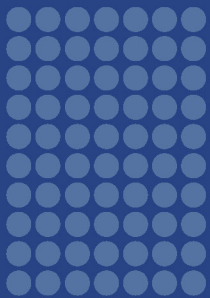
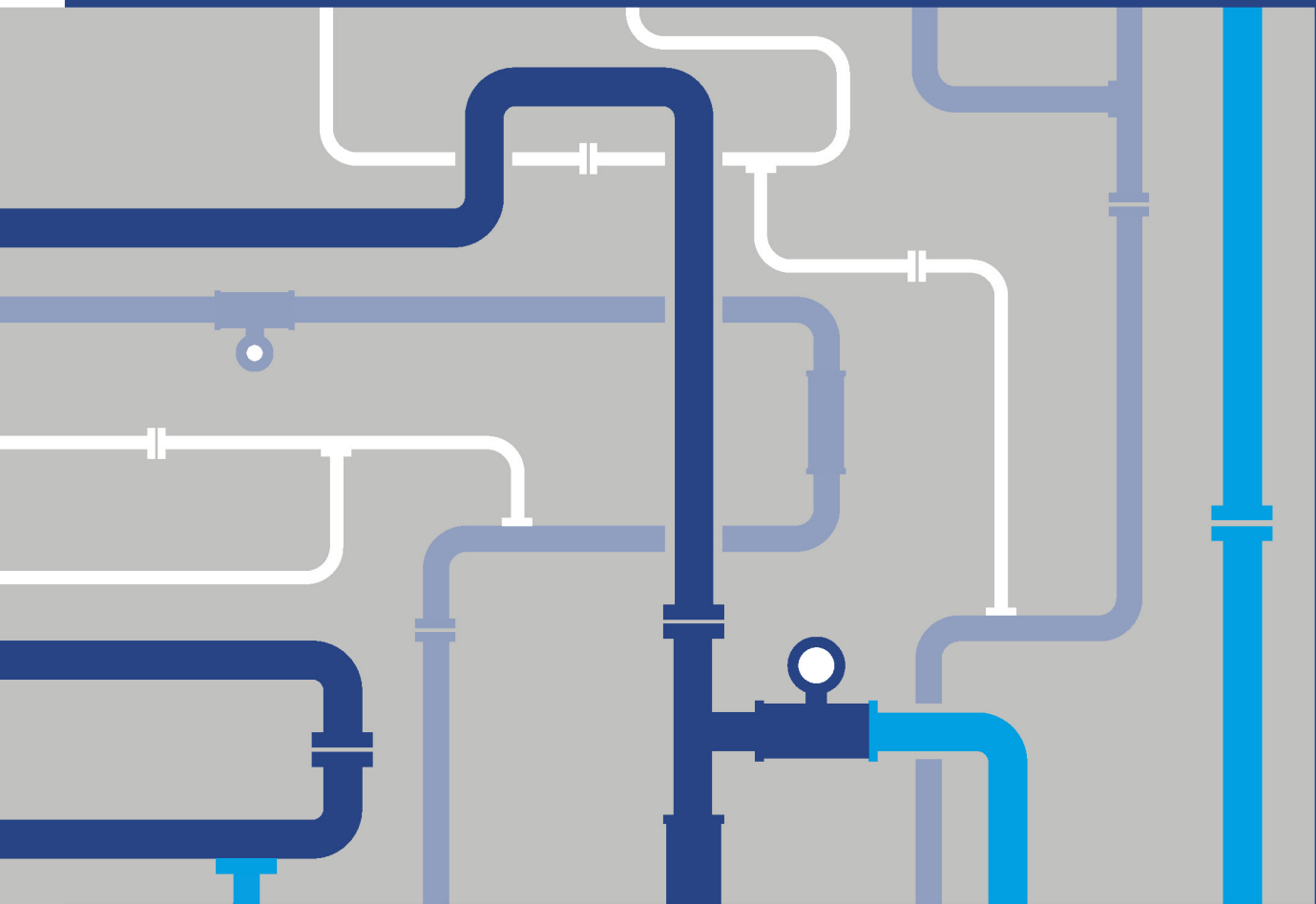




chapter 17
safety.



