MOOMBA SYDNEY PIPELINE
Review of Optimised Design for 2003 Load Reforecast

REPORT
for
EAST AUSTRALIAN PIPELINE LIMITED

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Prepared by

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REVIEW AND APPROVAL RECORD

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1. INTRODUCTION

In 1998 and 1999, Venton and Associates (Venton) undertook work for East Australian Pipeline Limited (EAPL) to develop an optimised design of the Moomba to Sydney Pipeline system (MSP) based on a forecast of loads between 1999 and 2014 (the 1999 report).

Since that time better knowledge has been gained of the impact of the Eastern Gas Pipeline (EGP) on the gas supply to the Sydney region. In particular, AGL has announced new long term gas supply arrangements for its SE Australian customer base that indicate a clear intention to diversify its supply sources including use of the EGP and a reduction its reliance on the MSP to supply its customers in NSW and the ACT. Furthermore the understanding of power station developments considered probable in 1998/9 is better known in 2003. As a result of those changes East Australian Pipeline Limited revised its forecast of volumes to be transported through the MSP in March 2003to reflect those changes in the gas market. These forecast volumes have been submitted to the ACCC. It is understood that these are being reviewed by ACIL Tasman.

EAPL requested Venton to undertake a review of the pipeline design required to satisfy EAPL's March 2003 reforecast of pipeline loads between 2003 and 2020 to assess whether the changed loads would result in a reduction in pipeline dimensions sufficient to make a significant change in the capital cost of the project. Use of 2020 as the appropriate design year is a slight extension of the 15 year design rule of thumb previously used which reflects the load growth that is forecast from 2014 and allows a degree of flexibility to respond to higher growth scenario than forecast by EAPL. The intention was to undertake the investigation in two parts:

1. A desktop level review of the design required to deliver the 2020 load and factored cost estimate using the cost data in the 1999 report.
2. If a significant change in the overall cost was indicated and the ACCC seek a detailed revision, the work scope would be expanded to include a design optimisation study and re-estimate of the capital cost of the network.

This presents the findings of the desktop study.

It concludes that:

- The size of the pipeline between Moomba and Young could be reduced to DN 500. The operating pressure of the pipeline would be retained at 15.3 MPa.
- The size of the Young to Culcairn pipeline could be reduced from DN 350 to DN 300. The operating pressure would remain unchanged at 10.2 MPa
- The dimensions and pressure ratings of the remainder of the network would be unchanged (with a DN 600, 10.2 MPa pipeline retained between Young and Wilton to provide storage capacity to satisfy anticipated increases in the load profile supplied by the Moomba to Wilton Pipeline.
- Three intermediate compressor stations are required on the pipeline to accommodate peak winter throughput.
- The capital cost saving delivered by the reduction in pipeline size is practically offset by the capital cost of the additional compressor stations, resulting in a net reduction in the capital cost of the pipeline of 3.6%. This is less than the accuracy of the estimate and is considered insignificant.
- The 1999 capital cost estimate remains a reasonable basis for establishing the optimised replacement cost of the pipeline even though the forecast 2003 load pattern has changed.

2. DESIGN BRIEF – STAGE 1

2.1 SCOPE

The stage 1 study is required to undertake a desktop level assessment of the pipeline network design required for a pipeline required to transport the peak flows forecast in winter 2020. The study design will be developed using a robust transient hydraulic model of the pipeline network.

The capital costs for the design will be projected using the cost data established in the 1999 report, with no allowance for cost changes or escalation that may have occurred since that time.

2.2 DESIGN ASSUMPTIONS

The following assumptions were made of facilitate the desktop study:

1. A forecast of the pipeline network load by year over the period 2003 – 2023 was provided by Agility.
2. APT provided typical current weekly peak winter load profile.
3. The network flow is the winter flow, defined as:

$$DesignDailyFlow = \frac{AnnualForecastFlow * 1.45}{365}$$

4. The hourly flow profile used in 1998/9 is used.
5. Peak winter flows in the other components of the pipeline network remain unchanged from the modelling undertaken in 1998/9, except that the 2003 forecast flow through Culcairn is to be used.
6. The pipeline model used in 1998/9 is used for the revised study.

