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Frac Ranching vs. Cattle Ranching: Exploring the Economic Motivations Behind Operator–Surface Owner Conflicts Over Produced Water Recycling Projects

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Water in Texas oilfields is enormously valuable, selling for five or more times what even water-desperate cities can afford to pay for it. The opportunity to sell frac water and disposal services also opens the door for a host of landowners to make substantial returns—including many who are located in areas with significant drilling activity, but who had largely been left out of previous booms because they didn't own mineral rights. Ranchers can now make many times more per year selling frac water and disposal rights than they did raising cattle. But produced water recycling threatens these rents, especially when offered at a price range palatable to operators. Conflicts are likely to result.

This brief explores the alignment (and misalignment) of economic incentives between water owners and oil and gas producers in greater depth. It also discusses the economic and legal realities that will influence the conversation between groundwater owners and prospective water recyclers and, ideally, inform potential business-side and legal resolutions to conflicts over water recycling issues.

Proactively acknowledging and addressing the issue can improve the sustainability of oilfield water resource usage, reduce potential risks from induced seismicity driven by injection disposal, and ultimately lower oil and gas production costs and make hydrocarbons produced in the Permian Basin and other U.S. unconventional resource basins even more competitive in the global marketplace.

WHY PRODUCED WATER RECYCLING IS INCREASING—AND POISED TO RISE FURTHER

Three key factors underpin the growth of produced water recycling activity. First, exploration and production (E&P) companies are amassing larger contiguous blocks of drillable acreage—particularly in the Permian Basin—and are building midstream infrastructure to maximize operational efficiencies and reduce costs, especially in water handling.[1] Second, frac chemistries can now increasingly support the use of minimally treated produced water.[2] Greater reuse of produced water can slash total life cycle water costs by reducing an operator's need to purchase water from landowners and decreasing the volumes of flowback and produced water that need to be disposed as oil and gas wells enter production. This in turn reduces lease operating costs and makes producers more globally competitive. Third, an increasingly sophisticated group of midstream water service providers—many of them backed by cash-flush private equity funds—is emerging, building infrastructure in high-activity areas and engaging in significant consolidation that could ultimately form the foundation of integrated

Barriers to oilfield produced water recycling erode economic value, strand useful oil and gas reserves, and squander precious groundwater resources in areas where aquifers can take decades or more to recharge.

