Wild Ride – What's Driving NGL Prices and Differentials?

Part 1: Rising Y-Grade Production and Tight Mont Belvieu Frac Capacity

- **U.S. natural gas liquids production is up sharply, spurred on in part by crude oil prices that encourage more drilling and completion, and flows of NGLs into the Mont Belvieu and Conway hubs are up.**
- **Fractionation capacity in Mont Belvieu — the nation's leading NGL hub — has not kept pace with NGL production growth; fractionators there are now operating at or near full capacity.**
- **Delays on the Mariner East 2 pipeline and off-and-on closures on Mariner East 1 have spurred more railed shipments of propane to Conway and markets served by that hub.**
- **The differentials between purity-product prices at Conway and Mont Belvieu widened and stayed wide.**
- **The situation is not likely to improve until new fractionators in Mont Belvieu come online over the next year and a half.**

1. Introduction

The U.S. NGL market has entered uncharted territory, with potentially significant implications for producers of crude oil and "wet" natural gas. Mont Belvieu fractionation capacity is either maxed out or close to it. Production of NGL purity products is — as always — constrained to what can be fractionated, and with ethane demand ramping up as new petchem plants come online and export markets beckon, ethane prices are soaring. At the same time, production of y-grade — that mix of NGLs separated out at gas processing plants — continues to increase in the Permian and around the country. Which raises important questions. For example, if the pace of fractionation cannot pick up until more fractionation capacity comes online, what happens to those incremental barrels of y-grade being produced? How much more y-grade can be squirreled away in underground storage caverns? And what happens if y-grade storage capacity fills up?

The fractionation capacity situation at the Mont Belvieu, TX, hub — home to the world's largest concentration of fractionators, and near a number of petchem plants, refineries and export terminals — has tightened considerably in the past several months. This is evidenced by a number of things: (1) rapidly rising prices for ethane at Mont Belvieu, (2) widening differentials between purity product prices at Conway, KS, and Mont Belvieu; (3) the railcars of "x-grade" NGLs (mixed NGLs with less ethane than y-grade that can be transported by rail) fanning out across the country looking for open fractionator space, including Permian barrels headed for Marcellus/Utica fracs; and (4) hyper-inflation in spot transportation and fractionation (T&F) fees

for Permian-sourced NGLs — between 70 and 80 c/gal now, around five times what T&F fees were before all this started. But more significant problems may lie ahead, because y-grade production from gas processing plants has continued to increase — it is up 500 Mb/d in the past year alone, even in the face of Permian crude and gas pipeline constraints.

Assuming y-grade production continues to rise, with fractionation maxed out, where will the y-grade go? In fact, the market is already dealing with this problem. Some y-grade is going into storage. Several major players are said to have millions of barrels of y-grade in storage, and are converting purity product storage caverns into y-grade service to store even more. Other y-grade is being piped to Louisiana for fractionation, but that outlet is understood to be filling fast. Still more y-grade — or more accurately, x-grade — is being shipped all over North America by rail and truck, again filling that distant capacity to the point where locals are concerned with getting their own barrels fractionated.

Addressing this NGL production/fractionation capacity conundrum and its possibly far-reaching implications for crude and wet-gas producers is a complicated task — one that will need to be addressed in two Drill Down Reports. **Part 1** provides an overview of the existing fractionators in Mont Belvieu and elsewhere in Texas, as well the NGL pipelines that supply them and the plans for additional pipeline and fractionation capacity. It also considers the variety of other factors — among them, delays in the completion of the Mariner East 2 pipeline and insufficient purity-products pipeline capacity from Conway to Mont Belvieu — that in recent months have combined to wreak havoc in the NGL market. With all that background in hand, **Part 2** will zero in on the events leading up to the current situation, and on the potential implications if y-grade production continues to outpace fractionation capacity.

1.1 How We Got Here

No story about the NGL market is easy to tell, and the dynamics affecting the market in the summer of 2018 were particularly complex. One important factor is that NGL production has been increasing quickly, driven in part by $65/bbl-plus crude oil prices that in 2018 have spurred increased drilling and completion activity in a number of major plays — especially the Permian, but also the Eagle Ford, SCOOP/STACK, Niobrara and Bakken. Also, the opening of new natural gas pipelines out of the Marcellus/Utica region has encouraged more drilling and completion there, and the Utica and "wet" Marcellus produce significant volumes of NGLs. Figure 1 shows that total U.S. production of NGLs from natural gas processing plants (blue bar segments) has doubled since 2011, to about 4.3 MMb/d, and that under RBN's "**Mid-Curve"** price scenario (current forward curve pricing for U.S. WTI Cushing oil and Henry Hub gas), NGL production is expected to rise to nearly 5.9 MMb/d by 2023.