Environment Effects Statement | May 2021

**western outer
ring main**



Contents

Chapter 17

17.1	Introduction	17-1
17.1.1	Overview.....	17-1
17.1.2	Pipeline safety regulatory requirements	17-2
17.2	Method	17-3
17.3	Existing conditions	17-5
17.3.1	Land within the Urban Growth Boundary	17-6
17.3.2	Land outside the Urban Growth Boundary	17-6
17.3.3	Other significant features.....	17-7
17.3.4	Geology and topography	17-7
17.4	APA risk management philosophy	17-8
17.5	Safety Management Study risk assessment.....	17-8
17.5.1	Location classes	17-8
17.5.2	Historical review of operational threats	17-9
17.5.3	Threat analysis	17-10
17.5.4	SMS Summary	17-13
17.6	Risk assessment for aspects not addressed in the Safety Management Study.....	17-14
17.7	Bushfire hazard analysis	17-16
17.8	Environmental management	17-18
17.8.1	Environmental management measures.....	17-18
17.8.2	Monitoring.....	17-21
17.9	Conclusion	17-21

17.1 Introduction

17.1.1 Overview

This chapter provides an assessment of safety aspects associated with the construction and operation of the Western Outer Ring Main (WORM) gas pipeline project (the Project). This chapter is based on the assessment presented in Technical report M *Safety* and APA's safety commitments.

Safety is a core value for APA. It is the first step in all APA activities, has been a vital input for the design of the Project and would continue to be of critical importance through construction and operation.

It is an objective of the *Pipelines Act 2005 (Vic)* (the Pipelines Act) to protect the public from environmental, health and safety risks resulting from the construction and operation of pipelines. Safety impacts are a specific matter the Minister for Energy, Environment and Climate Change will consider in determining the application for Pipeline Licence (Section 49 Pipelines Act).

The Safety assessment provided in this EES identifies and describes potential risks to people, property and community infrastructure from the Project. Understanding the safety hazards and risks associated with the Project enables the proponent to design systems and put in place procedures appropriate to the safeguarding of human life, assets and the environment.

The EES scoping requirements set out the following evaluation objectives:

- Provide for safe and cost-effective pipeline connection between the eastern and western sections of the Victorian Transmission System.

To assess the potential safety risks as a result of the Project, a risk assessment was performed through a Safety Management Study (SMS). The assessment included a review of the existing land use classifications within the study area in accordance with AS/NZS 2885¹ to gain an understanding of the existing and reasonably foreseeable land uses within the measurement length of the pipeline.

Other aspects closely related to the safety evaluation objective include blasting activities, flooding threats, land subsidence and vegetation conditions. These are addressed in the following reports and chapters:

- Technical report A and chapter 7 *Biodiversity and habitats*
- Technical report B and chapter 8 *Water*
- Technical report D and chapter 9 *Land stability and ground movement*
- Technical report E and chapter 10 *Contamination and greenhouse gas*
- Technical report F and chapter 12 *Noise and vibration*.

¹ Australian Standard AS/NZS 2885:2018. Pipelines – Gas and liquid petroleum.

17.1.2 Pipeline safety regulatory requirements

A Pipeline Licence is required for the Project under the Pipelines Act. Licensed pipelines are to be constructed and operated safely in accordance with the Pipelines Act and supported by the requirements in AS/NZS 2885.

Under the Pipelines Act, the pipeline licensee has a general duty to implement a range of safety measures to reduce foreseeable risks associated with operating a pipeline and to minimise, so far as is reasonably practicable, hazards and risks to public safety.

A Health and Safety Management Plan must be prepared and accepted by Energy Safe Victoria (ESV) as part of the Pipeline Licence process in accordance with the Pipelines Act and is a condition precedent for construction. The Health and Safety Management Plan for the construction phase of the Project is part of the Pipeline Licence Application (refer EES Attachment III). The Health and Safety Management Plan describes the risks and the controls to be implemented to eliminate or minimise the risks.

While this chapter and the Health and Safety Management Plan describe and assess the risks and management measures, it is the general duty of APA to reduce risk which drives the design, construction and operation of the Project in accordance with the Pipelines Act.

The existing Victorian Transmission System (VTS) has an approved Safety Case (approved by ESV) as per the requirements of the *Gas Safety Act 1997*. For the operation phase, it is proposed that the WORM would be incorporated into the current VTS Safety Case and the APA safety management systems could be applied.

The Project would be constructed and operated in accordance with the environmental management measures (EMMs), relevant standards, APA safety management policies and systems, approved Safety Management Plan and approved Environmental Management Plan (EMP). Refer to Chapter 20 *Environmental* management framework and Technical report M Safety for the full list of environmental management measures.

What is a Pipeline Licence?

A licence granted under the *Pipelines Act 2005*, granting the right to construct and operate a pipeline to transport petroleum on land subject to the licence.

