Australian Pipeline Trust

ROMA – BRISBANE PIPELINE NETWORK

Optimised Replacement Cost Study

Modelling of a 2005 (180 TJ/d) "Optimum" Pipeline

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1. SUMMARY

This report presents the results of a study to assess the "optimum" design of a replacement pipeline for the Roma-Brisbane pipeline system operating at the load estimated for the RBP in 2005, provided for the detailed study. This report is based on designs and capital cost estimates developed in the report "*Optimised Replacement Cost Study Report*" (Document 167-R-01), which is a reference document for this report.

Four designs were developed using unsteady state modelling to accommodate the distinctive load characteristics of this pipeline. As discussed in the Optimised Replacement Cost Study Report (Document 167-R-01), pipeline steady state "capacity" is not relevant because of the specific weekly load characteristics of the RBP supplying a base reticulation – commercial – industrial load, with a large peak load power station load superimposed that the pipeline "capacity". The weekly delivery in 2005 averaged over 7 days is 147 TJ/d. The peak hourly delivery rate in each week is equivalent to 224 TJ/d (9.33 TJ/h).

The lowest cost design optimised for the 2005 load is a DN 500 pipeline designed with a maximum operating pressure of 10.2 MPa, and a single mid line compressor station. Because this pipeline has a large volumetric capacity and modest compression, it also reflects the design with the lowest operating cost.

2. BASIS

The pipeline is assumed to be constructed along the route proposed for the optimised design in Venton & Associates report 167-R-01, for the reason identified in that report that the existing route through metropolitan Brisbane is so congested that the alternative route that uses existing road and power easements will be lower cost, and will provide increased safety through the residential area.

Modelling was undertaken to develop designs for the pipeline, using the loads developed for the main study in 2005. These included the Swanbank Intermediate power station, the Oakey power station and the network and industrial loads factored to represent the maximum weekly demand.

The unsteady state model was run for three or more consecutive week of maximum demand to confirm that the pipeline capacity was stable.

The modelling considered:

- A DN 350 pipeline with an initial and three (3) intermediate compressor stations operating at 15.3 MPa
- A DN 400 pipeline with an initial and three (3) intermediate compressor stations operating at 12.5 MPa
- A DN 450 pipeline with an initial and one (1) intermediate compressor station operating at 10.2 MPa.
- A DN 500 pipeline with one (1) intermediate compressor station operating at 10.2 MPa.

The DN 400 model was run with the Swanbank compressor station operated as an Intermediate and an Intermediate/Base load profile.

The DN 450 and DN 500 models were run with the Swanbank compressor station operated as an Intermediate profile.

The DN 350 pipeline was not able to sustain the Swanbank Intermediate / Base load profile.

Because the Swanbank load changed to Intermediate / Base load profile toward the end of 2005, the DN 350 pipeline was discarded as a satisfactory solution.

Aust-Wide Estimating has prepared an estimate for the pipeline by reviewing the detailed estimate developed for the optimised DN 500 pipeline, and factoring the estimate for the smaller diameter. The compressor station cost estimate was likewise factored down to reflect the cost of the lower powered 3 MW compressor units and auxiliary plant.

For the DN 400 pipeline, the compressor station cost is based on:

- The Wallumbilla booster compressor station equipped with two (2) 1 MW compressor units. This compressor station is essential to inject gas into the higher pressure transmission pipeline. It is considered that this station requires a standby unit to ensure that the facility can operate continuously.
- Intermediate compressor stations installed in the vicinity of Arubial and Gatton. Each of these stations is equipped with a single 3 MW compressor unit, with provision for future expansion to accommodate a future unit. These costs are similar to a current estimate for a single Solar C40 unit station and represent an upwards revision of the cost estimate for this pipe size.
- An intermediate compressor station installed in the vicinity of Dalby, equipped with two (2), 3 MW compressor units (duty and standby). This installation will minimise curtailment to deliveries during periods when either of the single unit stations is not available, as a result of maintenance requirements, or breakdown.

For the DN 450 pipeline, the compressor station costs are similar to those used in the original study, except that additional compression is not required for the Peat Lateral, and is deleted.

For the DN 500 pipeline, the compressor station costs are the same to those used in the original study, except that additional compression is not required for the Peat Lateral, and is deleted.

3. ESTIMATED CAPITAL COST

The estimated cost of the DN 400 pipeline to transport the nominal 2005 demand is $A462.5 million.

