# SYSTEM CAPABILITIES AND CONSTRAINTS

## Dominion Energy System Overview

The Company's system currently consists of approximately 19,360 miles of distribution and transmission mains serving more than 1,042,000 customers. The system operates at pressures that range up to 1,000 psig and is separated into many subsystems in order to deliver the pressures and volumes that customers require. The Company builds system models annually to determine when and to what extent system improvements will be required. Figure 4.1 shows the Company's high-pressure (HP) system, its service area, connecting interstate pipelines, and adjacent producing basins.

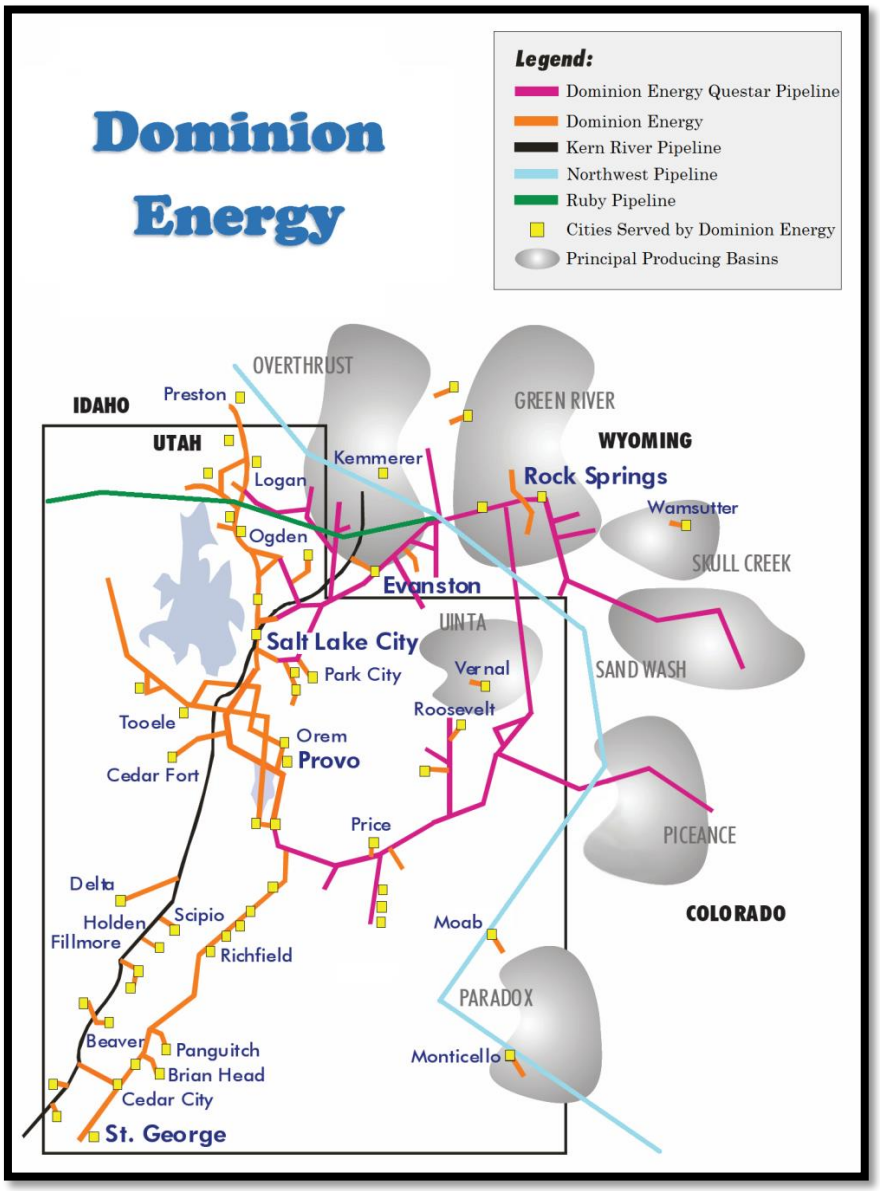


**Figure 4.1: Dominion Energy High Pressure System**

## Ongoing and Future System Analysis Projects

*Master Planning Models*

The Company creates gas network analysis (GNA) master planning models to more accurately predict impacts of system growth. The models are created using global growth projections as well as anticipated growth from specific planned developments in each area. The benefit of using this data is that the resulting system pressures will reflect the impact of the specific growth centers and provide improved projections of system impacts during a peak event.

*System Supply Analysis and Joint Operating Agreement*

The Company analyzes its gas supply contracts each year to determine if they will meet the coming year's demands. The Company carefully considers the upstream (interstate transmission pipelines) constraints and capabilities as well as the ability to acquire gas to deliver to its system on a Design-Peak Day. The purpose of this analysis is to determine the amount of gas required on a Design-Peak Day and if the current contracts (sales and transportation) facilitate this required delivery.