The Pipelines Act regulates the construction, operation and maintenance of pipelines. It outlines the requirements for obtaining a pipeline licence and the conditions of the licence.

The Minister of Energy, Environment and Climate Change, and Energy Safe Victoria (ESV) are co-regulators for the Pipelines Act.

The Health and Safety Management Plan required by the Pipelines Act is separate to the EMP. An EMP must also be prepared and accepted by the Minister for Energy, Environment and Climate Change as part of the Pipeline Licence process in accordance with the Pipelines Act. The EMP describes the Project risks to the environment and how APA will eliminate or minimise those risks. The draft EMP is part of the Pipeline Licence Application (refer EES Attachment III).

AS/NZS 2885.6 requires that risks be reduced As Low As Reasonably Practicable (ALARP). The *Gas Safety Act* references As Far As Practicable (AFAP) as the test to be applied in a safety case to show risks are meeting the owner's statutory general duties and obligations. The Work Health and Safety Act and Regulations require risks to be managed So Far As Is Reasonably Practicable (SFAIRP principle).

SFAIRP has been nominated by APA for this assessment because it is more stringent than ALARP and AFAP and SFAIRP recognises that no industry activity is entirely free from risk, and that there remains a level of risk where the cost of additional risk reduction measures is grossly disproportionate to the risk reduction achieved.

17.2 Method

The safety assessment comprised the following key tasks:

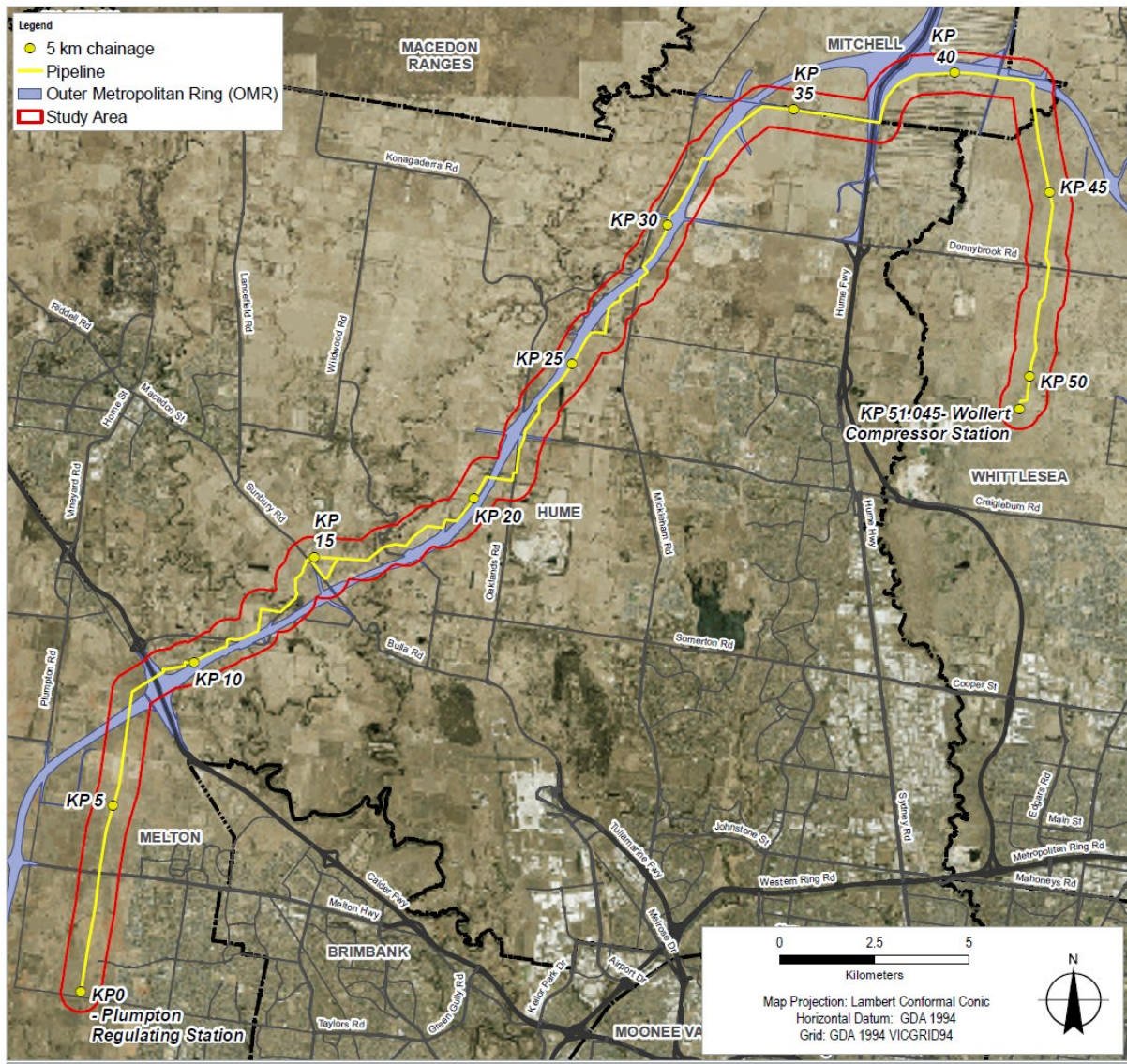
- Review of relevant legislation and policy at a national, state and local level.
- Establishment of a study area for safety. This was defined by calculating the Measurement Length for the Project as specified in AS/NZS 2885. The Measurement Length was calculated to be 659 m from the centreline of the pipeline alignment, as shown in Figure 17-1. The same Study Area was used for both the SMS and risk assessment.
- Characterisation of existing conditions including a review of the existing and reasonably foreseeable land uses, population densities, and sensitive natural environmental areas within the study area that could potentially be impacted by hazards from the Project.
- Review of the existing and reasonably foreseeable land uses within the Measurement Length to identify land use classifications defined in AS/NZS 2885. This in turn outlined the safety design requirements of the pipeline. The land use classifications informed both direct threats to the Project and the consequences of a pipeline failure to adjacent land users.
- Desktop assessment and baseline data review including:
 - A desktop literature review to ensure all relevant threats have been identified and evaluated for gas pipelines in Australia.
 - A desktop bushfire risk assessment was undertaken for the Project. The bushfire risk assessment was undertaken based on APA information and complemented by information obtained from publicly available information sources. It considered the potential bushfire risk factors associated with a fire being started through the construction and operation phases of the Project.
 - A desktop assessment of the vegetation and topography utilising the GHD ArcGIS mapping platform and the VicPlan mapping tool (VicPlan, 2020).
- Undertake a risk assessment which comprised two aspects:
 - The SMS assessment consistent with AS/NZS 2885 focused on risks, which considered both the impacts of a threat, and the associated likelihood of those impacts eventuating. The focus of the SMS was to prevent damage and loss of containment from the pipeline during the operation phase, considering threats from all project phases.
 - A risk assessment was carried out using an approach consistent with *AS/NZS ISO 31000:2018 Risk Management Process*. This risk assessment was used to identify the issues for workforce, nearby operations and public safety which are not assessed through the SMS assessment. Consequence and likelihood criteria were developed to assess these risks, which are provided in Table 17-1 and Table 17-2.
- Development of environmental management measures (EMMs) in response to the assessment. Refer to Chapter 19 *Environmental management framework* and Technical report M *Safety* for the full list of environmental management measures.
- Assessment of the residual risks of the Project assuming implementation of the environmental management measures.

