Jemena Gas Networks (NSW) Ltd

Pipeline Integrity Program

AS2885 Pipelines

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1. Purpose

The purpose of this Program is to identify the process for the determination of the activities being undertaken with respect to the integrity of the Jemena Gas Networks (**JGN**) high pressure (**AS**2885) pipeline assets.

1.1 Scope

This Program covers the following JGN assets, which accounts for around 400 km of our network and are considered the most critical. These assets are regarded as critical because if they fail, the adverse consequences, particularly safety and supply related risks, to customers and the community would be regarded as 'high' to 'catastrophic':

Table 1–1: JGN AS2885 Pipeline Systems

Name	Section	Commissioning Date	Length (km)	Diameter mm (DN+NPS)	MAOP (MPa)
Licenced Pipelines					
Licence 1: Wilton to Horsley Park Pipeline		1974	51	850 (34")	6.895
Licence 2: Wilton to Wollongong Pipeline	Licence 2A – Wilton to Mt Kiera	1975	21	500 (20")	6.895
	Licence 2B – Mt Kiera to Wollongong	1977	11	500 (20")	6.895
Licence 3: Horsley Park to Plumpton Pipeline		1975	9.4	500 (20")	6.895
Licence 7: Plumpton to Killingworth Pipeline		1978	143	500 (20")	6.895
Licence 8: Killingworth to Kooragang Island Pipeline	Licence 8A: Killingworth to Hexham	1979	19.5	500 (20")	6.895
	Licence 8B: Hexham to Kooragang Island	1979	11.6	350 (14")	6.895
	Licence 8C: Kooragang Island to Incitec	1981	1.8	250 (10")	6.895
Primary Mains					
Sydney Primary Main (**SPM**)	A. Horsley Park to Lidcombe	1976	22	550 (22")	3.5
	B. Lidcombe to Olympic Park	1976	2.2		
	C. Olympic Park to Mortlake	1968	5.4		
	D. Mortlake to Banksmeadow	1976	22.5		
	E. Banksmeadow to STA Botany	1982	4	150 (6")	
Sydney Primary Loop (**SPL**)	A. West Hoxton to Casula	1987	39	550 (22")	3.5
	B. Casula to Moorebank	1993		550 (22")	
	C. Moorebank to Tempe	2007		500 (20")	
Sydney North Primary Main (**SNPM**)	A. Mortlake to Putney	1976	1.6	500 (20")	3.5
	B. Putney to Stringybark	1976*	6.8	250 (10")	3.5

Name	Section	Commissioning Date	Length (km)	Diameter mm (DN+NPS)	MAOP (MPa)
	C. Stringybark to Willoughby	1976*	8.5	150 (6”)	3.5
Western Sydney Primary (**WSPM**)	A. Eastern Creek to Mt Druitt	2002	22	200 (8”)	3.5
	B. Mt Druitt to Werrington	1997			
	C. Werrington to Penrith	2002			
	D. Penrith to Penrith East	1998			
	E. Penrith East to Penrith PRS	2002			
	F. Penrith PRS to Emu Plains	2012			
Wollongong Primary Main (**WPM**)	A. Govett Cres to Wollongong PRS	1981/82	4.3	200 (8”)	3.5
	B. Wollongong PRS to Old Port Rd		3	150 (6”)	

*Sections of this main were extended or re-laid 1986; 1994; 2005.

1.2 Program Drivers

The drivers for the program of works related to the high pressure integrity management are:

- Safety, for both the public and workers, is non-negotiable. A large portion of JGN’s pipelines operate in urban or semi-urban areas. The on-going integrity of JGN’s high pressure pipelines is a critical element of mitigating any risks that have the potential to affect the safety of the public or workers.
- The JGN high pressure pipelines act as the foundation for the on-going delivery of gas to JGN’s customers. Any integrity events that lead to the loss of function of these pipelines is likely to have a major consequence with respect to the supply to JGN’s customers.
- The proactive management of the integrity of JGN’s pipelines is cost effective. Unplanned failure events lead to expensive repairs and material consequential losses.
- The future utilisation of the high pressure pipelines may involve different fluids, or mixtures of fluids and thus the integrity issues may change as the fluids transported change. Although not directly considered at this stage, as the market for renewable fuels develops, the integrity management of the assets will be modified to meet these changing conditions.

2. Pipeline Integrity Management Plan

Consistent with the regulatory requirement in Pipeline Licences[1], the JGN's high-pressure pipelines are operated in accordance with AS 2885, the Australian Standard for high-pressure gas pipelines designed, constructed, and operated throughout Australia.

AS2885 adopts a risk-based approach to manage safety. Risks are initially identified through a Safety Management Study (SMS). This study considers technical, environmental and operational factors such as age, material, condition, whether the pipeline traverses through areas of high community risk, etc. These identified risks are then managed to a level that is as low as reasonably practicable (ALARP) through a combination of design, physical, and procedural controls. The risk assessment of the threats and execution of these controls is outlined and overseen through a Pipeline Integrity Management Plan (PIMP). (refer to 2.1 for details).

AS2885.3 *Pipelines - Gas and Liquid Petroleum: Part 3 Operation and Maintenance*[2] requires pipeline operators to have a Pipeline Integrity Management Plan (**PIMP**):

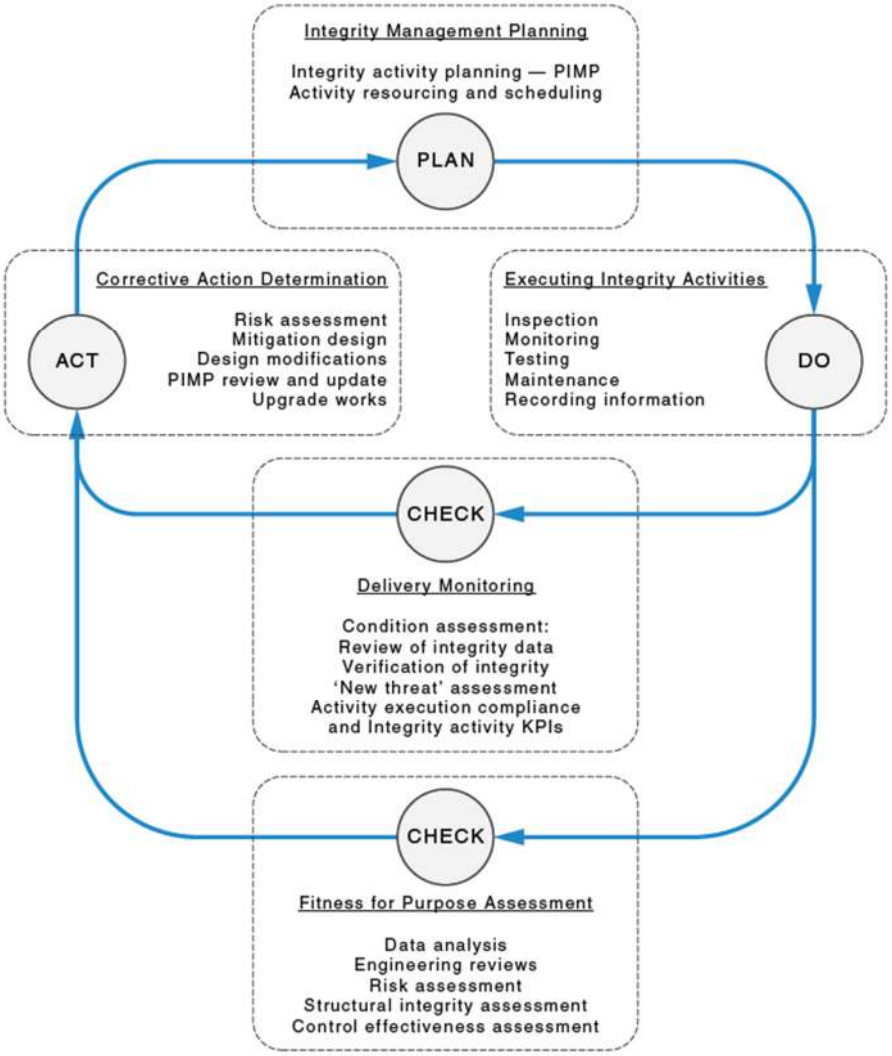
> *All controls and modifications determined by the integrity management process shall be documented in a PIMP. A PIMP may reference other PMS plans and procedures, including engineering documentation and equipment maintenance plans.*

The overarching process for pipeline integrity management is provided in Figure 5.1 of AS2885.3 and is reproduced below:

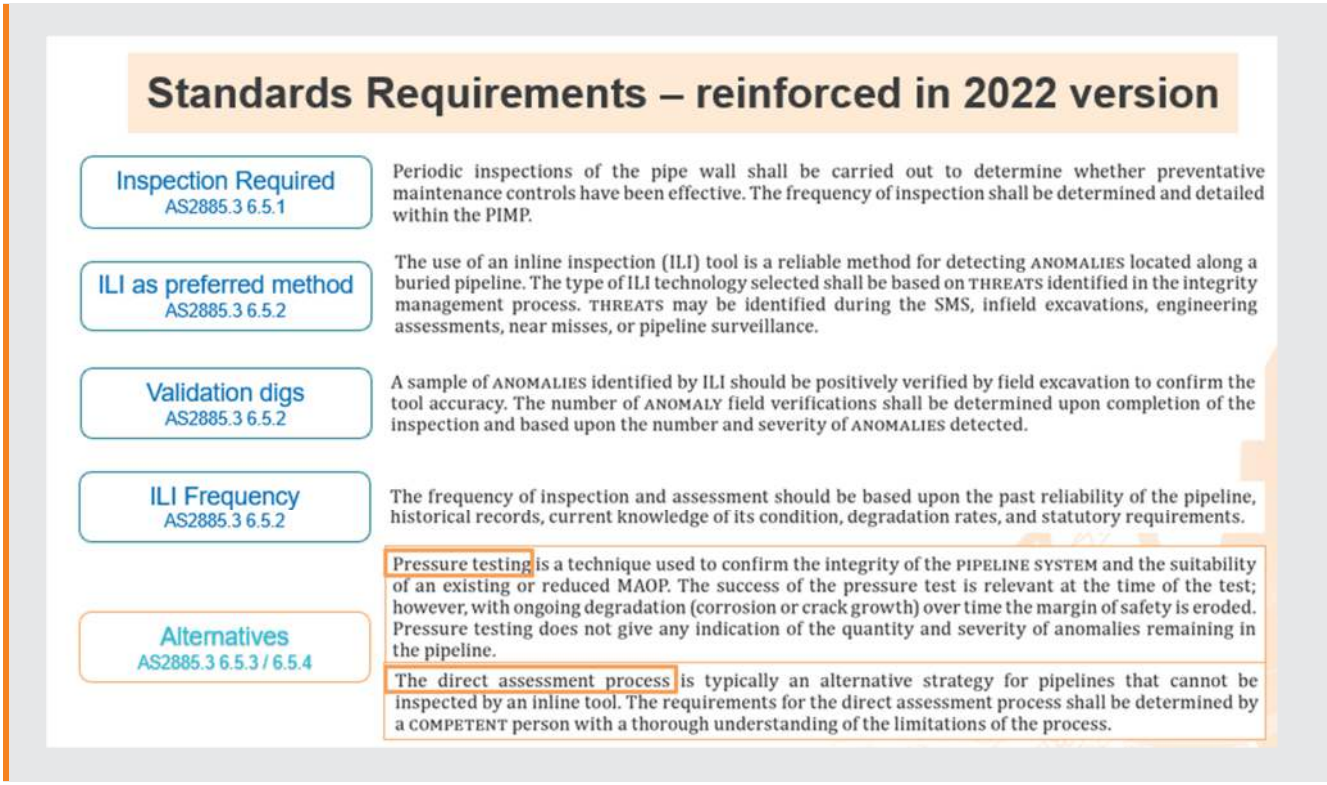
1 JGN Trunk Pipeline Licences 1 2 3 7 and 8" can be accessed via the following link: http://ecms/otcs/cs.exe/open/298714404

2 The NSW Pipelines Act and NSW Gas Supply Act both oblige JGN to meet the requirements of AS 2885.3.

Figure 5.1: Pipeline Integrity Cycle



The 2022 version of AS2885.3 reinforced the integrity management requirements for high pressure pipelines. The callout box below outlines the key elements in AS2885.3.



2.1 Other referenced documents

JGN references other documentation to meet the requirements of the PIMP. The relationship of the other documentation is outlined in Appendix A.

The JGN Pipeline Asset Class Strategy[3] outlines details of the condition assessments for each of the pipelines. The purpose of this document is to explain how the pipelines asset class contributes to achieving JGN's asset objectives. The ACS offers a high-level overview of JGN's pipeline management approach, summarising the current strategy, asset performance, and identifying current and emerging risks along with their associated controls, whether current or proposed.

To meet the AS2885.3 PIMP requirement, JGN produces the Field Operations and Maintenance Specification[4] (**FOMS**) on an annual basis. FOMS is an integral part of the Jemena Asset Management System, outlining the operational and maintenance guidelines for JGN AS2885 assets. This document serves to define the operational and maintenance activities and their respective frequencies to ensure compliance with regulatory requirements.

