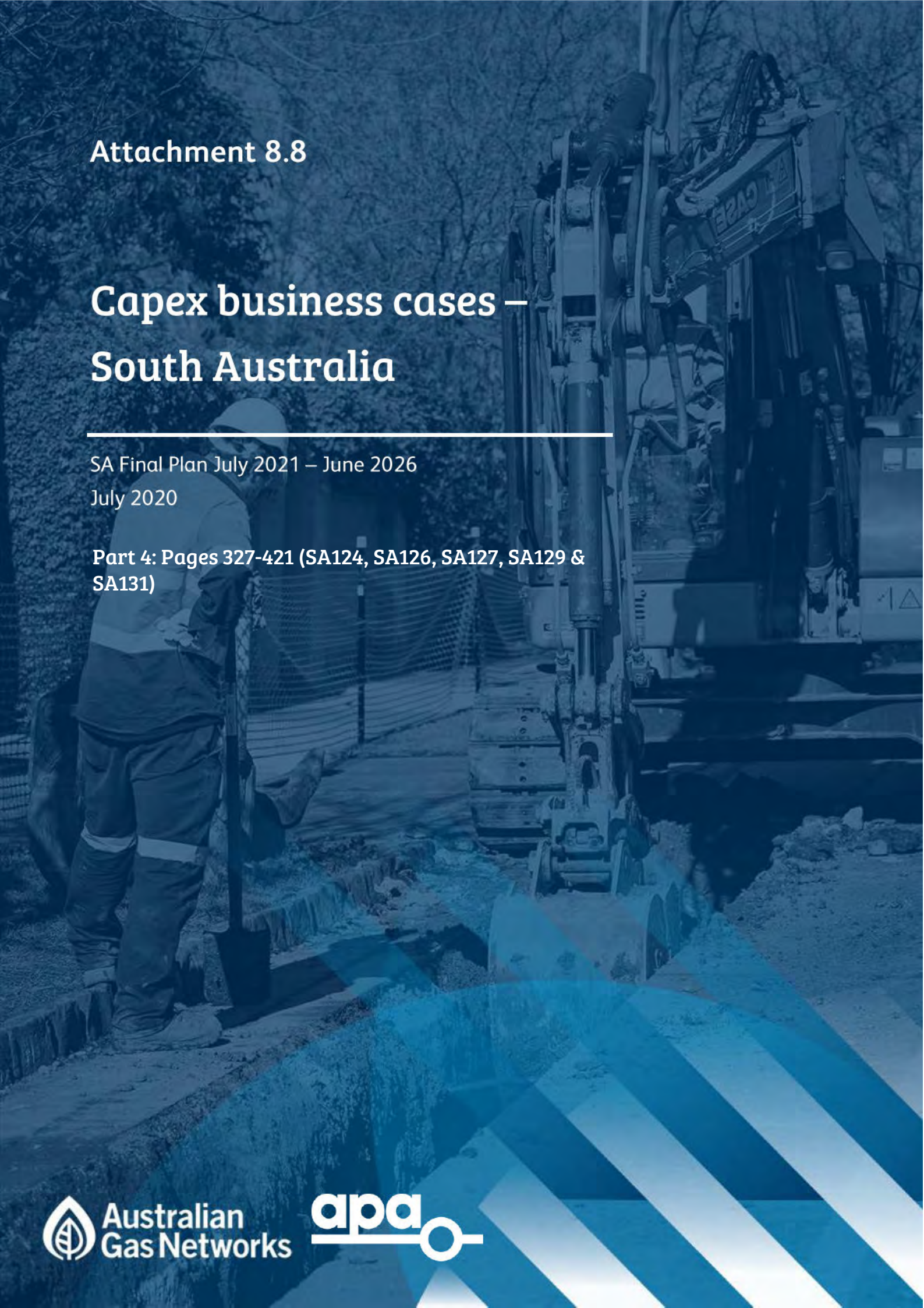

Attachment 8.8

Capex business cases – South Australia

SA Final Plan July 2021 – June 2026

July 2020

Part 4: Pages 327-421 (SA124, SA126, SA127, SA129 & SA131)

Australian Gas Networks

apa

Contents

SA124 – Kingsford Regional Industrial Estate

1.1 Project approvals

Table 1.1: Business case SA124 – Project approvals

Prepared by	David Holden, Senior Stakeholder Engagement Representative, APA
Reviewed by	Jason Morony, Manager Capital Delivery SA, APA
Approved by	Grant Macauley, Manager Business Development and Contracts, APA Mark Beech, General Manager Network Operations, AGN

1.2 Project overview

Table 1.2: Business case SA124 – Project overview

Description of the problem / opportunity	Kingsford Regional Industrial Estate (KRIE) is a 170 hectare site located between Gawler and Roseworthy, 46 km north of Adelaide. The KRIE has been identified by State Government as a key area for major industrial development, which has rezoned the area to encourage development of manufacturing and other industrial facilities. The KRIE is not currently connected to the natural gas network. Regional Development Australia and the local council have expressed a desire for gas supply in the area, and local businesses have indicated support for an extension of the natural gas network to the region. The KRIE is already home to a number of medium-to-large businesses. Expansion of the gas network to the industrial estate is expected to commence during 2021/22. We estimate the Kingsford development will result in around 10 new industrial and commercial (I&C) customer connections to the natural gas distribution network over 20 years. This business case considers the costs and benefits of connecting the Kingsford Regional Industrial Estate to the natural gas network.
Untreated risk	Not applicable. This project is not addressing an existing asset risk. The Kingsford project is growth-driven and is justified as it provides incremental revenues which exceed incremental costs (positive net present value).
Options considered	• **Option 1** – Connect KRIE to the Gawler high pressure network via Thiele Highway ($2.7 million) • **Option 2** – Maintain status quo, do not offer a gas supply to the area (no upfront capital costs, however the potential incremental revenue will be foregone) Additional technical options we considered were the extension of the existing steel transmission pipeline and/or a direct connection into the SEA Gas pipeline. However, as can be seen from Appendix A, the SEA Gas pipeline is too far from the Kingsford Regional Industrial Estate to make a direct connection economically viable. The additional excess capacity provided by a high pressure steel connection would improve security of supply in the region, but would provide a level of capacity above what is required in the near future. The existing high pressure polyethylene network is only 2km from the Kingsford estate. The estate is served by an established main road (Thiele Highway), so an obvious, safe, and economical pipeline route already exists. For these reasons, alternative technical solutions to Option 1 were not developed further in this business case.
Proposed solution	Option 1 is the proposed solution. Connecting KRIE to the Gawler network will provide a natural gas supply to the businesses already located at the industrial estate, as well as helping support further expansion of the site to accommodate more businesses. KRIE is located between two new housing developments (Roseworthy and Concordia), which suggests continued growth and new business and investment in the area is likely. Existing businesses at the Kingsford Estate have already expressed an interest in connecting to natural gas. We expect to connect five I&C customers during the next access arrangement (AA) period (July 2021 to June 2026).

	The KRIE connection returns the best NPV, and satisfies the incremental revenue test under the National Gas Rules. Option 2 (not supplying the KRIE) is not recommended, as the opportunity for new connections and incremental revenue will be foregone. Increasing the number of gas connections benefits all customers connected to the gas distribution network, as it means the total network costs are spread across a larger customer base.
Estimated cost	The forecast direct capital cost (excluding overhead) during the next AA period (July 2021 to June 2026) is $2.7 million.

$'000 2019/20	21/22	22/23	23/24	24/25	25/26	Total
Kingsford Regional Industrial Estate	2,661.8	-	-	-	-	2,661.8

Basis of costs	All costs in this business case are expressed in real unescalated dollars at December 2019 unless otherwise stated. Some tables may not add due to rounding.
Alignment to our vision	This investment aligns with Delivering for Customers as it will ensure existing and new businesses at the KRIE will have access to natural gas supply. The proposed solution is also Sustainably Cost Efficient, as it returns the best NPV, which is positive within 16 years, and increases the number of connections to the SA network, thereby helping spread costs across a larger customer base.
Consistency with the National Gas Rules (NGR)	**NGR 79(1)** – the proposed option is prudent as there is evidence of natural gas demand in the area and ongoing growth over the next 25 years. The increased number of connections means total network costs are spread over a larger customer base, which helps achieve the lowest sustainable cost of providing services. **NGR 79(2)** – proposed capex is justifiable under NGR 79(2)(b), as the present value of the expected incremental revenue generated as a result of the network expansion to KRIE exceeds the present value of the capital expenditure, returning the best NPV, which is positive within 16 years. **NGR 74** – the forecast costs and are based on the latest market rate testing and estimated demand in the region is based on evidence provided by developers and prospective customers. An NPV assessment has been conducted for the recommended option. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.
Treated risk	Not applicable.
Stakeholder engagement	We are committed to operating our networks in a manner consistent with the long-term interests of our customers. To facilitate this, we conduct regular stakeholder engagement to understand and respond to the priorities of our customers and stakeholders. Feedback from stakeholders is built into our asset management considerations and is an important input when developing and reviewing our expenditure programs. Our customers have told us their top three priorities are price/affordability, reliability of supply, and maintaining public safety. They also told us they expect us to deliver a high level of public safety. Making natural gas available to customer in the KRIE is consistent with our customers' priorities. Increasing the number of connections and maintaining the viability of natural gas as a complementary (and alternative) energy source to electricity helps spread network costs and keep gas affordable. More significantly, customers continually tell us during our engagements that they value natural gas and see it as an important part of the energy mix. It is therefore in keeping with customers' expectations for us to expand the network to areas where there is a clear demand for natural gas.
Other relevant documents	• Attachment 8.2 Strategic Asset Management Plan • Supporting Information 8.8.6 SA124 NPV & Options Analysis

1.3 Background

KRIE is a 170 hectare site located between Gawler and Roseworthy, 46 km north of Adelaide. The northern suburbs of Greater Adelaide have been identified as a major growth area for South Australia, forming part of the South Australian Government's 30-year growth strategy[96]. The KRIE is earmarked as a key area for industrial development, with State Government rezoning the area to encourage development of manufacturing and other industrial facilities.[97]

The KRIE is not currently connected to the natural gas network. While the estate and surrounding area is largely undeveloped, the KRIE is already home to a number of medium-to-large businesses, including a fabrication facility, a wine bottle storage facility, and a glass bottle manufacturer. The owner of these businesses has expressed strong support for bringing natural gas supply to the estate.[98]

Over the course of the last decade the local council, Regional Development Australia and the State Government have received multiple enquiries from investors seeking to locate their businesses and develop major industries in the KRIE. [99] A major barrier to securing those investors and regional jobs for South Australia has been the lack of natural gas supply available to the Estate.[100]

Some of the potential industries that have explored development at KRIE, but abandoned their interest due to lack of gas supply, include:

- pet food manufacturing (10,000 m^2 footprint);
- crematorium;
- ready-to-eat meal manufacturing; and
- pharmaceutical manufacturing.

The capital value of these industrial developments is in the multi millions, with the potential to provide up to one hundred local jobs.[101]

The natural gas network currently extends as far north as Willaston, in the north Gawler Region. The closest high pressure network point to the Kingsford Estate is approximately 2km south of the estate, on Horrocks Highway (see map provided in Appendix A). Given the expected demand for natural gas in the Kingsford Regional Industrial Estate and surrounds, we propose to extend the high pressure network north from Horrocks Highway along Thiele Highway to the Kingsford Estate.

1.3.1 Expected demand for natural gas

We propose to extend the natural gas network to the Kingsford Estate during 2021/22. Based on expected growth in the area, combined with demand from already established businesses, we expect to connect five I&C customers within the next AA period (July 2021 to June 2026).[102]

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96 https://livingadelaide.sa.gov.au/

97 Light Regional Council Development Plan December 2016.

98 Letter from Ahrens Group, September 2019, provided in Appendix C.

99 Letter from Department of Trade and Investment, provided in Appendix C.

100 Letter from Light Regional Council, August 2019, provided in Appendix C.

101 Ibid.

102 This estimate is based on connection enquiries to date, and advice from the SA Department for Trade and Investment, who confirmed they have received four or five enquiries relating to commercial development of the Kingsford Estate in the past five years (see Appendix C).

We estimate the KRIE development will result in around 10 new I&C customers connecting to the natural gas distribution network over 20 years. This estimate is based on discussions with the Kingsford Regional Industrial Estate developer, local council and local I&C businesses.

It is also worth noting KRIE is located in between two new residential estate that are under development; Roseworthy and Concordia. We have already begun commencing expansion and reticulation of the natural gas network into the Roseworthy area, and plan to expand the network to supply Concordia over the next five years. This supports our view that growth in the area is likely to be strong, and suggests Kingsford is likely to attract further I&C customers as the local population increases.

From a resourcing perspective it makes economic sense to undertake the KRIE expansion works at or around the same time as we plan to deliver the Roseworthy and Concordia works, given the developments are all in the same region. This will facilitate a consolidated and coordinated planning phase that allows us to achieve pipeline alignment efficiencies, improve hydraulic network design, maximise common trenching opportunities and deliver economies of scale regarding construction.

The Light Regional Council has also expressed a desire for delivering the KRIE expansion concurrently with the Roseworthy development:

> *The supply of gas into KRIE would be a game-changer for regional South Australia's competitive advantage when compared to interstate industrial precincts. Our liaison with APA Group to plan for the supply of natural gas into the Roseworthy Township Expansion (RTE, adjacent the KRIE) is a significant step towards the provision of a supply into KRIE.*
>
> *We strongly urge you to plan for the supply of natural gas into the KRIE concurrently with the RTE works, such that industries are able to make KRIE investment decisions with confidence. Council is currently preparing investment prospectuses for a number of precincts, including the KRIE, and is therefore expecting additional interest for developments in this area. We would love to be able to state that gas is (or will be) available to this area in those marketing documents.*[103]

1.4 Risk assessment

Risk management is a constant cycle of identification, analysis, treatment, monitoring, reporting and then back to identification (as illustrated in Figure 1.1). When considering risk and determining the appropriate mitigation activities, we seek to balance the risk outcome with our delivery capabilities and cost implications. Consistent with stakeholder expectations, safety and reliability of supply are our highest priorities.

Figure 1.1: Risk management principles

The KRIE expansion is driven by forecast growth. There is therefore no current or underlying supply, safety or failure risk associated with existing assets in Kingsford.

[103] Ibid.

1.4.1 Risk associated with not connecting the KRIE

If the KRIE expansion project is not delivered, an opportunity for efficiently increasing the number of I&C customer connections to the South Australian gas distribution network will be foregone. Under the price cap form of regulation, by increasing the number of customer connections, the costs of operating, maintaining and expanding the network are spread across a larger customer base. This means the cost to serve each customer is lower, and the impact on customers' bills is less.

More significantly, there is sufficient evidence from the local authorities and prospective customers in the Kingsford region that a natural gas connection is desired. Light Regional Council has expressed a desire to bring natural gas to the region to promote investment in the KRIE. We would therefore be exposed to some reputational risk if we choose not to provide a reliable and affordable natural gas supply where it is desired by customers.

1.5 Options considered

Essentially, there are two options with regard to providing a natural gas supply to the KRIE:

- Option 1 – Connect KRIE to the Gawler high pressure network via Thiele Highway; or
- Option 2 – Maintain status quo, do not offer a gas supply to the area.

Given the proximity of the KRIE to the northern extremity of the Gawler network and the already established Thiele Highway, there is only one economical and technically feasible pipeline route for connecting the estate to the high pressure network (via Thiele Highway). As a result, no alternative pipeline routes have been considered.

We have given thought to the timing of the project, and during initial project scoping considered whether there is merit in delaying or deferring the KRIE connection. The KRIE while home to some businesses, is largely undeveloped. As a result, delivering the work now would be less expensive and cause considerably less disruption to customers (akin to a greenfield project) than if we were to wait and install the pipeline when the site is developed further.

Moreover, one of the reasons why the estate remains largely undeveloped is due to the absence of gas. Businesses are unlikely to locate at Kingsford Regional Industrial Estate until natural gas supply is available[104], therefore there is little value in waiting for the demand to occur organically before extending the main to the estate.

Developing the project now makes economic sense, particularly given the demand for natural gas in the area is relatively certain. In addition, the local council has strongly urged us to deliver the project concurrently with the Roseworthy expansion, which will be delivered during the current and next AA periods.

We therefore consider deferring the KRIE expansion would not be a prudent or efficient option and have not pursued it further in this business case.

These two options (to connect or not to connect) are discussed in the following sections.

[104] Refer to supporting letters from stakeholders provided in Appendix C.

1.5.1 Option 1 – Connect KRIE to the Gawler high pressure network via Thiele Highway

Under this option, we would connect the KRIE to the existing Gawler natural gas distribution network. This would involve connecting to the high pressure mains at Horrocks Highway, and extending north along Thiele Highway to the estate.

We would install 2 km of DN280 polyethylene trunk main, running along Thiele Highway, and a total of 1.5 km of DN180 polyethylene within the estate. Refer to Appendix A for a map of the proposed mains extension.

During the next AA period we expect to connect 5 new I&C customers within the KRIE.

1.5.1.1 Cost assessment

The direct cost of this option is $2.7 million (see Table 1.3).

Table 1.3: Cost estimate – Option 1, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Trunk mains DN280 / DN180	2,661.8	-	-	-	-	2,661.8
Total ($)	**2,661.8**	**-**	**-**	**-**	**-**	**2,661.8**

The inlets & meters cost of this option is $0.1 million over the next AA period, as provided in Table 1.7. Note that approval of these costs is not sought as part of this business case. These costs are forecast at a macro level and are included as part of our growth capex forecast. This is included in the provided capex model and reflects:

- the number of connections estimated in our demand forecast; and
- the average unit rate provided in our unit rate document.

Table 1.4: Reticulation costs – Option 1, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Inlets	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Meters	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total ($)	**8.7**	**8.7**	**8.7**	**8.7**	**8.7**	**43.4**

Refer to Appendix B for a more detailed cost breakdown.

1.5.1.2 Alignment with vision objectives

Table 1.5 shows how Option 1 aligns with our vision objectives.

Table 1.5: Alignment with vision – Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	-
Delivering for Customers – Reliability	-
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	-
A Good Employer – Employee Engagement	-

Vision objective	Alignment
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	-
Sustainably Cost Efficient – Delivering Profitable Growth	Y
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 1 aligns with our objective of *Delivering for Customers*, as it will ensure customers who want to connect to natural gas, can connect to natural gas.

Option 1 also aligns with our objective of being *Sustainably Cost Efficient*, as expanding the network to serve KRIE will increase the number of network connections, spreading the total network costs over a larger customers base. Installing the distribution assets now, while the site is largely undeveloped is also the most efficient method of providing natural gas supply.

1.5.2 Option 2 – Maintain status quo

Under this option we would not extend the network into the KRIE, and no additional capex would be incurred.

1.5.2.1 Cost assessment

While there are no additional upfront costs associated if we maintain the status quo, we will forego the opportunity for incremental revenue from up to 10 new I&C connections over the next 20 years.

1.5.2.2 Alignment with vision objectives

Table 1.6 shows how Option 2 aligns with our vision objectives.

Table 1.6: Alignment with vision – Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	-
Delivering for Customers – Reliability	-
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	-
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	-
Sustainably Cost Efficient – Delivering Profitable Growth	N
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 2 would not align with *Delivering for Customers*, as business in KRIE that want a natural gas connection will not be able to connect to the network. Option 3 would also not be *Sustainably Cost Efficient*, as it would not deliver profitable growth in the network.

1.6 Summary of costs and benefits

Table 1.7 presents a summary of how each option compares in terms of the estimated cost, the residual risk rating, and alignment with our objectives.

To assess which solution is likely to cost the most over time, we have conducted a net present value assessment of Option 1. We have not included Option 2 (maintaining the status quo) in the NPV assessment as no costs or incremental revenue would be incurred under this option.

Table 1.7: Comparison of options

Option	Estimated cost ($ million)	Alignment with vision objectives	25yr NPV ($ million)
Option 1	2.7	Aligns with Delivering for Customers and Sustainably Cost Efficient	1.8
Option 2	-	Does not align with Delivering for Customers or Sustainably Cost Efficient	n/a

We considered additional technical options including the extension of the existing steel transmission pipeline and/or a direct connection into the SEA Gas pipeline. However, as can be seen from Appendix A, the SEA Gas pipeline is too far from the KRIE to make a direct connection economically viable. Moreover, while the additional excess capacity provided by a high pressure steel connection would improve security of supply in the region, it would provide a level of capacity above what is required in short-to-medium term.

The existing high pressure polyethylene network is only 2km from the KRIE. The estate is served by an established main road (Thiele Highway), so an obvious, safe, and economical pipeline route already exists.

For these reasons, alternative technical solutions to Option 1 were not developed further in this business case.

1.7 Recommended option

Option 1, connecting KRIE to the Gawler network via Thiele Highway, is the recommended option.

1.7.1 Why is the recommended option prudent?

There is sufficient evidence of demand for natural gas in the area. The State Government, local businesses and local authorities have expressed a desire for a natural gas supply, and see it as integral to ongoing economic growth in the region. The industrial estate is already served by a main road, and is only located 2 km north of the existing polyethylene network. A safe an accessible pipeline connection route along Horrocks Highway and Thiele Highway is therefore already established.

Option 1 returns the best NPV, which is positive over 16 years, and results in an NPV of $1.8 million after 25 years. As a result, it passes the incremental revenue test specified under NGR 79(2)(b).

Connecting to the existing Gawler network now will enable new businesses to connect immediately and will drive faster growth than if we were to wait for organic growth to occur.

Option 2 (not supplying the KRIE) is not recommended, as the opportunity for new connections and incremental revenue will be foregone.

1.7.2 Estimating efficient costs

Key assumptions in the cost estimation include:

- the cost estimate is based on costing the activities that comprise the work breakdown structure;
- the rates utilised in costing these activities are based on current vendor and contractor rates in 2019 and historical costing; and

- the distribution assets will be installed along the accessible Horrocks Highway/Thiele Highway route identified.

This project will be delivered using a combination of internal and external resources. The project will be initiated internally by the asset manager. Design, project management and installation will be completed by contractors. Contractors will be selected through a competitive tender process. Quality assurance and project closure will be handled by internal resources.

Current project delivery practices and controls such as advanced planning and scheduling of work are in place to effectively manage risk in delivery. The risk of not completing this project is considered to be low. Delivery of this project is planned to be phased over the AA period.

The forecast cost breakdown is shown in the table below, which includes the delivery of the trunk mains (the subject of this Business Case) and also the associated reticulation costs to connect the new customers.

Table 1.8: Cost estimate – $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Trunk cost ($[redacted]/m)	**2,661.8**	-	-	-	-	**2,661.8**
No. of inlets	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Inlet costs ($[redacted] inlet)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
No. of meters	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Meter cost ($[redacted]/meter)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total	**2,670.5**	**8.7**	**8.7**	**8.7**	**8.7**	**2,705.2**

The following table shows the costs escalated to June 2021 dollars.

