

Gas Market Reform Group

Auctionable Quantity Risk

Report Date: 14 August 2017

FINAL

Cover Note:

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1 Executive Summary

The following report has been developed using publicly available Gas Bulletin Board (GBB) historical data for the period November 2016 to June 2017 to examine the volume of available auctionable transportation and the firmness of that quantity based on uplift in actual volumes into that auctionable quantity.

The report has been prepared to provide some insight into the extent to which capacity purchased through the day-ahead auction that the AEMC has recommended could be interrupted if shippers with primary capacity renominate on the gas day and the auction product is an interruptible product. It should be further noted that the GBB data has been aggregated and some care should be taken with its interpretation as this report has been developed as a guide to the relative firmness of Auctionable Quantities, not a definitive assessment of operational risk.

Definition of Terms

For this report, the term *Auctionable Quantity* has been defined as the Total Daily Contract Quantity for a pipeline less than Firm Nominations. The term *Actual Uplift* has been defined as the calculated volume when Actual Deliveries exceeds Firm Nominations and would therefore theoretically impact the firmness of the Auctionable Quantity depending on the quantum of the Auctionable Quantity sold.

This volume is ignored if the Actual Deliveries are less than the Firm Nominations (i.e. no Actual Uplift). The use of Actual Deliveries may also include other as available or interruptible services on the pipeline, which could overstate the risk of interruptibility.

Risk of Interruption

The report, amongst other things, looks at the maximum and average auction quantity for each pipeline as well as the risk of interruption. For each day during the analysis period, the level of interruption has been classified as:

- No interruption if the Auctionable Quantity is not reduced by Actual Uplift;
- Limited interruption if the Auctionable Quantity is reduced by less than 10% as a result of Actual Uplift;
- Moderate interruption if the Auctionable Quantity is reduced by 10-49% as a result of Actual Uplift;
- Significant interruption if the Auctionable Quantity is reduced by 50-79% as a result of Actual Uplift; and
- Severe interruption if the Auctionable Quantity is reduced by more than 80% as a result of Actual Uplift.

Pipelines Examined

The pipelines that have been examined include Eastern Gas Pipeline (EGP), Moomba to Sydney Pipeline (MSP), South East Australia Gas Pipeline (SEA), Moomba to Adelaide Pipeline (MAPS), Roma to Brisbane Pipeline (RBP), Queensland Gas Pipeline (QGP), Darling Downs Pipeline (DDPL), Berwyndale to Wallumbilla Pipeline (BWP), Carpentaria Gas Pipeline (CGP), Wallumbilla to Gladstone Gas Pipeline (WGGP) and Tasmanian Gas Pipeline (TGP).

South West Queensland Pipeline has been excluded from the report as the pipeline has concurrent bidirectional nominations and the gross directional nominations, contract and

renomination data were unable to be extracted from GBB or any other publicly available data sources.

General Observations

Based on the analysis that has been conducted the following observations can be made:

- The Moomba to Adelaide Pipeline System (section 6) regularly report nominations in excess of the pipeline's nameplate capacity, with the actual flows being on average 43TJ/d below nominations, and very rarely exceeding the nominations. This has resulted in a very low percentage of interruption although this could be related to data issues rather than implications on the auction market. This help provide an explanation for the *complex* descriptor in Table 1.
- The pipelines with a low (<50%) proportion of average Auctionable Quantity compared to Maximum Auctionable Quantity are Berwyndale to Wallumbilla Pipeline, Carpentaria Gas Pipeline, Eastern Gas Pipeline, Moomba to Adelaide Pipeline, Queensland Gas Pipeline and Wallumbilla to Gladstone Pipeline with more 50%.
- The pipelines with the highest moderate (>10% reduction) interruptibility are Berwyndale to Wallumbilla Pipeline, Carpentaria Gas Pipeline, Roma to Brisbane Pipeline, SEA Gas Pipeline and Wallumbilla to Gladstone Pipeline.
- The cross section of pipelines with the combination of both low Auctionable Contract Quantity and high interruptibility are Berwyndale to Wallumbilla Pipeline, Carpentaria Gas Pipeline and Wallumbilla to Gladstone Gas Pipeline.

Summary of Findings

Table 1 summarises the Maximum and Average Auctionable Quantity for each of the pipelines as well as the probability/risk for each of the interruption classification groups has been provided in terms of % of days within the analysis period of November 2016 to June 2017. Finally a subjective description of the pipeline has been provided for context.

Table 1—Minimum, 10% Percentile, Average, 90% Percentile and Maximum Auctionable Quantity, and Risk of Interruption by Classification for each pipeline during analysis period of Nov 2016 to June 2017

	Auctionable Quantity (TJ/d)					% Risk of Interruption				
	Minimum	10%	Average	90%	Maximum	No Impact (0%)	Limited (0-9%)	Moderate (10-49%)	Significant (50-79%)	Severe (>80%)
EGP	0	11	69	125	171	91.2%	5.4%	2.0%	0.0%	1.5%
MSP	48	117	186	257	292	81.6%	14.6%	3.8%	0.0%	0.0%
SEA Gas	1	95	139	187	215	70.8%	18.9%	9.9%	0.0%	0.5%
MAPS	0	0	54	107	169	97.5%	1.9%	0.6%	0.0%	0.0%
RBP	0	74	103	132	154	47.9%	33.2%	17.1%	1.4%	0.5%
QGP	0	7	14	21	35	81.2%	12.6%	5.3%	1.0%	0.0%
DDPL	99	153	243	270	270	84.9%	12.7%	2.4%	0.0%	0.0%
BWP	0	25	82	130	164 ¹	56.9%	23.2%	14.7%	5.2%	0.0%
CGP	0	12	17	25	42	55.5%	21.8%	20.4%	2.4%	0.0%
WGGP	88	170	364	544	792	64.6%	18.9%	15.1%	1.4%	0.0%
TGP	0	0	43	57	65	90.8%	4.6%	4.6%	0.0%	0.0%
SWQP	Excluded due to data limitations									

¹ Berwyndale to Wallumbilla Pipeline had a maximum Auctionable Quantity of 413TJ/d during a period of reverse flows. Natural direction limit was 164TJ/d.

2 Report Framework and Structure

This report has been developed with the following structure.

Section 1 gives a high-level summary of the results for all of the pipelines, which are covered individually in more detail in sections 2 to 13. The analysis in each of the sections 2 to 13 is concerned with a single pipeline system.

The analysis for each pipeline includes:

- An overview of the flows on the pipeline, including
 - firm nominations (GasBB term: FIRMN) which are reported as at the nomination cut-off time between 12 to 24 hours before the start of the gas day;
 - actual flow (GasBB term: Actual Flow) which is reported up to 30 hours following the end of the gas day by pipeline operator;
 - capacity (GasBB term: Capacity Outlook) which is the reported capacity in advance of the day; and
 - contracted capacity (GasBB term: Contracted Capacity) which is reported prior to the gas day;
- Analysis of the difference between the firm nomination and the actual flow on each gas day by season;
- Analysis of the difference between the pipeline's available capacity and the actual flow of gas on each gas day by season;
- Analysis of the difference between the auctionable quantity of capacity (i.e. contracted quantity minus firm nominations), and the actual flow of gas on each gas day by season.

2.1 Scope of Works and Approach

Pipeline scope

The scope of the project will cover the following pipelines:

- RBP
- QGP
- SWQP/QSN ← Excluded due to data limitations
- CGP
- MSP
- MAPS
- SEA Gas
- EGP
- TGP
- BWP
- Darling Downs
- Wallumbilla to Gladstone pipeline

Horizon scope



The historical analysis has been based on the period between November 2016 and June 2017 due to the additional data availability regarding gas contracting quantities with new gas transparency requirements.

Data sources

Energy Edge has drawn data from primary data sources being predominantly:

- Gas Bulletin Board publications
- STTM data feeds
- WGSB data feeds
- DWGM data feeds

Information has been captured by Energy Edge in proprietary SQL databases and they will be interrogated using SQL query tools.

Energy Edge has drawn upon the secondary data which represents a processed version of the primary data above and managed through the proprietary Gas Market Analysis Tool (GMAT).

Data analysis methodologies

The objective of the analysis is to use historic data to examine the quantity of capacity that could be subject to the auction (measured as contracted capacity less firm nomination) and the risk the auction product would be interrupted as a result of actual deliveries differing from firm nominations.

We will analyse these historical pipeline nomination data by gas day and compare against forecast capacity to establish the residual capacity available for non-firm auction products.

The primary methodology involves the following:

- Extract firm nominated volumes on each pipeline
- Extract the contracted capacity of each pipeline
- Establish the amount of capacity that could be subject to the auction (i.e. contracted capacity – firm nomination data)
- Measure the uplift variations in the firm nominations used in the calculation of the auction quantity from the actual flows.

3 Eastern Gas Pipeline

The Eastern Gas Pipeline (EGP) runs along the Victoria and NSW east coast and connects Longford to Sydney. The pipeline has continuously operated over the analysis period, with no periods of missing data. There have been material intra-day nominations by the pipeline operator over the analysis period.

3.1 EGP - Flow analysis

Figure 1 shows the firm nomination, actual flows, capacity and contracted capacity of the EGP over the analysis period. It seems that there is some seasonal behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 2).

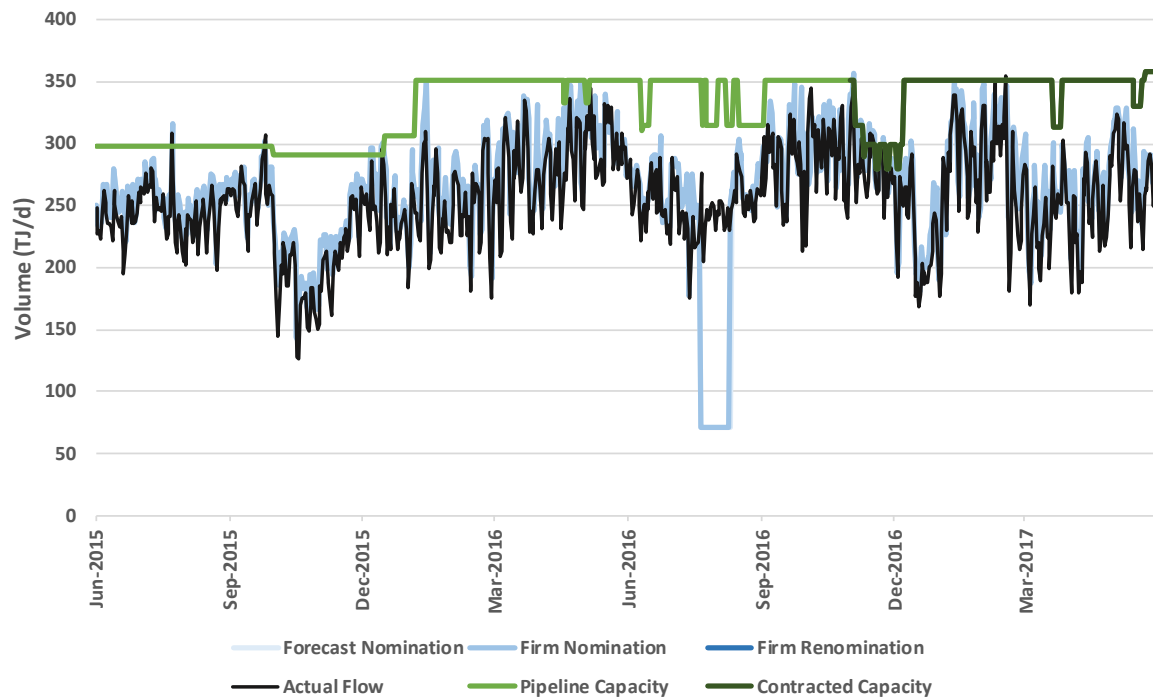


Figure 1—EGP - Nominations, Actual Flows and Capacity

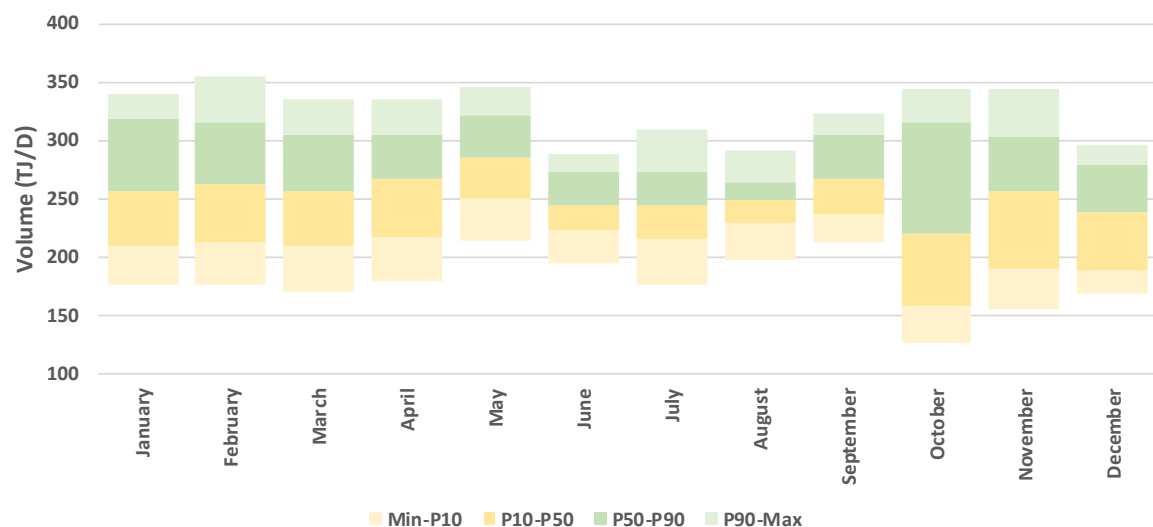


Figure 2—EGP - Distribution of actual volumes per month

3.2 EGP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity of gas that was transported on a given gas day.

Figure 3 shows that there is general alignment between the firm nomination and the actual quantity shipped on the pipeline. The clear exception occurs over the period 21-Jul-2016 to 09-Aug-2016, where the firm nominations were considerably lower than the actual flow.

Figure 4 shows that most of the gas days, the actual flow is typically within the range -29TJ/d (P10) and 2.9TJ/d (P90) of the firm nomination. The slight skew can be seen where the actual quantity of gas delivered was slightly less than the nominated quantities with a range of -16.6TJ/d (P35) to -8.8TJ/d (P65).

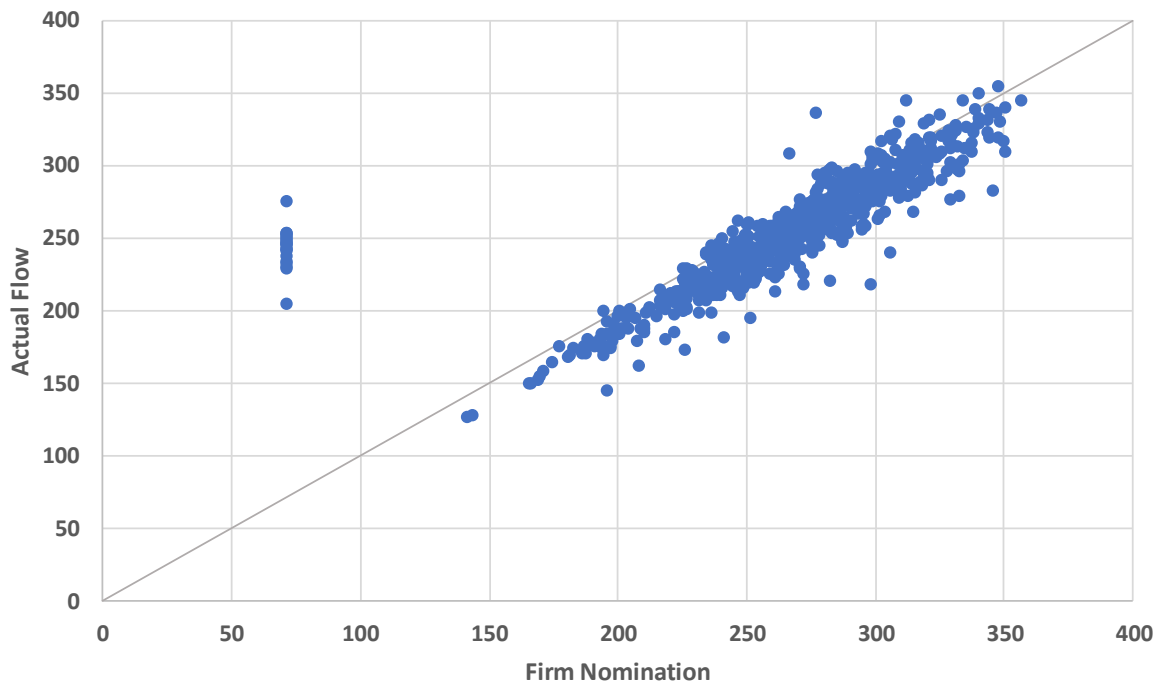


Figure 3—EGP - Scatterplot of Firm Nomination vs Actual Flow

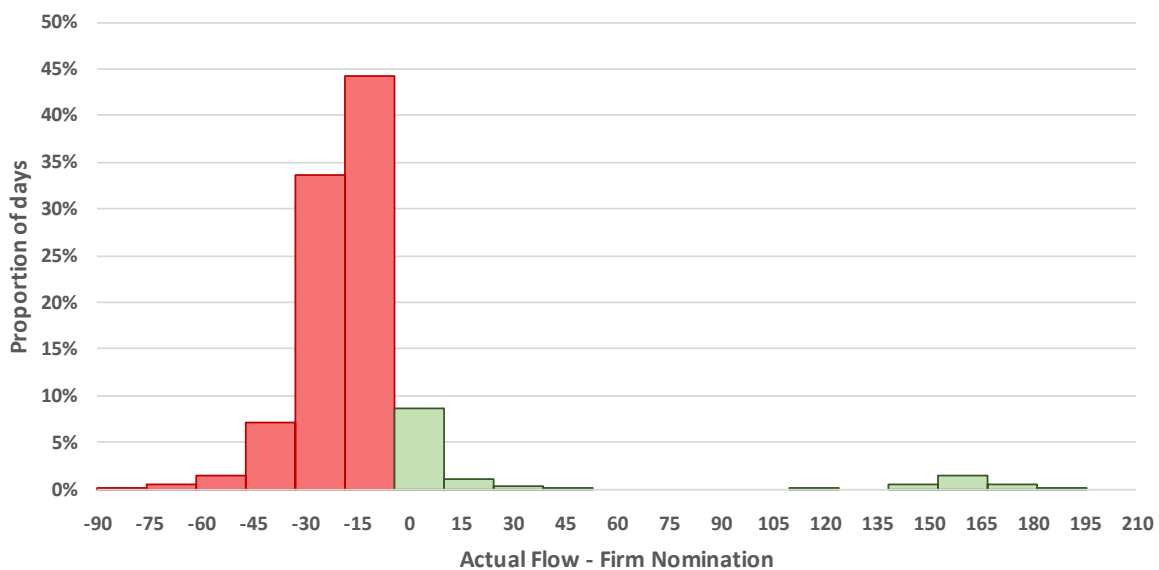


Figure 4—EGP - Histogram of Actual Flow less Firm Nomination

3.3 EGP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 5 shows the pipeline capacity that is available for a gas day removing the firm nominations. There are 13 days where the firm nominations exceed the pipeline capacity. There is typically 18.8TJ/d (P10) to 115.1TJ/d (P90) of capacity available in excess of the firm nominations until the pipeline capacity is reached.

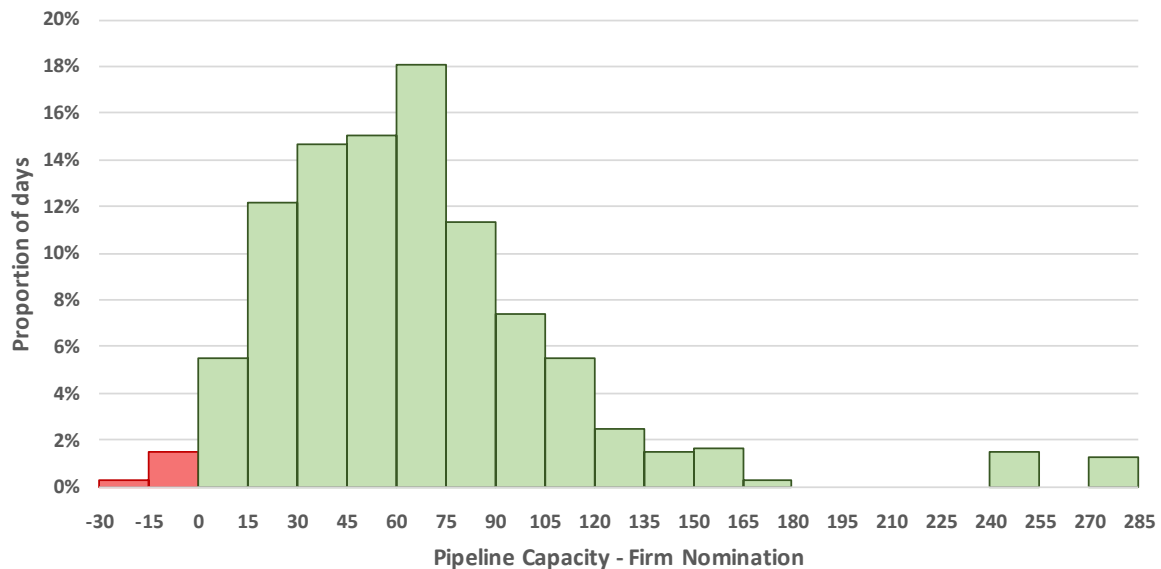


Figure 5—EGP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 6 shows the pipeline capacity that is available for a gas day after removing the actual flow. There are 9 days where the actual flow exceeds the pipeline capacity. There is typically 31.3TJ/d (P10) to 127.9TJ/d (P90) of unused capacity in the pipeline.

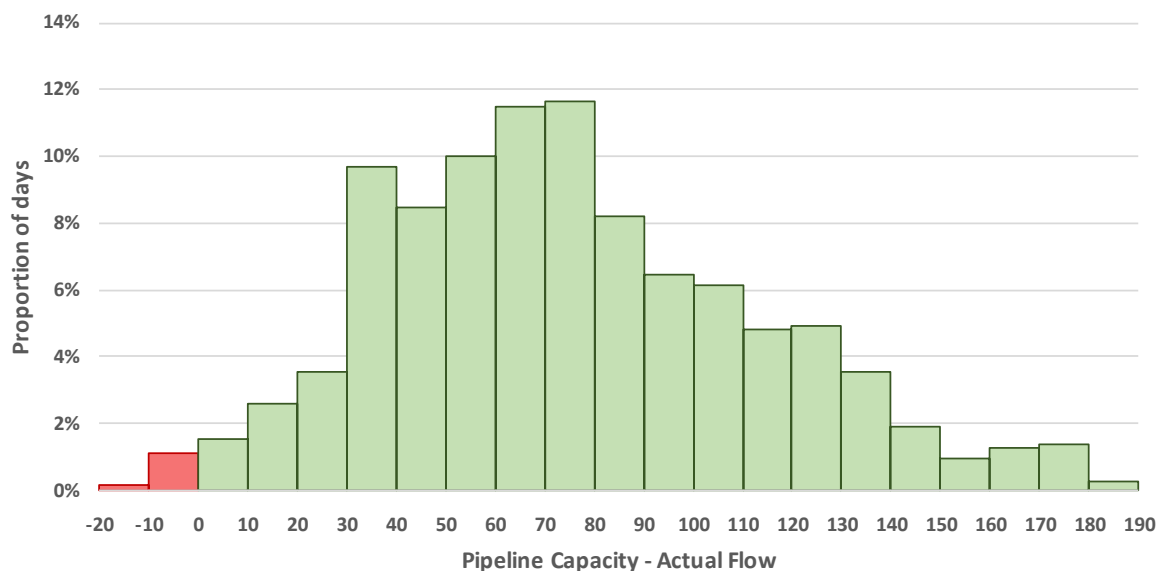


Figure 6—EGP - Distribution of the remaining capacity after accounting for the actual flow.

3.4 EGP - Auction Quantity

Figure 7 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

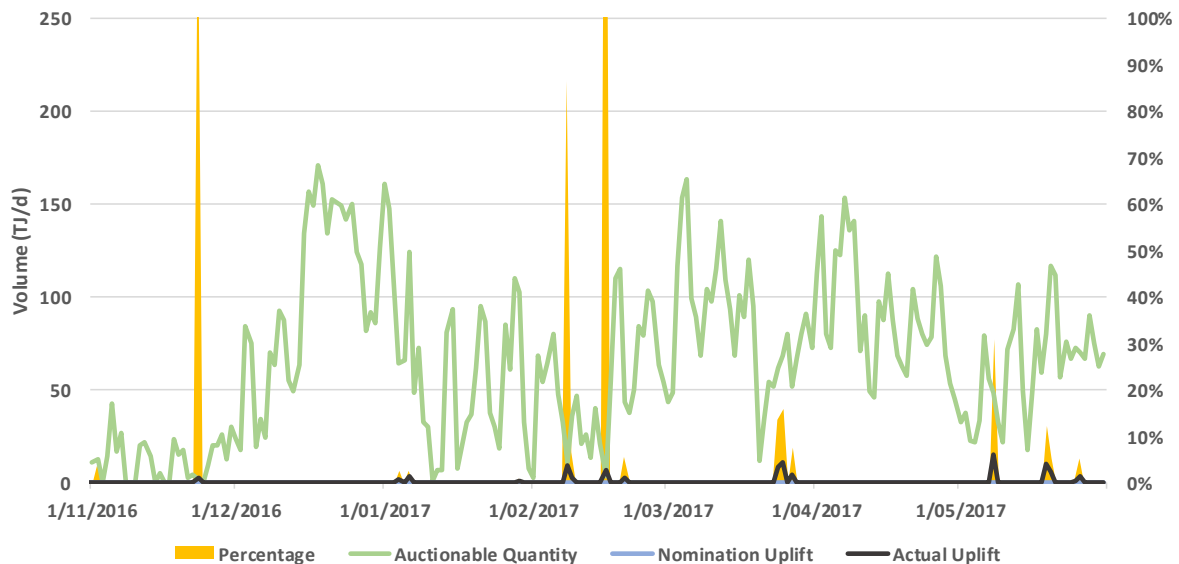


Figure 7 – EGP - Auction Quantity

The auctionable quantity is typically in the range 11TJ/d (P10) to 125TJ/d (P90) with eight days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (91.2%) or limited impact (5.4%). There were three days where the auctionable quantity was reduced by more than 80%.

