Jemena Gas Networks (NSW) Ltd

Licence 7 - Plumpton to Pitt Town Isolation

Options Analysis

GAS-1295-RP-PL-007

1 April 2024

Jemena

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1. EXECUTIVE SUMMARY

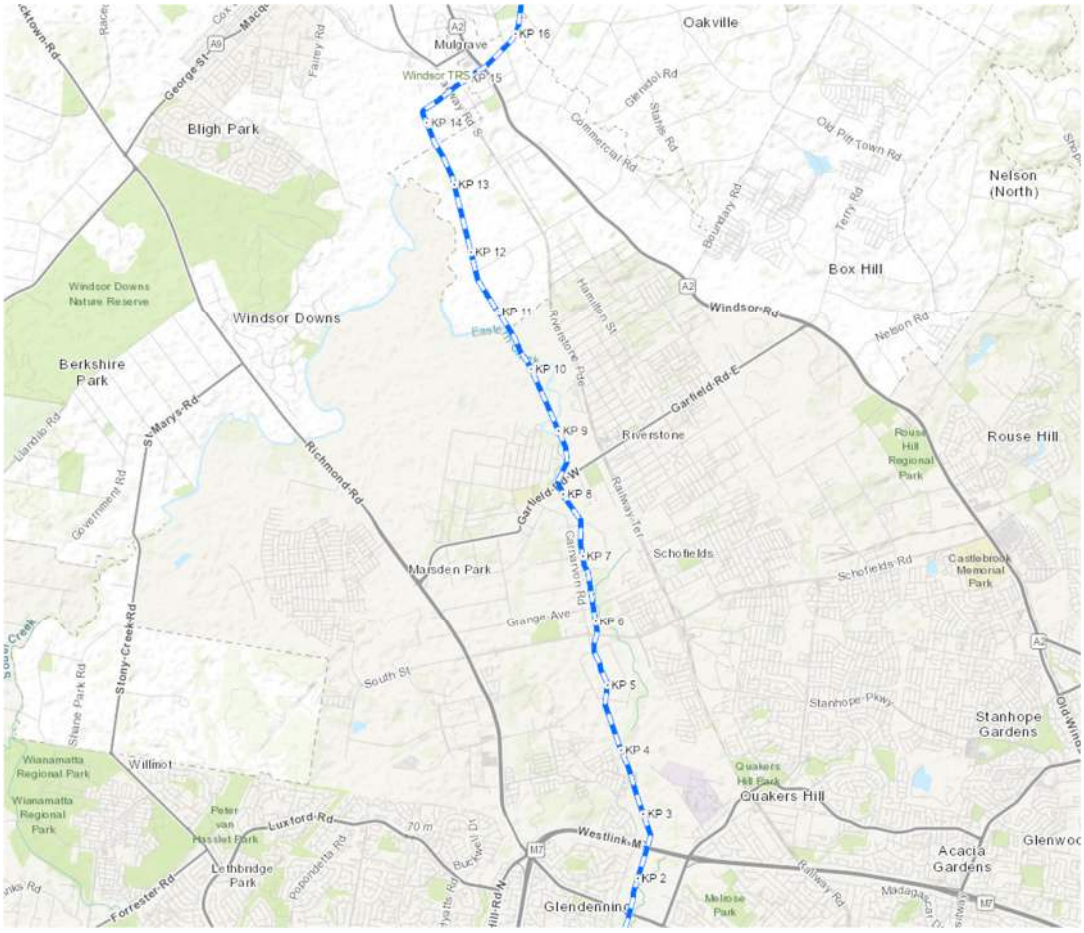
1.1 PROJECT AND KEY DRIVERS

Jemena Gas Networks (JGN)s Licence 7 Pipeline, known as the Northern Trunk Pipeline, traverses Sydney's north west growth corridor between Stonecutters' Ridge and Mulgrave (KP 2.5 to KP 15) shown below in figure 1. The ongoing development of medium and high density residential properties in this area will have an impact on the location class of the pipeline and therefore the requirements for protection and risk mitigation as dictated in AS2885.1.

One requirement is the spacing of Main Line Valves (**MLV**) or Automatic Line Break Valves (**ALBV**) along the pipeline, required for isolation in the case of a loss of containment (LoC) event. Currently MLVs are located at Plumpton and Pitt Town, a distance of 20km which is in line with the guidance provided in AS2885.1 for R2 locations (30km). A change in location class to T1 requires MLV spacing to be decreased to 15km and the development of the land around the pipeline in this area would necessitate a change in location class (to T1) for the majority of the pipeline between the existing MLVs. Therefore the pipeline will become non-compliant to the requirements of AS2885.1.

Further to this, a review of the current ALBV assemblies installed during pipeline construction found that these facilities do not provide adequate, safe ability to blowdown the adjacent pipeline sections under current work health and safety requirements.

Figure 1 – North-west Sydney growth area



1.2 CREDIBLE OPTIONS

The following options were assessed for this project and are provided in Table 1 below. The table shows the capital and operational costs of each option in present value terms.

