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Operations Engineering - System Planning and Analysis

QUESTAR Gas

Feeder Line 23 Replacement Size Analysis

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System Analysis Performed by: Mike Platt

Scope

Feeder Line 23 (FL23) is a 35 mile pipe that currently runs from North Ogden area to Logan. The line's diameter varies from 10-inch to 12-inch. The feeder line delivers gas from the Hyrum Gate Station to the rest of the Northern High Pressure (HP) system. This feeder line is expected to have sections replaced starting in fall of 2011. This analysis considers the replacement size in relation to present and future system operation.

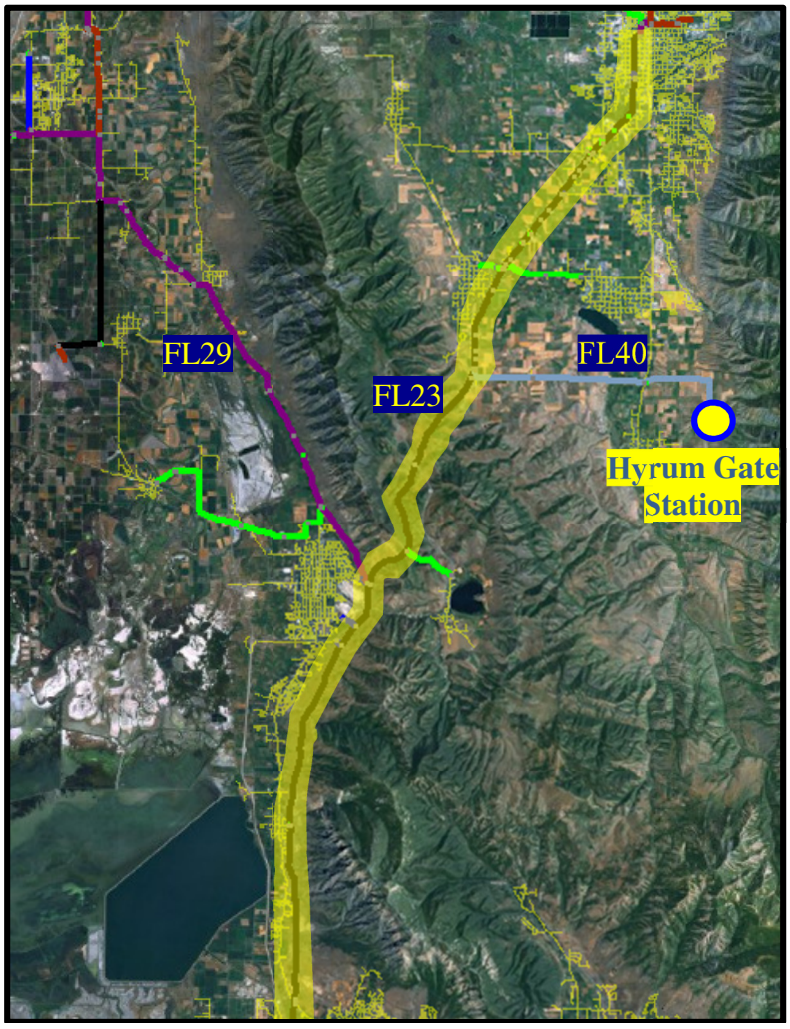

Figure 1: Map of Feeder Line 23

Operating Conditions

In the current system, the north end of FL23 is regulated down to 300 psig. This section will not be required to have regulation once the feeder line has been replaced. This will ultimately increase overall pressures in the region by reducing the resistance to gas from Hyrum to the extremities of the system.

There are two options under consideration to increase the gas flow to this region. One option is to install a new tap onto Ruby Pipeline, which is currently being constructed. This, if installed, would be located on Feeder Line 29 (FL29) just west of FL23. Another option would be to install a "North Ogden Gate" through Questar Pipeline Company (QPC) which would be located east of FL19 and north of Sunset Gate. Each of these options has merit and may be employed; however, replacing FL23 with the appropriate diameter pipe could delay the need for these alternatives.