The EGP would be classified as a pipeline with large auctionable quantities and a 3.5% risk of moderate or greater impact on contracted quantities.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	11
Median	65
90th Percentile	125
Maximum	171

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	91.2%
Limited (less than 10%)	5.4%
Moderate (10% to 50%)	2.0%
Significant (50% to 80%)	0.0%
Severe (Over 80%)	1.5%

4 Moomba to Sydney Pipeline

The Moomba to Sydney Pipeline (MSP) connects Moomba to Sydney via Young, Canberra and rural New South Wales. The pipeline has continuously operated over the analysis period. The pipeline is capable of haul in both directions and this is reflected in the variable capacity.

4.1 MSP - Flow analysis

Figure 8 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the MSP over the analysis period. It seems that there is some seasonal behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 9).

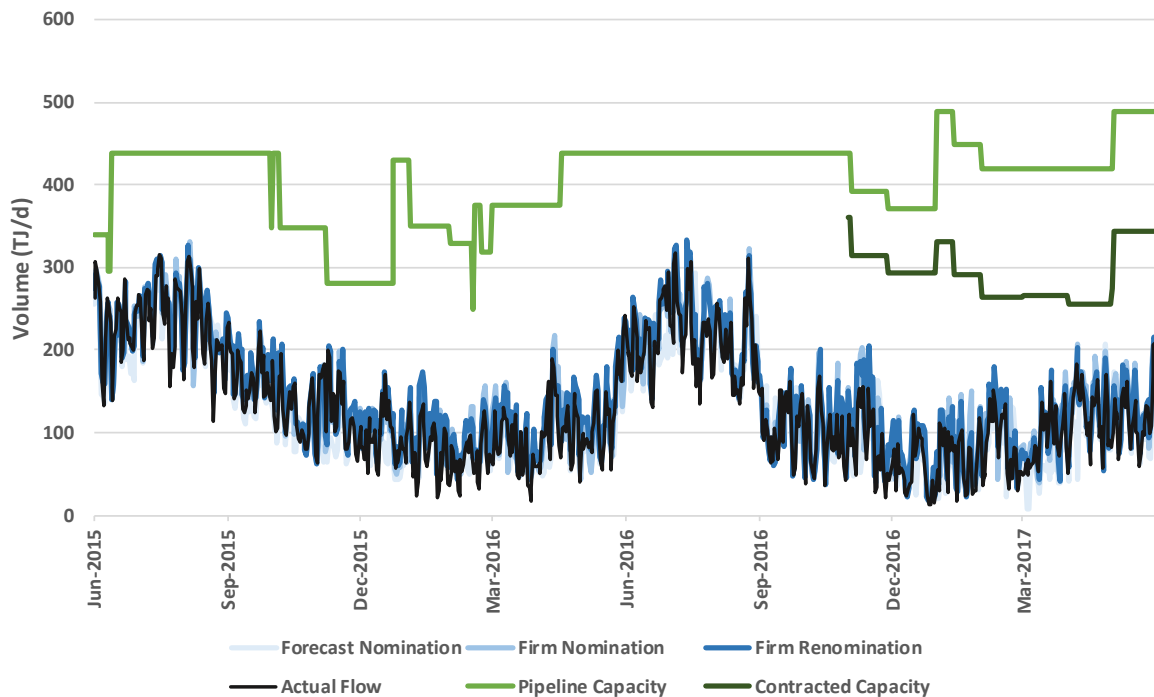


Figure 8—MSP - Nominations, Actual Flows and Capacity

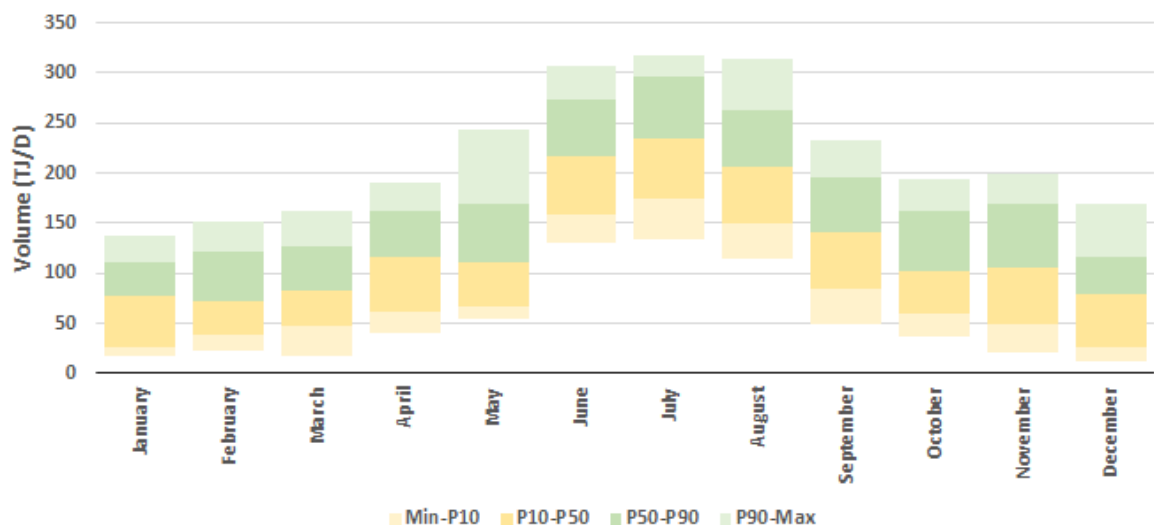


Figure 9—MSP - Distribution of actual volumes per month

4.2 MSP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 10 shows that there is general skew between the firm nomination and the actual quantity shipped on the pipeline where actual flows are approximately 15TJ/d less than nominations (see Figure 11).

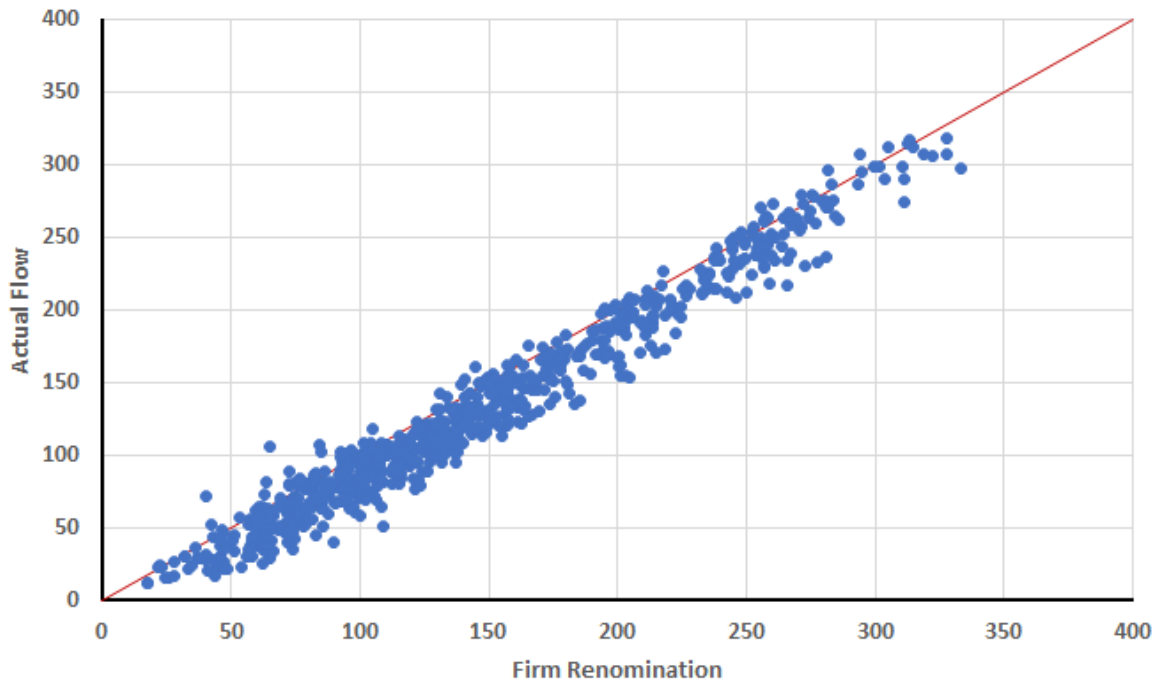


Figure 10—MSP - Scatterplot of Firm Nomination vs Actual Flow

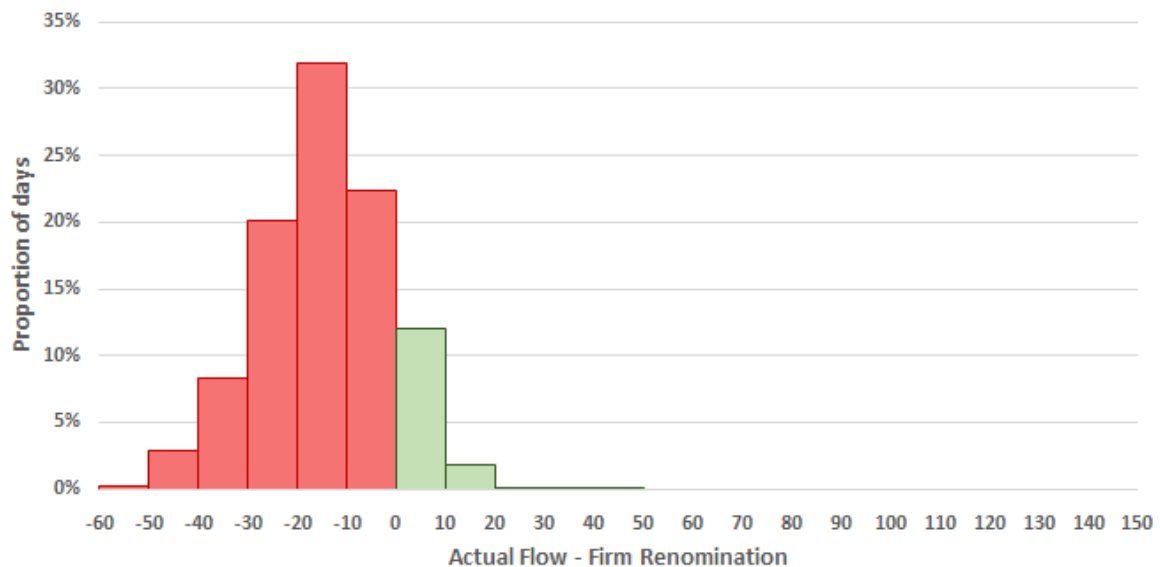


Figure 11—MSP - Histogram of Actual Flow less Firm Nomination

4.3 MSP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 12 shows the pipeline capacity that is available for a gas day removing the firm nominations under most conditions.

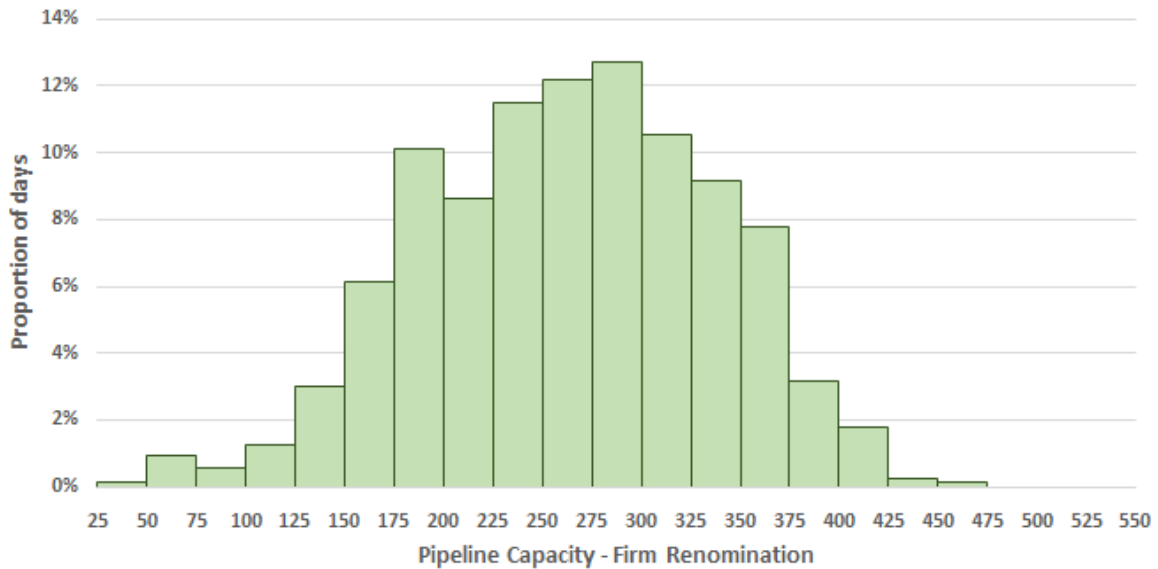


Figure 12—MSP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 13 shows the pipeline capacity that is available for a gas day after removing the actual flow.

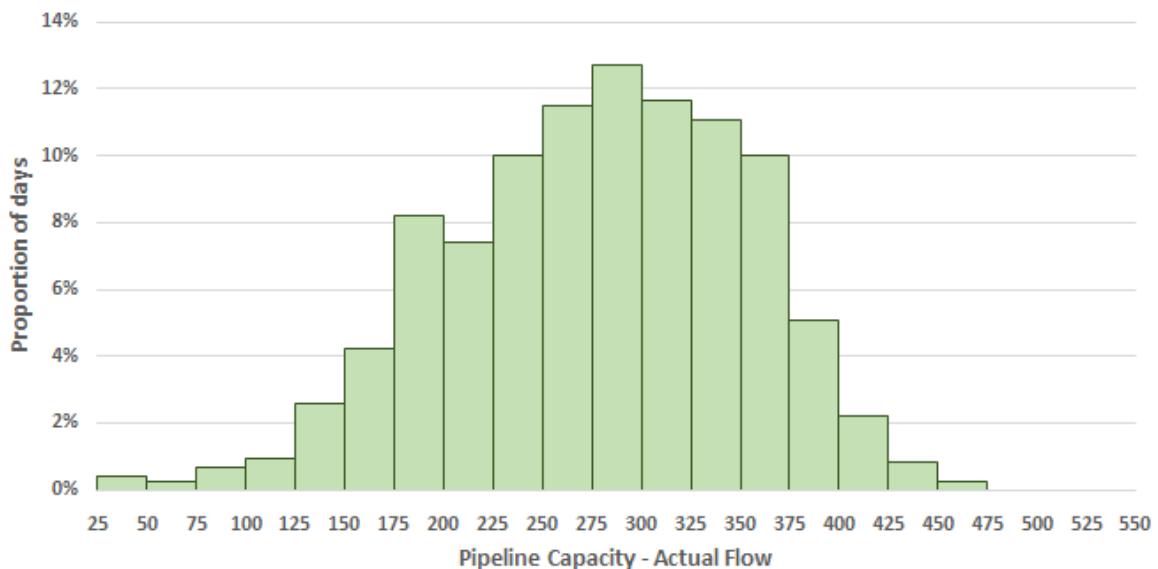


Figure 13—MSP - Distribution of the remaining capacity after accounting for the actual flow.

4.4 MSP – Auction Quantity

Figure 14 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

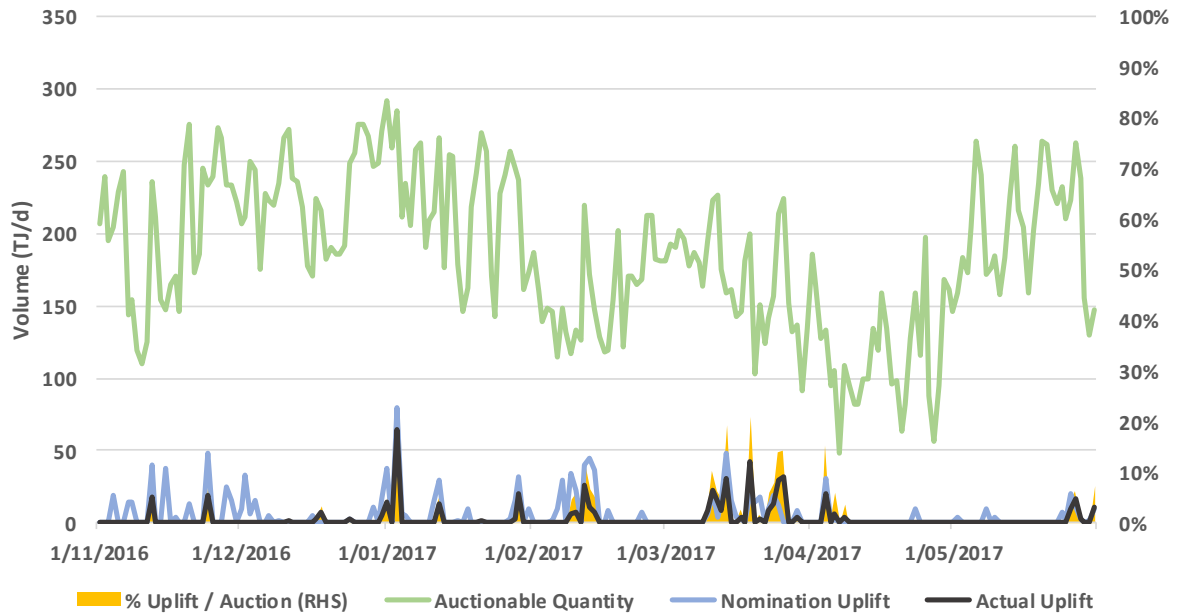


Figure 14 - MSP - Auction Quantity

The auctionable quantity is typically in the range 117TJ/d (P10) to 257TJ/d (P90) with no days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (81.6%) or limited impact (14.6%). There were no days where the auctionable quantity was reduced by more than 80%.

The MSP would be classified as a pipeline with large auctionable quantities and a 3.8% risk of moderate or greater impact on contracted quantities.

Auctionable Quantity	Volume (TJ/d)
Minimum	48
10th Percentile	117
Median	184
90th Percentile	257
Maximum	292

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	81.6%
Limited (less than 10%)	14.6%
Moderate (10% to 50%)	3.8%
Significant (50% to 80%)	0.0%
Severe (Over 80%)	0.0%

5 SEA Gas Pipeline

The South East Australia Gas Pipeline (SEA Gas) connects Port Campbell region to Adelaide, via Canberra and rural New South Wales. The pipeline has continuously operated over the analysis period.

5.1 SEA - Flow analysis

Figure 15 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the SEA Gas pipeline over the analysis period. It seems that there is some seasonal behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 16).

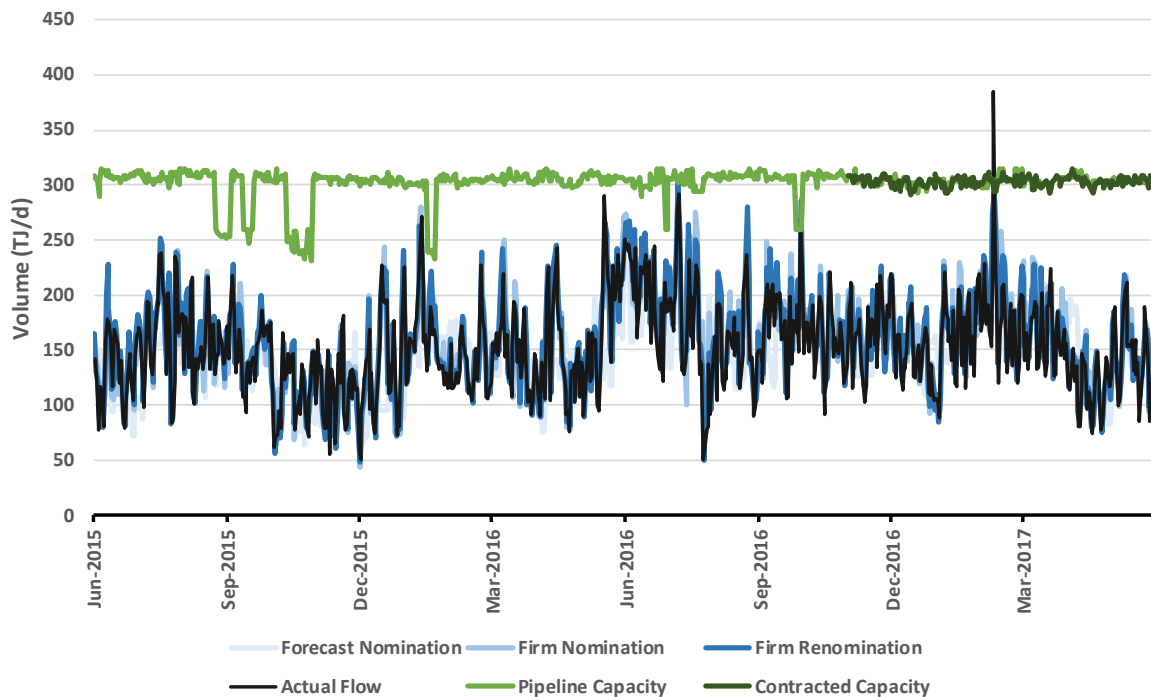


Figure 15—SEA - Nominations, Actual Flows and Capacity

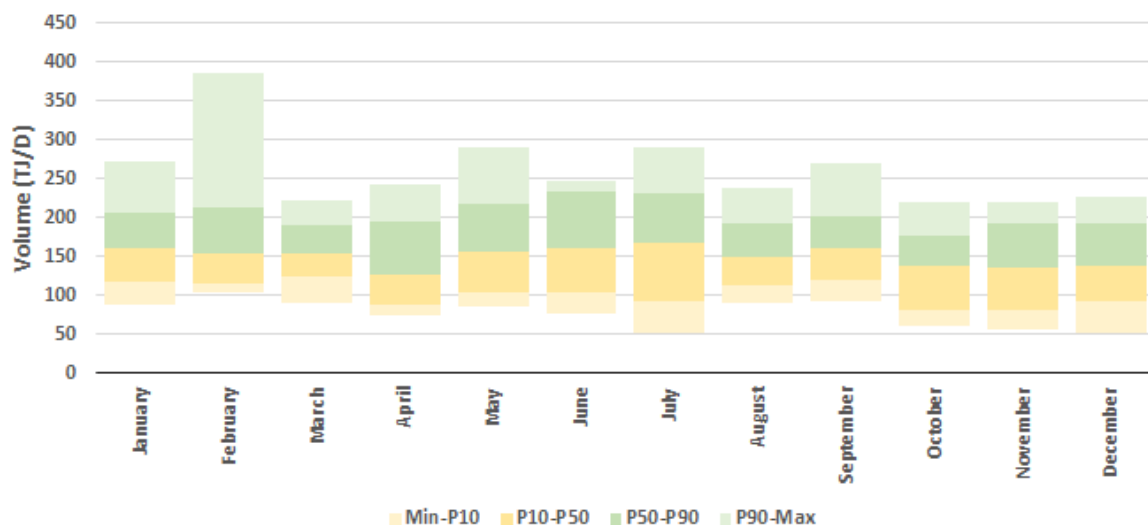


Figure 16—SEA - Distribution of actual volumes per month

5.2 SEA – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day. Figure 17 shows a slight skew of approximately 6TJ/d lower actual flows compared to firm nomination volumes (see Figure 18).