Table 1.9: Escalated cost estimate ($'000 2020/21)

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Total unescalated trunk only ($ Dec 19)	2,661.8	-	-	-	-	2,661.8
Escalation	89.7	-	-	-	-	89.7
Total escalated ($ Jun 21)	**2,751.5**	-	-	-	-	**2,751.5**

1.7.3 Consistency with the National Gas Rules

In developing these forecasts, we have had regard to Rule 79 and Rule 74 of the NGR. With regard to all projects, and as a prudent asset manager, we give careful consideration to whether capex is conforming from a number of perspectives before committing to capital investment.

Rule 79(1)

The proposal to conduct the necessary network expansion works to connect the Kingsford development is consistent with the requirements of NGR 79(1). Specifically, we consider that the capital expenditure is:

- Prudent – the expenditure is necessary in order to supply natural gas to new customers. The local council and customers has expressed a desire to offer natural gas to residents, and historical penetration rates indicate that substantial demand for natural gas will occur. The proposed asset design is consistent with accepted industry practice and current standards, and will enable new customers to connect immediately. Practicable options have been considered, and the most prudent option to support the ongoing growth and integrity of the network has been considered. The proposed expenditure is therefore consistent with that which would be incurred by a prudent service provider.

- Efficient – installing the natural gas distribution assets along an established, easily accessible highway corridor is the most efficient solution. The forecast costs have been developed using current vendor rates and historical precedent. The preferred option returns the best NPV.

- Consistent with accepted industry practice – the recommended technical solution is consistent with current standards, and is the most economical solution to connect KRIE to the Gawler network.

- To achieve the lowest sustainable cost of delivering pipeline services – the proposed option has the lowest direct costs and returns a positive NPV after 16 years. Increasing the number of customers connected to the network helps spread total network costs over a larger customers base and helps us deliver pipeline services at a lower cost per customer.

NGR 79(2)

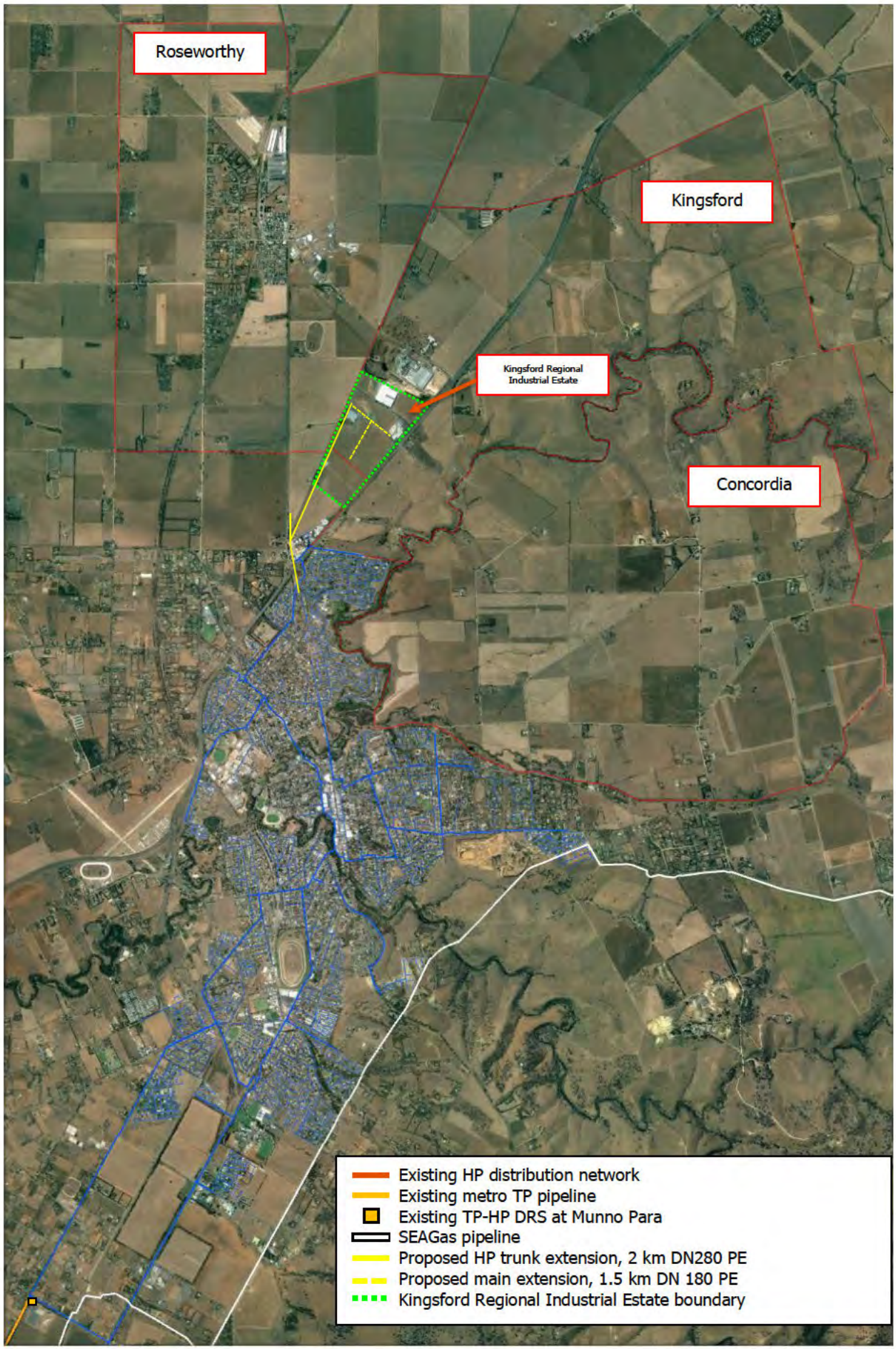
The proposed capex is justifiable under 79(2)(b) as the present value of the expected incremental revenue generated as a result of the network expansion and reticulation into KRIE exceeds the present value of the capital expenditure, returning the best NPV.

NGR 74

The forecast costs are based on the latest market rate testing and estimated demand in the region is based on evidence provided by developers and prospective customers. We have also used precedent set in similar network expansions to inform the forecast number of connections and penetrations rates. An NPV assessment has been conducted for the recommended option. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

Appendix A – Asset location map

A.1: Indicative location of proposed assets



A.2: Concordia Land Management master plan

Appendix B – Cost estimates

Cost Estimate – trunk main (2 km of DN280 and 1.5 km of DN180)

Category	Description	Units	Units QTY	Number of sites	Unit Cost $/ unit	Total $'000
Materials						
Pipe, valves and fittings	DN280 polyethylene pipe, valves and fittings	metres	[redacted]	[redacted]	[redacted]	[redacted]
	DN180 polyethylene pipe, valves and fittings	metres	[redacted]	[redacted]	[redacted]	[redacted]
Other	Freight, storage, and handling	each	[redacted]	[redacted]	[redacted]	[redacted]
Total Materials						[redacted]
Labour						
Project management, design and initiation	Project manager	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Project engineer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Planning engineer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	GIS technician	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Draftsperson	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Site Supervisor	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Compliance and communication officer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	HSE representative	hours	[redacted]	[redacted]	[redacted]	[redacted]
Project site labour and delivery (2.0 Km of DN280)	Contractor rate (based on historical rates)	metres	[redacted]	[redacted]	[redacted]	[redacted]
	Reinstatement (based on historical rates)	metres	[redacted]	[redacted]	[redacted]	[redacted]
	Traffic Control (based on historical rates)	metres	[redacted]	[redacted]	[redacted]	[redacted]
Project site labour and delivery (1.5 Km of DN180)	Contractor rate (based on historical rates)	metres	[redacted]	[redacted]	[redacted]	[redacted]
	Reinstatement (based on historical rates)	metres	[redacted]	[redacted]	[redacted]	[redacted]
	Traffic Control (based on historical rates)	meters	[redacted]	[redacted]	[redacted]	[redacted]
	Survey Alignment, land acquisition and third party permits	each	[redacted]	[redacted]	[redacted]	[redacted]

Category	Description	Units	Units QTY	Number of sites	Unit Cost $/ unit	Total $'000
	Non destructive testing	each	[redacted]	[redacted]	[redacted]	[redacted]
	Pressure testing (hydro test)	each	[redacted]	[redacted]	[redacted]	[redacted]
	Commissioning	each	[redacted]	[redacted]	[redacted]	[redacted]
Total Labour						[redacted]
Grand Total						**2,661.8**

Appendix C – Supporting letters

C.1: Letter from SA Department for Trade and Investment

Government of South Australia
Department for Trade and Investment

Mr David Holden
Business Development Manager
Australian Gas Infrastructure Group
330 Grange Road
KIDMAN PARK SA 5025
Email: David.Holden@agig.com.au

Dear Mr Holden

Thank you for your email dated 20 May 2020 regarding the possible extension of gas infrastructure to Kingsford Industrial Estate.

I can advise that we have received four or five enquiries over the past five years pertaining to commercial development at Kingsford Industrial Estate by food manufacturers, including by a pet food manufacturer, and a ready meal manufacturer.

I can confirm that in each case limited access, or significant establishment costs for connecting to an adequate industrial gas supply in a timely manner, were the reasons Kingsford Industrial Estate was not selected either for shortlisting or as the preferred location.

Thankyou for your enquiry, and please contact me if any further information is required.

Yours sincerely

Nicolle Sincock
DIRECTOR

2 / 6 / 2020

Food, Wine and Agribusiness Division
Level 6, The Conservatory, 131-139 Grenfell Street, Adelaide SA 5000 | GPO Box 320, Adelaide SA 5001 | DX541
Tel (+61) 08 8303 2400 | Fax (+61) 08 8226 9533 | ABN: 93360648417

C.2: Letter from Ahrens Group

Ahrens Group Pty Ltd ABN 76 114 260 230
Wilhelm Road, Kingsford SA 5118 PO Box 2, Sheaoak Log SA 5371
T +61 8 8521 0000 F +61 8 8521 0099 W ahrens.com.au

Ahrens

6 September 2019

Mr David Holden
Gas Development Representative
APA Group
PO Box 171
Findon SA 5023

Dear David

Natural Gas Supply to the Kingsford Industrial Estate

The Ahrens Group Kingsford Industrial Estate development, forms part of the greater Kingsford Regional Industrial Estate precinct, bounded by the Sturt Highway, the Thiele Highway and Argent Road to the north. The site is ideally located at the junction of existing major freight routes linking key food and wine regions of the Barossa Valley and Riverland districts via the Sturt Highway and the wine, livestock, grain and fodder production areas of the Mid North districts via the Horrocks and Thiele Highway, through to the Port of Adelaide via the Northern Expressway and the Northern Connector project currently under construction.

The Kingsford Industrial Estate provides unique capability to support large industrial development with direct access to major freight routes with established buffer zones to existing and planned future residential development. Close proximity to the townships of Gawler and Roseworthy and easy commuting distance to townships within the Barossa Valley, Kapunda, Freeling and surrounding areas as well as the Northern suburbs area within the City of Playford and City of Salisbury, provides much needed employment opportunities and access to a skilled manufacturing and production workforce.

Apart from the current established industries within the Kingsford site, being the Ahrens Group fabrication facility, a wine bottle storage warehouse and the Orora glass bottle manufacturing facility, the estate remains largely undeveloped. Over the course of the last decade there has been interest from a number of businesses looking to establish manufacturing and production facilities on the site. To date, the lack of available natural gas supply has been a major impediment to each of the proposed developments proceeding.

Some of the industries which have not been able to proceed due to due to lack of natural gas supply, include:

- Ready-to-eat meal processing facility
- Pet Food processing facility
- Pharmaceutical processing facility

The scale of this development is demonstrated through some of the preliminary architectural designs attached.

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Ahrens

The supply of Natural gas to the Kingsford Estate will provide significant opportunity through the availability of energy to enable development of world class manufacturing and processing facilities for the benefit of the local region and South Australia as a whole. The Ahrens Group strongly supports this proposal.

Please do not hesitate to contact me via telephone 08 8521 0000 if you wish to discuss this matter further

Yours sincerely,

Brian Sickerdick
Project Manager

C3: Letter from Light Regional Council

Doc ID: 389708

21 August 2019

LIGHT REGIONAL COUNCIL

David Holden
Gas Development Representative
APA Group
PO Box 171
Findon SA 5023

Dear David

Natural Gas Supply to Kingsford Regional Industrial Estate

The Kingsford Regional Industrial Estate (KRIE) is a 170 hectare estate bounded by the Sturt Highway, the Thiele Highway, Argent Road to the north and existing industrial land to the south. Kingsford Industrial Estate was identified by the State Government as a key area for major industrial development, and was rezoned under a Ministerial Development Plan Amendment to support development of the Orora glass bottle manufacturing facility. Apart from an engineering fabrication facility and a wine bottle warehouse the estate remains largely un-developed and used for cropping. Development of the Estate is essential to the expansion of industry in the northern region of Adelaide, and will provide employment opportunities for the surrounding area.

Over the course of the last decade the Council, Regional Development Australia and (former State Government Department) Investment Attraction South Australia has received multiple enquiries from investors seeking to locate their businesses and develop major industries in the KRIE. A major barrier to securing those investors and regional jobs for South Australia has been the lack of natural gas supply available to the Estate.

Some of the potential industries that have explored development at KRIE, but abandoned their interest due to lack of gas supply, include:

- Pet food manufacturing (10,000m^2 footprint)
- Crematorium
- Ready-to-eat meal manufacturing
- Pharmaceutical manufacturing

The capital value of these industrial developments is in the multi millions, with 10's-100's of local jobs.

The importance of industrial development within KRIE will be highlighted in the Council's Economic Development Plan which is currently under preparation. An economic analysis report by Lucid Economics shows that manufacturing, underpinned by the glass bottling and wine sector, is the largest industry in Light Regional Council and accounts for 1/3rd of the local value-add economy.

Manufacturing at KRIE has been highlighted as a key growth industry opportunity for Light Regional Council, having a local competitive advantage with excellent access to interstate transport routes and suitably zoned land with buffers all around to sensitive receptors.

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Telephone: (08) 8525 3200
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93 Main Street, Kapunda, SA 5373

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12 Hanson Street, Freeling, SA 5372

Light Regional Council ABN: 33 455 841 625

The supply of gas into KRIE would be a game-changer for regional South Australia's competitive advantage when compared to interstate industrial precincts. Our liaison with APA Group to plan for the supply of natural gas into the Roseworthy Township Expansion (RTE, adjacent the KRIE) is a significant step towards the provision of a supply into KRIE.

We strongly urge you to plan for the supply of natural gas into the KRIE concurrently with the RTE works, such that industries are able to make KRIE investment decisions with confidence. Council is currently preparing investment prospectuses for a number of precincts, including the KRIE, and is therefore expecting additional interest for developments in this area. We would love to be able to state that gas is (or will be) available to this area in those marketing documents.

Please do not hesitate to contact me on telephone 8525 3200 should you wish to discuss the content of this letter further.

Yours sincerely,

Kieren Chappell
General Manager, Economic Development

C4: Letter from Regional Development Australia

Regional Development Australia
BAROSSA • GAWLER • LIGHT • ADELAIDE PLAINS

6 September 2019

ABN 70 509 677 325

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Mr David Holden,
APA Group,
Networks Commercial
David.holden@apa.com.au

Dear David

Proposed Extension of Gas Supply to Kingsford Industrial Estate

Regional Development Australia Barossa (RDAB) supports the extension of gas supply infrastructure to Kingsford Industry Estate at Roseworthy.

Kingsford is the most important industrial land in the wider Barossa region, and is home to significant elements of the wine industry supply chain including bottle manufacture, bottling plant, storage and transport and Ahrens Group – industrial, mining and farm construction manufacture and services. Adjacent Roseworthy light industry park also has complementary advanced manufacturing and advanced agri-technology and agri-services businesses. Roseworthy (agriculture and animal and veterinarian sciences) Campus of Adelaide University is also nearby offering important R & D capability to resident businesses.

Limiting factors in further development of this industry park have been stormwater management and gas supply to the site. The stormwater management plan is in implementation with the expansion of Roseworthy township and a comprehensive stormwater management plan.

Accordingly it is timely to now extend gas to the site and facilitate further significant investment in the manufacturing and agri-services supply chain. The wider area is experiencing substantial population growth and to support and maintain that growth, jobs – sustainable jobs – are required. The calibre of existing park residents gives confidence in the calibre of future investment there.

RDA BGLAP supports the proposal for timely, catalyst investment in gas supply.
Yours Sincerely,

Anne Moroney, CEO

An Australian Government Initiative

Government of South Australia

The Barossa Council

Gawler

Light Regional Council

Adelaide Plains Council

SA126 – Cathodic Protection Remote Monitoring

1.1 Project approvals

Table 1.1: Business case SA126 – Project approvals

Prepared by	Peiman Vakili, Gas Networks and Pipeline Engineer, APA
Reviewed by	Robin Gray, SA Operations Manager, APA
Approved by	Craig Bonar, Head of Engineering and Planning Networks, APA Mark Beech, General Manager Network Operations, AGN

1.2 Project overview

Table 1.2: Business case SA126 – Project overview

Description of the problem / opportunity	The South Australia (SA) natural gas distribution networks include approximately 200 km of metropolitan steel transmission pressure (TP) pipelines and 200 km of steel distribution pipelines, which deliver gas to over 450,000 customers. Cathodic Protection (CP) assets are used to protect steel pipelines against corrosion. These assets consist of sacrificial anodes and impressed current cathodic protection (ICCP) units, and are monitored by test points installed along the transmission and distribution pipelines. With our ageing transmission pipeline infrastructure (30-45 years) and with an increasing number of other assets underground that can interfere with cathodic protection measures, it is prudent to install proactive cathodic protection monitoring. The installation of CP monitoring units on transmission pipelines is considered good industry practice and in recent years the cost of monitoring equipment has reduced significantly. It is now considered cost-effective for the additional asset management benefits, in particular as reactive repairs/replacement cost 2 to 5 times the amount of proactive maintenance. Benefits include the ongoing asset integrity measurement of our key high value and high risk assets, identifying faults earlier, avoiding short term expensive reactive costs and better informing asset management plans to maximise asset life. This business case considers installing [redacted] remote monitoring units on CP test points on our transmission pipelines that are capable of sending data to the Supervisory Control and Data Acquisition (SCADA) system. This will result in a remotely monitored solution for early detection of CP defects, which will help reduce the risk of accelerated corrosion.
Untreated risk	As per risk matrix = **Moderate**
Options considered	• **Option 1** - Install remote CP monitoring on [redacted] test posts in the Adelaide Metropolitan TP system ($0.5 million) • **Option 2** – Maintain status quo (no additional upfront capital cost)
Proposed solution	Option 1 is the proposed solution because: • the reducing cost of monitoring equipment in recent years enables procurement and installation of devices at a reasonable cost; • the solution aligns with industry practice for pipelines and facilitates early detection of CP defects in comparison to six monthly voltage potential surveys; and • CP remote monitoring significantly reduces the risk of undetected accelerated corrosion and incidents between CP surveys on assets that are already 30 to 45 years old.
Estimated cost	The forecast direct capital cost (excluding overhead) over the next access arrangement (AA) period (July 2021 to June 2026) is $0.5 million.

	$'000 2019/20	**21/22**	**22/23**	**23/24**	**24/25**	**25/26**	**Total**
	CP remote monitoring	301.4	175.8	-	-	-	477.2
Basis of costs	All costs in this business case are expressed in real unescalated dollars at December 2019 unless otherwise stated. Some tables may not add due to rounding.						
Alignment to our vision	This project aligns with the Delivering for Customers aspect of our vision. It delivers for customers by mitigating the risk to public health & safety, as well as ensuring security and reliability of gas supply. It also links to the Sustainably Cost Efficient aspect of our vision. Installing proactive monitoring is a cost effective solution to address this issue of CP system integrity, with the long term costs of a reactive asset replacement being greater than proactive monitoring and scheduled replacement.						
Consistency with the National Gas Rules (NGR)	This project complies with the following National Gas Rules (NGR): **NGR 79(1)** – the proposed solution is consistent with good industry practice, several practicable options have been considered, and market rates have been tested to achieve the lowest sustainable cost of providing this service. **NGR 79(2)** – proposed capex is justifiable under NGR 79(2)(c)(ii), as it is necessary to maintain the integrity of services. **NGR 74** – the forecast costs are based on the latest market rate testing and project options consider the asset management requirements as per the latest Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.						
Treated risk	As per risk matrix = **Low**						
Stakeholder engagement	We are committed to operating our networks in a manner that is consistent with the long-term interests of our customers. To facilitate this, AGN conducts regular stakeholder engagement to understand and respond to the priorities of our customers and stakeholders. Feedback from stakeholders is built into our asset management considerations and is an important input when developing and reviewing our expenditure programs. Our customers have told us their top three priorities are price/affordability, reliability of supply, and maintaining public safety. They also told us they expect AGN to deliver a high level of public safety and are satisfied that this is current practice. The proposed CP monitoring program represents a shift to proactive asset management, which results in earlier detection of corrosion and lower short term reactive costs and improved long term asset planning. Proactively installing monitoring helps address the public safety risk and is therefore consistent with the current safety practices customers have told us they value. Undertaking the proposed program will also help maintain reliability of supply at the lowest sustainable cost, minimising the impact on customers' gas bills.						
Other relevant documents	• Attachment 8.2 Strategic Asset Management Plan						

1.3 Background

The SA natural gas distribution networks include approximately 200 km of metropolitan steel TP pipelines and 200 km of steel distribution pipelines, which deliver gas to over 450,000 customers. Most of the TP pipelines in the Adelaide metropolitan area are 30 to 45 years old. Coating defects, metal loss and corrosion defects have been identified on a number of these TP pipelines (e.g. M21, M53, and M12), which has led us to review the effectiveness of our corrosion detection and treatment capabilities.

Most of our transmission and distribution steel pipelines are protected by CP. CP is the utilisation of the electrical properties of the steel pipes to provide a system for the protection of the buried pipes

against corrosion. Remote monitoring of CP data is considered industry good practice and allows for proactive detection of when the pipeline is not fully cathodically protected. If loss of CP were to occur on these pipelines as a result of CP unit faults, insulating joints or flanges failing, interference from other companies' CP systems or being earthed by other asset contact, remote monitoring can be used to detect the reduced CP.

Currently, reduced CP is identified via the six monthly survey. Remote monitoring will allow reduced protection to be identified immediately, which can help reduce corrosion acceleration. Remote monitoring of CP provides a sample of data sufficient to analyse the efficiency of CP units generally.

Figure 1.1: - Remote monitoring units installed as part of CP for transmission pipelines

Performance of a CP system can be affected by other infrastructure and natural phenomenon, as listed in AS 2832.1. A sample of these are:

- stray currents from third party pipelines that are CP protected;
- stray currents from railways (electric) and high voltage power lines;
- latent soil conditions (pH, degree of aeration, dissolved salts);
- telluric effects (altering of the earth's magnetic field due to the sun); and
- soil conductivity (rainfall, water table movement).