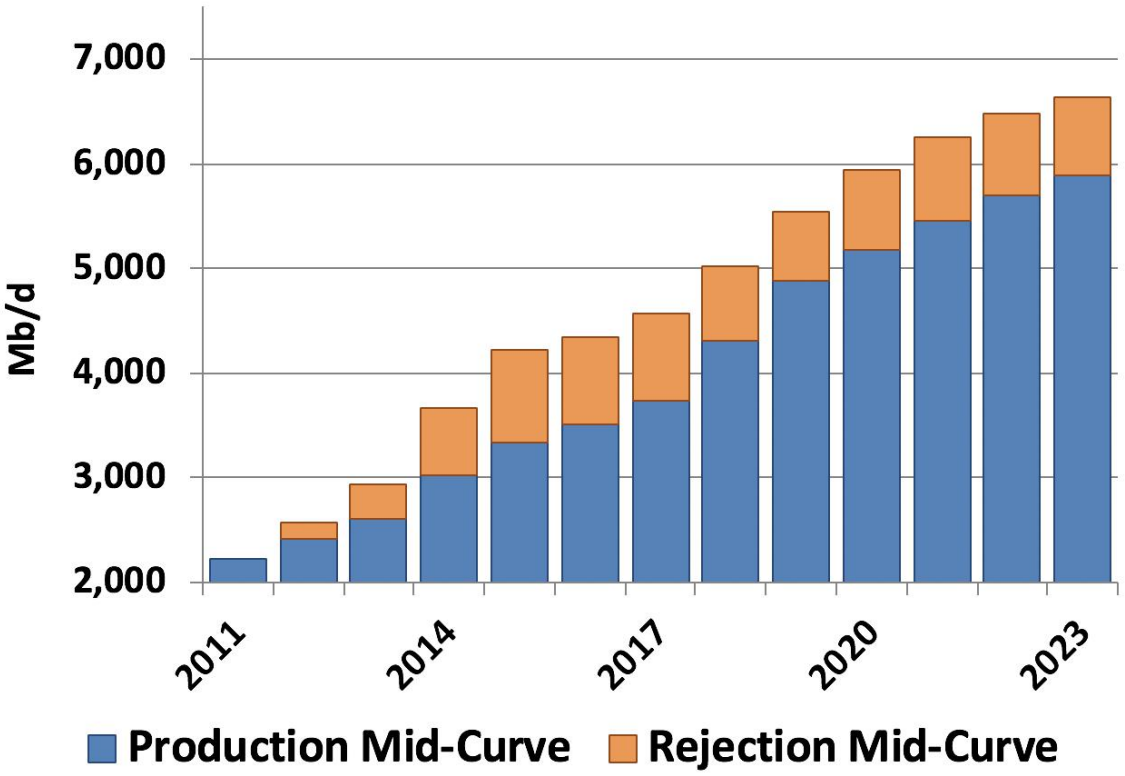

Figure 1 – U.S. NGL Production 2011-23; Source: RBN

The orange bar segments in Figure 1 show that due to NGL pipeline constraints, oversupply and other factors, a substantial portion of the ethane emerging from U.S. wells will continue to be "rejected" into natural gas (and sold at the per-MMBtu price of gas) rather than separated out and sold as a purity product to steam crackers (ethylene plants). In 2018, an estimated 700 Mb/d or so of ethane is being rejected, and under the Mid-Curve scenario, rejected volumes are expected to remain relatively constant through the early 2020s.

All of the NGLs that are produced need to be transported either to storage or to fractionation plants, where they are separated into purity products like ethane, propane, normal butane, isobutane and natural gasoline. Similarly, all of the purity products that are separated out at fractionators need to either be stored or transported to U.S. end users (steam crackers, refineries and — for propane and normal butane — industrial, commercial and residential consumers of LPG) or to marine terminals for export. Transport and storage of NGLs is complicated by the fact that for mixed NGLs (y-grade) and purity products to remain in their liquid state, they must be transported and stored under high pressure.