The compressor station cost represents a significant burden to the pipeline capital cost ($87 million). The estimate is reported against the cost of the "Optimised" DN 500 pipeline, shown in Figure 12-3 of the Optimised Design report (Document 167-R-01). This clearly shows the impact of the compressor stations on the capital cost.

The factored estimates have adjusted only the items that are substantially changed by the diameter change, including materials, aspects of construction and compressor stations. The cost for support services (land, environment, cultural heritage etc.) are unchanged from the values used in the DN 500 optimised pipeline estimate.

For the DN 400 pipeline, the EPCM allowance for compressor stations is reduced from 12.5% of the installed cost to 8.5%, because savings are expected from applying similar designs at three sites. The allowance is reduced to 10% for the 450 design, because savings are expected through commonality.

For the DN 400 pipeline, the contingency applied to the construction portion of the estimate is reduced from 12.5% of the estimated cost to 10 %, because the factoring may not adequately reflected the effect of the smaller pipe diameter, and also the application of a smaller contingency is appropriate to the construction of multiple similar compressor stations. The 12.5% contingency is retained for the DN 450 design.

For the DN 500 pipeline, the compressor and contingency allowances are unchanged from those used in the original DN 500 optimised design.

Table 12-3 Capital Cost Breakdown by Cost Area (Case 2 Only)

Cost Item	Estimated Capital Cost ($M'000s)			
	"Optimised" DN 500 Pipeline	**DN 500 – 2005 Pipeline**	**DN 450 – 2005 Pipeline**	**DN 400 – 2005 Pipeline**
Pipeline	368,202	346,273	322,884	315,940
Compressor Stations	53,980	46,997	90,911	133,000
Receipt & Delivery Stations	13,729	13,752	13,873	13,652
Land	13,341	13,362	13,480	13,266
Buildings	2,090	2,094	2,113	2,079
Communications	4,803	4,811	4,853	4,776
Other Plant & Equipment				
Total	**456,145**	**427,289**	**448,114**	**485,712**

4. 2005 "OPTIMUM" DESIGN

The cost comparison shows the combined impact of the pipe diameter / pressure, and compressor stations.

For the 2005 load only, a DN 500 pipeline with a single compressor station and designed for a pressure limit of 10.2 MPa (not 12.5 MPa as in the original "optimised" design) is the lowest cost, showing the advantage that can be taken by a lower pressure large diameter pipeline, with a single compressor station for the weekly load profile imposed on this pipeline.

The 10.2 MPa, DN 450 pipeline cost is $45.3M less than the DN 500 design optimised for the 25 year forecast (167-R-01). However the additional compressor station required for the DN 450 pipeline adds approximately $37M to the cost, practically eliminating the saving in pipe. Likewise the DN 400 pipeline with 3 intermediate compressor stations actually increases the cost, compared with either of the two alternative designs.

5. "SPARE" CAPACITY IN THE OPTIMISED DESIGNS

The 2005 "Optimum" designs are essentially "full" for the 2005 load profile. For each case, the pipeline is essentially fully packed at the time that the peak load power station load commences each Monday morning, and by the time that the peak load power station stops on Friday evening, the re is insufficient line pack to sustain continued full load power station operation (ie minimum pressure at the Swanbank offtake).

Because of this, incremental cost (compression) is required for forecast loads in the years beyond 2005.

The designs that are limited to 10.2 MPa operating pressure are expected to require some future looping to deliver the loads forecast in the latter part of the period for which the "optimised" pipeline is intended to provide.

6. COMPRESSOR STATION COST

The compressor station cost impact on the pipeline capital cost is very significant. It is some time since a new 3-5 MW compressor station has been constructed, and for this reason Venton has assessed the estimated cost for roughly similar compressor stations.

The estimated cost is less than the cost quoted to design supply and construct a single 4 MW unit compressor station for the Gove gas pipeline. This quotation was provided by the turnkey contractor responsible for the 4 MW compressor stations installed on the SEA Gas pipeline, so there is some confidence that the estimated cost reasonably reflects the capital cost or a new compressor station designed for installation in locations like Dalby and Gatton, where issues like noise and visual amenity are more significant than construction in a remote location.

Furthermore, APT has advised that the budget for a single Solar C40 compressor station planned for the RBP is $25 M. This provides reasonable substantiation of the compressor station cost used in the estimate.

These costs are in the same order as the cost used in the estimate, and provide confidence in the quality of the estimates.