Table 1: Options Summary

Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
Options	Maintain Status Quo (Do Nothing)	Install Blowdown Riser assembly at Windsor TRS	Install a new ALBV with venting capability	Install Blowdown Riser assembly at Plumpton TRS	Install blowdown riser assembly at Plumpton and Windsor TRS and install new ALBV
Description	Do Nothing, depressurising pipeline will occur as per the current isolation plan.	Modify Windsor TRS inlet piping to include a blowdown riser.	Install new ALBV mid-way between Plumpton and Pitt Town with bypass assembly and blowdown riser.	Modify Plumpton TRS inlet piping to include a blowdown riser.	Modify Plumpton and Windsor TRS inlet piping to include a blowdown riser, in addition to installing an MLV to isolate the pipeline section between Plumpton and Pitt Town
Pros	No immediate cost or effort required	This will reduce the safe blow down time The blow down of the pipeline will be at designated safe area within the facility away from residential buildings. The Plumpton TRS can continue to supply customers without impact.	This will achieve the recommended valve spacing requirement of AS2885. Reduce the safe blow down time for each new 10kms section.	This will reduce the safe blow down time The blow down of the pipeline will be at designated safe area within the facility away from residential buildings.	This will reduce the safe blow down time The blow down of the pipeline will be at designated safe area within the facility away from residential buildings. Will meet the recommended valve spacing requirement of AS2885
Cons	Drawdown time is excessive Valve spacing will still be 20kms	Some minor design modification to the TRS will be required Valve spacing will still remain 20kms	Significant capital investment required. Requires hot tap and stopple arrangement to install a new valve.	Some minor design modification to the TRS will be required Valve spacing will still remain 20kms Plumpton TRS will need to be shutdown	Significant capital investment required. Requires hot tap and stopple arrangement to install a new valve.
Improves public and asset safety	Fatality risk exists	Failure risk significantly reduced	Failure risk significantly reduced	Failure risk significantly reduced	Failure risk significantly reduced
Maintain reliability of supply / security of supply in future	Significant supply risk	Supply risk significantly reduced	Supply risk significantly reduced	Supply risk significantly reduced	Supply risk significantly reduced
Compliance to AS2885	Non-Compliant	Non-Compliant	Meets compliance	Non-Compliant	Meets compliance
Cost Effectiveness	No capital investment	Moderate expenditure required	Large capex expenditure required	Moderate expenditure required	Large capex expenditure required
Treated Risk Ranking	High	High	Moderate	High	Moderate

Criteria	Option 1	Option 2	Option 3	Option 4	Option 5
Cost Estimate (Capital)	$ 0	$1.2M	$3.12M	$1.6 M	$5.9M
Options Analysis	○ Does not address the issue	◐Partially addresses the issue	● Fully addresses the issue	◐Partially addresses the issue	● Fully addresses the issue
Recommended order of options	Not Recommended	2	1	3	4

1.3 RECOMMENDATION

Option 3: Install a new ALBV with a venting capability is the recommended solution.

Based on the options analysis of the identified threats, associated risk ratings, and the business needs, it is recommended that the most viable, practical and cost effective solution for addressing the compliance issues associated with the increasing land development around the Northern Trunk Pipeline as well as the safety issues associated with blowing down the pipeline. This option aligns with the imperative of ensuring public safety, maintaining the integrity of JGN's gas distribution system, and safeguarding Jemena's financial stability.

1.4 CONSUMER ENGAGEMENT

Customers told us that safety is non-negotiable and expect affordability to be prioritised but not at the expense of safety and reliability[1]. Customers do not want us to do anything that could jeopardise theirs or our staffs' safety and well-being.

To ensure we meet customer service expectations we plan to inspect all our high-pressure pipelines that provide gas services to our customers as it ensures the integrity of the pipe is monitored and maintained to an acceptable safety standard. This is a critical activity as inspection of the pipeline enables us to pick up abnormalities on the pipe that may pose safety issues resulting in harm to the public or a loss of gas supply event to our customers. Although converting the old mains to being piggable has a significant upfront costs, it is in the long-term interests of customers as it provides the lowest cost option in the long term and ensures safety and reliability to our customers.

1.5 NATIONAL GAS RULES

Option 3: Install a new ALBV with a venting capability has been chosen as the recommended option to fulfil the objectives of this project.

The capex is consistent with rule 79(2) of the National Gas Rules as it is necessary in order to maintain and improve the safety of services (Rule 79(2)(c)(i)) and it is necessary in order to maintain the integrity of services (R79(2)(c)(ii)). The Licence 7 pipeline is an aging asset and is being affected by significant encroachment of land development with increased population density. These encroachments significantly increase the consequence of a pipeline failure therefore changing the risk profile with concern to public safety.

The proposed solution is also consistent with rule 79(1)(a) of the National Gas Rules:

[1] Customer Engagement Straight Talk, October2018, p.24 – ECMS Link: http://ecms/otcs/cs.exe/link/312685373

- Prudent – In the absence of this expenditure the Licence 7 pipeline would reach a point where it could no longer continue to operate within an acceptable risk profile. Therefore, the expenditure is required to maintain gas reliability and to comply with regulatory obligations (refer to Section 2.3 for details)

These are the requirements of a prudent operator.

- Efficient – The option selected is the most cost effective long term option that meets the necessary operational requirements in order to remain compliant with legal obligations and Australian standards. The cost estimates for this project were developed from actual costs of a similar project that underwent a competitive tender process, and quotations received from vendors.
- Consistent with accepted and good industry practice – Addressing the risks associated with the pipeline blowdown is accepted as good industry practice. Complying with the obligations set out by the Code where by the proposed reinforcement is consistent with good industry practice.
- Necessary to achieve the lowest sustainable cost of delivering pipeline services –The proposed project balances the risk of reliability, disruption to community and cost to customers to provide the lowest sustainable cost. A cost that proactively addresses a reliability issue to more than 350,000 customers, thereby avoiding reactive measures that would otherwise cause disruption to our customers.

The project is also consistent with rule 79 (2)(c), because it is necessary to:

- Maintain and improve the safety of services (79(2)(c)(i)) – if loss of containment occurs as a result of pipeline failure, then there would be a high risk to public safety, and will also expose Jemena to significant, compounded financial and reputational risk if there is insufficient capability to respond to an incident of this criticality.
- Maintain the integrity of service (79(2)(c)(ii))- If the recommended option is not implemented and if pipeline failure occurs , an immediate repair will be required which may not be possible and result in an extended interrupted / restricted supply of gas to our customers.

