Jemena Gas Networks (NSW) Ltd

Pipelines Asset Class Strategy

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Abbreviations

AA	Access Arrangement
ABS	Asset Business Strategy
ACS	Asset Class Strategy
AER	Australian Energy Regulator
AIP	Asset Investment Plan
ALARP	As Low As Reasonably Practicable
ALBV	Automatic Line Break Valves
AMS	Asset Management System
APaIR	Asset Performance and Integrity Review
COWP	Capital and Operation Work Plan
CP	Cathodic Protection
DCVG	Direct Current Voltage Gradient
FOMS	Field Operations and Maintenance Specification
FSA	Formal Safety Assessment
ILI	In Line Inspections
IT	Information Technology
JCARS	Jemena Compliance and Risk System
JGN	Jemena Gas Networks
MAOP	Maximum Allowable Operating Pressure
NSW	New South Wales
PRS	Primary Regulating Station
RASCI	Responsible, Accountable, Supportive, Consulted, Informed
SAOP	Safety and Operating Plan
SPM	Sydney Primary Main
TRS	Trunk Receiving Station
UAG	Unaccounted for Gas

Asset class snapshot

Asset sub-classes

- Piggable pipelines
- Non-piggable pipelines

Expenditure drivers

For the lowest practicably sustainable cost

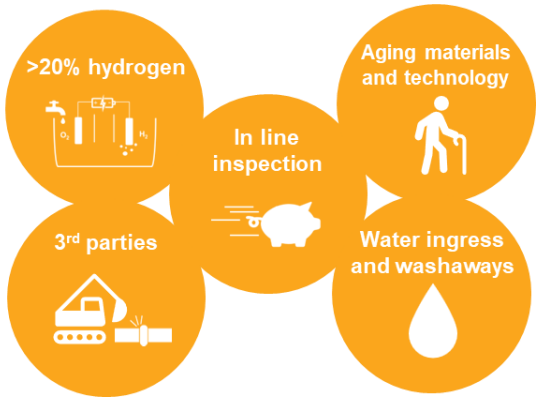
Asset management considerations

- Whole of life costs
- Pigging vs pressure reduction
- Contemporary technologies and innovations

Performance

Maximum Allowable Operating Pressure reductions	
Pipeline patrol compliance	
Third party Type A incident	
Third party Type B incident	
Engineering encroachment reviews	
CP field test compliance	
Maintenance plan compliance	
Opex budget control	
Renewable gas KPI development	

Emerging risks and opportunities



Key initiatives

- Washaway repairs and riverbed crossing inspections
- Northern trunk pigging frequency and SPM in line inspection reconfiguration and/or de-rating
- Technology improvements for integrity management
- Wollongong pipeline repurpose for renewable gas >20% hydrogen
- Auto Line Break Valves (ALBV) integrity review

PART A: Strategy and asset management principles

1. Purpose of this document

The purpose of this Pipelines Asset Class Strategy (**ACS**) is to explain the approach and principal methods by which the pipelines asset class contributes to delivering the Jemena Gas Networks (**JGN**) asset objectives. The JGN asset objectives are defined in the JGN Asset Business Strategy (**ABS**) and driven by the overarching Jemena Networks Strategy. The ACS is reviewed and updated annually and considers up to a 20-year outlook for the asset class.

Figure 1–1: Summary of JGN asset objectives and asset management principles

As shown in Figure 1–1, the Jemena Networks Strategy sets out what we want to achieve with our network assets (both gas and electricity) as a Group. This informs our JGN asset objectives, which outline what we want to achieve with our gas network assets. We then have a set of asset management principles, which inform the approach we will take to achieving our JGN asset objectives.

The role of the ACS is to bring these together and provide a high level explanation of **how** we will manage the asset class. From here we can develop the various business cases and works programs that form our annual work plan, budgets, and ongoing expenditure forecasts.

The Pipelines ACS includes information about each asset sub-class, including:

- **Drivers for expenditure** – the key asset management drivers that inform why and when we invest in our gas trunk and primary main pipeline
- **Asset management considerations** – the important factors we consider when determining when and how to invest in our trunk and primary main pipelines
- **Asset performance** – information about performance, condition, and service levels
- **Emerging risks and priorities** – identified threats, opportunities, strengths and weakness that we need to be aware of and factor into our pipelines asset management plans
- **Key initiatives** – taking all the above into consideration, the ACS provides a high level summary of key initiatives / asset management practices we will undertake to ensure our trunk and primary mains meet the JGN asset objectives

The ACS also includes appendices containing contextual information on the asset class profile. This is the detailed information about the type, specifications, life expectancy and lifecycle management of the pipelines asset sub-classes in service across the JGN distribution network.

1.1 Structure of this ACS

Main body

The main body of ACS is structured into three broad parts, to allow the document to be reviewed and updated easily:

- **Part A: Strategy and asset management principles** – this section makes the link between the ACS and the overarching Jemena Network Strategy, summarising the asset class objectives, expenditure drivers and governance process for trunk and primary mains and their component assets.

  The information in Part A should be relatively static, only changing when there is a material change to the overarching Jemena strategies. While Part A should be revisited as part of the annual ACS review, it is unlikely to require significant updates, and should be reserved for a major review every five years.

- **Part B: Asset performance** – this section summarises the current performance and risk associated with the asset class. It also includes as summary of asset quantities as at the end of the last full calendar year. Part B is essentially a summary of the critical information from the annual Asset Performance and Integrity Review (**APaIR**), as well as the relevant asset risk register for each asset class.

  The information in Part B should be high level only, with the finer detail on asset performance and risk available in the related APaIR and risk register. Part B should be reviewed and updated annually, to reflect the critical information from these two documents.

- **Part C: Emerging risks and priorities** – this section summarises any risk or opportunities that we need to be aware of when managing the asset class. This may include, for example; technical obsolescence; pending supply or specification changes; government policy; or technical developments/innovation.

  Part C should also include a high-level summary of the current key initiatives or asset management approach being applied to the asset class. It does not need to go into detail on specific projects or costing (as this information is contained in the individual business cases and Capital and Operating Work Plan (**COWP**)), it just needs to provide the Asset Class Owner a high-level view of the strategies we are undertaking.

  The information in Part C should be reviewed and updated annually, to make sure it still reflects the emerging risks, priorities and current projects.

Appendices

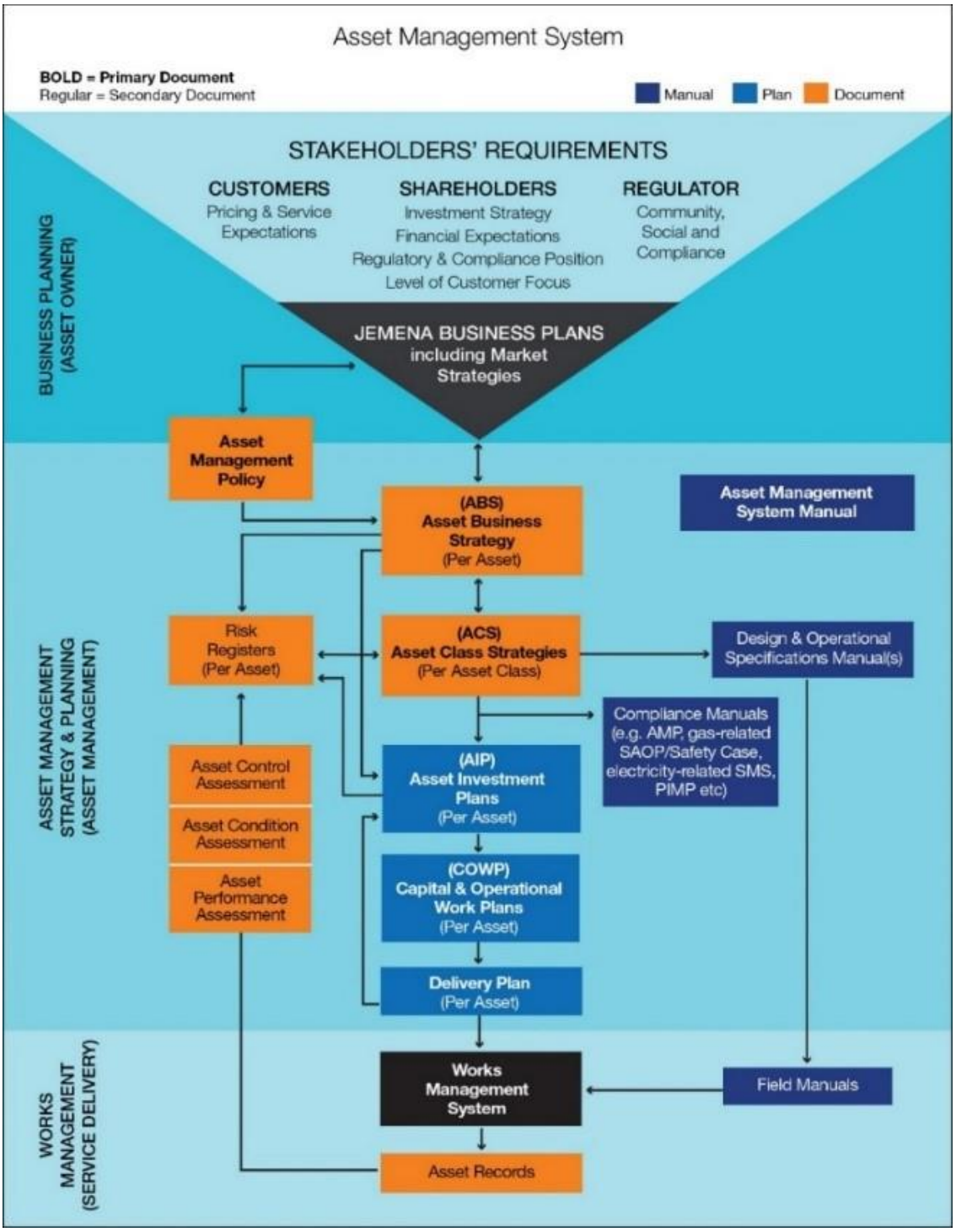
The ACS also includes appendices that contain additional exhaustive information on the asset class type, failure modes, lifecycle management, regulatory and legislative framework, and information requirements. The information in these appendices is relatively static in nature and should not require an annual update. It should be reserved for a major review every five years.

Much of the information contained in the appendices is drawn from other parts of our Asset Management System (**AMS**) (see Figure 1-2). Pipelines asset information is collated in the ACS to provide a central source of useful and contextual information for the Asst Class Owner. The ACS provides line of sight across our AMS and demonstrates consistency with the holistic asset management good practice contemplated by the ISO 55001 asset management standard.

1.2 Asset management system

The relationship between the ACS and other documents within JGN's asset management system is illustrated in Figure 1-2.

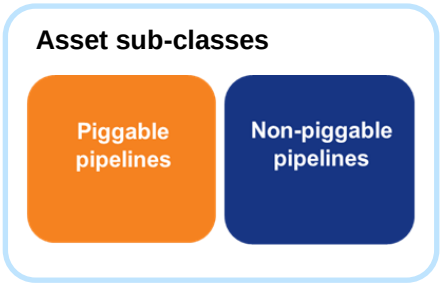
Figure 1-2: JGN Asset Management System document hierarchy



A detailed description of JGN's asset management system and its constituent parts is available in the Jemena Asset Management System Manual[1]

[1] JEM AM MA 0001 Jemena Asset Management System Manual

2. Description of assets covered



This ACS is for the pipeline's asset class, which comprises the following asset sub-classes:

- Piggable pipelines (Licence 1, 2a, 3, 7 and 8, the Sydney Primary Main (Horsley Park to Lidcombe), Sydney Primary Loop and the Western Sydney Primary Main); and
- Non-piggable pipelines (the Wollongong Primary Main, Sydney Primary Main (excluding HP to Lidcombe), Licence 2b and Licence 8c).