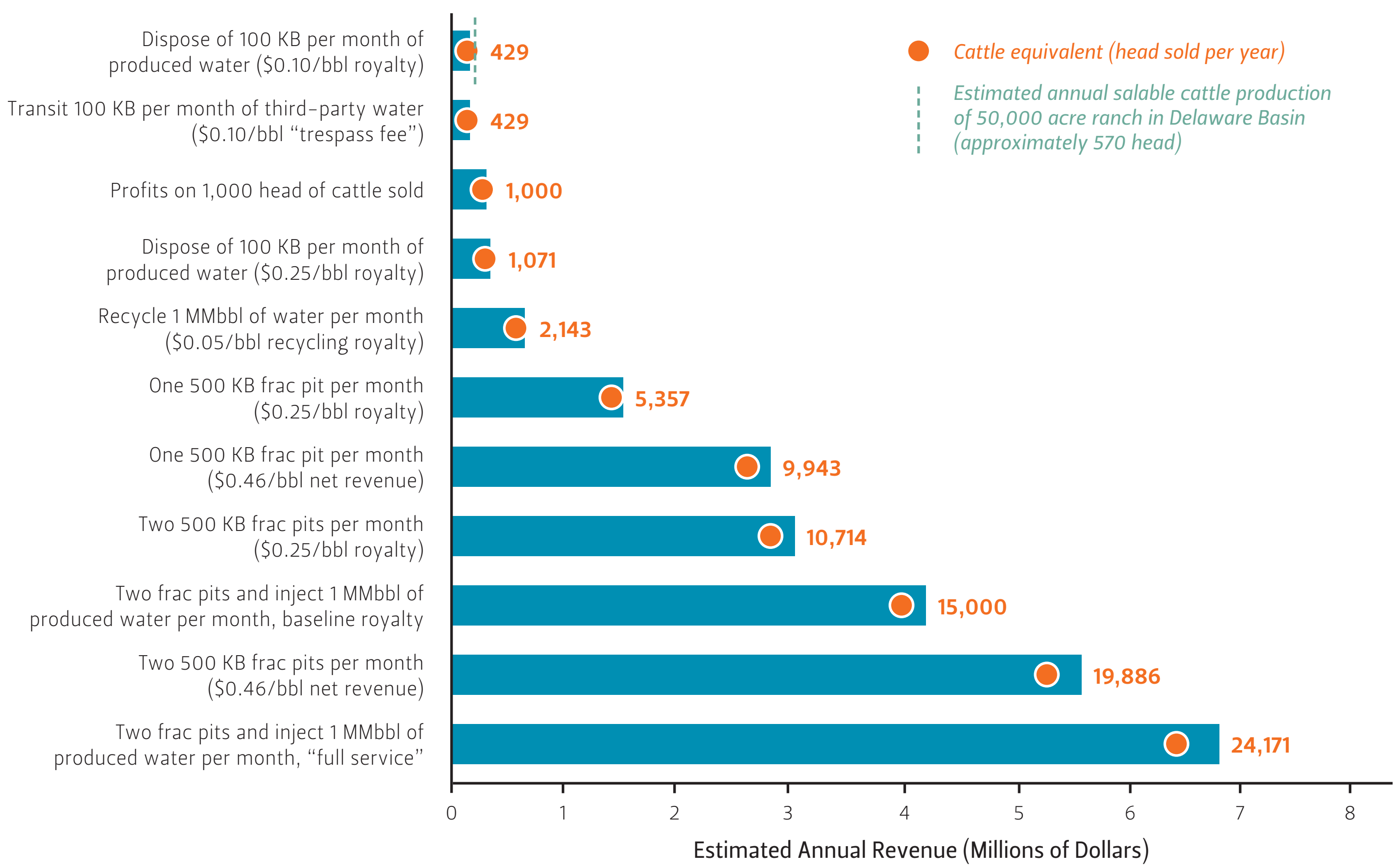
oilfield water management networks in core parts of the Permian Basin and other plays.[3]

Midstream investments by third-party service providers and E&P companies that have built proprietary water sourcing, disposal, and recycling systems are setting the stage for a new oilfield water ecosystem. The new order most likely will increasingly be centered on produced water reuse and recycling via integrated systems, rather than the "old" model of lease-by-lease water sourcing and disposal that has proven so profitable to many surface owners in recent years.

HOW GREATER PRODUCED WATER REUSE COULD PRECIPITATE CONFLICT BETWEEN LANDOWNERS AND E&Ps

Boosting access to infrastructure that facilitates recycling and reuse of produced water offers E&Ps an opportunity to substantially reduce lease operating expenses in a sustainable manner. If oil prices rise, this can help offset cost inflation in other areas companies generally have less ability to control, such as pressure pumping. But it also is likely to create points of economic friction between surface owners, who seek to maximize water revenues, and oil and gas developers, who seek to reduce water costs and move away from potable water supplies. As this author noted in February 2017:

FIGURE 1 — PROFITABILITY OF SELLING FRAC WATER AND DISPOSAL SERVICES VS. RAISING CATTLE, TRANS-PECOS TEXAS



NOTE KB = thousand barrel; bbl = barrel; MMbbl = million barrel; baseline royalty = $0.25/bbl for water sales, $0.10 for saltwater disposal

SOURCES Author's estimates based on conversations with industry sources; cattle profit data, Texas A&M AgriLife Extension Service.

Landowners (typically farmers and ranchers) would likely oppose significant growth in produced water recycling that did not yield revenues to the surface owner. The reason is simple: freshwater sales to energy operators yield much higher rents than do farming or ranching… For surface owners in this position, greater use of produced water that displaces potential freshwater sales would be a distinct threat to the profitability of their land and ranching operations.[4]

RANCH-LEVEL ECONOMIC IMPACTS OF SUPPLYING FRAC WATER AND PRODUCED WATER DISPOSAL SERVICES

By law, surface owners in Texas own the groundwater that E&Ps need to complete wells, and they also control the pore space into which produced water from wells is disposed. They can thus make money on both ends of the water value chain. The impact has been transformative, as land-rich cattle ranchers who were cash poor and consistently teetered on the edge of bankruptcy less than a decade ago can now make millions of dollars per year selling water to the oilfield and hosting saltwater disposal wells on their lands.