Comply with a regulatory obligation (79(2)(c)(iii))- Jemena is required by regulation to ensure the pipeline is operated in a safe manner and a continuous supply of gas to customers is maintained at all times. 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.

2. PROJECT BACKGROUND AND KEY DRIVERS

2.1 PROJECT BACKGROUND

The Northern Trunk Pipeline is a vital asset for Jemena Gas Networks (JGN), supplying gas to more than 350,000 customers across North Western Sydney, the Central Coast, Newcastle and Hunter regions. The maximum operating pressure of the pipeline is currently restricted (ROP) to 4.5 MPa and it operates in compliance with the Australian Standard AS2885.3 and by extension the Pipelines Act (1967).

The pipeline was commissioned in 1980 and was originally constructed through farmland in the West and North West of the Sydney Basin. Being design to be fit for purpose at time with a high design factor (0.8) leading to a relatively thin wall pipe (5.3mm is areas) reflecting the low consequence of the failure in these rural areas.

In the years since its construction the North West of Sydney has grown substantially in population. Further plans for more residential land development will encroach into the measurement length of the pipeline. An increase in dwellings inside the measurement length impacts the location class of the pipeline and by extension the requirements for risk management and compliance to the standard. Current planned developments in this area and their impact include:

- West Schofields Development (shown in Figure 2 below), KP 4-8 to become T1, S[2], C[3], CIC[4]
- Garfield Rd realignment KP 8-9 to become R2, C, CIC (same requirements as T1)
- Riverstone West Precinct, KP 9-12 to become R2, I[5], CIC (same requirements as T1)

These developments alone will move the majority of the pipeline in between the existing isolation points to T1 or equivalent location class, triggering increased risk mitigation measures enforceable under AS2885.1. One of these requirements relates to the spacing of MLVs or ALBVs which moves from 30km spacing in R2 to 15km in T1. The current spacing of ALBV's on the pipeline is 20km, thus a change in location class for this section triggers the need for this project as a matter of compliance to the standard.

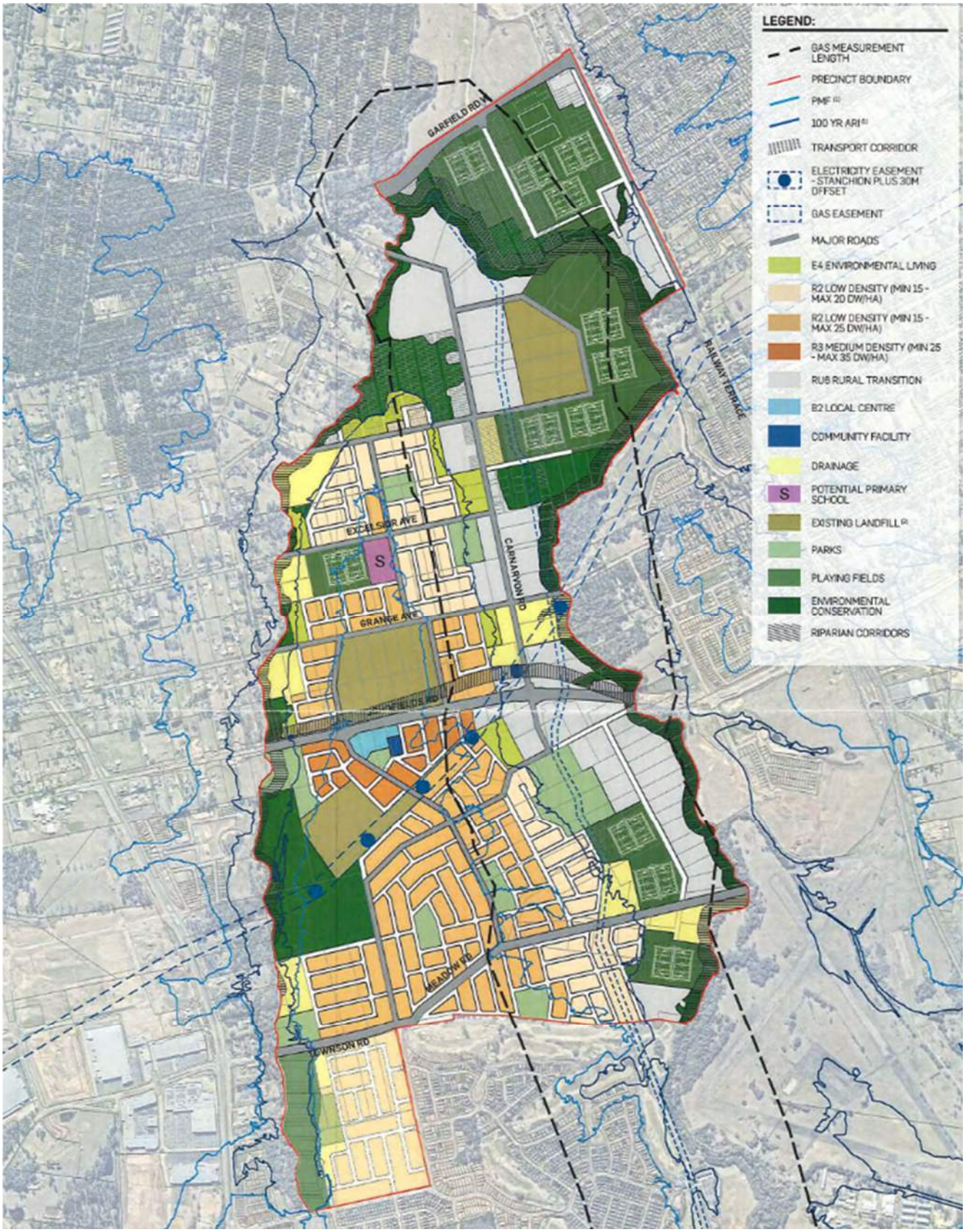
2 Sensitive – Secondary location class

3 Crowd – Secondary location class

4 Common Infrastructure Corridor – Secondary location class

5 Industrial – Secondary location class

Figure 2: West Schofields Development



2.2 IDENTIFIED NEED

The above mentioned developments at West Schofields[6] and Riverstone West[7] have each been subject to the AS2885.6 Safety Management Study (SMS) process. These risk assessments along with the Licence 7 five yearly SMS[8] have identified the threat of these encroachments along with the future required change in location class and the risk of non-compliance with Australian Standards and by extension, Regulation.