The CP system creates an electrical circuit that utilises the conductivity of the soil, thus the resistivity of the surrounding soil also affects the performance. Resistivity changes with soil moisture at pipeline depth, thus in periods of prolonged drought CP performance can be reduced.

CP systems are currently monitored by driving to each test post and measuring the CP voltage potential. These readings are taken every six months on transmission and distribution pipelines by a CP technician. However, there are some deficiencies with this approach:

- transient loss of protection is not detected unless the occurrence is aligned with an inspection, such as telluric or stray current activity;

- equipment failure or anode depletion is not detected until the next inspection;
- reverse polarity (the pipeline becomes the sacrificial anode) is not detected until the next inspection; and
- unknown events such as stray currents leading to repeated transient loss of protection are not normally detected.

Advances in digital technology have reduced the cost and size of CP remote monitoring systems. In the past, these systems have only been economically justified when CP units are located in extremely remote areas. Today small, robust, battery powered devices using wireless technology are available for a significantly lower cost. These units can use the mobile telecommunications network to transmit data. Moreover, reactive repairs/replacement cost 2 to 5 times the amount of proactive maintenance.

Two types of CP are used in the Adelaide metropolitan gas network; sacrificial anodes, and impressed current cathodic protection (ICCP). Sacrificial anodes are installed in some areas of the distribution system. The metropolitan gas distribution network contains 2,405 sacrificial anodes monitored through 2,224 test points over multiple CP control areas.

There are 13 ICCP units installed in the network, which are used to provide corrosion protection for transmission pipelines and parts of the distribution steel mains. SCADA monitoring is installed on the ICCP units, but this only allows remote monitoring of CP only at the location of these units. It is beneficial to be able to remotely monitor the CP voltage potential at the test posts located between the ICCP units in order to determine the efficiency of the CP system.

1.4 Risk assessment

Risk management is a constant cycle of identification, analysis, treatment, monitoring, reporting and then back to identification (as illustrated in Figure 1.2). When considering risk and determining the appropriate mitigation activities, we seek to balance the risk outcome with our delivery capabilities and cost implications. Consistent with stakeholder expectations, safety and reliability of supply are our highest priorities.

Figure 1.2: Risk management principles

Our risk assessment approach focuses on understanding the potential severity of failure events associated with each asset and the likelihood that the event will occur. Based on these two key inputs, the risk assessment and derived risk rating then guides the actions required to reduce or manage the risk to an acceptable level.

AGN's risk management framework is based on:

- AS/NZS ISO 31000 Risk Management – Principles and Guidelines;
- AS 2885 Pipelines-Gas and Liquid Petroleum; and
- AS/NZS 4645 Gas Distribution Network Management.

The Gas Act 1997 and Gas Regulations 2012, through their incorporation of AS/NZS 4645 and the Work Health and Safety Act 2012, place a regulatory obligation and requirement on AGN to reduce risks rated high or extreme to low or negligible as soon as possible (immediately if extreme). If it is

not possible to reduce the risk to low or negligible, then we must reduce the risk to as low as reasonably practicable (ALARP).

When assessing risk for the purpose of investment decisions, rather than analysing all conceivable risks associated with an asset, we look at a credible, primary risk event to test the level of investment required. Where that credible risk event has an overall risk rating of moderate or higher, we will undertake investment to reduce the risk.

Seven consequence categories are considered for each type of risk:

1 **Health & safety** – injuries or illness of a temporary or permanent nature, or death, to employees and contractors or members of the public

2 **Environment** (including heritage) – impact on the surroundings in which the asset operates, including natural, built and Aboriginal cultural heritage, soil, water, vegetation, fauna, air and their interrelationships

3 **Operational capability** – disruption in the daily operations and/or the provision of services/supply, impacting customers

4 **People** – impact on engagement, capability or size of our workforce

5 **Compliance** – the impact from non-compliance with operating licences, legal, regulatory, contractual obligations, debt financing covenants or reporting / disclosure requirements

6 **Reputation & customer** – impact on stakeholders' opinion of AGN, including personnel, customers, investors, security holders, regulators and the community

7 **Financial** – financial impact on AGN, measured on a cumulative basis

A summary of our risk management framework, including definitions, has been provided in Attachment 8.10.

The primary risk associated with the lack of CP monitoring on pipelines in parts of the network is that underperformance or failure of the CP system goes undetected for six months or more. This can lead to accelerated corrosion on a distribution or TP pipeline that may cause a significant safety incident causing serious permanent injury, or supply interruption to >1,000 customers.

The untreated risk[105] rating is shown in Table 1.3

Table 1.3: Risk rating – untreated risk

Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	High
Consequence	Major	Minimal	Significant	Minor	Significant	Minor	Minor	
Risk Level	High	Negligible	Moderate	Low	Moderate	Low	Low	

A lack of remote CP monitoring on transmission pipelines has the potential to delay and miss the detection of CP defects, which could lead to accelerated corrosion and pipeline defects. In certain circumstances this could result in a gas release that could have a major health and safety impact. As a result, the untreated risk is considered high.

[105] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

1.5 Options considered

We have identified the following options to address the risks associated with corrosion detection:

- **Option 1** – Install remote CP monitoring on [redacted] test posts in the Adelaide Metropolitan TP system; or
- **Option 2** – Maintain status quo.

These options are discussed in the following sections.

1.5.1 Option 1 – Install remote CP monitoring on [redacted] test posts in the Adelaide Metropolitan TP system

Under this option we will install remote CP monitoring on [redacted] test posts the Adelaide metropolitan area. The six-monthly survey will continue to occur to ensure the test posts are in good condition and to validate data captured by remote data loggers. The six-monthly test point survey is a controlled test where all the test points on a given structure are assessed within a short period of time to ascertain CP condition. The benefits of remote monitoring these test points is that the survey can be conducted at precisely the same time, improving data quality to a level not yet achieved. In addition, the performance of the CP units can be monitored almost continuously.

Refer to Appendix D for the list of test posts and their locations.

1.5.1.1 Cost assessment

The estimated direct capital cost of this option is $0.5 million.

Table 1.4: Cost estimate – Option 1, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	35.2	175.8	-	-	-	211.0
Materials	266.2	-	-	-	-	266.2
Total	**301.4**	**175.8**	-	-	-	**477.2**

The remotely monitored units will require some maintenance costs for occasional failure, data transmission fees and three-year battery replacement estimated at $[redacted] unit per year.

This project is prudent from a safety and cost perspective over the short and long term as having improved and early data informing asset management plans and strategies for some of our highest value and risk assets is an important proactive measure to avoid future reactive costs.

1.5.1.2 Risk assessment

This option reduces the risk from high to low. This is because the ability to continually monitor CP performance means the likelihood of CP failure leading to undetected corrosion that causes a safety incident is reduced from unlikely to remote. Constant monitoring also means a gas escape is more likely to be detected early, so the volume of gas released is less. This reduces the safety consequences of an incident from major to significant.

Table 1.5: Risk assessment – Option 1

Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minor	
Risk Level	Low	Negligible	Low	Negligible	Negligible	Negligible	Negligible	

The costs of installing proactive monitoring have significantly decreased in recent years. CP monitoring is now a practicable option, therefore Option 1 is a reasonable risk treatment that reduces the risk to ALARP at a low cost.

1.5.1.3 Alignment with vision objectives

Table 1.6 shows how Option 1 aligns with our vision objectives.

Table 1.6: Alignment with vision – Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 1 would align with the *Delivering for Customers* aspect of our vision, as the installation of proactive monitoring on cathodic protection systems prevents undetected corrosion that may result in a loss of containment or loss of customer supply.

The proposed solution is also *Sustainably Cost Efficient,* as the benefits for long term asset management and the avoidance of short term reactive work significantly outweigh the relatively small investment monitoring equipment.

1.5.2 Option 2 – Maintain status quo

Under this option we would continue with the current practice of site visits every six months to perform cathodic protection system performance checks. This means the risks to CP performance as a result of non-continuous monitoring, which include reverse polarity, stray currents and data quality, are not mitigated. The efficiency of ICCP units would also be left undetermined.

1.5.2.1 Cost assessment

There are no upfront costs associated with this option, however undetected accelerated corrosion will result in reactive repairs or mains isolation. Further, as pipelines fail and/or pose a significant health and safety risk they would need to be repaired reactively.

A reactive replacement resourcing approach is significantly more costly. In addition to this any undetected corrosion will almost certainly be more progressed than it otherwise would be. Reactive repairs will therefore be compounded with an increasing scope of works.

1.5.2.2 Risk assessment

Current corrosion risk controls include:

- protective coatings on transmission steel pipelines;
- six-monthly CP surveys (readings taken at test posts);
- cathodic protection assets (impressed current)

Despite these controls, Option 2 does not reduce the untreated safety and operations risk rating. This is because Option 2 does not address the likelihood that CP units can fail or are underperforming. The compliance risk would be reduced as there is at least a recognised mitigation activity in place (inspections). The residual risk rating under this option is shown in Table 1.7.

Table 1.7: Risk assessment – Option 2

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	High
Consequence	Major	Minimal	Significant	Minor	Minor	Minor	Minor	
Risk Level	High	Negligible	Moderate	Low	Low	Low	Low	

1.5.2.3 Alignment with vision objectives

Table 1.8 shows how Option 2 aligns with our vision objectives.

Table 1.8: Alignment with vision – Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	N
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	N
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 2 would not align with our objective of *Delivering for Customers*, as it would not address the risks of accelerated corrosion, which could lead to a public safety issue regarding loss of containment and/or loss of supply due to pipeline isolation during reactive maintenance.

The costs of installing proactive monitoring has reduced over recent years and therefore not undertaking the project would not align with our objective to be *Sustainably Cost Efficient*. We would not realise the long term asset management investment benefits of having more reliable data on our assets, nor avoid shorter term reactive costs.

1.6 Summary of costs and benefits

Table 1.9 presents a summary of how each option compares in terms of the estimated cost, the residual risk rating, and alignment with our objectives.

Table 1.9: Comparison of options

Option	Estimated cost ($ million)	Treated residual risk rating	Alignment with vision objectives
Option 1	0.5	Low	Aligns with *Delivering for Customers* and *Sustainably Cost Efficient*
Option 2	No additional upfront capital cost	High	Does not align with *Delivering for Customers* or *Sustainably Cost Efficient*

1.7 Recommended option

The proposed solution is Option 1 because it provides the lowest sustainable cost per risk reduction over the long term. Option 2 will not reduce the risk to ALARP and is therefore not considered prudent.

1.7.1 Why is the recommended option prudent?

Option 1 is a cost effective solution to reduce the risk posed by lack of adequate CP monitoring on steel transmission pipelines. Remote CP monitoring will allow early detection of:

- reverse polarity (the pipeline becomes the sacrificial anode);
- transient loss of protection;
- equipment failure or anode depletion;
- unknown events such as stray currents leading to repeated transient loss of protection; and
- accelerated corrosion of TP pipelines.

This project will be delivered using internal resources. An assigned project manager will initiate and coordinate project activities. We will design and procure the equipment required for remote CP monitoring in 2021/22 and ensure data validation testing is performed post installation. We will install the units on the test posts during 2022/23.

1.7.2 Estimating efficient costs

The forecast cost breakdown is based on the following assumptions:

- A remote CP monitoring unit can be installed in 4 hours;
- material rates are based on current vendor material rates; and
- labour rates are calculated based on a work breakdown structure approach as there are no historical costs available for reference.

The estimated capital cost of installing [redacted] monitoring units is $0.5 million.

Table 1.10: Cost estimate – Option 2, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Scope	Design and Procure Materials	Installation				

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	35.2	175.8	-	-	-	211.0
Materials	266.2	-	-	-	-	266.2
Total	**301.4**	**175.8**	**-**	**-**	**-**	**477.2**

The following table shows the costs escalated to June 2021 dollars.

Table 1.11: Escalated replacement of valves cost estimate ($'000)

	2021/22	22/23	23/24	23/25	25/26	Total
Total unescalated ($ Dec 19)	301.4	175.8	-	-	-	477.2
Escalation	10.2	6.8	-	-	-	17.0
Total escalated ($ Jun 21)	**311.6**	**182.6**	**-**	**-**	**-**	**494.2**

1.7.3 Consistency with the National Gas Rules

In developing these forecasts, we have had regard to Rule 79 and Rule 74 of the NGR. With regard to all projects, and as a prudent asset manager, we give careful consideration to whether capex is conforming from a number of perspectives before committing to capital investment.

NGR 79(1)

The proposed solution is prudent, efficient, consistent with accepted and good industry practice and will achieve the lowest sustainable cost of delivering pipeline services:

- **Prudent** – The expenditure is necessary in order to ensure sufficient condition monitoring of high value high risk assets do not unknowingly deteriorate. Failure to address corrosion risks could result in leakage or isolation of a larger than necessary section of pipeline in an emergency situation, therefore increasing the number of customers cut off from supply. The proposed expenditure is therefore consistent with that which would be incurred by a prudent service provider.
- **Efficient** – Installation of proactive monitoring is the most practical and cost-effective option. Costs have been based on market rates and where contractors are engaged, this will be based on a competitive process. The expenditure is therefore consistent with what a prudent service provider acting efficiently would incur.
- **Consistent with accepted and good industry practice** – Proactive corrosion detection in maintaining TP pipelines is consistent with Australian Standard AS 2885.3 Pipelines - Gas and Liquid Petroleum, Part 3: Pipeline Integrity Management and AS/NZS 4645 distribution. Reducing the risks posed by corroding transmission pipelines in a manner that balances costs and risks is also consistent with these standards. We therefore consider the proposed capital expenditure is in accordance with accepted good industry practice.
- **To achieve the lowest sustainable cost of delivering pipeline services** – Continuous proactive condition assessments are necessary to maintain the long term integrity of the pipelines. Failure to do so could result in additional expenditure (reactive response to pipeline failure). The project is therefore consistent with the objective of achieving the lowest sustainable cost of delivering services.

NGR 79(2)

The proposed capex is justifiable under 79(2)(c)(ii), as it is necessary to maintain the integrity of services. A more reactive approach will inevitably lead to disruption of service and gas supply to customers.

NGR 74

The forecast costs are based on the latest market rate testing and project options consider asset management requirements as per the Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

Appendix A – Summary of CP assets

Area	Frequency of CP surveys	No. of test points	No. of anodes	No of control areas	Total length of gas mains (km)
Minor	12 months	499	511	504	697
North	6 months	559	738	193	662
Priority	6 months	290	158	35	356
Regional	6 months	206	182	56	1,088
South	6 months	670	816	211	2,017
Total	**N/A**	**2224**	**2405**	**999**	**4,821**

ICCP Unit No	Frequency of Inspection	Description
TR Unit 10765	6 months	Corner of Greenhill Rd. and Portrush Rd. Linden Park
TR Unit 10177	6 months	Corner of Commercial Rd and John Rice Avenue
TR Unit 30007	6 months	Morrow Rd. O'Sullivans Beach
TR Unit West beach	6 months	10113 Corner Fawnbrake Crescent and Tapleys hill Rd.
TR Unit 30006	6 months	Corner of Duval Drive and States Rd. Morphett Vale
TR Unit 30005	6 months	Tiller Drive, Seaford
TR Unit 30002	6 months	Corner of Flagstaff Rd. and Black Rd. Flagstaff Hill
TR Unit	6 months	Cromwell Road Kilburn
TR Unit 30001	6 months	Corner of Regan Avenue and Morphett Rd. Morphettville
TR Unit 18452	6 months	Corner of Essington Lewis Ave and Hambridge Tce. Whyalla
TR Unit 18451	6 months	Lane between Fisk and Kinnane Ave. Whyalla
TR Unit 18450	6 months	Corner of Wittwer st and Ramsey St. Whyalla
TR Unit 18449	6 months	Corner of Kloeden St. and McDouall Stuart Ave. Whyalla

Appendix B – Comparison of risk assessments for each option

Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	High
Consequence	Major	Minimal	Significant	Minor	Significant	Minor	Minor	
Risk Level	High	Negligible	Moderate	Low	Moderate	Low	Low	

Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minor	
Risk Level	Low	Negligible	Low	Negligible	Negligible	Negligible	Negligible	

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	High
Consequence	Major	Minimal	Significant	Minor	Minor	Minor	Minor	
Risk Level	High	Negligible	Moderate	Low	Low	Low	Low	

Appendix C – Cost estimates

C.1: Option 1 – Install remote CP monitoring on TP (242 test posts)

Category	Description	Units	Units QTY	Number of sites	Unit Cost $/ unit	Total $'000
Materials						
	Test Point Logger - AEGIS	each	[redacted]	[redacted]	[redacted]	[redacted]
	Stainless Steel Box and mount	each	[redacted]	[redacted]	[redacted]	[redacted]
Total Materials						**266.2**
Labour						
	Project Manager	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Corrosion Engineer (for design and testing validation)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	CP Technician	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Interface software with SCADA	each	[redacted]	[redacted]	[redacted]	[redacted]
Total Labour						**211.0**
Total Project						**477.2**

Appendix D – List of 242 test posts to have remote CP data loggers installed

Cathodic Protection Test Point Number	Location
10048	MERSEY RD OPP SOLVAY RD OSBORNE 5017
10049	MERSEY RD OPP YANDRA ST TAPEROO 5017
10050	STRATHFIELD TCE NR VICTORIA RD TAPEROO 5017
10051	VICTORIA RD CNR WILLOCHRE RD LARGS NORTH 5016
10052	VICTORIA RD CNR CENTRE ST LARGS BAY 5016
10106	MORNINGTON ST NR CROSS RD PLYMPTON 5038
10107	PINE ST NR CROSS RD EDWARDSTOWN 5039
10113	TAPLEYS HILL RD CNR FULTON ST GLENELG NORTH 5045
10115	TAPLEYS HILL RD NR WEST BEACH RD WEST BEACH 5024
10116	TAPLEYS HILL RD NR FAWNBROKE CRES WEST BEACH 5024
10152	KETTERING RD NR GMH ENTRANCE ELIZABETH 5112
10177	MILL RD 50m EAST GREYHOUND RD WATERLOO CORNER 5110
10178	DIMENT RD 80m WEST BAGSTERS RD SALISBURY NORTH 5108
10179	BRIDGE RD 48m NTH McIntyre RD PARA HILLS 5096
10180	No. 50 WYNN VALE DR PARA HILLS 5096
10181	WYNN VALE DR 900m EAST BRIDGE RD IN SYPHON BOX. SALISBURY EAST 5109
10182	WYNN VALE DR WEST WATER TANKS WYNN VALE 5127
10183	WYNN VALE DR AT FRIENDSHIP CRT WYNN VALE 5127
10184	WYNN VALE DR 60m EAST GREENRIDGE CRT SURREY DOWNS 5126
10185	THE GOLDEN WAY 100m NTH WYNN VALE RD PARA HILLS 5096
10186	SURREY FARM DR 20m WEST AVALON DR GOLDEN GROVE 5125
10187	BRIDGE RD OPP GARNET ST SALISBURY EAST 5109
10188	THE GROVE WAY 150m EAST SURREY FARM DR GOLDEN GROVE 5125
10189	THE GROVE WAY 200m WEST GOLDEN GROVE RD GOLDEN GROVE 5125
10190	YATALA VALE RD OPP PAULINE ST SURREY DOWNS 5126
10191	YATALA VALE RD OPP HANCOCK RD SURREY DOWNS 5126
10192	YATALA VALE RD 124m EAST LITTLER DR FAIRVIEW PARK 5126
10193	YATALA VALE RD 154m EAST BUCKLEY CRES FAIRVIEW PARK 5126
10194	YATALA VALE RD 11m WEST SEAVIEW RD FAIRVIEW PARK 5126
10195	SEAVIEW RD CNR GREENWITH RD YATALA VALE 5126
10196	GREENWITH RD E.O.M OPP P.G.H BRICKS YATALA VALE 5126
10201	DEAN HARVEY DVE OPP RAILWAY TCE CAVAN 5094
10202	CROSS KEYS RD OPP LEVELS RD CAVAN 5094
10203	MONTAGUE RD WEST MAIN NTH RD POORAKA 5095
10204	141 MONTAGUE RD POORAKA 5095
10206	57 MONTAGUE RD POORAKA 5095
10208	PEACHEY RD 100m STH BRADPOLE ST ELIZABETH WEST 5113

Cathodic Protection Test Point Number	Location
10265	TAPLEYS HILL RD OPP WEETUNGA ST FULHAM 5024
10266	TAPLEYS HILL RD 25m STH VALETTA (syphon box) FULHAM 5024
10282	TAPLEYS HILL RD 10m NTH GRANGE RD SEATON 5023
10332	WILLISON RD STH RAILWAY CAR PARK ELIZABETH SOUTH 5112
10401	TAPLEYS HILL RD STH CLARKE TCE SEATON 5023
10428	CHURCHILL RD NR CROSS RD (syphon box) GLANDORE 5037
10434	TAPLEYS HILL RD NR ANDREW ST ROYAL PARK 5014
10436	HENSCHKE ST NR MAGAZINE RD DRY CREEK 5094
10489	BLACKS RD 400m WEST FLAGSTAFF HILL RD O'HALLORAN HILL 5158
10490	BLACKS RD 30M EAST SOUTH RD FLAGSTAFF HILL 5159
10500	BRIGHTON RD OPP BROADWAY RD GLENELG 5045
10501	BRIGHTON RD CNR BYRE RD SOMERTON PARK 5044
10502	BRIGHTON RD NR FRANCIS ST NORTH BRIGHTON 5048
10503	BRIGHTON RD OPP JETTY RD SYPHON BOX BRIGHTON 5048
10518	HUGHES ST NR FLETCHER RD PETERHEAD 5016
10520	BRIGHTON RD STH SHOREHAM ST BRIGHTON 5048
10521	AUGUSTA ST NR SCOTT ST SYPHON BOX GLENELG 5045
10551	SEMAPHORE RD OPP MEAD ST GLANVILLE 5015
10552	CAUSEWAY RD OPP PELHAM ST ETHELTON 5015
10553	LANGHAM PL NR GRACECHURCH ST PORT ADELAIDE 5015
10604	RAILWAY BRIDGE 20m EAST COMMERCIAL RD PORT ADELAIDE 5015
10605	JENKINS ST CNR FLORENCE ST ROSEWATER 5013
10606	NORTH ARM RD CNR CORMACK RD OTTOWAY 5013
10607	CORMACK RD NR WINGFIELD RD WINGFIELD 5013
10660	SPRING ST OPP WEBBER ST QUEENSTOWN 5014
10661	TAPLEYS HILL RD OPP SPRING ST QUEENSTOWN 5014
10663	506 BRIDGE ROAD PARA HILLS 5096
10664	BRIDGE RD NTH KESTERS RD PARA HILLS 5096
10665	BRIDGE RD OPP RESEARCH RD PARA HILLS 5096
10682	TAPLEYS HILL RD NR MORLEY ST SEATON 5023
10683	TAPLEYS HILL RD STH BALLATER ST SEATON 5023
10687	247 CORMACK RD DRY CREEK 5094
10688	CORMACK RD CNR MAGAZINE RD WINGFIELD 5013
10703	HIGH ST 400m WEST OF MAGAZINE RD DRY CREEK 5094
10752	PEACHY RD 30m STH RUDGE ST DAVOREN PARK 5113
10753	PEACHY RD 20m STH EDGECOMBE RD DAVOREN PARK 5113
10754	PEACHEY RD 130m STH CRITTENDON RD SMITHFIELD PLAINS 5114
10765	445 GREENHILL RD TUSMORE 5065
10808	DARLEY RD OPP O-BAHN STATION IN PARK PARADISE 5075
10822	ST.BERNARDS RD 20m SOUTH WOODFORDE RD MAGILL 5072