To put the ranch-level economic impacts into perspective, consider the following: a ranch that fills a 500,000-barrel frac pit twice per month with fresh water and *only* collects a royalty of $0.25/barrel (bbl) could realistically generate $3 million per year in profit. That is the same profit it would likely clear selling nearly 11,000 feeder steers annually at the average price over the past five years (Figure 1).[5] And the ranch could make that money by selling only 33,000 to 34,000 barrels per day, or roughly enough to fill two Olympic swimming pools.

A ranch that becomes a full-service water provider—through investing in water supply wells, a 1 million-barrel sales pit, and supporting equipment—could likely realize a net water sales price of $0.46/bbl, yielding nearly $6.8 million in combined water sales and disposal royalties (Figure

FIGURE 2 — CAPITAL AND OPERATING COSTS OF PRODUCING FRESHWATER FROM A 500-FOOT-DEEP WELL COMPLEX

Capital Costs

Annual sales volume, barrel (bbl)	12,775,000
Monthly sales volume, bbl	1,064,583
Daily sales volume, barrels per day (bpd)	35,000
Evaporation and system losses	10%
Annual production required to support target sales level, bbl	14,052,500
Daily production required to support target sales level, bpd	38,500
Number of wells	5
Capital cost per well, including pump	$100,000
Total capital cost of wells	$500,000
Capital cost of pad, power supply, damage payments to surface owner, etc.	$500,000
Capital cost of storage pond, 1 million bbl	$1,500,000
Total CAPEX	$2,500,000
Finance period, years	15
Number of payments	180
Cost of capital	10%
Monthly payment	$26,865
Annual CAPEX plus interest payout	**$322,382**
Capital costs per barrel sold	**$0.025**

Operating Costs

Annual water volume sold, bbl	12,775,000
Mass moved, lbs.	4,898,701,500
Feet water lifted	500
Total work done, lb.-ft.	2,449,350,750,000
Electric power equivalent, kilowatt hours (kWh)	922,466
Pump efficiency coefficient	65%
Estimated electricity used, kWh	1,419,179
Electricity cost per kWh	$0.09
Total power cost	$120,630
Annual repair and maintenance costs	$16,119
Annual total variable cost	**$136,749**
Variable cost per bbl sold	**$0.011**

Total cost per bbl of water at "edge of supplier pit"	**$0.036**

SOURCES Interview with Delaware Basin frac water vendor; D.W. Robinson, "Construction and Operating Costs of Groundwater Pumps for Irrigation in the Riverine Plain," CSIRO Land and Water, Technical Report 20/02, January 2002, http://bit.ly/2kNvvAY (pump efficiency data); Bill Peacock, "Energy and Cost Required to Lift or Pressurize Water," University of California, Tulare Cooperative Extension, Pub. IG6-96, http://bit.ly/2iaui67; Energy Information Administration, http://bit.ly/2zokZUa (electricity costs).

A ranch that fills a 500,000-barrel frac pit twice per month with fresh water and only collects a royalty of $0.25/bbl could realistically generate $3 million per year in profit. That is the same profit it would likely clear selling nearly 11,000 feeder steers annually at the average price over the past five years.

1). This revenue figure is based on a $0.50/bbl water price plus capital and operating costs of approximately $0.04/bbl required to produce the water and get it into the sales pit. Figure 2 details the full set of assumptions used in this calculation.