The U.S.'s largest NGL storage, fractionation, and purity-products distribution hub is located in Mont Belvieu (about 30 miles east of Houston); the hub has more than 250 MMbbl of NGL and purity-product storage capacity, 2.2 MMb/d of fractionation capacity, and pipeline access to a large number of steam crackers, refineries and export docks. A much smaller NGL hub is located 700 miles to the northwest of Mont Belvieu in Conway, KS.

A while back, when crude oil prices were hovering around $50/bbl, producers were wary of entering into the long-term "take-or-pay" contracts needed to support the development of new fractionation capacity. As a result, there was a lag in the development of new fractionators, and now, with crude prices near $70/bbl and NGL production rising, the 2.2 MMb/d of existing

"frac" plants at Mont Belvieu are operating at or very near their full capacity and a scramble is on to build additional fractionation capacity there and elsewhere along the Texas coast (near steam crackers, refineries and export docks) to handle the increasing flows. Also, delays in completing Energy Transfer Partners' 275-Mb/d Mariner East 2 purity-product pipeline from Scio, OH, to the company's Marcus Hook, PA, marine terminal (near Philadelphia) have spurred Marcellus/Utica producers to send propane via rail to Conway (or to Midwest markets served by Conway), further increasing the volumes of NGLs flowing into the Kansas hub.

Like Mont Belvieu, Conway is an interconnected system of storage caverns and fractionators, with pipes bringing mixed NGLs in for processing and other pipes moving purity products out. In addition, there are rail racks for moving product in and out. However, Conway has far fewer fractionators — only four compared to nearly two dozen (and more on the way) in Mont Belvieu. It also has far less storage — less than 10% of the underground salt cavern capacity that Mont Belvieu offers.

The root of the current problem is that while Conway has available fractionation capacity that theoretically could be put to work to "assist" Mont Belvieu's maxed-out fractionators, there is only very limited purity-product pipeline capacity between Conway and Mont Belvieu and those pipelines are already operating at full capacity. Figure 2 is a schematic depiction of the major NGL pipeline flow patterns in the middle of the U.S., with the Conway-to-Mont Belvieu corridor playing a leading role. Almost all of NGLs flowing from the Bakken, Niobrara, SCOOP/STACK, Permian and Eagle Ford are transported in the form of y-grade (green arrows) — that is, they have not yet been fractionated into ethane, propane and other purity products. Even with the increasing production of NGLs, there is sufficient pipeline capacity in place to move these y-grade volumes to Mont Belvieu or Conway, and from Conway to Mont Belvieu. But there are only three pipelines normally capable of moving purity products directly from Conway to Mont Belvieu (blue arrow): ONEOK's Sterling I, Sterling II, and Sterling III pipes, which together have the capacity to move 393 Mb/d of y-grade and purity NGLs south to Mont Belvieu. That means that much of the y-grade that is flowing into Conway is not fractionated there — instead, it needs to move on to Mont Belvieu as y-grade for fractionation.