2.3 PROJECT DRIVERS AND OBLIGATIONS

Based on the identified risk, a solution is required to ensure the assets are compliant with the obligations and requirements of the Gas Supply Act 1996 No. 38[9] and by extension the Gas Supply (Safety and Network Management) Regulation 2013[10] and Australian Standard AS 2885.3[11].

- *Jemena will not be able to meet its obligations under the Gas Supply Act 1996 No.38 - Facilitate the continuity of supply of natural gas to customers and Consider the development of efficient and safe gas distribution systems*

The current approved safety and operating plan accepted by the **NSW** regulator is Jemena's Safety Case (**SAOP**) of New South Wales (**NSW**) gas assets. The **SAOP** calls on the **JGN ACS** as the principal document which defines the approach and principal methods by which each asset class contributes to delivering Jemena's Asset Management and Health and Safety objectives as defined in the **JGN** Asset Business Strategy (**ABS**). These are to:

- *Compliance with Australian Standards AS 2885.1*[12] *and AS 2885.3*[13]
- Operate and maintain Jemena assets in a way that protects or enhances community safety; and
- Be the customers' first choice for world leading, reliable and sustainable energy solutions.

Jemena as a prudent gas operator, takes into account and complies with relevant standards (such as codes, Australian Standards, guidelines or other requirements) when operating a gas network.

The change in external operating conditions, ie the pipelines location class, necessitates action to ensure continued compliance to the Regulations.

Summary of identified threats and associated risk ratings (as per Group risk management manual and AS2885.1 Risk Matrix) are provided below. The untreated risk levels as determined by the Jemena and AS2885 risk assessment matrices is shown in Table 2. Refer to Appendix A for the detailed risk assessment.

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6 AS2885 SMS Report - West Schofields - Rev 0 IFU LINK

7 Sakkara Riverstone West Precinct SMS Rev A LINK

8 GAS-1295-RP-RM-003 Licence 7 - Five(5) Yearly Safety Management Study LINK

9 Gas Supply Act 1996 No. 38 – Part 1 Section 3 clause (1) subclause (b1), clause (3), and clause (3A)

10 Gas Supply (Safety and Network Management) Regulation 2013 Link

11 AS2885.3 – 2012 – Pipeline – Gas and Liquid Petroleum Part 3: Operation and Maintenance, Section 6: Pipeline Structural Integrity, including but not limited to operational control, corrosion protection, pipe wall integrity and inspection

12 AS2885.1: 2012 Pipelines - Gas and Petroleum; Part 1- Design and Construction

13 AS2885.3: 2012 Pipelines - Gas and Petroleum; Part 3- Operation and Maintenance

Table 2 – Untreated Risk Ratings

Risk Category	Threat Cause	Threat Consequence	Untreated Jemena Risk Rating	Untreated AS 2885 Risk Rating
Crisis & Emergency Management	Encroachment of new residential property developments into the measurement length of the pipeline impacting the location class and leading to under-preparedness for an emergency (Loc) event	In the event of a Loss of Containment, Jemena/Zinfra is unable to respond in an appropriate timeframe/with appropriate efficiency leading to regulatory scrutiny and/or further reputational damage	High	N/A[14]
Legal / Regulatory Compliance	Encroachment of new residential property developments into the measurement length of the pipeline impacting the location class and leading to non-compliance to AS2885.1 and AS2885.3	Increased regulatory scrutiny and/or fines/penalties for non-compliance	High	N/A[15]

2.4 ASSUMPTIONS

Table 3 lists the assumptions that are applicable to this Options Analysis.

Table 3: General assumptions and implications

S.No.	Assumptions	Implication
1.	Planned developments proceed in line with current plans and the requirements of performed SMSs	Location class changes as anticipated, development beyond the current plans would require further risk mitigation.
2.	MLV spacing is critical to emergency response and regulatory compliance	Requirement for this a new MLV mandatory and requires construction at a new site . to provide appropriate spacing.

[14] AS2885.6 Risk definitions do not cover “Crisis & Emergency Management”

[15] AS2885.6 Risk definitions do not cover “Legal / Regulatory Compliance”

3. CREDIBLE OPTIONS

The following options were identified to address the identified risks.

- Option 1: Maintain status quo (Do Nothing)
- Option 2: Install blowdown riser assembly at Windsor TRS
- Option 3: Install a new ALBV with venting capability
- Option 4: Install blowdown riser assembly at Plumpton TRS
- Option 5: Install blowdown riser assembly at both Plumpton and Windsor TRS and install new ALBV

All options are explained in detail below.

3.1 OPTION 1 – MAINTAIN STATUS QUO (DO NOTHING)

This option is not considered to be acceptable as it does not address the issue of non-compliance with the standard in terms of the MLV spacing or improve the ability to blowdown the pipeline in the case of an emergency loss of containment event.