To put the revenue numbers expressed above into perspective, the Waggoner Ranch northwest of Dallas—one of the 20 largest ranches in the United States—has a cattle herd of approximately 6,800 cows.[6] If we assume that 70 percent of these animals are breeding females, that these breeding cows have a 90 percent pregnancy rate, and that the weaning percentage (i.e., surviving calves) is 90 percent, the ranch could produce in the neighborhood of 3,800 weaned calves per year. Assuming a herd-wide cull rate of 10 percent, this would imply an additional 380 salable animals per year.[7] Based on the model outlined in Figure 3, sales of weaned calves plus cull sales of older animals would yield approximately $1.2 million per year in profit ($280 in blended profit per animal x 4,180 animals annually).

The reality for a rancher in the Midland or Delaware Basins is likely to be much different. A ranch in those regions generally requires around 50 acres of grazing area per cow, meaning that even a 50,000-acre ranch (of which there are few) likely could at most host 1,000 head and produce perhaps 570 salable calves per year once the breeding cycle is underway. At the five-year average prices for a 500-pound live steer in Oklahoma City, which offers a reasonable proxy for assessing the value of cattle in West Texas, 570 calf sales per year would yield slightly under $160,000 in profits (Figure 3).

As is likely abundantly clear by this point, cattle ranching economics simply cannot compete with the returns reaped by selling water and charging disposal or recycling fees. Landowners who have come to depend on income generated from selling water and disposal services to the oilfield likely will stoutly resist plans by E&Ps to save money by recycling produced water.

CONTRACTUAL FRICTION POINTS BETWEEN LANDOWNERS AND OIL AND GAS DEVELOPERS

For operators who did not sign surface use agreements with landowners, produced water recycling faces fewer barriers, because under Texas law, the accommodation doctrine grants mineral owners and lessees "the right to use as much of the surface as is reasonably necessary to extract and produce the minerals."[8] Produced water is part of the groundwater estate and, by extension, the surface estate. As such, unless there are contractual agreements to the contrary, an E&P that chooses to recycle produced water should generally be able to do so under the accommodation doctrine.[9]

But for operators who have signed contracts (i.e., surface use agreements) that restrict groundwater use and/or ask for on-tract "disposal" of water, it can be more difficult to recycle produced water in a cost-effective manner. Generally speaking, surface owners who fear the loss of water sales and disposal revenues in many cases will likely either (a) refuse to renegotiate surface use agreements to allow recycling or (b) seek to renegotiate them by asking for a "recycling royalty" that recaptures a significant portion of the water sales revenues and disposal fees that would otherwise be lost as a result of increased produced water recycling.

The present value of large, near-term payments for frac water purchases will generally make them much more attractive to landowners than the lower per barrel price of produced water recycling deals. Furthermore, companies are likely to adopt a "hub and spoke" model that uses large, centralized water treatment facilities to maximize economies of scale.[10] If produced water is recycled from multiple surface tracts to a central facility, landowners might seek a prorated distribution of a recycling royalty, perhaps apportioned on the basis of surface acreage size or volumes derived from specific tracts.

FIGURE 3 — ECONOMIC RETURNS OF A COW-CALF OPERATION IN TRANS-PECOS TEXAS (2017)

Revenue	Head Proportion	CWT Per Head	Price/Unit	Subtotal	Total
Steer	0.430	5.50	$200.36	$473.86	$47,386.09
Heifer	0.270	5.00	$178.93	$241.56	$24,156.09
Cull Cow	0.150	11.00	$71.00	$117.15	$11,715.00
Cull Bull	0.040	18.00	$81.00	$58.32	$5,832.00
Total Revenue				**$890.89**	**$89,089.18**

Costs	Quantity	Price/Unit	Subtotal	Total
Pasture lease — fixed	1 acre	$1.60	$1.60	$160.00
Capital investment and depreciation — fixed			$421.87	$42,186.79
Production costs — variable (feed, vet, repairs, labor, interest)			$187.60	$18,760.36
Total Costs			**$611.07**	**$61,107.15**

Total Revenues – Total Costs	**$279.82**	**$27,982.03**
	Per Head	**Enterprise Total**

NOTES 1 CWT = 100 lbs.; calculations based on herd size of 100 breeding females. Pricing based on five-year average price for 500-lb. steer on Oklahoma City.