The elements that are included as pipelines assets are:

- pipeline easements (usually around 25 metres wide);
- pig launchers and receivers;
- cathodic protection systems;
- emergency equipment; and
- main line valves for those that aren't remotely actuated.

Figure 2–1 shows how the pipeline asset class features within the broader gas distribution network.

Figure 2–1: Schematic of JGN asset classes – pipeline assets

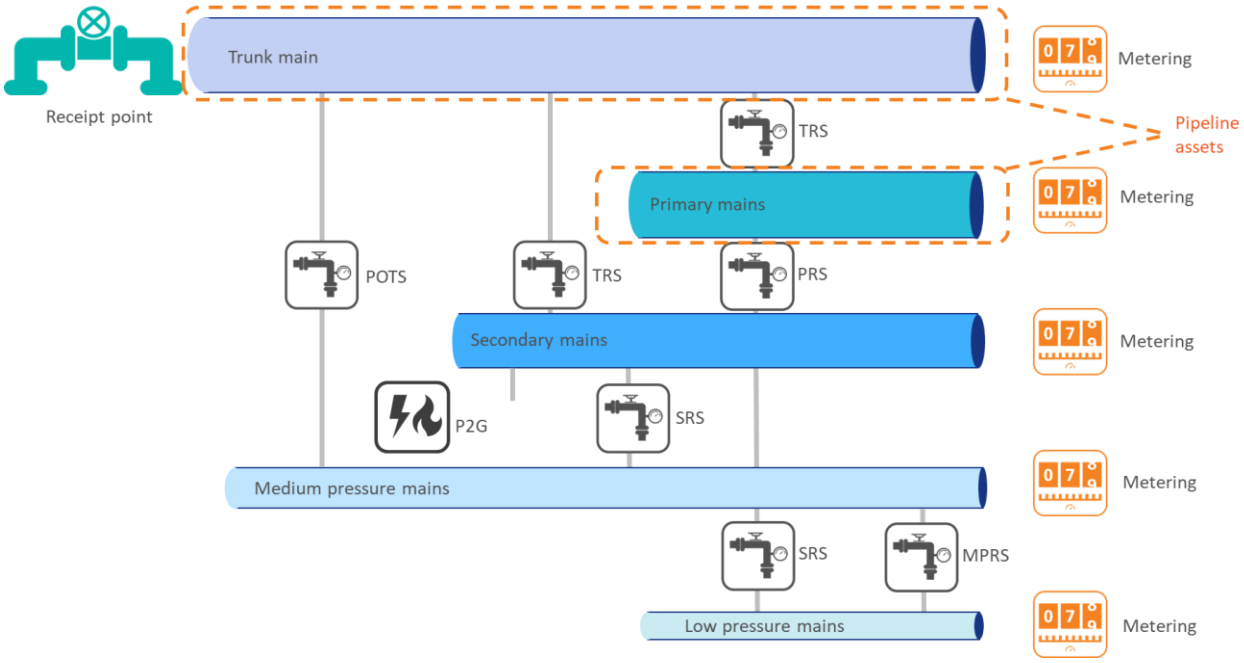


Table 2-1 summarises JGN's pipelines assets by sub-class, including areas served by the pipelines and pipeline length.

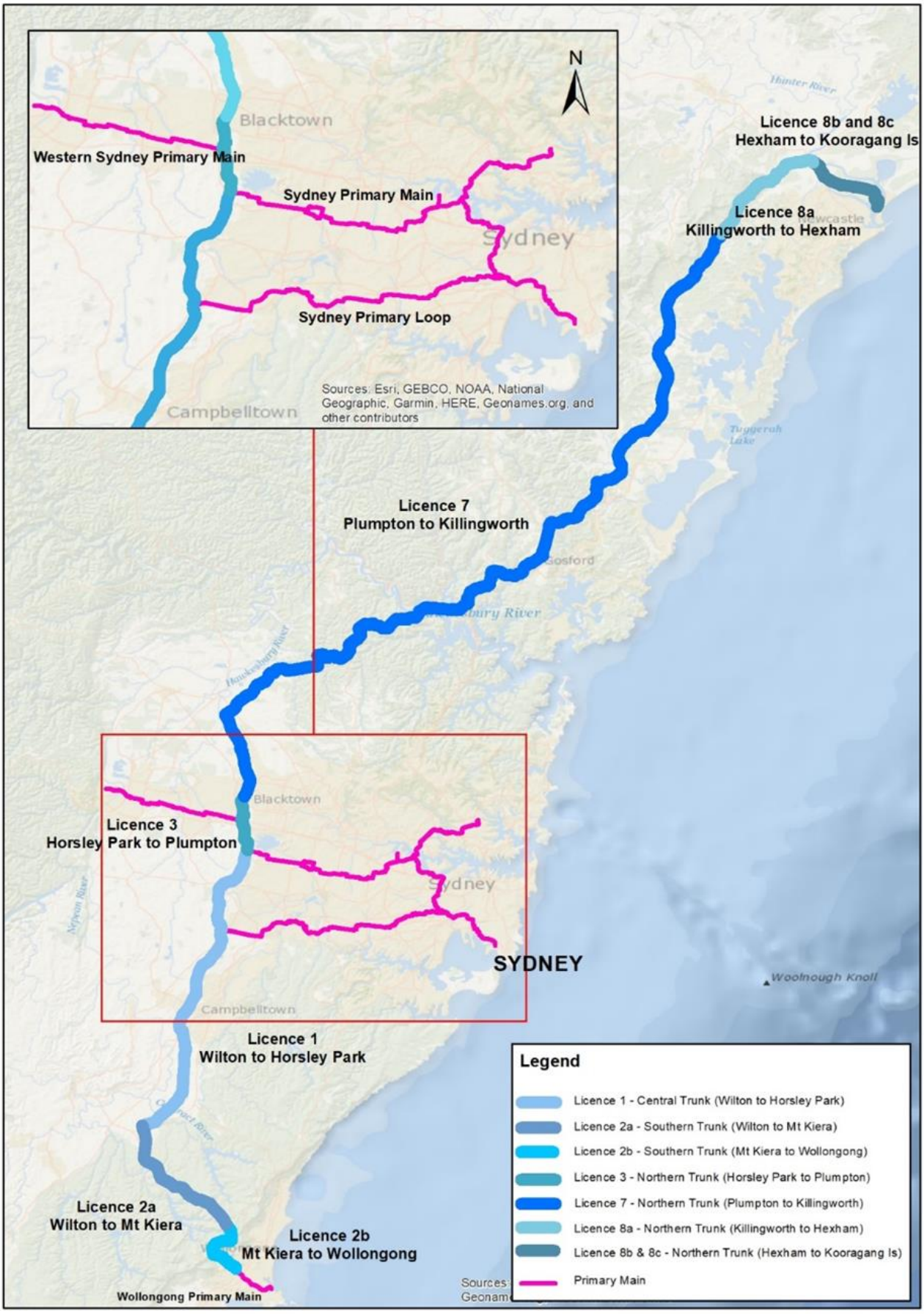
Table 2-1: Summary of key pipelines asset types, by sub-class

Asset sub-class	Element	Length
Piggable	**Central Trunk (Licence 1)** – Carries gas from Wilton to Horsley Park to serve the Sydney region and onwards to the Northern Trunk.	51 km
	Southern Trunk (Licence 2a) – Piggable portion is section 2a, Wilton Trunk Receiving Station (**TRS**) to Mt Keira, which carries gas from Wilton to serve the Wollongong region.	21 km
	Northern Trunk (Licences 3, 7 and 8a&b) – An extension of the Central Trunk, which carries gas from Horsley Park to serve the Central Coast and Newcastle regions.	183.8 km
	Sydney Primary Loop, consisting of: a) the original DN550 section of pipe from West Hoxton TRS to Moorebank which itself was constructed in two stages (West Hoxton TRS to Casula then Casula to Moorebank); and b) the interconnection to the new DN500 section from Moorebank to Tempe Primary Regulating Station (**PRS**).	39 km
	Western Sydney Primary Main, consisting of: consisting of: a) the DN200 Penrith Primary Main which starts at Eastern Creek TRS and ends at Penrith PRS; and b) the DN200 extension of the Penrith Primary Main from Penrith PRS to the new Emu Plains PRS.	22 km
	Sydney Primary Main – The piggable portion is a DN550 section between Horsley Park and Lidcombe.	22 km
Non-piggable	**Southern Trunk (Licence 2b)** – Carries gas from Mt Keira to Govett Crescent to serve the Wollongong region.	11 km
	Northern Trunk (Licence 8c) – as per piggable, however a short section is currently un-piggable	1.8 km
	Wollongong Primary Main – consists of DN150/200 pipe starting at Figtree (Govett Cres) MLV and extending past Wollongong PRS.	7.3 km
	Sydney Primary Main, consisting of: a) a DN550 section from Lidcombe through to Mortlake Automatic Line Break Valve (**ALBV**), continuing down to Banksmeadow PRS near Port Botany. The remaining section is DN150 between Banksmeadow PRS and Botany Bus Depot; and b) the Sydney North DN150/250 Primary Main that is connected to the DN500 primary main at Breakfast Point and ends at Willoughby PRS, supplying gas to the Sydney North regions.	51 km

A detailed asset description, along with failure modes and our lifecycle management methodologies, is provided in Appendix B and Appendix C.

Figure 2–2 shows the location of our trunk and primary mains.

Figure 2–2: JGN trunk and primary mains map



3. Strategy and asset management principles

3.1 Alignment of asset objectives

The pipelines asset class objectives are designed to support the overarching JGN asset objectives. The JGN asset objectives are detailed in the JGN Asset Business Strategy (**ABS**).

The pipelines asset class objectives, along with the measures and targeted used to assess performance against these objectives, are presented in Table 3-1.

Table 3-1: Alignment of pipelines asset class objectives

JGN asset objective	Pipelines asset class objective	Asset class measure	Target
Meet customers' service expectations	Maintain current service levels to customers & compliance to regulatory / legislative requirements.	Maximum Allowable Operating Pressure (**MAOP**) reductions	0
Maintain asset safety, reliability and compliance	Maintain asset integrity and targeted risk levels, only improving risks where efficient to do so.	Pipeline patrol compliance	99.5%
		Third party Type A incident	0
		Third party Type B incident	6
		CP field test compliance	99.5%
		Maintenance plan compliance	90%
Reduce capital investment intensity	Reduce the cost of investing in and maintaining facility assets, without compromising risk.	Demonstrated alignment on capital spend, reviewed quarterly	Within 10% of budget target (+/-)
Optimise operational spend		Opex budget control	Opex costs at or below Access Arrangement (**AA**) allowance level.
Increase network competitiveness to remain sustainable and viable			
Facilitate net zero for JGN and our customers	Renewable gas readiness	Develop renewable gas KPI's to support asset objective	2024

3.2 Asset management principles

As detailed in the ABS and JGN-10 strategies, the operating environment and stakeholder expectations are crucial inputs into how we operate and invest in the network. External factors, including regulations, technical standards, technological advances, and customer requirements are regularly evolving, which means we must regularly review and monitor the strategic drivers for investment.

The ABS identifies the following principles that influence how we manage our assets. A summary of how these principles relate to the pipelines asset class is provided in the table below.