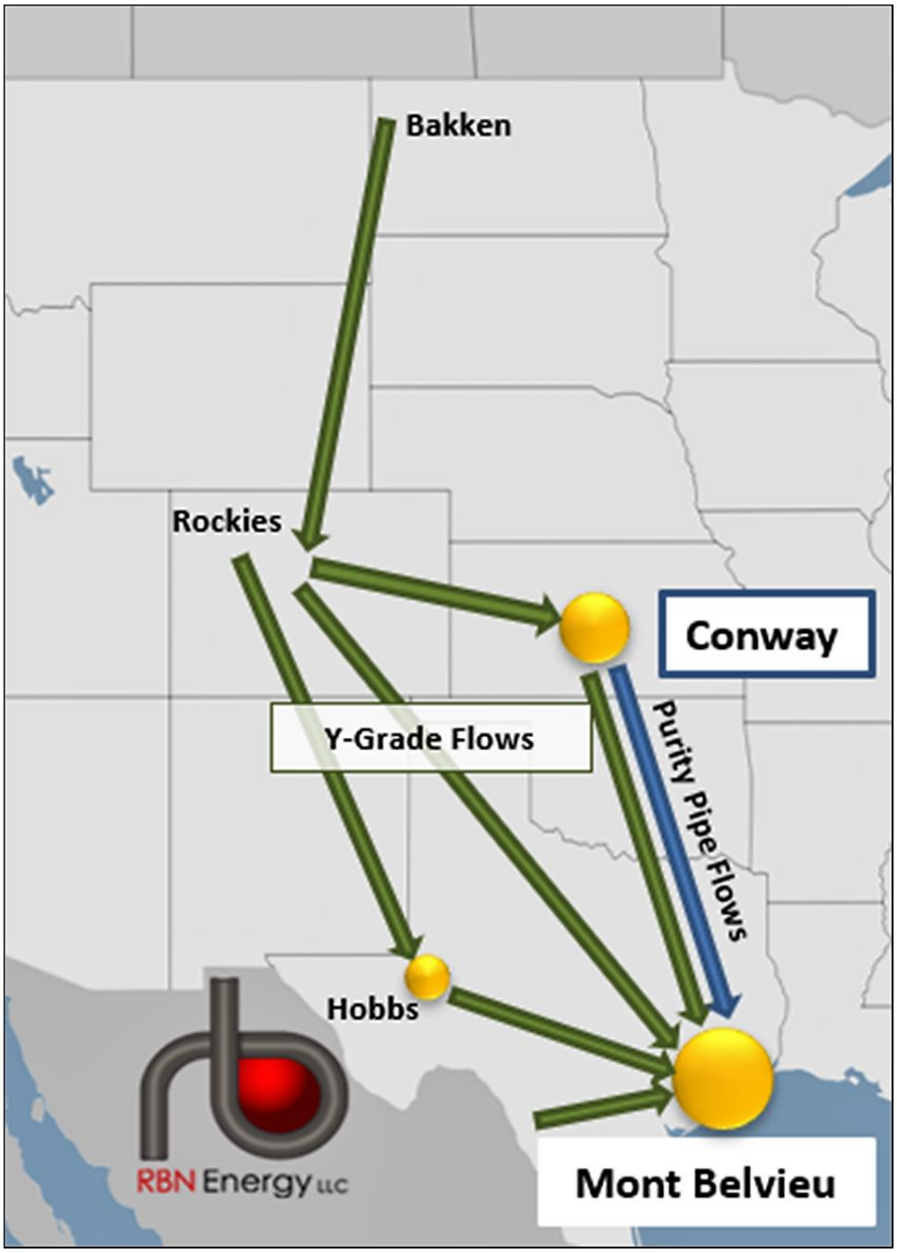

Figure 2 – Conway-Belvieu NGL Flows; Source: RBN

This has led to a situation in which propane at Conway has been selling at a very steep discount to propane at Mont Belvieu. Historically, prices for propane and other purity products at Conway closely tracked those at Mont Belvieu. For example, propane at Conway traditionally has sold for only a few cents/gallon (c/gal) less than the price at Mont Belvieu. This reflects the fact that propane demand for petrochemical feedstocks and exports along the Gulf Coast is far greater than seasonal propane demand for residential, commercial, agricultural and other sectors in the Midcontinent and Midwest. As a result, a lot of propane moves south to the Mont Belvieu market, both in the form of purity propane, and as a component of mixed NGL streams (y-grade), and the differential between Conway and Mont Belvieu for most of the year tends to gravitate around the few-cents-per-gallon cost to transport the barrels 700 miles south.