Cathodic Protection Test Point Number	Location
10838	TUSMORE AVE 14m SOUTH NEWCASTLE AVE LEABROOK 5068
10839	ST BERNARDS RD 20m NTH LEABROOK AVE ROSTREVOR 5073
10841	HOLDEN ST 20m STH THE PARADE KENSINGTON PARK 5068
10849	THE PARADE 100m EAST OF BRIANT RD MAGILL NORTH 5072
10865	OPP 3 ANTARLO RD INGLE FARM 5098
10866	CNR MONTAGUE RD & SULLIVAN RD INGLE FARM 5098
10886	WALKLEYS RD NTH GR JUNCTION RD VALLEY VIEW 5093
10891	SUDHOLZ RD OPP BLACKS RD GILLES PLAINS 5086
10894	SUDHOLZ RD STH LONGVIEW RD WINDSOR GARDENS 5087
10920	NEWTON RD NTH HAMBLEDON RD NEWTON 5074
11011	VICTORIA RD AT CEMENT WKS BIRKENHEAD 5015
11013	DIMENT RD 160m EAST HELPS RD WATERLOO CORNER 5110
11023	BRIGHTON RD NTH CECELIA ST NORTH BRIGHTON 5048
11026	MILL RD 480m EST GREYHOUND RD WATERLOO CORNER 5110
11027	MILL RD 220m WEST HEASLIP RD WATERLOO CORNER 5110
11028	DIMENT RD 130m EAST HEASLIP RD SALISBURY NORTH 5108
11029	DIMENT RD 530m EAST HEASLIP RD BURTON 5110
11030	DIMENT RD 200m WEST HELPS RD SALISBURY NORTH 5108
11031	DIMENT RD 570m EAST HELPS RD SALISBURY NORTH 5108
11032	DIMENT RD 170m WEST BOLIVAR RD SALISBURY NORTH 5108
11033	DIMENT RD 200m EAST BOLIVAR RD SALISBURY NORTH 5108
11034	DIMENT RD 560m EAST BOLIVAR RD SALISBURY NORTH 5108
11035	DIMENT RD 130m WEST WHITES RD SALISBURY NORTH 5108
11036	DIMENT RD CNR SECANT RD SALISBURY NORTH 5108
11037	DIMENT RD NR VIRGINIA RD SALISBURY NORTH 5108
11038	COMMERCIAL RD 370m WEST RAILWAY LINE ELIZABETH SOUTH 5112
11039	COMMERCIAL RD 120m EAST KETTERING RD SALISBURY 5108
11040	PORTER ST OPP BRIAN ST ELIZABETH VALE 5112
11041	PORTER ST OPP MARCH ST ELIZABETH SOUTH 5112
11042	SAINTS RD 120m WEST FENDON RD SALISBURY PLAIN 5109
11043	SAINTS RD 131m EAST GODDARD RD SALISBURY PLAIN 5109
11044	SAINTS RD OPP BARNDIOOTA RD SALISBURY PARK 5109
11045	SAINTS RD 13m WEST MAIN NTH RD SALISBURY PLAIN 5109
11046	MAIN NTH RD 344m NORTH STANBELL RD SALISBURY PLAIN 5109
11047	MAIN NTH RD 45m SOUTH STANBELL RD SALISBURY PLAIN 5109
11048	SMITHS RD 130m EAST MAIN NTH RD SALISBURY EAST 5109
11049	SMITHS RD 31m WEST G;PICESTER ST SALISBURY EAST 5109
11050	BRIDGE RD OPP MARQUISITE ST PARA HILLS 5096
11051	BRIDGE RD 26m SOUTH WELBY AVE PARA HILLS 5096
11052	BRIDGE RD 35m NORTH HAZEL RD SALISBURY EAST 5109

Cathodic Protection Test Point Number	Location
11057	BRIDGE RD CNR WYNNVALE DR SALISBURY 5108
11073	AFRICAINE RD GLENELG NORTH 5045
11108	BLACK RD 450M EAST OF SOUTH RD FLAGSTAFF HILL 5159
11109	BLACK RD 600M EAST OF SOUTH RD FLAGSTAFF HILL 5159
11150	GILLINGHAM RD NR MILK DEPOT ELIZABETH 5112
11165	PANALATINGA RD SOUTH OF PIMPALA RD MORPHETT VALE 5162
11166	PANALATINGA RD NR.LANTANA RD REYNELLA 5161
11167	PANALATINGA RD NR CHILD CARE CENTRE MORPHETT VALE 5162
11169	MAIN SOUTH RD NR ELLA CT O'HALLORAN HILL 5158
11170	MAIN SOUTH RD 45M STH OF BLACK RD O'HALLORAN HILL 5158
11278	COVENTRY RD NR CURTIS RD MUNNO PARA 5115
11279	COVENTRY RD OPP FRADD RD MUNNO PARA 5115
11280	COVENTRY RD 100m STH DALKEITH RD MUNNO PARA 5115
11296	BLACKS RD CNR NORTH EAST RD HILLCREST 5086
11308	RICHMOND RD OPP ASHFORD RD KESWICK 5035
11342	PANALATING RD NR GOLF COURSE WOODCROFT 5162
11343	WHEATSHEAF RD CNR PANALATINGA RD SYPHON BOX MORPHETT VALE 5162
11344	245CORMACK RD WINGFIELD 5013
11345	DRAIN 600M NTH GRAND JUNCTION RD WINGFIELD 5013
11346	DRAIN 28 M NTH GRAND JUNCTION RD WINGFIELD 5013
11347	DRAIN 600m STH GRAND JUNCTION RD REGENCY PARK 5010
11348	DRAIN 1200m STH GRAND JUNCTION RD REGENCY PARK 5010
11349	NAWEENA RD CNR CAMIRA ST REGENCY PARK 5010
11350	IN PONY CLUB END GALLIPOLI GR REGENCY PARK 5010
11351	GALLIPOLI GR 150m NTH REGENCY RD REGENCY PARK 5010
11352	OLD LEVELS RD NEAR MAIN NTH RD T/POST ONLY POORAKA 5095
11354	MILL RD CORNER HEASLIP RD WATERLOO CORNER 5110
11355	Magazine Rd 50m Nth Of Henschke St Dry Creek 5094
11368	BLACKS RD NR THE BOULEVARD(SYPHON BOX AT SURGE ARRERSTOR T/POST) FLAGSTAFF HILL 5159
20483	Chief St opp main gate Brompton 5007
20484	PORT RD OPP. CATOR ST (CENTRE PLANTATION) WEST HINDMARSH 5007
20485	PORT RD OPP BOURN AVE (CENTRE PLANTATION) WEST HINDMARSH 5007
20486	PORT RD OPP WAY TCE (CENTRE PLANTATION) WELLAND 5007
20487	PORT RD OPP EAST AVE (ON FOOTPATH) WEST CROYDON 5008
20488	WEST ST NEAR PORT RD BROMPTON 5007
20489	PORT RD OPP BERTIE ST (CENTRE PLANTATION) WEST HINDMARSH 5007
20490	PORT RD CNR KING ST (CENTRE PLANTATION) CROYDON 5008
20491	PORT RD OPP WELLAND SHOPPING CENTRE WELLAND 5007
20492	PORT RD CNR EAST AVE (CENTRE PLANTATION) ALLENBY GARDENS 5009

Cathodic Protection Test Point Number	Location
20499	GRAVES ST 30m EAST OF NEWTON RD NEWTON 5074
20500	GRAVES ST 35m WEST OF MEREDITH ST NEWTON 5074
20501	MEREDITH ST LANEWAY BESIDE BUS DEPOT FENCE (behind gate) NEWTON 5074
20502	Magazine Rd 300m Nth Of Gate Station Dry Creek 5094
20503	Magazine Rd Near Gate Station Dry Creek 5094
30001	MORPHETT RD CNR REGAN AV TR UNIT MORPHETTVILLE 5043
30002	FLAGSTAFF RD CNR BLACKS RD T.R. UNIT FLAGSTAFF HILL 5159
30005	37 TILLER DR, SEAFORD SA 5169, Australia
30007	MORROW RD T.R. UNIT LONSDALE 5160
30101	CITY GATE MAGAZINE RD DRY CREEK 5094
30102	MAGAZINE RD 20m STH CORMACK RD DRY CREEK 5094
30103	CHURCHILL RD STH OF DRAIN DRY CREEK 5094
30104	CHURCHILL RD NTH GRAND JUNCTION RD(SYPHON BOX) DRY CREEK 5094
30105	CHURCHILL RD STH GRAND JUNCTION RD(SYPHON BOX) DRY CREEK 5094
30106	CHURCHILL RD 20M STH JERSEY ST(SYPHON BOX) KILBURN 5084
30107	EXETER ST 40M NTH NAPIER ST(SYPHON BOX) DEVON PARK 5008
30108	CHIEF ST SECOND ST BROMPTON 5007
30109	BROMPTON WRKS NEXT TO L.P.G WRKSHOP(SYPHON BOX IN CORNER) BROMPTON 5007
30110	PORT RD OPP GEORGE ST(SYPHON BOX) THEBARTON 5031
30111	WILLIAM STCNR SIR DONALD BRADMAN DVE(SYPHON BOX) MILE END SOUTH 5031
30112	MOSS AVE COMMERCIAL ST(SYPHON BOX) MARLESTON 5033
30113	BIRDWOOD TCE STH McEWIN AVE PLYMPTON 5038
30114	BIRKALLA TCE STONEHOUSE RD PLYMPTON 5038
30115	MORPHETT RD TRAM LINE PLYMPTON 5038
30116	MORPHETT RD 50m STH OAKLANDS RD OAKLANDS PARK 5046
30117	MORPHETT RD ADDISON RD WARRADALE 5046
30118	MORPHETT RD FOLKESTONE RD DOVER GARDENS 5048
30119	YACCA AVE YOUNG ST SEACLIFF 5049
30120	SHERLOCK RD SCHOLEFIELD RD KINGSTON PARK 5049
30121	NEWLANDS AVE OPP COOLINGA RD MARINO 5049
30122	COVE RD WESTCLIFFE GATE (SYPHON BOX) HALLETT COVE 5158
30123	COVE RD KURNABINNA TCE HALLETT COVE 5158
30124	10 COLUMBIA CRES HALLETT COVE 5158
30125	AT REFINERY REG LONSDALE 5160
30126	MEYER RD NR BRIDGE LONSDALE 5160
30127	CHRISTIE RD. NR.MITSUBISHI LONSDALE 5160
30201	RAMSAY AVE NR MORPHETT RD SYPHON BOX SEACOMBE GARDENS 5047
30202	FLAGSTAFF HILL RD 60m STH MAIN STH RD SYPHON BOX DARLINGTON 5047

Cathodic Protection Test Point Number	Location
30203	FLAGSTAFF HILL 100m NTH BONNEYVIEW RD FLAGSTAFF HILL 5159
30204	OPP REGANO RD FLAGSTAFF HILL FLAGSTAFF HILL 5159
30205	FLAGSTAFF HILL RD 120m NTH BLACKS RD FLAGSTAFF HILL 5159
30206	GUNYA ST NR BLACKS RD FLAGSTAFF HILL 5159
30207	BLACKS RD CNR DAVEYS RD FLAGSTAFF HILL 5159
30208	BLACKS RD CNR CROSSING RD ABERFOYLE PARK 5159
30209	FLAGSTAFF HILL RD CNR BONNEYVIEW RD FLAGSTAFF HILL 5159
30210	FLAGSTAFF HILL RD DE ROSE RD FLAGSTAFF HILL 5159
30211	MARION RD OPP MELBOURNE ST MARION 5043
30212	MARION RD OPP BRIARDALE ST STURT 5047
30213	BRADLEY GVE CNR TIMOTHY CRT MITCHELL PARK 5043
30214	STURT RD 100M EAST OF MARION RD BEDFORD PARK 5042
30215	BLACKS RD WEST GLENDALE AVE ABERFOYLE PARK 5159
30216	MELBOURNE ST CNR EMBERT ST STURT 5047
30217	RAMSAY AV CNR MILLER ST SEACOMBE GARDENS 5047
30218	RAMSAY AV CNR SPRING ST SEACOMBE GARDENS 5047
30501	BRITAIN DR NR SALTFLEET ST PORT NOARLUNGA 5167
30502	CLIFF AVE NR JANE ST PORT NOARLUNGA 5167
30503	HELSMAN TCE NR FLINDERS AVE SEAFORD 5169
30504	GRIFFITHS DR OPP FIRST AVE MOANA 5169
30505	COMMERCIAL RD NR LENNARD DR MOANA 5169
30506	MASLIN BEACH RD COMMERCIAL RD MASLIN BEACH 5170
30507	COMMERCIAL RD OPP OLEANDER DV MASLIN BEACH 5170
30508	OLD COACH RD THOMAS RD MASLIN BEACH 5170
30509	PORT RD OLD COACH RD ALDINGA 5173
30510	QUINLIVEN RD OPP FALCON ST PORT WILLUNGA 5173
30511	ROWLEY RD 95m STH MCREA ST ALDINGA 5173
30512	DALKEITH AVE CNR GRAND BVD SEAFORD HEIGHTS 5169
30701	REFINERY RD AT REFINERY GATE LONSDALE 5160
30702	DYSON RD 300m NTH O'SULLIVAN BEACH RD LONSDALE 5160
30703	HALES DR NR MORROW RD LONSDALE 5160
30704	MORROW RD NR BAGSHAW RD LONSDALE 5160
30705	DYSON RD OPP KENNEY ST LONSDALE 5160
30706	DYSON RD STH BEACH RD LONSDALE 5160
30707	DYSON RD 50m NTH HONEYPOT RD NOARLUNGA DOWNS 5168
30708	RIVER RD 150M EAST NEW RD NOARLUNGA DOWNS 5168
30709	RIVER RD CNR MORTON RD NOARLUNGA DOWNS 5168
30710	RIVER RD STH PERRY RD NOARLUNGA DOWNS 5168
30711	CHURCH HILL RD NR PIGGOT RANGE RD HACKHAM 5163
30712	OLD HORSESHOE INN AT METER EOM OLD NOARLUNGA 5168

Cathodic Protection Test Point Number	Location
30713	ABBATOIRS OPP METER (COW PADDOCK) NOARLUNGA CENTRE 5168
40010	0IL REFINERY PORT STANVAC 5160
40018	P.G.H. HALLETTS
40019	S.A. BREWING THEBARTON 5031
40029	MITSUBISHI CLOVELLY PARK 5042
40031	DSTO
40042	TRANS ADELAIDE MORPHETTVILLE 5043
40500	S.A.GAS.CO BROMPTON 5007

SA127 – Isolated steel pipe from cathodic protection

1.1 Project approvals

Table 1.1: Business case SA127 – Project approvals

Prepared by	Peiman Vakili, Gas Networks and Pipeline Engineer, APA
Reviewed by	Robin Gray, SA Operations Manager, APA
Approved by	Craig Bonar, Head of Engineering and Planning Networks, APA Mark Beech, General Manager Network Operations, AGN

1.2 Project overview

Table 1.2: Business case SA127 – Project overview

Description of the problem / opportunity

The South Australia (SA) natural gas distribution networks deliver gas to over 450,000 customers, and as part of the distribution network there are approximately 200 km of steel distribution pipelines.

There are [redacted] short isolated sections of steel pipe located in various areas of the Adelaide metropolitan and regional network that have no cathodic protection (CP). These sections are largely at creek crossings, large storm water crossings, road intersections and bridge crossings. They range in length from 5 m to 200 m and are typically 30 to 40 years old.

Corrosion prevention measures are required to mitigate public safety or loss of supply risks, whilst also ensuring we maximise steel pipe asset lives. Unfortunately, these short isolated sections cannot be connected to nearby CP control areas as they are located within the polyethylene (PE) distribution systems, typically operating at medium pressure (100 kPa).

We strive for a fully fused PE distribution network where reasonable to do so, as this is the ideal solution from an asset management perspective, however, we are mindful that this may not always be practical or cost effective.

This business case considers options to address the risk of corroding isolated steel sections at the 70 identified locations.

Untreated risk

As per risk matrix = **Moderate**

Options considered

- **Option 1** – Protect [redacted] sections of CP isolated steel pipe with anodes and replace the remaining [redacted] sections with PE pipe ($1.2 million)
- **Option 2** – Replace all [redacted] CP isolated steel pipe sections with PE pipe ($5.0 million)
- **Option 3** – Maintain the status quo (no upfront capital cost)

A further option of recoating the isolated steel pipe sections was considered, however the excessive cost and impracticality of this option means it was not pursued further.

Proposed solution

Option 1 is the proposed solution because:

- protecting [redacted] sections of CP isolated steel pipe with anodes and replacing the remaining [redacted] sections with PE pipe is the most cost effective solution; and
- the solution aligns with industry practice and facilitates pipeline protection from further corrosion defects on assets that are already 30 to 40 years old.

Estimated cost

The forecast direct capital cost (excluding overhead) over the next access arrangement (AA) period (July 2021 to June 2026) is $1.2 million.

$'000 2019/20	21/22	22/23	23/24	24/25	25/26	Total
Isolated steel sections	109.0	276.6	266.2	266.2	254.2	1,172.3

Basis of costs

All costs in this business case are expressed in real unescalated dollars at December 2019 unless otherwise stated. Some tables may not add due to rounding.

Alignment to our vision	This project aligns with the *Delivering for Customers* aspect of our vision, as it mitigates the risk to public health and safety, as well as ensuring security and reliability of gas supply. It also links to the *Sustainably Cost Efficient* aspect of our vision, as a balance of PE replacement and anode bags is a cost effective solution to address the risk of corrosion. The long term risks of reactive asset replacements are greater than proactive scheduled replacement.
Consistency with the National Gas Rules (NGR)	This project complies with the following National Gas Rules (NGR): **NGR 79(1)** – the proposed solution is consistent with good industry practice, several practicable options have been considered, and market rates have been tested to achieve the lowest sustainable cost of providing this service. **NGR 79(2)** – proposed capex is justifiable under NGR 79(2)(c)(i) and (ii), as it is necessary to maintain the safety and integrity of services. **NGR 74** – the forecast costs are based on the latest market rate testing and project options consider the asset management requirements as per the latest Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.
Treated risk	As per risk matrix = **Low**
Stakeholder engagement	We are committed to operating our networks in a manner that is consistent with the long term interests of our customers. To facilitate this, we conduct regular stakeholder engagement to understand and respond to the priorities of our customers and stakeholders. Feedback from stakeholders is built into our asset management considerations and is an important input when developing and reviewing our expenditure programs. Our customers have told us their top three priorities are price/affordability, reliability of supply, and maintaining public safety. They also told us they expect us to deliver a high level of public safety and are satisfied that this is current practice. The proposed installation of CP and replacement with PE represents a shift to proactive asset management, which results in earlier detection of corrosion and lower short term reactive costs, with improved long term asset lives. Proactively installing CP or replacing with PE helps address the public safety risk and is therefore consistent with the current safety practices customers have told us they value. Undertaking the proposed program will also help maintain reliability of supply at the lowest sustainable cost, minimising the impact on customers' gas bills.
Other relevant documents	• Attachment 8.2 Strategic Asset Management Plan

1.3 Background

The SA natural gas distribution networks deliver gas to over 450,000 customers, and contains around 200 km of steel distribution pipelines. The majority of steel pipelines are subject to a CP system, which helps inhibit onset of corrosion.

In 2019, we conducted a desktop exercise using our Geospatial Information System (GIS) to identify the steel pipes within our network that are not protected by CP. Our process was as follows:

- we identified a number of steel sections located in the PE distribution areas that are isolated from CP;
- we cross checked this list against the 'as constructed drawings' to ensure that these sections are not a result of operator error in updating the GIS; and
- we then cross checked this list against the mains replacement program and removed those sections that will be subject to mains replacement in the next 10 years.

Through this process we identified [redacted] short sections of steel pipeline connected within the PE networks across metropolitan Adelaide and regional SA that do not have CP systems installed and cannot be connected to nearby CP control areas. They range in length from 5 m to 200 m and are typically 30 to 40 years old.

These isolated steel sections are typically at creek crossings, large storm water crossings, road intersections and bridge crossings. As shown in Figure 1.1 below, a typical culvert crossing will comprise an exposed steel pipe connected to the bridge, with two further buried steel sections at either side of the crossing that tie into the PE mains.

Figure 1.1: Culvert crossing

Without CP, these mains are subject to accelerated corrosion presenting a risk of major gas escape which could affect the health and safety of the public and the security and reliability of supply to customers.

Mitigating the risk of accelerated corrosion on the unprotected steel pipe can be conducted by either replacing these sections with polyethylene pipe or installing sacrificial anodes. However, steel pipe that forms part of a bridge or culvert crossing can only be replaced by bored PE pipe. This is because PE insertion into the existing steel asset will not allow sufficient network capacity, and exposed PE is not a suitable replacement material at these locations.

1.4 Risk assessment

Risk management is a constant cycle of identification, analysis, treatment, monitoring, reporting and then back to identification (as illustrated in Figure 1.2). When considering risk and determining the appropriate mitigation activities, we seek to balance the risk outcome with our delivery capabilities and cost implications. Consistent with stakeholder expectations, safety and reliability of supply are our highest priorities.

Figure 1.2: Risk management principles

Our risk assessment approach focuses on understanding the potential severity of failure events associated with each asset and the likelihood that the event will occur. Based on these two key inputs, the risk assessment and derived risk rating then guides the actions required to reduce or manage the risk to an acceptable level.

Our risk management framework is based on:

- AS/NZS ISO 31000 Risk Management – Principles and Guidelines;
- AS 2885 Pipelines-Gas and Liquid Petroleum; and

- AS/NZS 4645 Gas Distribution Network Management.

The Gas Act 1997 and Gas Regulations 2012, through their incorporation of AS/NZS 4645 and the Work Health and Safety Act 2012, place a regulatory obligation and requirement on us to reduce risks rated high or extreme to low or negligible as soon as possible (immediately if extreme). If it is not possible to reduce the risk to low or negligible, then we must reduce the risk to as low as reasonably practicable (ALARP).

When assessing risk for the purpose of investment decisions, rather than analysing all conceivable risks associated with an asset, we look at a credible, primary risk event to test the level of investment required. Where that credible risk event has an overall risk rating of moderate or higher, we will undertake investment to reduce the risk.