Table 3–2: How the ABS asset management principles apply to the pipelines asset class

ABS asset management principles	Summary	Pipelines ACS
Prioritise safety and service	Our priority is to make certain our assets are safe, and provide the service or function our customers and staff need.	Pipeline design and management standards align with Australian Standards such as AS/ANZ 2885, to ensure JGN has safe and reliable trunk and primary mains in alignment with good industry practice. Where practicable, in-line inspection (pigging) is conducted periodically to assess pipeline integrity. Our preference is to make all trunk and primary mains piggable where economically efficient to do so.
Listen to our customers and stakeholders	We will listen to customer feedback and seek to offer them the network services they want, working within the regulatory and legislative framework set by our stakeholders.	In addition to maintaining safe and reliable pipelines, customers want us to consider the most cost effective replacement and maintenance strategy, and that materials are future gas ready.
Maximise asset value	Where possible we will seek to change the investment triggers for replacement/rehabilitation of assets such as meters, facilities, pipelines and network pressure mains, with a view to extending asset life where safe and prudent to do so.	We maximise asset life through ongoing assessments of asset performance. We conduct in line inspections where practicable, to inform whether we can extend the life of assets where safe. We pursue innovative non-network solutions to reduce capital intensity, deferring spend where it is safe and prudent to do so.
Net zero	We will pursue opportunities to use our assets, or connect new assets, to help reduce our own or our customers' emissions, where economically efficient to do so.	We will consider the likelihood of renewable gases, including hydrogen, passing through the pipelines, and ensure they can transport alternative gases in the timeframes required. We will seek to connect new biomethane and other renewable gas facilities to the trunk and primary system for an efficient cost.
Incremental approach	We will adopt an incremental approach to modernising and adapting the network, introducing new asset types as older assets fall due for replacement, avoiding large-scale, high-cost replacement programs where practicable.	Where prudent and cost effective we will incrementally replace or modify pipelines and their components with >20% hydrogen blend materials.
Use data to inform decisions	We will seek to inform our asset management practices with better data, for example using more sophisticated leak detection data to target mains and services replacement.	Ongoing gas quality and measurement data is critical to asset management decisions. This area is under constant review, as network hydraulic modelling evolves with new renewable gas injection points. We will use this data to inform future pipeline requirements.
Pursue innovation	We will follow technological advancements and investigate how we can apply innovative solutions to ensure the gas network remains valued by customers.	Investigations into tool that can perform inline inspections through various pipeline diameters. Trial the use of Electromagnetic Acoustic Tool (EMAT) as part of continuous improvement. Continued demonstration of the network's ability to transport less carbon intensive gas with projects such as Malabar Biomethane production plant connection and the Western Sydney Green Gas Trial.

3.3 Expenditure drivers and asset management considerations

The primary function of the pipelines asset class is to transport gas safely and reliably to customers' properties. As prudent asset managers, our role is to ensure our trunk and primary mains continue to operate securely, conducting regular inspections and protecting our assets from third party damage. We also have a responsibility to ensure the pipelines remain fit-for-purpose. This may mean changing the pipeline's operating pressure to reflect changing demand, or ensuring the pipelines are ready to transport alternative and or renewable gases.

As summarised in Figure 3–1, we generally invest in our assets to address safety risks, address any pressure or service issues, and to ensure asset integrity – which includes making sure we can carry out the necessary integrity checks. A more recent expenditure driver is enabling net zero emissions. This involves conducting the necessary testing and works to make sure our trunk and primary mains are able to safely transport renewable gases. Our aim is to manage the pipelines asset class for the lowest practicably sustainable cost.

Figure 3–1: Drivers of expenditure in pipelines asset class

These expenditure drivers are described further below:

- **Safety** – It is vital our network assets remain safe and compliant. We replace, repair, or reconfigure pipelines when they pose and unacceptable safety risk. This may be due to deterioration in asset performance, or a change in the local environment that increases the risk associated with asset failure and/or gas leaks. It is also important that our networks are constructed in compliance with AS/NZS 2885 and its relevant parts, and that our pipeline activities and asset management align with ISO 55001. This enables us to demonstrate to ourselves, our customers, external stakeholders and business partners that we maintain industry good practice, whilst managing our risk to as low as reasonably practicable.
- **Reliable service –** It is vital our network assets continue to provide the required levels of service. Our networks and flow stopping activities are designed such that third party damage incidents as well as planned and reactive maintenance is such that it does not interrupt the supply to residential, commercial or industrial customers where possible. Hydraulic modelling and network design ensure that pressures and capacity are carefully balanced to remain above the minimum allowable, whilst also being mindful that higher pressures result in increased pipeline stress and consequences should rupture occur.
- **Integrity –** The trunk and primary mains are the central arteries of the gas network in NSW. These pipelines are underground, which makes them difficult to inspect for corrosion or weaknesses that may result in a gas leak. Trunk and primary mains transport gas at high pressures, which means the risks posed by a leak can be catastrophic. Integrity inspections are key drivers of investment. In-line inspection (known as pigging) is the global industry accepted method to measure the integrity of pipelines and identify corrosion/weaknesses. As per industry good practice, we invest in our pipelines to make them piggable, or where this is not possible, de-rate pipeline to secondary pressure or undertake integrity digs and rehabilitate.

- **Enable net zero** – We have a responsibility under the Safeguard Mechanism and the Government's Net Zero 2050 targets to reduce our greenhouse gas emissions, and to use our network assets to help customers reduce theirs. The largest source of greenhouse gas emissions from our network is unaccounted for gas (**UAG**), particularly fugitive gas (either through venting or leaks). Therefore, where there is an opportunity to use our network assets to reduce or better track our greenhouse gas emissions we will consider investment. Similarly, where renewable or lower-emissions gas are introduced into the gas distribution system, we must also invest in the appropriate network assets to ensure they remain safe.

Cost and affordability are always a factor. When incurring expenditure against these drivers, our aim is always to address the issue at the lowest practicably sustainable cost. Note this may not always mean the cheapest option. In making our investment decisions we consider the longer-term use of the assets in question, along with a suite of additional considerations. For the pipelines asset class, these key considerations are:

- **Whole of life costs** – will constructed infrastructure (new or replacement) be capable of delivering safe and reliable volumes and pressures in the medium and long term?
- **Pigging vs pressure reduction** – is the pipeline piggable, and if not, would it make economic sense to reconfigure the pipeline to make it piggable? What is the ongoing use case (demand) for the pipeline and would it be more prudent to de-rate the pipeline and reduce the integrity risk?
- **Contemporary technologies and innovations** – is a like-for-like replacement the best option? What new material and technology developments are likely to emerge during the asset's useful like?
- **Facilitating net zero:**
  - **Renewable gas ready** – will the assets be ready for renewable gas of the future?

Taking these considerations, our expenditure drivers, and our asset objectives into account, we select the most prudent and efficient strategy for managing each asset class and sub-class of asset.

3.4 Asset strategies

Our strategy for trunk and primary mains is to prudently extend the life of network assets through proactive condition and assessment programs. Provided the assets meet operational and performance measures, we do not enforce an artificial replacement age.

Historically, we have managed trunk and primary mains through spot checks (integrity digs) inspecting the condition of the pipework. We then use the data collected to infer the pipe condition and operational safety elsewhere in similar locations. This practice is acceptable where pipelines are within their design life and the cost of undertaking a spot check is reasonable. However, for ageing, critical assets such as the Sydney Primary Main (**SPM**), we have changed our strategy for managing the SPM to account for two things:

1. the condition of the SPM is deteriorating; and
2. the cost of integrity digs is increasing, which means spot checks are becoming less efficient.

Our strategy is therefore to de-rate the main where achievable. Where de-rating is not feasible, we will look to reconfigure the pipeline to enable pigging.

De-rating reduces the risk from loss of containment, which is especially important given the SPM traverses through densely populated parts of Sydney. Reconfiguring the main to enable pigging means we can detect corrosion and any potential damage early, allowing for prompt repairs to the pipeline before the loss of containment occurs.

To meet customer needs for safety and reliability requirements, JGN monitors and assesses each network asset in compliance with relevant legislative requirements in accordance with *AS/NZS 2885 Pipelines* and its constituent parts.

We maintain the performance of our assets through proactive and reactive maintenance and to the extent it makes economic sense to repair, rather than replace assets. As network assets age, the amount of expenditure required

to maintain acceptable safety and reliability performance increases. At the point where the cost of corrective maintenance outweighs the benefits, or the asset fails, we replace our assets and consider economies of scale by assessing the viability of replacing other similar condition assets in proximity.

Where network assets are no longer fit for purpose, an assessment is undertaken to cost effectively install renewable gas ready assets or components. For network assets this is pertinent to pipelines that may be subject to greater than a 20% hydrogen gas blend. However, greater than 10% hydrogen blend is not expected to materialise within the next 5 years, and the current pipelines can accommodate up to 10% hydrogen without further assessments, as well as 100% biomethane.

Our pipelines are ready for renewable gas –100% biomethane or up to 10% hydrogen/natural gas blends can be transported safely with little investment or reconfiguration required. However, with the increasing volume of renewable gas and the potential to have greater than 20% hydrogen in the network after 2030, we are taking prudent steps to test our pipelines for the impact of hydrogen (such as potential embrittlement), and identifying the most effective way of getting ready for high volume hydrogen blends.

3.5 ACS planning horizons

The ACS consider three forecasting horizons when planning, with the two-year COWP being the most accurate. The AIP taking a 7-year view, and a 20-year outlook to ensure planning for the long term benefit of customers.

Over time, planning profiles have been informed by the objectives outlined in the ABS as well as customer expectations, JGN's regulatory and operating environments, asset condition and risk. The forecast beyond two years is more subject to change as these factors evolve, and even more so beyond year seven[2]. Therefore, any forecast is indicative only and represents the projects required for this asset class to continue to support the JGN objectives.

3.6 Governance

This ACS is reviewed to ensure ongoing alignment with the Jemena Network Strategy and the asset objectives outlined in the ABS, and to account for any additional asset performance and risk information. Table 3-3 outlines the **RASCI** for this ACS.

Table 3-3: RASCI Governance table for Pipelines ACS

Element	Descriptor	Group/Person
Responsibility	Who is responsible for carrying out the entrusted task?	Asset Management – Gas Distribution
Accountable (Approval)	Who is responsible for the whole task and who is responsible for what has been done?	GM Asset and Operations – Gas
Support	Who provides support during the implementation of the activity / process / service?	Network Services Asset Management – Gas Distribution
Consultation	Who can provide valuable advice or consultation for the task?	Strategy and Commercial Asset Investment Network Services Risk and Assurance
Inform	Who should be informed about the task progress or the decisions in the task?	EGM Networks

[2] Seven years is the planning horizon of the AIP.

PART B: Asset performance

4. Asset performance against objectives

Performance across the pipelines asset class is generally good. We are currently meeting or exceeding all asset performance indicators and have actions in place to address any underperformance.

Detailed information on performance in each asset class, including detailed condition assessment is provided in the Pipelines APaIR. For the purpose of this ACS, Table 5–1 provides a summary of current performance against indicators.

Table 4–1: Pipelines asset class performance against objectives and indicators

Pipelines asset class objective	Asset class measure	Target	2023 performance	Status
Maintain current service levels to customers & compliance to regulatory / legislative requirements.	Maximum Allowable Operating Pressure reductions	0	0	
Maintain asset integrity and targeted risk levels, only improving risks where efficient to do so.	Pipeline patrol compliance	99.5%	100%	
	Third party incident - Type A	0	1	
	Third party incident - Type B	6	3	
	CP field test compliance	99.5%	100%	
	Maintenance plan compliance	90%	100%	
Reduce the cost of investing in and maintaining facility assets, without compromising risk.	Opex budget control	Opex costs at or below Access Arrangement (**AA**) allowance level.	Below allowance	
Renewable gas readiness	Develop renewable gas KPI's to support asset objective	2024	NA	New

5. Current asset condition, risks and controls

The purpose of this section of the ACS is to provide a high-level overview of asset condition, and to highlight the highest priority risks associated with each sub-class. This section serves as an annual snapshot, presenting key asset condition and risk issues that require management.