[3] Refer to GAS-999-PA-PL-002 – JGN - Pipelines Asset Class Strategy - http://ecms/otcs/cs.exe/open/322879221

[4] Refer to GAS-960-SP-ME-019 – Gas Distribution – AS2885 Field Operations and Maintenance Specification (FOMS) http://ecms/otcs/cs.exe/open/317078273

3. Approach to Integrity Management

3.1 Overview

AS2885 requires JGN, based on its knowledge and assessment of a pipeline's design, construction, maintenance and operations records, and also based on its assessment of the safety and supply risks, to determine an integrity monitoring program which is sufficient to effectively identify, monitor and control integrity threats. Having done so, implementation of an integrity monitoring program which is not capable of effectively identifying, monitoring and controlling integrity threats cannot be considered good industry practice.

JGN's approach to the management of the integrity management of its pipeline systems includes the following streams:

1. Inspection (Pigs and digs). This stream includes:
    a) Construction of facilities required to undertake the inspection processes, generally in the form of reconfiguring existing pipeline by installing pig launcher and receivers.
    b) Inspection processes, generally through the use of In-line Inspection (**ILI**) tools, also known as intelligent pigs.
    c) Validation digs that are used to validate and calibrate the ILI results.
    d) Where pipelines are not able to be configured for ILI tools, or until pipelines are reconfigured and facilities for ILI constructed, other inspection techniques that may be applicable include:
        I) Direct Current Voltage Gradient (**DCVG**) – a technique to determine the condition of coating on an underground pipeline
        II) Direct visual inspection.
2. Changes to Operation. This stream includes:
    a) Review of operating pressures leading to a reduction in the pressure, mitigating some of the threats to the integrity of the pipeline or the consequences from an integrity event. The pressure is in the form of a hoop stress and a reduction in the hoop stress increases the effective safety margin. Where an asset has a level of deterioration, reduction in the hoop stress (pressure) will effectively improve the integrity of the asset. Changes in pressure level can only be applied where there is no effect on supply reliability for customers.
    b) Review of operating conditions, other than the operating pressure, such as cyclic loading, can mitigate threats to pipeline integrity or the consequences of integrity events. The operation of the asset may also affect the integrity of the asset in other ways. For example, the cyclic operation of an asset, with relatively deep pressure cycles will increase the exposure to fatigue initiated events. Amending the operation to reduce cycling will decrease the exposure and effectively enhance asset integrity.
    c) Changes to cathodic protection regimes can also enhance the integrity of an asset.
    d) Changes to maintenance regimes, such as adjustments to surveillance, valve maintenance, coating repairs, etc will also improve the integrity of an asset.
3. Enhance safety devices and ancillary equipment
    a) New isolation valves or other safety devices may provide an increased level of protection to the integrity of an asset.
    b) New or enhanced cathodic protection equipment may provide an increased level of protection to the integrity of an asset.
4. Remediation of assets

a) Physical changes can also enhance the ongoing integrity of an asset, such as the provision of enhanced protection for an above ground asset or the programmed recoating of an asset. This may even require the rerouting or location change for an asset.

b) Implementing physical protection measures such as concrete slabs or HDPE plates over buried pipelines enhances safety and minimizes risk of external interference. These measures ensure compliance with AS2885 standards and NSW regulations, contributing to the overall safety of the asset.

5. Other –

a) Specialist reviews and monitoring of water crossings can identify potential changes to a pipeline crossing that if not managed can lead to pipeline integrity events. Following the 2022 failure of the APA pipeline in the vicinity of Bathurst, the NSW Department of Climate Change, the Environment, Energy and Water (**DCCEEW**) has required pipeline operators to review water crossings on a more regular basis.

b) Licence 1, Licence 3 and Licence 7 have and continue to be affected by the longwall mining activities that occur in the vicinity of these pipelines. From time to time, JGN in conjunction with the mine operators and the NSW Mines Subsidence Board, is required to monitor these pipelines to ensure any effects of the mining on the integrity of the pipelines are proactively managed.

c) Regular inspection and monitoring of pipeline easement (Licence 1, Licence 2, Licence 3, 7 & 8) is critical to prevent erosion threats. Recent unprecedented weather events have caused significant damage to JGN's pipeline easements and access tracks, and also accelerated vegetation growth. JGN is reviewing its monitoring and remediation programs to match the increased level of resources required.

3.2 Inspection

3.2.1 In-line Inspection

AS2885.3 requires:

> *Periodic inspections of the pipe wall shall be carried out to determine whether preventative maintenance controls have been effective. The frequency of inspection shall be determined and detailed within the PIMP.*

AS2885.3[5] sets out that the industry benchmark for achieving the requirements for periodic inspection is ILI, commonly known as intelligent pigging. The efficiency and effectiveness of ILI, together with the catastrophic risk from a loss of integrity mean that it is universally employed where possible. Good industry practice is to undertake inspections at a maximum frequency of 10-years unless specific risk factors require more regular intervals. This is a consistent view across ATCO Gas, AGIG, Evoenergy and APA.[6]

Not all pipelines were designed to accommodate ILI and typically rely on other less effective techniques (combining DCVG surveys and direct inspection), typically those built in the 1960s and 1970s before ILI tools were commonplace. However, where feasible, pipelines across Australia are being modified to allow ILI to occur or, in some locations, de-rated, to manage integrity risks as the pipelines age.

The use of ILI, with a maximum inspection period of 10 years, is also consistent with international good practice.[7]

Overall this means:

- Long term industry experience has demonstrated that ILI is the only proven method for reliably and efficiently assessing pipeline metal loss features over its entire length and that ILI should be adopted at least every 10 years.

[5] Refer to Section 6.5.1 and 6.5.2 AS 2885.3 for Integrity Assessment Techniques

[6] See ATCO Gas (page 46), AGIG (page 68), APA (page 8) and Evoenergy (page 1).

[7] The Institute of Gas Engineers and Management IGEM/TD/1; American Society of Mechanical Engineers ASME B31.8S

- On this basis ILI inspection should, where possible be the prime method of integrity assessment
- The intent of AS2885.3 is that a pipeline should be made piggable unless there is a valid and compelling reason not to.

AS2885.3 allows for alternative integrity monitoring regimes in certain circumstances, but it should not be inferred that the Standard considers that the alternatives provide an equivalent level of integrity assessment.

Good industry practice is to specify ILI inspection utilising a risk-based approach for inspection intervals and the configuration or type of tool or tools to be deployed.

Inspection intervals are set based upon the risk factors determined from what is known about the threat characteristics and findings from previous inspections – i.e. *past reliability of the pipeline, historical records, current knowledge of its condition, degradation rates or statutory requirements (*AS2885.3). The industry has also adopted a cap or maximum interval limit of 10 years.

ILI tools are configured to inspect for the threat characteristics that have been determined for the pipeline being inspected. The tools must be capable of detecting and sizing/sentencing (depth and length) anomalies/features of those threats. In order to determine different threat characteristics, different tools may need to be utilised, leading to some pipelines having multiple ILI 'runs' with those different tools. The sensitivity and detectability of the threat characteristics is also dependent upon the nature and capability of the tool.

The types of threat characteristics an ILI tool might be used to identify include:

- Third-party damage:
  - Potential corrosion over time from coating damage . Metal loss will reduce pressure containment strength of the pipe causing a potential gas release;
  - Dent and gouge may cause pipe rupture due the unstable nature of the defect under pressure.
- Pipe Corrosion (external and internal):
  - General corrosion;
  - Pitting corrosion.
- Cracking
  - Environmental (e.g. Stress Corrosion Cracking (**SCC**))
  - Fatigue cracking
  - Hydrogen Induced Cracking (**HIC**)
- Material and construction defects:
  - Pipe lamination;
  - Weld misalignment;
  - Ovality;
  - Rock-dent.
- Others:
  - Ground movements induced pipe distortions e.g. deformation, ovality, buckle etc.
  - Pipe displacement (global).

3.2.2 Validation Digs

In accordance with AS2885.3, validation digs are used to calibrate the ILI data and are an essential part of pipeline integrity management.

Once the ILI data collected during the inspection is analysed, and preliminary results are reported. However, knowing which anomalies require remediation isn't always clear-cut. To ensure tool accuracy, in-ditch validation is performed. This confirms that the ILI data matches actual defects. JGN physically inspects the pipeline at specific locations to validate the findings from the ILI tool. The results from in-ditch validation are analysed, and specific findings are reported. This information helps prioritize repair or replacement actions. The continual feedback loop improves tool accuracy over time, allowing for adjustments in technology and future integrity runs.

Based on the findings of the validation digs the remediation digs are completed. Note repairs could be required at either verification or remediation digs but they are not considered in this budget. Some pipelines will require substantial repairs depending on condition, while others will require less, the excavation budget applied is an average value based on previous dig campaigns.

3.2.3 Direct Current Voltage Gradient

DCVG is an industry accepted method for detecting coating defects utilising the cathodic protection system. AS2885.3 outlines the use of DCVG as a key set of supporting data for the indirect assessment of pipelines, particularly where ILI is not an option. The method provides an indication of some coating defects, however, it does not provide an indication that metal loss due to corrosion is occurring. Where DCVG is used as a primary means of corrosion monitoring, the following uncertainties need to be recognised:

- There is limited correlation between %IR and defect size. Many factors can influence the %IR reading that is obtained from a given defect. Furthermore, there is little correlation between defect size and the probability of corrosion occurring. Therefore, a dig-up regime based on %IR cannot be relied on to identify coating defects which are more likely to be subject to corrosion.
- The DCVG technique may not detect significant causes of corrosion such as beneath coating damage from rocks or other debris that allows moisture to permeate but shields cathodic protection current flow. Shielding can also occur under coating that is susceptible to disbondment such as tape wrap, heat shrink sleeves and coal tar enamel (all of which are used on the JGN network).
- DCVG is limited by the local environment, and can be impeded by other local cathodic protection systems or by the ground surface, such as asphalt or concrete – especially where there is reinforcement (reo) in place.

An effective integrity monitoring regime requires dig-up and visual inspection regime to confirm whether corrosion is occurring at any given location. However, it is limited by the reliability of the techniques used to determine the dig-up location. As discussed above DCVG does not necessarily detect all locations where active corrosion may be occurring, and therefore cannot be relied upon for locating sites for visual inspection. Inspections from DCVG indications together with other data such as from cathodic protection potential surveys, corrosion coupon or electric resistance probe data, dig-ups at locations not associated with DCVG, CP current demand and trending, can provide assurance that significant corrosion is unlikely (although none of these techniques can determine the extent of corrosion under shielded coating defects). However these techniques, which can be regarded as aligning with the NACE external corrosion direct assessment (ECDA) process (ref NACE SP0502), should only be considered as indicative of the level of risk of corrosion occurring.

3.2.4 Direct Visual Inspection

Direct Visual Inspection requires the pipeline to be able to be physically inspected. Inspection can be of the coating only, however, generally the inspection requires the coating to be removed to provide direct visual inspection of the metallic surface. Generally, the inspection will also include techniques such as Magnetic Particle Inspection (**MPI**) or ultrasonic thickness measurement or other methods available once the pipeline is exposed.

Direct Visual Inspection can be undertaken where either the pipeline is already exposed (i.e. not buried, on a bridge, etc.) or where the pipeline is exposed through an inspection dig-up.

4. Licenced Pipelines

This section summarises the threats to the Licenced Pipelines. Further information or background is available in the Safety Management Studies for each of the pipelines.

4.1 Key integrity threats

The following table outlines the key integrity threats facing JGN Licenced Pipelines. This summary is provided in Table 4-1, is complemented by detailed information found in the Pipeline Asset Class Strategy[8]. These threats have been identified through ongoing assessments conducted during routine maintenance, inspections and various pipeline projects.

Table 4–1: Licence Pipeline Threat Summary

Category	Specific Threat	Lic 1	Lic 2		Lic 3	Lic 7	Lic 8	
			Lic 2A	Lic 2B			Lic 8A	Lic 8B+C
Corrosion threats	Internal	-	-	-	-	-	-	-
	External	✓	✓	✓	✓	✓	✓	✓
	AC Corrosion	●	●	●	●	✓	✓	●
Cracking threats	SCC	●	-	-	-	-	-	-
	Fatigue	-	-	-	-	-	-	-
	Hydrogen Induced	-	-	-	-	-	-	-
Material / Construction	Weld defects	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-
Time independent	Lightning	●	●	●	●	●	●	●
	Earthquake	●	●	●	●	✓	✓	✓
	Land movement	●	●	✓	●	●	●	●
	Washaway	✓	✓	✓	✓	✓	✓	✓
	External loading	✓	✓	✓	✓	✓	✓	✓
	Mines subsidence	✓	✓	✓	-	✓	✓	-
	External (3rd party) Interference	✓	✓	✓	✓	✓	✓	✓
	Sabotage	✓	✓	✓	✓	✓	✓	✓
	Water crossing	●	●	●	●	✓	●	✓
Undetected damage		✓	✓	✓	✓	✓	✓	✓

✓	Asset is impacted
●	Asset has potential to be impacted
-	No evidence of impact

[8] Refer to GAS-999-PA-PL-002 – JGN - Pipelines Asset Class Strategy - http://ecms/otcs/cs.exe/open/322879221

4.2 Integrity Mitigation Options

To address the challenges mentioned above, Table 4–2 outlines mitigation options to mitigate each of the identified threats. By implementing these measures, JGN can safeguard the integrity and longevity of our pipeline assets, ensuring public safety and maintaining reliability of supply to the customers.