The Company and Dominion Energy Questar Pipeline (DEQP) work together each year to update a Joint Operating Agreement (JOA) as part of this analysis. The JOA includes details regarding the pressures and flows available at the jointly operated gate stations, as well as operational and facilities responsibilities. One objective of this agreement is to ensure that the Company receives adequate inlet pressures to these stations in order to maintain system reliability. This is a complicated process that requires detailed collaboration due to the fact that the flows at these stations fluctuate through the day to match the changing demands on the Company's system.

*Interruption Analysis*

A number of customers on the Company's system have chosen to purchase service on an interruptible rate utilizing any available system capacity. Because the system is not designed for these customers, it is important to understand the temperatures at which an interruption would be expected. The Company performs an interruption test on an annual basis. The interruption analysis divides the system into interruption zones and determines the temperature at which interruption of a specific zone is appropriate to ensure reliable service to the surrounding firm customers.

*Operational Models*

The Company prepares for planned maintenance and construction work as well as unforeseen events that impact system capabilities by developing and maintaining operational models of the system. The Company maintains these models to represent current conditions that exist in the system. The Company's engineers review these models on an ongoing basis with The Company's Gas Control, Gas Supply, Marketing, Operations, and Measurement and Control departments in order to inform them of expected system conditions.

**System Modeling and Reinforcement**

The Company utilizes steady-state Intermediate High Pressure (IHP) gas network computer models to determine the required system improvements needed to maintain required operational pressures throughout the distribution system. The Company uses these models to identify the required locations and sizing of new mains and/or regulator stations. The Company also uses the models to compare the required flow from the regulator stations to the maximum delivery capacity of the existing regulator stations. This analysis provides the Company with the information necessary to determine which reinforcements the Company should construct each year. Based on the modeling results, the Company constructs a number of IHP mains, new regulator stations and upgrades to existing regulator stations.

The HP system models have more variables than the IHP system models and are also used to design for customer demand and growth. Engineers consider gate station capacities, existing supply contracts, supply availability, line pack and the piping system in conducting HP analysis. Because HP projects typically take longer to complete than IHP projects, the Company must identify the need for HP improvements earlier than would be required for IHP projects. The Company and the interstate pipeline companies that supply its system collaborate to identify potential constraints to ensure that the Company's supply needs can be met.

**Model Verification**

The Company verifies the accuracy of the steady-state (24-hour period) GNA models using recorded pressure data and calculated demands. The Company's engineers built steady-state models to represent the system conditions that were present on Thursday January 22, 2018 using actual data from that day. Model settings were adjusted to match the actual temperatures and other conditions for this day. The model pressures were compared to actual pressures at 127 verification points, 125 of these points were found to be within 7% of the actual pressures on that day. One hundred and twenty-three of the pressures in the verification model were within 5% of the actual pressure. Based on this analysis, the Company has deemed the loads and infrastructure utilized in the GNA models are accurate, and the models can confidently be used for their intended purpose.

The Company verifies the unsteady-state (hourly results for a 24-hour period) models in the same manner as the steady-state models. The temperatures and the gate station flows and pressures are matched as closely as possible. The Central and Northern Regions are the largest of the Company's connected HP systems with seven gate stations and two primary maximum allowable operating pressure (MAOP) zones. There are other smaller isolated systems which also require unsteady-state model analysis included in the results (Figures 4.3 – 4.8). The unsteady-state model minimum pressures were found to be within 7% of the actual minimum pressures at 125 verification points on that day. One hundred and nineteen of the pressures in the verification model were within 5% of the actual pressure. The results of these comparisons confirm the accuracy of the unsteady-state models.

## Gate Station Flows vs. Capacity

The Company's system models must accurately emulate the physical pressure and flow limitations of each specific station. To ensure this, The Company completes a capacity study each year for each of the gate stations on the system. The Company calculated hourly and daily flow capacities for each station based on facility limitations, set pressures, and inlet pressures provided by the upstream pipelines. Some stations have specific minimum pressures based on contractual volumes. Other stations have fluctuating inlet pressures based on the changing flow on the Company's system. For the stations with changing inlet pressures, this analysis was based on the inlet pressures included in the JOA.

There are a number of other gate stations that are near 100% utilization shown in Table 4.1. These stations will be upgraded as necessary in the coming years in order to accommodate their respective required flows. Each of these stations is either flowing at capacity in last year's JOA or is nearing the physical capacity of the station.