More detailed information on asset condition is available in the Pipelines APaIR. The full suite of asset risks, along with a more contemporary view of the risk status is recorded in the Pipelines asset risk register.

5.1 Piggable pipelines

5.1.1 Condition assessment

The condition of the piggable trunk and primary mains has been assessed as either 'strong', 'adequate' or 'fair'.

The following table summarises the asset condition for each piggable pipeline.

Table 5–1: Asset condition – piggable pipelines

Asset	Asset condition	Comment
Central Trunk (Licence 1)	Adequate	During the reporting period, a few coating anomalies were detected through DCVG surveys, attributed to encroachment works. As these defects were outside the proposed road works, no excavation took place, and they will be monitored and assessed after the scheduled ILI in 2024. In the previous reporting period, a risk was identified at the intersection of the Licence 1 and EGP pipelines at Wilton. Investigation in Q3, 2022, confirmed, through Non-Destructive Testing (NDT), vibration, and strain monitoring, that velocities were within acceptable limits, and there was no integrity threat to the pipe welds due to fatigue. There are currently no other known pipe wall defects or outstanding anomalies on the pipeline that require further investigation before the next ILI run in 2024.
Southern Trunk (Licence 2a)	Adequate	A review of ILI and pipeline corridor management data has determined that the overall condition of the pipeline is Adequate, presenting no significant risk to pipeline integrity. However, certain sections have been impacted by erosion resulting from recent weather events, also revealing coating defects. There is plan in place to address the erosion issue and investigate one identified coating defect. Notably, there are no other known pipe wall defects on the pipeline, and there are no outstanding pipe wall anomalies requiring further investigation from the 2018 ILI.
Northern Trunk (Licences 3, 7 and 8)	Fair	Following a review of the available condition assessment and control effectiveness data, the pipeline's condition is deemed fair. The evaluation is based on identification of significant girth weld corrosion along the Licence 7 and 8 pipelines, which was prompted by recent dig-ups as a result of the 2018 ILI data. Although most of the critical corrosion areas have been addressed, discrepancies in ILI and validation dig data for defects at the Heat Affected Zone (HAZ) and Jemena's obligation to raise pressure to 5.0 MPa in 2024 for the Kurri Kurri Power station prompted a decision to re-run the ILI in 2023. Additionally, sections of the pipeline have suffered notable erosion, requiring

Asset	Asset condition	Comment
		remediation, and several washaway projects are in progress. Substantial vegetation along the easement requires slashing, and proposed adjacent development along Licence 7 easement may impact compliance with the AS2885 standard for high consequence areas. As such the pipeline demands careful attention and consideration in the upcoming years.
Sydney Primary Loop	Adequate	A review of the integrity and control effectiveness data has determined that the pipeline condition is Adequate with no identified new threats or control failures that would adversely affect the pipeline integrity. There are currently no known pipe wall defects on the pipeline and no pipe wall anomalies significant enough to require further investigation before the next ILI run in 2025.
Sydney Primary Main (Horsley Park to Lidcombe) (piggable section)	Adequate	The 23km of the SPM DN550 (22”) pipeline underwent its first inspection since operation in 2021. The most notable finding was an external wall loss of 66% at KP2.62 in Wetherill Park. Of the 54 external corrosion anomalies, 15 were concentrated within 2m in Wetherill Park, and 16 exhibited over 20% wall loss, with 7 located in the same pipe joint. Only 2 dents with no metal loss were found, indicating effective protection from 3rd party hits by the pipeline's concrete capping. Three validation digs were required, with all completed and repaired except one in Berala, delayed due to being under a Sydney Water asset. Additionally, approximately 4.5km near Berala rail station was found unprotected due to rail traction and blown spark gap issues, with a mitigation control in progress. Overall, the SPM section's condition is deemed adequate.
Western Sydney Primary Main	Strong	A review of the integrity and control effectiveness data has determined that the pipeline condition is Strong with no identified new threats or control failures that would adversely affect the pipeline integrity. There are currently no known defects on the pipeline and the two validation digs conducted in 2020 based on the recent ILI in 2018.

5.1.1.1 Age profile

Table 5–2: Installation dates – piggable pipelines

Asset sub-class	Element	Installed
Piggable	**Central Trunk (Licence 1)**	November 1974
	Southern Trunk (Licence 2a)	May 1975
	Northern Trunk	
	(Licence 3)	June 1975
	(Licence 7)	July 1978
	(Licence 8)	December 1979
	Sydney Primary Loop	
	West Hoxton to Casula	1987
	Casula to Moorebank	1993
	Moorebank to Tempe	2007

	Sydney Primary Main	
	Horsley Park to Lidcombe	1976
	Western Sydney Primary Main	
	Eastern Creek to Mt Druitt	2002
	Mt Druitt to Werrington	1997
	Werrington to Penrith	2002
	Penrith East	1998
	Penrith West	2002
	Emu Plains	2012

5.1.2 Risks and controls

Risks related to pipeline assets are captured in the risk register in ECMS. The following table summarises the current risks and controls associated with piggable pipelines that were identified as inadequate/not at target levels in the most recent APAIR review. These risks should be prioritised for mitigation.

Table 5-3: Piggable pipelines risks and controls identified as being below target and prioritised for action

Piggable pipelines			
#	Issue / Threat	Risk ranking	Recommendation
1	The Northern Trunk section from Plumpton to Pitt Town (KP 0 to KP20) exhibits predominantly 5.3 and 5.9mm wall thickness, posing a credible rupture threat at MAOP of 6.895 MPa. Ongoing development is prompting an imminent upgrade of the location class to T1 (residential), rendering these sections non-compliant with AS2885 High Consequence Area requirements. HDD testing has confirmed the potential for through-wall penetration, establishing HDD failure as a credible threat to the Northern Trunk pipeline.	High	To address the identified threat in the Northern Trunk section, it is recommended to actively monitor residential development in this area. Future development plans should incorporate green spaces or roads around the pipeline easement to create a residential buffer. Additionally, exploring physical protection measures, such as HDPE plates or concrete encasement, is advised to safeguard against potential damage. The lands team should maintain ongoing council liaison and awareness sessions to ensure Jemena is well-informed and proactive regarding new developments and major infrastructure projects within the pipeline's measurement length.
2	Substantial deterioration of existing tracks and significant erosion along the pipeline, easement resulting in a considerable loss of cover for Licence 2a pipeline at Wilton, with one location having a remaining cover of only 300mm. Failure to address this issue could expose the pipeline, potentially causing increased external stresses, third party damage, and the risk of aggravating pipe wall defects.	High	Reinstate and restore the depth of cover of the exposed pipeline to protect it from exposure, implement drainage control measures to redirect runoff flows away from pipeline easement, remediate coating defects, and repair and stabilise existing access tracks for safe and efficient pipeline management. A project BAB-RAK-000132 has been initiated and is in progress.
3	Critical anomalies detected by the ILI in the 2023 ILI run on the Northern Trunk needs to be validated to ensure there is no discrepancy in ILI data sizing particularly near the heat affected zone prior to increasing the pressure to meet Kurri Kurri Power station supply demand.	High	Carry out an integrity dig to inspect and confirm pipeline integrity and also evaluate the ILI tool accuracy based on the 2023 ILI run. This verification process is important in ensuring the anomalies detected by the ILI do not affect the ability for Jemena to safely operate the asset at the specified MAOP.
4	The current operating pressure of the JGN trunk system is 4.5 MPa, presenting a challenge due to the Kurri Kurri Power station's requirement for a minimum of 5.0 MPa. Ensuring a safe and standards-compliant implementation of this pressure increase is crucial. Failure to conduct thorough reviews may lead to potential pipeline failure, risking severe penalties from the regulator.	High	It is recommended to conduct a comprehensive review of all trunk mains, assessing their fitness for service and Safety Management Studies. This is essential to address the increased pressure requirement while mitigating potential risks associated with the change, ensuring the safety of the public and preserving the integrity of the asset
5	The identification of multiple washaways and erosion along the Northern Trunk pipeline alignment poses a significant threat. This has led to substantial damage to access tracks, rendering them	Significant	Three specific sites (Pitt Town, Somersby and Freemans Waterhole) have been identified requiring rehabilitation for damaged access tracks, gully erosion, and trails. It is recommended to implement backfilling, install cross

Piggable pipelines			
	increasingly vulnerable and unstable. Failure to address this issue promptly will result in the rapid deterioration of the easement and access tracks, hindering routine patrols, CP surveys, and causing potential vehicle damage due to the formation of large ruts and other obstacles		banks, and enhance the drainage system to ensure the ongoing stability and accessibility of the Northern Trunk pipeline. A project BAB-RAK-000117 has been initiated and is in progress Additional sites at Wakefield, Canoelands, and Sugarloaf Conservation areas also require remediation, necessitating a new washaway remediation project
6	River Crossing Warning Signs are falling apart, faded and out of date which could lead to third party damaging the pipeline due to the lack of information.	Significant	A project is current underway to develop new river crossing signage for all JGN pipelines, aiming to meet specific criteria. This includes ensuring corrosion resistance for the marine environment, a durable design with a minimum life expectancy of 20 years, and weather resistance against saltwater and UV radiation. The lettering will be large enough to be legible from 100m and will incorporate reflective elements to enhance safety, particularly during low light conditions..
7	To maintain safety and security of supply to the public, the integrity and stability of pipelines that cross rivers is critical to Jemena to prevent any potential risks such as pipeline exposure, erosion, or damage due to sediment deposition	Significant	Inspections of major river crossings in CY23 confirmed no signs of erosion or loss of cover in most of the river crossings. However, evidence of erosion was observed at the Hunter River, Wyong River, and Parramatta River crossings. Therefore, it is recommended to conduct surveys every two years or after a major flood event & develop a risk based inspection schedule for subsequent surveys.
8	Inadequate or drainage of CP current due to no electrical isolation between the facility earthing and pipeline CP has led to under-protection of the Licence 2 pipeline. If left untreated, this issue could result in external corrosion of the buried pipework.	Significant	Install 4 FIK's at the inlet and outlet of the Wilton PLS runs 1 & 2 and provide sacrificial anode system to protect the buried pipework in the PLS station. (Project had previously been initiated in CY22 but is yet to be implemented)

5.1.2.1 Existing controls

Existing integrity and operational failure controls applied to piggable pipelines include cathodic protection (**CP**), direct current voltage gradient (**DCVG**) and use of easements. An assessment of the current effectiveness of these controls is shown in the following table.

Table 5–4: Existing control effectiveness – piggable pipelines

Sub-Class 1: Piggable	CP	DCVG	ILI	Easement
Licence 1	Strong	Adequate	Adequate	Adequate
Licence 2a	Adequate	Fair	Adequate	Fair
Licence 3,7,8	Adequate	Fair	Fair	Fair
Sydney Primary Loop	Adequate	Not able to assess	Strong	Adequate
Sydney Primary Main (Hp-Lid)	Fair	Adequate	Adequate	Adequate
Western Sydney Primary Main	Strong	Strong	Adequate	Adequate

Risks to operation, environment and reputation are also responded to in accordance with the:

- Jemena Emergency Management Plan JEM-PL-0013
- Crisis Management Plan JEM-PL-014
- AS2885 Pipeline Repair Plan GAS-999-OM-PL-001
- Crisis and Emergency Management Training and Exercise Framework JEM-PL-0017

Full details regarding control effectiveness can be located in the APAIR.

5.2 Non-piggable pipelines

5.2.1 Condition assessment

The condition of the non-piggable trunk and primary mains has been assessed as either ‘‘strong’, ‘adequate’ or ‘fair’.

The following table summarises the asset condition for each non-piggable pipeline.