In case of a loss of containment:

- The ALBV's at Plumpton and Pit Town will shut.
- The pressure in the line will be gradually drawn down through Plumpton and Windsor TRS'.
- Once pressure reaches 1000kPa the DN200 bypass valves and Huber-Yale closures are opened to blow down the remaining gas
- The estimated time required to reach 1000 kPa is approximately 6 hours (dependent on time of year and time of day).
- Subsequently, it will take around 12 hours to reduce the pressure to atmospheric levels

3.1.1 BENEFITS & DRAWBACKS:

The expected benefits and drawbacks of this option are provided in the Table below:

Table 5 : Benefits and Drawbacks of Option 1

Benefits	Drawbacks	Risk Reduction	
		Jemena	AS2885
• No Capital outlay	• Does not treat identifies risks to Emergency Management and Regulatory Compliance • Does not improve the ability to blow down the pipeline in case of emergency	High	N/A

3.2 OPTION 2: INSTALL BLOWDOWN RISER ASSEMBLY AT WINDSOR TRS

This option involves modifying the station inlet piping at Windsor TRS to include a purpose built blowdown riser. This improves the time taken to blowdown the pipeline section safely but does not address the issue of compliance to AS2885.1 for spacing of pipeline isolation valves.

3.2.1 CONSTRAINTS

The following constraints provided in Table are applicable to Option - 2

Table 6: Constraints for Option 2

Description	Implication
Modification to station inlet piping will required in-service welding and hot tapping to complete in order to not disrupt supply.	In-service welding and hot tapping are high risk activities that have the potential to interrupt supply if not carried out correctly.

3.2.2 BENEFITS & DRAWBACKS:

The expected benefits and drawbacks of this option are provided in the Table below:

Table 7: Benefits and Drawbacks of Option 2

Benefits	Drawbacks	Risk Reduction	
		Jemena	AS2885
• Minimal capital outlay • Significantly reduces safe blowdown time • Blowing down the pipeline will be performed in a designated safe area within a Jemena controlled facility away from residential buildings. • Plumpton TRS can continue to supply customers without impact.	• Modification to pipework will be required to install blowdown riser, including need for in-service welding and hot tapping operations • Valves spacing not compliant with AS2885.1	High	N/A

3.3 OPTION 3: INSTALL A NEW ALBV WITH VENTING CAPABILITY

This option involves installing a new Automatic Line Break Valve mid-way between Plumpton and Pitt Town, approximately between KP 8 and 9. The new valve will be designed to include a bypass assembly having an adequate ball and plug valve arrangement along with a blowdown riser to depressurise either the upstream or downstream section of the pipeline. This setup will significantly reduce the blowdown time of either the new upstream or downstream sections as well as reducing the total inventory of gas lost in a such an event. It also ensure the pipeline system meeting the isolation valve spacing requirements in AS2885.1.

3.3.1 CONSTRAINTS

The following constraints provided in Table 8 are applicable to Option - 3

Table 8: Constraints for Option 3

Description	Implication
Land access	The ideal location for the valve is on low lying land adjacent to South Creek, this is only accessible via the right of way from the nearest cross street

3.3.2 BENEFITS & DRAWBACKS:

The expected benefits and drawbacks of this option are provided in the Table 9 below:

Table 9: Benefits and Drawbacks of Option 3

Benefits	Drawbacks	Risk Reduction	
		Jemena	AS2885
• Significantly reduces safe blowdown time • Blowing down the pipeline will be performed in a designated safe area within a Jemena controlled facility away from residential buildings. • Plumpton TRS can continue to supply customers without impact. • Complies with AS2885.1 isolation spacing requirements	• Requires significant capital investment	Moderate	N/A

3.4 OPTION 4: INSTALL BLOWDOWN RISER ASSEMBLY AT PLUMPTON TRS

This option involves modifying the station inlet piping at Plumpton TRS to include a purpose built blowdown riser. This improves the time taken to blowdown the pipeline section safely but does not address the issue of compliance to AS2885.1 for spacing of pipeline isolation valves.

3.4.1 CONSTRAINTS

The following constraints provided in Table 10 are applicable to Option - 4

Table 10: Constraints for Option 4

Description	Implication
Modification to station inlet piping will required in-service welding and hot tapping to complete in order to not disrupt supply.	In-service welding and hot tapping are high risk activities that have the potential to interrupt supply if not carried out correctly.

3.4.2 BENEFITS & DRAWBACKS:

The expected benefits and drawbacks of this option are provided in the 11 below:

Table 11: Benefits and Drawbacks of Option 4

Benefits	Drawbacks	Risk Reduction	
		Jemena	AS2885
• Minimal capital outlay • Significantly reduces safe blowdown time • Blowing down the pipeline will be performed in a designated safe area within a Jemena controlled facility away from residential buildings.	• Modification to pipework will be required to install blowdown riser, including need for in-service welding and hot tapping operations • Valves spacing not compliant with AS2885.1	High	N/A

3.5 OPTION 5: INSTALL A NEW ALBV WITH VENTING CAPABILITY

This option is a combination of options 2, 3, and 4 and involves installing a new Automatic Line Break Valve mid-way between Plumpton and Pitt Town, as well as modifying the station inlet pipeline at Windsor and Plumpton TRS to install blowdown risers. This setup will significantly reduce the blowdown time of either the new upstream or downstream sections over and above the other options as well as reducing the total inventory of gas lost in a such an event. It also ensure the pipeline system meeting the isolation valve spacing requirements in AS2885.1.

3.5.1 CONSTRAINTS

The following constraints provided in Table are applicable to Option - 5

Table 12: Constraints for Option 5

Description	Implication
Land access	The ideal location for the valve is on low lying land adjacent to South Creek, this is only accessible via the right of way from the nearest cross street
Modification to station inlet piping will required in-service welding and hot tapping to complete in order to not disrupt supply.	In-service welding and hot tapping are high risk activities that have the potential to interrupt supply if not carried out correctly.