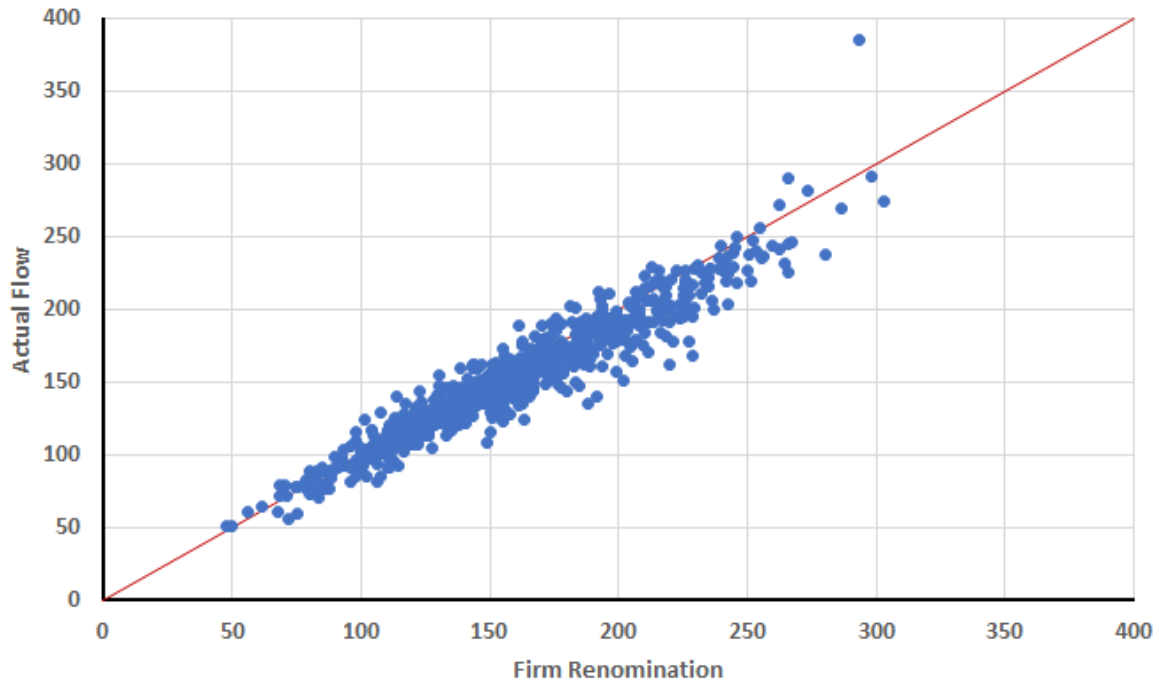


Figure 17—SEA - Scatterplot of Firm Nomination vs Actual Flow

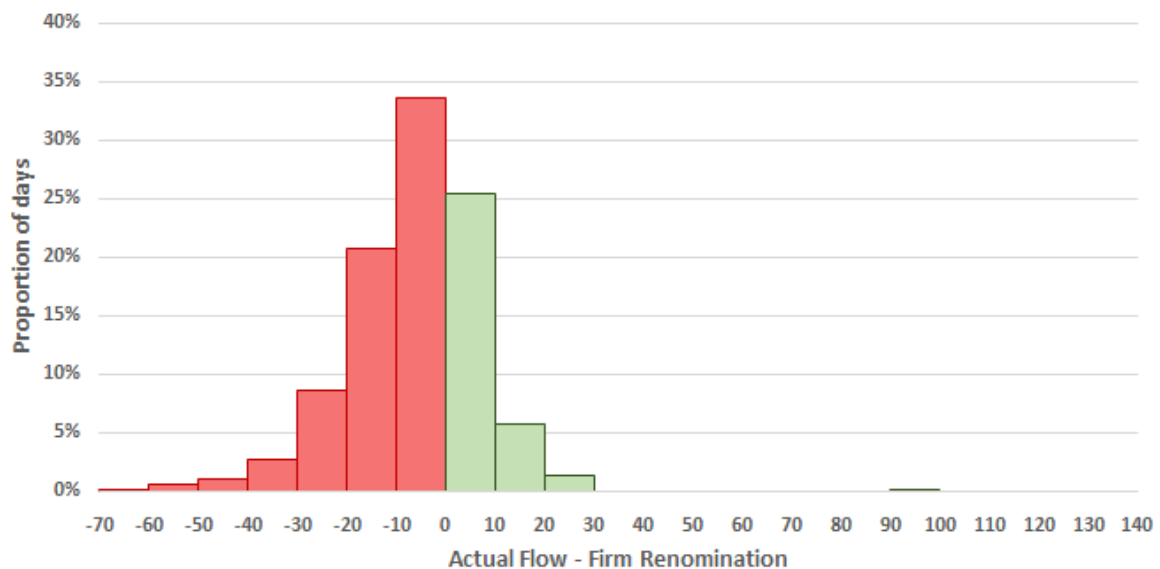


Figure 18—SEA - Histogram of Actual Flow less Firm Nomination

5.3 SEA - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 19 shows the pipeline capacity that while there are long periods of available capacity, the pipeline nominations can exceed the capacity limits.

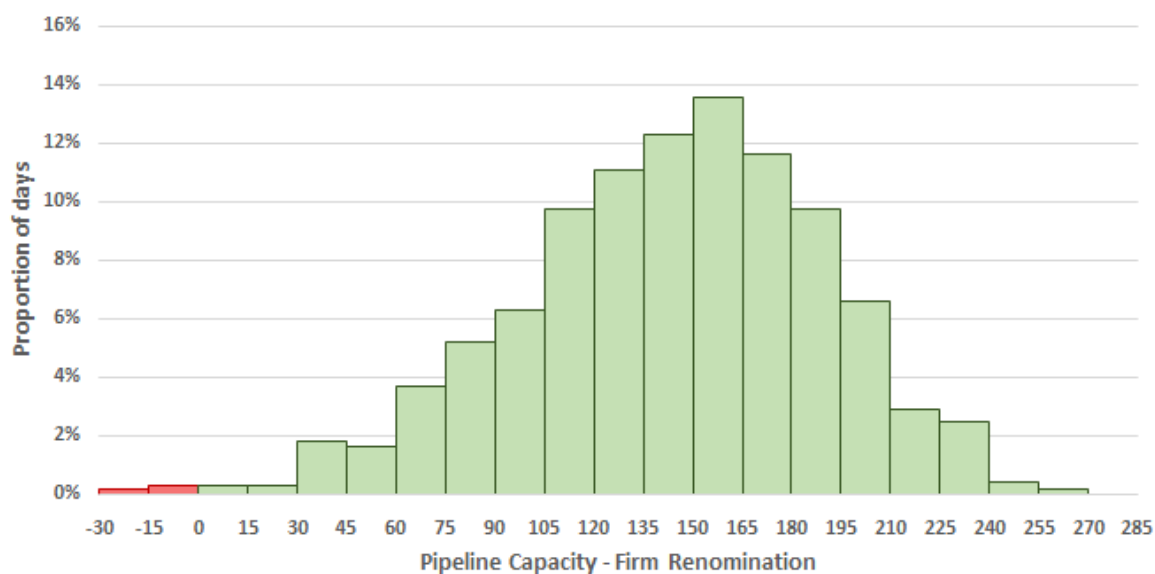


Figure 19—SEA - Distribution of the remaining capacity after accounting for firm nominations.

Figure 20 shows the pipeline capacity that is available for a gas day after removing the actual flow which shows a reduced number of actual flows that exceed the capacity with a notable exception of 9th February where volumes exceed capacity by 100TJ/d and blackouts impacted South Australian electricity network.

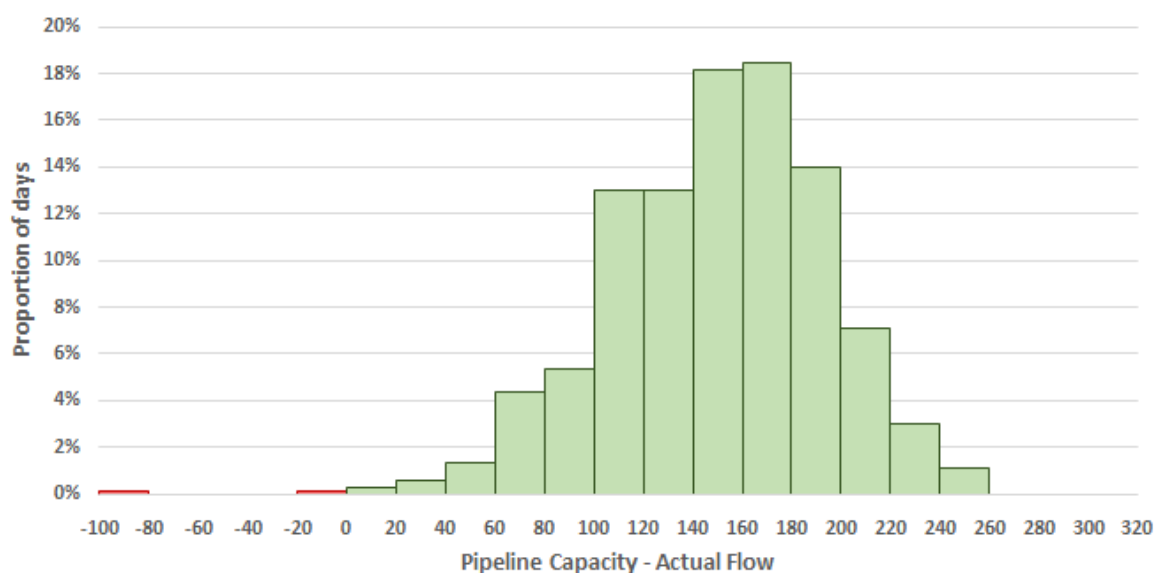


Figure 20—SEA - Distribution of the remaining capacity after accounting for the actual flow.

5.4 SEA – Auction Quantity

Figure 21 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

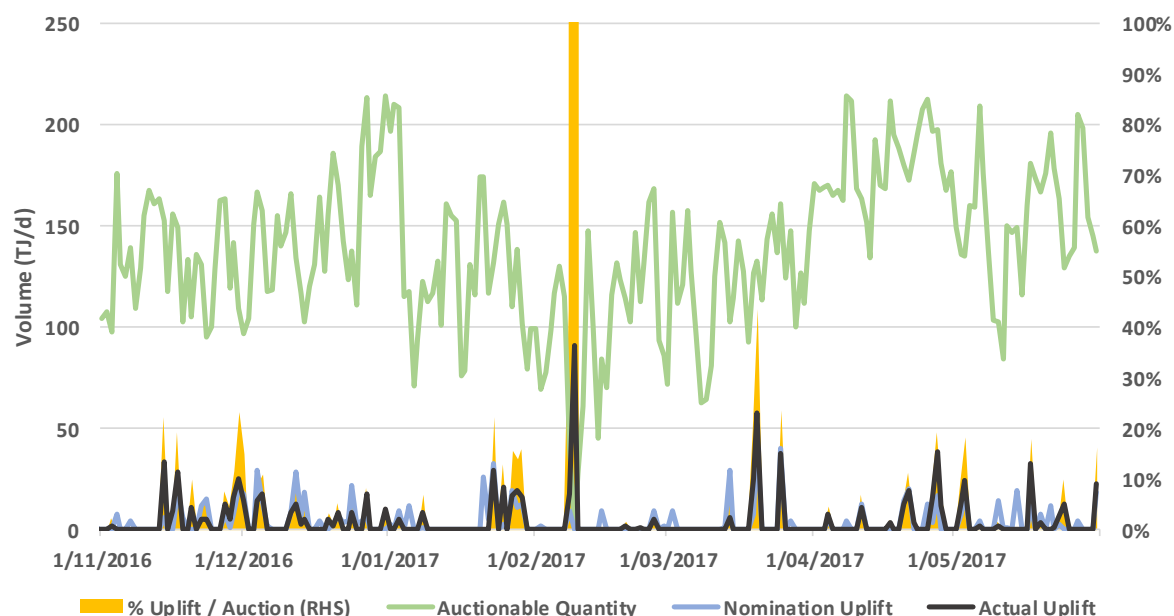


Figure 21 - SEA - Auction Quantity

The auctionable quantity is typically in the range 95TJ/d (P10) to 187TJ/d (P90) with no days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (71.1%) or limited impact (19.0%). There were one day where the auctionable quantity was reduced by more than 80% and in fact the actual quantity exceeded the contract quantity by more than 100TJ/d during the South Australian hot weather conditions of 9th February.

The SEA would be classified as a pipeline with large auctionable quantities and a 10% risk of moderate or greater impact on contracted quantities.

Auctionable Quantity	Volume (TJ/d)
Minimum	1
10th Percentile	95
Median	139
90th Percentile	187
Maximum	215

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	70.8%
Limited (less than 10%)	18.9%
Moderate (10% to 50%)	9.9%
Significant (50% to 80%)	0.0%
Severe (Over 80%)	0.5%

6 Moomba to Adelaide Gas System

The Moomba to Adelaide Pipeline System (MAPS) connects Moomba gas production facilities to Adelaide, including Riverlands pipeline and gas generators just north of Adelaide city. The pipeline has continuously operated over the analysis period.

6.1 MAPS - Flow analysis

Figure 22 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the MAPS over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 23).

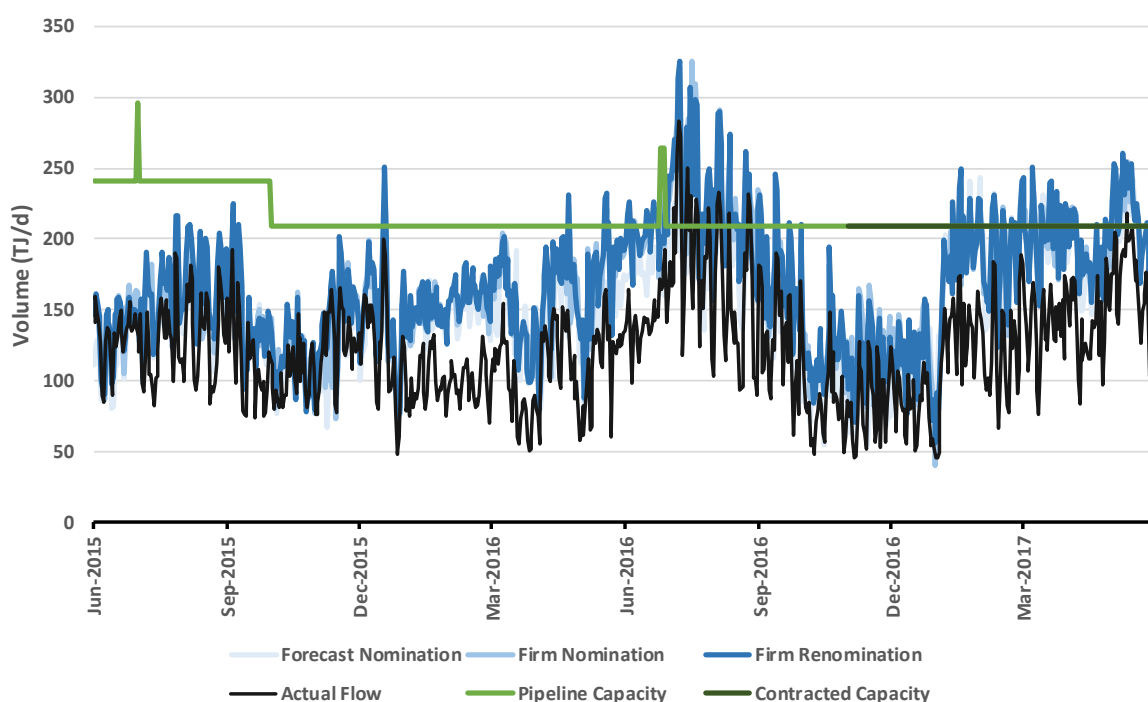


Figure 22—MAPS - Nominations, Actual Flows and Capacity

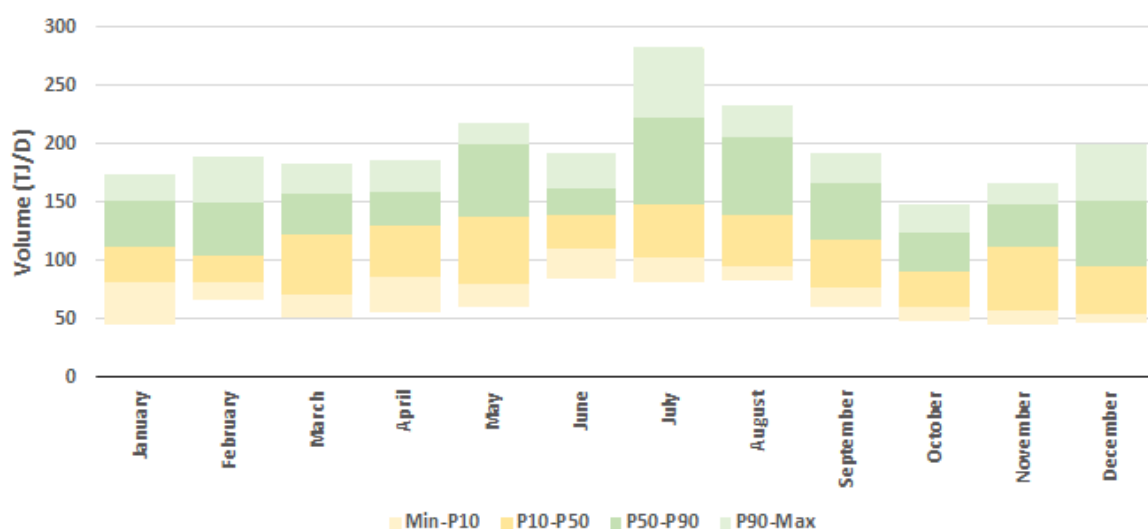


Figure 23—MAPS - Distribution of actual volumes per month

6.2 MAPS – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 24 shows that there is a regular and substantial skew to the data with the actual flows almost always being less than the firm nomination quantities. The actual flow is typically 43TJ/d below the firm nomination with standard error range of -22TJ/d to -65TJ/d (see Figure 25).

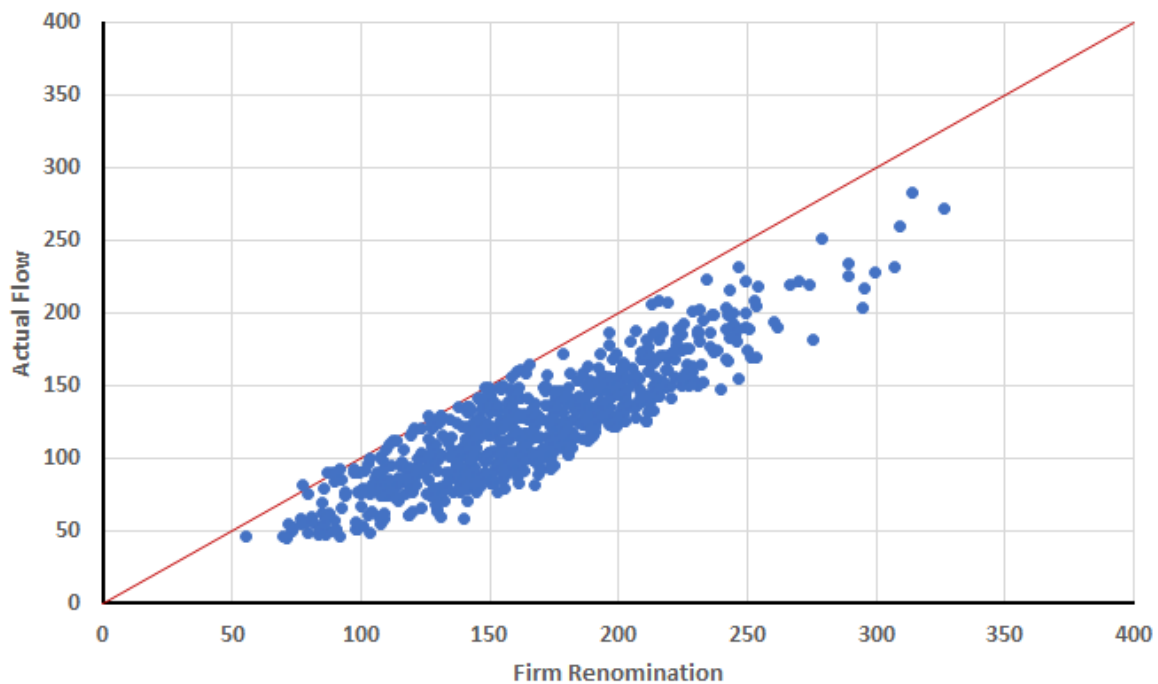


Figure 24—MAPS - Scatterplot of Firm Nomination vs Actual Flow

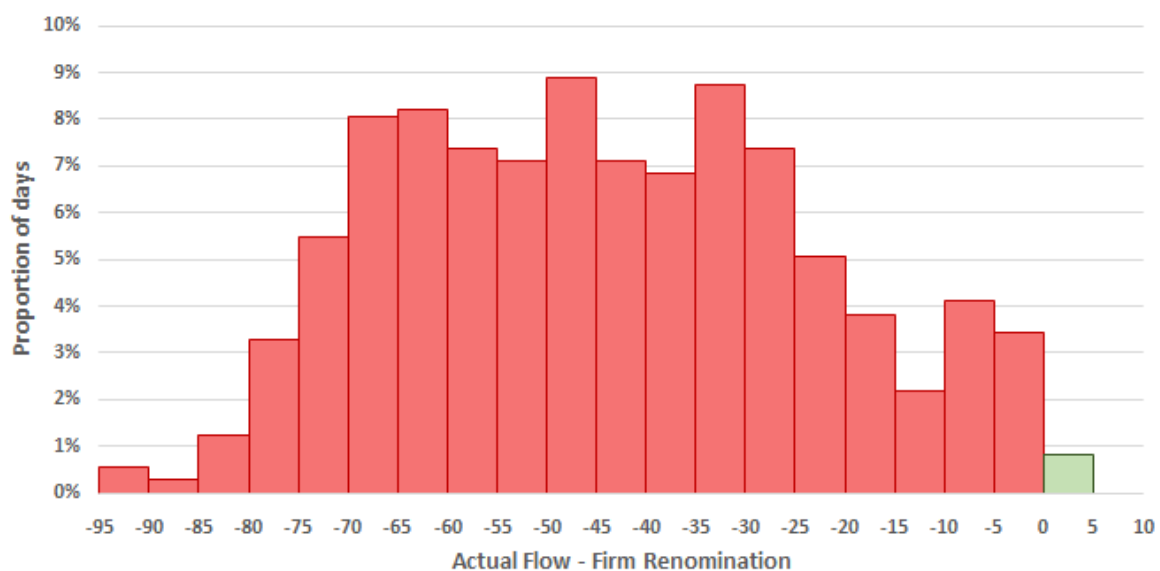


Figure 25—MAPS - Histogram of Actual Flow less Firm Nomination

6.3 MAPS - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day. Figure 26 shows that pipeline capacity is regularly negative with firm nominations that exceed the pipeline capacity.

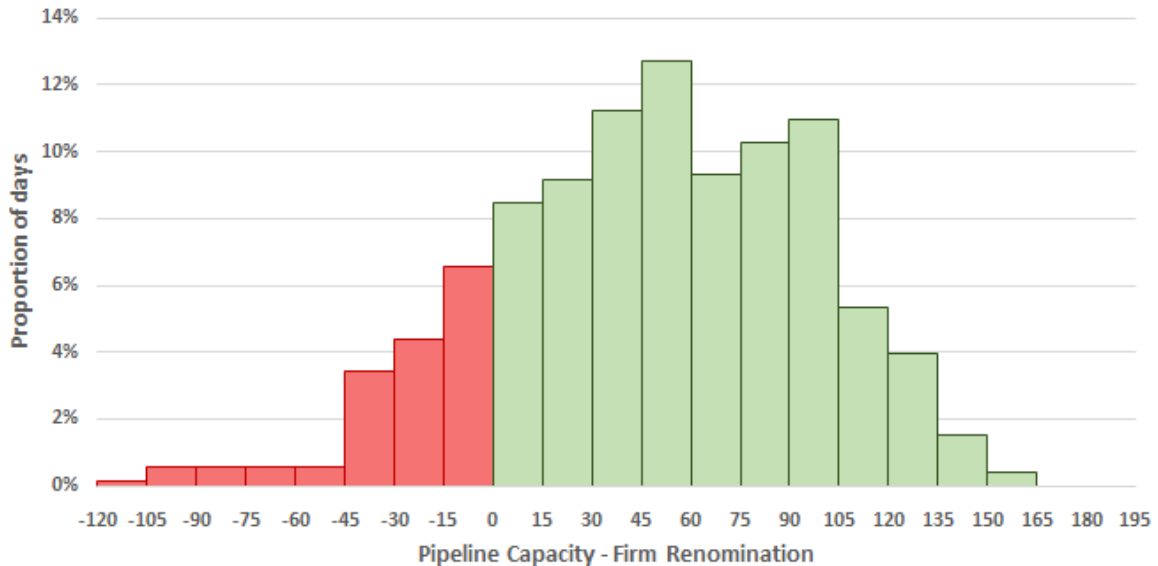


Figure 26—MAPS - Distribution of the remaining capacity after accounting for firm nominations.

Figure 27 shows the unused pipeline capacity allowing for the actual flows on the day. While the average capacity is 92TJ/d and less pronounced compared to nominations, the pipeline still has significant component of days with negative capacity.

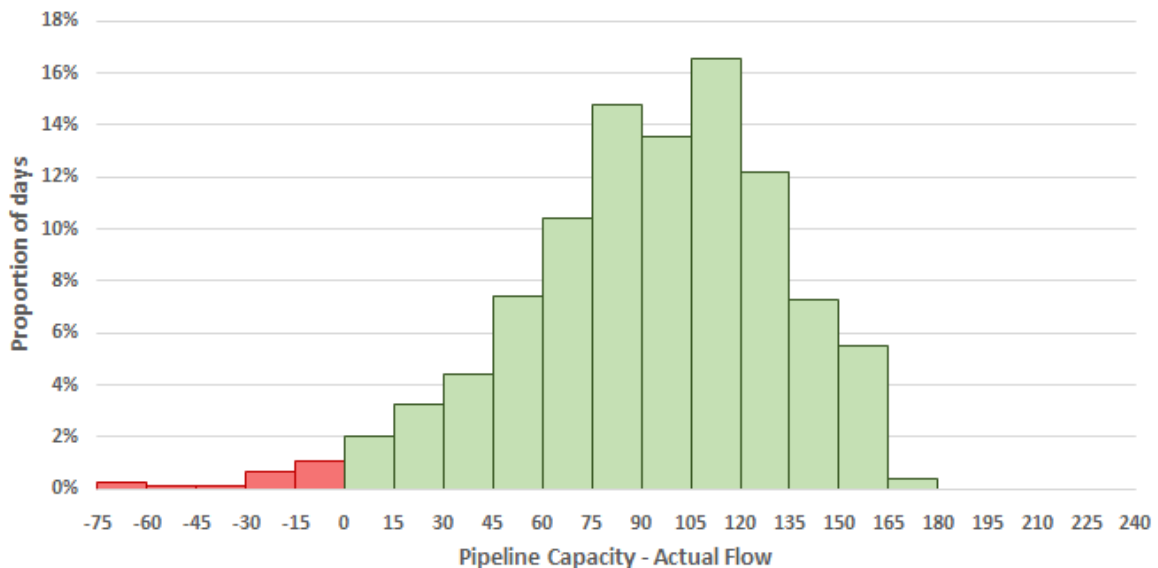


Figure 27—MAPS - Distribution of the remaining capacity after accounting for the actual flow.