Table 5–5: Asset condition – non-piggable pipelines

Asset	Asset condition	Comment
Southern Trunk (Licence 2b)	Fair	Based on the integrity and control effectiveness data review, the pipeline condition is assessed as 'Fair.' A recent DCVG assessment in December 2023 identified multiple coating defects along the 11km pipeline, with nine defects exhibiting IR ratings greater than 10%, and the largest defect recorded a rating of 25.9% IR. No dig-ups have occurred in recent years, and as the pipeline is currently un-piggable, the asset's condition cannot be confirmed with certainty.
Northern Trunk (Licence 8c)	Adequate	The pipeline condition is assessed as Adequate following a review of CP, DCVG, DI, and ROW data. A 2021 DCVG survey along the 1.8km length found no coating defects. With no recent dig-ups and the pipeline being un-piggable, the asset's condition cannot be conclusively confirmed.

		Nevertheless, no new threats or control failures that would compromise pipeline integrity have been identified.
Wollongong Primary Main	Adequate	The pipeline condition is deemed Adequate after evaluating CP, DCVG, DI, and ROW data. A consistent trend of under-protection is noted in recent CP surveys, particularly in sections along the WPM primary main, notably T28, which has been under-protected for several years. The recent DCVG identified only one coating defect, however, there has been no direct inspections carried out on the asset in the recent years. Since, the pipeline is un-piggable, the confirmation of the asset condition cannot be conclusive..
Sydney Primary Main	Fair	After reviewing CP, DCVG, DI, EA, and ROW data, the pipeline condition is assessed as 'Fair.' As part of CP surveys, the P4 section of the SPM, spanning 0.5km at TP24, was consistently found to be under-protected in all surveys. The 2021 DCVG revealed numerous coating defects, categorizing the overall coating condition of SPM as poor. Integrity digs along the non-piggable section showed no significant corrosion. However, a Type A encroachment was reported in Chatswood, where an unauthorized water tapping band compromised Jemena ROW controls over the SPM pipeline. Given the pipeline sections on SPM are currently unpiggable, the asset condition cannot be confirmed with certainty but requires careful attention and consideration in the coming years..

5.2.1.1 Age profile

Table 5-6: Installation dates – non-piggable pipelines

Asset sub-class	Element	Installed
Non-piggable	**Southern Trunk (Licence 2b)**	1977
	Licence 8c (Kooragang Island to Incitec)	1981
	Wollongong Primary Main	1981 / 1982
	Sydney Primary Main Mortlake ALBV to Banksmeadow PRS, Mortlake ALBV to Putney ALBV, Stringybark Creek MLV to Willoughby PRS, Broadmeadow PRS to Botany Bus Depot Flemington PRS to Mortlake ALBV Putney ALBV to Stringybark Creek MLV	 1976 1968 1975, 1986, 1994 and 2005

5.2.2 Risks and controls

Risks related to pipeline assets are captured in the risk register in ECMS. The following table summarises the current risks and controls associated with non-piggable pipelines that were identified as inadequate/not at target levels in the most recent APAIR review. These risks should be prioritised for mitigation.

Table 5–7: Non-piggable pipelines risks and controls identified as being below target and prioritised for action

Non-piggable pipelines			
#	Issue / Threat	Risk ranking	Recommendation
1	Licence 2b pipeline – Mt Kiera to Wollongong (un-piggable section) Long term integrity management of Licence 2b pipeline (specifically the tunnel section) needs to be determined to manage the threat of external corrosion due to disbonded HSS resulting in a loss of containment (the DCVG survey has also identified number of coating defects in the recent coating survey)	High	The integrity of Licence 2B is being addressed through Project BAB-RAK-000063. This project is currently on hold due to the potential consideration of using the pipeline as a hydrogen storage vessel. An Options Analysis (GAS-1499-RP-IN-001) developed in CY19 suggested de-rating this section. The ongoing analysis is focused on assessing the scope and feasibility of this recommendation, aiming to determine whether it is advisable to make the pipeline piggable or de-rate the section to a secondary pressure..
2	Licence 8c pipeline – Kooragang Island to Incitec (un-piggable) Long term integrity management of Licence 8c pipeline requires consideration to manage the threat of external corrosion attributed to disbanded HSS, posing a risk of loss of containment. This concern is highlighted by the observed significant corrosion under disbanded HSS along the rest of the Northern Trunk	High	It is recommended to reconfigure the pipeline to enable In-Line inspection
3	A 4.5km segment along the P2 on SPM (Auburn PRS to Flemington PRS) has inadequate CP, primarily due to severe stray currents originating from DC traction at Berala. This poses at potential risk of external corrosion, which could result in pinhole gas leak leading to serious explosion and the potential for one or more fatalities	High	It is recommended that Sydney Trains investigate the faulty spark gap, and Jemena reactivate an inactive old drainage bond system at Berala and assess any improvement. If the problem persists, then install a new TRAD system at TP6 in Berala
4	SPM (Mortlake to Willoughby) Possible 2” (DN50) valve with blowdown riser at Stimulus Street in Willoughby could result in 3rd party damage leading to loss of containment.	Significant	Pothole and confirm the existence of the riser and valve. Cut and remove the riser and protect with HDPE plate This location has been included in the scope of CAT2 Depth of Cover Risk Mitigation project (BAB-RAK-
5	SPM (Mortlake to Willoughby) Unmapped shallow features (such as vertical risers found at Mowbray Rd) could be hit by third party resulting in gas escape	Significant	Review technology to identify further instances of unmapped shallow features. Sections of SPM in the past had been surveyed using Pipeline Current Mapper and some sections were surveyed using GPR, although shallow areas were identified but hard to spot a vertical riser.
6	Wollongong Primary Main	Significant	Faulty FIK in EGP station at Five Island road Cringila has not been fixed and further investigation to be conducted to rectify the issue.

Non-piggable pipelines			
	FIK shorting issue at Wollongong PRS resulting in inadequate CP and under protection of WPM.		
7	Wollongong Primary Main Long term integrity management of Wollongong Primary Main to manage the threat of external corrosion due to disbonded HSS resulting in a loss of containment	High	On hold due to the option of repurposing the pipeline to be Hydrogen storage for Illawarra region.

5.2.2.1 Existing controls

Existing integrity and operational failure controls applied to non-piggable pipelines include cathodic protection (CP), direct current voltage gradient (DCVG) and use of easements. An assessment of the current effectiveness of these controls is shown in the following table.

Table 5-8: Existing control effectiveness – non-piggable pipelines

Sub-Class 1: Piggable	CP	DCVG	Direct Inspections	Easement
Licence 2b	Adequate	Fair	Not able to assess	Fair
Licence 8c	Adequate	Adequate	Not able to assess	Adequate
Sydney Primary Main	Fair	Fair	Adequate	Fair
Wollongong Primary Main	Fair	Adequate	Not able to assess	Adequate

Risks to operation, environment and reputation are also responded to in accordance with the:

- Jemena Emergency Management Plan JEM-PL-0013
- Crisis Management Plan JEM-PL-014
- AS2885 Pipeline Repair Plan GAS-999-OM-PL-001
- Crisis and Emergency Management Training and Exercise Framework JEM-PL-0017

Full details regarding the control effectiveness can be located in the APAIR.

Part C: Emerging issues and priorities

6. Emerging risks and priorities

This section highlights the key emerging risks and priorities for the pipelines class. This is not an exhaustive list, and any new risks or priorities that emerge during the year should be captured in the asset class risk register, and then documented in the following year's ACS and captured in the ECMS.

6.1.1.1 De-rating section of the Sydney Primary Main

The DN150 (6") Lane Cove to Willoughby segment of the SPM is approximately 7.5 km long, and was constructed in 1976. This segment of the main is an ageing asset, approaching 50 years of operation and most recent integrity digs reveal the main is at present, subject to unacceptable condition degradation due to two significant threats:

- uncontrolled / undetected corrosion under disbonded heat shrink sleeves (HSS);
- uncontrolled / undetected corrosion around girth welds
- third party damage at shallow locations of the main, or where vertical risers are not marked on existing drawing and increase the risk of contact during excavations by JGN or others.

These threats pose an unacceptable level of safety risk to the public due to the possibility of ignited gas leak resulting in fire or explosion.

A recent incident, where a water tapping band was illegally installed by a Sydney Water contractor in Chatswood, underscores the reality of this threat. Despite a depth of cover of 1.1m, the contractor mistook the gas pipeline for a water main due to the blue jacket coating, and drilled almost 40% (1.92mm) into the 4.8mm pipe wall thickness. This incident was discovered by Jemena during separate potholing works, which prompted an emergency response to safely remove the unauthorised water fitting and repair the pipeline using a composite sleeve.

Figure 6–1: Chatswood Type A incident (Unauthorized Water Tapping Band)

Since this segment of the SPM travels through high consequence areas, including sensitive locations such as childcare and aged care centres, schools, hospitals and Chatswood shopping centre, we plan to de-rate this section of the SPM to secondary pressure. Lowering the pressure in this main will reduce the consequences of a loss of containment from either uncontrolled corrosion or damage due to third party damage.

6.1.1.2 Inspecting the remaining Sydney Primary Main

Just like the section of the SPM discussed above, we currently verify the condition of the SPM and the materials put in place to protect against pipeline corrosion by conducting spot checks (integrity digs) by digging holes and inspecting the condition of the pipework. We then use the data collected to infer the pipe condition and operational safety elsewhere. These spot checks can also be expensive given the restoration work and traffic management required.

The risk of loss of containment increases over time. This is because the protective materials and the pipeline itself are more likely to have degraded and there is a greater chance the pipeline has been damaged by a third party (and not reported to us).

Unlike the Lane Cove to Willoughby section, we plan to make modifications to the remaining sections of the SPM to inspect the pipeline more thoroughly through the use of pigging. Pigging the pipeline periodically provides a complete picture of the condition of the pipeline, allowing us to identify and correct material defects, which makes it a safer option and is also cheaper than conducting spot checks over the next 30 years.

Before we can use a pig, we need to modify the pipe in certain locations to ensure the pig can travel through tight bends. We also need to modify the main to be able to send and receive the pig.

6.1.1.3 Relocating pipework Or Installing mechanical protection

When we design the network, we aim to lay high pressure pipes away from populated or sensitive areas. The benefit is twofold. Firstly, this lessens the chance the pipework is damaged and secondly, it lowers the risk to the public in the event that there is a gas escape.

However, as Sydney has grown, the environment around our trunk and primary pipelines has changed. In many areas there has been significant development. In one instance, a school has been built in close proximity to the primary main, with the main now in the school grounds. This has changed the risk and consequence of a gas escape.

While damage to our high pressure mains is rare (due to the measures we currently have in place) the impact on public safety and the economy can be significant. Jemena prefers relocating the gas main in such cases if economically viable. However, if costs outweigh benefits, as seen in a specific project with significant construction challenges, Jemena opted to install mechanical protection slabs instead to protect the asset.

6.1.1.4 Northern Trunk In-Line Inspection Frequency

The 172km long DN500 Northern Trunk (Licence 3, 7 & 8a - Horsley Park to Hexham) underwent an ILI inspection in 2018 using a BHGE 20” MFL tool. Following this, Jemena conducted 11 integrity digs from 2019 to 2022 to assess pipeline condition and validate ILI results. A noticeable difference was observed between the reported ILI feature size to the actual feature size found in the field. On some occasions the % of these anomalies were underestimated in the ILI reports.

