Permian Oilfield Water Midstream Moves Toward Consolidation and Integration Phase

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Please Cite As:
Gabriel Collins, “Permian Oilfield Water Midstream Moves Toward Consolidation and Integration Phase,” PBWIEC 2019, 21 February 2019, Midland, TX
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Frac source water: 76,000 metric tons
Produced water: Over 250,000 metric tons
Crude oil and liquids: 68,000 metric tons
Pipe, sand, misc. consumables: Approx. 10,000 metric tons

Long-Lateral Permian Oil Well Inputs and Outputs Weigh ~405,000 metric tons

Empire State Building Weighs ~340,000 metric tons

~400-450 wells completed/month

Water will likely account for approximately 80% of lifetime “mass moved” for many Permian Basin wells.

Source: CME Group, Empire State Realty Trust, FracFocus, TexasBrine.com

This analysis assumes 500,000 barrels of oil produced, with a water-to-oil ratio of 3:1. In many cases, wells will ultimately produce more oil and at a higher water cut.
Tapping the Ancient Sea: Putting Water Volumes Into Perspective

Permian Produced Water “Flow”

Permian Basin Crude Oil Production (exc. NGL)

Source: Plains All American, NGL Energy Partners

Permian Produced Water “Stock”

Midland Basin Premium Zone Spacing Assumptions vs. Peers

Source: Diamondback Energy, January 2019

Delaware Basin Premium Zone Spacing Assumptions vs. Peers

Source: Plains All American, NGL Energy Partners
The molecular endowment of a given block of acreage is geologically fixed, but the other elements of the unconventional oil & gas development equation are highly dynamic. These include drilling and completion costs, materials sourcing, and midstream services to evacuate oil, gas, and produced water. All are subject to cost reduction via technological improvements—and most of all—solutions delivered through more deeply integrated infrastructure and when feasible, economies of scale.

What Management Said Almost 2 Years Ago:
“The majority of these cost savings are expected to be sustainable due to significant enhancements in the power and water-handling infrastructure over the past few years.”
—Devon Q4 2016 Operations Report

What is Happening Now:
The company’s investments in fixed infrastructure like power and pipelines, as well as sand, dedicated rigs, and frac crews appear to be delivering lower operating expenses even as activity heats back up and service cost inflation looms Basin-wide.

Cost savings ultimately accrue to the bottom line, as Devon reported $66 million in free cashflow on $322 million of revenue in 2Q2018 for its Delaware Basin assets.
Permian Oil Production Growth Has Been a Major Global Shock Absorber

The Permian Basin Has Become the World’s Premier Non-OPEC, Non-Middle East Source of Oil Supply Growth

Thought Exercise: What if the Permian Unconventional Space Hadn’t Taken Off?

Without the Permian unconventional boom, US oil production would likely be more than 20% lower than its current level.

Permian output has grown by 2.5 million bpd from its January 2008 baseline, largely driven by unconventionals. This is more than the total loss in Venezuela’s oil production since Hugo Chavez took power in 1999.

Source: BP Statistical Review of World Energy 2018, EIA

Source: EIA, OPEC Monthly Oil Market Report
Permian Basin Oilfield Water Space Increasingly Popular

Source: Company Reports, Corporation Wiki, EIA (Permian crude data)
The Permian Basin Oilfield Water Space: Game Version

Source: AdWeek
Why Is Consolidation Likely
CAPEX-intensive commodity markets often naturally evolve towards sector domination by a few players. Pipelines and oil ports are there. Will oilfield water be next?

- Labor
- Frac spreads
- Sand
- **Water**
- OCTG
- Rigs

**Upstream/Quasi-Upstream**

- Liquids takeaway
- Gas takeaway
- Gas processing

**Midstream**

- Storage
- Refining
- Export capacity

**Perspective:**

- PAA’s Cactus-II pipeline that costs $1.1 billion will be able to absorb 585 kbd of production (aka about a year of net output growth)
- The associated produced water—potentially 2 million bpd—could require $500 million worth of new SWDs (assuming 25 kbd per well capacity and $6-to-$6.5 million final cost)
Integrated Water Services: Scale Drives Value and is Operationally Necessary

**Demand Side**

<table>
<thead>
<tr>
<th>Frac water demand, '000 bpd</th>
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<td>3-Rig Program</td>
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<td>5-Rig Program</td>
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<td>7-Rig Program</td>
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<td>10-Rig Program</td>
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- These projections assume 8.0 wells completed per year per rig (based on 9+ wells completed per rig per year implied from annualizing COG’s data from the first 3 quarters of 2018) and an average volume of 600 thousand barrels of water per frac. Increasing productivity from pad drilling and/or larger frac sizes could significantly increase the water volume demanded per active rig.