SOURCES Base template from Rob Hogan, associate professor and extension economist, Texas A&M AgriLife Extension Service, http://bit.ly/2g9os05; pricing information derived from "Historic Cattle Prices," Ag Decision Maker, Iowa State University Extension and Outreach, http://bit.ly/2gh0BzK; U.S. Department of Agriculture National Agriculture Statistics Service (Trans-Pecos Texas Pasture Rents), obtained via Texas Agriculture Law Blog, http://bit.ly/2hG6WRN.

SOLUTIONS NEEDED

Despite the inherent frictions between landowners and E&Ps, the reality is that for optimal long-term development of the Permian Basin's world-class hydrocarbon resources, the two parties need to find ways to get along. Industrial-scale produced water recycling will likely become a key point of competitive differentiation for Permian Basin producers, particularly if oil prices remain at or below $60/bbl for a sustained period. In the current price environment, companies scrutinize expenditures much more carefully and are more sensitive to the financial implications of high total life cycle water costs. This in turn makes them much more willing to implement produced water recycling programs, even if that potentially risks inflaming relations with landowners. A landowner holding out for more money on water sales and disposal fees today thus risks creating a situation in which companies:

1. invest less in developing the resources under their tract (a sub-optimal economic outcome that risks wasting resources);
2. deploy capital elsewhere entirely;
3. are forced to use potable water resources that could have instead been preserved through recycling produced water; or
4. decide to develop the project without a surface use agreement and allow the accommodation doctrine to govern their relationship with the surface owner.

Barriers to oilfield produced water recycling erode economic value, strand useful oil and gas reserves, and squander precious

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groundwater resources in areas where aquifers can take decades or more to recharge. Yet relying on a common law doctrine that is generally highly deferential to mineral developers also carries risks. In the immediate term, foregoing a surface use agreement and proceeding with or without a landowner's consent sets the stage for an even more conflictual and sour relationship, which potentially makes many types of oil and gas-related operational activities more difficult to perform.

In the medium term, if landowners feel they have been "steamrolled," their frustrations could reach the agendas of both the Texas Legislature and local or county governmental bodies, which could substantially raise operators' compliance and regulatory cost burdens. And in the medium and longer terms, adversarial relationships between oil and gas operators and landowners would undermine one of the original core objectives of greater produced water recycling: preserving and bolstering companies' social license to develop water-intensive unconventional oil and gas resources in water scarce areas.

So how can operators and landowners potentially mitigate these frictions? And more pointedly, what does the spectrum of potential solutions include? Ultimately, an E&P will have to decide what approach it is most comfortable with: continuing with the status quo, reaching a financial accommodation with the landowner, or taking a more confrontational stance and perhaps even litigating over portions of surface use agreements that landowners claim restrict produced water recycling.

Two core emerging realities will help shape this discussion. First, as operators with larger contiguous tracts begin to broaden their internal recycling operations and potentially consider taking produced water from and/or supplying frac fluid back to neighboring operators, such critical mass could potentially begin eroding landowners' pricing power, particularly on the freshwater sales side.

Second, landowners who continue to insist on large fees for water sourcing and disposal—especially if they do not also hold mineral interests—will find operators to be increasingly willing to (a) develop the minerals without a surface use agreement at all, or (b) refuse to sign surface use agreements unless the landowner removes frac water purchase requirements and reduces tract disposal fees. If a landowner took legal action to try and prevent the operator from drilling, he/she would encounter the reality that under Texas law, the mineral estate owner has "the right to use as much of the surface as is reasonably necessary to extract and produce the minerals."[11]

The accommodation doctrine protects *existing* surface uses, not potential future revenue streams, which is what frac water sales and disposal rents would be in a contract between a landowner and a driller seeking to develop a tract. Furthermore, water recycling by the operator would not prevent the landowner from selling water to other operators in the area. Finally, decisions on the accommodation doctrine to date have all centered on physical interference with, or harm to, activities that are literally performed on the surface, such as farming. Courts *have not* applied the accommodation doctrine to prevent mineral developers from taking actions aimed at conserving specific resources, such as water, that they might have previously sourced from a tract upon which they are drilling and completing wells.