While a change in ILI frequency from 10 to 7 years was made based on 2018 findings, a recent Minmi integrity dig in October 2022 revealed a 90% wall loss compared to the 32% reported in the ILI. This significant discrepancy and Jemena's obligation to raise trunk mains' operating pressure to 5.0 MPa in CY24 for Kurri Kurri Power station demand led to the recommendation to re-run the ILI in CY23. The 2023 ILI results, received in December 2023, indicate a notable increase in external corrosion anomalies, suggesting a continuous deterioration of the pipeline. The ILI frequency will likely be maintained at 7 years, and this will be confirmed during the Fitness for Service assessment planned in CY24

6.1.1.5 River Crossing Inspections

Jemena operates several natural gas pipelines crossing various rivers and waterways through buried, submerged crossings. An integral part of the integrity management process for river crossings involves assessing any changes in the pipeline's state concerning the riverbed. Regular monitoring of riverbed conditions is crucial to prevent potential risks such as pipeline exposure, erosion, or damage due to sediment deposition.

Despite not conducting river crossing surveys since 2015, except for visual checks, Jemena decided in CY23 to inspect all major critical river crossings (9 sites) using multi-beam echo sounder technology to accurately determine the riverbed bottom. A sub-bottom profiler was employed to identify the depth and position of the pipeline, establishing a baseline for developing an adequate strategy and frequency for the long-term proactive management of the pipelines.

The initial assessment found no exposed pipes in the surveyed profiles, but challenges were encountered in distinguishing between pipe and rocks in the service trench. Sub-bottom profiling, while having limitations and effectiveness dependent on various situational factors, confirmed that the pipe/rock cover is not exposed in the crossings. Future monitoring is recommended periodically, especially after large storm events. In particular Campbell Island to Hexham (Hunter River), Wyong River and Parramatta River crossings due to existing evidence of erosion.

Jemena plans to conduct a comprehensive review of the riverbed crossing data in CY24 as part of the fitness-for-service assessment and determine the appropriate monitoring frequency based on a risk-based approach, intending to conduct surveys every two years and after significant storm events to appropriately mitigate the risk and better understand the rate of deterioration. These results will be compared with 2023 data to adjust frequency as needed

Table 6–1: Riverbed crossings program

River crossings	Pipeline	Approx length	Last surveyed
Hunter River (Hexham to Campbell Island	Licence 8 (DN350)	34m	2023
Hunter River (Campbell Island to Hexham Island)	Licence 8 (DN350)	119m	2023
Hunter River (Hexham to Kooragang Island)	Licence 8 (DN350)	96m	2023
Hawkesbury River	Licence 7 (DN500)	780m	2023
Mooney Mooney Creek	Licence 7 (DN500)	94m	2023
Wyong River	Licence 7 (DN500)	51m	2023
Dora Creek	Licence 7 (DN500)	71m	2023
Parramatta River (Putney)	Sydney Primary Main (DN500)	310m	2023
Majors Bay Reserve (Mortlake)	Sydney Primary Main (DN550)	285m	2023

6.1.1.6 Northern Trunk & Southern Trunk- Washaways

In the last couple of years, the pipeline easement across the JGN network has experienced significant deterioration due to erosion and washaways caused by floods and heavy rainfall events. These erosions have primarily occurred on the Northern Trunk pipeline, with some instances also along the Southern Trunk pipeline.

Aerial and ground patrols have revealed substantial deterioration of the existing access tracks and erosion along the pipeline easements, resulting in a significant loss of cover over the pipelines in some instances. The majority of these erosion issues have been attributed to concentrated runoff flows directed into the drainage system, following the same path as the pipeline.

In most cases, restoration of the pipeline's depth of cover requires backfilling, along with drainage control to divert runoff flows away from the pipeline easement. Access tracks also need drainage controls, such as contour banks, to divert water away from the tracks and prevent future erosion hazards or degradation.

In recent years, Jemena has successfully rectified and remediated several washaway sites, such as Wakefiled, Ryhope, and Scaddens Ridge along the Northern Trunk. However, there are still numerous locations around the Northern Trunk that require attention and remediation. It is forecasted that Jemena will continue to restore these sites for a minimum of 3 to 4 years.

Figure 6–2: Access track erosion Southern Trunk (Picton Rd) (prior to repairs)

Figure 6–3: Gully erosion (Northern Trunk Somersby) (prior to repairs)

Figure 6–4: Gully erosion (Northern Trunk Wakefiled north of previous repairs) (prior to repairs)

6.1.1.7 Northern Trunk (Patrol frequency)

The Ground patrol is undertaken on the Licence 7 pipeline from Plumpton to just a little upstream of Cattai Creek (KP25.4) on a weekly basis, whereas the ground patrol from KP25.4 (Cattai Creek) to Killingworth was previously set on a three monthly basis.

A risk assessment (GAS-1295-RP-RW-001) was undertaken due to the increased number of Type B encroachments, easement and access track maintenance issues arising in the last 3 years. It was agreed that it takes three months or more to identify damage to easements, unauthorized third party activities and damage to existing markers etc. Thus, it was recommended to change the frequency from three monthly to monthly for the Licence 7 section between Pebble Hill Rd, Cattai and Killingworth.

Aerial patrol is undertaken on a weekly basis along the entire pipeline route. Major development has occurred between KP 0 to KP 12 in Schofields and Riverstone areas adjacent to the pipeline whereas pockets of development have occurred on the eastern side of Hawkesbury River around KP75 to KP76, KP98 to KP99 and KP118 to KP119. Thus, aerial patrol requirement remains unchanged.

6.1.1.8 Auto Line Break Valves (ALBV)

Along with teams operating Facilities, we are experiencing more occasions when auto line break valves are not fully sealing, thereby letting gas past when in the closed position. These valves will stop the vast majority of gas in an emergency situation; however some gas will still be passing that must be managed to avoid an unsafe situation.

ALBV's are also used to isolate pipeline sections for maintenance purposes, enabling our staff to safely work in gas free environments. If these valves are passing we must use additional and time consuming flow stopping methods, at further expense, to create a safe working environment.

We will be conducting a full assessment of these assets to determine a repair and replacement strategy.

6.1.1.9 Repurposing of Wollongong pipeline (including Licence 2b and WPM)

The Wollongong pipeline is currently being considered as a hydrogen storage facility. For this to be achieved further integrity reviews must be conducted on the pipeline to allow for the safe re-purposing. The isolation of this section of transmission pipeline from the existing network will have a impact on network security of supply.

The pipeline's current ability to provide backfeed in an emergency scenario has value, however this risk of removing the backfeed is being assessed against the value of providing a hydrogen ready pipeline and storage facility to inform asset management decisions in future.

6.1.1.10 New pipelines requirements

There are currently no new pipelines required to maintain reliability or supply in this asset class.

Historically we have seen growth in how much gas people use at peak times – on cold winter days. Over the last few decades, we have seen peak consumption grow as customers have installed new gas appliances and increased their overall usage.

Given the history of rising peak consumption we had planned for this trend to continue. However, over the current regulatory period, we saw peak consumption growth slow. This is likely due to saturation of instantaneous hot water and a shift to using electricity for heating.

We observed these changes as part of our capacity monitoring, and have cancelled projects such as the extension of the Northern Primary main to support supply to the Sydney Northern Beaches, which are no longer required. We have taken the changes in peak consumption growth into account when forecasting future peak demand. As a result, we have not forecast any significant capital expenditure to accommodate demand growth from existing customers.

7. Projects and asset management initiatives

7.1 Ongoing projects and initiatives

This section provides a high-level overview of the key asset management and initiatives underway. The full list of projects can be found in the Asset Investment Plan (**AIP**) and the Capital and Operating Work Plan (COWP).

Table 7–1 presents a summary of the types of projects that are being undertaken by JGN networks to meet the requirements of the Pipelines ACS.

Table 7–1: Summary of ongoing pipelines asset class key projects and initiatives

Ongoing project/initiative	Description (what and why)
Functional checks and planned maintenance	A preventive maintenance program to provide assurance that all critical units and components are working and within specification and that qualified personnel will consistently execute maintenance procedures and practices. This is essential to allow us to maintain safety, asset integrity, and performance standards.
Emergency equipment checks	Annual emergency response equipment checks at various storage locations.
Pipeline inspections	• Small sections that are non-piggable (i.e., close to the stations) – Integrity assessments based on condition monitoring • In line inspections (**ILI**) at 10 yearly intervals • Inspect and repair pipe wall defects found with ILI and from DCVG surveys – as required
Corrosion detection and prevention	• DCVG for non-piggable sections at 5 yearly intervals • CP system inspection • CP Surveys
Pipeline and easement protection	• Aerial patrols • Ground patrol/ foot • Control regrowth of vegetation – as required • Maintain easement and access tracks – as required • Maintain pipeline signage – as required • Landowner contact - annual
Reactive maintenance	Undertaking reactive maintenance in response to faults.
ILI reconfiguration	**Modifying pipelines to enable pigging, where practicable and economically efficient to do so.**

7.2 New projects and initiatives

This section provides a high-level overview of new initiatives designed to help address emerging risks and meet our asset objectives. Projects/initiatives in this section will commence within the next two years.

Further information on these new/proposed initiatives is available in the COWP and in the individual business cases.

Table 7–2: Summary of new pipelines asset class key projects and initiatives

New project / initiative	Description (what and why)
Washaway repairs	Reinstatement of ground cover access tracks that have been washed away by heavy rainfall and flooding. Multiple sites have been identified, which will need to be prioritised based on their condition and repaired in the next 3 to 4 years.
Riverbed crossing inspections	Based on recent inspections and CY23 data, future monitoring will occur periodically, particularly after significant storm events. Monitoring frequency for each site will be determined through a risk-based approach, with plans for surveys every two years and after notable storm events. Adjustments to the frequency will be made based on a comparison with 2023 data.
Northern trunk ILI frequency	The 2023 ILI results for the Northern Trunk, though not thoroughly reviewed or comprehensively analysed, show a significant increase in external corrosion anomalies, suggesting an ongoing pipeline deterioration. The ILI frequency is likely to be maintained at 7 years, with confirmation expected during the Fitness for Service assessment in CY24, allowing adjustments as necessary.
Electromagnetic Acoustic Transducer (EMAT) tool	In CY24, Jemena plans to trial an advanced pigging tool on Licence 1 (Central Trunk) to assess its potential for hydrogen readiness studies, specifically in detecting crack-like features
Wollongong pipeline	Repurposing of an existing pipeline into a hydrogen storage facility as part of hydrogen readiness preparations and supporting the integration of renewable gas into the transmission system.

Appendix A Regulatory and legislative environment

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A1. Summary of key legislative requirements

This section summarises the key legislative requirements and technical standards relating to pipeline assets. These requirements are factored into our asset management strategies and help inform the investments and operating activities we undertake to manage asset performance.