**Supply Side—For SWDs, Recycling, and in the Future, Re-Purposing**

**Source:** NM OCD, Author’s Analysis

**COG “Vast” Development, 7 Wells, Lea County, NM**

3.6 mmbbl cumulative water production, about 31 thousand “truckload equivalents”
Volume Diversity Reduces Water Midstreams’ Cashflow Risk

NGL Permian Water Solutions 2018 YTD Volumes Received, By Well (Mmbbl)

- Greater volume stability is a key value driver.
- A smaller midstream whose portfolio consists of a relatively few wells that are high-quality and attract large volumes is likely worth more as part of a bigger midstream firm. There is potential for a natural value uplift.
- In other words, the post-M&A whole can be worth more than the sum of the individual parts.

Source: Texas RRC
Size Could Improve Water Midstream Competitiveness if E&P Consolidation Continues

1. Potential Acquirer is Scaling Up
   Lateral Length, ft

   Drilling longer laterals

   Operator X

2. Potential Acquiree (Ideally Adjacent) Has Proven Acreage But Not Yet Scaled Up

   Potential upsizing opportunity

   Operator Y

Source: NM OCD, Author’s Analysis (Research assistance provided by Nosa James)
Recycled Water Could Now Account for Close to 10% of Permian Frac Sourcewater Supplies

**Estimated Daily Average Recycled Water Volumes by Selected Permian Operators, Bpd**

- **2Q2018**
  - Oxy (NM), 84,752
  - Cimarex, 91,933
  - Pioneer, 55,407
  - EOG (Permian), 35,439
  - XTO (Permian), 32,990
  - Apache, 38,537
  - Concho, 22,798
  - Laredo, 25,565
  - Primexx, 19,532

- **3Q2018**
  - Oxy (NM), 53,026
  - Cimarex, 91,933
  - Pioneer, 42,577
  - EOG (Permian), 38,539
  - XTO (Permian), 39,461
  - Apache, 29,042
  - Concho, 22,798
  - Laredo, 16,680

**Estimated Proportion of Recycled Water as % of Total Frac Fluid Stream, 3Q2018**

- **Oxy (NM)**: 95%
- **Cimarex**: 46%
- **Concho**: 37%
- **Laredo**: 10%
- **EOG (Permian)**: 87%
- **XTO (Permian)**: 70%
- **Apache**: 80%
- **Pioneer**: 40%
- **Devon (NM)**: 25%
- **Calion**: 15%
- **Encana**: 13%

Source: Company Reports, Credit Suisse, Author’s Estimates

Methodology: Take management statements to investors, any other corporate communications I could locate detailing produced water re-use intentions or actual volumes/proportions, and a Credit Suisse research report on the same topic, apply these numbers to frac water usage data each operator reported to FracFocus and estimate recycling volumes for 2Q2018 and 3Q2018.
Can Greater Recycling Help Optimize the Oilfield Water Investment Cycle?

**CAPEX to Dispose of 50 kbd of Produced Water**

Option 1: Delaware Sands SWD
- 2 wells @ 25 kbd per well
- $5 million-to-$6.5 million per well
- $10 million-to-$13 million

Option 2: Devonian/Ellenburger SWD
- 2 wells @ 25 kbd per well
- $8 million-to-$12 million per well
- $16 million-to-$24 million

Option 3: Recycling
- 1000 kb pond capacity
- $1.25/bbl of built storage
- $1,000k for process units
- $2.25 million

- CAPEX differences favor recycling. OPEX parameters will vary depending on scale and quality of incoming water, as well as E&P customer needs.
- The core question is: do recycling investments early in a play’s development when frac’ing is most intense and the demand for feedstock water is highest help defer SWD investments that can then be made later when PW flows are more predictable and capital and capacity optimization are easier to do?

Water Production Profile of Top-Tier Wells in Lea County, NM

Examined sample of approximately 600 wells completed in Lea County by Apache, COG, Devon, EOG, and Mewbourne and ranked them according to the cumulative oil volume produced in their first 6 months of reported production. Curve built from average of data from the 10 wells clustered around the 75th and 50th percentiles, respectively.

- Peaky, front-loaded flows.
Private equity funds generally target a 2.5 times multiple of invested capital ("MOIC") when they sell a business.

Sample data from a real-world, big name PE fund
Carlyle Group investor slides, June 2018

Key Points

- Superior, diversified track record
  - 2.5X MOIC on realized and partially realized investments
  - 13 significant fund families
  - Experience across multiple deployment and exit cycles

Table 9: MOIC
The target value of gross MOIC used by PE investors.

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Permian Oilfield Water Predictions

A. Within 12 months from today (start date August 2018)
   - A major Permian-focused water midstream firm goes public or has a similarly large liquidity event
   - At least 3 additional large private equity companies enter the space
   - At least 3 sizeable (80 kbd+ avg. actual volume handled) water midstream firms in the Permian will be acquired by a larger player
   - Treated co-mingled produced water will began to be re-sold at a commercial price

B. Within the next 24 months (by August 2020)
   - There will have been a billion-dollar oilfield water transaction in the Permian
   - At least five Permian-focused entities other than Pioneer Water Management will be transporting and injecting 500 kbd or more of produced water

C. Within the next 36 months (i.e. by August 2021)
   - At least 4 million bpd of incremental produced water (relative to August 2018) must be handled
Cutting-Edge Texas Groundwater and Oilfield Water Research