**Table 4.1: Gate Stations Nearing Capacity in the JOA**

| Station | 2018-2019 (MMcfd) | Station Capacity (MMcfd) | % Utilization | Upgrade Year |
|---|---|---|---|---|
| Bluebell | 8.451 | 9.25 | 91% | TBD[59] |
| Central | 44.93 | 46.28 | 97% | 2024 |
| Hyrum | 122.04 | 151.90 | 88% | 2019 |
| Jeremy Ranch | 19.07 | 29.15 | 84% | 2025 |
| Rockport (Heber Tap) | 14.50 | 16.05 | 90% | 2022 |

In addition to these specific gate stations, the total gate station capacity[60] of the Northern HP system is approaching maximum capacity. Residential and commercial growth in Utah is increasing demand for natural gas along the Wasatch Front. In 2017, The Company determined that the system would benefit from a new gate station, served by Kern River Gas Transmission (KRGT), to feed Northern Utah within the next three years. This new gate station will provide the ability to bring additional firm gas to the Wasatch Front. In addition, when FL23 is replaced, there will be additional capacity available to the Wasatch Front through the Hyrum Gate Station.

## System Pressures

Once the Company verifies the GNA models and properly sets contractual obligations and station capacities, it uses the models to analyze the gas distribution system to verify that it has adequate pressures in order to supply customers. The Company uses Design-Peak-Day models for this analysis. Design-Peak-Day models include firm loads for sales and transport customers. The Company uses the daily contract limits for applicable customers and assumes that interruptible demands are curtailed during the Design-Peak Day.

[59] While Bluebell is near capacity, the Vernal system experiences greater increases in system pressure if the capacity at Island Park is increased. Island Park capacity will be increased prior to this heating season.
[60] Reflects station Capacity when combined with gas supply and upstream transportation contracts.

*Northern*

The Northern Region includes the distribution system throughout Salt Lake City and northern Utah, including Box Elder, Cache, Davis, Morgan, Salt Lake, Summit, Tooele, Utah, Wasatch, and Weber counties. The Company serves this region through interconnects with DEQP at Meter Allocation Point (MAP) 164 using the Hyrum, Little Mountain, Payson, Porter's Lane, and Sunset stations. The Company also serves the region through Payson gate station from DEQP's Main Line 104 (MAP 332), multiple smaller taps from DEQP (MAP 162) and KRGT at Eagle Mountain, Lake Side, Hunter Park, and Riverton stations.

In the steady-state model, the calculated low point in the main portion of northern system is 242 psig, in Preston, Idaho. The lowest steady-state pressure is in the Summit/Wasatch system, in Woodland, which is 315 psig. These pressures remain higher than the Company's minimum allowable design pressure of 125 psig.

The steady-state pressures at some of the key locations in the Company's system are shown in Table 4.2. The locations on the system are shown in Figure 4.2. The Company models these pressures on a Design-Peak Day at system endpoints and low points in the area and important intersections. The Company builds steady-state models using average daily flows that most closely represent average pressures for the Design-Peak Day. The unsteady-state GNA models profile demands throughout the day, and represent the pressure fluctuations throughout the Design-Peak Day.

**Table 4.2: Dominion Energy High Pressure System Steady-State Design-Peak Day Pressures**

| Location | Pressure (psig) |
|---|---|
| Endpoint of FL 29 – Plymouth | 258 |
| Endpoint of FL 36 – West Jordan | 314 |
| Endpoint of FL 48 – Stockton | 338 |
| Endpoint of FL 51 – Plain City | 383 |
| Endpoint of FL 54 – Park City | 370 |
| Endpoint of FL 62 – Alta | 301 |
| Endpoint of FL 63 – West Desert | 322 |
| Endpoint of FL 70 – Promontory | 285 |
| Endpoint of FL 74 – Preston | 242 |
| Endpoint of FL 106 – Bear River City | 310 |
| Intersection of FL 29 & FL 23 – Brigham City | 412 |