2.3 DESIGN DAILY LOADS (WINTER PEAK)

System loads forecast for the peak winter day for loads delivered from the nominated pipeline are:

Load	2014	2020
Main Pipeline (Moomba – Wilton)	300	399
Canberra	55	55
Wagga	15	15
Junee – Griffith	7	7
Culcairn	21	21
Northern Laterals	25	25

Loads in the Main Pipeline and at Culcairn are reduced from those used in 1999. Loads for the other pipelines are unchanged from those used in the 1999 study.

2.4 PIPELINE CONFIGURATION AT 1999

The pipeline network considered in the 1999 report consisted of:

- A DN 600 pipeline between Moomba and Young, operating at 15.3 MPa.
- A DN 600 pipeline between Young and Wilton operating at 10.2 MPa.
- A DN 300 pipeline between Dalton and Canberra, operating at 10.2 MPa
- A DN 150 pipeline network from Young (the northern laterals)
- A DN 350 pipeline between Young and Culcairn, operating at 10.2 MPa
- A DN 150 pipeline between Burnt Creek and Griffith, operating at 10.2 MPa

The pipeline required an inlet compressor station at Moomba, and a small booster compressor station at Young for the Northern Laterals, with incremental compression throughout the pipeline life (the first facility being required in 2000).

3. PIPELINE CONFIGURATION FOR 2020 LOAD

The hydraulic model used for the 1999 report was retrieved and the revised load and load profile for Wilton and Culcairn applied to it.

The model was run on the assumption that compressor stations would be located in the same positions as adopted for the 1999 report. Changes were made to the Moomba to Young, Young to Wilton and Young to Culcairn pipelines, and the set points of compressors adjusted until the minimum pipeline configuration required to deliver the nominated flows at pressures exceeding the minimum pressures established in the 1999 report (representing contractual commitments) were achieved.

The pipeline network considered in the 1999 report consisted of:

- A DN 500 pipeline between Moomba and Young, operating at 15.3 MPa.
- A DN 600 pipeline between Young and Wilton operating at 10.2 MPa.
- A DN 300 pipeline between Dalton and Canberra, operating at 10.2 MPa
- A DN 150 pipeline network from Young (the northern laterals)
- A DN 300 pipeline between Young and Culcairn, operating at 10.2 MPa
- A DN 150 pipeline between Burnt Creek and Griffith, operating at 10.2 MPa

The model pipeline requires compression at:

- The pipeline inlet (Moomba)
- Compression at Binerah Downs, Questa Park, Bulla Park, Pine Ridge, and Young together with the small compressor currently installed on the northern laterals pipeline. In 2020 the Binerah Downs compressor requires 5 MW of compression power, while the Questa Park, Bulla Park and Pine Ridge compressor stations require 6.5 MW of compressor power. The peak power demand at Young is 5 MW.

  The minimum pressure at Wilton with this configuration is 7 MPa, suggesting that the model is applying too high a pressure at the Young compressor station.

The minimum pressure at Culcairn using a DN 300 pipeline between Young and Culcairn is 7.6 MPa. A DN 350 pipeline between Young and Culcairn increases the minimum pressure at Culcairn to 7.8 MPa suggesting that a further reduction in the diameter of this pipeline may be possible with additional modelling effort.

4. PIPELINE CONFIGURATION FOR 2014 LOAD

The network load in 2003 is 95.9 PJ/a while in 2014 it is forecast to be 98.4 PJ/a (ie, approximately the same).

To provide an assessment of the performance of the 2020 pipeline network during the initial years of the forecast, the model was run using the load forecast in 2014.

This showed that compression was required at:

- Binerah Downs
- Questa Park

- Pine Ridge
- Young

Inspection of the output showed that the power required from the Binerah Downs and Questa Park compressor stations at this time is 2-3 MW, and it was concluded that with additional work it could be shown that one of these facilities could be eliminated either by relocation of by more detailed hydraulic modelling.

The Young compressor station was only required at peak times, as was the small compressor required for the Northern Laterals. It was decided that the model should provide both these facilities, the Young unit because should an upstream compressor fail, boosting at Young would provide continuity of supply to the Sydney market. The Northern Laterals compressor is a small unit and is considered necessary to provide continuity of supply.