6.4 MAPS – Auction Quantity

Figure 28 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

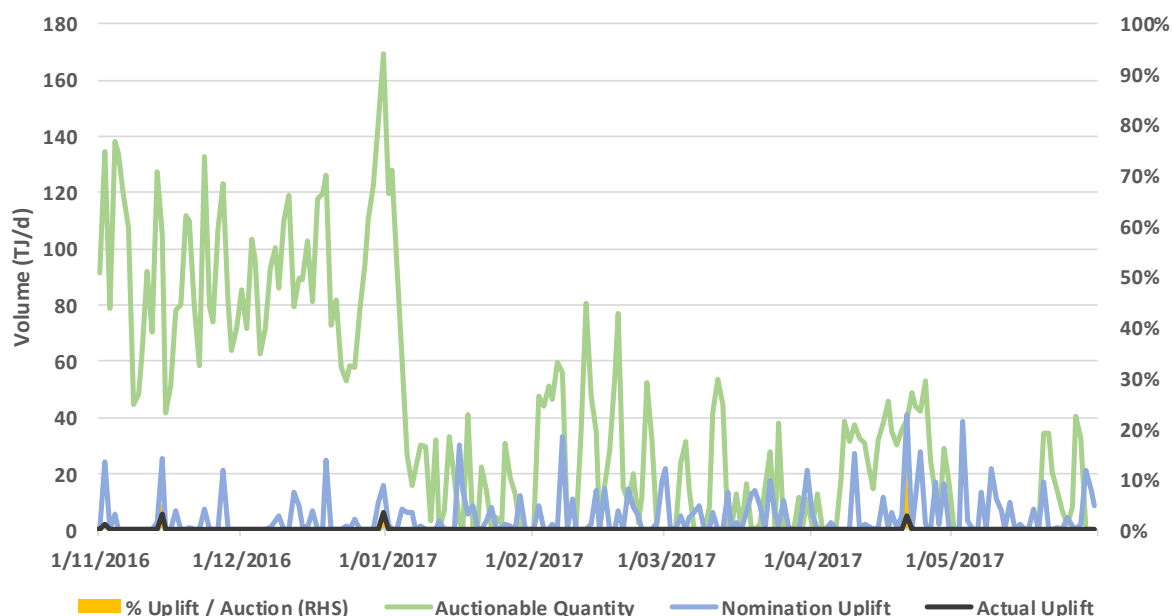


Figure 28 – MAPS - Auction Quantity

The auctionable quantity is typically up to 107TJ/d (P90) with many days (25.9%) with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (97.5%) or limited impact (1.9%). There were no days where the auctionable quantity was reduced by more than 80%. The MAPS would be classified as a pipeline with moderate auctionable quantities and a 0.6% risk of moderate or greater impact on contracted quantities.

It should be noted that the analysis of the MAPS is not considered robust and is complex due to the systemic error between Nominations and Actual flows.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	0
Median	31
90th Percentile	107
Maximum	169

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	97.5%
Limited (less than 10%)	1.9%
Moderate (10% to 50%)	0.6%
Significant (50% to 80%)	0.0%
Severe (Over 80%)	0.0%

7 Roma to Brisbane Gas Pipeline

The Roma to Brisbane connects Roma to the Brisbane Short Term Trading Market Hub with side connections to the Surat gas production fields and gas turbines at Braemar and Oakey. The pipeline has continuously operated over the analysis period.

7.1 RBP - Flow analysis

Figure 29 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the RBP over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 30).

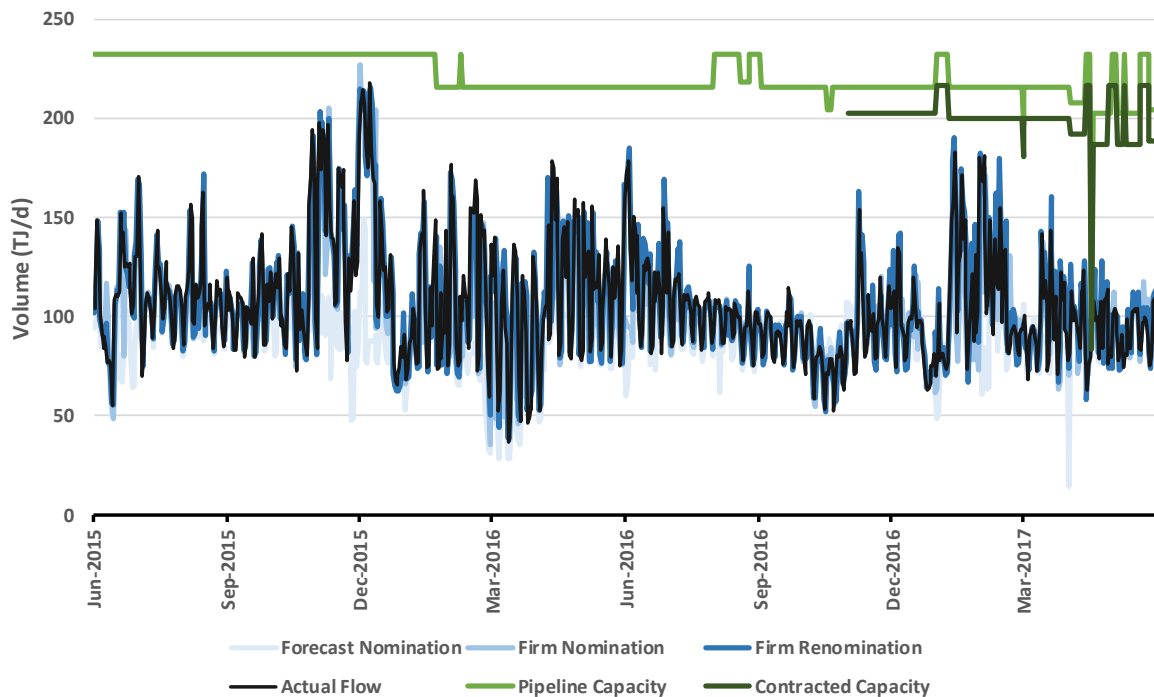


Figure 29—RBP - Nominations, Actual Flows and Capacity

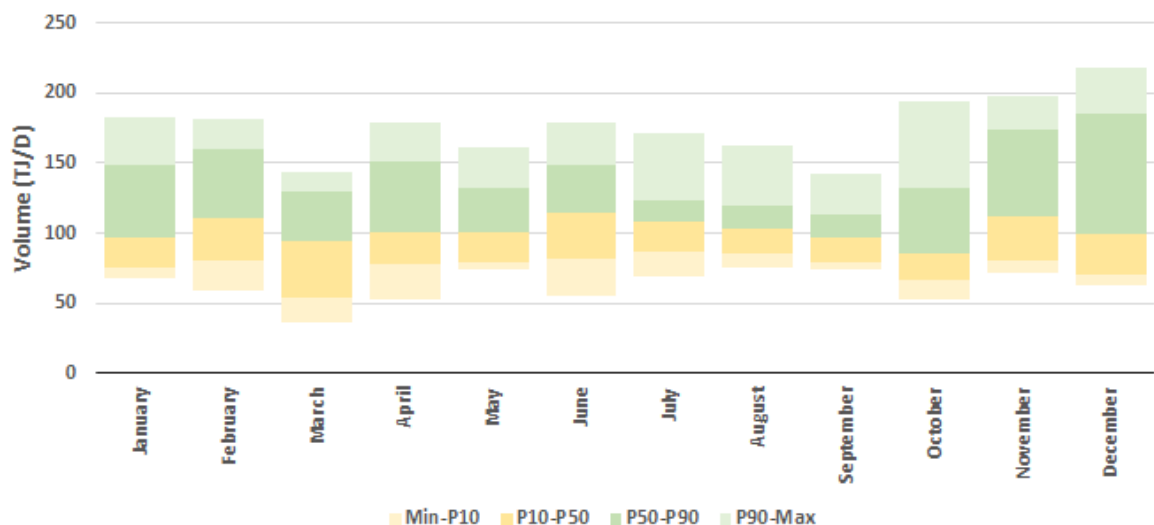


Figure 30—RBP - Distribution of actual volumes per month

7.2 RBP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 31 shows that there is much tighter alignment between the firm nomination and the actual quantity shipped on the pipeline. The actual flow is typically within the normal range of -9TJ/d and 7J/d of the firm nomination (see Figure 32).

There does not appear to be any directional skew between the actual quantity of gas delivered and the nominated quantities.

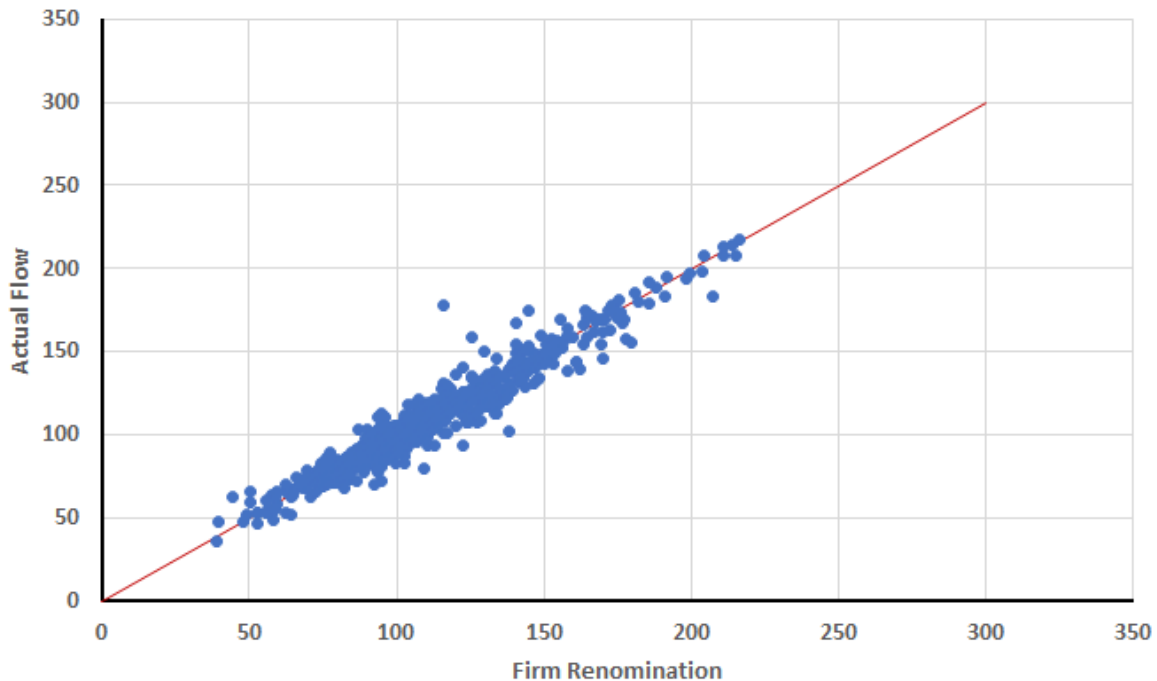


Figure 31—RBP - Scatterplot of Firm Nomination vs Actual Flow

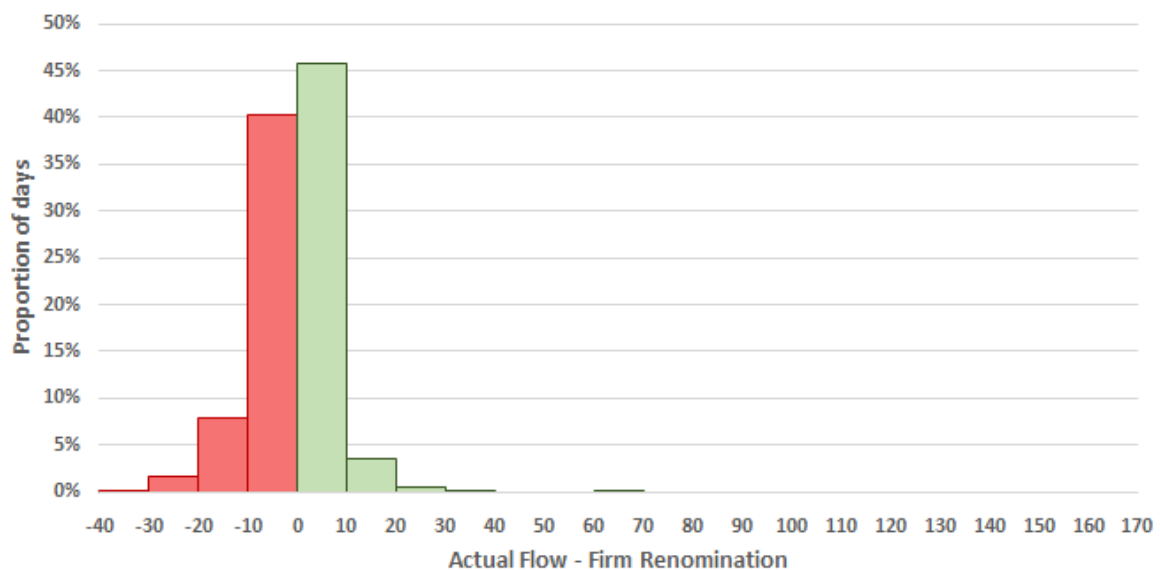


Figure 32—RBP - Histogram of Actual Flow less Firm Nomination

7.3 RBP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 33 shows the pipeline capacity that is available for a gas day removing the firm nominations. There are significant levels of capacity available under most periods of the analysis.

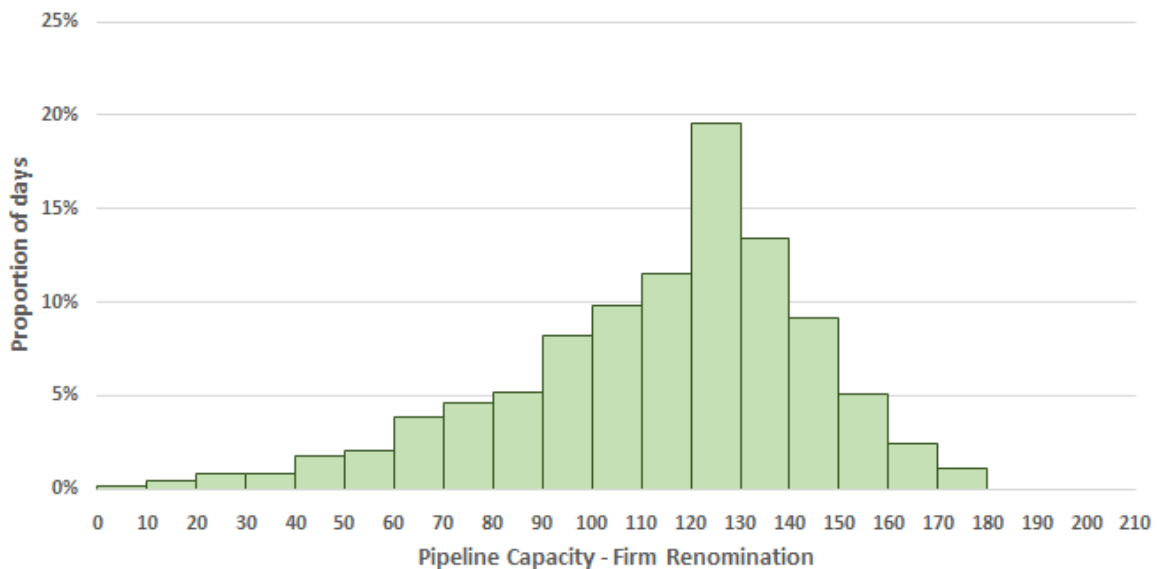


Figure 33—RBP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 34 shows the pipeline capacity that is available for a gas day after removing the actual flow. Again, most of the time, there is significant capacity with some periods of less than 30TJ/d.

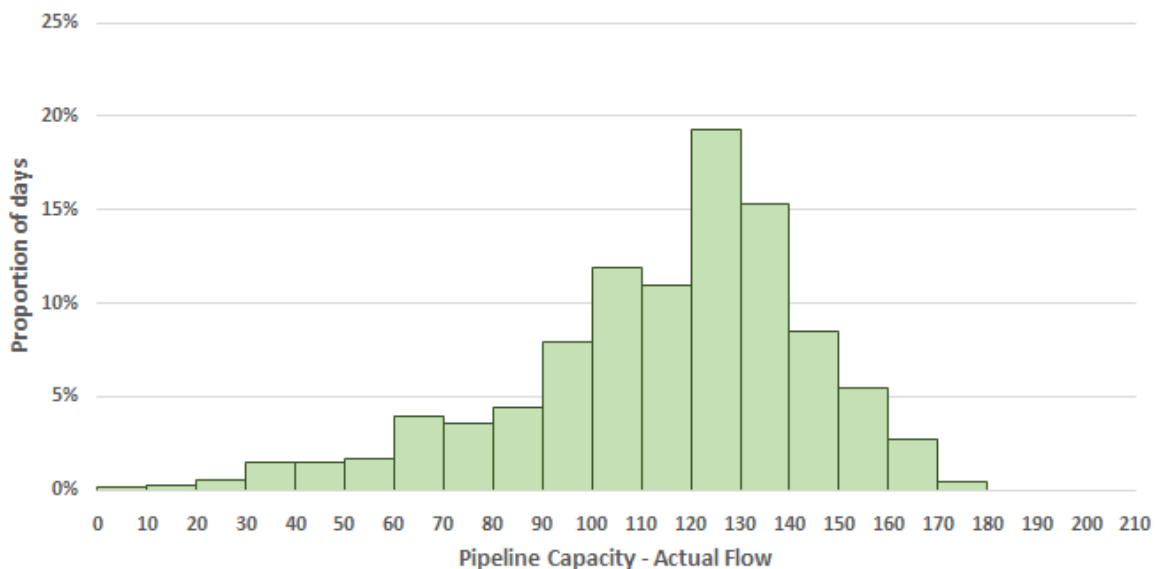


Figure 34—RBP - Distribution of the remaining capacity after accounting for the actual flow.

7.4 RBP – Auction Quantity

Figure 35 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

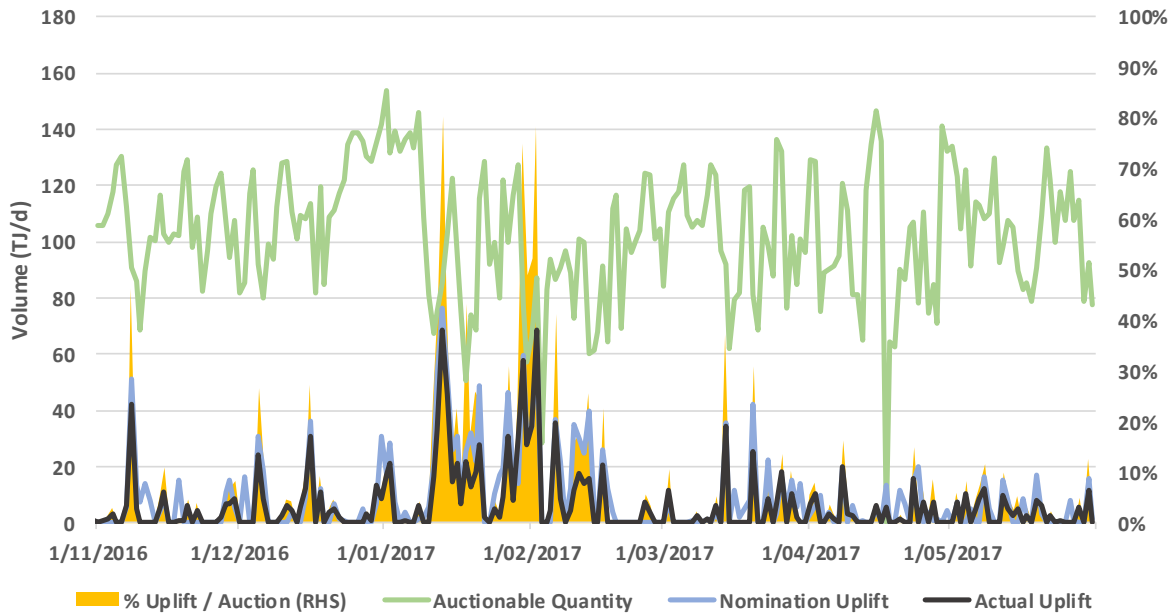


Figure 35 – RBP - Auction Quantity

The auctionable quantity is typically in the range 74TJ/d (P10) to 132TJ/d (P90) with no days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (47.9%) or limited impact (33.2%). There was one day where the auctionable quantity was reduced by more than 80%. The RBP would be classified as a pipeline with large auctionable quantities and a 19% risk of moderate or greater impact on contracted quantities.

Large amount of Actual Uplift during January/February 2017 due to discretionary intraday consumption by Oakey Power Station driven by very high electricity price outcomes.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	74
Median	104
90th Percentile	132
Maximum	154

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	47.9%
Limited (less than 10%)	33.2%
Moderate (10% to 50%)	17.1%
Significant (50% to 80%)	1.4%
Severe (Over 80%)	0.5%

8 Queensland Gas Pipeline

The Roma to Brisbane connects Roma to the Brisbane Short Term Trading Market Hub with side connections to the Surat gas production fields and gas turbines at Braemar and Oakey. The pipeline has continuously operated over the analysis period.

8.1 QGP - Flow analysis

Figure 29 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the QGP over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 30).

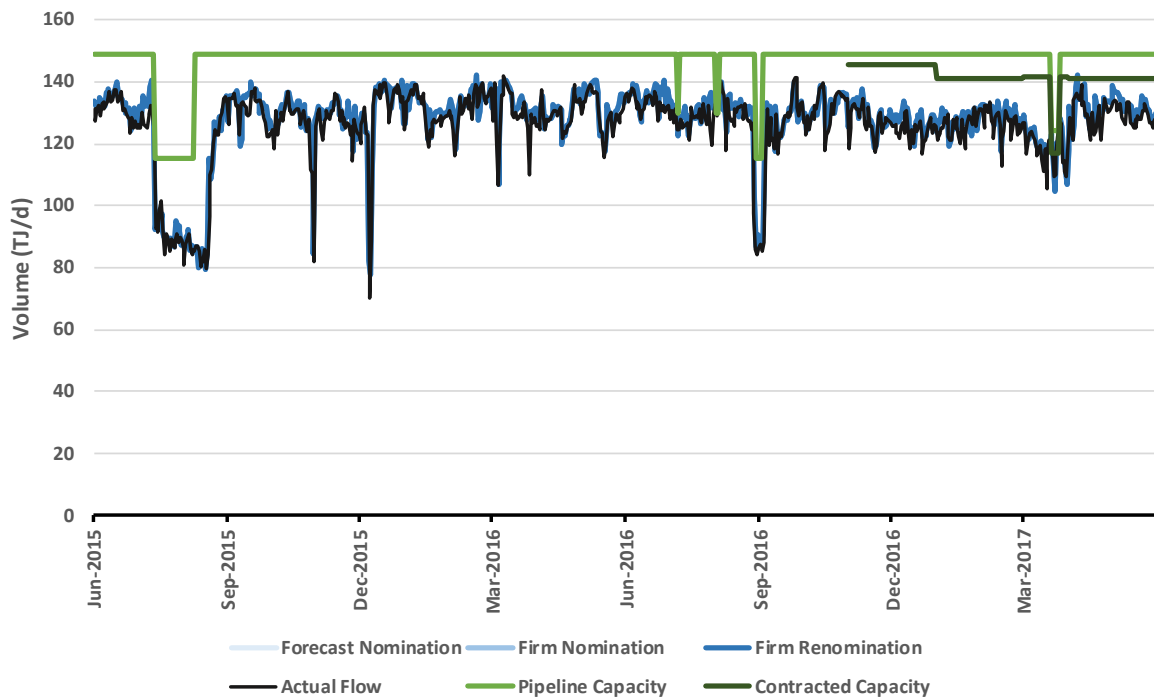


Figure 36—QGP - Nominations, Actual Flows and Capacity

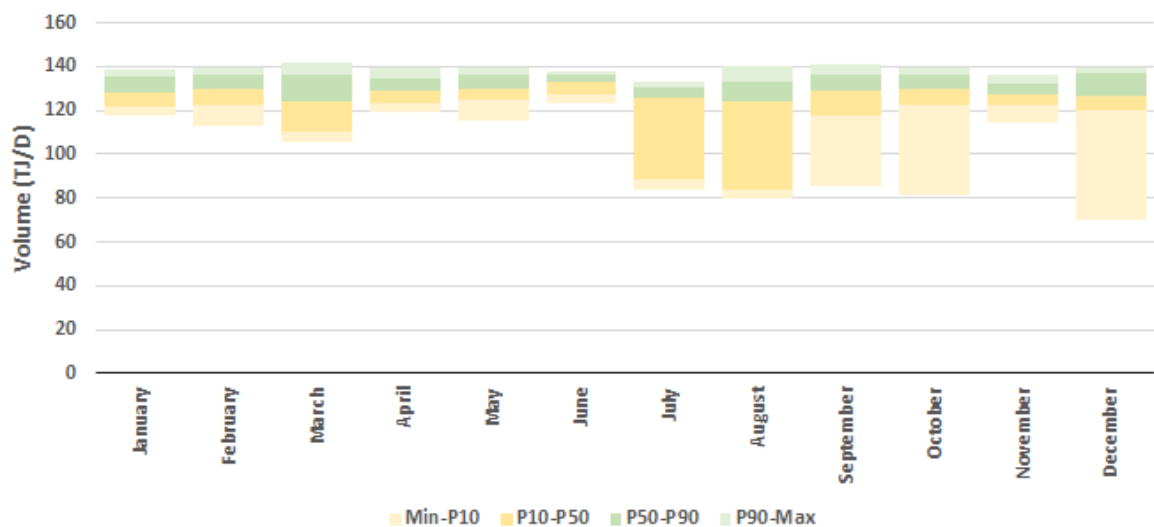


Figure 37—QGP - Distribution of actual volumes per month

8.2 QGP – Firm Nominations vs Actual Quantity

This section compares the forecast nominations and the actual quantity that was transported on a given gas day as the firm nominations were unchanged from the forecast. Figure 31 shows a very small skew (-2TJ/d) from forecast nomination to actual quantities which fits the profile of the assets within the Gladstone industry region (see Figure 32).