Table 4–2: Integrity Mitigation Options Summary for JGN Licenced Pipelines

		Lic 1	Lic 2		Lic 3	Lic 7	Lic 8		
			Lic 2A	Lic 2B			Lic 8A	Lic 8B	Lic 8C
	In-line Inspection capable	✓	✓	-	✓	✓	✓	✓	-
	Pressure reduction	●	●	✓	●	●	●	●	●
	Reconfigure pipeline to allow ILI	-	-	-	-	-	-	-	✓
	Integrity Dig / validation Digs	✓	✓	✓	✓	✓	✓	✓	✓
	Operation & maintenance (CP, Coating surveys, patrolling)	✓	✓	✓	✓	✓	✓	✓	✓
	Other operational changes	-	-	-	-	-	-	-	

The following sections provide detail on our proposed Pipeline Integrity Management Program for each of the above licences.

4.3 Licence 1 Program

The Licence 1 Pipeline is current 85% High Consequence Area (HCA), based on the 2024 SMS location class assessment, this number is increasing over time with encroachment of the housing developments in the South Western Sydney growth corridor.

The integrity inspection program RY26-RY30 for Licence 1 includes:

1. Inspection
    a) Facility Construction
        i) No new facilities are required.
    b) Inspection Programs
        i) In-line Inspection - No ILI is anticipated in the period. An EMAT ILI tool will be utilised in RY25 to inspect Licence 1 for potential cracking due to SCC. This is in response to SCC identified on the Licence 16 pipelines owned by APA. Licence 1 is an extension of Licence 16 that was designed and constructed at the same time from the same materials.

            Stress corrosion cracking was identified in the MSP (Licence 16) following a pipeline failure in 1982 immediately downstream of Moomba compressor station, six years after commissioning. The failure was identified to be the result of high pH stress corrosion cracking (SCC). Subsequent to the 1982 failure and replacement of the first 28.5km of pipeline, a SCC monitoring program was implemented on the MSP, with priority given to the sections immediately downstream of compressor stations.

            However, subsequent to further inspection findings in more recent years, SCC has been found to exist over significant sections of the MSP, which is in conflict with the reported literature that indicates 90% of SCC occurs within 20km of compressor stations. Recently (Feb 2019) an SCC colony was found

on the MSP between Moss Vale and Sally's Corner in NSW utilising EMAT tool, where the ground temperature and coating type are similar to that of the Central Trunk.

Based on the findings on the MSP which has a similar environment, temperature, CP level and coating to Licence 1, the review has found that it is possible that an SCC environment could be developed on the Licence 1 pipe surface. Therefore, JGN has decided to run an EMAT tool on Licence 1 pipeline to verify that SCC is not occurring at levels that can have an immediate impact to its integrity.

The EMAT tool will be in addition to the Geometric and Magnetic Flux Leakage (**MFL**) tools, which detect corrosion and geometric defects. The ILI frequency using MFL tool for Licence 1 pipeline is currently set at ten years interval. The frequency of the EMAT tool will be assessed after the first EMAT run planned in RY25.

ii) Validation Digs - There are four inspection digs planned. These digs are to validate the ILI EMAT tool that is to be run in RY25. As this is the first EMAT tool to be utilised for Licence 1, the four validation digs will be imperative for the confirmation of the results from the EMAT tool and to provide calibration of data.

iii) DCVG – DCVG surveys will continue to be performed on un-piggable laterals / offtakes on a 5 yearly basis. Where large coating defects will be identified, it will be compared with other inspection data such as CP, to prioritise any excavations, if required.

I) Appin – BHP Tower Colliery Offtake – DN 100 – 2km offtake.

II) Campbelltown TRS offtake – KP22.5

III) West Hoxton TRS offtake – KP36

iv) Integrity Digs – Opportunistic inspections and repairs, including recoating with modernized coating system due to the aging Coal Tar Enamel coating, are conducted in conjunction with 3rd party encroachment activities to mitigate the increase risks posed by such encroachments, which could limit JGN's future accessibility for maintenance activities.

2. Operational Changes

The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure is being reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – Extensive urbanization of Sydney along the Licence 1 pipeline route has resulted in upgrading the pipeline's location class as per the AS2885 standard. The development has prompted JGN to review its current marker spacing along the pipeline's route. Consequently, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline easement. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline.

5. Other

    a) Mines Subsidence monitoring – While there are no active longwall mining activities along the Licence 1 pipeline, no works are currently planned during the RY26 - RY30 period. However, mining subsidence risk are regularly reviewed as part of the periodic 5 yearly SMS review. If any threat is identified, it will require JGN to investigate, monitor the subsidence, and perform strain measurements to establish the impact of any subsidence.

4.4 Licence 2 Program

The Licence 2 Pipeline is current 15% High Consequence Area (HCA), based on the 2024 SMS location class assessment, this number not expected to increase given the majority of the alignment traverses rural water catchment land.

4.4.1 Licence 2A

The integrity inspection program RY26-RY30 for Licence 2A includes:

1. Inspection

    a) Facility Construction

        i) No new facilities are required.

    b) Inspection Programs

        i) In-line Inspection. An MFL ILI tool will be deployed to confirm:

        - Any internal or external corrosion
        - Any corrosion growth rates
        - Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
        - Any pipeline alignment change due ground movement.

        The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.

        ii) Validation Digs. There are two inspection digs planned. These digs are to validate the ILI tool that is to be run in RY28. Any additional digs are likely to be carried out in the RY31 to RY35 period.

2. Operational Changes

    The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure will be reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

    No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

    a) No new safety devices have been identified as required.

4. Remediation

    a) No mains relocation nor additional works on exposed mains have been identified.

b) Washaway Remediation Projects – Unprecedented rain events have severely damaged JGN Lic 2 easement and access tracks, while also substantially increased vegetation growth along the easement. This deterioration hinders routine patrols, CP surveys, and access for any required emergency repairs. To address this threat posed by washaway and erosion, JGN plans to undertake easement and access track remediation over the next 3-4 years, with at least 1 or 2 projects planned along the License 2 pipeline.

5. Other

a) Mines Subsidence monitoring – While there are no active longwall mining activities along the Licence 2 pipeline, no works are currently planned during the RY26 - RY30 period. However, mining subsidence risk are regularly reviewed as part of the periodic 5 yearly SMS review. If any threat is identified, it will require JGN to investigate, monitor the subsidence, and perform strain measurements to establish the impact of any subsidence.

b) No other monitoring or activities have been identified.

4.4.2 Licence 2B

The integrity inspection program RY26-RY30 for Licence 2B includes:

1. Inspection

a) Facility Construction

i) No ILI facilities exist for the ILI inspection of Licence 2B. New facilities will need to be constructed, if In-Line inspection will be required in the future.

b) Inspection Programs

i) In-line Inspection. No inspection program is planned. An ILI inspection, the industry preferred technique to validate the structural integrity of high pressure pipelines, will only be undertaken if the pipeline is to be repurposed to carry an alternate future fuel (potentially hydrogen). The current plan for JGN is to de-rate the pipeline's pressure from the current ROP of 3,500 kPa to a reduced MAOP of 1,050 kPa. This would change the operating and maintenance regime to align with AS4645 rather than AS2885.

ii) Validation Digs. As there is no planned ILI, there are no identified validation digs. However, if an ILI tool is deployed, validation digs will required. Additionally if any other inspection such as DCVG identifies potential integrity anomalies, validation digs may be undertaken.

iii) DCVG (coating surveys) – Last DCVG survey was performed on Licence 2b pipeline in December 2023. As per the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, as mentioned above, if the Licence 2b pipeline is de-rated to secondary pressure, DCVG surveys will no longer be performed.

2. Operational Changes

a) The JGN Lic2B and WPM Integrity Management Options Analysis (GAS-1499-RP-IN-001) outlines the recommendation to mitigate the consequence of pipeline failure to ALARP by, the following:

> *Derate the pipeline to secondary pressure is the recommended solution costing AUD $2,012,065[9]. Implementing this option will reduce the impact of pipeline failure and thus reduce the health and safety risk rating from High to Moderate (Jemena) / Low (AS2885). No additional integrity management is required to comply with the standard requirements. This option is also focused on customer benefits as it will retain the supply without burdening the customers. However, Option 2 is considered as well if both pipelines will be utilised for Hydrogen storage to support the transition towards low carbon future.*

3. Safety Devices

[9] Note this is a preliminary CAPEX costing and may have been modified in later review.

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

5. Other

a) Mines Subsidence monitoring – Dendrobium Mine extension project is currently active in this area between KP 29 to KP30. As per discussions with BHP surveyors, There are no active longwall mining activities along the Licence 2 pipeline, no works are currently planned during the RY26 - RY30 period. However, mining subsidence risk are regularly reviewed as part of the periodic 5 yearly SMS review. If any threat is identified, it will require JGN to investigate, monitor the subsidence, and perform strain measurements to establish the impact of any subsidence.

b) No other activities are anticipated for this pipeline.

4.5 Licence 3 Program

The Licence 3 Pipeline is current 86% High Consequence Area (HCA), based on the 2024 SMS location class assessment, this number not expected to increase given the majority of the alignment traverses rural water catchment land.

The integrity inspection program RY26-RY30 for Licence 3 includes:

1. Inspection

a) Facility Construction

i) No new facilities are required.

b) Inspection Programs

i) In-line Inspection. An MFL ILI tool will be deployed (including Licence 7 and 8A) to confirm:

- Any internal or external corrosion
- Any corrosion growth rates
- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
- Any pipeline alignment change due ground movement.

The ILI tool deployment will be based upon a 7 year cycle. This cycle has been determined by the level of corrosion rates identified between the previous ILI programs. matching good industry practice for on-going inspection.

ii) Validation Digs. Validation digs are to be carried out in the RY31 to RY35 period.

iii) DCVG – DCVG surveys will continue to be performed on un-piggable laterals / offtakes on a 5 yearly basis. Where large coating defects will be identified, it will be compared with other inspection data such as CP, to prioritise any excavations, if required.

I) Eastern Creek TRS offtake – KP5.3

II) Plumpton TRS offtake – KP9.4

2. Operational Changes

a) The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions

caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure is being reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

b) No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – Extensive urbanization of Sydney along the Licence 3 pipeline route has resulted in upgrading the pipeline's location class as per the AS2885 standard. The development has prompted JGN to review its current marker spacing along the pipeline's route. Consequently, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline easement. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline.

5. Other

a) No other monitoring or activities have been identified.

4.6 Licence 7 Program

The Licence 7 Pipeline is current 21% High Consequence Area (HCA), based on the 2024 SMS location class assessment, this number expected to increase gradually with parts of the alignment traversing the North West Sydney growth corridor and various developments in the Central Coast region.

The integrity inspection program RY26-RY30 for Licence 7 includes:

1. Inspection

a) Facility Construction

i) No new facilities are required.

b) Inspection Programs

i) In-line Inspection. An MFL ILI tool will be deployed (in conjunction with Licence 3 and 8A) to confirm:

- Any internal or external corrosion
- Any corrosion growth rates
- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
- Any pipeline alignment change due ground movement.

The ILI tool deployment will be based upon a 7 year cycle. This cycle has been determined by the level of corrosion rates identified between the previous ILI programs. matching good industry practice for on-going inspection.

ii) Validation Digs. Validation digs are to be carried out in the RY31 to RY35 period.

iii) DCVG – DCVG surveys will continue to be performed on un-piggable laterals / offtakes on a 5 yearly basis. Where large coating defects will be identified, it will be compared with other inspection data such as CP, to prioritise any excavations, if required.

I) Windsor TRS offtake – KP15

II) Maroota POTS offtake – KP9.4

III) Gosford TRS offtake – KP77.3

IV) Warnervale POTS offtake – KP100.9

V) Wyong TRS offtake – KP104.2

VI) Colongra Lateral Offtake (MOMS) – KP110.1

VII) Wyee POTS offtake – KP115.2

VIII) Morisset POTS offtake – KP119.2

2. Operational Changes

a) The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure is being reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

b) No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) The need for a new ALBV has been identified by an encroachment SMS, due to continuous urban development along the Licence 7 pipeline easement. The purpose of this project is to comply with the recommended spacing for isolation valves for T1 residential location class as per AS2885.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – Extensive urbanization of Sydney along the Licence 7 pipeline route has resulted in upgrading the pipeline's location class as per the AS2885 standard. The development has prompted JGN to review its current marker spacing along the pipeline's route. Consequently, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline easement. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline.

c) Washaway Remediation Projects – Unprecedented rain events have severely damaged JGN Lic 7 easement and access tracks, while also substantially increased vegetation growth along the easement. This deterioration hinders routine patrols, CP surveys, and access for any required emergency repairs. To address this threat posed by washaway and erosion, JGN plans to undertake easement and access track remediation over the next 3-4 years, with at least 3 or 4 projects planned along the License 7 pipeline.