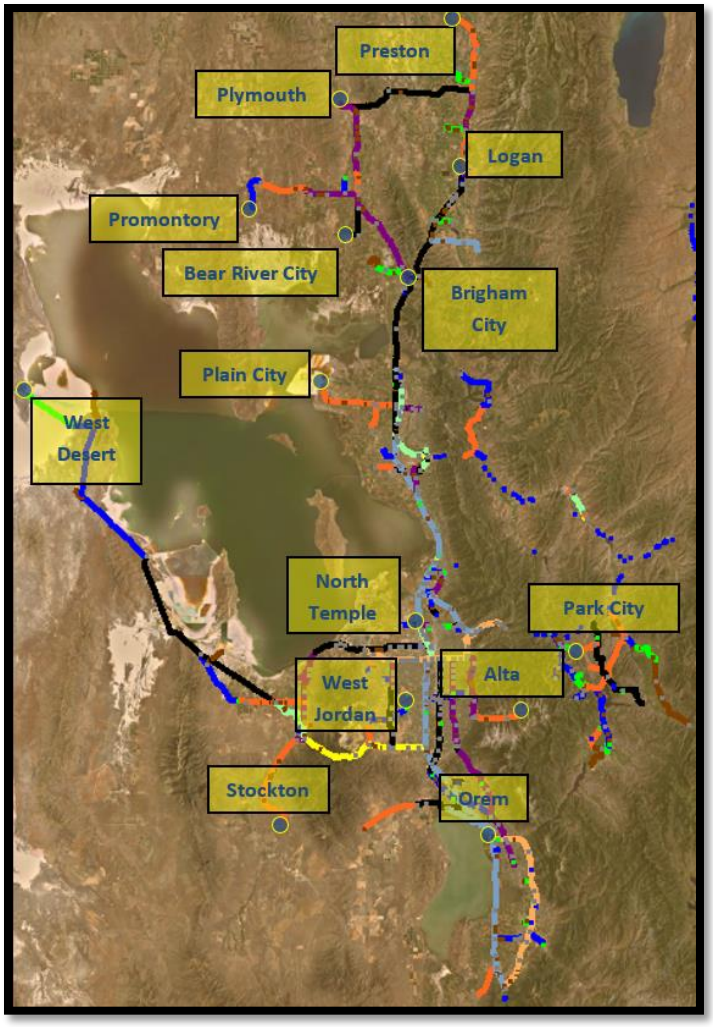


**Figure 4.2: Northern Region Key Pressure Locations**

The curves shown in Figure 4.3, Figure 4.4, and Figure 4.5 are the expected Design-Peak-Day pressures for the Northern Region HP system. In the projected unsteady-state models, the low point in the Northern Region is West Jordan at 151 psig. The lowest predicted pressure in the Summit Wasatch subsystem is at the Woodland regulator station with 182 psig during the peak hour.

In the HP system north of the North Temple station, the minimum pressure occurs at Plain City with a minimum pressure of 231 psig. While these pressures are well above operational minimums, the gate stations in the North are all expected to reach their maximum capacities on a Design-Peak Day. In order to maintain pressures in this area, the Company requires additional gate station capacity and pressure support by 2020. The one existing station in this area that is not at capacity due to upstream constraints is Hyrum Gate Station. However, Hyrum is constrained due to the size of FL23, which is scheduled for replacement as part of the Company's Infrastructure Rate Adjustment Tracker program. Increasing the diameter of FL23 not only increases pressures in the area, it is necessary to allow more gas to flow from Hyrum Gate into the Northern system.