Table A1–1: Summary of key legislative requirements and technical standards relating to pipelines assets

Legislative requirement / technical standard	Summary of requirements
Gas Supply Act 1996 No 38 (NSW)	Sets out the overarching objectives to promote the efficient use of gas and deliver a safe and reliable supply of gas. Specifies requirements to facilitate the continuity of supply of natural gas to customers.
Gas Supply (Safety and Network Management) Regulation 2013	Sets out the regulations governing the safe supply of gas and establishes an obligation for network operators to lodge, implement and review safety and operating plans. JGN's key output under this Regulation is the JGN Safety and Operating Plan (**SAOP**), which sets out the strategies for ensuring the continued safe management and operation of the network, and how the business will comply with relevant legislative requirements and Australian Standards.
Pipelines Act 1967 No. 80 (NSW)	Sets out the overarching objectives for licence holders to construct, operate and maintain a pipeline.
Pipelines Regulation 2013 No. 484 (NSW)	Sets out the overarching requirements for licence holders to satisfy the objectives as set out by the Pipelines Act 1967 No. 80 (NSW). JGN's key output under this Regulation is the JGN pipeline management plan, which sets out the plans, policies and procedures that relate to the pipeline operated under a licence, and describes (and forms part of) the pipeline management system under AS2885.
AS 4564:2011 Specification for general purpose natural gas	This Standard sets out requirements for the safe composition, transportation and supply of general purpose natural gas for use in natural gas appliances and equipment, and for use as fuel in natural gas vehicles.
AS 2885.0-2018 Pipelines — Gas and liquid petroleum Part 0: General requirements	Provides general requirements and guidance on the scope, purpose, application and other aspects of the AS 2885 series of Standards.
AS 2885.1-2018 Pipelines — Gas and liquid petroleum Part 1: Design and construction	Specifies requirements for design and construction of carbon and carbon-manganese steel pipelines and associated piping and components that are used to transmit single-phase and multi-phase hydrocarbon fluids, such as natural and manufactured gas, liquefied petroleum gas, natural gasoline, crude oil, natural gas liquids and liquid petroleum products.
AS 2885.2-2016 Pipelines — Gas and liquid petroleum Part 2: Welding	Specifies the minimum requirements for materials, welding consumables, welding processes, weld preparations, qualifications of welding procedures and personnel, and fabrication and inspection requirements for the construction and maintenance welding of carbon and carbon-manganese steel pipelines down to 3.2 mm wall thickness, designed and constructed in accordance with AS 2885.1-2007.
AS 2885.3:2022 Pipelines – Gas and Liquid Petroleum Part 3: Operation and Maintenance	Specifies the minimum requirements for the operation and maintenance of pipelines (and facilities) complying with AS2885.1 and AS2885.2.
AS/NZS 2885.5:2002 Pipelines — Gas and liquid petroleum Part 5: Field pressure testing	Sets out methods for the hydrostatic testing of petroleum pipelines, which are a mandatory requirement of AS 2885.1 and AS 2885.3. It may also be used for testing other pipelines including pipelines designed to, or operated to, AS 1697.

AS/NZS 2885.6:2018 Pipelines — Gas and liquid petroleum Part 6: Pipeline Safety Management	This Standard specifies the SAFETY MANAGEMENT PROCESS for PIPELINE SYSTEMS and covers all elements of the system designed, constructed or operated under the AS(/NZS) 2885 series of Standards, including MAINLINE PIPE and PIPELINE ASSEMBLIES, STATIONS and control systems. As safety management is a continuous process, this Standard applies throughout the life cycle of a PIPELINE SYSTEM from design to abandonment.
Safety Case (SAOP) of Jemena Gas Assets (NSW)	This Safety Case describes the operation and maintenance of gas assets in a safe and reliable manner. The arguments and evidence for safety is assured by an appropriate Asset Management System operating under a controlled environment in accordance with the applicable gas legislation and regulatory instruments across various Australian jurisdictions.
National Gas Rules	National Gas Rules governs access to natural gas pipeline services and elements of broader natural gas markets. It includes economic value tests (specifically Rules 79 and 91) that set requirements for efficient capital and operating expenditure.
National Greenhouse and Energy Reporting Act 2007	Covers the obligations for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information, and includes the obligations to reduce emissions under the safeguard mechanism.

Appendix B Asset overview

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B1. Piggable pipelines

A piggable pipeline is a pipeline that is designed with sufficiently long radius bends, consistent internal diameter and pig launcher and receiver facilities. The current piggable and non-piggable pipeline sections are described in chapter 2 of this ACS.

B1.1 Risks associated with these assets

JGN is subject to the Jemena Risk Management Policy (and the Group Risk Management Manual) for the management of high pressure pipelines, which alongside the AS2885 Safety Management Study (SMS) process provides the robust framework for managing risk.

Common risks for JGN pipelines are recorded in the Jemena Compliance and Risk System (JCARS). Specific threats are captured within a facility specific risk register and assessed to determine the risk level. Risks assessed as low and moderate are broadly acceptable. Significant and high risks require action to reduce the risk to low, or As Low as Reasonably Practicable (**ALARP**). Extreme risks are not acceptable other than in extraordinary circumstances. We develop action plans for all risks identified as significant or higher.

The primary types of risk that impact trunk and primary mains are:

- asset failure (e.g., corrosion or design defects);
- operational risks (e.g., human error);
- vandalism (e.g., forced entry into sites);
- natural environment events (i.e., bushfires or floods)
- failure or reduction in control effectiveness (e.g., mechanical failure);
- regulatory or reputational risks; and
- asset lifecycle risks (obsolescence of equipment).

B1.2 Criticality

An asset criticality assessment[3] has been conducted for the piggable pipelines. The piggable pipelines asset sub-class is assessed as (AC5) ‘extreme’.

An extreme criticality prioritises the asset sub-class in relation to:

- maintenance backlog reduction;
- application of analysis techniques for optimised planned maintenance; and
- application of analysis techniques for spare parts requirements and inventory levels.

[3] As per the procedure detailed in Asset Criticality Assessment Procedure (JEM-AM-PR-0016).

B1.3 Failure modes

Table B1–1: Piggable pipelines failure mode assessment

Asset	Failure type	Failure mode	Controls
Piggable pipelines	Integrity	Corrosion leading to loss of supply or loss of containment	• Cathodic protection • Inline inspection • Coating
	Integrity	Design defect leading to loss of supply	• Project management methodology • Quality control
	Operational	Third party hits leading to loss of containment or supply	• Depth of cover • Pipeline markers • Dial Before You Dig • Liaison • Encroachment management process • Patrols
	Operational	Over pressurisation leading to loss of containment	• Pressure relief devices • SCADA monitoring/alarms
	Operational	Under/over temperature leading to loss of supply or loss of containment	• Pressure relief devices • Design basis • SCADA monitoring/alarms of temperature transmitters
	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Detailed work procedures • Control assessment reporting and condition monitoring to set frequencies • Review and approval of operating procedures
	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits
	Natural environment events	Overstress of pipe leading to loss of supply or loss of containment	• Watercourse crossings designed to mitigate washaways, buoyancy

B1.4 Life expectancy

Jemena NSW trunk and primary main pipelines are typically designed with a life expectancy of 50 years. However, pipeline design life itself is a notional figure that provides a trigger for the pipeline to be reviewed against changes in societal tolerance of risk, characteristic of adjoining land usage, any deterioration in physical condition and a MAOP and remaining life review.

Factors affecting the life expectancy of piggable pipelines include:

- exposed mains subject to environmental conditions;
- third party encroachment activities;
- historical poor construction activities;
- operations & maintenance activities; and

- network growth.

Pipeline components deemed to be at the end of their design life are assessed for fitness of purpose. A pipeline's life is usually extended after such reviews and following any necessary actions have been completed.

B2. Non-piggable pipelines

A non-piggable pipeline is a pipeline that has under-sized valves, inconsistent internal pipe diameters, bends of insufficient diameter or no pig launcher or receiver. Additional data on the integrity of the pipe wall thickness cannot be collected and other, less effective methods of assessment are used to determine the condition of the pipeline. The current piggable and non-piggable pipeline sections are described in chapter 2 of this ACS.

B2.1 Risks associated with these assets

Risks related to non-piggable pipelines are managed under the same frameworks as piggable pipelines.

B2.2 Criticality

An asset criticality assessment has been conducted for the non-piggable pipelines. The non-piggable pipelines asset sub-class is assessed as (AC5) 'extreme'.

B2.3 Failure modes

Table B2–1: Non-piggable pipelines failure mode assessment

Asset	Failure type	Failure mode	Controls
Non-piggable pipelines	Integrity	Corrosion leading to loss of supply or loss of containment	• Cathodic protection • Coating
	Integrity	Design defect leading to loss of supply	• Project management methodology • Quality control
	Operational	Third party hits leading to loss of containment or supply	• Depth of cover • Pipeline markers • Dial Before You Dig • Liaison • Encroachment management process
	Operational	Over pressurisation leading to loss of containment	• Pressure relief devices • SCADA monitoring/alarms
	Operational	Under/over temperature leading to loss of supply or loss of containment	• Pressure relief devices • Design basis • SCADA monitoring/alarms of temperature transmitters
	Operational	Ineffective or inadequate maintenance activities leading to loss of supply or loss of containment	• Detailed work procedures • Control assessment reporting and condition monitoring to set frequencies • Review and approval of operating procedures
	Regulatory	Breach of licence requirements leading to loss of license to operate	• Licence audits

	Natural environment events	Overstress of pipe leading to loss of supply or loss of containment	• Watercourse crossings designed to mitigate washaways, buoyancy

B2.4 Life expectancy

Jemena NSW trunk and primary main pipelines are typically designed with a life expectancy of 50 years. However, pipeline design life itself is a notional figure that provides a trigger for the pipeline to be reviewed against changes in societal tolerance of risk, characteristic of adjoining land usage, any deterioration in physical condition and a MAOP and remaining life review.

Factors affecting the life expectancy of piggable pipelines include:

- exposed mains subject to environmental conditions;
- third party encroachment activities;
- historical poor construction activities;
- operations & maintenance activities; and
- network growth.

Pipeline components deemed to be at the end of their design life are assessed for fitness of purpose. A pipeline's life is usually extended after such reviews and following any necessary actions have been completed.

Appendix C Lifecycle management

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C1. Piggable pipelines

JGN manages the life cycle of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as outlined in section 7 of the Asset Management System (AMS) Manual.

The Australian Standard AS/NZS2885 established a set of requirements for managing safety through integrity. Jemena manages the Life Cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as indicated in the AMS.

The AMS drives the delivery of the requirements as set out in AS/NZS2885 through a Plan, Do, Check & Act approach. Table C1–1 details more specifically the requirements of the Standard against the AMS.

Table C1–1: AS2885 requirements mapped to AMS

AS2885 objectives	AMS methodology
Structural integrity in accordance with AS 2885.3, section 6 to confirm the pipeline can continue to contain fluids at the design conditions	The structural integrity of the pipelines is reviewed annually as part of the AMS. The Pipelines Asset Strategy group within Jemena review the following data and produce annual condition reports to confirm the condition of the pipeline and identify any mitigation actions required to ensure the continued integrity: Pipeline degradation data from ILI Data from direct field examination Coating defect survey results Cathodic protection monitoring data Pipeline ROW condition including erosion and vegetation overgrowth
The type and configuration of any defects, the rate of corrosion and the minimum remaining wall thickness	Type and configuration of any defects identified are reported in the Annual Direct Inspection Operational Report.
The completion or review of a safety management study (SMS) conducted in accordance with AS 2885.6 and the identification of any changes required to the mitigation methods	This review takes input from: Prior SMS and location class review reports and action close out reports which are produced following each 5 yearly SMS Review. The AMS includes a live risk register which gets threat inputs from the Annual Control Effectiveness reports. Any changes required to the mitigation methods are identified through the live risk register which facilitates risk assessments based on the Jemena Risk Manual. The output of the review is captured in two documents: The Asset Performance and Integrity Reviews which are reviewed on an annual basis. Any changes to the mitigation measures are captured in the Field Operations and Maintenance Specification.
Adequacy of the pipeline management systems, Pipeline Integrity Management Plan (PIMP), operating and maintenance, emergency response and the safety and environmental procedures	A review of the adequacy and currency of the following documents will be provided in this review: Field Operations and Maintenance Specification (known as the Pipeline Integrity Management Plan) Emergency Management Plan and emergency procedures Operational and Maintenance Plan Environmental Management Plan

AS2885 objectives	AMS methodology
	Any shortcomings identified in this report will be reported as a new threat to the live risk register in the AMS and appropriate actions will be undertaken.

C1.1 Creation

New pipeline assets are largely created via demand for capacity and market expansion. This is discussed in the Capacity Design Specification Manual (GDN-1999-SP-DN-001).

The Pipelines Design and Construction Specification, currently under development, is a part of the Jemena AMS. This specification outlines the design, construction and testing requirements for Jemena's AS2885 assets.