Seven consequence categories are considered for each type of risk:

1 Health & safety – injuries or illness of a temporary or permanent nature, or death, to employees and contractors or members of the public

2 Environment (including heritage) – impact on the surroundings in which the asset operates, including natural, built and Aboriginal cultural heritage, soil, water, vegetation, fauna, air and their interrelationships

3 Operational capability – disruption in the daily operations and/or the provision of services/supply, impacting customers

4 People – impact on engagement, capability or size of our workforce

5 Compliance – the impact from non-compliance with operating licences, legal, regulatory, contractual obligations, debt financing covenants or reporting / disclosure requirements

6 Reputation & customer – impact on stakeholders' opinion of AGN, including personnel, customers, investors, security holders, regulators and the community

7 Financial – financial impact on AGN, measured on a cumulative basis

A summary of our risk management framework, including definitions, has been provided in Attachment 8.10.

Current controls include protective coatings on steel pipelines, however as these assets are 30-40 years old, additional measures are required to ensure asset lives and performance are not compromised.

The primary risk associated with a lack of CP on a steel gas main on a creek or culvert crossing is accelerated corrosion. This can lead to a leak that may cause a significant incident causing serious injury or hospitalisation of a member of public or employee, or supply interruption to >1,000 customers. It can also cause some reputational damage, as the asset failure may lead to the bridge/crossing being closed, which can disrupt traffic. However, the reputational impact is likely to be minor.

Because the steel pipeline crossing is typically exposed, the potential for escaped gas entering a building or collecting in sufficient quantities to cause explosion if ignited is low, therefore the health and safety risk consequence is rated significant (rather than the major consequence rating applied to most other high pressure gas assets). However, the risk of injury and supply interruption always remains where there is a gas leak. Therefore, the untreated risk rating for corroded steel pipelines at crossings is moderate.

The untreated risk[106] rating is shown in Table 1.3.

Table 1.3: Risk rating – untreated risk

Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Moderate
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Moderate	Negligible	Moderate	Low	Low	Low	Negligible	

1.5 Options considered

We have identified the following options to address the risks associated with undetected accelerated corrosion on a steel gas main, without cathodic protection:

- **Option 1** – Protect [redacted] sections of CP isolated steel pipe with anodes and replace the remaining [redacted] sections with PE pipe;
- **Option 2** – Replace all [redacted] CP isolated steel pipe sections with PE pipe; or
- **Option 3** – Maintain the status quo.

These options are discussed in the following sections.

A further option of recoating the isolated steel pipe sections was considered, however the excessive cost and impracticality of this option made it imprudent and unreasonable so it was not pursued further.

1.5.1 Option 1 – Protect 47 sections of CP isolated steel pipe with anodes and replace the remaining 23 sections with PE pipe

Under this option, we will address the [redacted] sections of CP isolated steel pipe as follows:

- [redacted] sections will be protected by installing [redacted] sacrificial anodes and associated test posts; and
- [redacted] sections, all less than 15m in length, will be replaced with PE pipe.

A list of these 70 sections of unprotected steel pipe is provided in Appendix A.

New anodes will be installed as part of the routine six-monthly test post checks undertaken throughout the rest of the network. The installation of new PE pipe will be managed as per the Strategic Asset Management Plan. The costs associated with inspection and maintenance required for these new assets will be undertaken as part of our routine programs and are not included in this business case. The incremental and small associated operating costs are considered immaterial.

In an ideal scenario all steel sections would be replaced as a fully fused PE solution as it would fully mitigate the risk and result in a more uniform distribution system. However, cathodically protecting steel is an accepted practice and must be considered where costs are deemed excessive for replacement.

1.5.1.1 Cost assessment

The estimated capital cost of this option is $1.2 million and will be delivered over the AA period.

[106] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

A cost analysis was conducted to determine the cost efficiency of replacing steel sections versus installing a number of sacrificial anodes to mitigate the risk.

The cost analysis concluded:

- in situations where the steel pipe is completely buried and/or the section is less than 15 meters in length, the cost of installing an anode is very similar to the cost of replacement with PE pipe. Hence replacing steel pipe with PE pipe for these sections is a more cost-effective solution for the risk reduction achieved; and
- for exposed to the air environment and /or the section is greater than 15 meters in length, it is more suitable and cost effective to install sacrificial anodes to protect the buried sections of steel pipe.

Table 1.4: Cost estimate – Option 1, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	38.9	259.1	248.7	248.7	236.7	1,032.0
Materials	70.2	17.5	17.5	17.5	17.5	140.3
Total	**109.0**	**276.6**	**266.2**	**266.2**	**254.2**	**1,172.3**

This project is prudent from a safety and cost perspective over the short and long term because satisfactory corrosion prevention measures are an important proactive measure to extending the asset life and avoid future reactive costs.

This option is consistent with our risk management framework and vision objectives.

1.5.1.2 Risk assessment

This option reduces the risk from moderate to low. This is because the installation of CP reduces the likelihood of corrosion causing a safety incident from unlikely to remote. The risk of corrosion on the replaced steel mains is eliminated altogether.

Table 1.5 shows the residual risk associated with the proposed combination of the installation of anodes and replacement with PE pipe.

Table 1.5: Risk assessment – Option 1

	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Low	Negligible	Low	Negligible	Negligible	Negligible	Negligible	

Though the untreated risk is rated moderate, a moderate is not ALARP. A mixture of CP installation and pipeline replacement is a practicable option, therefore Option 1 is a reasonable risk treatment that reduces the risk to low at an efficient cost.

1.5.1.3 Alignment with vision objectives

Table 1.6 shows how Option 1 aligns with our vision objectives.

Table 1.6: Alignment with vision – Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	Y

Vision objective	Alignment
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 1 would align with the *Delivering for Customers* aspect of our vision, as the installation of cathodic protection systems prevents undetected corrosion that may result in a loss of containment or loss of customer supply.

The proposed solution is also *Sustainably Cost Efficient,* as the benefits for long term asset life and the avoidance of short-term reactive work significantly outweigh the investment in corrosion preventive measures.

1.5.2 Option 2 – Replace all [redacted] sections of CP isolated steel pipe with PE pipe

Under this option, all [redacted] sections of CP isolated steel pipe will be replaced with equivalent sections of PE pipe. The replacement of some sections of steel pipe located below stormwater culverts or at intersections will require boring at a higher cost. Information on the [redacted] sections is provided at Appendix A.

The new PE pipe will be managed as per the Strategic Asset Management Plan. The costs associated with inspection and maintenance required for these new assets will be undertaken as part of our routine programs and are not included in this business case. The incremental and small associated operating costs are considered immaterial.

Once complete, we would have a fully fused PE pipe solution requiring no corrosion protection measures that would fully mitigate the risk and result in a more uniform distribution system.

1.5.2.1 Cost assessment

The estimated capital cost of this option is $5 million.

This is based on a unit cost of $[redacted] per steel section replaced, using current material and labour rates for pipeline replacement and an average section length of approximately 15m.

Table 1.7: Cost estimate – Option 2, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	967.1	967.1	967.1	967.1	967.1	4,835.6
Materials	34.8	34.8	34.8	34.8	34.8	174.0
Total	**1,001.9**	**1,001.9**	**1,001.9**	**1,001.9**	**1,001.9**	**5,009.6**

This project is prudent from a safety perspective as it mitigates the risk of corrosion altogether, but is not a cost efficient solution. This option is inconsistent with some of our vision objectives and the risk management framework.

1.5.2.2 Risk assessment

This option reduces the risk from moderate to negligible as it completely mitigates the risk of corrosion on the identified steel mains. This is because they will be replaced with PE pipe that does not corrode.

The residual risk rating under this option is shown in Table 1.8.

Table 1.8: Risk assessment – Option 2

	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Negligible
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

1.5.2.3 Alignment with vision objectives

Table 1.9 shows how Option 2 aligns with our vision objectives.

Table 1.9: Alignment with vision – Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 2 would align with our objective of the *Delivering for Customers* aspect of our vision, as the replacement of the [redacted] sections of steel pipe with PE removes the risk of steel mains corrosion at these locations entirely.

Although Option 2 results in the lowest risk outcome, it would not align with our objective to be *Sustainably Cost Efficient* as the investment would be considered excessive for the risk benefits. We would be going above and beyond the requirements of the governing standard AS/NZS 4645.

1.5.3 Option 3 – Maintain the status quo

Under this option we would take a reactive approach to asset management of these [redacted] steel sections. We currently rely on protective coatings on steel pipes (now 30 to 40 years old) and address corrosion by performing reactive maintenance for identified leaks.

We would not replace any sections, nor install cathodic protection for protection against corrosion.

1.5.3.1 Cost assessment

There are no upfront costs associated with this option, however undetected accelerated corrosion will result in reactive repairs and/or mains isolation. Further, as pipelines fail they would need to be repaired reactively. In addition, this will allow any undetected corrosion to progress resulting in a greater proportion of replacement rather than repair.

An asset failure could result in a major gas escape, property damage, public disruption, injury to the public and, in extreme circumstances, fatalities. It is expected that the cost to reactively repair a pipeline would be at a minimum 2-5 times greater than a proactive approach. This is due to the need to isolate supply, penalty charges, expedited materials and bespoke fabrication, as well as conservative estimates regarding increases in labour costs due to out of hours working, increased supervision and delivering customer support throughout an unplanned interruption.

This option would also lead to largely unquantifiable costs associated with the disruption of supply to customers, as well as the public safety risk associated with asset failure and an uncontrolled release of gas. This would not align with our vision objectives or risk management principles.

1.5.3.2 Risk assessment

This option is inconsistent with our risk management framework as it does not reduce the health and safety risks associated with corrosion on the identified steel mains sections. Disruption to supply or occurrence of a safety incident can also result in significant reputational damage.

The residual risk rating under this option is shown in Table 1.10.

Table 1.10: Risk assessment – Option 3

	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Moderate
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minor	
Risk Level	Moderate	Negligible	Moderate	Low	Low	Low	Low	

It is therefore inconsistent with the risk management framework, which requires the risk to be reduced to low or ALARP.

1.5.3.3 Alignment with vision objectives

Table 1.11 shows how Option 3 aligns with our vision objectives.

Table 1.11: Alignment with vision – Option 3

Vision objective	Alignment
Delivering for Customers – Public Safety	N
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	N
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N

Vision objective	Alignment
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 3 would not align with our objective of *Delivering for Customers*, as it would not address the risks of corrosion on these ageing steel assets, which could lead to a public safety issue regarding loss of containment and/or loss of supply due to pipeline isolation during reactive maintenance.

Option 3 would not align with our objective of *Sustainably Cost Efficient*. We would not maximise the asset life nor mitigate shorter term reactive costs that will cost more than a planned proactive approach.

1.6 Summary of costs and benefits

Table 1.12 presents a summary of how each option compares in terms of the estimated cost, the residual risk rating, and aligning with our objectives.

Table 1.12: Comparison of options

Option	Estimated cost ($ million)	Treated residual risk rating	Alignment with vision objectives
Option 1	1.2	Low	Aligns with Delivering for Customers and Sustainably Cost Efficient
Option 2	5.0	Negligible	Does not align with Delivering for Customers or Sustainably Cost Efficient
Option 3	No upfront capital cost	Moderate	Does not aligns with Delivering for Customers or Sustainably Cost Efficient Does not reduce risk to low or ALARP

1.7 Recommended option

The proposed solution is Option 1 because it provides the lowest sustainable cost per risk reduction over the long term.

1.7.1 Why is the recommended option prudent?

Option 1 is the most cost effective solution to reduce the risk posed by lack of CP on the steel pipe sections to low. Moreover, the cost of implementation is proportionate to the reduction in risk. It is therefore consistent with good industry practice and our asset strategy in the Strategic Asset Management Plan and the risk management framework.

It supports the vision and values in relation to:

- *Delivering for Customers*, as the installation of CP systems prevents undetected corrosion that may result in a loss of containment or loss of customer supply; and
- *Sustainably Cost Efficient*, as the benefits for long term asset life and the avoidance of short-term reactive work significantly outweigh the investment in corrosion preventive measures.

1.7.2 Estimating efficient costs

The forecast cost breakdown is based on the following assumptions:

- This project will be delivered using a combination of internal and external resources as follows: a corrosion engineer will complete design and procurement of material, external contractors will be engaged through a competitive tender process to install solution, QA will be conducted by a CP technician;
- Material rates for anodes and pipe are based on current vendor material rates; and
- Labour rates are calculated based on a work breakdown structure.

Table 1.13 presents a breakdown of the program by cost category. Table 1.14 provides the costs escalated to June 2021 dollars.

Table 1.13: Project cost estimate by cost category, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Scope	Design & initiation	[redacted] x anodes [redacted] section	[redacted] x anodes [redacted] section	[redacted] x anodes [redacted] section	[redacted] x anodes [redacted] section	[redacted] x anodes [redacted] section
Labour	38.9	259.1	248.7	248.7	236.7	1,032.0
Materials	70.2	17.5	17.5	17.5	17.5	140.3
Total	**109.0**	**276.6**	**266.2**	**266.2**	**254.2**	**1,172.3**

Table 1.14: Escalated project cost estimate ($'000)

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Total unescalated ($ Dec 19)	109.0	276.6	266.2	266.2	254.2	1,172.3
Escalation	3.7	10.7	11.9	13.5	14.2	53.9
Total escalated ($ Jun 21)	**112.7**	**287.3**	**278.1**	**279.7**	**268.4**	**1,226.1**

More detail on the cost breakdown is provided in Appendix C.

1.7.3 Consistency with the National Gas Rules

In developing these forecasts, we have had regard to Rule 79 and Rule 74 of the NGR. With regard to all projects, and as a prudent asset manager, we give careful consideration to whether capex is conforming from a number of perspectives before committing to capital investment.

Rule 79(1)

The proposed solution is prudent, efficient, consistent with accepted and good industry practice and will achieve the lowest sustainable cost of delivering pipeline services:

- **Prudent** – The expenditure is necessary in order to ensure sufficient corrosion prevention of assets so they do not unknowingly deteriorate. Failure to address corrosion risks could result in leakage or isolation of a larger than necessary section of pipeline in an emergency situation, therefore increasing the number of customers cut off from supply. The proposed expenditure is therefore consistent with that which would be incurred by a prudent service provider.

- Efficient – Installation of corrosion protection and replacement with PE is the most practical and cost-effective option. Costs have been based on market rates and where contractors are engaged, this will be based on a competitive process. The expenditure is therefore consistent with what a prudent service provider acting efficiently would incur.

- Consistent with accepted and good industry practice – Reducing the risks posed by corroding steel pipes in a manner that balances costs and risks is consistent with accepted good industry practice.

- To achieve the lowest sustainable cost of delivering pipeline services – The installation of corrosion prevention and replacement with PE maximises the asset life whilst mitigating short term additional expenditure (reactive response to steel pipe failure). The project is therefore consistent with the objective of achieving the lowest sustainable cost of delivering services.

Rule 79(2)

The proposed capex is justifiable under 79(2)(c)(i) and (ii), as it is necessary to maintain the safety and integrity of services. A more reactive approach will inevitably lead to uncontrolled gas leaks and disruption of service and gas supply to customers.

NGR 74

The forecast costs are based on the latest market rate testing and project options consider asset management requirements as per the latest Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

Appendix A – Summary of CP isolated steel sections

A.1: Locations of proposed [redacted] sacrificial anodes to protect [redacted] sections of CP isolated steel pipe

Mains key	Nominal Diameter (mm)	Nominal Pressure	Length of Steel Section (m)	Street Name	Suburb	No of anodes required	Bore required
A00005219143	200	Medium	296	LYONS	DERNANCOURT	[redacted]	NO
A00027771784	80	Medium	3	KELHAM	HILLCREST	[redacted]	NO
A00005194263	50	Medium	81	OXFORD	HILLCREST	[redacted]	NO
A00007950643	200	Medium	103	LYONS	HOLDEN HILL	[redacted]	YES
A00029214245	150	Medium	103	LYONS	HOLDEN HILL	[redacted]	NO
A00005215701	200	Medium	42	VALIANT	HOLDEN HILL	[redacted]	YES
A00005215790	150	Medium	25	VALIANT	HOLDEN HILL	[redacted]	NO
A00016899154	100	Medium	4	GROVE	MARLESTON	[redacted]	NO
A00005723095	100	Medium	50	BOANDIK	MOUNT GAMBIER	[redacted]	YES
A00048008702	50	Medium	3	BROLGA	MOUNT GAMBIER	[redacted]	NO
A00048984195	100	Medium	40	STURT	MOUNT GAMBIER	[redacted]	YES
A00057880862	150	Medium	24	STURT	MOUNT GAMBIER	[redacted]	NO
A00005726490	25	Medium	82	KENTUCKY	MOUNT GAMBIER	[redacted]	NO
A00005725311	40	Medium	12	MAYFAIR	MOUNT GAMBIER	[redacted]	NO
A00005724852	25	Medium	79	REGENT	MOUNT GAMBIER	[redacted]	NO
A00005726496	50	Medium	26	DALKEITH	MOUNT GAMBIER	[redacted]	NO
A00039926759	100	Medium	206	NORTH	MOUNT GAMBIER	[redacted]	YES
A00005725061	40	Medium	141	OLD KENT	MOUNT GAMBIER	[redacted]	NO
A00005726069	80	Medium	115	PICK	MOUNT GAMBIER	[redacted]	NO
A00048011680	50	Medium	20	PICK	MOUNT GAMBIER	[redacted]	YES
A00051805130	100	Medium	18	WEHL	MOUNT GAMBIER	[redacted]	YES
A00005149986	100	Medium	25	RUSSELL	WOODVILLE PARK	[redacted]	NO
A00005417197	40	Medium	224	NASH	GRANGE	[redacted]	NO
A00005245510	100	Medium	106	CASEMATE	HIGHBURY	[redacted]	NO
A00005245048	32	Medium	101	CHRISTINA	HOPE VALLEY	[redacted]	NO

Mains key	Nominal Diameter (mm)	Nominal Pressure	Length of Steel Section (m)	Street Name	Suburb	No of anodes required	Bore required
A00005724056	50	Medium	185	CURRAWONG	MOUNT GAMBIER	[redacted]	NO
A00041310066	100	Medium	155	LAKE	MOUNT GAMBIER	[redacted]	NO
A00032742692	50	Medium	43	PICKWORTH	FAIRVIEW PARK	[redacted]	NO
A00005499180, A00008074270 & A00016913886	200	Medium	62	ANZAC	GLENELG EAST	[redacted]	YES
A00005420095	50	Medium	78	NORTHEY	HENLEY BEACH	[redacted]	YES
A00005415576	40	Medium	38	SUSSEX	HENLEY BEACH	[redacted]	NO
A00005418351	150	Medium	58	SEAVIEW	HENLEY BEACH SOUTH	[redacted]	NO
A00005245084	32	Medium	50	ASCHAM	HOPE VALLEY	[redacted]	NO
A00005245114	32	Medium	36	FISHER	HOPE VALLEY	[redacted]	NO
A00005352988	50	Medium	39	MARCO	INGLE FARM	[redacted]	NO
A00005725407 & A00032322757	50	Medium	75	JOHN	MOUNT GAMBIER	[redacted]	YES
A00057880816 & A00008085651	80	Medium	65	KRUMMEL	MOUNT GAMBIER	[redacted]	NO
A00007944882 & A00005720659	100	Medium	42	LAKE	MOUNT GAMBIER	[redacted]	NO
A00005724587	40	Medium	22	LOCKE	MOUNT GAMBIER	[redacted]	NO
A00005254196	50	Medium	36	SEWELL	PAYNEHAM	[redacted]	NO
A00005113233	50	Medium	75	DAWN	RIDGEHAVEN	[redacted]	NO
A00005119433	50	Medium	81	LEWIS	TEA TREE GULLY	[redacted]	YES
A00005215281 & A00005215537	80	Medium	40	FLOCKHART	VALLEY VIEW	[redacted]	YES
A00005245663	50	Medium	67	MANNUM	VISTA	[redacted]	NO
A00005158410	80	Medium	81	RALPH	WEST CROYDON	[redacted]	NO
A00005412702 & A00005412905	50	Medium	65	BAKER	GRANGE	[redacted]	NO

Mains key	Nominal Diameter (mm)	Nominal Pressure	Length of Steel Section (m)	Street Name	Suburb	No of anodes required	Bore required
A00005215560 A00005215652 A00005215837 A00007862370	80 and 100	Medium	44	NORTH EAST	VALLEY VIEW	[redacted]	YES

A.2: Locations of [redacted] steel pipe sections to be replaced

Mains Key	Nominal Diameter (mm)	Nominal Pressure	Length of Steel Section (m)	Street Name	Suburb	Bore required
A00005498283	150	Medium	4	ANZAC	GLENELG EAST	NO
A00016913670	150	Medium	4	ANZAC	GLENELG EAST	NO
A00016721129	50	Medium	11	ROSEWOOD	HIGHBURY	NO
A00007932524	32	Medium	4	ELLIOTT	HOLDEN HILL	NO
A00008083479	40	Medium	4	AWOONGA	HOPE VALLEY	NO
A00016943698	40	Medium	7	AWOONGA	HOPE VALLEY	NO
A00005245066	50	Medium	15	FISHER	HOPE VALLEY	NO
A00005236551	80	Medium	17	VALLEY	HOPE VALLEY	NO
A00027764090	50	Medium	11	HALIDON	INGLE FARM	NO
A00005108246	50	Medium	26	NORTH EAST	MODBURY	NO
A00005219498	50	Medium	34	WELLOCH	MODBURY	NO
A00027696513	50	Medium	16	ALEXANDER	MODBURY NORTH	NO
A00005358519	50	Medium	16	WARREN	MODBURY NORTH	NO
A00005508672	50	Medium	10	RALLI	PLYMPTON PARK	NO
A00005691323	25	Medium	26	COLLEGE	PORT ADELAIDE	NO
A00005230071	50	Medium	15	CONSTANTINE	ROSTREVOR	NO
A00005693274	50	Medium	4	KAUPER	ROYAL PARK	NO
A00005245900 A00060392097	40	Medium	31	PERSEVERANCE	VISTA	NO
A00005422277	32	Medium	14	LILY AVENUE	SEATON	NO

Mains Key	Nominal Diameter (mm)	Nominal Pressure	Length of Steel Section (m)	Street Name	Suburb	Bore required
A00005669143	80	Medium	15	LADY GOWRIE	NORTH HAVEN	NO
A00032754104	25	Medium	18	GRAND JUNCTION	HOPE VALLEY	NO
A00039029134	50	Medium	12	LE HUNTE	WAYVILLE	NO
A00005418357	150	Medium	6	SEAVIEW	WEST BEACH	NO

Appendix B – Comparison of risk assessments for each option

Untreated	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Moderate
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Moderate	Negligible	Moderate	Low	Low	Low	Low	

Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Low	Negligible	Low	Negligible	Negligible	Negligible	Negligible	

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Negligible
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Option 3	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Moderate
Consequence	Significant	Minimal	Significant	Minor	Minor	Minor	Minimal	
Risk Level	Moderate	Negligible	Moderate	Low	Low	Low	Low	