5. Other

a) Water crossing inspections – JGN conducts hydrographic surveys on a series of river crossings to accurately locate the current river bottom, enabling comparison to previous surveys using multi-beam echo sounders. Sub bottom profilers are utilized to locate the height and position of the pipeline. Ensuring long-term proactive integrity management of the pipelines requires periodic monitoring of these river crossings, particularly after significant flood events.

Below is the current plan for riverbed crossing of pipelines on Licence 7 pipeline.

Table 3-3 Licence 7 River Crossings

River crossings	Pipeline	Approx length	Last surveyed	Next Survey
Hawkesbury River	Licence 7 (DN500)	780m	2023	2028
Mooney Mooney Creek	Licence 7 (DN500)	94m	2023	2028
Wyong River	Licence 7 (DN500)	51m	2023	2026
Dora Creek	Licence 7 (DN500)	71m	2023	2026

b) Mines Subsidence monitoring – While there are no active longwall mining activities along the Licence 7 pipeline, no works are currently planned during the RY26 - RY30 period. However, mining subsidence risk are regularly reviewed as part of the periodic 5 yearly SMS review. If any threat is identified, it will require JGN to investigate, monitor the subsidence, and perform strain measurements to establish the impact of any subsidence.

4.7 Licence 8 Program

4.7.1 Licence 8A

The Licence 8A Pipeline is current 32% High Consequence Area (HCA), based on the 2024 SMS location class assessment, this number is not expected to increase given the alignment traverse predominantly rural area without any current plans for development.

The integrity inspection program RY26-RY30 for Licence 8A includes:

1. Inspection
   a) Facility Construction
      i) No new facilities are required.
   b) Inspection Programs
      i) In-line Inspection. An MFL ILI tool will be deployed (in conjunction with Licence 3 and 7) to confirm:
         - Any internal or external corrosion
         - Any corrosion growth rates
         - Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
         - Any pipeline alignment change due ground movement.

      The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.

ii) Validation Digs. Validation digs are to be carried out in the RY31 to RY35 period.

iii) DCVG – DCVG surveys will continue to be performed on un-piggable laterals / offtakes on a 5 yearly basis. Where large coating defects will be identified, it will be compared with other inspection data such as CP, to prioritise any excavations, if required.

I) Minmi POTS offtake – KP154

II) AGL Hexham Meter set offtake – KP162.7

III) Hexham TRS offtake – KP163

2. Operational Changes

a) The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure is being reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

b) No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – The need for additional markers along Licence 8 pipeline arises because existing markers have either been damaged or removed by 3rd parties and not reinstated. Consequently, as part of JGN's review of marker signage, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline easement. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline.

c) Washaway Remediation Projects – Unprecedented rain events have severely damaged JGN Lic 8 easement and access tracks, while also substantially increased vegetation growth along the easement. This deterioration hinders routine patrols, CP surveys, and access for any required emergency repairs. To address this threat posed by washaway and erosion, JGN plans to undertake easement and access track remediation over the next 3-4 years, with at least 1 or 2 projects planned along the License 8 pipeline.

4.7.2 Licence 8B

The Licence 8B Pipeline is current 42% High Consequence Area (HCA), based on the 2024 SMS location class assessment, this number is not expected to increase given the alignment traverse predominantly protected land on Kooragang Island (outside the industrial area)

The integrity inspection program RY26-RY30 for Licence 2A includes:

1. Inspection

a) Facility Construction

i) No new facilities are required.

b) Inspection Programs

i) In-line Inspection. An MFL ILI tool will be deployed to confirm:

- Any internal or external corrosion

- Any corrosion growth rates
- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
- Any pipeline alignment change due ground movement.

The ILI tool deployment will occur on a 7 year cycle, determined by the corrosion rates identified between the previous ILI programs. This is in alignment with good industry practice for on-going inspection.

ii) Validation Digs. As there is no planned ILI, there are no identified validation digs. However, if an ILI tool is deployed there may be validation digs. Additionally is any other inspection such as DCVG identifies potential integrity anomalies, validation digs may be undertaken.

iii) DCVG survey for the entire Licence 8b pipeline is no longer performed as it is a piggable pipeline. Coating surveys are only performed on a case-by-case basis, usually as part of encroachment activities.

2. Operational Changes

a) The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure is being reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

b) No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – The need for additional markers along Licence 8b pipeline arises because existing markers have either been damaged or removed by 3rd parties and not reinstated. Consequently, as part of JGN's review of marker signage, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline easement. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline.

5. Other

a) Water crossing inspections – JGN conducts hydrographic surveys on a series of river crossings to accurately locate the current river bottom, enabling comparison to previous surveys using multi-beam echo sounders. Sub bottom profilers are utilized to locate the height and position of the pipeline. Ensuring long-term proactive integrity management of the pipelines requires periodic monitoring of these river crossings, particularly after significant flood events.

Below is the current plan for riverbed crossing of pipelines on License 8a pipeline.

Table 4-4 Licence 8a River Crossings

River crossings	Pipeline	Approx length	Last surveyed	Next Survey
Hunter River (Hexham to Campbell Island	Licence 8 (DN350)	34m	2023	2026
Hunter River (Campbell Island to Hexham Island)	Licence 8 (DN350)	119m	2023	2026
Hunter River (Hexham to Kooragang Island)	Licence 8 (DN350)	96m	2023	2026

4.7.3 Licence 8C

The Licence 8B Pipeline is current 100% High Consequence Area (HCA), based on the 2024 SMS location class assessment.

The integrity inspection program RY26-RY30 for Licence 2A includes:

1. Inspection

    i) Construction activities are being undertaken to enable ILI of the Licence 8c pipeline between Kooragang Island TRS to Incitec (now Orica) section of the Northern Trunk Pipeline. This includes the installation of launcher at Kooragang TRS and receiver near the Orica production site . These activities are outlined in JGN Northern Trunk – Licence 8c Pigging Facilities Options Analysis (GAS-1295-RP-PL-006).

    > *Option 2: Reconfigure the pipeline to enable in-line inspection by constructing pigging facilities is the recommended solution.*
    >
    > *Based on the options analysis considering 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 integrity issues associated with the Licence 8c pipeline is to proceed with the reconfiguration of the pipeline to enable in-line inspection. 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.*
    >
    > *Reconfiguring the pipeline to enable in-line inspection not only represents the most prudent approach to addressing these critical issues but also stands as a fiscally responsible choice that aligns with long term sustainability objectives. It provides the necessary assurance of safety, reliability, and compliance while mitigating the financial risks associated with unexpected and costly repair works. This recommendation underscores the significant benefits and prudent risk mitigation offered by this option, making it the best choice for Jemena's strategic approach to the Licence 8c pipeline's project*

b) Inspection Programs

    i) In-line Inspection. An MFL ILI tool will be deployed from Kooragang TRS to Incitec (now Orica) in RY28 to confirm:

    - Any internal or external corrosion
    - Any corrosion growth rates

- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.

- Any pipeline alignment change due ground movement.

- The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.

ii) Validation Digs. There are two inspection digs planned in RY29. These digs are to validate the ILI tool that is to be run in RY28. Any additional digs are likely to be carried out in the RY31 to RY35 period.

iii) DCVG (coating surveys) – Last DCVG survey was performed on Licence 8C pipeline in June 2021. As per the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, as mentioned above, if the Licence 8C pipeline is reconfigured to enable ILI, DCVG surveys will no longer be performed.

2. Operational Changes

a) The JGN Trunk System has a formal Maximum Allowable Operating Pressure (MAOP) of 6.895 MPa but has been operating at a Reduced Operating Pressure (ROP) of 4.5 MPa since 2004 due to restrictions caused by the Mallaty Creek subsidence. With the successful completion of the Mallaty Creek subsidence project, this reduced operating pressure is being reassessed during RY24 / RY25 to allow the operating pressure to be at least 5.0 MPa.

b) No, other operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – The need for additional markers along Licence 8c pipeline arises because existing markers have either been damaged or removed by 3rd parties and not reinstated. Consequently, as part of JGN's review of marker signage, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline easement. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline.

5. Primary Mains Integrity Management

This section summarises the threats to the Primary Mains. Further information or background is available in the Safety Management Studies for each of these pipelines.

5.1 Key integrity threats

Table 5-1 summarise the key integrity threats to the JGN Primary Pipelines. Supporting information is also contained in the Pipelines Asset Class Strategy.

Table 5–1: Primary Main Threat Summary

Category	Specific Threat	Primary Main Pipeline Systems																		
		SPL			SPM					SNPM			WSM						WPM	
	Subsection	A	B	C	A	B	C	D	E	A	B	C	A	B	C	D	E	F	A	B
Corrosion threats	Internal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	External	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cracking threats	SCC	-	-	-	●	●	●	●	●	-	-	-	-	-	-	-	-	-	-	-
	Fatigue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Hydrogen Induced	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Material / Construction	Weld defects	-	-	-	●	●	●	●	●	●	●	●	●	●	●	-	-	-	●	●
	Pressure testing	-	-	-	●	●	●	●	●	-	-	-	-	-	-	-	-	-	-	-
	Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Time independent	Lightning	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Earthquake	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Land movement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Washaway	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	External loading	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Mines subsidence	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	External Interference	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Sabotage	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	Water crossing	-	-	-	-	-	✓	-	-	✓	-	-	-	-	-	-	-	-	-	-
	Exposed pipeline	-	-	-	-	✓	-	✓	-	-	-	-	-	-	-	-	-	-	-	-
Undetected damage		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

5.2 Integrity Mitigation Options

To address the challenges mentioned above, Table 4–2 outlines mitigation options to mitigate each of the identified threats. By implementing these measures, JGN can safeguard the integrity and longevity of our pipeline assets, ensuring public safety and maintaining reliability of supply to the customers. All primary mains are currently considered to be within High Consequence Area (HCA), based on the latest SMS location class assessment.

Table 5–2: : Integrity Mitigation Options Summary for JGN Primary Mains

Options	SPL			SPM					SNPM			WSM						WPM	
	A	B	C	A	B	C	D	E	A	B	C	A	B	C	D	E	F	A	B
In-line Inspection capable	✓	✓	✓	✓	●	●	-	-	-	-	-	✓	✓	✓	✓	✓	✓	-	-
Pressure reduction	-	-	-	-	-	-	-	-	-	-	✓	-	-	-	-	-	-	✓	✓
Other operational changes	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

5.3 Sydney Primary Loop

The integrity inspection program RY26-RY30 for the Sydney Primary Loop (**SPL**) includes:

1. Inspection
   a) Facility Construction
      i) No new facilities are required.
   b) Inspection Programs
      i) In-line Inspection. A MFL ILI tool will be deployed from West Hoxton to Tempe (all three sections in one run) to confirm:
         - Any internal corrosion
         - Any corrosion growth rates
         - Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
         - Any pipeline alignment change due ground movement.

         The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.
      ii) Validation Digs. There are three inspection digs planned. These digs are to validate the ILI tool that is to be run in RY26. Any additional digs are likely to be carried out in the RY31 to RY35 period.
      iii) Integrity Digs – Opportunistic inspections and repairs are conducted in conjunction with 3rd party encroachment activities to mitigate the increase risks posed by these encroachments, which could limit JGN's future accessibility for maintenance activities.
2. Operational Changes

a) No operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

5.4 Sydney Primary Main

The integrity inspection program RY26-RY30 for SPM includes:

1. Inspection

a) Facility Construction

i) Construction activities are being undertaken to enable ILI of the SPM. This includes the resetting of the Lidcombe site to enable a ILI to pass through the site, construction of an ILI receiver site at Banksmeadow. These activities are outlined in JGN Sydney Primary Main – Lidcombe to Banksmeadow Pigging Facilities Options Analysis (GAS-1400-RP-CP-005).

> *Option 2: Reconfigure the pipeline to enable in-line inspection by constructing pigging facilities 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 integrity issues associated with the SPM (Lidcombe to Banksmeadow) pipeline is to proceed with the reconfiguration of the pipeline to enable in-line inspection. 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.*
>
> *Reconfiguring the pipeline to enable in-line inspection not only represents the most prudent approach to addressing these critical issues but also stands as a fiscally responsible choice that aligns with long term sustainability objectives. It provides the necessary assurance of safety, reliability, and compliance while mitigating the financial risks associated with unexpected and costly repair works. This recommendation underscores the significant benefits and prudent risk mitigation offered by this option, making it the best choice for Jemena's strategic approach to the Lidcombe to Banksmeadow pipeline's project*

b) Inspection Programs

i) In-line Inspection. An MFL ILI tool will be deployed from Horsley Park to Banksmeadow in RY26 (all three sections in one run) to confirm:

- Any internal corrosion
- Any corrosion growth rates
- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
- Any pipeline alignment change due ground movement.

The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.

ii) Validation Digs. There are three inspection digs planned. These digs are to validate the ILI tool that is to be run in RY26. Any additional digs are likely to be carried out in the RY31 to RY35 period.

iii) Integrity Digs – Opportunistic inspections and repairs, including recoating sections of aging Coal Tar Enamel with a modern coating system, are conducted in conjunction with 3rd party encroachment activities to mitigate the increase risks posed by such encroachments, which could limit JGN's future accessibility for maintenance activities.

iv) DCVG survey for SPM (Horsley Park to Lidcombe) section is no longer performed as it is a piggable pipeline. Coating surveys are only performed on a case-by-case basis, usually as part of encroachment activities.

v) DCVG (coating surveys) – The last DCVG survey was conducted on sections B,C, D & E of the SPM pipeline between March and September 2021. According to the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, if section B, C and D of the SPM are reconfigured to enable ILI, DCVG surveys will no longer be performed for these sections. The exception is section E, which will continue to undergo DCVG surveys until it is also reconfigured. This is expected to occur in the RY31 to RY35 period.