Because compression is only required at peak winter periods, the capital cost estimate provides for the installation of two single unit 7 MW stations on the main pipeline, and a single 3-4 MW unit at Young. This installation will achieve the gas transportation required, but will require operational methods to ensure continuity of supply should a unit fail when it is required during the winter peaks.

5. CAPITAL COST ESTIMATE

Using the estimate data prepared for the 1999 report and factoring it for the changed pipe sizes, and using typical greenfields compressor station costs, the comparative costs of the pipeline network are summarised in the following Table. Since the significant change is to the Moomba – Young and the Young – Culcairn pipeline, only the cost for these pipelines is tabulated:

Cost Item	**Estimated Capital Cost 1999 ($'000s)**		**Estimated Capital Cost 2003 ($'000)s**	
	Moomba to Young	**Young to Culcairn**	**Moomba to Young**	**Young to Culcairn**
	DN 600	DN 350	DN 500	DN 300
Pipe	249,463	15,509	198,204	13,522
Survey & Easement	6,962	4,335	6,962	4,335
Environmental	7,500	2,420	7,500	2,420
Construction	204,805	23,901	189,548	21,752
Stations	69,108	4,654	110,537	4,384
Direct Project Cost	537,118	50,819	512,751	46,413
Indirect Cost	161,547	13,858	154,944	12,659
Total	698,665	64,677	667,695	59,072
Total for These Pipelines	**763,342**		**726,767**	
Change			-36,575	
Capital Cost All pipelines and facilities– 1999 report	**1,058,216**			
Revised Capital Cost – 2003 (1999 cost plus difference 2003)			**1,021,641**	
			-3.6%	

Note: The indirect cost estimate is developed on the same basis as the 1999 report, ie including a 10% contingency expenditure.

As detailed in Venton's letter to EAPL on 12 May 2003, the contingency expenditure is required given the high level "factored" nature of the estimate, signifying an allowance for cost omissions that is experienced in estimating pipeline projects. The allowance is not intended and nor should it be used as providing an additional allowance for use as a "not to be exceed" estimate required by some boards for project approval.

ATTACHMENT 1

CAPITAL COST ESTIMATE

EAPL OPTIMISED SYSTEM DESIGN (BASE CASE 1999)