Appendix C – Cost estimates

C.1: Option 1 – Install [redacted] sacrificial anodes and replace [redacted] CP isolated steel sections

Part 1 - Install 69 Anodes with test posts						
Category	**Description**	**Units**	**Units QTY**	**Number of sites**	**Unit Cost $/ unit**	**Total $'000**
Materials						
Materials	Anode, wire, syphon, water feed and other materials	each	[redacted]	[redacted]	[redacted]	[redacted]
Total Materials						**82.8**
Labour						
It is assumed 1 new anode with test post can be installed in 8 hours						
	Project Manager	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Corrosion Engineer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	CP Technician	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Crew (3 ppl incl. team leader)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Excavator (8T)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Tipper Truck (8T)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Vac Truck	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Traffic Control (2 ppl including ute)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Reinstatement (assuming 5 sqm - footpath and including backfill material and compaction)	Sqm	[redacted]	[redacted]	[redacted]	[redacted]
Total Labour						**736.2**
Total Part 1						**819.0**

Part 2 - Replace 23 sections of steel pipe with PE pipe						
Category	**Description**	**Units**	**Units QTY**	**Number of sites**	**Unit Cost $/ unit**	**Total $'000**
Materials						
Materials	Pipe, flanges, fittings and venting tees	each	[redacted]	[redacted]	[redacted]	[redacted]
Total materials						**57.5**
Labour						
It is assumed pipe section (up to 15m long) can be replaced per 1 day shift (8 hrs)						
	Project Manager	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Project Engineer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Site Supervisor	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Crew (3 ppl incl. team leader)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Excavator (8T)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Tipper Truck (8T)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Vac Truck	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Traffic Control (2 ppl including ute)	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Reinstatement	Sqm	[redacted]	[redacted]	[redacted]	[redacted]
Total labour						**295.9**
Total part 2						**353.4**

Summary of Project Costs Category	Description	Total $'000
Materials		
Materials	Part 1 - Install [redacted] new anodes with test posts	[redacted]
	Part 2 - Replace [redacted] sections of steel pipe with PE pipe	[redacted]
Total Materials		**140.3**
Labour		
Labour	Part 1 - Install [redacted] new anodes with test posts	[redacted]
	Part 2 - Replace [redacted] sections of steel pipe with PE pipe	[redacted]
Total Labour		**1,032.0**
Total Project		**1,172.3**

C.2: Option 2 – Replace [redacted] CP isolated steel sections with PE pipe

Option 2 - Replace [redacted] sections of steel pipe with PE pipe						
Category	**Description**	**Units**	**Units QTY**	**Number of sites**	**Unit Cost $/ unit**	**Total $'000**
Materials						
Pipe & fittings		each	[redacted]	[redacted]	[redacted]	[redacted]
Total materials						**174.0**
Labour						
Replacement of sections up to 15m long (1 day/ each)			[redacted]	[redacted]	[redacted]	[redacted]
Replacement of sections >15m and <50m long (2 days/each)			[redacted]	[redacted]	[redacted]	[redacted]
Replacement of sections >50m and <80m long (3days/each)			[redacted]	[redacted]	[redacted]	[redacted]
Replacement of sections >80m and <200m long (5 days/each)			[redacted]	[redacted]	[redacted]	[redacted]
Replacement by bores			[redacted]	[redacted]	[redacted]	[redacted]
Total labour						**4,835.6**
Total option 2						**5,009.6**

SA129 – Industrial and commercial overpressure risk reduction

1.1 Project approvals

Table 1.1: Business case SA129 – Project approvals

Prepared by	Nick Rubbo, Integrity Engineer, APA
Reviewed by	Robin Gray, SA Operations Manager, APA
Approved by	Craig Bonar, Head of Engineering and Planning, APA Mark Beech, General Manager Network Operations, AGN

1.2 Project overview

Table 1.2: Business case SA129 – Project overview

Description of the problem / opportunity	The South Australian gas distribution network has more than 33,000 industrial and commercial (I&C) customer metering facilities. I&C metering facilities are used to supply and measure the high volumes of gas supplied to our I&C customers and as such are a critical network asset. Metering facilities are made up of the meter unit itself and the meter set. The meter set comprises valves, pipework, regulators, fittings and other minor components. 686 I&C customers are supplied with large meter sets that have a service bypass line. The purpose of the bypass line is to allow us to maintain the customer's supply while we shut down and conduct maintenance on the primary service line. In 2016 the standard design for large I&C meter sets was modified to include a regulator on the bypass line. This new design reduces the risk the customer's equipment could become overpressurised when the bypass line is in use. This change was made in line with good industry practice and design standards, and allows I&C maintenance to be conducted with minimum disruption to the customer. Work to commence installation of regulators on bypass lines of new large I&C meter sets commenced in 2016. At 1 July 2020, 533 large I&C meter sets with unregulated bypass lines remain in the SA network. This business case considers the costs and benefits of installing regulators on [redacted] of these outstanding bypasses over the next access arrangement (AA) period (July 2021 to June 2026), as well as other options to manage the overpressure risk. The remaining [redacted] large I&C meter sets shall be addressed during the following access arrangement period.
Untreated risk	As per risk matrix = **High**
Options considered	• **Option 1** – Continue with current practice of isolating the customer's supply during maintenance (zero upfront capex, however there is potential for ongoing costs/compensation charges associated with supply interruption) • **Option 2** – Install a pressure regulator on the bypass line of [redacted] large I&C meter sets ($2.5 million) • **Option 3** – Replace [redacted] large I&C meter sets with new specification meter sets that feature pressure regulators as standard ($5.8 million)
Proposed solution	This business case recommends Option 2, as it achieves the required risk reduction associated with overpressurisation of customer equipment at the lowest sustainable cost, with the minimum disruption to customers. The recommended option is in line with current industry good practice and design standards, and consistent with our Strategic Asset Management Plan. It removes the risk of human error contributing to the likelihood of high consequence safety outcomes without interrupting customer supply.

Estimated cost	The forecast direct capital cost (excluding overhead) during the next AA period (July 2021 to June 2026) is $2.5 million.

$'000 2019/20	21/22	22/23	23/24	24/25	25/26	Total
I&C overpressure	466.3	466.3	507.9	507.9	507.9	2,456.3

Basis of costs	All costs in this business case are expressed in real unescalated dollars at December 2019 unless otherwise stated. Some tables may not add due to rounding.
Alignment to our vision	Addressing the risk of I&C overpressure events aligns with our vision in relation to: • *Delivering for Customers* as proactive installation of a pressure regulator on the bypass line for I&C customers will remove the risk of human error causing an event that damages customer equipment or results in a major gas-in-building scenario with the potential for ignition. It will also allow us to maintaining continuity and reliability of supply; and • *Sustainably Cost Efficient* as augmenting existing assets rather than installing a new meter set is the lowest sustainable cost of reducing the overpressure risk.
Consistency with the National Gas Rules (NGR)	**NGR 79(1)** – the proposed solution is consistent with good industry practice, several practicable options have been considered, and market rates have been tested to achieve the lowest sustainable cost of providing this service. **NGR 79(2)** – proposed capex is justifiable under NGR 79(2)(c)(i), as it is necessary to maintain the safety of services. **NGR 74** – the forecast costs and are based on the latest market rate testing and project options consider the asset management requirements as per the Strategic Asset Management Plan. This business case considers the costs and the benefits of each option. The estimate has been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.
Treated risk	As per risk matrix = **Low**
Stakeholder engagement	We are committed to operating our networks in a manner that is consistent with the long-term interests of our customers. To facilitate this, we conduct regular stakeholder engagement to understand and respond to the priorities of our customers and stakeholders. Feedback from stakeholders is built into our asset management considerations and is an important input when developing and reviewing our expenditure programs. Our customers have told us their top three priorities are price/affordability, reliability of supply, and maintaining public safety. They also told us they expect us to deliver a high level of public safety and are satisfied that this is current practice. The proposed I&C overpressure risk reduction capital expenditure is designed to ensure the network operates in line with good industry practice, safety standards and compliance requirements, thereby helping maintain a safe and reliable service to our customers. These activities are consistent with stakeholder expectations of our network and the level of service our customers value. By augmenting the existing assets rather than replacing the I&C meter set entirely, we are adopting the solution with the lowest sustainable cost, and therefore minimising the impact on customers' gas bills.
Other relevant documents	• Attachment 8.2 Strategic Asset Management Plan

1.3 Background

I&C metering facilities are made up of the meter unit itself and the meter set assembly which includes the valves, pipework, regulators, fittings and other minor components. Note the meter units are not within scope of this business case. This business case is for capital works on the **meter sets only**. Replacement of meter units is covered by the Meter Replacement Plan.

There are more than 33,000 I&C meter sets in the network. Meter sets are critical to provide continuity of supply to I&C customers, regulate mains distribution pressure to customer supply pressure, and accurately measure the volume of gas supplied.

The type of meter set at each I&C customer's premises varies depending on that customer's load requirements. Most I&C customers have diaphragm style meters without bypass lines (see Figure 1.2). However, 686 of our larger I&C customers have rotary/turbine meter sets that feature a bypass line (see Figure 1.1). The purpose of the bypass line is to allow us to conduct routine maintenance on the meter set at these customers' premises without disrupting supply.

Figure 1.1: I&C rotary/turbine meter set with bypass

Figure 1.2 I&C diaphragm meter set without bypass

The bypass line for our 686 customers with I&C rotary/turbine meter sets typically includes one or two isolation valves that separate the upstream high (350 kPa) or medium (90 kPa) pressure from the downstream customer supply pressure. During maintenance of the duty stream, these bypass line isolation valves can be opened and manually throttled and monitored to maintain gas supply to the customer, while the duty stream on the meter set is shut down.

In 2016 the standard design for large I&C meter sets was modified to include a regulator on the bypass line. This new design reduces the risk the customer's equipment could become overpressurised when the bypass line is in use. Work to commence installation of regulators on bypass lines of new large I&C meter sets commenced in 2016, with 153 bypass lines being upgraded by the end of 2019/20. At 1 July 2020, [redacted] large I&C meter sets with unregulated bypass lines remain.

Managing the overpressure risk is a high priority for AGN. An overpressure incident in the Queensland gas distribution network in June 2019, which was caused by human error during manual throttling, has led us to review our practices in SA.

Prior to the Queensland incident, standard practice when undertaking maintenance on large I&C meter sets with bypass lines was to manually throttle the bypass valve and monitor the pressure. However, in the Queensland incident the bypass valve was accidently opened for an extended period, and the customer's installation became overpressurised, damaging the appliance pressure regulators and other equipment.

A review of the incident showed the issue could easily have resulted in more severe consequences, including a major gas-in-building scenario with the potential for ignition. The incident could have been prevented if there had been a pressure regulator on the bypass.

As a short term risk mitigation since the Queensland incident, we have changed our maintenance practice on these unregulated bypasses. We now isolate the customer's supply during maintenance. This means no gas is flowing during maintenance and overpressurisation cannot occur.

However, this also means the customer is without a natural gas supply while maintenance is conducted. Many of these large I&C customers depend on a continual gas supply for their operations, therefore interrupting their supply is both undesirable and unsustainable. Coordinating planned maintenance to eliminate (or at least minimise) customer disruption is often impractical and in some cases unachievable.

Through our ongoing engagement program, customers have advised us that reliability and continuity of supply is important to them. In this business case we therefore consider alternatives to the current practice of isolating supply, and we recommend that installing regulators on the [redacted] remaining unregulated bypasses (or replacing the entire meter set with a new-specification set that includes a bypass as standard) is a more prudent and customer-focused risk control. All [redacted] unregulated bypasses will be addressed over the next ten years, with [redacted] proposed for the next AA period (July 2021 to June 2026) and the remainder in the following period.

1.4 Risk assessment

Risk management is a constant cycle of identification, analysis, treatment, monitoring, reporting and then back to identification (as illustrated in Figure 1.3). When considering risk and determining the appropriate mitigation activities, we seek to balance the risk outcome with our delivery capabilities and cost implications. Consistent with stakeholder expectations, safety and reliability of supply are our highest priorities.

Figure 1.3: Risk management principles

Our risk assessment approach focuses on understanding the potential severity of failure events associated with each asset and the likelihood that the event will occur. Based on these two key inputs, the risk assessment and derived risk rating then guides the actions required to reduce or manage the risk to an acceptable level.

AGN's risk management framework is based on:

- AS/NZS ISO 31000 Risk Management – Principles and Guidelines;
- AS 2885 Pipelines-Gas and Liquid Petroleum; and
- AS/NZS 4645 Gas Distribution Network Management.

The Gas Act 1997 and Gas Regulations 2012, through their incorporation of AS/NZS 4645 and the Work Health and Safety Act 2012, place a regulatory obligation and requirement on AGN to reduce risks rated high or extreme to low or negligible as soon as possible (immediately if extreme). If it is not possible to reduce the risk to low or negligible, then we must reduce the risk to as low as reasonably practicable (ALARP).

When assessing risk for the purpose of investment decisions, rather than analysing all conceivable risks associated with an asset, we look at a credible, primary risk event to test the level of investment required. Where that credible risk event has an overall risk rating of moderate or higher, we will undertake investment to reduce the risk.

Seven consequence categories are considered for each type of risk:

1 **Health & safety** – injuries or illness of a temporary or permanent nature, or death, to employees and contractors or members of the public

2 **Environment** (including heritage) – impact on the surroundings in which the asset operates, including natural, built and Aboriginal cultural heritage, soil, water, vegetation, fauna, air and their interrelationships

3 **Operational capability** – disruption in the daily operations and/or the provision of services/supply, impacting customers

4 **People** – impact on engagement, capability or size of our workforce

5 **Compliance** – the impact from non-compliance with operating licences, legal, regulatory, contractual obligations, debt financing covenants or reporting / disclosure requirements

6 **Reputation & customer** – impact on stakeholders' opinion of AGN, including personnel, customers, investors, security holders, regulators and the community

7 **Financial** – financial impact on AGN, measured on a cumulative basis

A summary of our risk management framework, including definitions, has been provided in Attachment 8.10.

The primary risk event identified for I&C meter sets with an unregulated bypass line is that a downstream customer's equipment becoming overpressurised during maintenance of the duty line. This occurs as a result of the bypass valve being left open for an extended period, causing damage to customer equipment and/or serious harm.

The untreated risk is rated as high because if a bypass line has no regulator or similar risk controls, there is potential for overpressurisation, which can damage equipment and cause a leak within the customer's facility. This can lead to a gas-in-building scenario, which if ignited, can cause injury to the public and, in extreme circumstances, fatality.

The untreated risk[107] rating is presented in Table 1.3.

Table 1.3: I&C overpressure risk assessment – Untreated risk

Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	High
Consequence	Major	Minimal	Minor	Minimal	Minor	Minor	Minimal	
Risk Level	High	Negligible	Low	Negligible	Low	Low	Negligible	

1.5 Options considered

Different options have been considered to address the risks associated with the overpressurisation of I&C customer equipment. The options are:

- **Option 1** – Continue with current practice of isolating the customer's supply during maintenance;
- **Option 2** – Install a pressure regulator on the bypass line of [redacted] large I&C meter sets; or
- **Option 3** – Replace [redacted] large I&C meter sets with new-specification meter sets that feature pressure regulators as standard.

These options are discussed in the following sections.

[107] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

1.5.1 Option 1 – Continue with current practice of isolating the customer's supply during maintenance

Under Option 1, we would continue to isolate the customer's natural gas supply when performing maintenance on each of the [redacted] meter sets with unregulated bypass lines. We would only replace these legacy meter sets with new specification meter sets (which feature regulated bypasses as standard) upon failure.

We would endeavour to undertake planned preventive maintenance activities. However, the practicality of isolating supply has, and is expected to continue to cause delays and deferral of maintenance for some I&C customers. This will increase the cost of coordinating and undertaking maintenance in the short term, and increase the likelihood of asset failure over the longer term. Moreover, isolating supply causes considerable disruption to customers, many of whom rely on an uninterrupted gas supply to conduct business operations.

1.5.1.1 Cost assessment

There would be no upfront capital cost associated with this option. The capital cost of replacing the I&C meter sets would only be incurred upon failure.

In the short term, this would put downward pressure on gas distribution tariffs and allow resources to be deployed elsewhere. However, over the longer term a reactive asset management approach would increase network tariffs and the overall resource requirement.

Current operating costs associated with I&C meter set maintenance are higher than they otherwise would be if we did not have to isolate supply. This is due to the additional coordination activities and after hours works required to isolate customer. Conservative estimates put these additional costs at $163,000 per annum (see Appendix B).

As a prudent asset manager, we consider the continued isolation of I&C customers with unregulated bypass lines is not sustainable.

1.5.1.2 Risk assessment

Option 1 – our current practice – eliminates the overpressure safety risk as isolating the customer's supply means there is no gas present. As a result, the overall risk is reduced from high to moderate (see Table 1.4).

Table 1.4 Risk assessment – Option 1

Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Frequent	Remote	Frequent	Frequent	Frequent	Moderate
Consequence	Minor	Minimal	Minor	Minimal	Minor	Minor	Minimal	
Risk Level	Negligible	Negligible	Moderate	Negligible	Moderate	Moderate	Low	

However, our current risk treatment does not reduce the risk to ALARP. I&C meter sets are typically the single point of supply for I&C customers. As such, the operations risk (interruption to supply) is rated moderate for Option 1 because supply has to be interrupted whenever maintenance is required. While the consequence rating of doing this is minor (as only one customer is affected per isolation), the likelihood is rated as frequent (occurring many time in one year). Regular supply interruptions also causes rising customer dissatisfaction, and carries a moderate compliance and reputational risk.

Option 1 reduces the risk from high to moderate, but does not reduce the risk to low or ALARP. As such, it is inconsistent with our risk management framework.

1.5.1.3 Alignment with vision objectives

Table 1.5 shows how Option 1 aligns with our vision objectives.

Table 1.5: Alignment with vision – Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

This option does not align with our objective of *Delivering for Customers*, as even though it does addresses the safety risks associated with overpressurisation of downstream assets, it causes ongoing disruption to customer service and supply.

Isolating supply for I&C customers each time maintenance is required is not in line with customer expectations. In many instances it is not possible to find mutually agreeable times to shut down operations. An inability to undertake maintenance may also result in non-compliance with regulatory requirements. For example, AS 60079 specifies electrical equipment in hazardous areas must be inspected every three years and any defects found must be rectified.

The increased additional cost of office administration and coordination required to schedule the isolation, as well as more after hours operational work results in increasing expenditure for both AGN and I&C customers, which does not align to our objective to be *Sustainably Cost Efficient*.

1.5.2 Option 2 – Install a pressure regulator on the bypass line of [redacted] large I&C meter sets

Under this option we would install regulators on [redacted] of the [redacted] currently unregulated bypass lines for I&C customers within the next five years. The remaining [redacted] would be completed during the following AA period.

Installing a regulator on all I&C bypass lines would remove the risk of human error during maintenance activities, significantly reducing the overpressure risk.

The new regulator will be maintained as part of the normal routine preventative maintenance activities on the I&C meter sets. The additional time for checking functionality of the bypass regulator while completing normal scheduled preventative maintenance is not material.

1.5.2.1 Cost assessment

The estimated capital cost of installing [redacted] regulators on I&C customer bypass lines is $2.5 million. This estimate is based on current material and labour rates for new I&C installations and assumes [redacted] identified I&C unregulated bypass lines will be addressed over the next five years (see Table 1.6).

Table 1.6: Cost assessment - Option 2, $'000 real 2019/20

	2020/21	2021/22	2022/23	2023/24	2024/25	Total
Scope	Design procure & fabricate	Design, procure fabricate & install	Fabricate & install	Fabricate & install	Fabricate & install	[redacted] I&C meter set bypass lines addressed
Materials	170.6	170.6	113.8	113.8	113.8	682.5
Labour	295.6	295.6	394.2	394.2	394.2	1,773.8
Total	**466.3**	**466.3**	**507.9**	**507.9**	**507.9**	**2,456.3**

Option 2 will also reduce costs associated with the coordination of maintenance activities and additional expenditure of operating outside of normal operating hours.

1.5.2.2 Risk assessment

Option 2 reduces the untreated risk rating from high to low for the [redacted] completed sites, and achieves a lower risk rating than the current controls applied in Option 1 (moderate).

Table 1.7: Risk assessment – Option 2

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Minor	Minimal	Minimal	Minimal	Minimal	
Risk Level	Low	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Installing a regulator on the bypass reduces the likelihood of an overpressure risk occurring as it eliminates the potential for human error. It also reduces the risk consequence it is less likely that the volume of gas released would be significant if there was an issue on the bypass line. Option 2 also eliminates the need to isolate the I&C customer. As a result, this risk treatment reduces the risk to ALARP.

1.5.2.3 Alignment with vision objectives

Table 1.8 shows how Option 2 aligns with our vision objectives.

Table 1.8: Alignment with vision – Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	Y
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 2 aligns with the *Delivering for Customers* aspect of our vision, as proactive augmentation of existing I&C metering facilities will help maintain reliability of supply and mitigate the risk of public safety incidents. Staff working directly on the meter set would have a safe working environment and the downstream customer would be safe from elevated operating pressures in the network.

The proposed solution is also *Sustainably Cost Efficient* as mitigating the risk through meter set augmentation of existing assets is the lowest sustainable cost of managing the overpressure risk.

1.5.3 Option 3 – Replace [redacted] outstanding large I&C meter sets with new specification meter sets that feature pressure regulators as standard

Under this option, we would proactively replace [redacted] I&C meter sets that have been identified as having an unregulated bypass line. Each of these meter facilities would be replaced over the next five years with current industry standard fabricated components, at a rate of approximately [redacted] per year. The remaining [redacted] meter sets will be addressed in the following AA period.

1.5.3.1 Cost assessment

The estimated capital cost of replacing [redacted] meter facilities over the next five years is $5.75 million. This estimate is based on the current material and labour rates for I&C installations of meter sets of comparable size, which range from $[redacted] to $[redacted] to build, with an installation cost of approximately $[redacted] Therefore, a unit rate of $[redacted] has been used (the $[redacted] average build cost plus installation) and assumes all [redacted] I&C meter sets will be replaced over the next five years (see Table 1.9).

Table 1.9: Cost assessment - Option 3, $'000 real 2019/20

Option 3	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Replacement volumes	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Labour	255.4	638.5	766.2	766.2	766.2	3,192.5
Materials	204.6	511.5	613.8	613.8	613.8	2,557.5
Total	**460.0**	**1,150.0**	**1,380.0**	**1,380.0**	**1,380.0**	**5,750.0**

This option would deliver the same safety risk reduction as Option 2, but at a higher cost to customers. Replacing rather than augmenting the existing meter sets would reduce the overall risk associated with the assets, as they would be replaced with current industry standard fabricated components.

Replacing these assets would require rigorous planning and the scheduled isolation of some I&C customers' gas supply while work was undertaken. We would seek to schedule the replacements to coincide with the replacement of some metering units where those metering units are reaching their replacement cycle within the period. However, this scheduling would not materially improve the disruption to customers, estimated cost, or overall cost efficiency of the solution.