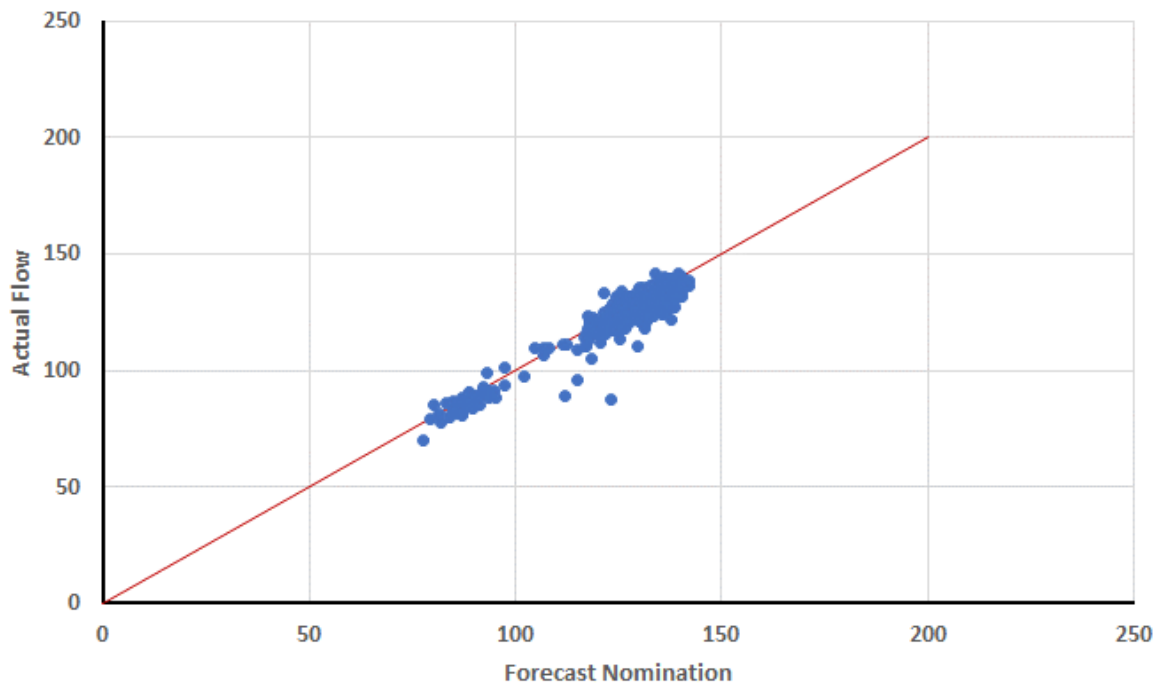


Figure 38—QGP - Scatterplot of Firm Nomination vs Actual Flow

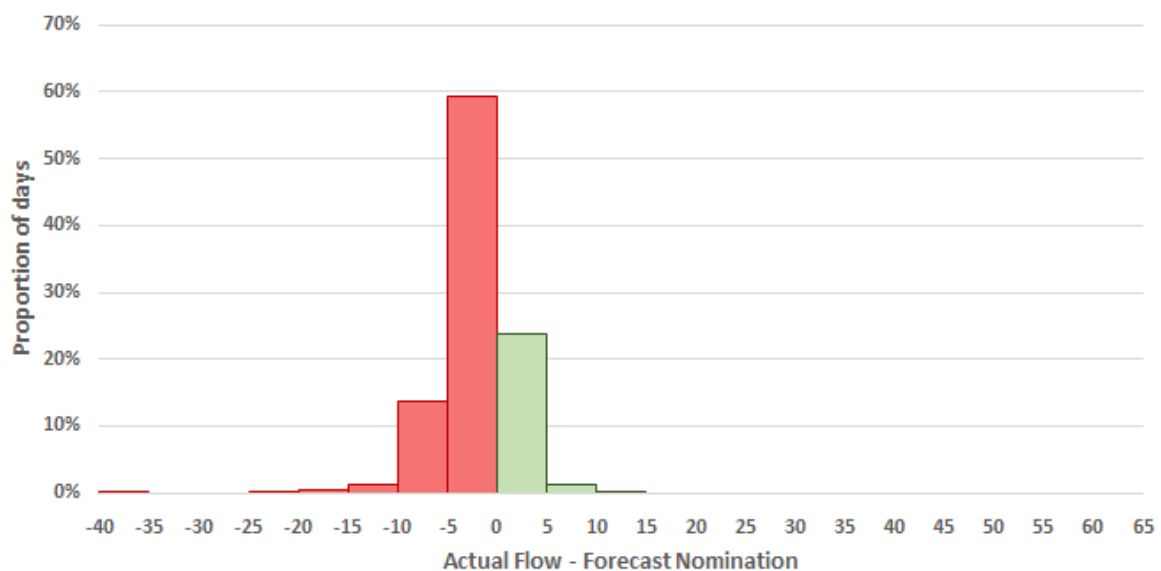


Figure 39—QGP - Histogram of Actual Flow less Firm Nomination

8.3 QGP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 33 shows the pipeline capacity that there is regularly 10-20TJ/d of available capacity.

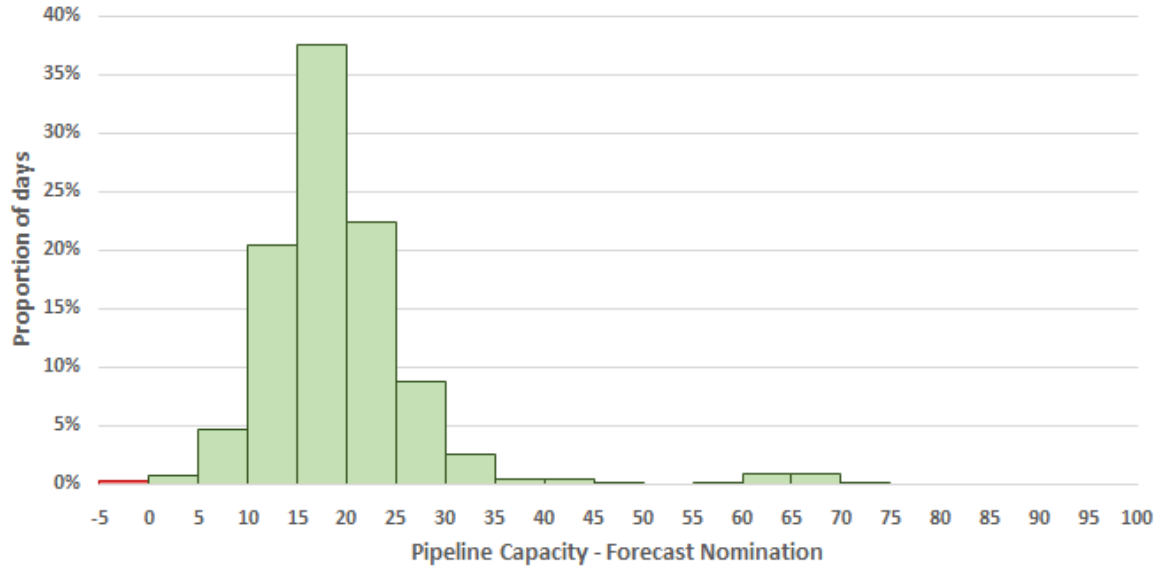


Figure 40—QGP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 34 shows the pipeline capacity that there is regularly 10-20TJ/d of available capacity.

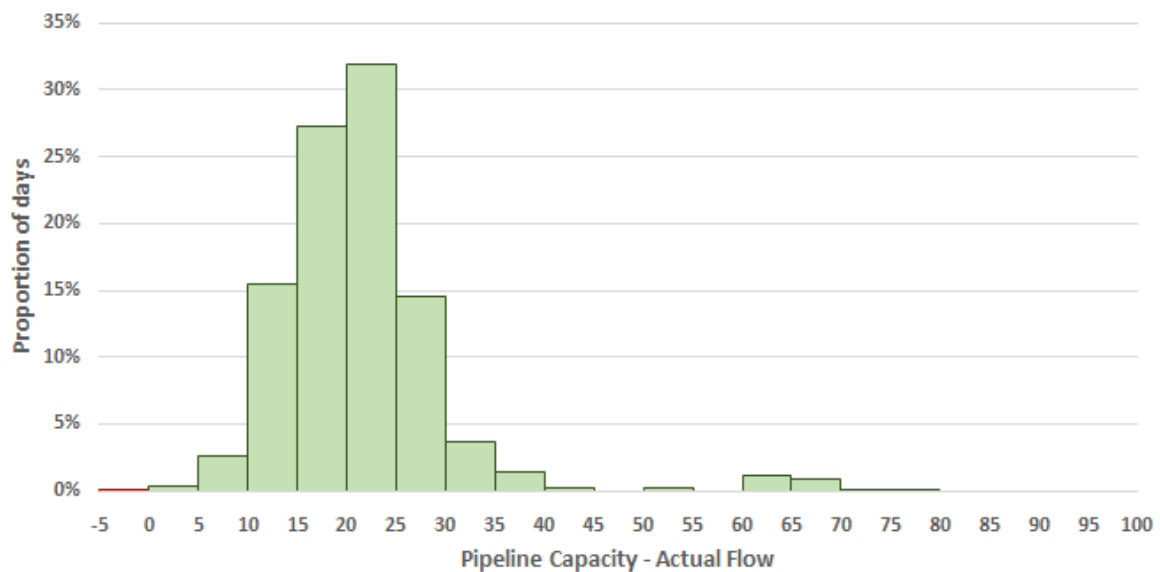


Figure 41—QGP - Distribution of the remaining capacity after accounting for the actual flow.

8.4 QGP – Auction Quantity

Figure 42 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

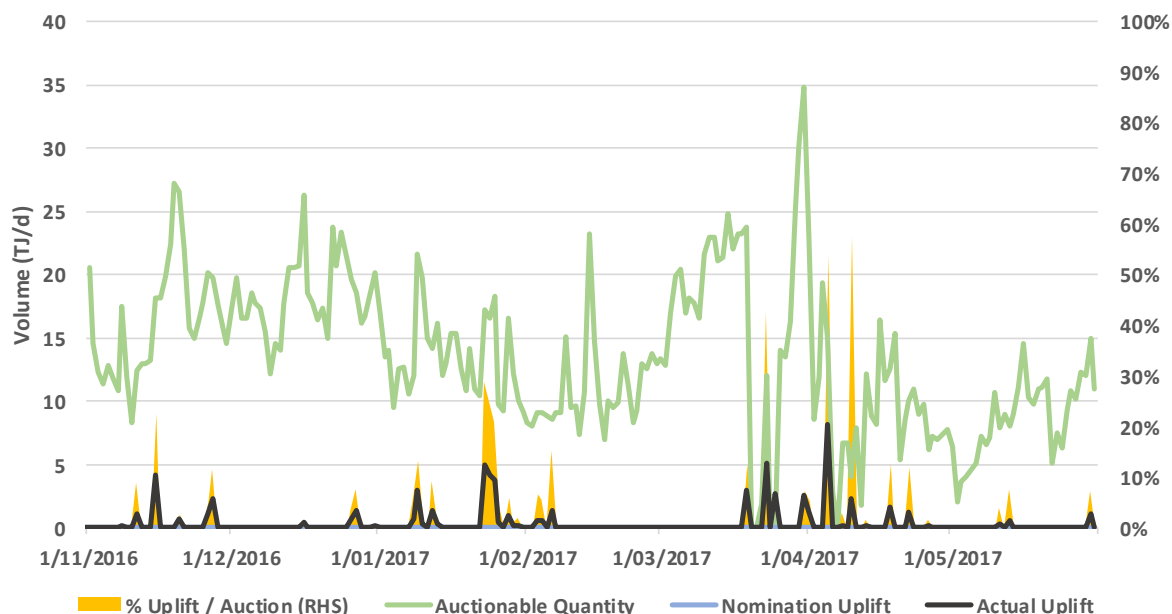


Figure 42 – QGP - Auction Quantity

The auctionable quantity is typically in the range 7TJ/d (P10) to 21TJ/d (P90) with five days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (81.2%) or limited impact (12.6%). There were no days where the auctionable quantity was reduced by more than 80%.

The QGP would be classified as a pipeline with moderate auctionable quantities and a 6.3% risk of moderate or greater impact on contracted quantities.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	7
Median	13
90th Percentile	21
Maximum	35

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	81.2%
Limited (less than 10%)	12.6%
Moderate (10% to 50%)	5.3%
Significant (50% to 80%)	1.0%
Severe (Over 80%)	0.0%

9 Darling Downs Gas Pipeline

The Darling Downs Pipeline System (DDPL) connects Wallumbilla to the Darling Downs Power Station. The pipeline only commenced reporting from 1 June 2016.

9.1 DDPL - Flow analysis

Figure 43 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the DDPL over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 44).t

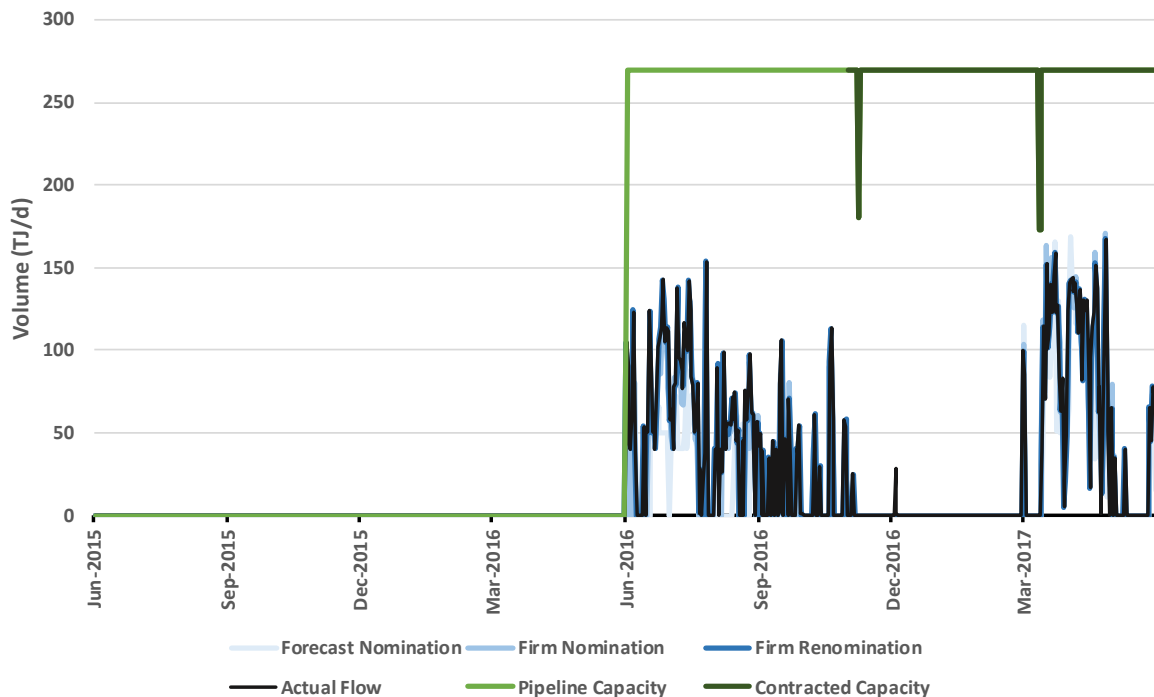


Figure 43—DDPL - Nominations, Actual Flows and Capacity

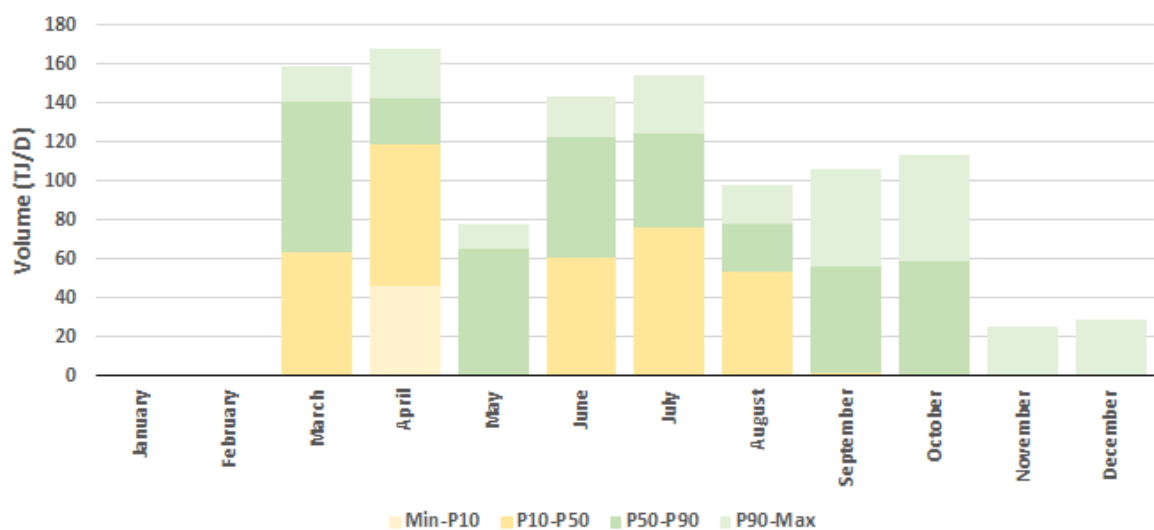


Figure 44—DDPL - Distribution of actual volumes per month

9.2 DDPL – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day. Figure 45 shows that very high alignment between the firm nomination and the actual quantity (see Figure F).

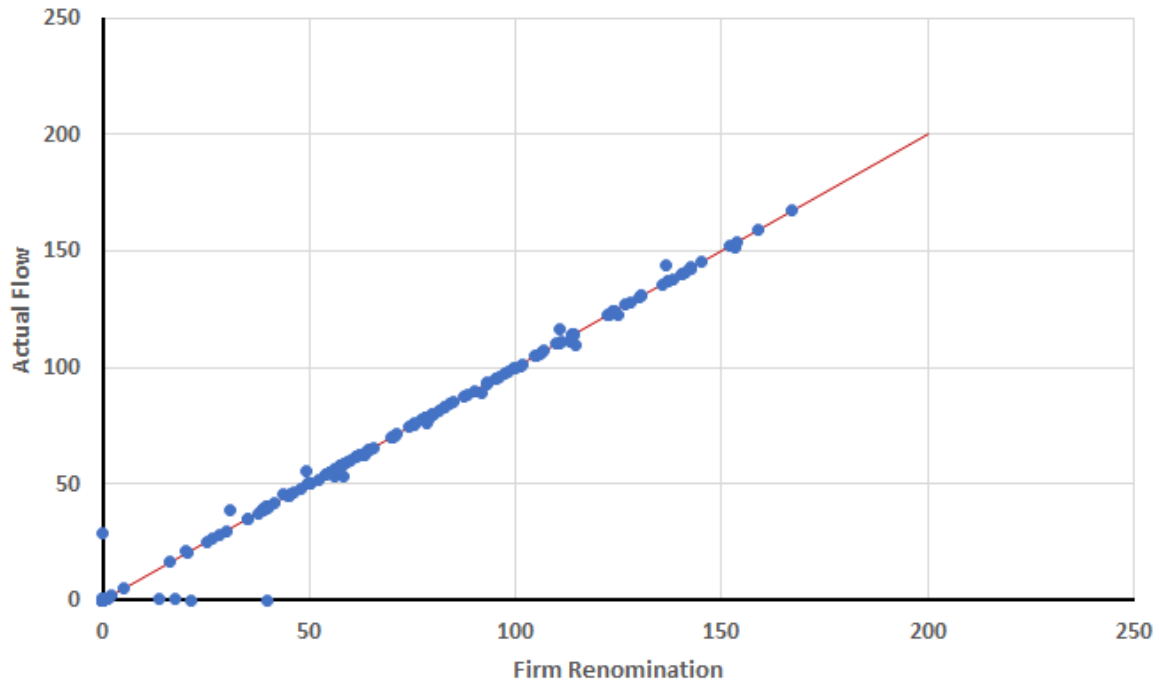


Figure 45—DDPL - Scatterplot of Firm Nomination vs Actual Flow

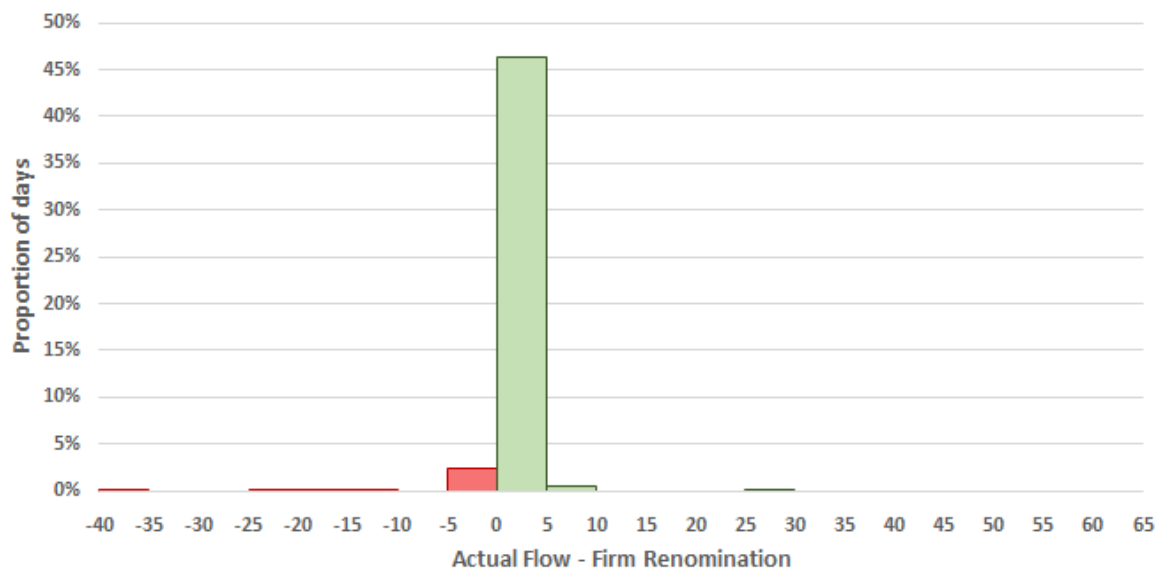


Figure 46—DDPL - Histogram of Actual Flow less Firm Nomination

9.3 DDPL - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 47 shows the pipeline capacity that is available for a gas day removing the firm nominations which shows large capacity availability.

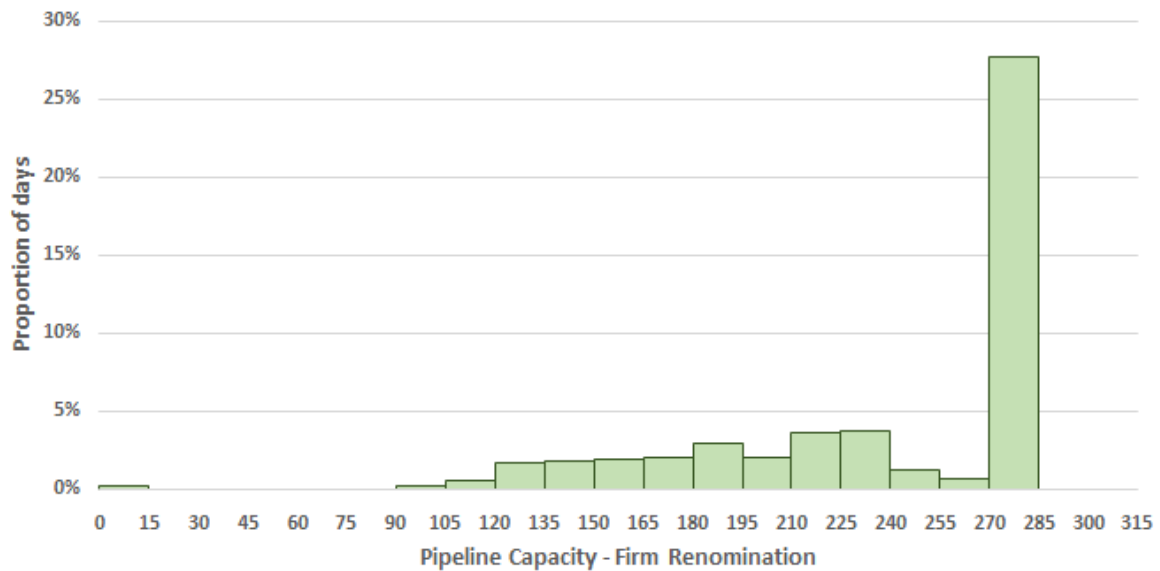


Figure 47—DDPL - Distribution of the remaining capacity after accounting for firm nominations.

Figure 48 shows the unused pipeline capacity that is available for a gas day after allowing for actual flow rates which shows large capacity availability.