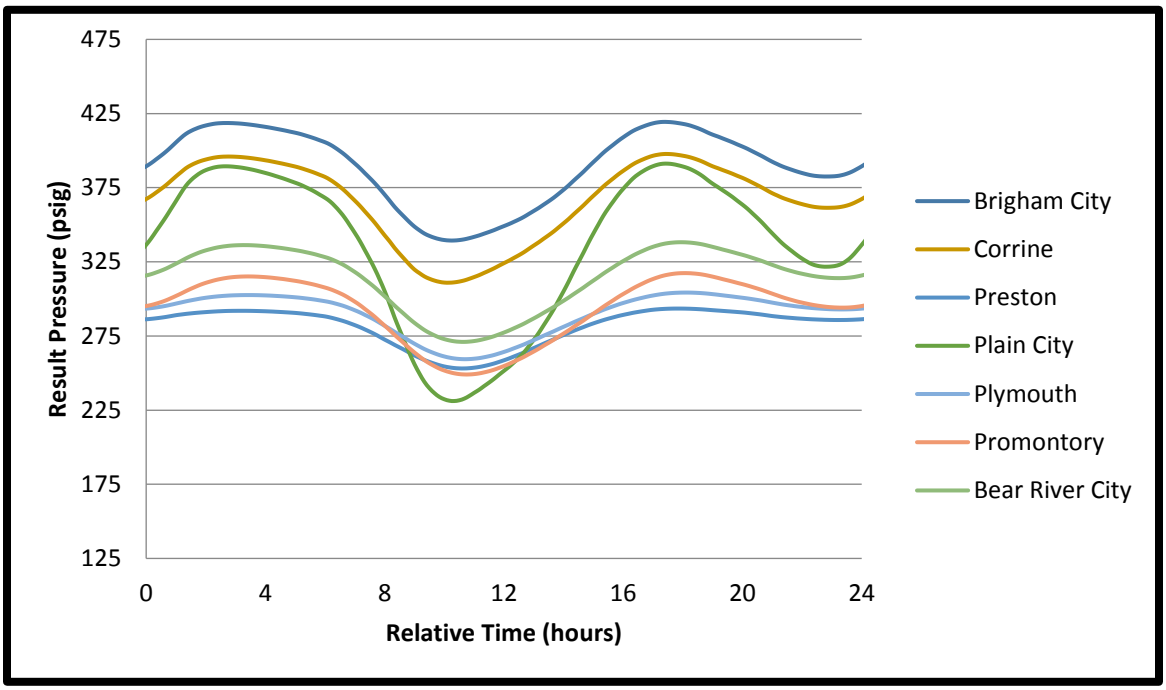


**Figure 4.3: 2018-2019 Northern Unsteady-State Design-Peak-Day Pressures (North of North Temple)**

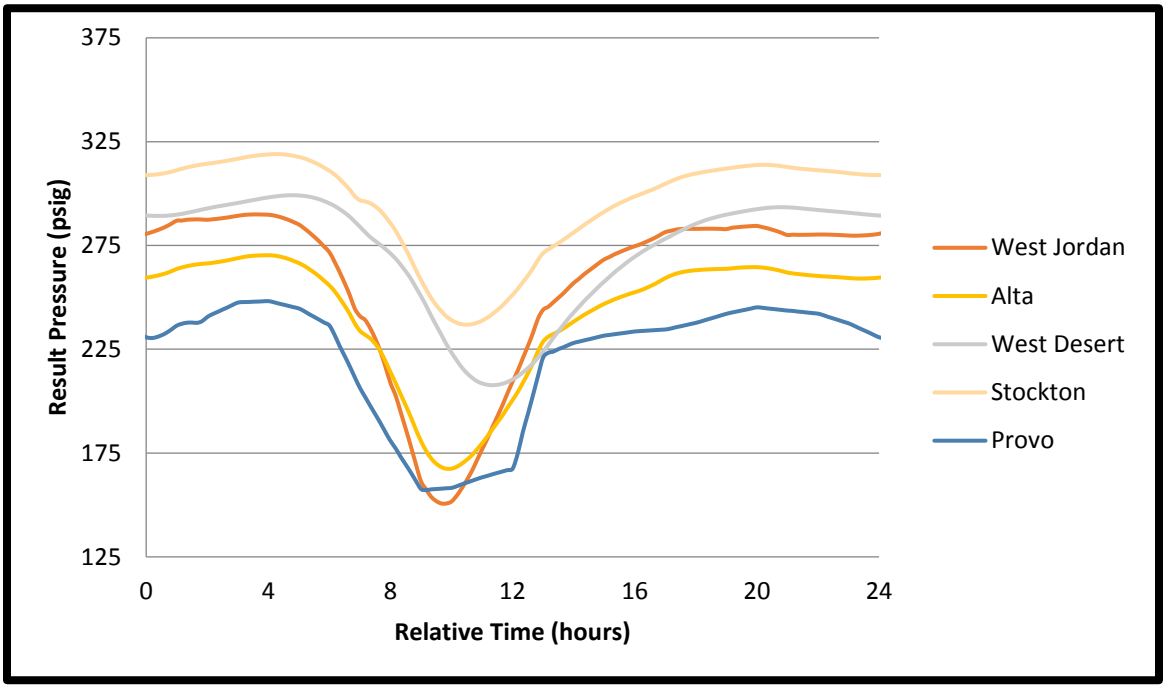


**Figure 4.4: 2018-2019 Northern Unsteady-State Design-Peak-Day Pressures (South of North Temple)**

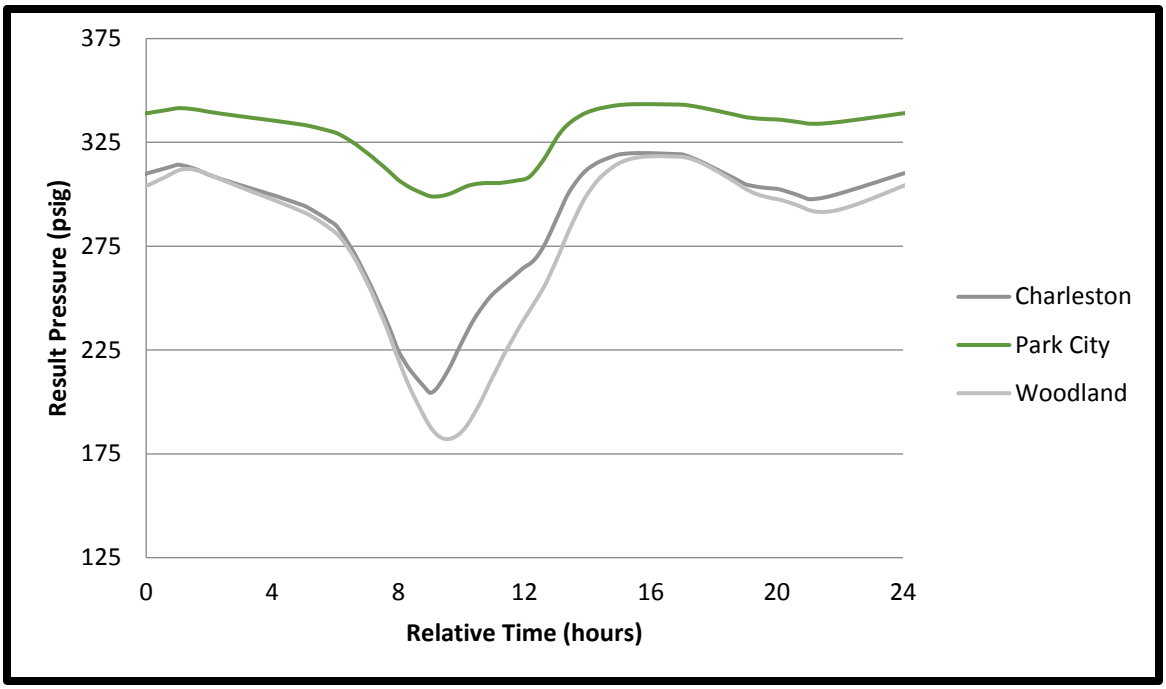


**Figure 4.5: 2018-2019 Northern Unsteady-State Design-Peak-Day Pressures (Summit and Wasatch Counties)**

*Eastern (North)*

The Eastern (North) Region includes Duchesne, Uintah, Carbon, and Emery counties, including the cities of Price and Vernal. The Vernal area is served from DEQP by two gate stations through MAP 163 and MAP 334. Minimum pressures in the Vernal system reach a minimum of 179 psig.