3.5.2 BENEFITS & DRAWBACKS:

The expected benefits and drawbacks of this option are provided in the Table below:

Table 13: Benefits and Drawbacks of Option 5

Benefits	Drawbacks	Risk Reduction	
		Jemena	AS2885
• Significantly reduces safe blowdown time • Blowing down the pipeline will be performed in a designated safe area within a Jemena controlled facility away from residential buildings. • Plumpton TRS can continue to supply customers without impact. (Dependant on location of LoC) • Complies with AS2885.1 isolation spacing requirements	• Requires significant capital investment especially when compared to benefits over other options. • Blowdown time improvement is incremental and reaching a point of diminishing return where it will not have a meaningful impact during an emergency scenario.	Moderate	N/A

4. RECOMMENDATION

4.1 RECOMMENDED SOLUTION

Option 3: Install a new ALBV with a venting capability is the recommended solution.

Based on the options analysis of the identified threats, associated risk ratings, and the business needs, it is recommended that the most viable, practical and cost effective solution for addressing the compliance issues associated with the increasing land development around the Northern Trunk Pipeline. This option aligns with the imperative of ensuring public safety, maintaining the integrity of JGN's gas distribution system, and safeguarding Jemena's financial stability.

Implementation of this option satisfies the objectives of the opportunity brief to both enable faster, safe blowdown of the pipeline and maintain compliance to AS2885.

Option 1 (Maintain Status Quo) is **not recommended** as it does not mitigate the identified risks.

Option 2 (Install Blowdown Riser assembly at Windsor TRS) is **not recommended** as while it would provide for faster, safe blowdown of the pipeline, it does not meet the objective of code compliance.

Option 4 (Install Blowdown Riser assembly at Plumpton TRS) is **not recommended** for the same reason as option 2, but has the further drawback of cutting supply to Plumpton TRS during the blowdown operation.

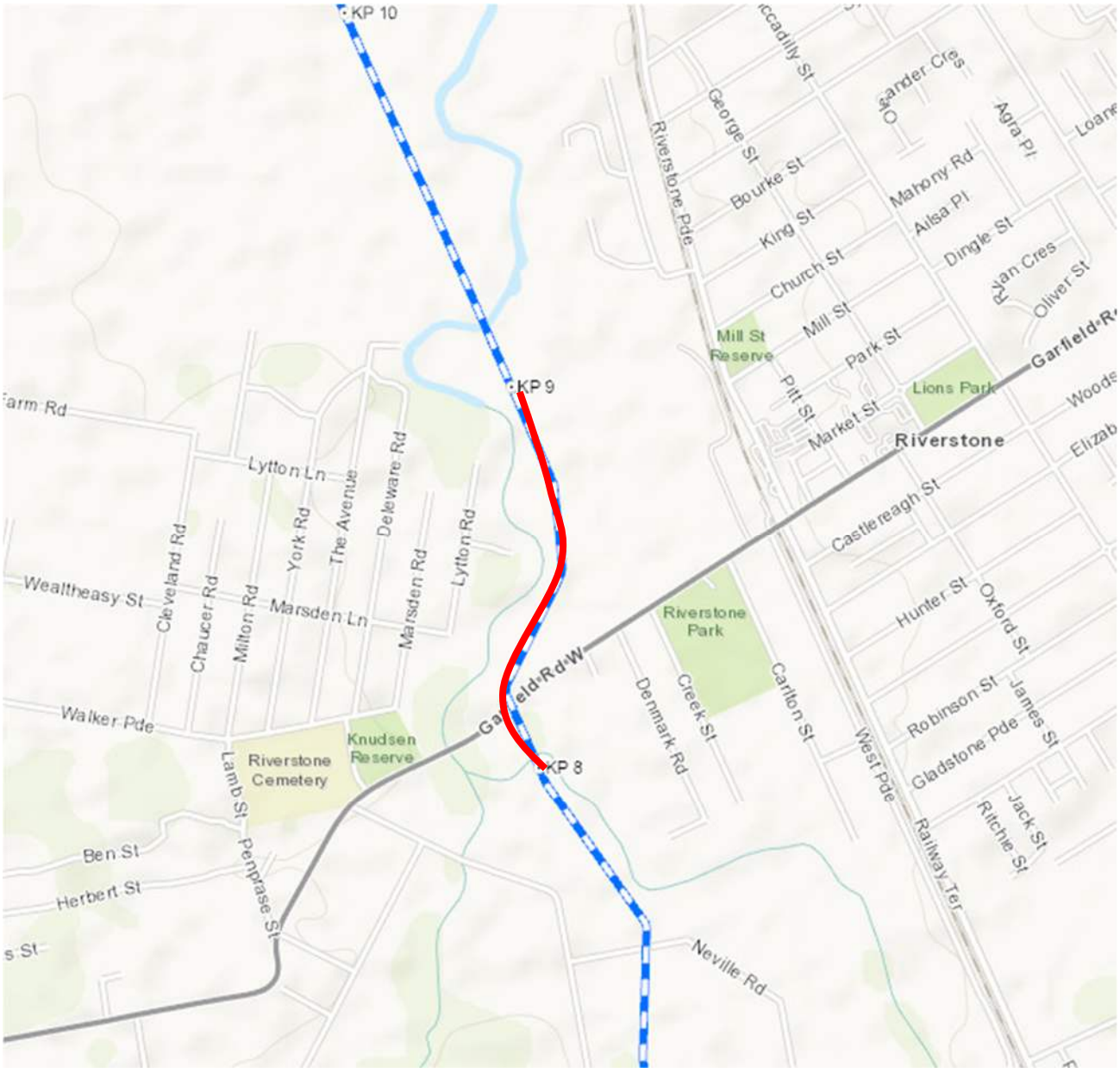
Option 2 (Install blowdown riser assembly at both Plumpton and Windsor TRS and install new ALBV) is **not recommended** as while it satisfies all of the objectives of the opportunity brief, the benefit provided by the expanded scope is minimal when compared to the increased cost.