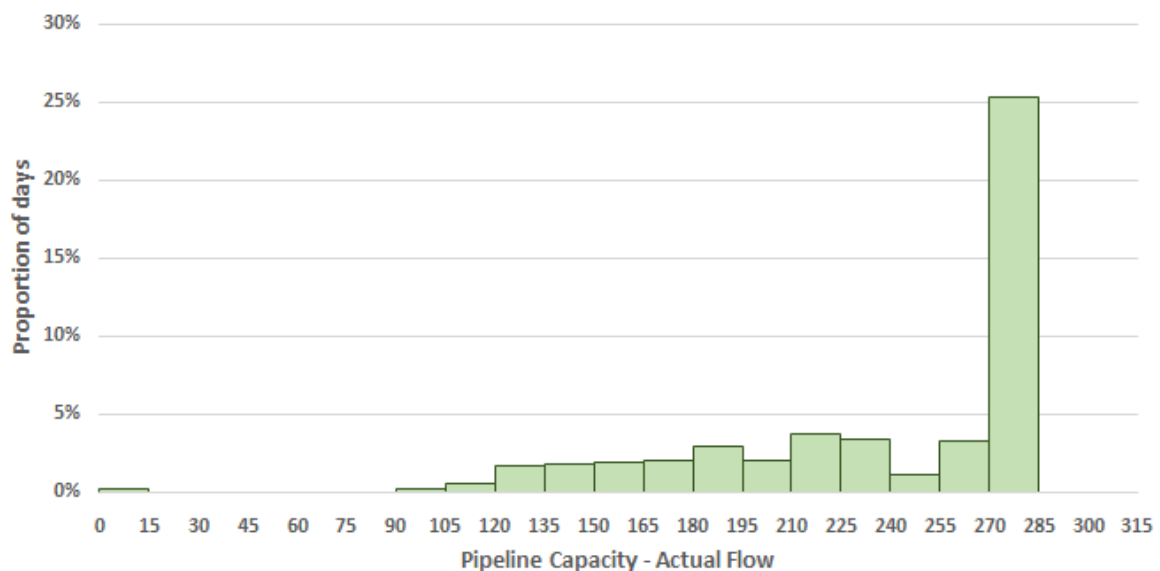


Figure 48—DDPL - Distribution of the remaining capacity after accounting for the actual flow.

9.4 DDPL – Auction Quantity

Figure 49 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

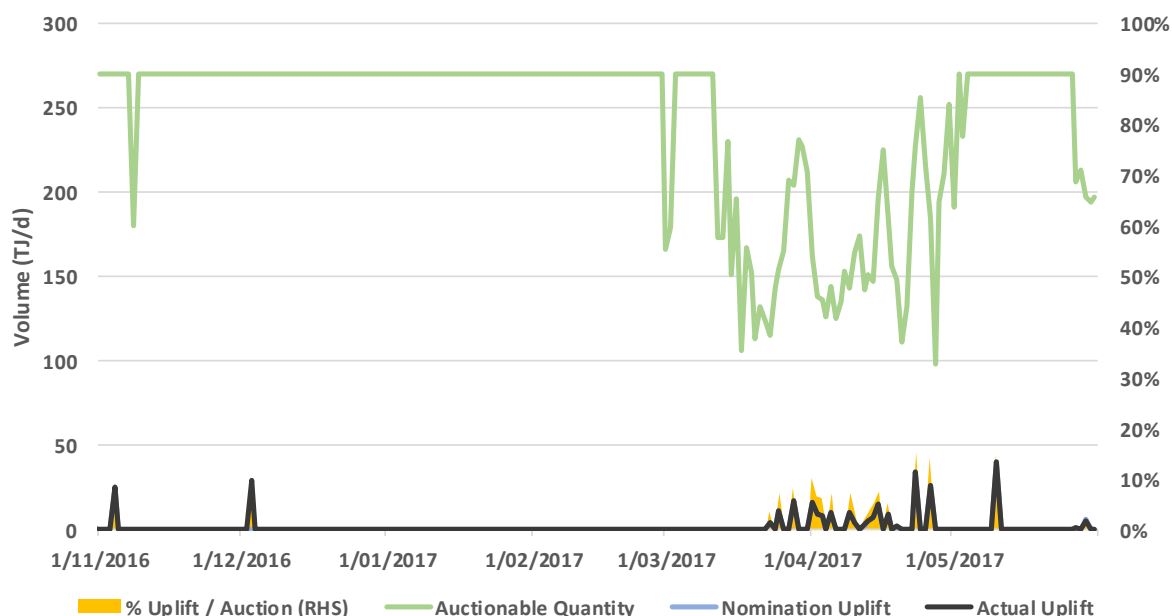


Figure 49 – DDPL - Auction Quantity

The auctionable quantity is typically at its maximum value of 270TJ/d with no days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (84.9%) or limited impact (12.7%). There were no days where the auctionable quantity was reduced by more than 80%.

The DDPL would be classified as a pipeline with large auctionable quantities and a 2.4% risk of moderate or greater impact on contracted quantities.

Auctionable Quantity	Volume (TJ/d)
Minimum	99
10th Percentile	153
Median	270
90th Percentile	270
Maximum	270

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	84.9%
Limited (less than 10%)	12.7%
Moderate (10% to 50%)	2.4%
Significant (50% to 80%)	0.0%
Severe (Over 80%)	0.0%

10 Berwyndale to Wallumbilla Gas Pipeline

The Berwyndale to Wallumbilla Pipeline (BWP) connects Wallumbilla to the Berwyndale production facilities at the start of the Wallumbilla to Gladstone Pipeline.

10.1 BWP - Flow analysis

Figure 50 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the BWP over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 51).

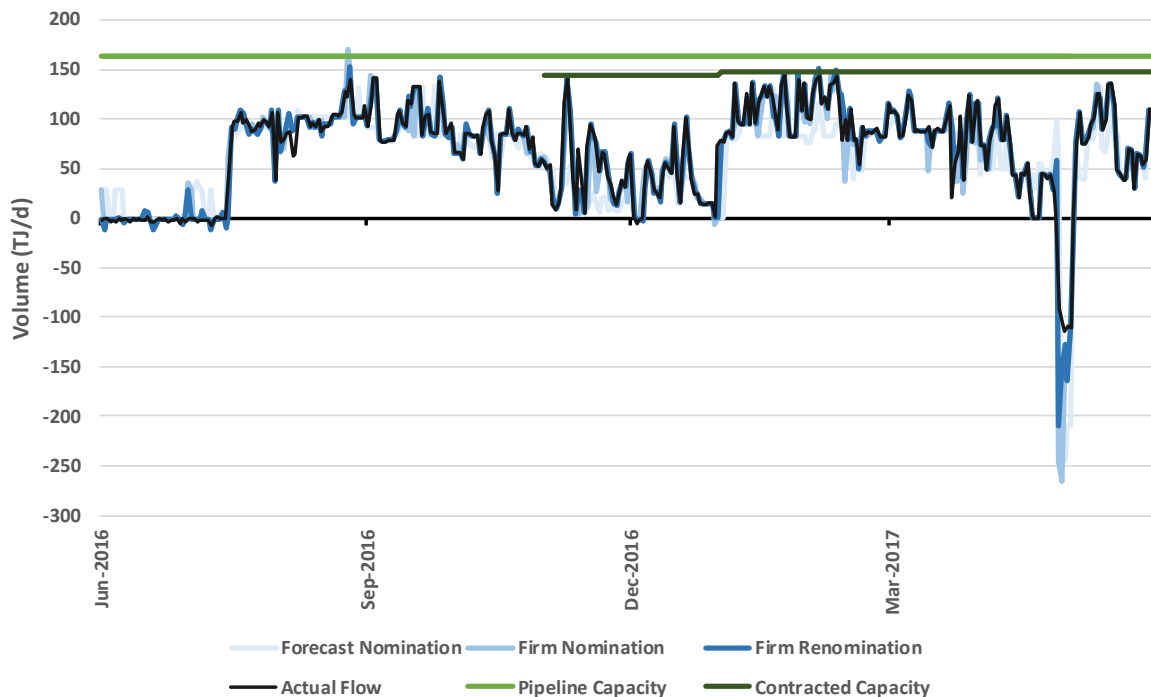


Figure 50—BWP - Nominations, Actual Flows and Capacity

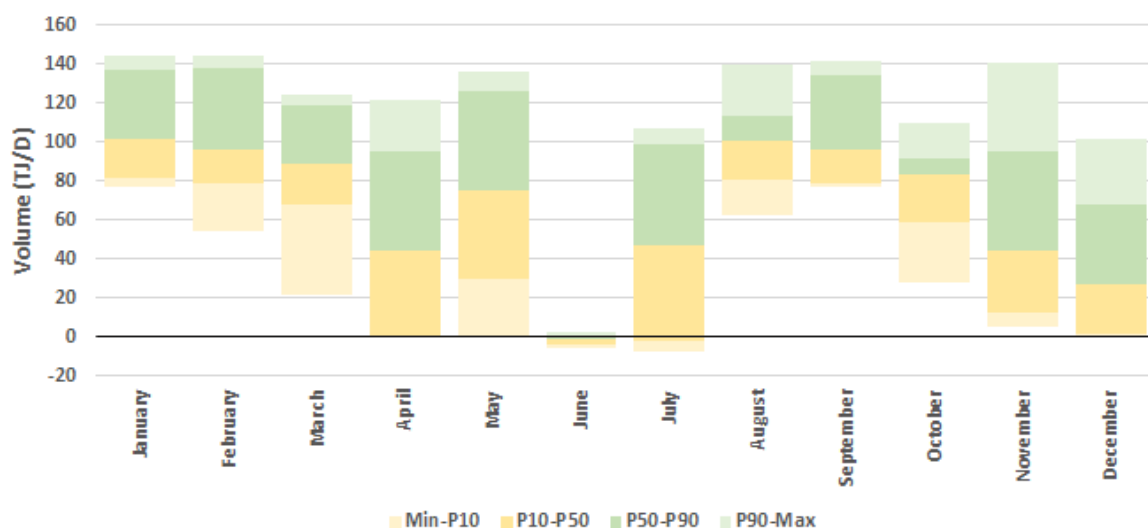


Figure 51—BWP - Distribution of actual volumes per month

10.2 BWP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 52 shows that there is general alignment between the firm nomination and the actual quantity shipped on the pipeline while flows are positive. There is more error when the flows are negative with actual flows being limited compared to nomination (see Figure 53).

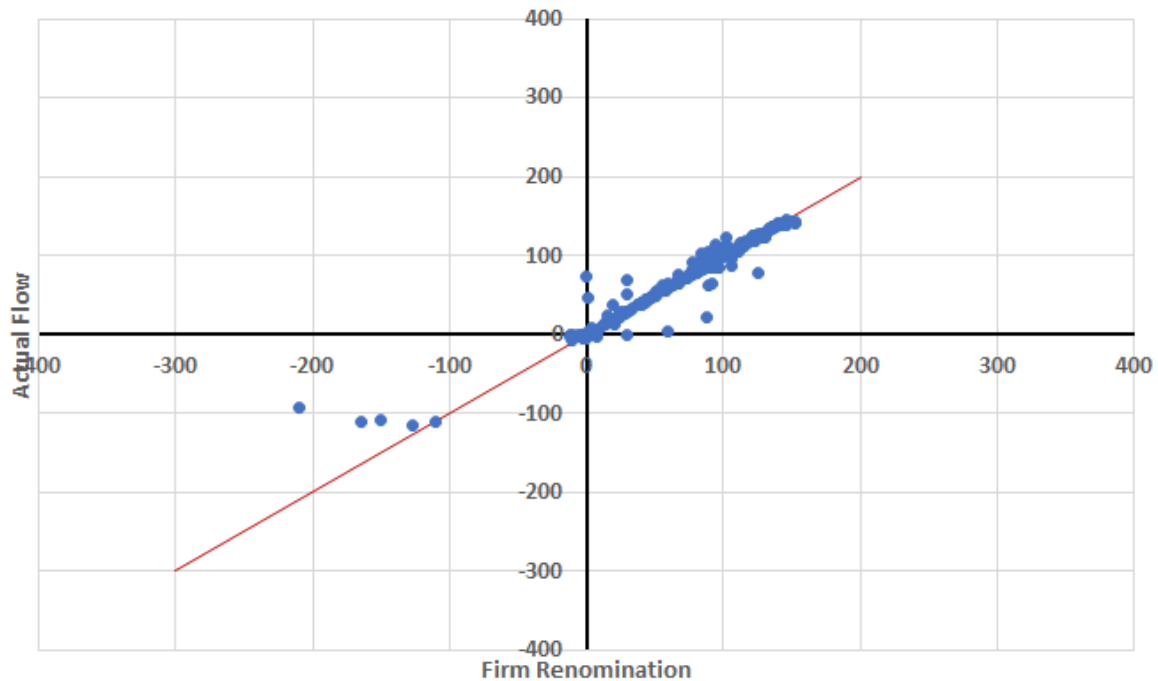


Figure 52—BWP - Scatterplot of Firm Nomination vs Actual Flow

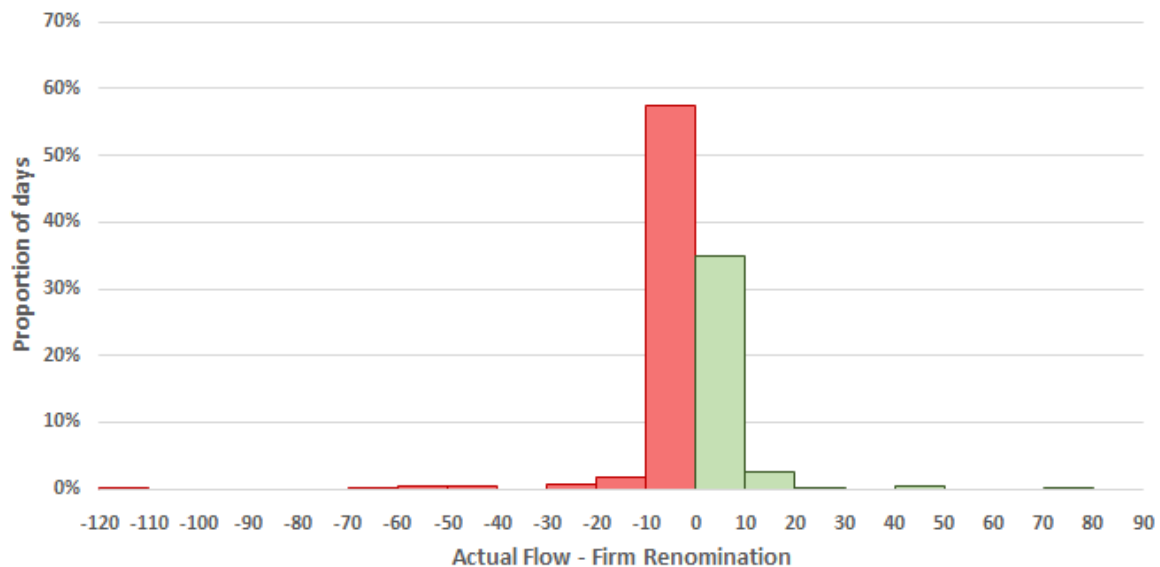


Figure 53—BWP - Histogram of Actual Flow less Firm Nomination

10.3 BWP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 54 shows the pipeline capacity that is available for a gas day removing the firm nominations.

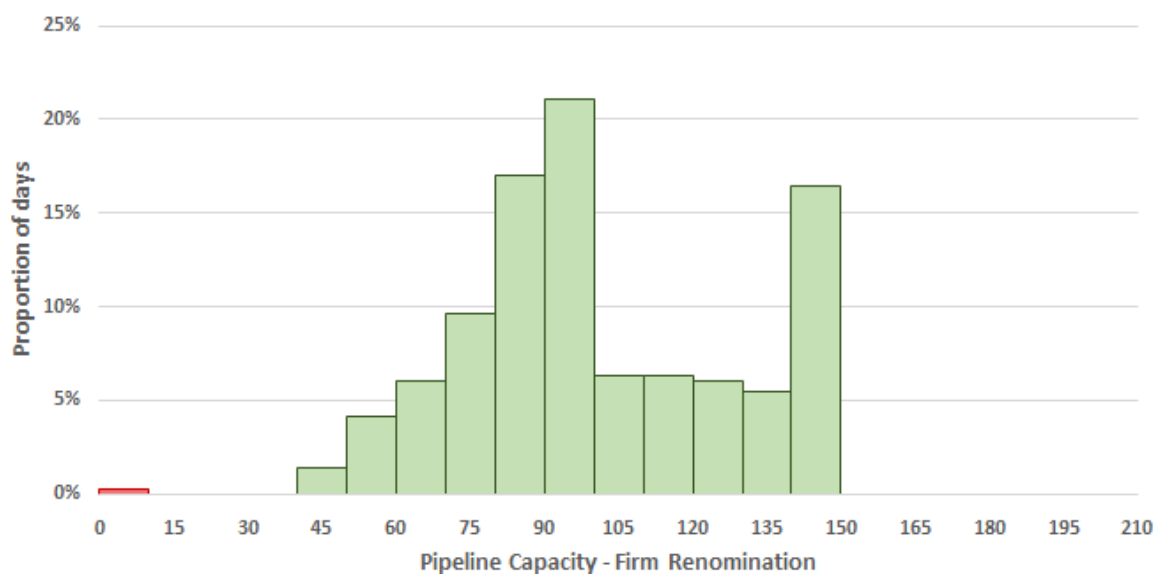


Figure 54—BWP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 55 shows the pipeline capacity that is available for a gas day after removing the actual flow.

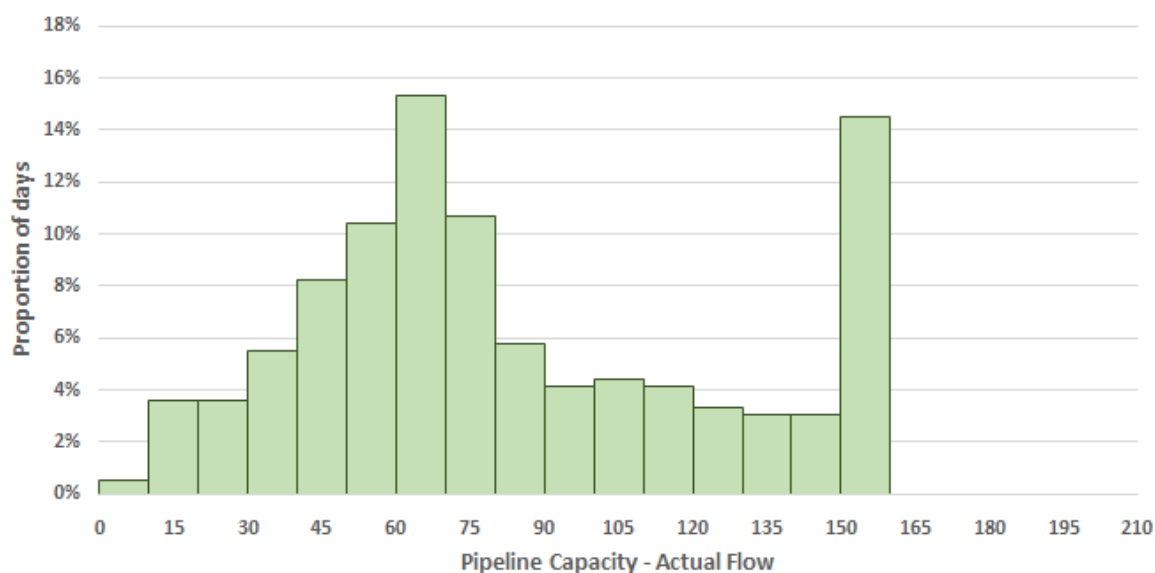


Figure 55—BWP - Distribution of the remaining capacity after accounting for the actual flow.

10.4 BWP – Auction Quantity

Figure 56 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations) and the uplift of Nomination Uplift (to Intraday Nominations) and Actual Uplift (to Actual Flows).

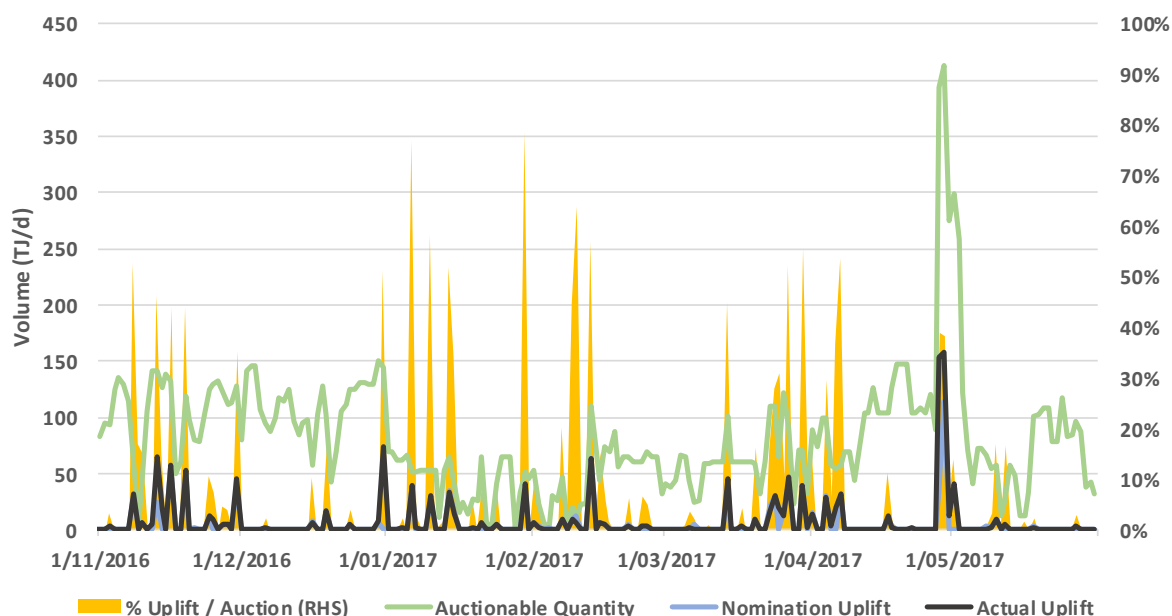


Figure 56 – BWP - Auction Quantity

The auctionable quantity is typically in the range 25TJ/d (P10) to 130TJ/d (P90) with one day with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (56.9%) or limited impact (23.2%). There were no days where the auctionable quantity was reduced by more than 80%. The BWP would be classified as a pipeline with moderate auctionable quantities and a 19.9% risk of moderate or greater impact on contracted quantities.

The BWP has been identified as a pipeline where auctionable quantities would be considered at risk.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	25
Median	70
90th Percentile	130
Maximum	413

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	56.9%
Limited (less than 10%)	23.2%
Moderate (10% to 50%)	14.7%
Significant (50% to 80%)	5.2%
Severe (Over 80%)	0.0%

11 Carpentaria Gas Pipeline

The Carpentaria Gas Pipeline (CGP) connects Ballera to Mt Isa.

11.1 CGP - Flow analysis

Figure 57 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the CGP over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 58).

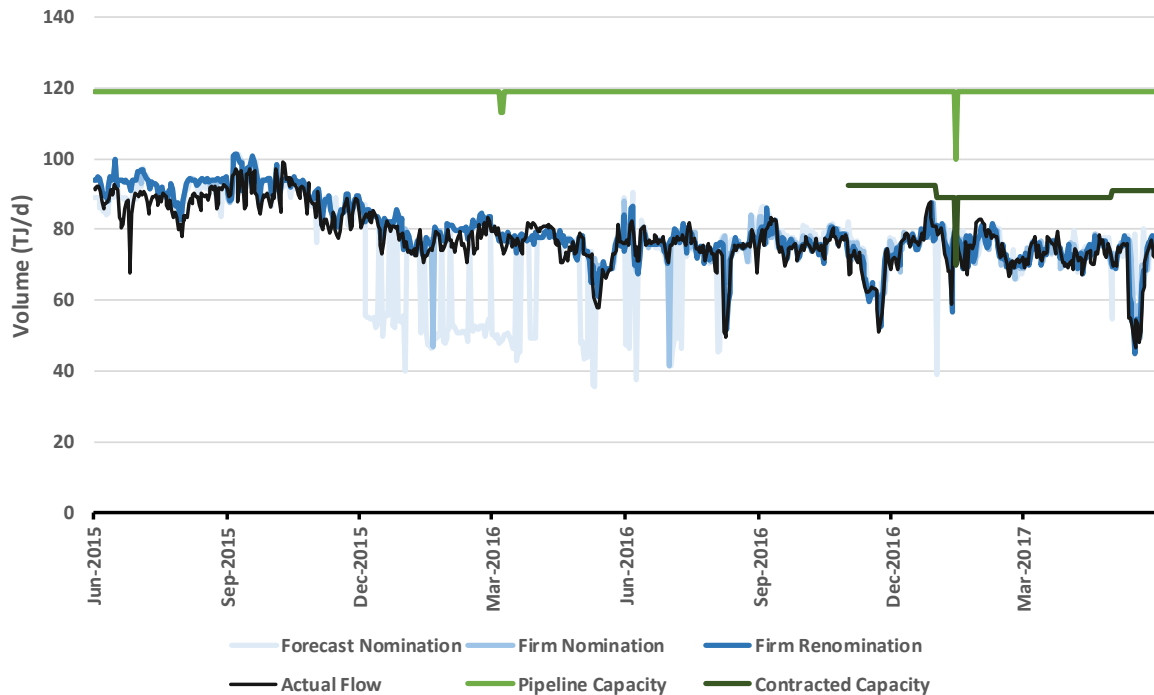


Figure 57—CGP - Nominations, Actual Flows and Capacity

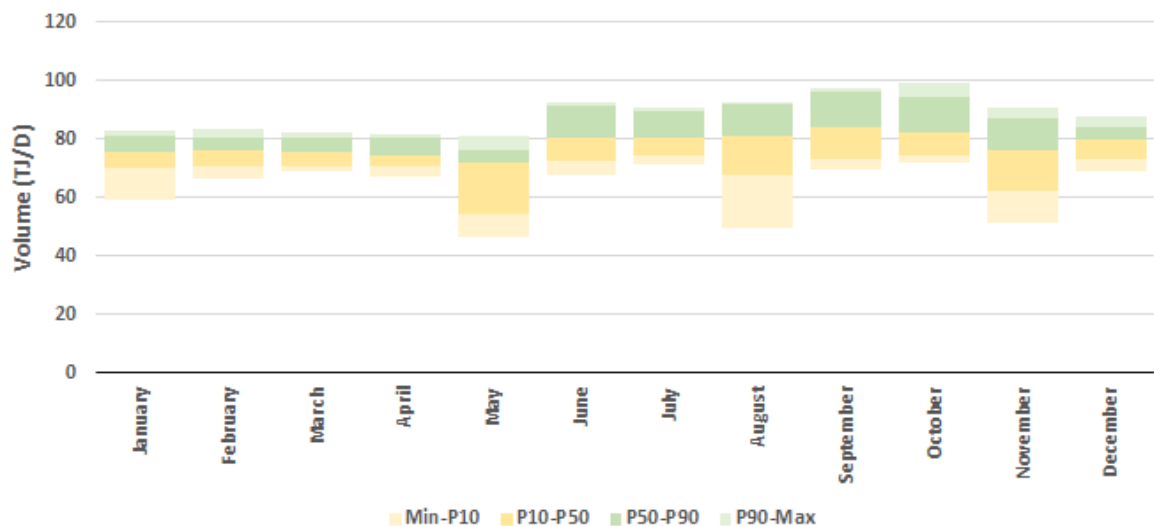


Figure 58—CGP - Distribution of actual volumes per month

11.2 CGP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 59 shows that there is general alignment between the firm nomination and the actual quantity shipped on the pipeline. The actual flow is typically within the normal range -5TJ/d and +2TJ/d of the firm nomination (see Figure 60).