Pressures are continuing to decline in the Fort Duchesne area. Currently, the minimum pressure at Fort Duchesne is 135 psig. In order to maintain pressures, the Company must loop or replace the FL43. The Company plans to install a new gate station in Ioka, in 2019, which will increase pressures at Fort Duchesne until the line can be replaced. FL 43 is identified to be replaced as part of the Infrastructure Rate Adjustment Tracker and will be scheduled for replacement in the next five years.

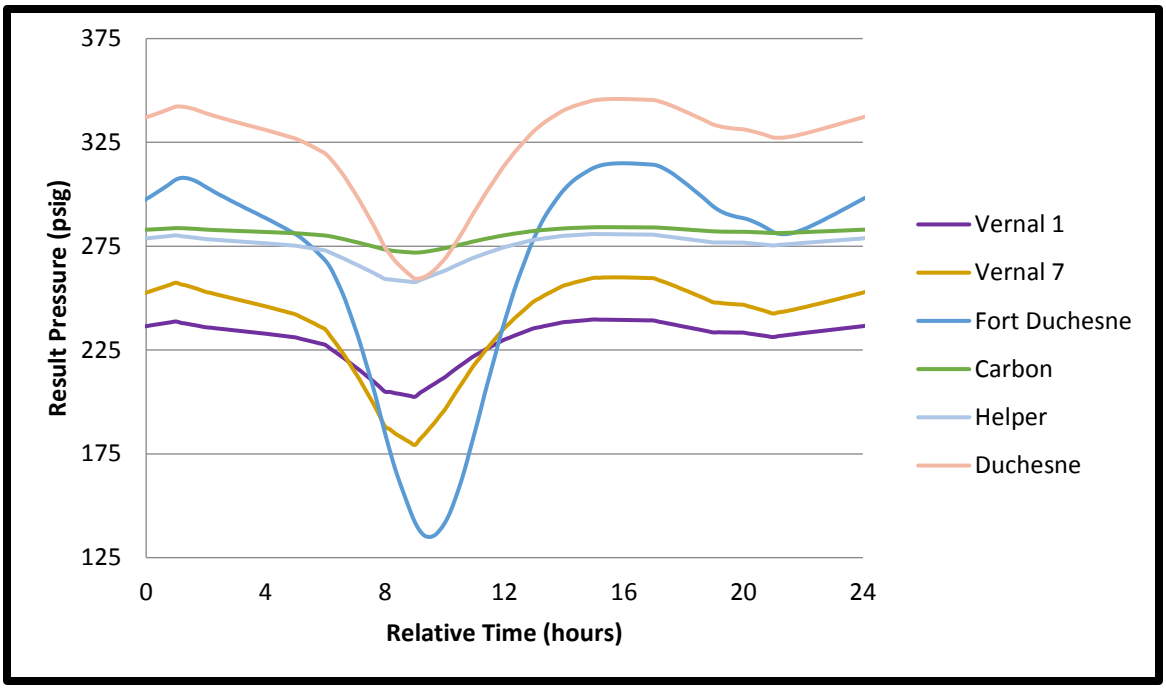


**Figure 4.6: 2018-2019 Eastern (North) Unsteady-State Design-Peak-Day Pressures**

*Eastern (Northwest Pipeline)*

The Eastern (Northwest Pipeline) Region includes the cities of Moab, Monticello and Dutch John. The Company serves these areas from Northwest Pipeline with two stations in Moab, one station in Monticello, and one station in Dutch John.