4.2 SCOPE

The preferred scope of the work includes:

- The selection of an appropriate location for the new ALBV and blowdown facility considering:
  - Length of new pipeline segments
  - Proximity to residential housing
  - Proximity to waterways (flooding)
  - Access to the site via easement/roads
- Design of the ALBV to incorporate:
  - Bypass with ball and plug valves suitable for balancing pressure across the MLV
  - Provision for the safe blowdown of either the upstream or downstream segment of the pipeline including valves suitable for throttling flow and any noise attenuation required
- Construction and commissioning of the designed station contained wholly within the existing pipeline easement.

Figure 3: Proposed ALBV location range



4.3 COST DETAILS

4.3.1 COST METHODOLOGY

The cost estimate is based on the received quotations from the approved Jemena pigging vendor and actual costs of similar projects that underwent a competitive tendering process, which is all incorporated into Jemena's Project Estimation Model (PEM) developed by the FEED Project Manager.

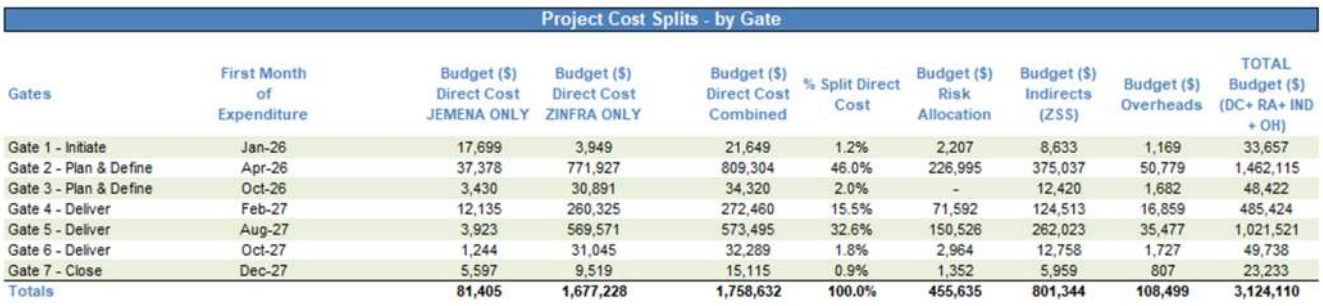
4.3.2 SUMMARY OF COSTS

The summary of the cost estimate is provided in **Table** :

Table 14: Project Estimation

Activities	Item	Project Estimate ($000,2018)
Putney to Stringybark		
Pigging Facilities	Materials	$ 224 k
	Contractor Costs	$ 1,212 k
	Jemena / Zinfra Labour	$ 322 k
	Risk (excl overhead)	$ 456 k
	Total Direct Costs	**$ 2,214 k**
	Indirect & Overheads	**$ 910 k**
	Total Direct costs + Overheads	$ 3,124 k

Figure 4: Project Estimate Model (Extract)



Project Cost Splits - by Gate

Gates	First Month of Expenditure	Budget ($) Direct Cost JEMENA ONLY	Budget ($) Direct Cost ZINFRA ONLY	Budget ($) Direct Cost Combined	% Split Direct Cost	Budget ($) Risk Allocation	Budget ($) Indirects (ZSS)	Budget ($) Overheads	TOTAL Budget ($) (DC+ RA+ IND + OH)
Gate 1 - Initiate	Jan-26	17,699	3,949	21,649	1.2%	2,207	8,633	1,169	33,657
Gate 2 - Plan & Define	Apr-26	37,378	771,927	809,304	46.0%	226,995	375,037	50,779	1,462,115
Gate 3 - Plan & Define	Oct-26	3,430	30,891	34,320	2.0%	-	12,420	1,682	48,422
Gate 4 - Deliver	Feb-27	12,135	260,325	272,460	15.5%	71,592	124,513	16,859	485,424
Gate 5 - Deliver	Aug-27	3,923	569,571	573,495	32.6%	150,526	262,023	35,477	1,021,521
Gate 6 - Deliver	Oct-27	1,244	31,045	32,289	1.8%	2,964	12,758	1,727	49,738
Gate 7 - Close	Dec-27	5,597	9,519	15,115	0.9%	1,352	5,959	807	23,233
Totals		**81,405**	**1,677,228**	**1,758,632**	**100.0%**	**455,635**	**801,344**	**108,499**	**3,124,110**

5. TERMS AND DEFINITIONS

Term	Definition
AA	Access Arrangement
ACS	Asset Class Strategy
ALARP	As Low As Reasonably Practicable
ALBV	Automatic Line Break Valve
APAIR	Asset Performance and Integrity Report
AS	Australian Standards
CP	Cathodic Protection
DBYD	Dial Before You Dig
DCVG	Direct Current Voltage Gradient
DN	Diameter Nominal
HCA	High Consequence Area
ILI	In Line Inspection
JCARS	Jemena Compliance and Risk System
JGN	Jemena Gas Network
km	Kilometre
m	Metre
M	Million
M-W	Mortlake to Willoughby
M-LC	Mortlake to Lane Cove
MAOP	Maximum Allowable Operating Pressure
MFL	Magnetic Flux Leakage
MLV	Main Line Valve
NSW	New South Wales
PEM	Project Estimating Model
PIMP	Pipeline Integrity Management Plan
PRS	Pressure Regulating Station
RFE	Request For Estimate
SMS	Safety Management Study