There does not appear to be any skew between the actual quantity of gas delivered and the nominated quantities.

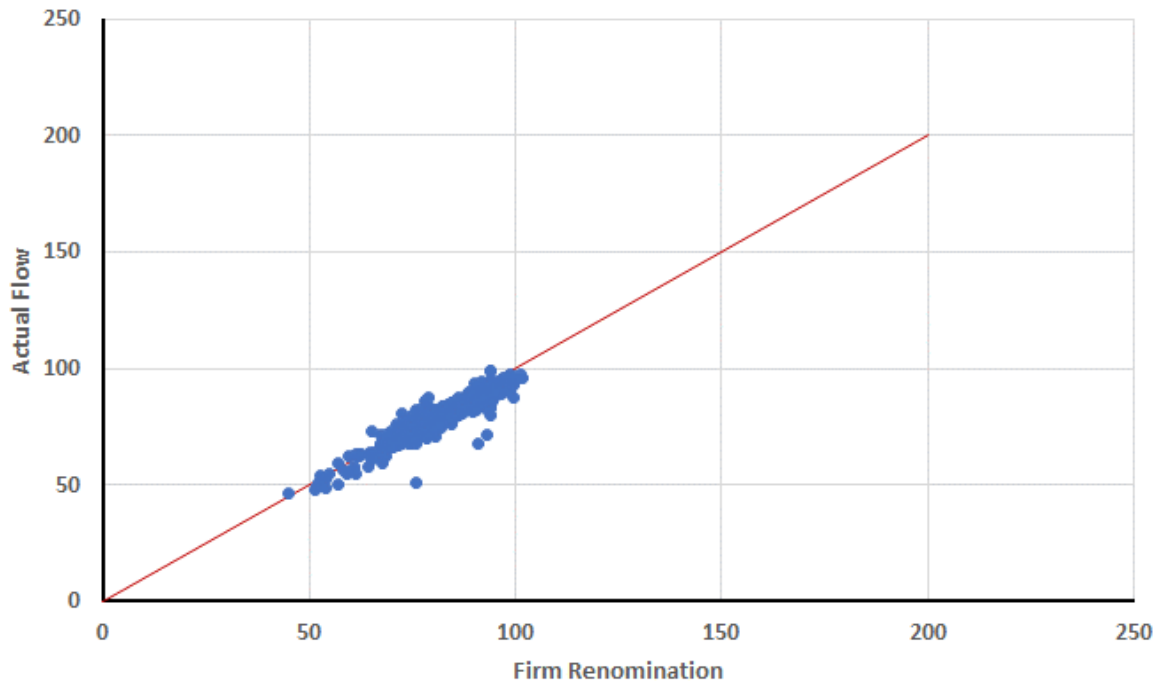


Figure 59—CGP - Scatterplot of Firm Nomination vs Actual Flow

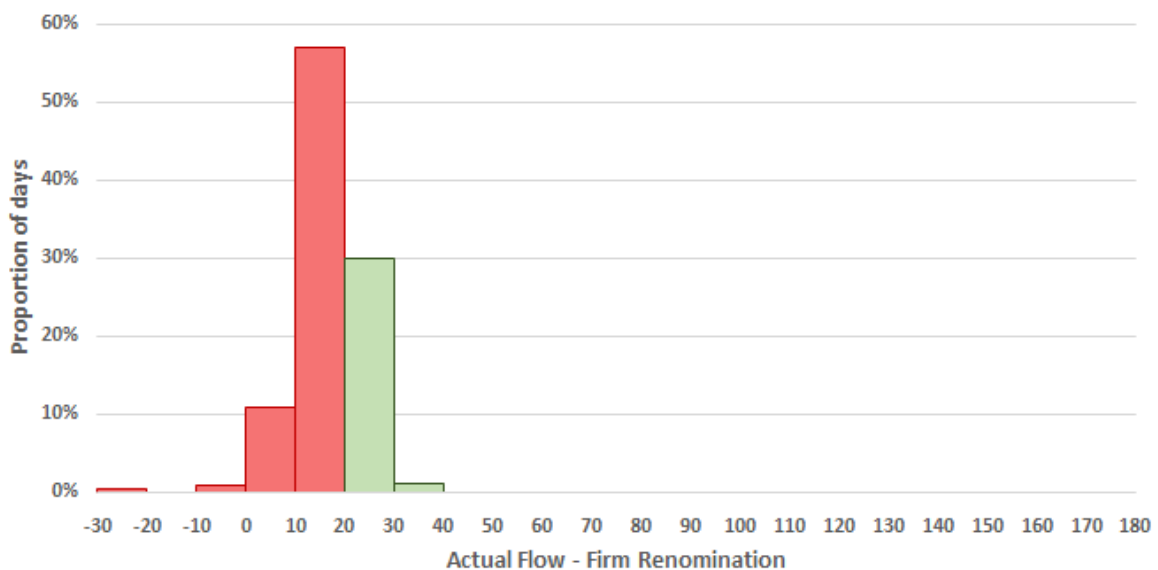


Figure 60—CGP - Histogram of Actual Flow less Firm Nomination

11.3 CGP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 61 shows the pipeline capacity that is available for a gas day removing the firm nominations.

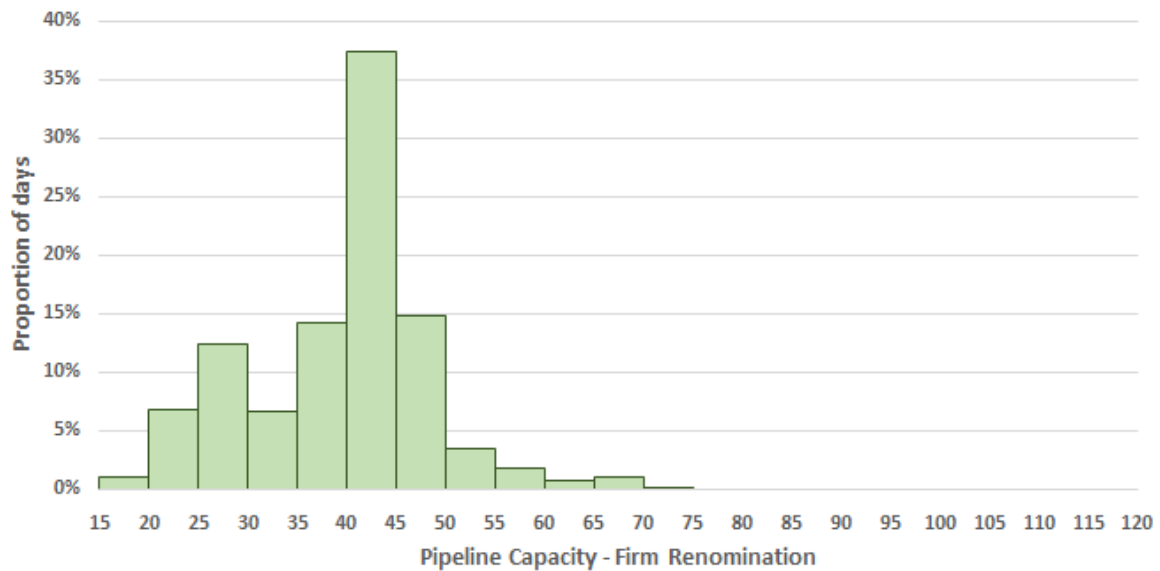


Figure 61—CGP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 62 shows the pipeline capacity that is available for a gas day after removing the actual flow.

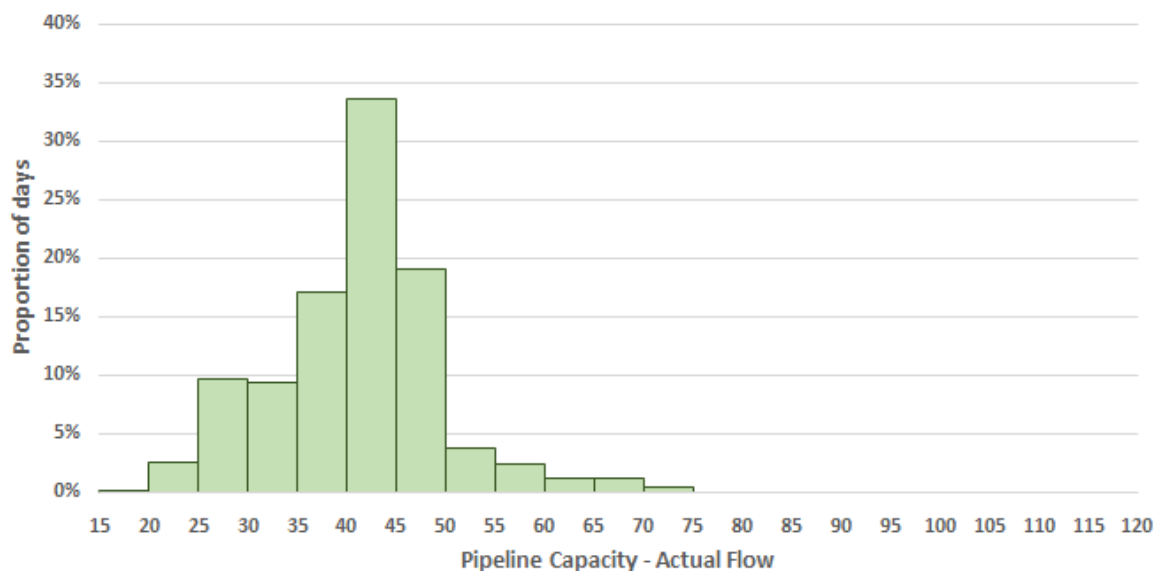


Figure 62—CGP - Distribution of the remaining capacity after accounting for the actual flow.

11.4 CGP – Auction Quantity

Figure 63 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

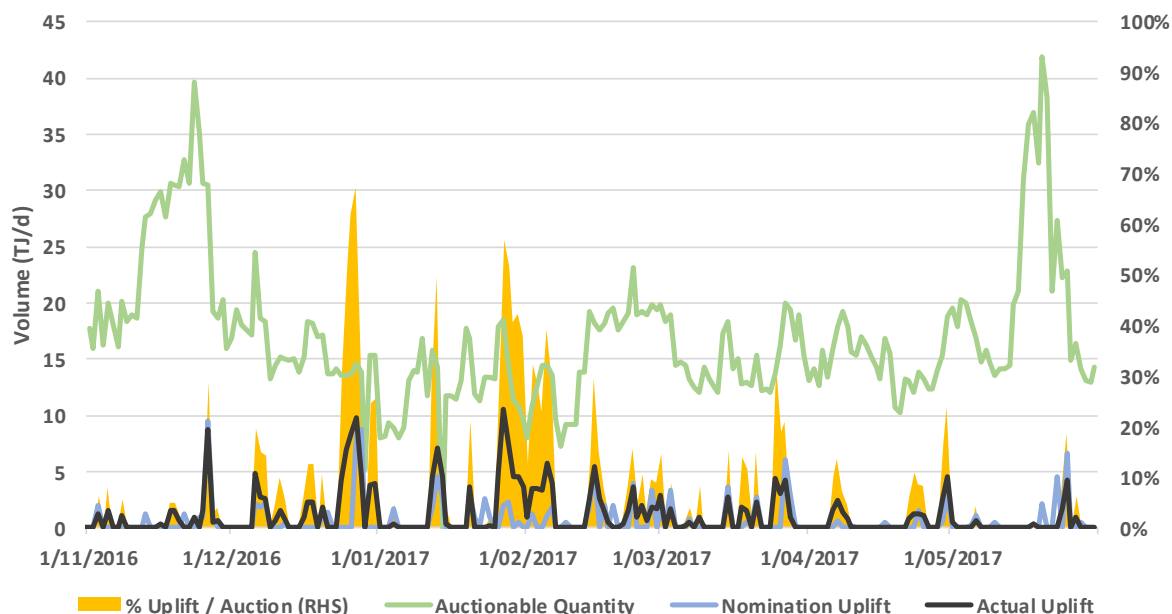


Figure 63 – CGP - Auction Quantity

The auctionable quantity is typically in the range 12TJ/d (P10) to 25TJ/d (P90) with one day with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (55.5%) or limited impact (21.8%). There were no days where the auctionable quantity was reduced by more than 80%. The CGP would be classified as a pipeline with limited auctionable quantity and a 22.8% risk of moderate or greater impact on contracted quantities.

The CGP has been identified as a pipeline where auctionable quantities would be considered at risk.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	12
Median	15
90th Percentile	25
Maximum	42

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	55.5%
Limited (less than 10%)	21.8%
Moderate (10% to 50%)	20.4%
Significant (50% to 80%)	2.4%
Severe (Over 80%)	0.0%

12 Wallumbilla to Gladstone Gas Pipeline

The Wallumbilla to Gladstone Gas Pipeline (WGGP) connects QCLNG Surat gas production fields with the QCLNG LNG Facility at Curtis Island. Data for the Wallumbilla to Gladstone Gas Pipeline only commenced on 26 October 2015 after the commencement of GLNG train 1 during early October.

12.1 WGGP - Flow analysis

Figure 64 shows the forecast nomination, firm nomination, actual quantity of gas transported, the capacity and contracted capacity of the WGGP over the analysis period. It seems that there is some behavior with regard to the actual quantity transported on the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 65).

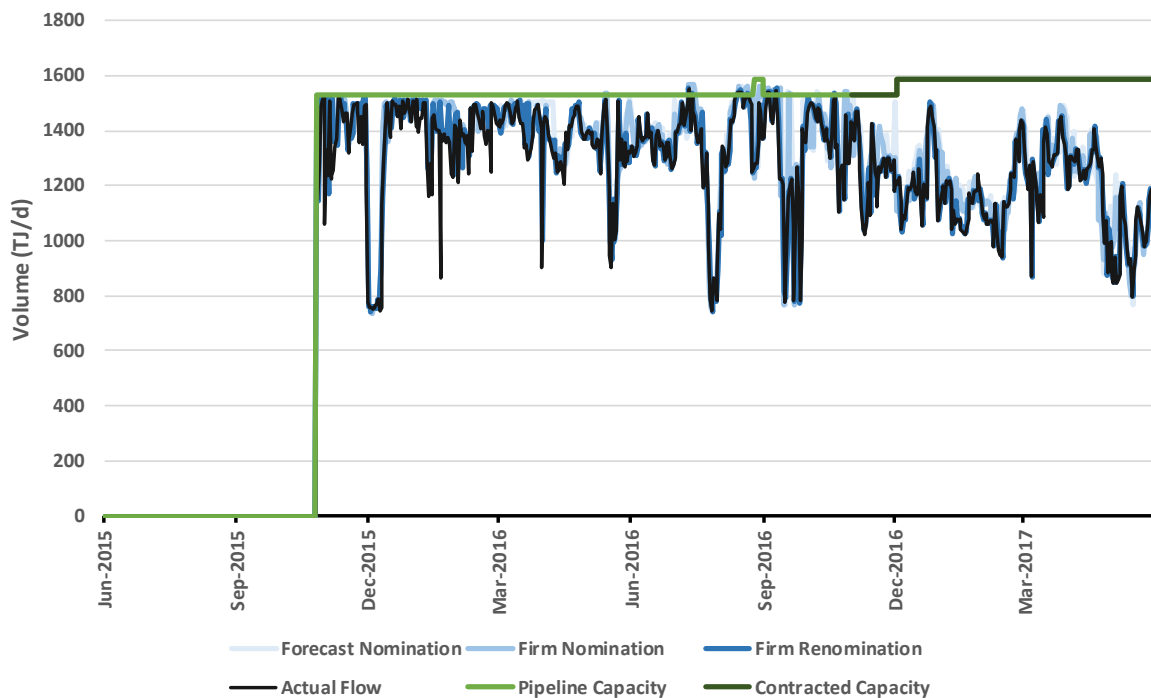


Figure 64—WGGP - Nominations, Actual Flows and Capacity

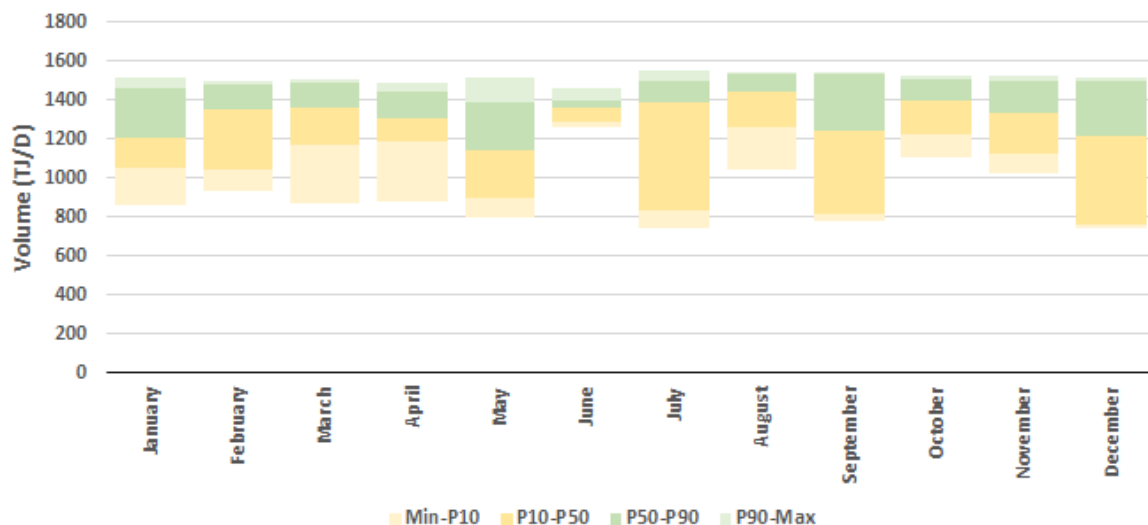


Figure 65—WGGP - Distribution of actual volumes per month

12.2 WGGP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 66 shows that there is general alignment between the firm nomination and the actual quantity shipped on the pipeline.

There appears to be any heavy skew for under specific circumstance for the actual quantity of gas delivered to be significantly lower than the firm nominated quantities highlight the impact of intra-day outages (see Figure 67).

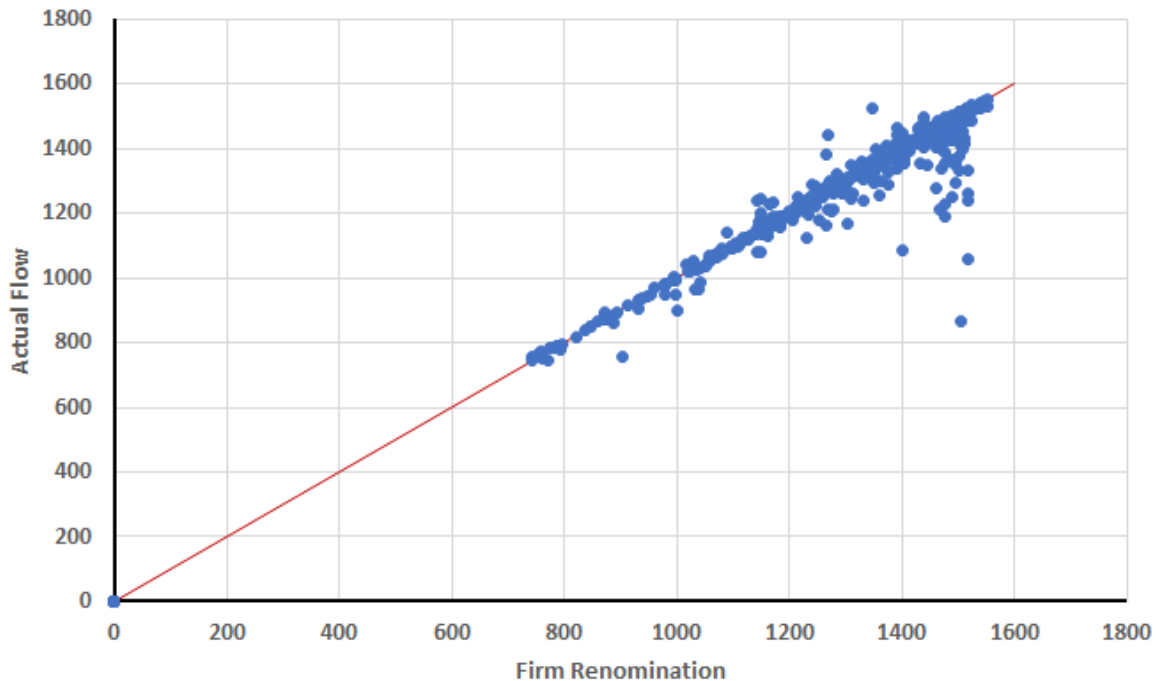


Figure 66—WGGP - Scatterplot of Firm Nomination vs Actual Flow

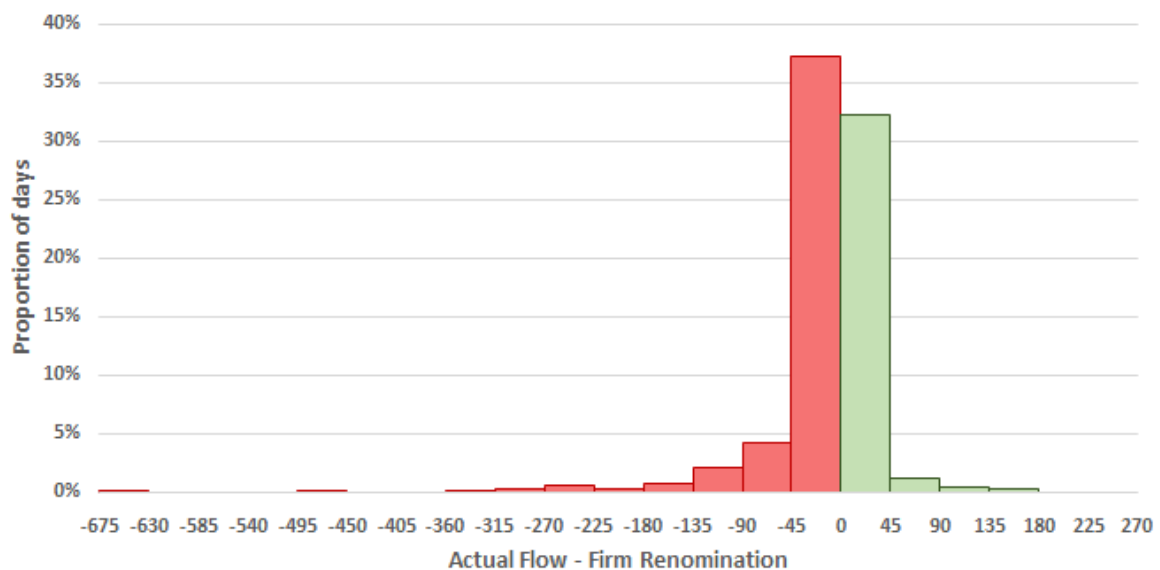


Figure 67—WGGP - Histogram of Actual Flow less Firm Nomination

12.3 WGGP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 68 shows the pipeline capacity that is available for a gas day removing the firm nominations.