2. Operational Changes

   a) No operational changes are expected during RY26 to RY30 period.

3. Safety Devices

   a) No new safety devices have been identified as required.

4. Remediation

   a) The SPM pipeline between Mortalke to Banksmeadow (section D) has several segments of above-ground exposed pipework installed over canals, which are susceptible to atmospheric corrosion where coating has degraded. JGN conducts monitoring and inspection of these exposed pipework every two years to evaluate pipeline coating quality and assess the risk of external corrosion. During the current AA period, from RY20 to RY25, JGN repaired three exposed mains on the SPM. Based on the visual inspections, JGN proposes to rehabilitate and refurbish the coating of the SPM pipeline at Richardson Crescent in Tempe, where approximately 18m of the pipeline is exposed and shows significant coating degradation with signs of rusting and corrosion. The project is scheduled for delivery in RY29.

   b) New or Upgrading of Marker Signs – Extensive urbanization of Sydney along the SPM pipeline route has resulted in upgrading the pipeline's location class as per the AS2885 standard. The development has prompted JGN to review its current marker spacing along the pipeline's route. Consequently, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline route. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline

   c) No mains relocation nor additional works on exposed mains have been identified.

5. Other

   a) Water crossing inspections – JGN conducts hydrographic surveys on a series of river crossings to accurately locate the current river bottom, enabling comparison to previous surveys using multi-beam echo sounders. Sub bottom profilers are utilized to locate the height and position of the pipeline. Ensuring long-term proactive integrity management of the pipelines requires periodic monitoring of these river crossings, particularly after significant flood events.

      Below is the current plan for riverbed crossing of pipelines on SPM pipeline.

Table 5-3 SPM River Crossings

River crossings	Pipeline	Approx length	Last surveyed	Next Survey
Majors Bay Reserve (Mortlake)	Sydney Primary Main (DN550)	285m	2023	2026

5.5 Sydney North Primary Main

5.5.1 Mortlake to Putney

The integrity inspection program RY26-RY30 for Mortlake to Putney section of the NSPM includes:

1. Inspection
   a) Facility Construction
      i) Construction activities are being undertaken to enable ILI of the Mortlake to Putney section of the WPM. This includes the installation of launcher at Mortlake and receiver at Putney. These activities are outlined in JGN Sydney Primary Main – Mortlake to Putney Pigging Facilities Options Analysis (GAS-1400-RP-CP-006).

> *Option 2: Reconfigure the pipeline to enable in-line inspection by constructing pigging facilities 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 integrity issues associated with the SPM (Mortlake to Putney) pipeline is to proceed with the reconfiguration of the pipeline to enable in-line inspection. 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.*
>
> *Reconfiguring the pipeline to enable in-line inspection not only represents the most prudent approach to addressing these critical issues but also stands as a fiscally responsible choice that aligns with long term sustainability objectives. It provides the necessary assurance of safety, reliability, and compliance while mitigating the financial risks associated with unexpected and costly repair works. This recommendation underscores the significant benefits and prudent risk mitigation offered by this option, making it the best choice for Jemena's strategic approach to the Mortlake to Putney pipeline's project*

   b) Inspection Programs
      i) In-line Inspection. An MFL ILI tool will be deployed from Mortlake to Putney in RY27 to confirm:

- Any internal corrosion
- Any corrosion growth rates
- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
- Any pipeline alignment change due ground movement.

The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.

ii) Validation Digs. There are two inspection digs planned. These digs are to validate the ILI tool that is to be run in RY27. Any additional digs are likely to be carried out in the RY31 to RY35 period.

iii) Integrity Digs – Opportunistic inspections and repairs, including recoating sections of aging HDPE (Blue Jacket) coating, are conducted in conjunction with 3rd party encroachment activities. These measures aim to mitigate the increased risks posed by such encroachments, which could potentially limit JGN's future accessibility for maintenance activities.

iv) DCVG (coating surveys) – The last DCVG survey was conducted on SNPM (Mortlake to Putney) in August 2021. According to the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, if SNPM section A, is reconfigured to enable ILI, DCVG surveys will no longer be performed for this section.

2. Operational Changes

a) No operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

5. Other

a) Water crossing inspections – JGN conducts hydrographic surveys on a series of river crossings to accurately locate the current river bottom, enabling comparison to previous surveys using multi-beam echo sounders. Sub bottom profilers are utilized to locate the height and position of the pipeline. Ensuring long-term proactive integrity management of the pipelines requires periodic monitoring of these river crossings, particularly after significant flood events.

Below is the current plan for riverbed crossing of pipelines on Sydney North Primary Main.

Table 5-4 SNPM River Crossing

River crossings	Pipeline	Approx length	Last surveyed	Next Survey
Parramatta River	SNPM (DN500)	800m	2023	2028

5.5.2 Putney to Ryde; Ryde to Stringybark

1. Inspection

a) Facility Construction

i) Construction activities are being undertaken to enable ILI of the Putney to Ryde and Ryde to Stringybark sections of the WPM. This includes the installation of launcher at Putney and receiver at Stringybark. These activities are outlined in JGN Sydney Primary Main –Putney to Stringybark Pigging Facilities Options Analysis (GAS-1400-RP-CP-004).

Option 2: Reconfigure the pipeline to enable in-line inspection by constructing pigging facilities 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 integrity issues associated with the SPM (Putney to Stringybark) pipeline is to proceed with the reconfiguration of the pipeline to enable in-line inspection. 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.

Reconfiguring the pipeline to enable in-line inspection not only represents the most prudent approach to addressing these critical issues but also stands as a fiscally responsible choice that aligns with long term sustainability objectives. It provides the necessary assurance of safety, reliability, and compliance while mitigating the financial risks associated with unexpected and costly repair works. This recommendation underscores the significant benefits and prudent risk mitigation offered by this option, making it the best choice for Jemena's strategic approach to the Putney to Stringybark pipeline's project

b) Inspection Programs

i) In-line Inspection. A MFL ILI tool will be deployed from Putney to Stringybark in RY30 to confirm:

- Any internal corrosion
- Any corrosion growth rates
- Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
- Any pipeline alignment change due ground movement.

The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection

ii) Validation Digs. Validation digs are to be carried out in the RY31 to RY35 period.

iii) Integrity Digs – Opportunistic inspections and repairs, including recoating sections of aging HDPE (Blue Jacket) coating, are conducted in conjunction with 3rd party encroachment activities. These measures aim to mitigate the increased risks posed by such encroachments, which could potentially limit JGN's future accessibility for maintenance activities.

iv) The last DCVG survey was conducted on SNPM (Putney to Stringybark) in August 2021. According to the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, if SNPM section B, is reconfigured to enable ILI, DCVG surveys will no longer be performed for this section.

v) The SNPM section between Putney to Stringybark has only one above-ground exposed pipework installed at Morrison Rd, Putney. The pipeline undergoes inspection and monitoring for atmospheric corrosion every 2 years. Currently, no remediation works are needed, and the exposed pipework will continue to be inspected and monitored for any coating degradation and signs of external corrosion.

2. Operational Changes

a) No operational changes are expected during RY26 to RY30 period.

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

b) New or Upgrading of Marker Signs – Extensive urbanization of Sydney along the SNPM pipeline route has resulted in upgrading the pipeline's location class as per the AS2885 standard. The development has prompted JGN to review its current marker spacing along the pipeline's route. Consequently, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline route. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline

5.5.3 Stringybark to Willoughby

1. Inspection

a) Facility Construction

No facilities exist, and assessment has determined due to the diameter and the construction method, ILI is not a feasible option for this section of pipeline.

b) Inspection Programs

i) No ILI will be conducted.

ii) Validation Digs. Since there is no planned ILI, no validation digs have been identified in the RY26 to RY30 period. However, if an ILI tool is deployed, validation digs may be required. Additionally if any other inspection, such as DCVG, identifies potential integrity anomalies, validation digs may be undertaken.

iii) The last DCVG survey was conducted on SNPM (Stringybark to Willoughby) in August 2021. According to the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, if SNPM section C, is downgraded to secondary pressure DCVG surveys will no longer be performed for this section.

2. Operational Changes

a) In 2019, JGN recommended that the pressure in the Stringbark to Willoughby Primary Main was downgraded from primary pressure to secondary pressure. This was documented in an Options Analysis (GAS-1400-RP-RM-003) that was submitted as part of the JGN 2020 Access Arrangement and subsequently approved by the AER. The JGN Options Analysis – SPM Integrity Management Stage 2 (GAS-1499-RP-IN-014) outlines the next phase in that project which requires the installation of a new secondary main on Forest Way to maintain supply for existing customers. This CAPEX solution has been recommended:

Sub-Option 3B are (is) recommended for the following reasons

- *The option addresses the objectives of the project, eliminating the risk of supply loss to customers in the scenario that the SPM from Lane Cove (Stringybark) to Willoughby is downrated.*
- *This option is the most cost efficient for CAPEX expenditure that addresses the identified risks*
- *The option uses a conventional strategy with minimal OPEX liability*
- *The works are a 'traditional' scope.*

3. Safety Devices

a) No new safety devices have been identified as 'required'.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

5.6 Western Sydney Primary Main

The integrity inspection program RY26-RY30 for PPM includes:

1. Inspection
   a) Facility Construction
      i) No new facilities are required.
   b) Inspection Programs
      i) In-line Inspection. A MFL ILI tool will be deployed in RY28 from Eastern Creek to Emu Plains (all five sections in one run) to confirm:
         - Any internal corrosion
         - Any corrosion growth rates
         - Any unidentified damage, such as unreported external interference leading to gouge or denting of the pipeline.
         - Any pipeline alignment change due ground movement.

         The ILI tool deployment will be based upon a 10 year cycle, matching good industry practice for on-going inspection.
      ii) Validation Digs. There are three inspection digs planned. These digs are to validate the ILI tool that is to be run in RY30. Any additional digs are likely to be carried out in the RY31 to RY35 period.
2. Operational Changes
   a) No operational changes are expected during RY26 to RY30 period.
3. Safety Devices
   a) No new safety devices have been identified as required.
4. Remediation
   a) No mains relocation nor additional works on exposed mains have been identified.
   b) New or Upgrading of Marker Signs – Extensive urbanization of Sydney along the WSPM pipeline route has resulted in upgrading the pipeline's location class as per the AS2885 standard. The development has prompted JGN to review its current marker spacing along the pipeline's route. Consequently, JGN will be installing additional marker signs over the next 2 – 3 years along the pipeline route. This initiative aims to enhance visibility of the asset presence and alert third parties planning to work near a JGN pipeline

5.7 Wollongong Primary Main

The integrity inspection program RY26-RY30 for WPM includes:

1. Inspection
   a) Facility Construction
      i) No ILI facilities exist for the ILI inspection of WPM pipeline. New facilities will need to be constructed, if In-Line inspection will be required in the future.
   b) Inspection Programs

i) In-line Inspection. No inspection program is planned. An ILI inspection, the industry preferred technique to validate the structural integrity of high pressure pipelines, will only be undertaken if the pipeline is to be repurposed to carry an alternate future fuel (potentially hydrogen). The current plan for JGN is to de-rate the pipeline's pressure from 3,500 kPa to 1,050 kPa. This would change the operating and maintenance regime to align with AS4645 rather than AS2885.

ii) Validation Digs. As there is no planned ILI, there are no identified validation digs. However, if an ILI tool is deployed, validation digs will required. Additionally if any other inspection, such as DCVG, identifies potential integrity anomalies, validation digs may be undertaken.

iii) DCVG (coating surveys) – Last DCVG survey was performed on WPM pipeline in April 2021. As per the JGN pipeline's ACS, DCVG surveys will continue to be performed on 5 yearly basis for un-piggable pipelines. However, as mentioned above, if the WPM pipeline is de-rated to secondary pressure, DCVG surveys will no longer be performed.

2. Operational Changes

a) The JGN Lic2B and WPM Integrity Management Options Analysis (GAS-1499-RP-IN-001) outlines the recommendation that to maintain the integrity of the Licence 2B, the following:

> *Derate the pipeline to secondary pressure is the recommended solution costing AUD $2,012,065[10]. Implementing this option will reduce the impact of pipeline failure and thus reduce the health and safety risk rating from High to Moderate (Jemena) / Low (AS2885). No additional integrity management is required to comply with the standard requirements. This option is also focused on customer benefits as it will retain the supply without burdening the customers. However, Option 2 is considered as well if both pipelines will be utilised for Hydrogen storage to support the transition towards low carbon future.*

3. Safety Devices

a) No new safety devices have been identified as required.

4. Remediation

a) No mains relocation nor additional works on exposed mains have been identified.

[10] Note this is a preliminary CAPEX costing and may have been modified in later review.