Analysis

In the initial analysis, the current system model was used to determine the possible effects various replacement diameters would have on the system if a full replacement were completed. Table 1 shows the system results of this analysis. The first row contains the model results of the existing system under peak conditions. The second row contains the exact same scenario without regulation between Logan and Richmond (a town north of Logan), this change will eventually be made as other feeder lines are replaced and will increase the take away capacity of Hyrum Gate. The next 4 rows contain the system results assuming the entire length of FL23 has been replaced with the labeled diameter.

In this scenario the system results continue to improve with the 24-inch. Since FL23 feeds both north and south from Hyrum gate and the expected flow from the second nearest gate, Sunset (in Layton), is constrained at approximately 70 MMcfd, the replacement size of FL23 could have a significant impact on the resultant pressures extending south beyond Layton. The southernmost point considered in this analysis was at Plain City, a low pressure point on the Questar Gas (QGC) HP system, which experienced significant (~56 psig) increases in pressure with a 20-inch or 24-inch replacement.

Table 1: 2010 Peak Minimum Pressures (psig)

	Promontory	Corinne	Mantua	Preston	Bear River City	Plymouth	Plain City
Existing	377	396	390	366	380	373	331
Existing*	382	395	389	378	385	381	336
12-inch	382	395	389	377	384	381	332
16-inch	388	396	389	384	390	388	373
20-inch	389	396	389	386	391	389	387
24-inch	390	396	389	387	392	390	387

** does not have regulation between Logan and Richmond*

The next step in analysis was to project future growth to determine the system outlook in 2030. The model was developed using the 20 year growth scenarios that identify probable growth centers. This was combined with the 2010 Integrated Resource Plan (IRP) annual peak day growth rate of approximately 1% for locations outside the analysis region. This allows the analysis to focus on the likely region specific challenges.

The system results for the 2030 model look similar to the 2010 model. The row representing the unchanged system, labeled "Peak", assumes that by this time the pressure reduction that occurs between Logan and Richmond has been removed. The 24-inch replacement provides the highest system pressures. The pressure results provided by a 24-inch replacement provide only marginally higher pressures than a 20-inch replacement.

Table 2: 2030 Peak Minimum Pressures (psig)

	Promontory	Corinne	Mantua	Preston	Bear River City	Plymouth	Plain City
Existing	335	345	320	329	339	389	167
12-inch	333	343	319	326	336	389	164
16-inch	356	358	329	352	358	389	197
20-inch	363	363	332	360	365	389	216
24-inch	365	365	333	362	367	389	224

One possible scenario involves installing different diameters of replacement heading north and south from FL40. The take away capacity at Hyrum Gate is independent of the northern section's diameter. Table 3 shows the minimum peak day pressure results assuming a 24-inch pipe is installed southward, as this will show the greatest impact, at various northward diameter replacements. These results show that the replacement diameter heading north has a significant influence on pressures, especially at Preston with a difference of 36 psig between 12-inch and 24-inch.

Table 3: 2030 Various Northern FL23 Replacement Diameter Pressures (psig)

	Promontory	Corinne	Mantua	Preston	Bear River City	Plymouth	Plain City
12-inch	342	361	333	326	346	389	224
16-inch	357	363	333	352	360	389	224
20-inch	363	364	333	360	366	389	224
24-inch	365	365	333	362	367	389	224

Capital Cost Analysis

The estimated costs for each possible diameter scenarios are shown below in Table 4.

Table 4: Estimated Costs

Option	South	North	Estimated Cost
1	20-inch	12-inch	$42,309,000
2	24-inch	12-inch	$48,132,000
3	20-inch	20-inch	$46,088,000
4	24-inch	24-inch	$56,147,000

Conclusions

Either Option 1 or Option 3 will meet the current and future needs of the HP system. This 20-inch replacement is consistent with the northern "trunk line" vision mentioned in the Feeder Line 19 (FL19) Replacement Analysis, which will connect all the northern gate stations with a 20-inch line. North of Hyrum Gate Station, the appropriate replacement diameter is 12-inch.