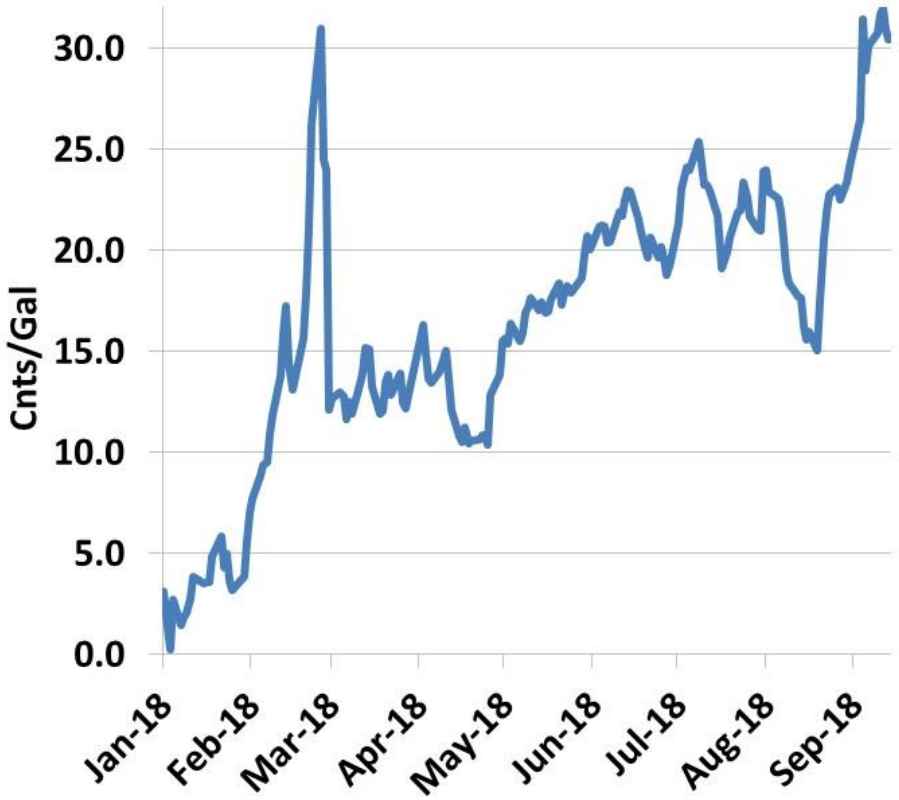

Figure 3 – Non-TET Mont Belvieu versus Conway Propane Prices; Source: OPIS

Until 2018, that is. This year, the differential blew out due to a disconnect between supply and demand resulting from pipeline capacity constraints between the Conway and Mont Belvieu markets. But in this case, there is more than one constraint involved.

In January, the differential (blue line in Figure 3) was a typical 3 c/gal. But the differential started to widen as increasing volumes of y-grade came into the Conway market from the Bakken, Niobrara and SCOOP/STACK. Some of this y-grade moved south to Mont Belvieu, while other volumes were fractionated in Conway into purity products. Also, as noted earlier, propane also has been pouring in to the Conway market area by rail from the Marcellus/Utica.

While increased propane supplies in Conway set the stage, the first big spike in the differential (to more than 30 c/gal) happened in the second half of February, not due to surplus propane in Conway, but instead because of demand in Mont Belvieu. There, a huge short squeeze was occurring, reportedly due to a shortage of “Non-TET” (also known as “non-LST”) barrels of propane suitable for export. (Generally speaking, non-TET propane has low ethane content; it is also called “low-e” propane.) Low-e propane is necessary for most overseas shipments of propane, and for a few days there were not enough barrels of propane with that specification to meet export demand. That shortage was alleviated in March and the differential fell back to about 13 c/gal.

But then on March 7 (2018), Mariner East 1 — Energy Transfer's existing purity-products pipeline from western Pennsylvania to Marcus Hook — was shut down due to the emergence of sinkholes that were blamed on the nearby construction of Mariner East 2. During the on-again, off-again shutdown period, still more Marcellus/Utica propane barrels were forced onto railcars, many of them targeting Conway or markets served by Conway. With this additional source of oversupply hitting the Conway market, the differential between Conway and Mont Belvieu widened to 23 c/gal.

This situation continued for much of the spring. But during June, all these factors eased. Mariner East 1 was back online in the first week of that month, and Marcellus/Utica propane barrels were again flowing to export markets via the pipeline to Marcus Hook. Also, all indications were that there were adequate volumes of low-e propane for exports. But the Conway vs. Mont Belvieu differential for propane remained high, averaging about 20 c/gal this past summer — again, far greater than the cost of moving barrels from Conway to Mont Belvieu. The same held true for the other purity products; As shown in Figure 4, since July, the differentials have continued to widen. Mont Belvieu ethane is now almost four times the price of ethane in Conway — a 40 c/gal differential. Propane is 30 c/gal higher, normal butane is higher by 34 c/gal and natural gasoline by 32 c/gal.