6. Program Costing

6.1 Inspection

6.1.1 New Facility Requirements

The new facility requirement costs were built up using the project estimation model in accordance with the Jemena Infrastructure Cost Estimation Methodology.

The costing was carried out with a top-down approach, utilising historical data from previous projects such as recent unit rates, tender prices, labour costs, and schedule or rates prices. The cost estimation process begins with understanding of the scope, resource, approval, environmental, material, lands, site and construction requirements. This includes developing the design of pigging facilities, identifying the type and duration of internal and external resources, the material requirements and delivery timeline, construction and site requirement and constraints in order to successfully facilitate the pigging facility construction.

From there, key assumptions, constraints and risks are identified to better understand the impact on the scope delivery, cost and timing. The total project cost is then established by calculating the internal labour, material, subcontractor, risk and indirect costs involved in each gating phase. The key elements of project costings are further described in JGN's project costing methodology.

Table 6–1: Summary of new pigging facilities

Pipeline	Project ID	Project Title	Project Cost	PEM Reference	OA/BC Reference	Delivery Year
Sydney Primary Main	10033694	SPM Pigging Facility Lidcombe to Banksmeadow	$7,730,147	JGN - RIN - 4.3 - 10033694 - SPM - Lidcombe to Banksmeadow Pigging Facilities - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10033694 - SPM - Lidcombe to Banksmeadow Pigging Facilities - OA - 20240628 - Public	RY26
Northern Sydney Primary Main	10033695	Putney - Stringybark Pigging Facility	$9,356,909	JGN - RIN - 4.3 - 10033695 - SPM - Putney - Stringybark Pigging Facilities - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10033695 - SPM - Putney - Stringybark Pigging Facilities - BC - 20240628 - Public	RY28
Licence 8C	10068009	Northern Trunk (Lic 8c) - Pigging Facilities	$6,546,940	JGN - RIN - 4.3 - 10068009 - Northern Trunk - Lic 8c - Pigging Facilities - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10068009 - Northern Trunk - Lic 8c - Pigging Facilities - OA - 20240628 - Public	RY27

Pipeline	Project ID	Project Title	Project Cost	PEM Reference	OA/BC Reference	Delivery Year
Northern Sydney Primary Main	10070627	SPM (Mortlake to Putney) - Pigging Facilities	$5,593,495	JGN - RIN - 4.3 - 10070627 - SPM - Mortlake to Putney Pigging Facilities - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10070627 - SPM - Mortlake to Putney Pigging Facilities - OA - 20240628 - Public	RY26

6.1.2 ILI Program

The ILI cost were built up using the project estimation model in accordance with the Jemena Infrastructure Cost Estimation Methodology. The costing was carried out with a top-down approach, utilising historical data from previous projects such as recent unit rates, tender prices, labour costs, and schedule or rates prices. The cost estimation process begins with understanding of the scope, resource, approval, environmental, material, lands, site and construction requirements.

This includes determining the type of inspection tools to use, such as cleaning tool, gauging tools, inspection tools, metal loss detection and sizing tool, crack detection and sizing tool, and so on. The cost is also influenced by the tool size and length of ILI runs, which vary between different licence pipeline. Aside from the cost of running the ILI, the estimates include the cost of conducting risk assessments workshops, pipeline surveys, material testing, and hiring a crane for mounting the ILI tool, among other expenses.

From there, key assumptions, constraints and risks are identified to better understand the impact on the scope delivery, cost and timing. The total project cost is then established by assessing the internal labour, material, subcontractor, risk and indirect costs involved in each gating phase.

Table 6–2: Summary of ILI program

Pipeline	Project ID	Project Title	Project Cost	PEM Reference	Delivery Year
Licence 2A	10068005	Southern Trunk (Lic 2a) - ILI	$2,575,519	JGN - RIN - 4.4 - 10068005 - Licence 2A ILI - PEMO - 20240628 - Public	RY28
Licence 3,7,8AB	10068012	Northern Trunk (Lic 378ab) - ILI	$2,575,519	JGN - RIN - 4.4 - 10068012 - Licence 3,7,8AB ILI - PEMO - 20240628 - Public	RY30

Pipeline	Project ID	Project Title	Project Cost	PEM Reference	Delivery Year
Licence 8C	10068010	Northern Trunk (Lic 8c) - ILI	$1,419,076	JGN - RIN - 4.4 - 10068010 - Licence 8C ILI - PEMO - 20240628 - Public	RY28
SPL Hoxton to Tempe	10038202	SPL – ILI	$2,552,074	JGN - RIN - 4.4 - 10038202 - SPL Hoxton to Tempe ILI - PEMO - 20240628 - Public	RY26
Penrith Primary	10068007	Penrith (WSPM) - ILI	$1,713,459	JGN - RIN - 4.4 - 10068007 - Penrith Primary ILI - PEMO - 20240628 - Public	RY28
SPM Horsley to Lidcombe	10043314	SPM (Horsley Park-Banksmeadow) - ILI	$2,213,545	JGN - RIN - 4.4 - 10043314 - SPM Horsley to Lidcombe ILI - PEMO - 20240628 - Public	RY26
SPM Putney to SB	10043326	SPM (Putney to SB) - ILI	$2,723,260	JGN - RIN - 4.4 - 10043326 - SPM Putney to SB ILI - PEMO - 20240628 - Public	RY30
SPM Mortlake to Putney	10069263	SPM (Mort to Putney) - ILI	$2,244,453	JGN - RIN - 4.4 - 10069263 - SPM Mortlake to Putney ILI - PEMO - 20240628 - Public	RY27

6.1.3 Validation Digs

The validation digs cost were built up using the project estimation model in accordance with the Jemena Infrastructure Cost Estimation Methodology. The costing was carried out with a top-down approach, utilising historical data from previous projects such as recent unit rates, tender prices, labour costs, and schedule or rates prices. The cost estimation process begins with understanding of the scope, resource, approval, environmental, material, lands, site and construction requirement, such as the number, location and complexity of validation digs required.

The location and number of the validation digs is determined using the ILI results to identify various potential anomaly locations along the pipeline sections. Once the location is chosen, each location will be excavated to expose the pipeline to validate the anomaly defect detected in the ILI results and assess the integrity of the pipeline. In addition, NDT is carried out to inspect the pipeline coating and measure the defects before the pipeline

is recoated and rehabilitated. The cost of the validation digs is also influenced by numerous external factors and can vary significantly depending on the location chosen. Council or TfNSW restrictions, environmental constraints, nightwork, complicated repair, expensive restoration, deep excavation, presence of contaminated soils and other reasons can all drive up the costs significantly.

From there, key assumptions, constraints and risks are identified to better understand the impact on the scope delivery, cost and timing. The total project cost is then established by assessing the internal labour, material, subcontractor, risk and indirect costs involved in each gating phase.

Table 6–3: summary of validation digs program

Pipeline	Project ID	Project Title	Project Cost	PEM Reference	Delivery Year
Licence 1	10043332	Central Trunk (Lic 1) – Validation Digs	$3,225,390	JGN - RIN - 4.4 - 10043332 - Licence 1 Validation Digs - PEMO - 20240628 - Public	RY26
Licence 2A	10068006	Southern Trunk (Lic 2a) - Validation Digs	$1,662,320	JGN - RIN - 4.4 - 10068006 - Licence 2A Validation Digs - PEMO - 20240628 - Public	RY30
Licence 8C	10068011	Northern Trunk (Lic 8c) - Validation Digs	$1,752,496	JGN - RIN - 4.4 - 10068011 - Licence 8C Validation Digs - PEMO - 20240628 - Public	RY30
SPL Hoxton to Tempe	10067996	SPL – Validation Digs	$3,687,093	JGN - RIN - 4.4 - 10067996 - SPL Hoxton to Tempe Validation Digs - PEMO - 20240628 - Public	RY27
Penrith Primary	10068008	Penrith (WSPM) - Validation Digs	$2,052,472	JGN - RIN - 4.4 - 10068008 - Penrith Primary Validation Digs - PEMO - 20240628 - Public	RY30

Pipeline	Project ID	Project Title	Project Cost	PEM Reference	Delivery Year
SPM Horsley to Lidcombe	10043315	SPM (Lidcombe to Mortlake) - Validation Digs	$2,847,623	JGN - RIN - 4.4 - 10043315 - SPM Horsley to Lidcombe Validation Digs - PEMO - 20240628 - Public	RY29
SPM Putney to SB	10043327	SPM (Putney to SB) - Validation Digs	$98,697	JGN - RIN - 4.4 - 10043327 - SPM Putney to SB Validation Digs - PEMO - 20240628 - Public	RY31
SPM Mortlake to Putney	10069268	SPM (Mort to Putney) - Validation Digs	$2,107,654	JGN - RIN - 4.4 - 10069268 - SPM Mortlake to Putney Validation Digs - PEMO - 20240628 - Public	RY29

6.1.4 Other Inspections

DCVG cost is based on RIN reported actual averaged over the past years. The allowance per year from RY26-30 is $250,000 to cover the DCVG requirements for various sections of pipelines.

Table 6–4: summary of DCVG program

Pipeline	Project ID	Project Title	Project Cost (O/C)	PEM Reference	RYs
Various sections	NA	DCVG allowance	$1,250,000	NA	RY26 – RY30

6.2 Operational Changes

The costs for projects with operational changes were built up using the project estimation model in accordance with the Jemena Infrastructure Cost Estimation Methodology. The costing was carried out with a top-down approach, utilising historical data from previous projects such as recent unit rates, tender prices, labour costs, and schedule or rates prices. The cost estimation process begins with understanding of the scope, resource, approval, environmental, material, lands, site and construction requirements.

For the Licence 2B and WPM Integrity Management project, the costs involve installing interconnection between Wollongong Primary main and the Wollongong secondary network, cut and cap the Wollongong PRS and implement operation change at Port Kembla MS and Mt Keira TRS to enable secondary pressure operation.

For the SPM Integrity Management Stage 2 project (Northern Sydney Primary), the costs include laying DN250 secondary steel main to provide the capacity required to supply the Northern Beaches area due to de-rating of the SPM from Lane Cove to Willoughby.

Key assumptions, constraints and risks are identified to better understand the impact on the scope delivery, cost and timing. The total project cost is then established by assessing the internal labour, material, subcontractor, risk and indirect costs involved in each gating phase.

Table 6–5: Summary of projects due to operational changes

Pipeline	Project ID	Project Title	Project Cost (O/C)	PEM Reference	OA/BC Reference	Delivery Year
Licence 2B	10038241	Lic 2B and WPM Integrity Management	$1,316,854	JGN - RIN - 4.3 - 10038241 - Lic 2B and WPM Integrity Management - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10038241 - Lic 2B and WPM Integrity Management - OA - 20240628 - Public	RY26
Northern Sydney Primary Main	10043035	SPM Integrity Management Stage 2	$15,780,795	JGN - RIN - 4.3 - 10043035 - SPM Integrity Management - Phase 2 - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10043035 - SPM Integrity Management - Phase 2 - BC - 20240628 - Public	RY26

6.3 Safety Devices

The safety device costs were built up using the project estimation model in accordance with the Jemena Infrastructure Cost Estimation Methodology. The costing was carried out with a top-down approach, utilising historical data from previous projects such as recent unit rates, tender prices, labour costs, and schedule or rates prices. The cost estimation process begins with understanding of the scope, resource, approval, environmental, material, lands, site and construction requirements.

The Licence 7 Isolation Valve Installation project was based on the design, material, and contractor costs of the recently completed Canberra Primary Main Isolation Valve project.

To account for inflation over the years, an allocated percentage of the CPI is applied to costs. From there, key assumptions, constraints and risks are identified to better understand the impact on the scope delivery, cost and timing. The total project cost is then established by assessing the internal labour, material, subcontractor, risk and indirect costs involved in each gating phase.

Table 6–6: Summary of safety devices projects

Pipeline	Project ID	Project Title	Project Cost (O/C)	PEM Reference	OA Reference	Delivery Year
Licence 7	10068019	Licence 7 Isolation Valve Installation	$2,956,311	JGN - RIN - 4.3 - 10068019 - Licence 7 - Plumpton to Pitt Town Isolation - PEMO - 20240628 - Public	JGN - RIN - 4.3 - 10068019 - Licence 7 - Plumpton to Pitt Town Isolation - OA - 20240628 - Public	RY28

6.4 Remediation

The remediation costs were built up using the project estimation model in accordance with the Jemena Infrastructure Cost Estimation Methodology. The costing was carried out with a top-down approach, utilising historical data from previous projects such as recent unit rates, tender prices, labour costs, and schedule or rates prices. The cost estimation process begins with understanding of the scope, resource, approval, environmental, material, lands, site and construction requirements.

The SPM Exposed Main - Richardson Cr, Marrickville project was based on the contractor costs of the recently completed Ferrers Road, Eastern Creek and Swansea Bridge rehabilitation projects.

Key assumptions, constraints and risks are identified to better understand the impact on the scope delivery, cost and timing. The total project cost is then established by assessing the internal labour, material, subcontractor, risk and indirect costs involved in each gating phase.