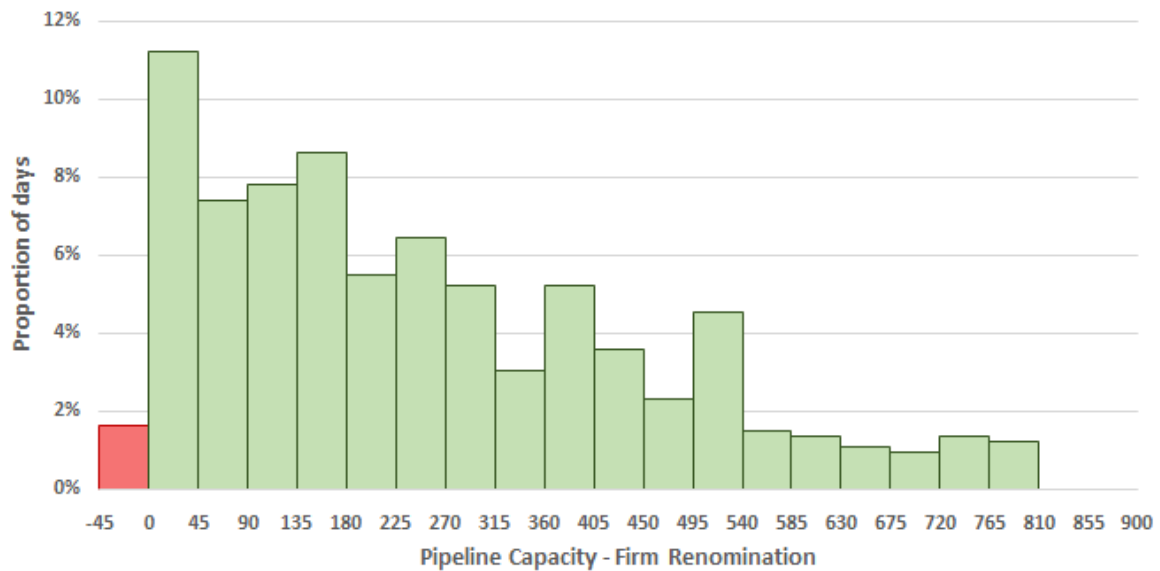


Figure 68—WGGP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 69 shows the pipeline capacity that is available for a gas day after removing the actual flow.

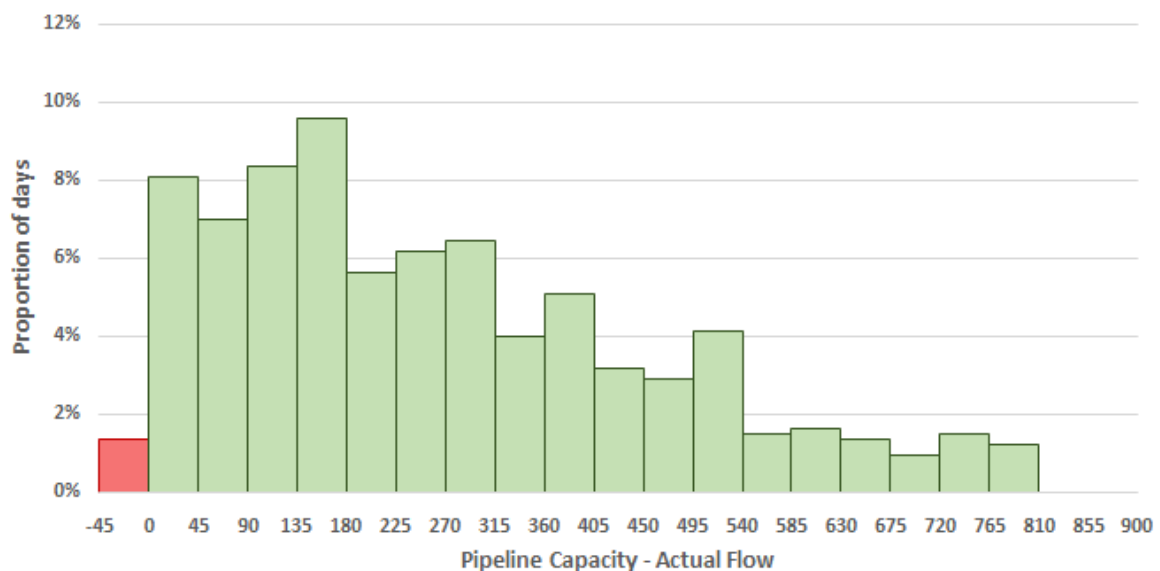


Figure 69—WGGP - Distribution of the remaining capacity after accounting for the actual flow.

12.4 WGGP – Auction Quantity

Figure 70 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

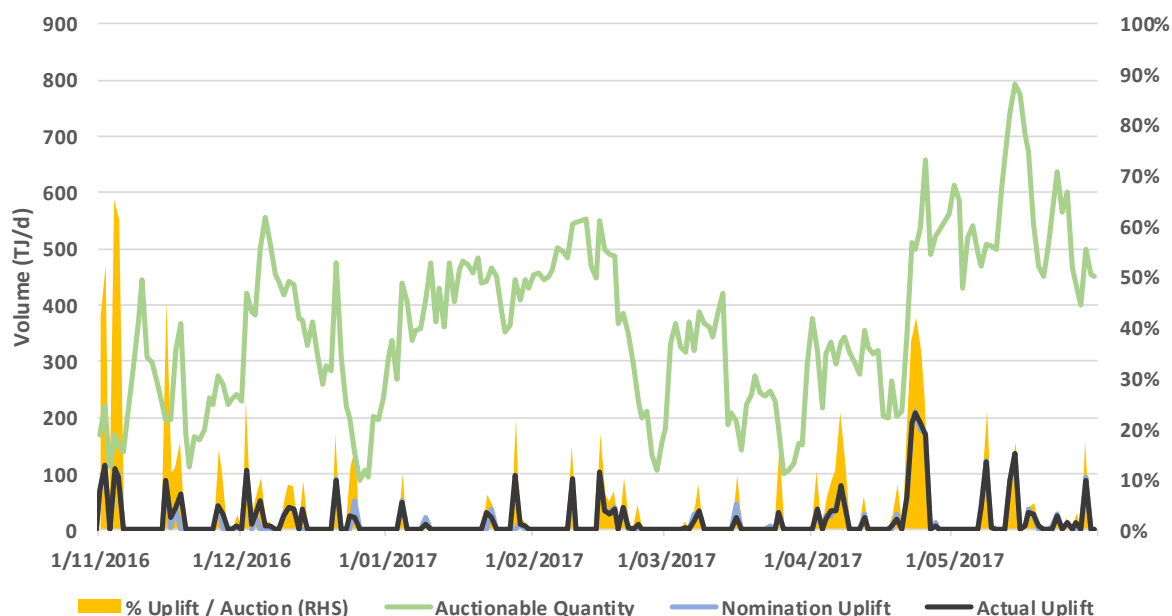


Figure 70 – WGGP - Auction Quantity

The auctionable quantity is typically in the range 170 TJ/d (P10) to 544 TJ/d (P90) with no days with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (64.6%) or limited impact (18.9%). There were no days where the auctionable quantity was reduced by more than 80%. The WGGP would be classified as a pipeline with large auctionable quantities and a 16.5% risk of moderate or greater impact on contracted quantities.

The WGGP has been identified as a pipeline where auctionable quantities would be considered at risk.

Auctionable Quantity	Volume (TJ/d)
Minimum	88
10th Percentile	170
Median	366
90th Percentile	544
Maximum	792

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	64.6%
Limited (less than 10%)	18.9%
Moderate (10% to 50%)	15.1%
Significant (50% to 80%)	1.4%
Severe (Over 80%)	0.0%

13 Tasmanian Gas Pipeline

The Tasmanian Gas Pipeline (TGP) includes the undersea gas pipeline from Longford Gas production facility with Georgetown in northern Tasmania as well as the transmission network throughout Tasmania.

13.1 TGP - Flow analysis

Figure 71 shows the forecast nomination, firm nomination, actual quantity of gas transported, the contracted and uncontracted capacity of the TGP over the analysis period. It seems that there is some behavior with regard to the actual quantity transported by the pipeline, but this is primarily a visual difference due to the range of volumes transported on a day within the given month (see Figure 72).

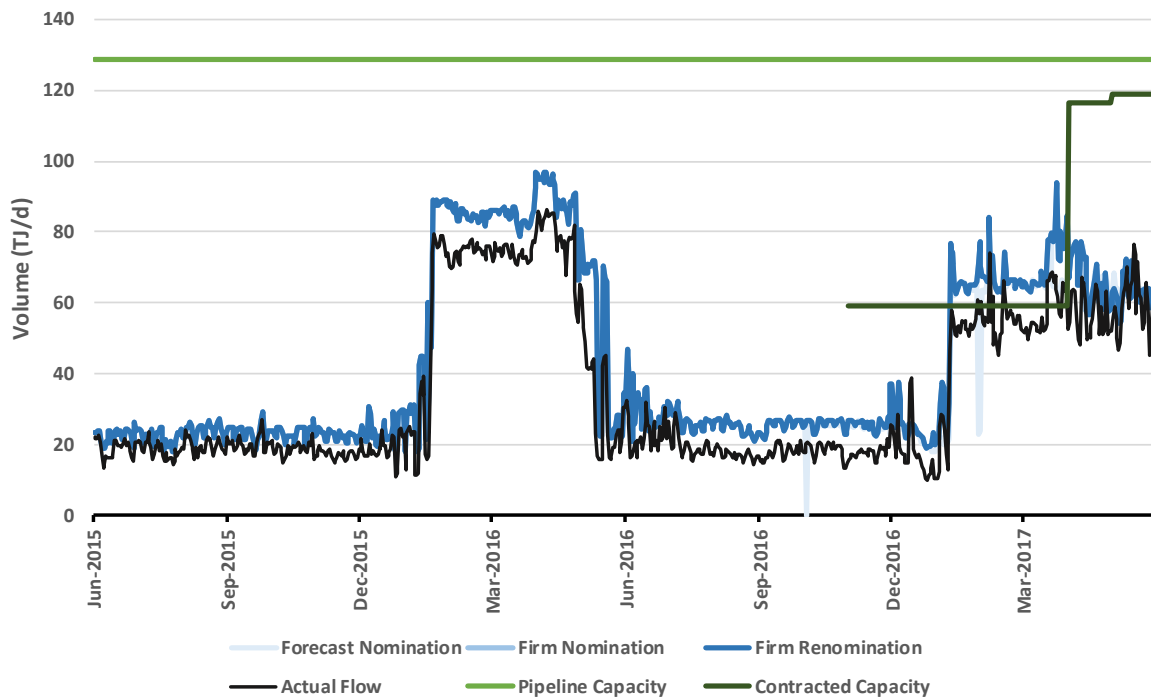


Figure 71—TGP - Nominations, Actual Flows and Capacity

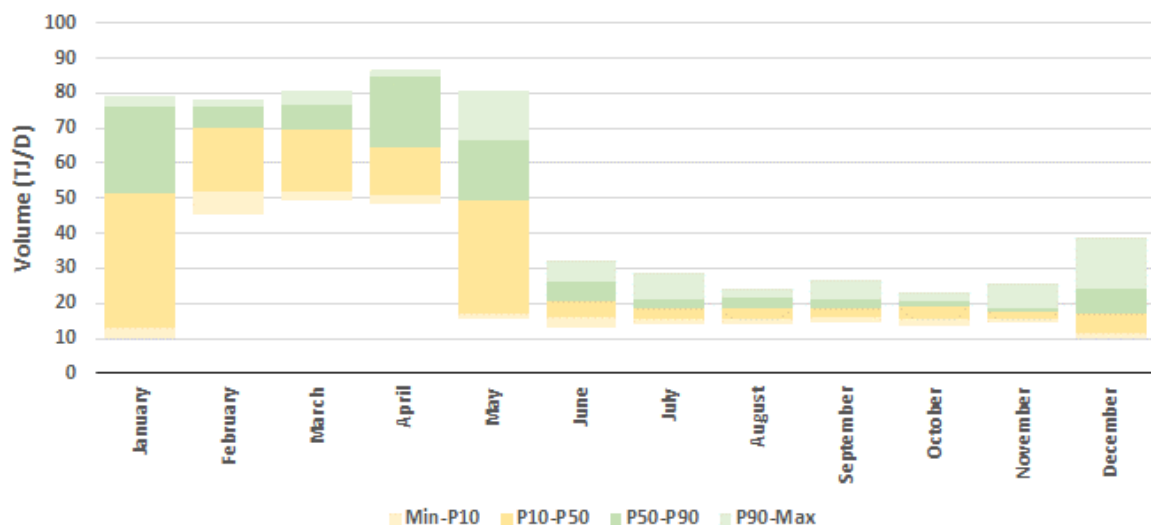


Figure 72—TGP - Distribution of actual volumes per month

13.2 TGP – Firm Nominations vs Actual Quantity

This section compares the firm nominations and the actual quantity that was transported on a given gas day.

Figure 73 shows that there is general alignment between the firm nomination and the actual quantity shipped on the pipeline. The actual flow is typically lower than the firm nomination with a notable skew of approximately 5-10TJ/d (see Figure 74).

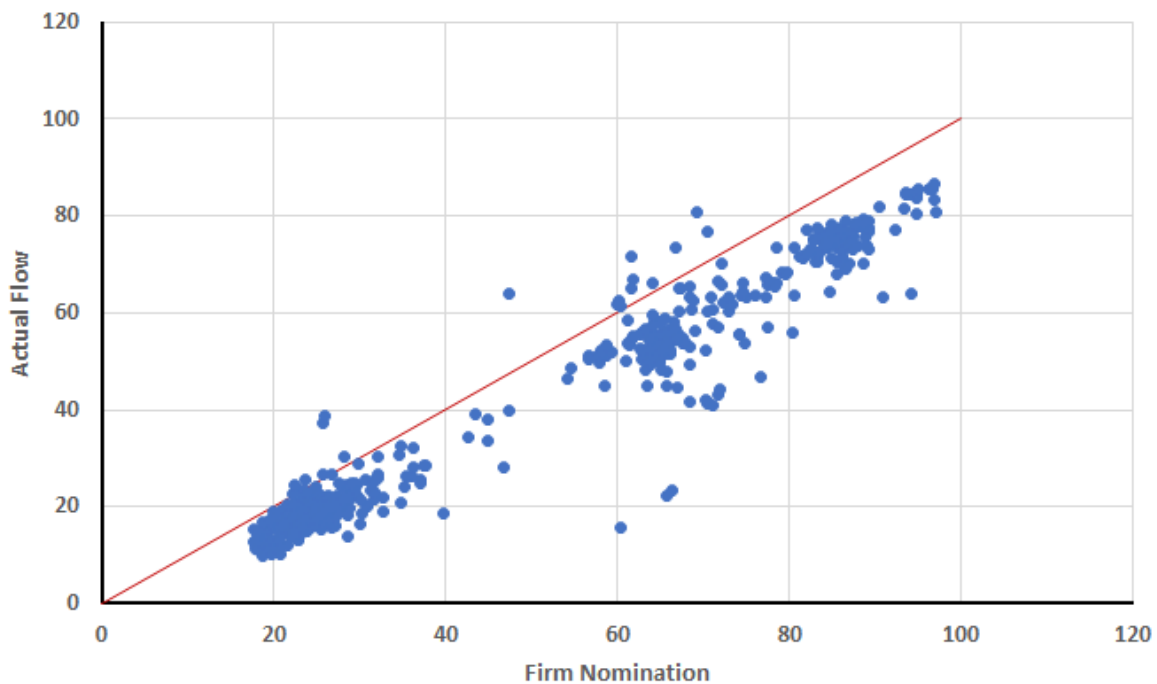


Figure 73—TGP - Scatterplot of Firm Nomination vs Actual Flow

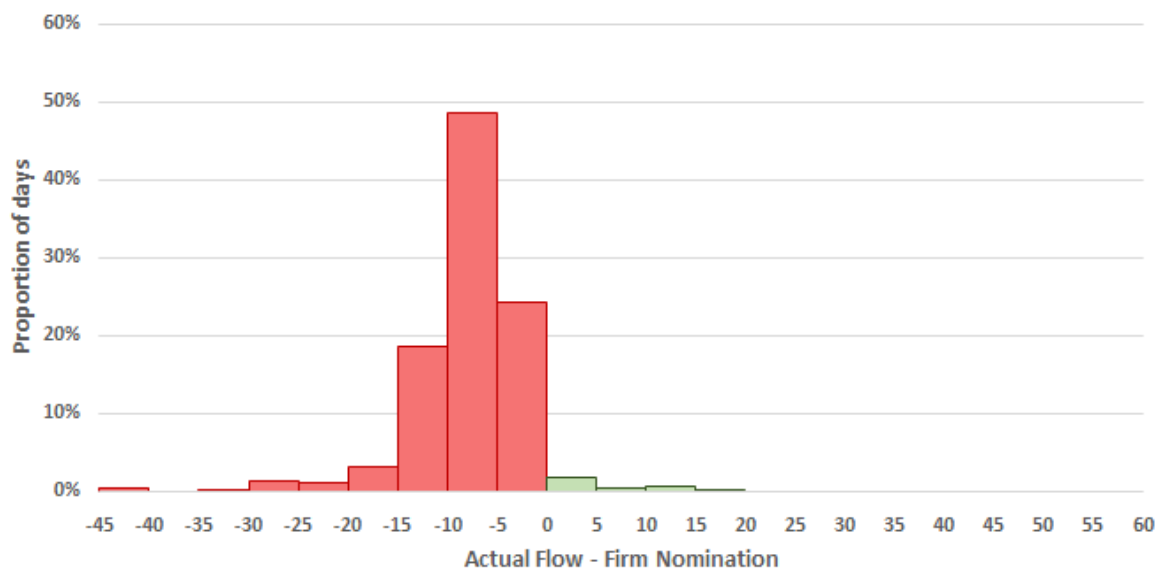


Figure 74—TGP - Histogram of Actual Flow less Firm Nomination

13.3 TGP - Pipeline Capacity

This section compares the firm nomination and actual quantities of gas shipped on the pipeline with the reported pipeline capacity on a given gas day.

Figure 75 shows the pipeline capacity that is regularly available for a gas day removing the firm nominations.

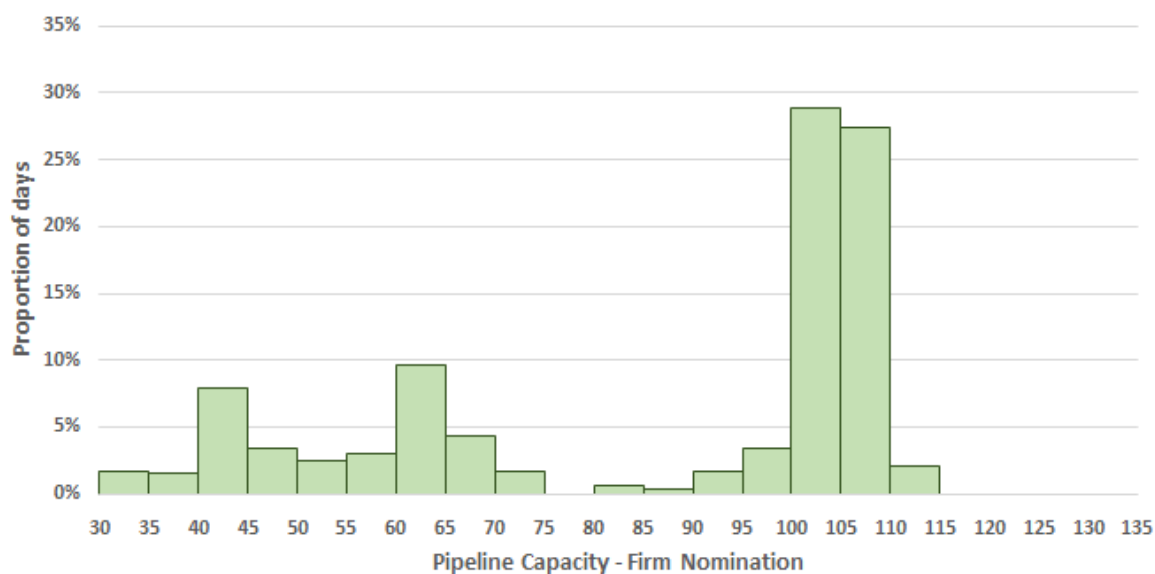


Figure 75—TGP - Distribution of the remaining capacity after accounting for firm nominations.

Figure 76 shows the pipeline capacity that is available for a gas day after removing the actual flow.

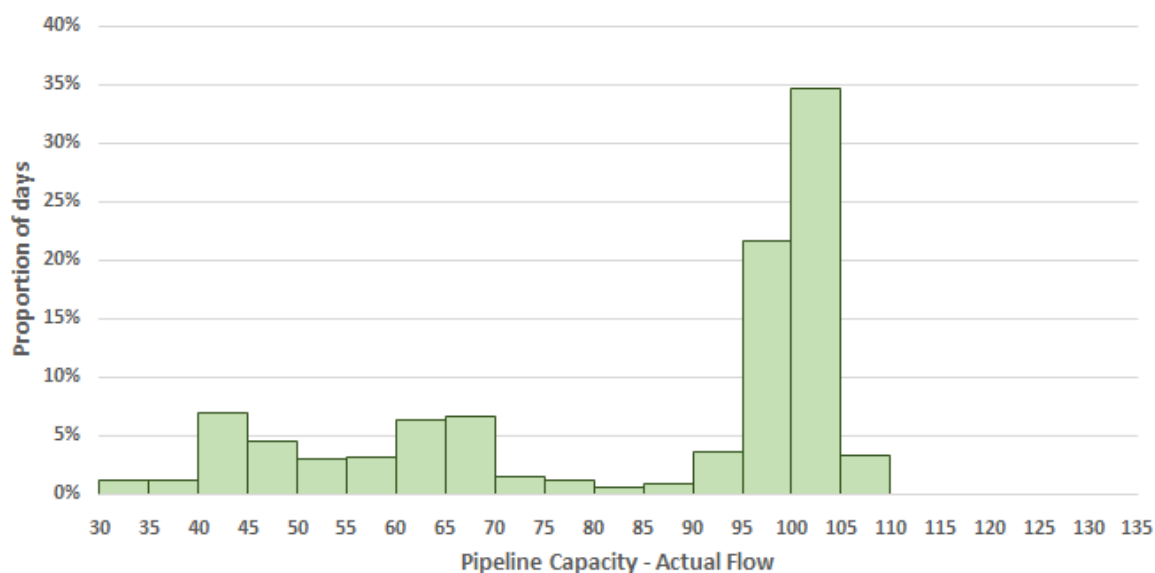


Figure 76—TGP - Distribution of the remaining capacity after accounting for the actual flow.

13.4 TGP – Auction Quantity

Figure 77 shows the impact on the Auction Quantity (Contracted Quantity less Firm Nominations), Actual Uplift (Increases from Firm Nomination to Actual Flows) as well as the percentage of Auctionable Quantity displaced by the Actual Uplift.

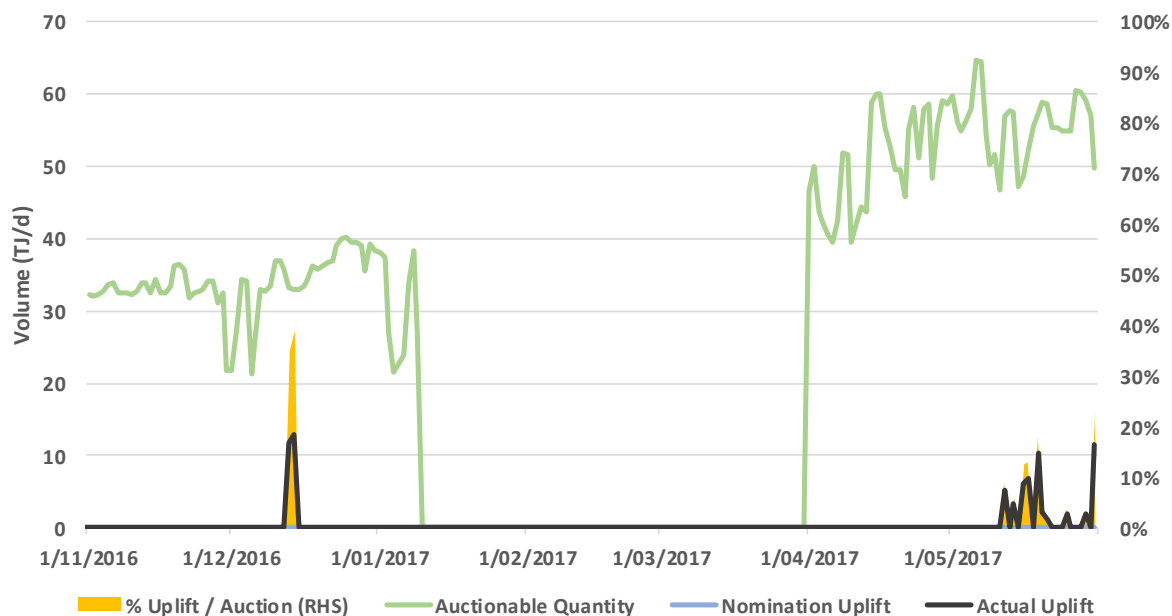


Figure 77 – TGP - Auction Quantity

The auctionable quantity is typically up to 57TJ/d (P90) with many days (38.2%) with no auctionable quantity available for contracting.

In terms of impact on contracted quantities by uplifts in actual flows from nominations; for the majority of the time, there was either no impact on the auctionable quantity (90.8%) or limited impact (4.6%). There were no days where the auctionable quantity was reduced by more than 80%.

The TGP would be classified as a pipeline with low auctionable quantities and a 4.6% risk of moderate or greater impact on contracted quantities.

Auctionable Quantity	Volume (TJ/d)
Minimum	0
10th Percentile	0
Median	33
90th Percentile	57
Maximum	65

Impact on Auctionable Quantity	Percent of analysis period
No impact (0% or negative)	90.8%
Limited (less than 10%)	4.6%
Moderate (10% to 50%)	4.6%
Significant (50% to 80%)	0.0%
Severe (Over 80%)	0.0%

Final Page Disclaimer:

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