1.5.3.2 Risk assessment

Option 3 reduces the untreated risk associated with overpressurisation of I&C meter sets from high to low for the 250 meter sets that have been replaced (see Table 1.10).

Table 1.10: Risk assessment – Option 3

Option 3	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Occasional	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Minor	Minimal	Minimal	Minimal	Minimal	
Risk Level	Low	Negligible	Low	Negligible	Negligible	Negligible	Negligible	

Option 3 achieve the same level of risk reduction as Option 2, but does so at a substantially higher cost. As with Option 2, the likelihood and consequence of an overpressure event is reduced, however there is a low operations risk given customers will occasionally have to be isolated while the new meter sets are installed.

1.5.3.3 Alignment with vision objectives

Table 1.11 shows how Option 3 aligns our vision objectives.

Table 1.11: Alignment with vision – Option 3

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	Y
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	-

Option 3 aligns with the *Delivering for Customers* aspect of our vision, as proactive risk mitigation of I&C meter facilities will help maintain reliability of supply and mitigate the risk of public and customer safety incidents. However, the solution to replace a meter set rather than augment the existing asset is a much more disruptive process to customers, who would be left without supply while the old asset is removed and the new asset installed.

This option is not *Sustainably Cost Efficient* as it is more than twice the cost of Option 2, while delivering few additional benefits.

1.6 Summary of costs and benefits

Table 1.12 presents a summary of how each option compares in terms of the estimated cost, the residual risk rating, and aligning with our objectives.

Table 1.12 – Summary of costs and benefits

Option	Estimated cost ($ million)	Treated residual risk rating	Alignment with vision objectives
Option 1	0	Moderate	This would achieve safety objectives, however it does not align with customer service and reliability objectives.

Option	Estimated cost ($ million)	Treated residual risk rating	Alignment with vision objectives
Option 2	2.5	Low – ALARP	This option provides the greatest risk reduction and aligns with all relevant vision objectives.
Option 3	5.8	Low	This option would achieve safety objectives, however it would not align with our objective to be sustainably cost efficient, as the cost of Option 3 is more than double Option 2.

1.7 Recommended option

Option 2 is the recommended option as it is the most cost-effective solution to reduce the risk of overpressurisation posed by the unregulated bypass lines at large I&C customer meter sets.

1.7.1 Why is the recommended option prudent?

Option 2 reduces the risk of unregulated bypass lines resulting in overpressurisation of I&C customer equipment without compromising customer supply. It provides a risk reduction proportionate to the cost associated with completing this project.

Option 2 aligns with the *Delivering for Customers* and *Sustainably Cost Efficient* aspects of our vision because:

- proactive augmentation of existing facilities will help maintain reliability of supply and mitigate the risk of public safety incidents; and
- the risk through meter set augmentation of existing assets is the lowest sustainable cost of managing the overpressure risk.

1.7.2 Estimating efficient costs

Key assumptions made in the cost estimation for the I&C over-pressure risk reduction project include:

- all [redacted] large I&C meter sets shall be completed during a 10 year period, with [redacted] completed during the next five years;
- costs are based on historical expenditure noting that these works are not new, with labour rates based on work breakdown structure of activities, and material rates based on historical costs for similar materials;
- estimates derived from contractual rates of vendors to be utilised;
- resource cost based on other similar projects ongoing at present or in previous AA periods; and
- original equipment manufacturer contractual rates for spares and labour that are part of our services agreements.

Table 1.13 presents a breakdown of the I&C overpressure risk reduction project by cost category. Table 1.14 provides the costs escalated to June 2021 dollars.

Table 1.13: Project cost estimate by cost category, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Materials	170.6	170.6	113.8	113.8	113.8	682.5

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	295.6	295.6	394.2	394.2	394.2	1,773.8
Total	**466.3**	**466.3**	**507.9**	**507.9**	**507.9**	**2,456.3**

Table 1.14: Escalated project cost estimate ($'000)

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Total unescalated ($ Dec 19)	466.3	466.3	507.9	507.9	507.9	2,456.3
Escalation	15.7	18.0	22.8	25.7	28.3	110.5
Total escalated ($ Jun 21)	**482.0**	**484.3**	**530.7**	**533.6**	**536.2**	**2,566.8**

1.7.3 Consistency with the National Gas Rules

In developing these forecasts, we have had regard to Rule 79 and Rule 74 of the NGR. With regard to all projects, and as a prudent asset manager, we give careful consideration to whether capex is conforming from a number of perspectives before committing to capital investment.

Rule 79(1)

The augmentation of I&C customer meter sets to install a regulator on each bypass line is consistent with the requirements of NGR 79(1)(a), Specifically, we consider that the capital expenditure is:

- **Prudent** – the expenditure is necessary in order to deliver gas safely and reliably to customer outlet points. The proposed risk treatment is consistent with accepted industry practice and current design standards and is proven to address the overpressure risk associated with I&C meter sets. Several practicable options have been considered to address the risk. The proposed expenditure can therefore be seen to be of a nature that would be incurred by a prudent service provider.

- **Efficient** – the forecast expenditure is based on historical average actuals and tender contract values. The proposed expenditure can therefore be considered consistent with the expenditure that a prudent service provider acting efficiently would incur. The project is being delivered at an achievable rate of installation.

- **Consistent with accepted and good industry practice** – the proposed expenditure follows good industry practice by ensuring that existing safety risks are addressed to as low as reasonably practicable and in line with current industry practice and design standards. The proposed capital expenditure is therefore such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice.

- To achieve the **lowest sustainable cost of delivering pipeline services** – the sustainable delivery of services includes reducing risks to as low as reasonably practicable and maintaining reliability of supply. The proposed solution allows us to undertake critical maintenance without disrupting customer supply, while at the same time reducing the overpressure risk to ALARP. Further, we have spread the works over a reasonable timeframe that balances risk reduction with network tariff impact.

Rule 79(2)

The proposed capex is justifiable under NGR 79(2)(c)(i), as it is necessary to maintain the safety of services. Continuing with current practice results in an unacceptable safety risk for customers and AGN is seeking to maintain a level of service consistent with industry and design standards.

As outlined in this business case, the current practice of completely isolating supply has proven to mitigate network integrity issues, but has not allowed us to maintain a level of service consistent with customer expectations.

Rule 74

The forecast costs are based on the latest market rate testing and project options consider the asset management requirements as per the Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

Appendix A – Comparison of risk assessments for each option

Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	High
Consequence	Major	Minimal	Minor	Minimal	Minor	Minor	Minimal	
Risk Level	High	Negligible	Low	Negligible	Low	Low	Negligible	

Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Frequent	Remote	Frequent	Frequent	Frequent	Moderate
Consequence	Minor	Minimal	Minor	Minimal	Minor	Minor	Minimal	
Risk Level	Negligible	Negligible	Moderate	Negligible	Moderate	Moderate	Low	

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Minor	Minimal	Minimal	Minimal	Minimal	
Risk Level	Low	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	

Option 3	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk
Likelihood	Remote	Remote	Occasional	Remote	Remote	Remote	Remote	Low
Consequence	Significant	Minimal	Minor	Minimal	Minimal	Minimal	Minimal	
Risk Level	Low	Negligible	Low	Negligible	Negligible	Negligible	Negligible	

Appendix B – Increase in planned maintenance costs due to complete I&C customer isolation

Item	Description		Comments
	Inputs		
A	Estimated No of meter sets with unregulated bypasses	[redacted]	
B	Estimated No of Unregulated bypasses (PM during normal Hours)	[redacted]	Assume 20% of total number of unregulated bypasses
C	Estimated No of Unregulated bypasses (PM during normal Hours)	[redacted]	Assume 80% of total number of unregulated bypasses
D	PM Duration/ technician (normal hours)	[redacted]	
E	PM Duration/ technician (after hours)	[redacted]	Include travel time, access issues, afterhours inductions and relighting customer
F	Rate for Technician (normal Hours)	[redacted]	
G	Rate for Technician (after Hours)	[redacted]	
H	Planner and Schedule time to liaise with customers and coordinate PMs for after hours and during normal hours.	[redacted]	Hour per meter set
I	Frequency of PMs per year on I&C customer meter set	[redacted]	
J	Planner and Scheduler cost per hour	[redacted]	
	Outputs		
K	Additional cost for PM on unregulated bypasses (after hours)	[redacted]	= (C x E x G) – (C x D x F)
L	Additional costs for Planner and Scheduler	[redacted]	= A x H x I x J
Total additional cost of performing PM's on unregulated bypasses for 1 year afterhours		[redacted]	

Appendix C – Cost estimates based on work breakdown structure

Category	Description	Unit	Qty	# of sites	$/ unit	Total $'000
Materials						
Pipe	Pipe for spool pieces, flanges, pete plug, elbows and other fittings	each	[redacted]	[redacted]	[redacted]	[redacted]
Regulators	Pressure regulator (Landis Gyr 1801 B)	each	[redacted]	[redacted]	[redacted]	[redacted]
Consumables	Nuts, bolts, welding consumables, coating	each	[redacted]	[redacted]	[redacted]	[redacted]
Other	Freight, storage, and handling (excl. pipe)	each	[redacted]	[redacted]	[redacted]	[redacted]
Total materials						**682.5**
Labour						
Project management, design and initiation	Project manager	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Project engineer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Welding engineer	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Draftsperson	hours	[redacted]	[redacted]	[redacted]	[redacted]
	Site Supervisor	hours	[redacted]	[redacted]	[redacted]	[redacted]
Fabrication of Spool Piece	Fabrication including welding, NDT, coating and pressure testing	hours	[redacted]	[redacted]	[redacted]	[redacted]
Installation of Spool Piece	Installation by 2 technicians on site	hours	[redacted]	[redacted]	[redacted]	[redacted]
Total labour						**1,773.8**
Total						**2,456.3**

SA131 – Reducing risk for transmission pressure pipelines in high consequence, sensitive use areas

1.1 Project approvals

Table 1.1: Business case SA131 – Project approvals

Prepared by	Nick Rubbo, Integrity Engineer, APA
Reviewed by	Robin Gray, Operations Manager SA Networks, APA
Approved by	Craig Bonar, National Planning and Engineering Manager, APA Mark Beech, General Manager Network Operations, AGN

1.2 Project overview

Table 1.2: Business case SA131 – Project overview

Description of the problem / opportunity

A review of our transmission pressure (TP) network in the Adelaide metropolitan area has identified four sections of transmission pressure pipeline, totalling [redacted] metres, which are in high consequence, sensitive use areas, susceptible to strike by an auger or excavator, and require additional measures to mitigate the threat of pipeline damage resulting in rupture.

These four short sections of TP pipelines are:

- located near a high consequence, sensitive use area (as defined in Australian Standard 2885 as areas where vulnerable members of the community congregate including childcare centres, schools, hospitals, aged care homes and prisons); and
- have no additional protection measures; and
- are not located beneath a roadway.

This business case considers various options for mitigating the risk of third party strikes and uncontrolled gas escapes in the four identified areas, thereby increasing protection for the most vulnerable members of the community.

Untreated risk

As per risk matrix = **High**

Options considered

- **Option 1** – Maintain status quo which, includes weekly pipeline patrols, Dial Before You Dig (DBYD) services and installing and maintaining pipeline marker signs (no upfront capex)
- **Option 2** – Install physical protection ($0.3 million)
- **Option 3** – Relocate pipelines that are near sensitive use areas under the road ($1.8 million)

Proposed solution

This business case recommends Option 2. Installing physical protection above the remaining four sections of pipeline in high consequence, sensitive use areas is the lowest sustainable cost of increasing the protection for vulnerable members of the community, while maintaining the existing pipeline pressure, and therefore throughput. This risk treatment is in line with current industry good practice and design standards, and consistent with our Strategic Asset Management Plan.

Estimated cost

The forecast direct capital cost (excluding overhead) over the next access arrangement (AA) period (July 2021 to June 2026) is $0.3 million.

$'000 2019/20	21/22	22/23	23/24	24/25	25/26	Total
Pipeline slabbing	266.7	-	-	-	-	266.7

The installation of physical barriers is prioritised for 2021/22.

Basis of costs	All costs in this business case are expressed in real unescalated dollars at December 2019 unless otherwise stated. Some tables may not add due to rounding.
Alignment to our vision	Reducing risk for TP pipelines in high consequence, sensitive use areas aligns with our vision in relation to: • *Delivering for Customers* as the installation of physical protection for the four remaining high consequence, sensitive areas will reduce the likelihood of an asset strike from a third party using an excavator or auger, therefore improving public health and safety outcomes and maintaining the reliability of the network; and • *Sustainably Cost Efficient* as augmenting existing assets rather than diverting the TP pipeline is the best practice solution and lowest sustainable cost of reducing the asset strike risk. It is also socially responsible to protect those vulnerable members of society that congregate in sensitive areas.
Consistency with the National Gas Rules (NGR)	**NGR 79(1)** – the proposed solution is consistent with good industry practice, several practicable options have been considered, and market rates have been tested to achieve the lowest sustainable cost of providing this service. **NGR 79(2)** – proposed capex is justifiable under NGR 79(2)(c)(i) as it is necessary to maintain the safety of services. **NGR 74** – the forecast costs and are based on the latest market rate testing and project options consider the asset management requirements as per the latest Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.
Treated risk	As per risk matrix = **Moderate**
Stakeholder engagement	We are committed to operating our networks in a manner that is consistent with the long-term interests of our customers. To facilitate this, we conduct regular stakeholder engagement to understand and respond to the priorities of our customers and stakeholders. Feedback from stakeholders is built into our asset management considerations and is an important input when developing and reviewing our expenditure programs. Our customers have told us their top three priorities are price/affordability, reliability of supply, and maintaining public safety. They also told us they expect us to deliver a high level of public safety and are satisfied that this is current practice. This proposed pipeline in high consequence, sensitive use areas risk mitigation project is designed to ensure the network operates in line with good industry practice and safety standards, thereby helping maintain a safe and reliable service to our customers. The proposed solution additional protection existing assets will also help to maintain the reliability of gas supply at the lowest sustainable cost, minimising the impact on customers' gas bills.
Other relevant documents	• Attachment 8.2 Strategic Asset Management Plan • Australian Standard 2885.6-2018 (AS 2885)

1.3 Background

TP pipelines operate with a maximum allowable operating pressure above 1,050 kPa and are managed in line with AS 2885. AS 2885 specifies requirements for the design and construction of steel pipelines and associated piping and components used to transmit single-phase and multi-phase hydrocarbon fluids. It also provides guidelines for use of pipe manufactured from certain non-steel or corrosion-resistant materials, and guidelines for the transport of supercritical carbon dioxide.

Below ground pipes are susceptible to being struck by third parties, particularly when augers or other drilling tools are being used. We aim to reduce the risk of third party strikes by building pipelines under roadways, and avoiding installing pipelines in locations where the consequences of an asset strike (and resultant leak) would be high.

It is not always possible to mitigate the risk in this way. Sometimes it is not practicable to confine the TP pipeline to the roadway. In some cases, urban spread means a location that was low risk at

the time of pipeline installation, has since become a high consequence and sensitive use area (for example if a school and/or housing estate has been built nearby).

Current controls for below ground assets include weekly pipeline patrols, the Dial Before You Dig service, liaison and installing pipeline marker signage. These measures are accepted industry practice for most pipelines. However, additional operational and physical controls are needed for TP pipelines located near to sensitive use areas if we are to reduce the risk to 'as low as reasonably practicable' (ALARP). [108]

Section 4.9 of AS 2885 requires AGN to classify each of our TP pipeline routes based on the location relative to land use. It then requires for each pipeline classified *as Residential (T1), High Density (T2), Industrial, Sensitive, Environmental, Heavy Industrial (where pipeline failure would create potential for consequence escalation), and Crowd (where determined by the Safety Management Study), it be designed such that rupture is not a credible failure mode.*

To promote public safety and to ensure we remain compliant with industry standards and good industry practice, we regularly assess our classification of TP pipelines. There have necessarily been changes to AS 2885 since the construction of many of our TP pipelines, coupled with an increase in urban encroachment. To accommodate this change we have reassessed the risk associated with out TP pipelines and whether we are managing that risk to ALARP.

Our review[109] has identified four short sections of TP pipeline totalling [redacted] metres (0.3% of the TP network) that require treatment because:

- they are located near a high consequence, sensitive use area;
- have no additional physical protection; and
- they are not located beneath a road.

The pipelines located in high consequence, sensitive use areas are:

1 M55 which is in a residential area, and in the vicinity of [redacted];

2 M12 which is in a residential area, and in the vicinity of [redacted];

3 M63 which is in a residential area, and in the vicinity of [redacted]; and

4 M143 which is in a residential area, and in the vicinity of [redacted].

More information on these identified high consequence, sensitive use areas is provided in Appendix B.

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[108] A sensitive use area is one where the consequences of asset failure are higher due to its proximity to members of the public who may be unable to protect themselves or evacuate quickly if a leak occurs. Examples include near childcare centres, schools, hospitals, aged care facilities or prisons. Under the guidance of AS 2885, we aim to reduce the risk associated with any TP asset located within 30 metres of a sensitive use area to ALARP.

The 30 metre radius is based on a calculation specified in AS 2885.6-2018. The calculation is based on the credible scenario whereby an auger pierces a TP pipeline creating a 50 mm hole, causing a major gas escape with ignition. The calculation determines the size of the radius around this ignited gas leak that is exposed to an energy of 4.7 kw/m^2, which will cause 2nd degree burns within 30 seconds of direct exposure. Since this is a sensitive location containing children, elderly or disabled the potential for injury to public is higher compared with a non-sensitive area.

[109] Conducted via pipeline patrols and desktop assessments.

This business case considers options to reduce the risk associated with these sections of pipeline.

1.4 Risk assessment

Risk management is a constant cycle of identification, analysis, treatment, monitoring, reporting and then back to identification (as illustrated in Figure 1.1). When considering risk and determining the appropriate mitigation activities, we seek to balance the risk outcome with our delivery capabilities and cost implications. Consistent with stakeholder expectations, safety and reliability of supply are our highest priorities.

Figure 1.1: Risk management principles

Our risk assessment approach focuses on understanding the potential severity of failure events associated with each asset and the likelihood that the event will occur. Based on these two key inputs, the risk assessment and derived risk rating then guides the actions required to reduce or manage the risk to an acceptable level.

AGN's risk management framework is based on:

- AS/NZS ISO 31000 Risk Management – Principles and Guidelines;
- AS 2885 Pipelines-Gas and Liquid Petroleum; and
- AS/NZS 4645 Gas Distribution Network Management.

The Gas Act 1997 and Gas Regulations 2012, through their incorporation of AS/NZS 4645 and the Work Health and Safety Act 2012, place a regulatory obligation and requirement on AGN to reduce risks rated high or extreme to low or negligible as soon as possible (immediately if extreme). If it is not possible to reduce the risk to low or negligible, then we must reduce the risk to as low as reasonably practicable (ALARP).

When assessing risk for the purpose of investment decisions, rather than analysing all conceivable risks associated with an asset, we look at a credible, primary risk event to test the level of investment required. Where that credible risk event has an overall risk rating of moderate or higher, we will undertake investment to reduce the risk.

Seven consequence categories are considered for each type of risk:

1 Health & safety – injuries or illness of a temporary or permanent nature, or death, to employees and contractors or members of the public

2 Environment (including heritage) – impact on the surroundings in which the asset operates, including natural, built and Aboriginal cultural heritage, soil, water, vegetation, fauna, air and their interrelationships

3 Operational capability – disruption in the daily operations and/or the provision of services/supply, impacting customers

4 People – impact on engagement, capability or size of our workforce

5 Compliance – the impact from non-compliance with operating licences, legal, regulatory, contractual obligations, debt financing covenants or reporting / disclosure requirements

6 **Reputation & customer** – impact on stakeholders' opinion of AGN, including personnel, customers, investors, security holders, regulators and the community

7 **Financial** – financial impact on AGN, measured on a cumulative basis

A summary of our risk management framework, including definitions, has been provided in Attachment 8.10.

The risk event identified for TP pipelines in high consequence, sensitive use areas is the potential for a third party asset strike (for example with an auger). This could result in a major gas escape, property damage, injury to the public and, in extreme circumstances, multiple fatalities. The safety consequences of a major gas escape in sensitive use areas can potentially be more severe, as they typically contain a large concentration of people who may not be able to evacuate the area quickly (e.g. aged care facilities or prisons).

A major rupture to a TP pipeline at sensitive use locations could also result in the loss of supply to >10,000 customers, resulting in a moderate operations risk. Accordingly, the reputational risk associated with the primary risk event also gives rise to a moderate risk rating.

The untreated risk[110] associated with unprotected TP pipelines in high consequence, sensitive use areas being affected by a third party asset strike is shown in Table 1.3.

Table 1.3: Risk assessment – Untreated risk

Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	High
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	High	Negligible	Moderate	Negligible	Negligible	Moderate	Negligible	

1.5 Options considered

Different options have been considered to address the risks associated with unprotected TP pipelines operating in high consequence sensitive use areas. These options are:

- **Option 1** – Maintain status quo which, includes weekly pipeline patrols, DBYD services and installing and maintaining pipeline marker signs;
- **Option 2** – Install additional physical protection; or
- **Option 3** – Relocate TP pipelines under the road through sensitive use locations.

These options are discussed in the following sections.

De-rating the entire length of each of the affected pipelines was also identified as an option. However, initial assessment suggested this option would require additional costs to modify district regulator stations and metering facilities, and could lead to insufficient spare capacity to cater for future growth. It was therefore not considered viable and not pursued in this business case.

Relocation of the TP pipeline around sensitive locations was also considered, however re-routing the pipeline through different streets in the local area was not reasonably practicable, nor cost effective. It was therefore not considered viable and not pursued in this business case.

[110] Untreated risk is the risk level assuming there are no risk controls currently in place. Also known as the 'absolute risk'.

1.5.1 Option 1 – Maintain status quo

With this option, we would continue with current controls for the identified 603 metres of unprotected TP pipeline in high consequence, sensitive use areas.

Current controls include:

- weekly pipeline patrols;
- liaison
- Dial Before You Dig service (DBYD); and
- pipeline marker signs.

Despite these controls, there have been recent incidents. For example, in September 2016 an unprotected TP pipeline in Arthurs Seat, Victoria was struck by an auger causing a leak. While this incident did not result in ignition, it is plausible that it may have.

Under this option, no additional works would be undertaken to reduce the likelihood of third party asset strikes to protect vulnerable members of the community.

1.5.1.1 Cost assessment

There would be no additional upfront capital cost (beyond the usual installation of signs) associated with this option.

This option does not decrease the likelihood of third party asset strikes in high consequence, sensitive use areas. An asset strike could result in a major gas escape, property damage, injury to the public and, in extreme circumstances, fatalities.

Each of these resulting events would significantly cost us and our customers. It is expected that the cost to reactively repair a TP Pipeline would be at a minimum 2-5 times greater than a proactive approach. This is due to the need to isolate supply, penalty charges, expedited materials and bespoke fabrication, as well as conservative estimates regarding increases in labour costs due to out of hours working, increased supervision and delivering customer support throughout an unplanned interruption.