Table 6–7: Summary of remediation projects

Pipeline	Project ID	Project Title	Project Cost (O/C)	PEM Reference	Delivery Year
Sydney Primary Main	10053729	SPM Exposed Main – Richardson Cr, Marrickville	$618,823	JGN - RIN - 4.3 - 10053729 - SPM Exposed Main - Richardson Cr, Marrickville - PEMO - 20240628 - Public	RY29

7. Summary

7.1 Operational Expenditure (real $2023 value)

Consistent with the requirements of Rule 91(1) of the National Gas Rules, JGN considers that the forecast operating expenditure over the 2025-30 regulatory period for JGN's Pipeline Integrity Management Plan is consistent with accepted good industry practice to maintain the integrity and safety of the pipeline and to comply with regulatory obligations.

Figure 7-1 JGN Integrity Program opex RY26-30

Pipeline	Activity	AA Period Total $M	
Licence 1	ILI	$ -	$ 3.23
	Digs	$ 3.23	
Licence 2A	ILI	$ 2.58	$ 4.24
	Digs	$ 1.66	
Licence 3,7,8AB	ILI	$ 2.58	$ 2.58
	Digs	$ -	
Licence 8C	ILI	$ 1.42	$ 3.17
	Digs	$ 1.75	
SPL Hoxton to Tempe	ILI	$ 2.55	$ 6.24
	Digs	$ 3.69	
Penrith Primary	ILI	$ 1.71	$ 3.77
	Digs	$ 2.05	
SPM Horley to Banksmeadow	ILI	$ 2.21	$ 5.06
	Digs	$ 2.85	
SPM Putney to SB	ILI	$ 2.72	$ 2.82
	Digs	$ 0.10	
SPM Mortlake to Putney	ILI	$ 2.24	$ 4.35
	Digs	$ 2.11	
DCVG Digs		$ 1.25	$ 1.25
TOTAL		**$36.70**	

Pipeline	Activity	# Digs	RY26	RY27	RY28	RY29	RY30	AA Period Total
Licence 1	ILI		$ -	$ -	$ -	$ -	$ -	$ -
	Digs	4	$ 3,191,237	$ 34,154	$ -	$ -	$ -	$ 3,225,390
Licence 2A	ILI		$ 39,185	$ 163,204	$ 2,373,130	$ -	$ -	$ 2,575,519
	Digs	2	$ -	$ -	$ 21,142	$ 444,192	$ 1,196,986	$ 1,662,320
Licence 3,7,8AB	ILI		$ -	$ -	$ 39,185	$ 163,204	$ 2,373,130	$ 2,575,519
	Digs	4	$ -	$ -	$ -	$ -	$ -	$ -
Licence 8C	ILI		$ -	$ 94,022	$ 1,142,170	$ 182,884	$ -	$ 1,419,076
	Digs	2	$ -	$ -	$ 13,415	$ 420,820	$ 1,318,261	$ 1,752,496
SPL Hoxton to Tempe	ILI		$ 2,552,074	$ -	$ -	$ -	$ -	$ 2,552,074
	Digs	3	$ 2,444,722	$ 1,242,371	$ -	$ -	$ -	$ 3,687,093
Penrith Primary	ILI		$ 39,185	$ 163,204	$ 1,511,070	$ -	$ -	$ 1,713,459
	Digs	3	$ -	$ -	$ 11,871	$ 597,183	$ 1,443,419	$ 2,052,472
SPM Horley to Banksmeadow	ILI		$ 2,169,061	$ 44,484	$ -	$ -	$ -	$ 2,213,545
	Digs	3	$ 45,482	$ 851,970	$ 178,887	$ 1,771,282	$ -	$ 2,847,623
SPM Putney to SB	ILI		$ -	$ -	$ 40,331	$ 163,204	$ 2,519,725	$ 2,723,260
	Digs	3	$ -	$ -	$ -	$ -	$ 98,697	$ 98,697
SPM Mortlake to Putney	ILI		$ 94,022	$ 1,967,547	$ 182,884	$ -	$ -	$ 2,244,453
	Digs	2	$ 24,695	$ 160,513	$ 95,619	$ 1,826,827	$ -	$ 2,107,654
DCVG	DCVG	5	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 1,250,000
	TOTAL		$ 10,849,663	$ 4,971,469	$ 5,859,705	$ 5,819,596	$ 9,200,217	$ 36,700,648
ILI		-	$ 4,893,526	$ 2,432,460	$ 5,288,770	$ 509,292	$ 4,892,854	$ 18,016,903
Digs		26	$ 5,706,136	$ 2,289,008	$ 320,935	$ 5,060,303	$ 4,057,363	$ 17,433,745
DCVG		5	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 250,000	$ 1,250,000
	TOTAL		$ 10,849,663	$ 4,971,469	$ 5,859,705	$ 5,819,596	$ 9,200,217	$ 36,700,648

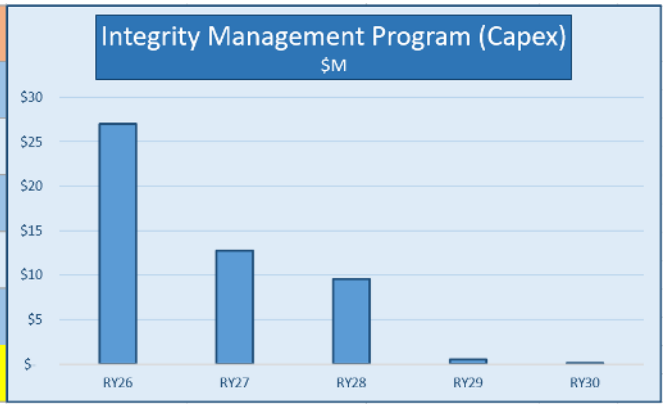
Figure 7-2 JGN Integrity Program RY26-30 opex RY26-30

7.2 Capital Expenditure (real $2023 value)

Consistent with the requirements of Rule 79 of the National Gas Rules, JGN considers that the forecast capital expenditure over the 2025-30 regulatory period for JGN's Pipeline Integrity Management Plan is consistent with accepted good industry practice to maintain the integrity and safety of the pipeline and to comply with regulatory obligations.

Figure 7-3 JGN Integrity Program capex RY26-30

Pipeline	Activity	AA Period Total $M	
Licence 2B	Operational Changes	$ 1.32	$ 1.32
Licence 7	Safety Devices	$ 2.96	$ 2.96
Licence 8C	Pigging Facility	$ 6.55	$ 6.55
Sydney Primary Main	Pigging Facility	$ 7.73	$ 8.35
	Remediation	$ 0.62	
Northern Sydney Primary Main	Pigging Facility	$ 14.95	$ 30.73
	Operational Changes	$ 15.78	
TOTAL		$49.90	



Pipeline	Activity	# Projects	RY26	RY27	RY28	RY29	RY30	AA Period Total
Licence 2B	Operational Changes	1	$ 1,228,442	$ 88,413	$ -	$ -	$ -	**$ 1,316,855**
Licence 7	Safety Devices	1	$ 64,993	$ 1,436,877	$ 1,454,442	$ -	$ -	**$ 2,956,312**
Licence 8C	Pigging Facility	1	$ 1,784,824	$ 4,593,655	$ 168,461	$ -	$ -	**$ 6,546,940**
Sydney Primary Main	Pigging Facility	1	$ 6,189,013	$ 1,541,134	$ -	$ -	$ -	**$ 7,730,147**
	Remediation	1	$ -	$ -	$ 192,149	$ 407,210	$ 19,464	**$ 618,823**
Northern Sydney Primary Main	Pigging Facility	2	$ 5,949,061	$ 1,107,833	$ 7,751,702	$ 141,808	$ -	**$ 14,950,404**
	Operational Changes	1	$ 11,820,297	$ 3,960,498	$ -	$ -	$ -	**$ 15,780,795**
TOTAL			**$ 27,036,630**	**$ 12,728,410**	**$ 9,566,754**	**$ 549,018**	**$ 19,464**	**$ 49,900,276**
Pigging Facility		4	$ 13,922,898	$ 7,242,622	$ 7,920,163	$ 141,808	$ -	$ 29,227,491
Safety Devices		1	$ 64,993	$ 1,436,877	$ 1,454,442	$ -	$ -	$ 2,956,312
Operational Changes		2	$ 13,048,739	$ 4,048,911	$ -	$ -	$ -	$ 17,097,650
Remediation		1	$ -	$ -	$ 192,149	$ 407,210	$ 19,464	$ 618,823
TOTAL			**$ 27,036,630**	**$ 12,728,410**	**$ 9,566,754**	**$ 549,018**	**$ 19,464**	**$ 49,900,276**

Appendix A
PIMP Elements in AMS

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A1. AS2885.3:2022 – Matrix of PIMP Requirements and Jemena's application through AMS documents for JGN and Evoenergy AS2885 assets.

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
	Section 6.3 Pipe Wall Integrity	Threats to the PIPELINE SYSTEM that might impact the pipe wall shall be identified in the PIMP. Where the most current SMS identifies threats (a) to (e) as credible, the PIMP shall reference the mitigations. The Licensee shall implement process and procedures to monitor and assess pipe wall integrity to maintain the required wall thickness Wall thickness and structural integrity is maintained to prevent leakage at the MAOP	GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications GAS-4999-SP-ME-001 Evo Energy – AS2885 Field Operations and Maintenance Specification	Section 6.1 – Planned Maintenance details about Jemena's inspections to manage pipe wall integrity and their frequencies • In-Line Inspections • Direct Inspections (based on DCVG and ILI)	GAS-999-RP-IN-003 JGN Pipelines APAIR provides annual pipeline condition based on the status of pipeline CP, coating, ILI, direct inspection & exposed mains GAS-4999-RP-IN-003 Evo Energy Pipeline Asset Performance and Integrity Report – July 2020 – June 2021 Appendix B – Direct Inspection Field Report (prepared for each integrity dig) ILI Reports from vendors after each ILI campaign.
			GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines GAS-4999-PA-IN-008 Evo Energy – Asset Class Strategy Pipeline 2020 – 2026	Sections 4.1 and 4.2 provides condition of the pipeline wall integrity for piggable and non-piggable pipelines	
	Section 6.5 Integrity Assessment Techniques	Periodic inspections of the pipe wall shall be carried out to determine whether preventative maintenance controls have been effective. The frequency of inspection shall be determined and detailed within the PIMP. As required by the PIMP, periodic inspections shall be carried out to identify actual or potential factors that could affect the integrity of the pipeline	GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications GAS-4999-SP-ME-001 Evo Energy – AS2885 Field Operations and Maintenance Specification	As above. Section 6.1 and Section 6.2 of FOMS provide Jemena's planned and corrective maintenance requirements.	GAS-999-RP-IN-003 JGN Pipelines APAIR provides annual pipeline condition based on the status of pipeline CP, coating, ILI, direct inspection & exposed mains (Section 3 and Section 5)
			GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines GAS-4999-PA-IN-008 Evo Energy – Asset Class Strategy Pipeline 2020 – 2026	Sections 4.1 and 4.2 provides condition of the pipeline wall integrity for piggable and non-piggable pipelines	
Section 7: Pipeline Corridor Management	Section 7.2 Pipeline Corridor Management	Safety Management Study to be carried out in accordance with the requirements of AS2885.1 (will be updated to AS2885.6 in new edition) The Licensee shall establish and implement procedures to monitor the effectiveness of the threat mitigation controls and to identify any new pipeline corridor threats and document any such threat in PIMP Procedural controls, by definition, apply to pipeline corridor threats. In this clause, these controls and the associated management systems may also apply to other threats covered under	GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications GAS-4999-SP-ME-001 Evo Energy – AS2885 Field Operations and Maintenance Specification	FOM – Section 5.3 to 5.6 provides the type of inspections that are performed on JGN & Evoenergy assets to manage its pipeline corridor. a) Pipeline Patrols b) Exposed Mains Inspection c) Landholder – Engagement/Contact Gas and BYDA Awareness FOM – Section 6.3 details the requirements to carry out these inspections. a) Encroach Management b) BYDA c) Monitoring of Works near pipelines d) Isolation	5 yearly and regular Safety Management Study reports and workshops conducted on a periodic basis. Jemena has an Encroachment Management System (EMS) where each non-standard encroachment is logged, reviewed and assessed. Standard encroachments are managed through GAS-960-GL-PL-001 Guidelines to Designing, Constructing and Operating around Existing AS2885 Natural Gas Pipelines. GAS-999-RP-IN-003 JGN Pipelines APAIR – Section 3 provides summary

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
		pipeline corridor management The Licensee shall establish a liaison program to communicate to the community and stakeholders the presence of the pipeline and the importance of the integrity of the pipeline for the safety of the public and environment		Venting and Purging	of SMS reviews, patrols, encroachments and BYDA. Section 5 details regarding encroachment and easement management. .
			GAS-999-PR-LM-001 AS2885 Gas Transmission Pipelines: Landholder Contact Procedure.	This procedure specifies how Jemena AS2885 gas transmission assets communications with stakeholders are maintained and recorded.	
	Section 7.3 Procedural Controls Section 7.4 Corridor Surveillance Section 7.5 Controlling Activities near the Pipeline	Procedural controls, by definition, apply to pipeline corridor threats threats. In this clause, these controls and the associated management systems may also apply to other threats covered under pipeline corridor management The Licensee shall establish a liaison program to communicate to the community and stakeholders the presence of the pipeline and the importance of the integrity of the pipeline for the safety of the public and environment Surveillance of the entire pipeline corridor shall be undertaken at least annually. Pipeline patrols shall be undertaken at a frequency that will enable the Licensee to be assured the pipeline corridor threats are identified and managed. Surveillance of the entire pipeline corridor shall be undertaken at least annually. Pipeline patrols shall be undertaken at a frequency that will enable the Licensee to be assured the pipeline	JEM FPF PL0012 Landholder & Stakeholder Engagement GAS-999-PA-LM-002 Lands (Gas) Asset Class Strategy GAS-499-PA-LM-001 WSGG Land Engagement Strategy GAS-1499-PA-LM-001 – NSW Stakeholder Engagement (Gas) Plan GAS-1499-PA-LM-002 - JGN Landholder Engagement Plan	These documents provide plans to Jemena Lands Team to deliver strategic, targeted and meaningful stakeholder and user liaison; and communication.	MIPELA X-Info (Land Holder Record Management System). MIPELA is a repository for all landholder details, property restrictions, access requirements, and communication records. As mentioned in Section 7.2
			GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications	FOM – Section 5.3 to 5.6 provides the type of inspections that are performed on JGN assets to manage pipeline corridor threats. a) Pipeline Patrols b) Exposed Mains Inspection c) Landholder – Engagement/Contact Gas and BYDA Awareness FOM – Section 6.3 details the requirements to carry out these inspections. a) Encroach Management b) BYDA c) Monitoring of Works near pipelines d) Isolation	Jemena uses SAP as its Computerised Maintenance Management System. It serves as its asset register, maintenance planning / scheduling tool and material management tool. All current data accessible through SAP Pipeline ROW Reports prepared by patrolmen after each patrol activity (started from Jan 2020) stored in EDMS Safety Management Study reports GAS-999-RP-IN-003 JGN Pipelines APAIR – Section 3 provides summary of SMS reviews, patrols, encroachments and BYDA. Section 5 details regarding encroachment and easement management.