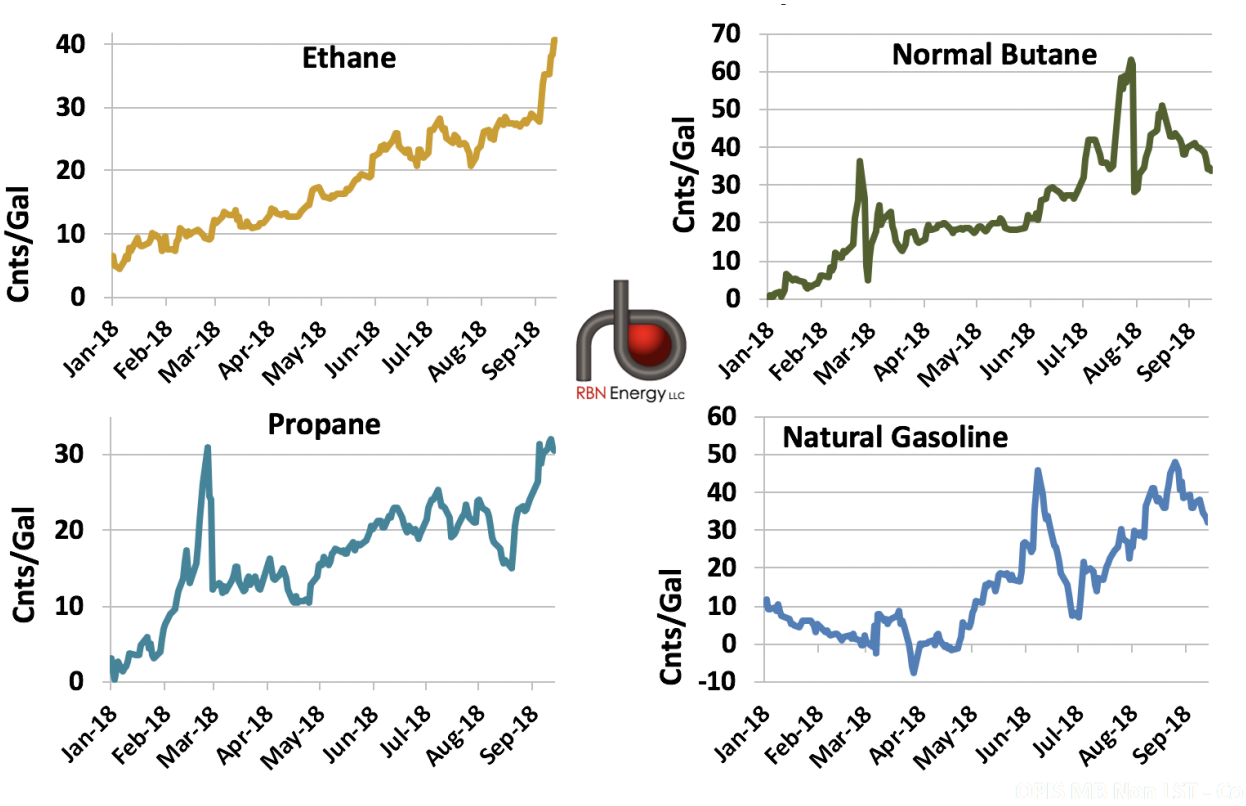

Figure 4 – Conway vs. Mont Belvieu Differentials for Purity Products; Source: RBN

There are actually three culprits affecting this market. First, there is not enough pipeline capacity that can move purity products fractionated in Conway to Mont Belvieu. Second, Conway's purity-product pipeline problem has been made worse with unit trains of propane coming into Conway from Marcellus/Utica due to the Mariner East setbacks. Had Mariner East 2 come online on time, it might have eliminated most railcar shipments of propane into the Conway market. But the completion of that pipeline has been pushed off until the end of the

third quarter of 2018 (late October), so those rail shipments continue, further expanding Conway supply and crowding capacity to move purity product south from Conway.

The third culprit is the biggest. While there is sufficient capacity to move pipeline y-grade from the Conway area to Mont Belvieu, there is no more fractionator capacity available to process that y-grade. It does no good to move additional y-grade from Conway to Mont Belvieu if there is no fractionator capacity there to process the mixed NGLs into purity products. Consequently, even though there is sufficient pipeline capacity to move more y-grade south, and pricing for purity products is far better in Mont Belvieu than in the Conway market, the lack of fractionator capacity acts like a constraint on inter-regional y-grade flows.

To sum up, increasing volumes of NGL production have been moving to Mont Belvieu in the form of y-grade, filling up the 2.2 MMb/d of fractionator capacity. But the new fractionation capacity planned at Mont Belvieu will only come online gradually, and it will be at least the first quarter of 2019 — and possibly not until a year or longer after that — before fractionation-capacity constraints in Mont Belvieu are resolved. Consequently, it is likely that Conway NGL prices will continue to trade at a significant discount to Mont Belvieu, spiking and correcting with each weather event, increment of new capacity, or other NGL market aberration.

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