The high profitability of "frac ranching" versus the much lower returns of traditional cattle ranching sets a tough stage for negotiations between landowners and E&Ps. Nevertheless, if produced water recycling grows and activity and infrastructure density become sufficient to sustain value-added trading of produced water, there is likely to be latitude to work out mutually beneficial solutions in the water recycling space. But as this process unfolds, expect a substantial rise in legal disputes between landowners and operators over oilfield water recycling. If things play out this way, such litigation would likely constitute an essential—if somewhat unpleasant—intermediate step as the law catches up with oilfield technology and best practices and provides greater clarity to guide future contractual decisions.

ENDNOTES

1. See, for instance, Noble Midstream Partners Second Quarter Earnings Call Presentation, August 2017, http://bit.ly/2hFOyse.

2. See, for instance, K. Nichols, J. Sawyer, J. Bruening, B. Halldorson, and K. Madhavan, "Development of a Large Scale Water Recycling Program for the Delaware Basin, New Mexico," Society of Petroleum Engineers (April 2017): doi:10.2118/186086-MS; R. Sharma, K. McLin, K. Bjornen, A. Shields, Z. Hirani, and S. Adham, "Fit-for-Purpose Treatment of Produced Water for Hydraulic Fracturing – A Permian Basin Experience," International Petroleum Technology Conference (December 2015), doi:10.2523/IPTC-18340-MS; and S. Kakadjian, J. Thompson, R. Torres, A. Pontifes, A. Rodriguez, and Y.A. Hamlat, "Permian Frac Systems Using Produced Water," Society of Petroleum Engineers (March 2015), doi:10.2118/172811-MS SPE.

3. See, for instance, "Rockwater Energy Solutions Enters into Definitive Agreement with Select Energy Services in Stock-for-Stock Merger Transaction," July 18, 2017, http://bit.ly/2xEt8qe; "WaterBridge Resources Acquires EnWater Solutions," Cision PR Newswire, August 22, 2017, http://prn.to/2kP1aSM; and "H2O Midstream Acquires Permian Basin Produced Water Assets from Encana Oil & Gas," June 14, 2017, http://bit.ly/2g9gaG1.

4. Gabriel Collins, Oilfield Produced Water Ownership in Texas: Balancing Surface Owners' Rights and Mineral Owners' Commercial Objectives (Houston: Rice University's Baker Institute for Public Policy, 2017), http://bit.ly/2yi8OYI.

5. Surface use agreements in the Texas Permian Basin frequently mandate that operators purchase all freshwater for use on the tract from the surface owner at prices that may run as high as $0.50/bbl. My simple model uses $0.25 in order to err more on the conservative side. The "purchase price" is in reality a royalty rate, under which the landowner/groundwater estate owner does not bear the cost of drilling a well or running the pumps.

6. Bryan Gruley, "For $725 Million, You Can Buy a Texas Ranch That's the Size of a Small Nation," *Bloomberg.com*, July 21, 2017, https://bloom.bg/2yJFFZw.

7. See, for instance: Mac Young, Joe Paschal, Levi Russell, and Steven Klose, "Profitability of Beef Cattle Best Management Practices in South Texas: Improving Profitability with Genetically Superior Sires and Higher Breeding Ratios," Farm Assistance Focus, March 2016, Texas A&M AgriLife Extension, http://bit.ly/2gEtl2d.

8. Merriman v. XTO Energy, Inc., 407 S.W.3d 244, 249 (Tex. 2013).

9. Robinson v. Robbins Petroleum Corp., Inc., 501 S.W.2d 865, 868 (Tex. 1973)(mineral owners are entitled to be protected for using salt water that was reasonably necessary to produce oil under the premises and terms described in a specific lease, which may be pooled and include acreage other than that from which the water originates).

10. See, for instance, Noble Energy's Billy Miner central gathering facility in the Delaware Basin. "NBL Barclays CEO Conference Presentation," Noble Energy Investor Relations, September 2017, http://bit.ly/2kNZkBp.

11. Merriman v. XTO Energy, Inc., 407 S.W.3d 244, 248-249 (Tex. 2013).

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