SMYS	Simplified Minimum Yield Strength
SPM	Sydney Primary Main
SPL	Sydney Primary Loop
T1	Residential
T2	High Density
TRS	Trunk Receiving Station
WT	Wall Thickness

6. REFERENCES

6.1 INTERNAL

1. GAS-1295-RP-RM-003 Licence 7 - Five(5) Yearly Safety Management Study LINK
2. GAS-1400-RG-RM-001 – JGN Sydney Primary Main Risk Register http://ecms/otcs/cs.exe/open/307521857
3. GAS-999-PA-PL-002 Asset Class Strategy Jemena Gas Networks - Pipelines_2022: http://ecms/otcs/cs.exe/open/321938051
4. GAS-999-RP-IN-003 JGN Pipelines Asset Performance and Integrity Review (APAIR) - July 2021 to June 2022": http://ecms/otcs/cs.exe/open/321230339
5. AS2885 SMS Report - West Schofields - Rev 0 IFU LINK
6. Sakkara Riverstone West Precinct SMS Rev A LINK

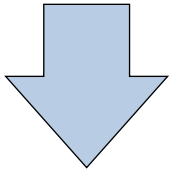
6.2 EXTERNAL

1. Australian Standard AS2885.1-2018, Pipelines – Gas and Liquid Petroleum Part 1 Design and Construction
2. Australian Standard AS2885.3-2022, Pipelines – Gas and Liquid Petroleum Part 3 Operation and Maintenance
3. Australian Standard AS2885.6-2018, Pipelines – Gas and Liquid Petroleum Part 6 Pipeline Safety Management
4. Gas Supply (Safety and Network Management) Regulation 2013 https://www.legislation.nsw.gov.au/regulations/2013-478.pdf

Appendix A Network Risk Assessment Summary

A risk assessment was conducted to determine the level of risk severity of the untreated risk. The table below shows the summary of results and then the treated risk summary for each option. The risk assessment was undertaken in accordance with the Jemena Risk Manual JAA MA 0050 Revision 7 (7/6/2017).

UNTREATED IMPACT/CONSEQUENCES								UNTREATED RISK SUMMARY		
Contributing Factors/ Scenario	Strategic	Financial	Safety	Operational	Regulatory & Compliance	Reputation	Comments	Consequence (Highest Impact)	Likelihood	Risk Level
(Crisis & Emergency Management) Encroachment of new residential property developments into the measurement length of the pipeline impacting the location class and leading to under-preparedness for an emergency (Loc) event	N/A	N/A	N/A	N/A	Severe (Jemena)	Severe (Jemena)	In the event of a Loss of Containment, Jemena/Zinfra is unable to respond in an appropriate timeframe/with appropriate efficiency leading to regulatory scrutiny: - Requirements for formal explanation and remedial action plans - Fines or penalties for breaches / non-compliances. - Associated reputational damage	Severe (Jemena)	Like (Jemena)	High (Jemena)
(Legal / Regulatory Compliance) Encroachment of new residential property developments into the measurement length of the pipeline impacting the location class and leading to non-compliance to AS2885.1 and AS2885.3	N/A	N/A	N/A	N/A	Severe (Jemena)	Severe (Jemena)	Increased regulatory scrutiny and/or fines/penalties for non-compliance and associated reputational damage	Severe (Jemena)	Likely (Jemena)	High (Jemena)



PREFERRED OPTION – Risk assessment summary				TREATED RISK SUMMARY		
Preferred Option/Treated risk	Cost	Benefit	Key Mitigations	Consequence	Likelihood	Risk Level
Option 1 – Maintain Status Quo (Integrity Dig Program)	Nil	- No immediate cost or effort required	Crisis & Emergency Management - None	Severe (Jemena)	Likely (Jemena)	High (Jemena)
			Legal / Regulatory Compliance - None	Severe (Jemena)	Likely (Jemena)	High (Jemena)
Option 2: Install Blowdown Riser assembly at Windsor TRS	$1.2M	- This will reduce the safe blow down time - The blow down of the pipeline will be at designated safe area within the facility away from residential buildings. - The Plumpton TRS can continue to supply customers without impact.	Crisis & Emergency Management - Reduces time to safely blowdown pipeline section	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena
			Legal / Regulatory Compliance - None	Severe (Jemena)	Likely (Jemena)	High (Jemena)
Option 3: Install a new ALBV with venting capability	$3.12M	- This will achieve the recommended valve spacing requirement of AS2885. - Reduce the safe blow down time for each new 10kms section.	Crisis & Emergency Management - Reduces time to safely blowdown pipeline section	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena
			Legal / Regulatory Compliance - Compliant to AS2885.1	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena

Option 4: Install Blowdown Riser assembly at Plumpton TRS	$1.6 M	- This will reduce the safe blow down time - The blow down of the pipeline will be at designated safe area within the facility away from residential buildings.	Crisis & Emergency Management - Reduces time to safely blowdown pipeline section	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena
			Legal / Regulatory Compliance - None	Severe (Jemena)	Likely (Jemena)	High (Jemena)
Option 5: Install blowdown riser assembly at both Plumpton and Windsor TRS and install new ALBV	$5.9M	- This will reduce the safe blow down time - The blow down of the pipeline will be at designated safe area within the facility away from residential buildings. - Will meet the recommended valve spacing requirement of AS2885	Crisis & Emergency Management - Reduces time to safely blowdown pipeline section	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena
			Legal / Regulatory Compliance - Compliant to AS2885.1	Severe (Jemena)	Rare (Jemena)	Moderate (Jemena