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
		corridor threats are identified and managed. Work procedures shall be identified in the PMS, documenting the requirements for the control of third party activities near the pipeline system. Controlling of 3rd party activities near Pipelines. Ensuring appropriate separation distances are maintained, no materials / vegetation are placed on top or near pipeline without approval Similarly, any change require Licensee review and SMS, if required. Also assessing vehicle load limits or any access restriction to easements etc.		Venting and Purging It provides general guidelines to assist 3rd parties with their design/construction proposal prior to submitting to Jemena for review and approval FOM – Section 6.3 details the requirements to carry out these inspections. a) Encroach Management b) BYDA c) Monitoring of Works near pipelines d) Isolation Venting and Purging	Jemena has an Encroachment Management System (EMS) where all non-standard encroachments are logged, reviewed and assessed. Type B encroachments are recorded in Encroachment Reports for each asset in ECMS Safety Management Study reports (encroachment / Land use Change) GAS-999-RP-IN-003 JGN Pipelines APAIR – Section 3 provides summary of SMS reviews, patrols, encroachments and BYDA. Section 5 details regarding encroachment and easement management.
Section 8 Station Operations and Maintenance	All sections	Maintenance of stations ensure that a) All devices and systems required to ensure the station operates within these limits are operable; and The structural and pressure integrity of stations is not compromised over time	GAS-999-RP-IN-004 Facilities APAIR Gas Markets	Facilities APAIR provides a summary of any significant asset integrity issue or maintenance planning for facilities. Facilities APAIR is updated annually.	5 yearly Safety Management Study report for each JGN pipeline (includes facilities structural integrity) Jemena uses SAP as its Computerised Maintenance Management System. It serves as its asset register, maintenance scheduling tool and material management tool. All current data accessible through SAP Facilities inspection reports prepared by technicians after each inspection activity (stored in ECMS) Facilities APAIR (annually assess condition of facilities)
Section 9: Anomaly Assessment and Defect Repair	Section 9.2 Initial Assessment & Response	This Section of the standard details the minimum requirements for the management of pipe wall anomalies and includes an assessment process to determine whether they are defects and, if	GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines GAS-4999-PA-IN-008 Evo Energy – Asset Class Strategy Pipeline 2020 – 2026	The ACS, discusses about Jemena strategy for managing piggable and non-piggable pipelines using the AS2885 four element approach	GAS-999-RP-IN-003 JGN Pipelines APAIR provides annual pipeline condition based on the status of pipeline CP, coating, ILI, direct inspection & exposed mains

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
		applicable, repair strategies and techniques. AS2885 Four-element approach i) Pre-assessment ii) Indirect inspection iii) Direct examination iv) Post-assessment	GAS-999-PR-IN-001 AS2885 Pipeline Anomaly Assessment	This procedure describes information required and steps taken to assess an anomaly found on an AS2885 Jemena pipeline to the requirements of AS288.3-2012.	(Section 3 and Section 5) In APAIR, based on the available records, risk ratings are evaluated and summarised in asset risk status and recommendations are made to undertake any further assessment or initiate a project to reduce the risk.
	Section 9.3 Anomaly Assessment	9.3 The objective of anomaly assessment is to determine whether a pipeline has the structural integrity to withstand all forces to which it may be subjected during operations (within prescribed safety margins) and determine whether the anomaly is a defect. The anomaly assessment is analysed and reviewed as required. It consists of activities including the following: - Pipe wall assessments. - Fitness for Service assessments. - Assessment of ILI results	GAS-999-PR-IN-001 AS2885 Pipeline Anomaly Assessment	information required and steps This procedure describes taken to assess an anomaly found on an AS2885 Jemena pipeline to the requirements of AS288.3-2012 Section 3: Anomaly Characterisation Section 4: Screening of anomalies (Table 4.1 – provides a guide to repair). Sections 4.1 and 4.2 provides condition of the pipeline wall integrity for piggable and non-piggable pipelines	Pipeline Opening Report, known as Appendix B – Direct Inspection Field Report (prepared for each integrity dig) – provides summary of anomaly, and method of repair based on Jemena's assessment GAS-999-RP-IN-003 JGN Pipelines APAIR provides annual pipeline condition based on the status of pipeline CP, coating, ILI, direct inspection & exposed mains (Section 5) Fitness for Service Review (Lic 29) GAS-999-RP-IN-003 JGN Pipelines APAIR provides annual pipeline status for ILI results (where applicable) (Section 5) In APAIR, based on the available records, risk ratings are evaluated and summarised in asset risk status and recommendations are made to undertake validation digs based on ILI results.

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
Section 10 Changes to Approved Operating Conditions	Section 9.4 Defect Repairs Section 9.5 Repair & Mitigation Methods	The objective of repair is to ensure that the repaired pipe is fit for purpose over the remaining pipeline life. The nature of external interference involves the removal of, or penetration of, the protective ground cover and the potential contact with the pipe.	GAS-960-GL-PL-002 AS2885 Pipeline Repair Guideline GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications GAS-4999-SP-ME-001 Evo Energy – AS2885 Field Operations and Maintenance Specification	This document provide guidelines on selecting and applying pipeline repair methods for various pipeline defects that may be found on Jemena AS2885 pipelines	
	Section 9.6 Pipeline Coating Repair	The objective of making a repair is to ensure that the structural integrity of the repaired pipe will withstand all the identifiable forces to which it may be subjected during operations, including the MAOP, cyclic pressure fluctuations and other stresses and strains as defined in AS/NZS 2885.1. The Licensee shall establish procedures to repair defects. The Licensee shall document these procedures in the PIMP. The objective of repair is to ensure that the repaired pipe is fit for purpose over the remaining pipeline life.	GAS-960-GL-PL-002 AS2885 Pipeline Repair Guideline	This document provide guidelines on selecting and applying pipeline repair methods for various pipeline defects that may be found on Jemena AS2885 pipelines	Case by Case basis, project specific repair plan would be prepared detailing the requirements of pressure reduction etc. When an MOP restriction needs to lifted after extended period, a project specific SMS will be undertaken as per AS2885.3 requirements.
	Section 10.3 Design Change Section 10.4 Design Change Assessment Section 10.5 MAOP upgrade	Pipelines are designed to operate safely and reliably. Any proposed or enforced changes to the design of an existing pipeline shall be fully evaluated to confirm continued safe and reliable operation. This Section of the standard details the minimum requirements to enable the impact of any change to be understood, to avoid the implementation of the change having an undesired or unintended impact elsewhere within the pipeline system.	GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications	The FOM document outlines the requirement for field operation and maintenance of AS2885 assets. c) Section 4: Pipeline operation and pressure settings.	Pipeline specific 5 yearly Safety Management Study Reports and database
			GAS-980-OM-CM-001 Change Management Manual	This document describes the process by which engineering changes to physical assets are controlled from initiation to completion as well as work flowing technical queries (including field technical queries)	GAS-999-RP-IN-003 JGN Pipelines APAIR – Location class review and any operational changes are reported in APAIR

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
		Changes to the operating conditions include any design condition changes, suspension of operation, decommissioning and abandonment. a) Design condition changes b) MAOP verification or upgrade c) Pipeline Modifications d) Review of pressure control and over pressure protection e) Review of location class f) Operation of suspended pipeline g) MAOP adjustment Where the MAOP of the pipeline is to be upgraded beyond the originally designed and established h) MAOP, the process defined in AS/NZS 2885.1 shall be followed.	GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines GAS-4999-PA-IN-008 Evo Energy – Asset Class Strategy Pipeline 2020 – 2026	Fitness for Service Review included a review of operating conditions as per AS 2885.3 requirements.	
			GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines .	The ACS, discusses about Jemena strategy for managing piggable and non-piggable pipelines using the AS2885 four element approach and meets the requirements for a Fitness for Service Assessment in AS 2885.3.	
	Section 10.6 Restricted Operating Pressure	An ROP shall be applied where an adjustment to pipeline system operating pressure below the MAOP needs to be implemented as a safety critical control to manage a change to the pressure-related threats or to the pressure-containment condition of the pipeline. The ROP shall remain in place until such time as a permanent control is implemented, the threat no longer exists, or the integrity of the line is re-established.	GAS-999-PR-IN-001 AS2885 Pipeline Anomaly Assessment (it was MOP reduction in AS2885.3 - 2012) GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines	The ACS, discusses about Jemena strategy for managing piggable and non-piggable pipelines. Where the assessment confirms that remediation is required, an approved remediation plan is developed to reinstate the pipeline to its design and MAOP	GAS-4005-RP-IN-003 – Evoenergy PL29 Remaining Life Review Fitness for Service Document for each JGN pipeline (Currently not available)
	Section 10.7 Increasing a Reduced MAOP	Where an MAOP has been previously reduced for operational or integrity reasons, under a previous edition of this Standard, it is acceptable for the MAOP to be increased after the reason(s) for the reduction have been rectified.	GAS-4999-PA-IN-008 Evo Energy – Asset Class Strategy Pipeline 2020 – 2026 GAS-999-PA-PL-002 Asset Class Strategy – JGN Pipelines	The ACS, discusses about Jemena strategy for managing piggable and non-piggable pipelines using the AS2885 four element approach	5 yearly Safety Management Study report for each JGN pipeline Fitness for Service Document for each JGN pipeline (Currently not available) In APAIR, based on the available records, risk ratings are evaluated and summarised in asset risk status and recommendations are made to undertake any further assessment or initiate a project on a case by case basis to reduce the risk.

AS2885.3 Reference	Detail Reference	Requirement	Jemena Document	Comment	Records / Assessment
	Section 10.8 Pipeline Suspension	The operation of a pipeline shall be considered suspended when the pipeline is taken out of service and the pipeline is no longer available for normal operation, see	Noted.		GAS-4005-RP-IN-003 – Evoenergy PL29 Remaining Life Review Fitness for Service Document for each JGN pipeline (Currently not available)
	Section 10.9 Pipeline Failure	Where a pipeline failure event occurs, an investigation (see Clause 2.3.4.3) shall be completed in conjunction with a failure event review sms to identify the root cause(s) of the failure event. Actions to address the root causes and prevent reoccurrence shall be identified and implemented in accordance with the outcomes identified in the SMS. A review and update of the relevant aspects of the PMS shall also be completed When a pipeline failure occurs a full and detailed root cause analysis shall be completed in conjunction with a safety management study and system review, and a mitigation strategy revised or developed to the pipeline being returned to full operation	ICAM – Incident Cause Analysis Method JAA HSE PR 0003 Investigating Incidents Procedure	Developed in response to a major incident or failure	
	Section 10.10 Pipeline Abandonment	A change in operating condition SMS shall be conducted to inform the requirements for the decommissioning and abandonment of a pipeline. When a pipeline is to be abandoned an abandonment plan, including an SMS and environment rehabilitation plan shall be compiled. Maintenance of stations ensure that b) All devices and systems required to ensure the station operates within these limits are operable; and c) The structural and pressure integrity of stations is not compromised over time	Pipeline Abandonment Plan (case by case basis) GAS-960-SP-ME-019 AS2885 Field Operations and Maintenance Specifications	As per the requirements of AS2885 The FOM document outlines the requirement for field operation and maintenance of AS2885 assets. Section 7: High Pressure Facilities	Prepared on a case by case basis if abandonment is required.