The system in this area is comprised of separate subsystems with individual gate stations connected to Northwest Pipeline. All of the segments in this area have adequate pressures and do not require any improvements to meet the demand for the 2018-2019 heating season.

*Southern (Main System)*

The Southern (Main System) Region encompasses the areas served by the Indianola, Wecco and Central stations including Richfield, Cedar City, and St. George. The Company serves these areas from DEQP at Indianola station through MAP 166 and from KRGT at Central and Wecco stations.

Using the steady-state model, the lowest modeled pressure on a Design-Peak Day is 314 psig at the Brian Head regulator station. All segments in this area have adequate pressures and do not require any improvement to meet the existing demand.

The Southern System will require substantial upgrades within the next ten years. The Company has monitored the Southern System growth since the Central Compressor station was installed. Based on the current projections, it is estimated that a new feeder line will need to be installed from the Bluff St station east to the Washington 2 tap line prior to heating season 2020-2021 in order to maintain system pressures. In the years following this tie across the system, FL81 will need to be looped to increase gas flow from the Central tap to St George.

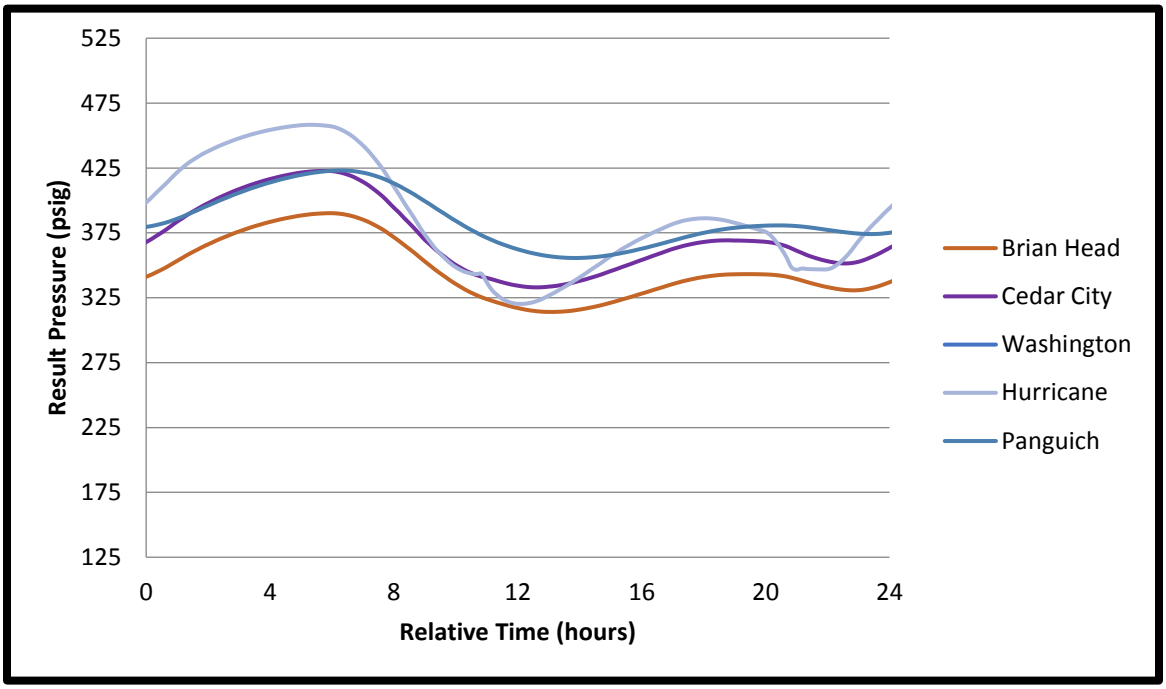


**Figure 4.7: 2018-2019 Southern Unsteady-State Design-Peak-Day Pressures**

*Southern (KRGT Taps)*

The Southern Region includes towns in Juab, Millard, Beaver, Iron, and Washington counties. This includes all towns south of the Payson Gate Station that are not part of the Indianola/Wecco/Central system). These areas are all single feed systems served by KRGT.