CAPITAL COST ESTIMATES - Forecast using 1999 Costs - No Escalation

	MOOMBA TO YOUNG		YOUNG TO WILTON		YOUNG TO CULCAIRN		DALTON TO CANBERRA		YOUNG TO LITHGOW		JUNEE TO GRIFFITH		2003 Revision Moomba to Young	2003 Revision Young to Culcairn
LINEPIPE DIA.	DN 600		DN 600		DN 350		DN 300		DN 150		DN 150		DN 500	DN 300
WALL THICKNESS (mm)	11.8		9		5.3		78% 4.8 / 22% 7.1		4.8		4.8		11.2	4.8
PIPE SPEC	API 5L X80		API 5L X70		API 5L X70		API 5L X70		API 5L X42		API 5L X42		API 5L X70	API 5L X70
CONSTRUCTION (m/day)	2100		2100		3500		3600		3400		3700		2100	3500
ROUTE LENGTH (km)	1034		265		218		58		270		179		1034	218
	QTY	**$'000**	**QTY**	**$'000**	**QTY**	**$'000**	**QTY**	**$'000**	**QTY**	**$'000**	**QTY**	**$'000**		**$'000**
LINEPIPE														
LINEPIPE (EX BHP) F.I.S. SITE					218 km	11396	58 km	2601	279 km	5301	179 km	3401		9777
LINEPIPE C.I.F. WOLLONGONG (EX JAPAN)	1034 km	206800	265 km	40423									162983	
FREIGHT WOLLONGONG TO SITE	182 kt	6915	35.6 kt	1347									5451	
YELLOWJACKET COATING (1000um)					218 km	4113	58 km	936	279 km	2340	179 km	1502		3745
FBE COATING (400um)	1034 km	35748	265 km	9162									29770	
sub total		249463		50932		15509		3537		7641		4903	198204	13522
SURVEY & EASEMENT														
ROUTE SURVEY	1034 km	775	265 km	292	218 km	165	58 km	45	279 km	376	179 km	224	775	165
GEOTECHNICAL INVESTIGATION	1034 km	517	265 km	193	218 km	100	58 km	50	279 km	185	179 km	100	517	100
EASEMENT DOCUMENT SUBMISSION	ITEM	1015	ITEM	960	ITEM	845	ITEM	320	ITEM	815	ITEM	540	1015	845
LANDOWNER CONTACT / NEGOTIATIONS	1034 km	1300	265 km	1000	218 km	800	58 km	150	279 km	800	179 km	800	1300	800
LAND VALUATIONS	1034 km	715	265 km	500	218 km	400	58 km	75	279 km	300	179 km	300	715	400
EASEMENT LODGEMENT/REGISTRATION	ITEM	780	ITEM	690	ITEM	635	ITEM	350	ITEM	570	ITEM	395	780	635
CLAIMS / DAMAGES & ACQUISITION	1034 km	1860	265 km	1645	218 km	1390	58 km	395	279 km	1295	179 km	810	1860	1390
sub total		6962		5280		4335		1385		4341		3169	6962	4335
ENVIRONMENT														
BIOLOGICAL SURVEYS	1034 km	1160	265 km	625	218 km	680	58 km	110	279 km	810	179 km	410	1160	680
CULTURAL SURVEYS / NATIVE TITLE	1034 km	4630	265 km	2270	218 km	1500	58 km	400	279 km	2000	179 km	1200	4630	1500
CONSTRUCTION MONITORING / AUDITS	1034 km	1710	265 km	475	218 km	240	58 km	75	279 km	400	179 km	200	1710	240
sub total		7500		3370		2420		585		3210		1810	7500	2420
PIPELINE CONSTRUCTION														
MOBILISATION & DEMOBILISATION	ITEM	9900	ITEM	5550	ITEM	2900	ITEM	750	ITEM	1300	ITEM	1300	9900	2700
CLEAR & GRADE R.O.W.	1034 km	2245	265 km	672	218 km	392	58 km	79	279 km	561	179 km	305	2245	392
STRINGING	182 kt	31857	35.6 kt	4910	9.98 kt	1478	2.45 kt	338	5.45 kt	805	3.5 kt	417	25112	1340
DITCHING - EASY	740 km	8600	170 km	2081	183 km	854	41 km	165	112 km	299	126 km	321	8600	770
DITCHING - RIP & EXCAVATE	164 km	6177	30 km	1246	27 km	657	13 km	169	140 km	1056	49 km	334	6177	590
DITCHING - DRILL & BLAST / ROCKSAW	130 km	18498	65 km	9434	8 km	603	4 km	272	27 km	979	4 km	126	18498	540
BENDING	1034 km	2419	265 km	618	218 km	421	58 km	94	279 km	238	179 km	143	2419	380
WELDING	1034 km	24183	265 km	6404	218 km	2893	58 km	678	279 km	1495	179 km	902	20139	2600
FIELD JOINTS	1034 km	8344	265 km	2138	218 km	1009	58 km	237	279 km	526	179 km	332	8344	900
RADIOGRAPHY	1034 km	8056	265 km	1997	218 km	823	58 km	213	279 km	431	179 km	278	6709	750
LOWER IN	1034 km	9864	265 km	2433	218 km	939	58 km	206	279 km	453	179 km	263	9864	856
