
Geology and Engineering

Frac Height Modeling Leads to Optimization

NuTech frac modeling and production history matching show fracs are not growing above the Brahaney B zone, with the most concentrated portions of the frac centered in the Brahaney C and Lower Brahaney.

<table>
<thead>
<tr>
<th>Well:</th>
<th>WAM#1</th>
<th>Spoke #2H</th>
<th>Sm. Nickel 3H</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propped Total Frac Height, feet</td>
<td>73</td>
<td>92</td>
<td>71</td>
<td>78.7</td>
</tr>
<tr>
<td>Propped Frac Up, feet</td>
<td>37</td>
<td>30.5</td>
<td>37</td>
<td>34.8</td>
</tr>
<tr>
<td>Propped Frac Down, feet</td>
<td>36</td>
<td>61.5</td>
<td>34</td>
<td>43.8</td>
</tr>
<tr>
<td>Drainage, Acres</td>
<td>107</td>
<td>158.5</td>
<td>233.6</td>
<td>166.4</td>
</tr>
</tbody>
</table>

Logs hung on Brahaney B Top
Brahaney C Top
Brahaney D Top

Chambliss Zone Unstimulated

Proppant Concentration

MMPF:

MAX: 5
MIN: 5
MAX: 220
MIN: 220
In 2016, Manzano placed two wells with thick Chambliss in the Lowermost Chambliss to attempt to frac through the entire section.

- The Chambliss zone is the 100 ft thick zone above the 80 ft thick Brahaney zone.
- It is the main pay interval of the offset West Brahaney Field operated by Walsh Petroleum.
- Manzano did not run a microseismic survey but through data sharing heard other operators were seeing 200 ft height growth. This fit Manzano’s frac modeling.

- Smashed Nickel sample with 11.5% porosity and 5.3 md
San Andres Isopach Map Ft Porosity > 4%
(20 ft contours, 1st yellow = 60 ft, 1st red = 140 ft, max = 200+ ft)
by Frac’ing wells with thicker ( > 25’ ) Chambliss Section….
with ~2X sand volume per lateral foot, we have added ~5,000 BO per foot of Net Chambliss Pay > 25’ Thick at an incremental cost of < $150,000 (<$0.75 per/incremental BO)
Drilling & Completion Cost – Reductions and Efficiencies

Drilling & Completion Costs ($ millions)

<table>
<thead>
<tr>
<th>1-mile Horizontal</th>
<th>Drill / Complete</th>
<th>Cement</th>
<th>Frac</th>
<th>Tangible</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg 2014</td>
<td>1.67</td>
<td>0.15</td>
<td>1.11</td>
<td>0.85</td>
<td>3.78</td>
</tr>
<tr>
<td>Avg 2015</td>
<td>1.15</td>
<td>0.07</td>
<td>0.53</td>
<td>0.42</td>
<td>2.17</td>
</tr>
<tr>
<td>Last 2</td>
<td>0.92</td>
<td>0.06</td>
<td>0.55</td>
<td>0.30</td>
<td>1.83</td>
</tr>
<tr>
<td>Change</td>
<td>-45%</td>
<td>-60%</td>
<td>-50%</td>
<td>-65%</td>
<td>-52%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.5-mile Horizontal</th>
<th>Drill / Complete</th>
<th>Cement</th>
<th>Frac</th>
<th>Tangible</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg 2014</td>
<td>1.89</td>
<td>0.15</td>
<td>1.45</td>
<td>1.05</td>
<td>4.54</td>
</tr>
<tr>
<td>Avg 2015</td>
<td>1.51</td>
<td>0.08</td>
<td>0.79</td>
<td>0.51</td>
<td>2.89</td>
</tr>
<tr>
<td>Last 3</td>
<td>1.22</td>
<td>0.07</td>
<td>0.76</td>
<td>0.36</td>
<td>2.41</td>
</tr>
<tr>
<td>Change</td>
<td>-35%</td>
<td>-53%</td>
<td>-48%</td>
<td>-66%</td>
<td>-47%</td>
</tr>
</tbody>
</table>

Historical / Projected Profitability of Proved Undeveloped Locations

- 1Q 2013: 145 MBOE/well, $3.25MM D&C, 36% IRR
- YE 2013: 187 MBOE/well, $3.25MM D&C, 45% IRR
- YE 2014: 292 MBOE/well, $2.64MM D&C, 69% IRR
- YE 2015: 285 MBOE/well, $1.85MM D&C, 40% IRR
- 3Q 2016: 315 MBOE/well, $1.9MM D&C, 67% IRR

Note that because longer laterals weren’t drilled until later in the Manzano project; only 1-mile laterals are described above to show maximum history; profitability of 1.5 mile laterals is higher.
Facilities Overview. Manzano invested $12 MM in infrastructure.

Infrastructure Overview

- 15 tank batteries
- 10 frac ponds (no problems sourcing frac water from the Ogallala Aquifer, purchase from surface owners)
- 31.5 miles of water disposal piping

**Avg Disposal Cost = $.18/BW**
CONCLUSIONS

- The San Andres is historically the most prolific reservoir in the Permian Basin. The San Andres formation is a good low cost, shallow, conventional candidate for horizontal development. For Manzano, the all in production costs averaged around $18/BO.

- **But Detailed mapping of the reservoirs is critical to determine reservoir thickness, potential reserves, and locate the presence of water. “It is not all good everywhere”**.

- Horizontal Drilling and Completion technology allowed Manzano to extend the western limits of the West Brahaney field beyond where vertical completions were formerly economic. Platang field is structurally on strike or updip to the adjacent West Brahaney field. Development is stratigraphically controlled by the limits of the porous dolomite facies to the west and north.

- Core, Mudlog and Water Saturation data should generally match up. In general, here and elsewhere, within the pay column, the best core perms retain the best So, whereas the tighter the dolomite, the lower the saturation of So/ higher the saturation of Sw.

- At Platang field, the actual average total field oil cut of 16% was not a lot different than pre-drilling marginal vertical wells (9% actual, 28% on IPs), it was just a lot more prolific (422 BOPD peak oil rate in the 1st Pilot well versus offset show well average production of 2 BOPD).

- While former vertical wells produced oil from the start, the horizontal wells do not. Large volumes of water and gel are used in fracing these wells. Using subpumps to move 3000 BFPD, We typically recover all of our load, and draw the pump intake pressure down to 1200 psi or more, before seeing oil cut start coming in (often 20-30 days). Usually the well’s oil production peaks 30 to 45 days after first oil.
Key Point: The San Andres dolomite facies can change rapidly. So results will vary.
Henry Pet. Susie 3704 Digital Logs & Landing Depths graciously provided by Henry Petroleum (All Red annotations are Manzano’s)

Landed 245’ below the Pi Mkr. in the Lwr Brahaney equivalent (180 ft of Chambliss and Brahaney are tight).

Susie 3704
Apache Thunderstruck
Apache Pearl

9/2016 DI Prod. Susie 53 Bopd (Now 80-90) Thunder 42 Bopd Pearl 21 Bopd (Now TA) All make>95% Water

RSWC Oil Saturation %

Top of Zone
ATTIC OIL
ATTIC WATER
5200 BASE ML SHOW
Base of Zone