The system in this area is comprised of separate subsystems with individual taps off KRGT. All segments in this area have adequate pressures and do not require any improvement to meet the existing demand.

*Wyoming*

The Wyoming Region includes Rock Springs, Evanston, Lyman, Kemmerer, Baggs, and Granger. The Company serves these areas from DEQP through MAP 168, MAP 169, MAP 177, from CIG at Wamsutter and Rock Springs, and from Williams Field Services (WFS) at La Barge and Big Piney.

The Company projects that the 2018-2019 Design-Peak-Day pressures in North Rock Springs will be 263 psig (Figure 4.8). In prior years, this location was one of the lowest in Wyoming. The Company installed a FL111 extension from the Foothill station to North Rock Springs, which increased the Design-Peak-Day minimum pressure over 100 psig.

Kemmerer, Wyoming has experienced sporadic growth over the past few years. The Company has determined that the gate station will need to be upsized. FL 91 will also need to be uprated this year in order to serve the Kemmerer demands on a Design-Peak Day. Pressures at Kemmerer shown in Figure 4.8 include an uprate of FL91 to 300 psig. Eventually, the Company will need to replace the feeder line serving this area with a larger diameter pipe.

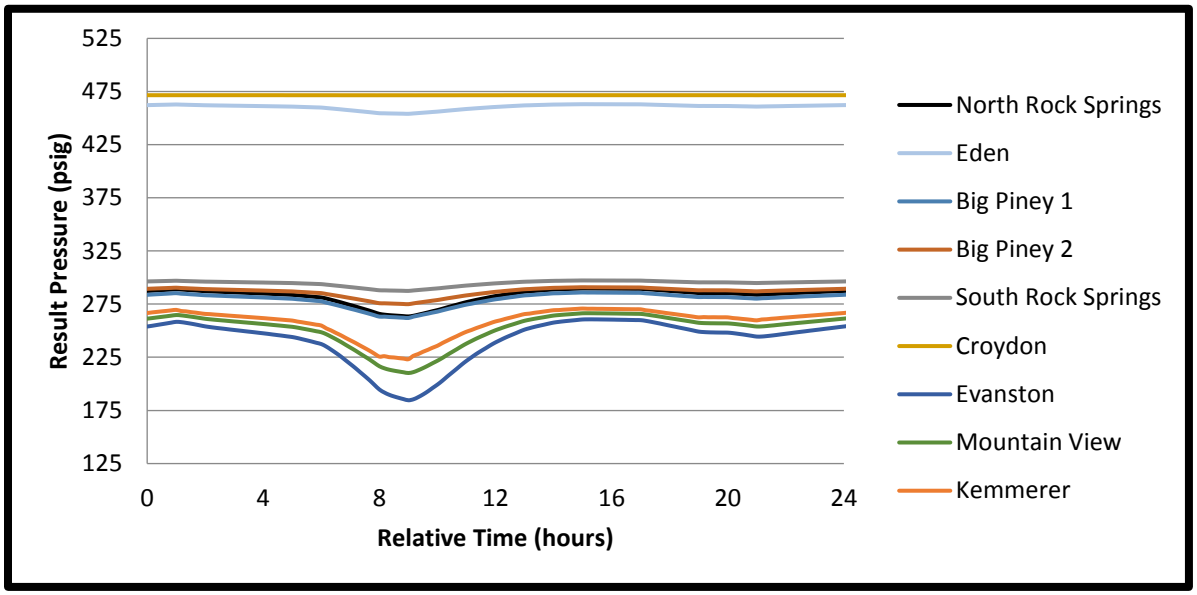


**Figure 4.8: 2018-2019 Wyoming Unsteady-State Design-Peak-Day Pressures**

## System Capacity Conclusions

The Company's HP system is capable of meeting the current Design-Peak-Day demands. The Company bases this assessment on GNA modeling that indicates that the gate stations and feeder line systems have adequate capacity to meet average-daily (on a Design-Peak Day) and peak hourly demands and the supply contracts are adequate. All system models show that pressures should not drop below the design minimum of 125 psig. As discussed below, the Company has plans to address any areas with projected pressures near the 125-psig minimum. The system will continue to grow along with the demand and the Company will conduct an analysis annually and address concerns to ensure that the system continues to meet the Design-Peak-Day needs.

The Company will discuss project options in the distribution action plan (DNG Action Plan) for these identified constraints and concerns:

- Increasing demand and limited supply in the Northern and Central Regions
- Low pressures at the endpoint of FL 51 near Plain City
- Low pressures in the Vernal HP system
- Low pressures in Fort Duchesne
- Demand growth in the Southern HP System
- Demand growth in Kemmerer