TRENCH BREAKERS	50 No	34	200 No	140			30 No	16	650 No	194			34	0
WEIGHT COATING / SET - ON WEIGHTS	20 km	1565	30 km	2598	5 km	186					15 km	238	1303	150
BEDDING & BACKFILL	1034 km	10672	265 km	2871	218 km	1474	58 km	339	279 km	764	179 km	423	10672	1303
E/O FOR PADDING	680 km	29986	198 km	9439	98 km	3589	47 km	1389	184 km	2217	126 km	1484	29986	3270
RIVER & CREEK CROSSINGS (DREDGED)	470 m	373	4800 m	4070	770 m	445	180 m	94	1630 m	465	900 m	256	373	400
HORIZONTAL DIRECTIONAL DRILLING	580 m	694	7400 m	8428	100 m	185			2350 m	914	900 m	320	694	168
ROAD & RAIL CROSSINGS	20 No	780	39 No	1598	25 No	404	5 No	90	31 No	286	20 No	202	780	368
TIE INS	1034 km	6514	265 km	1667	218 km	865	58 km	183	279 km	384	179 km	225	5837	788
HYDRO TESTING	1034 km	7030	265 km	1801	218 km	984	58 km	205	279 km	479	179 km	315	6299	817
DEWATERING & DRYING	1034 km	7026	265 km	1783	218 km	766	58 km	212	279 km	530	179 km	335	6295	636
GROUND & AERIAL MARKERS	1034 km	1442	265 km	369	218 km	304	58 km	81	279 km	613	179 km	250	1442	304
RESTORATION INCL FENCES & GATES	1034 km	3560	265 km	716	218 km	680	58 km	166	279 km	290	179 km	384	3560	680
CATHODIC PROTECTION	1034 km	1438	265 km	398	218 km	345	58 km	100	279 km	545	179 km	190	1438	345
SURVEY & AS BUILTS	1034 km	2028	265 km	660	218 km	480	58 km	130	279 km	590	179 km	345	2028	480
PRECOMMISSIONING	ITEM	800	ITEM	380	ITEM	225	ITEM	125	ITEM	250	ITEM	160	800	225
sub total		204085		74401		23901		6331		16664		9848	189548	21752
STATIONS & FACILITIES														
SCRAPER LAUNCHER OR RECEIVER	1 No	678	2 No	1356	2 No	662	2 No	596	6 No	828	2 No	276	602	596
COMBINED LAUNCHER / RECEIVER	6 No	6642	1 No	1107					1 No	226			5897	
MAIN LINE VALVE STATIONS	11 No	6688	9 No	5472	8 No	1948	3 No	654	14 No	1638	8 No	936	5938	1744
INLET COMPRESSION STN (2 X MARS 100)	ITEM	31100											31100	
Tiboburra Compressor 1x T70													20000	
Pine Ridge Compressor 1 x T70													20000	
Young Compressor 1 x C50													13000	
BOOSTER COMPRESSION	ITEM	10000								1500				
OFFTAKE - PRESS REG & METER (DN50)					1 No	103								103
OFFTAKE - PRESS REG & METER (DN100)					1 No	339					7 No	2632		339
OFFTAKE - PRESS REG & METER (DN150)	1 No	580			2 No	1022			6 No	3480			580	1022
PRESS REG, HEATER & METER (DN100)			5 No	2183										
PRESS REG, HEATER & METER (DN300)							1 No	1575						
PRESS REG, HEATER & METER (DN750)			1 No	5014										
COMMUNICATIONS & SCADA	ITEM	6800	ITEM	1850	ITEM	580	ITEM	225	ITEM	530	ITEM	325	6800	580
MAINTENANCE BASES	1 No	4120	1 No	1650									4120	
YOUNG OPERATIONS CENTRE W. EQUIPMENT	ITEM	1000											1000	
CORPORATE OFFICE FITOUT & EQUIPMENT	ITEM	1500											1500	
sub total		69108		18632		4654		3050		8202		4169	110537	4384
Direct Project Costs		537118		152615		50819		14888		40058		23899	512751	46413
CAPITALISED SPARES 1.5%		1037		279		70		46		123		63	1658	66
OWNERS PROJECT COSTS 2%		10742		3052		1016		298		801		478	10255	928
EPCM 7.5%		40284		11446		3811		1117		3004		1792	38456	3481
ESCALATION COST 1.8%		10605		3013		1003		294		792		472	10136	916
PROJECT FINANCING COST 6.8%		40064		11364		3784		1109		2983		1780	38292	3456
CONTINGENCY 10%		58814		12633		4174		1223		3290		1963	56146	3812
TOTALS $'000	**698,665**		**194,403**		**64,677**		**18,974**		**51,051**		**30,446**		**667,695**	**59,071**
Estimated Project Cost ($'000s)	**$1,058,216**												**1,021,640**	
												Change	**-3.46%**	