The purpose of this specification is to:

- define the design considerations to enable the production of compliant, consistent and standardised designs;
- define the design parameters to enable specific designs; and
- provide company standard practice for process efficiency where a variety of solutions exist.

This document also ensures consistency across all Jemena pipeline assets for pipeline design and construction activities.

C1.2 Asset operation and maintenance

The way assets are operated and maintained is an important factor in how they perform and how long they remain serviceable. Our approach is to ensure assets perform within their design guidelines to enable the lowest sustainable life cycle cost. This includes operating assets within acceptable parameters, which may change over the life of an asset as they degrade.

The Field Operations and Maintenance Specification, currently under development, is a part of the Jemena AMS. This specification outlines the Field Operations and Maintenance requirements for Jemena's AS2885 assets.

The purpose of this document is to provide outline instructions and procedures for performing field operation and maintenance tasks on Jemena's AS2885 assets in accordance with relevant legislation and Jemena's operational, societal and environmental objectives.

We have implemented a preventive maintenance program to provide assurance that all critical units and components are working and within specification and that qualified personnel will consistently execute maintenance procedures and practices.

The planned maintenance activities for piggable pipelines include:

- Emergency equipment:
  - Emergency response equipment checks at various storage locations
- Pipeline Inspections
  - Small sections that are non-piggable (i.e., close to the stations) – Integrity assessments based on condition monitoring
  - ILI at 10 yearly intervals
  - Inspect and repair pipe wall defects found with ILI and from DCVG surveys – as required

- Corrosion
  - DCVG for non-piggable sections at 5 yearly intervals
  - CP system inspection
  - CP surveys
- Pipeline and easement protection
  - Aerial patrols
  - Ground patrol/ foot
  - Control regrowth of vegetation – as required
  - Maintain easement and access tracks – as required
  - Maintain pipeline signage – as required
  - Landowner contact - annual

We undertake ad-hoc maintenance and inspection activities based upon the findings of risk assessment, planned and condition based maintenance activities and also as directed by management to address unforeseen events. Examples of ad-hoc maintenance activities include creek restoration, washaways, unscheduled regulator overhauls, metal loss inspections, and pipeline coating repairs. Examples of ad hoc inspections include additional right-of-way patrols following natural events, supervision of third party activities and coating conditions surveys of poor cathodic protection levels.

There are no non-standard or major operation and maintenance programs that are required to address specific risks associated with the pipelines.

C1.2.1 Asset replacement/disposal

Refer to GTS-999-RP-CE-001 Jemena Pipelines Abandonment.

C2. Non-piggable pipelines

JGN manages the life cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as outlined in section 7 of the AMS Manual.

The Australian Standard AS/NZS2885 established a set of requirements for managing safety through integrity. Jemena manages the Life Cycle integrity of the asset from its inception at asset creation including design, construction, commissioning, operation and maintenance through to disposal as indicated in the AMS.

Non-piggable assets are managed in the same manner as piggable assets, except to the extent that inline inspections are unable to be performed.

C3. Information requirements

Jemena's AMS provides a hierarchical approach to understanding the information requirement to achieve Jemena's business objectives at the asset class. In summary, the combination of Jemena's Business Plan, the ABS and various ACSs all provide the context for and determine the information required to deliver the JGN asset objectives and the pipeline asset class objectives.

From these business objectives, it is possible to identify at a high-level the business information systems' content required to support these objectives (Table C3–1).

Table C3–2 identifies the current and future information requirements to support the asset class's critical decisions and their value to the asset class.

Table C3–3 provides the information initiatives required to provide the future information requirements. Included within this table is the risk to the asset class from not completing the initiative.

All of the information required by the pipelines asset class is available within Jemena's current business systems.

Table C3–1: JGN objectives and information requirements

Business objective	Jemena information sources	Externally sourced data
Maintain customer KPIs	• Jemena Business Plan • JGN Market Strategy • JGN ABS • Monthly JGN KPI report • JGN Corporate Scorecard • VOC reports / studies	• AER Network Performance Reports • Other gas networks' regulatory proposals and public planning/performance reports • AER Consumer Challenge Panel reports
Maintain asset safety and reliability KPIs and comply with regulations and legislative instruments	• Jemena Business Plan • JGN Market Strategy • JGN ABS • Monthly JGN KPI report • JGN Corporate Scorecard • Safety Management Studies • Safety Case (SAOP) of Jemena Gas Assets (NSW) • Jemena Risk Management Policy (and the Group Risk Management Manual) • Jemena Compliance and Risk System (JCARS) • Asset risk registers • Design Basis Manuals • Pipelines APaIR • Operations and Maintenance Specification • Operations, Control, Monitoring and Response Specification • AMS Manual • Capacity Design Specification Manual	• Gas Supply Act 1996 No 38 (NSW) • Gas Supply (Safety and Network Management) Regulation 2013 • Pipelines Regulation 2013 No. 484 (NSW) • Pipelines Act 1967 No. 80 (NSW) • AS 4564:2011 Specification for general purpose natural gas • AS 2885.0-2018 Pipelines — Gas and liquid petroleum Part 0: General requirements • AS 2885.1-2018 Pipelines — Gas and liquid petroleum Part 1: Design and construction • AS 2885.2-2016 Pipelines — Gas and liquid petroleum Part 2: Welding • AS 2885.3:2012 Pipelines – Gas and Liquid Petroleum Part 3: Operation and Maintenance • AS/NZS 2885.5:2002 Pipelines — Gas and liquid petroleum Part 5: Field pressure testing

Business objective	Jemena information sources	Externally sourced data
		• AS/NZS 2885.6:2018 Pipelines — Gas and liquid petroleum Part 6: Pipeline Safety Management • AER Network Performance Reports • Other gas networks' regulatory proposals and public planning/performance reports
Reduce capital investment intensity	• JGN Market Strategy • JGN ABS • JGN Corporate Scorecard • Asset Investment Plan • VOC reports / studies • Jemena Investment Governance Framework	• AER benchmarking • AER regulatory determinations • Other gas networks' regulatory proposals and public planning/performance reports • Market testing
Reduce operational spend	• JGN Market Strategy • JGN ABS • JGN Corporate Scorecard • Asset Investment Plan • VOC reports / studies • Jemena Investment Governance Framework	• AER benchmarking • AER regulatory determinations • Other gas networks' regulatory proposals and public planning/performance reports • Market testing
Facilitate net zero	• ECMS • GPA hydrogen readiness report • Renewable Gas Strategy • Emissions reduction strategy	• ENA reports • Other gas network's regulatory proposals and public planning/performance reports • Competitor analysis • Future fuel CRC Report
Increase long term competitiveness of networks through higher asset utilisation and by connecting profitable new customers	• JGN Market Strategy • JGN ABS • Pipelines APaIR	• AER benchmarking • AER regulatory determinations • Other gas networks' regulatory proposals and public planning/performance reports

Table C3–2: Pipelines assets critical decisions business information requirements

Critical business decision	Current information usage	Future information requirement	Value to asset class (High, Medium, Low with justification)
When do pipeline integrity controls get altered in response to changing conditions?, e.g. changes in pipeline wall thickness, or controls not decreasing integrity risk, or controls not operating to specification	Cathodic Protection	Digital format interoperable with GIS	High – Cathodic protection on pipe lengths lowers containment integrity loss risk. Unprotected pipe needs increased investigation and monitoring.
	Pipeline Attribution (Coating, Manufacturer, Material, etc)	Needs reviewing to ensure it adds to pipeline integrity controls information	High
	'Pig' Data	Digital format interoperable with GIS	High – faster assessment of pipe integrity attribution lowering the risk of containment integrity loss
	Integrity Digs	Digital format interoperable with GIS	High – supports locating future integrity digs and understanding pipeline degradation risks.
	Pipeline Inspections	Digital record available in real-time	High – faster assessment of changes in 'external to' pipe integrity conditions
	Pipeline encroachment – DBYD	Digital format interoperable with GIS	High – faster assessment of changes in 'external to' pipe integrity conditions
	3rd Party hits and near misses	Digital record available in real-time	High – faster assessment of changes in 'external to' pipe integrity conditions
	Drawings	Digital format interoperable with GIS	Med – increases the information available to manage the pipeline
	Maintenance Records	Digital record available in real-time	High – faster assessment of changes in pipeline integrity conditions
	Weld Records	Digital format interoperable with GIS	Med – faster assessment of changes in pipeline integrity conditions
	Soils Mapping	Digital format interoperable with GIS	Med – information on soil ph. and other physical characteristics which assist in managing the pipeline integrity
	Incidents / Emergencies	Digital record available in real-time	High – evaluation of current and future risks in managing pipeline integrity
	Right of Way Attribution	Digital format interoperable with GIS	Med – lowers pipeline integrity loss risks caused by 3rd parties.

	Commercial Agreements	Digital format interoperable with GIS	High – increases information on the management of the pipeline.
	Surface Features (Erosion, etc)	Digital format interoperable with GIS	High – lowers containment integrity loss risk on 'non-piggable' pipeline sections

Table C3–3: Information initiatives to support business information requirements

Information initiative	Use case description	Asset class risk in not completing	Data quality requirement
Mobility	Gas Pipeline staff use mobility technology to record pipeline control activities in real-time, which then is available in the GIS in near real-time	High	Complete, Current, Accurate, Consistent (GIS Asset ID to SAP Asset ID)
Dynamic Segmentation	Use 'dynamic segmentation' to represent changing integrity controls along the pipeline. Could assist in creating a linear model of pipeline integrity loss risk (see below).	High	Complete, Current, Accurate
Connectivity Model	Create geometric networks for each Gas Pipeline. Enables improved QA/QC of pipeline features.	Med	Complete, Current, Accurate
Maintenance records (Planned and corrective)	'Classified' (work code, completed, etc.) maintenance records geospatially represented in near real-time	High	Complete, Current, Accurate, Consistent (GIS Asset ID to SAP Asset ID)
Cleanse current pipeline datasets	Review and update the current pipeline datasets to be current and complete. For example; missing 'Right of Way' features.	High	Complete, Current, Geospatially Accurate, Consistent (GIS Asset ID to SAP Asset ID)
Pipeline Inspections	Geospatially represent pipeline inspection data in near real-time.	High	Complete, Current, Accurate, Consistent (GIS Asset ID to SAP Asset ID)
'Pig' Data	Geospatially represent 'Pig' data in near real-time.	High	Complete, Current, Accurate, Consistent (GIS Asset ID to SAP Asset ID)
Integrity Digs	Geospatially represent 'Integrity dig' data in near real-time.	High	Complete, Current, Accurate
Network incidents and 3rd party damage	Network incidents and 3rd Party damage geospatially represented in near real-time.	High	Complete, Current, Geospatially Accurate, Consistent (GIS Asset ID to SAP Asset ID)
Cathodic Protection	Implementation of a Cathodic Protection (CP) data model within the GIS to geospatially represent and attribute CP assets	High	Complete, Current, Geospatially Accurate, Consistent (GIS Asset ID to SAP Asset ID)
Capture of 'unstructured' asset information	Capture of drawings, welds, etc. into Drawbridge and other unstructured	High	Complete, Current, Consistent (Asset ID to

Information initiative	Use case description	Asset class risk in not completing	Data quality requirement
	information (Commercial Agreements) into the ECMS,		Asset ID across repositories)
External geospatial datasets	Sourcing a range of network reference data from custodians external to Jemena. For example; Soil pH.	High	As sourced
Browser Viewer	Implement a Browser based viewer which enables Gas Pipeline staff to view and interrogate pipeline and pipeline controls information via a geospatial interface. Including the ability to compare data values and changes over time.	High	As consumed by 'Viewer'.
Pipeline Risk Modelling	Model changes in the containment integrity along the pipeline based on pipe attribution and changes in control measures.	High	Complete, Current, Accurate,