This option would also lead to largely unquantifiable costs associated with the disruption of supply to customers, as well as the public safety risk associated with asset failure and an uncontrolled release of gas. This would not align with our vision objectives or risk management principles.

1.5.1.2 Risk assessment

Option 1 is inconsistent with our risk management framework as it does not address the health and safety risk associated with a third party asset strike in high consequence, sensitive use areas to low or ALARP. Disruption to supply or occurrence of a safety incident can also result in significant reputational damage.

Table 1.4 shows the residual risk associated with unprotected TP pipelines in high consequence, sensitive use areas if Option 1 is pursued.

Table 1.4: Risk assessment – Option 1

Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	High
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	High	Negligible	Moderate	Negligible	Negligible	Moderate	Negligible	

1.5.1.3 Alignment with vision objectives

Table 1.5 shows how this option aligns with our vision objectives.

Table 1.5: Alignment with vision – Option 1

Vision objective	Alignment
Delivering for Customers – Public Safety	N
Delivering for Customers – Reliability	N
Delivering for Customers – Customer Service	N
A Good Employer – Health and Safety	N
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	N

Option 1 would not align with our objective of *Delivering for Customers*, as it would not address the safety risks associated with operating TP pipelines in high consequence, sensitive use areas.

Option 1 would also not align with our objective of remaining *Sustainably Cost Efficient*. By not taking safety measures to protect our vulnerable members of the community, we are not being socially responsible.

Not addressing the safety risk associated with operating TP pipelines in high consequence, sensitive use areas is inconsistent with asset management practice within the pipeline industry.

1.5.2 Option 2 – Install physical protection

Under Option 2 we would install concrete or polyethylene slabbing over the 603 metres of unprotected TP pipeline in high consequence, sensitive use areas. Installing this physical barrier will reduce the likelihood of an asset strike from an excavator or auger.

The slabbing will be buried above the pipeline with clearance between the slabbing and the asset. If an auger or excavator was to dig above an asset with this slabbing protection, the equipment will experience resistance when the slab is hit, prompting the equipment operator to stop, thereby preventing the pipeline from being struck.

Note that all new pipelines are installed beneath a road wherever possible, as the roadway offers a degree of physical protection as well as reducing the likelihood that the pipeline would be excavated without the proper precautions being taken. Installation of slabbing is an efficient solution for existing pipelines that the cost of relocating under a road would be prohibitive, or for new pipelines than cannot be placed under a road.

1.5.2.1 Cost assessment

The estimated capital cost of installing slabbing above the [redacted] metres of unprotected TP pipeline in high consequence, sensitive use areas over the next five years is $0.3 million. This estimate is based in current material and labour rates for slabbing and assumes each of the four identified areas are prioritised to be addressed in 2021/22.

Table 1.6: Cost estimate – Option 2, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	180.4	-	-	-	-	180.4
Materials	86.3	-	-	-	-	86.3
Total	**266.7**	-	-	-	-	**266.7**

1.5.2.2 Risk assessment

Option 2 is consistent with our risk management framework. While this option does not present the lowest treated risk, it reduces the risk to as low as reasonably practicable (ALARP) and is achieved at a significantly lower cost than Option 3 (which achieves the lowest risk rating).

Table 1.7 shows the residual risk associated with installing physical protection (slabbing) over the 603 metres of TP pipeline in high consequence, sensitive use areas (Option 2).

Table 1.7: Risk assessment – Option 2

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Moderate
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	Moderate	Negligible	Low	Negligible	Negligible	Low	Negligible	

1.5.2.3 Alignment with vision objectives

Table 1.8 shows how this option aligns with our vision objectives.

Table 1.8: Alignment with vision – Option 2

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	-
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	-
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	Y
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

Option 2 aligns with our objective of *Delivering for Customers*, as it would address the safety risks associated with operating TP mains around vulnerable members of the community in high consequence, sensitive use areas.

Option 2 aligns with our objective of remaining *Sustainably Cost Efficient*. This option is socially responsible as it would allow AGN to protect the community from third party asset strikes in high consequence, sensitive use areas. Installing concrete or polyethylene slabbing is consistent with accepted asset management practice an industry benchmarks. Slabbing is considered to be the most cost efficient and good practice solution to reduce the identified risk.

1.5.3 Option 3 – Relocate TP pipelines under the road at sensitive use areas

Under Option 3 we would relocate the TP pipelines under the road through the high consequence, sensitive use areas. Relocating the TP mains under the road aligns with industry standard practice and the Strategic Asset Management Plan, whereby new TP pipelines are installed underneath roads as standard (where practicable), acting as physical protection and reducing the likelihood of being struck by an auger.

This would involve relocating 690 metres of new pipelines under the road, flowstopping the TP main, isolating the identified sections to reconnect the pipeline, and decommission the existing assets at risk. This option would also require significant detailed design and planning.

The four identified areas would be prioritised for 2021 to 2023, and take two years to complete.

1.5.3.1 Cost assessment

The estimated capital cost of installing TP pipelines under roads in high consequence, sensitive use areas over the next five years is estimated to be $1.8 million.

This estimate is based on current material and labour rates for installing 690 metres of new pipelines and also includes extensive TP flowstopping, connections and decommissioning of existing pipeline at risk. The overall unit rate is [redacted] per meter due to the large proportional amount of flow stopping and connections required for short length of mains installation.

Table 1.9: Cost estimate – Option 3, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Materials	276.1	276.1	-	-	-	552.1
Labour	613.8	613.8	-	-	-	1,227.7
Total	**889.9**	**889.9**	**-**	**-**	**-**	**1,779.8**

This option would provide the lowest risk solution, but at a higher cost to us and our customers than Option 2. It is therefore consistent with the risk management framework and some (but not all) of our vision objectives.

1.5.3.2 Risk assessment

Option 3 reduced the health and safety risk associated with a third party asset strike in these specific high consequence, sensitive use areas from high to moderate. This option achieves the same level of risk reduction as Option 2, as the roadway at these identified locations acts as a physical barrier equivalent to slabbing, which mitigates the potential threat occurring at these locations. However, the cost of achieving this risk reduction via Option 3 is significantly more expensive.

Table 1.10: Risk assessment – Option 3

Option 3	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Finance	Risk Rating
Likelihood	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Moderate
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	Moderate	Negligible	Low	Negligible	Negligible	Low	Negligible	

1.5.3.3 Alignment with vision objectives

Table 1.11 shows how this option aligns with our vision objectives.

Table 1.11: Alignment with vision – Option 3

Vision objective	Alignment
Delivering for Customers – Public Safety	Y
Delivering for Customers – Reliability	-
Delivering for Customers – Customer Service	Y
A Good Employer – Health and Safety	-
A Good Employer – Employee Engagement	-
A Good Employer – Skills Development	-
Sustainably Cost Efficient – Working within Industry Benchmarks	N
Sustainably Cost Efficient – Delivering Profitable Growth	-
Sustainably Cost Efficient – Environmentally and Socially Responsible	Y

Option 3 would align with our objective of *Delivering for Customers*, as it would address the safety risks associated with operating high-pressure mains around vulnerable members of the community in high consequence, sensitive use areas.

However, Option 3 is not the most *Sustainably Cost Efficient* solution. While laying mains under the road achieves the same level of risk reduction, it is considerably more expensive to relocate an existing pipeline than it is to install slabbing above it.

1.6 Summary of costs and benefits

Table 1.12 presents a summary of how each option compares in terms of the estimated cost, the residual risk rating, and aligning with our objectives.

Table 1.12: Comparison of options

Option	Estimated cost ($ million)	Treated residual risk rating	Alignment with vision objectives
Option 1	0	High	This would fail to achieve safety and reliability objectives or meet industry standards.
Option 2	0.3	Moderate - ALARP	This is consistent with our risk management framework and would align with all relevant vision objectives.
Option 3	1.8	Moderate – ALARP	This option achieves the necessary risk reduction, but at a significantly higher cost than option 2. It therefore does not align with our objective to be sustainably cost efficient.

1.7 Recommended option

Option 2 is the proposed solution to reduce the risk posed by TP pipelines in high consequence, sensitive use areas, in the most efficient and cost effective manner.

1.7.1 Why is the recommended option prudent?

Option 2 delivers a solution that addresses the risk of TP pipelines in high consequence, sensitive use areas to ALARP at the lowest cost. It is therefore consistent with good industry practice and AGN's asset strategy in the Strategic Asset Management Plan and the risk management framework.

It supports the vision and values in relation to:

- *Delivering for Customers*, as it would address the safety risks associated with operating high-pressure mains around vulnerable members of the community in high consequence, sensitive use areas; and
- *Sustainably Cost Efficient*, as it is socially responsible to protect vulnerable members of the community. Installing a physical barrier is consistent with accepted asset management practice and is the most cost efficient solution.

1.7.2 Estimating efficient costs

Key assumptions made in the cost estimation for the slabbing program include:

- costs based on historical expenditure noting that these works are standard practice;
- estimates derived from contractual rates of vendors to be utilised;
- resource cost based on other similar projects ongoing at present or in previous AA periods; and
- original equipment manufacturer contractual rates for spares and labour that are part of our services agreements.

Table 1.13 presents a breakdown of the slabbing program by cost category. Table 1.14 provides the costs escalated to June 2021 dollars.

Table 1.13: Project cost estimate by cost category, $'000 2019/20

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Labour	180.4	-	-	-	-	180.4
Materials	86.3	-	-	-	-	86.3
Total	**266.7**	-	-	-	-	**266.7**

Table 1.14: Escalated project cost estimate ($'000)

	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Total unescalated ($ Dec 19)	266.7	-	-	-	-	266.7
Escalation	9.0	-	-	-	-	9.0
Total escalated ($ Jun 21)	**275.7**	-	-	-	-	**275.7**

1.7.3 Consistency with the National Gas Rules

In developing these forecasts, we have had regard to Rule 79 and Rule 74 of the NGR. With regard to all projects, and as a prudent asset manager, we give careful consideration to whether capex is conforming from a number of perspectives before committing to capital investment.

Rule 79(1)

The installation of physical protection above our TP pipelines is consistent with the requirements of NGR 79(1)(a). Specifically, we consider that the capital expenditure is:

- Prudent – the expenditure is necessary in order to increase the protection for the public in sensitive use areas. Installing physical protection is therefore prudent if we are to maintain the integrity of the pipeline at such locations. The proposed risk treatment is consistent with accepted industry practice and current design standards, and is proven to address the risk associated with third party TP pipeline strikes. Several practicable options have been considered to address the risk. The proposed expenditure is therefore consistent with that which would be incurred by a prudent service provider.

- Efficient – historical average actuals and tender contract values. The proposed expenditure can therefore be considered consistent with the expenditure that a prudent service provider acting efficiently would incur.

- Consistent with accepted and good industry practice – the proposed expenditure follows good industry practice by ensuring that existing safety risks are addressed to ALARP and in line with current industry practice and design standards. The proposed capital expenditure is therefore such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice.

- To achieve the lowest sustainable cost of delivering pipeline services – the sustainable delivery of services includes reducing risks to as low as reasonably practicable and maintaining reliability of supply, whilst achieving the lowest sustainable costs by undertaking the works in line with the relevant useful life and adopting proven new and emerging technologies and techniques that reduce long-term costs.

Rule 79(2)

The proposed capex is justifiable under NGR 79(2)(c)(i), as it is necessary to maintain the safety of services. Not addressing the risk of third party TP pipeline strikes in high consequence, sensitive use areas results in an unacceptable safety risk to vulnerable members of our community and is inconsistent with our risk management framework.

Consistent with the Strategic Asset Management Plan, and as outlined in this business case, the installation of physical protection above our TP pipelines has proven to reduce the risk of third party asset strikes and will allow us to maintain a level of service consistent with customer expectations.

Moreover, this is the most cost-efficient solution to reduce the identified risk and is slabbing is current industry standard practice.

Rule 74

The forecast costs are based on the latest market rate testing and project options consider the asset management requirements as per the latest Strategic Asset Management Plan. The estimate has therefore been arrived at on a reasonable basis and represents the best estimate possible in the circumstances.

Appendix A – Comparison of risk assessments for each option

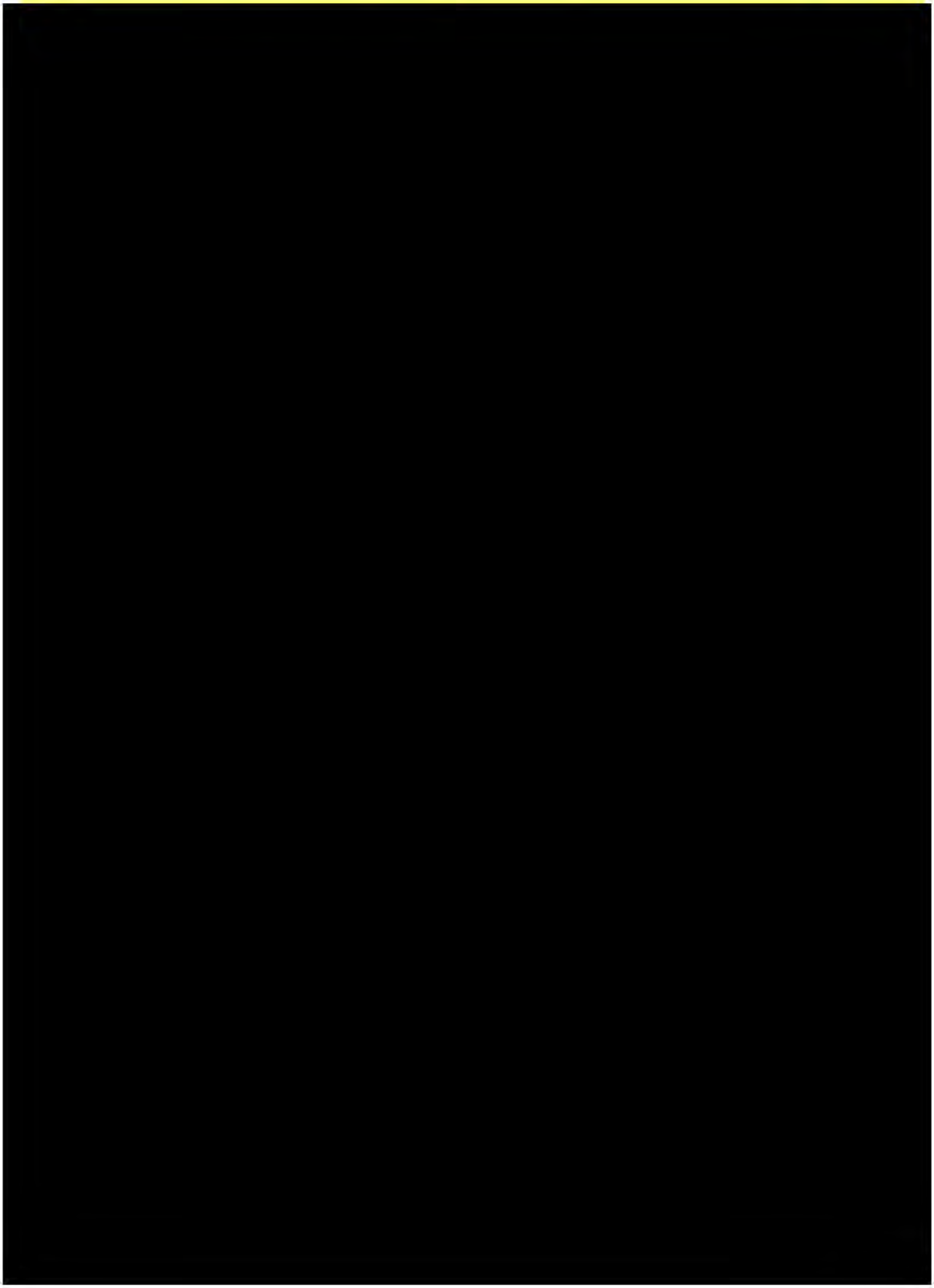
Untreated risk	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	High
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	High	Negligible	Moderate	Negligible	Negligible	Moderate	Negligible	

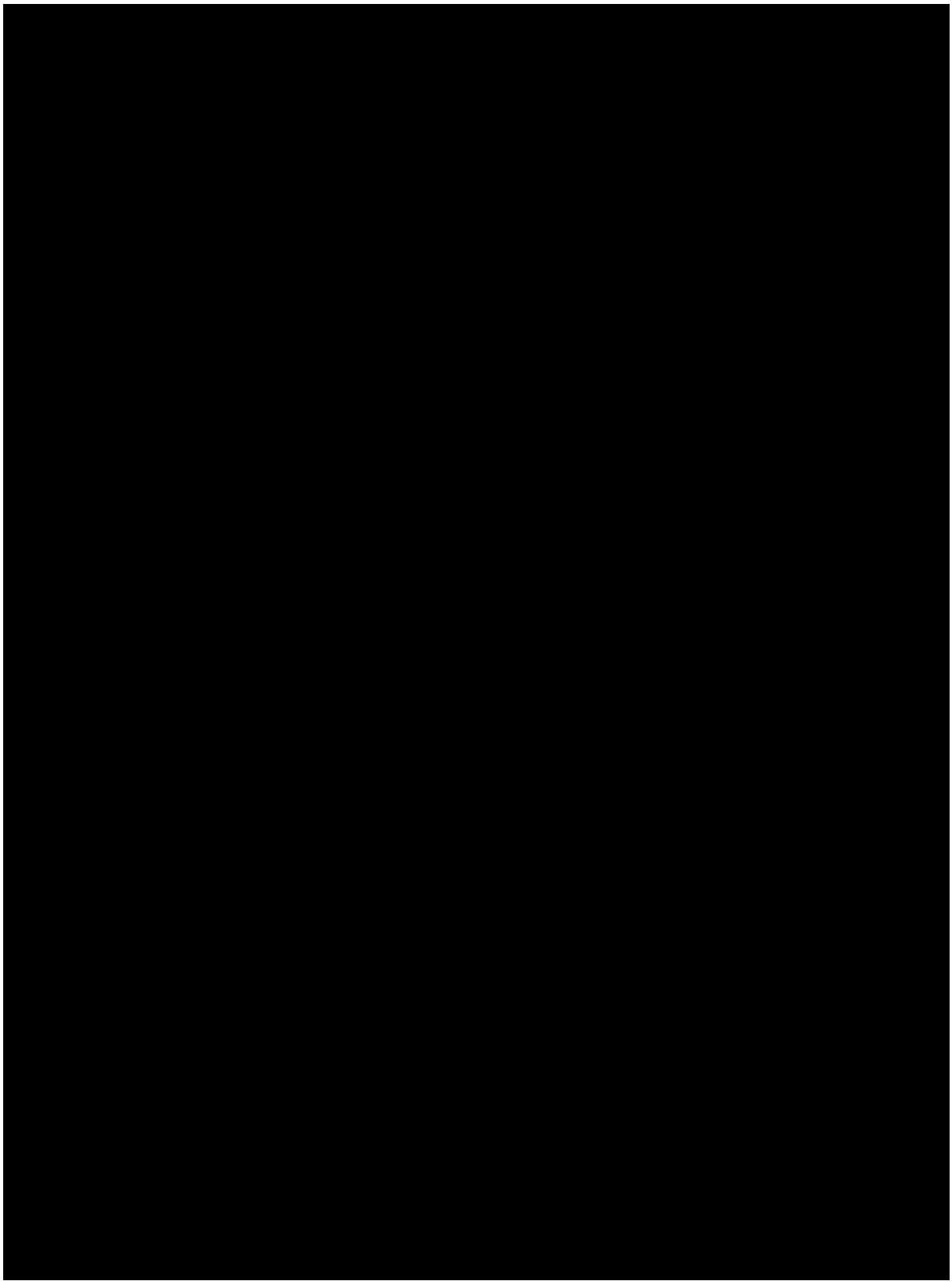
Option 1	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Remote	Remote	Remote	Remote	Remote	Remote	Remote	High
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	High	Negligible	Moderate	Negligible	Negligible	Moderate	Negligible	

Option 2	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Moderate
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	Moderate	Negligible	Low	Negligible	Negligible	Low	Negligible	

Option 3	Health & Safety	Environ-ment	Operations	People	Compliance	Rep & Customer	Financial	Risk Rating
Likelihood	Rare	Rare	Rare	Rare	Rare	Rare	Rare	Moderate
Consequence	Catastrophic	Minimal	Major	Minor	Minor	Major	Minor	
Risk Level	Moderate	Negligible	Low	Negligible	Negligible	Low	Negligible	

Appendix B – Identified high consequence sensitive use areas





Location	Name	Land Use	Pipeline	Pipeline Nominal Diameter	Pipeline Wall Thickness	Primary Location Class	Secondary Location Class	Length of slabbing required (m)
[redacted]	[redacted]	[redacted]	M55	150	4.8	T1	Sensitive	8
[redacted]	[redacted]	[redacted]	M12	250	6.35	T1	Sensitive	140
[redacted]	[redacted]	[redacted]	M63	200	6.35	T1	Sensitive	215
[redacted]	[redacted]	[redacted]	M143	300	6.39	T1	Sensitive	240

Appendix C – Cost breakdown

Option 2

Category	Description	Units	Units QTY	Number of sites	Unit Cost $/ unit	Total $'000
Materials						
Slabbing	Polyethylene slabbing on M55, 2m long each Slab	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Slabbing	Polyethylene slabbing on M12, 2m long each Slab	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Slabbing	Polyethylene slabbing on M63, 2m long each Slab	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Slabbing	Polyethylene slabbing on M143, 2m long each Slab	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Other	Freight, storage, and handling	Each	[redacted]	[redacted]	[redacted]	[redacted]
Total Materials						**86.3**
Labour						
Project management design and initiation	Project manager	Hours	[redacted]	[redacted]	[redacted]	[redacted]
	Site Supervisor	Hours	[redacted]	[redacted]	[redacted]	[redacted]
	GIS technician	Hours	[redacted]	[redacted]	[redacted]	[redacted]
	HSE representative	Hours	[redacted]	[redacted]	[redacted]	[redacted]
	Third party permits (DPTI, SAPN)	Each	[redacted]	[redacted]	[redacted]	[redacted]
Install Slabbing M55	Excavate, install slabbing and reinstate on M55 (based on 1 day for 3 man crew)	Hours	[redacted]	[redacted]	[redacted]	[redacted]
	Excavator (8T)	Hours	[redacted]	[redacted]	[redacted]	[redacted]
	Tipper Truck (8T)	Hours	[redacted]	[redacted]	[redacted]	[redacted]
Install Slabbing M12	Excavate, install slabbing and reinstate on M12 (based on historical rate)	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Install Slabbing M63	Excavate, install slabbing and reinstate on M63 (based on historical rate)	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Install Slabbing M143	Excavate, install slabbing and reinstate on M143 (based on historical rate)	Metres	[redacted]	[redacted]	[redacted]	[redacted]
Total Labour						**180.4**
Total Project						**266.7**