What is the Measurement Length?

The Measurement Length (ML) is the area of consequence in the extremely unlikely event of a full loss of containment of gas (full-bore rupture of the pipeline) plus the gas being ignited, which may cause injury after 30 seconds of exposure. The ML is calculated based on operating pressures using methods outlined in Australian Standards.

- Specifying the monitoring required to evaluate whether the Project meets the environmental management measures and detailing contingency measures as required.

Figure 17-1 Safety study area



G:\311252997\GIS\Maps\Working\Safety\1252997_Safety_Pipeline
 Locality Map_Embedded_RevC.mxd

Data source: APA, 2020; GHD, 2020; DELWP, Vicmap, 2020 Created by: kgardner

Table 17-1 Consequence criteria

Level	People	Assets/property	Biophysical environment
Insignificant	Minimal impact on health and safety	Maximum risk less than \$5,000	No effect; minor on-site effects rectified immediately with negligible residual effect
Minor	Injuries requiring first aid treatment	Maximum risk less than \$500,000	Impact very localised (<0.1 ha) and very short term (weeks), minimal rectification
Moderate	Injury or illness requiring hospital treatment	Maximum risk less than \$5 million	Localised (<1 ha) and short term (<2 year) effects, substantially rectified within a year or so
Major	One or two fatalities, several people with life-threatening injuries	Maximum risk less than \$50 million	Major impact well outside pipeline corridor or site; long term severe effects or rectification difficult
Severe	Multiple fatalities result	Risk may exceed \$50 million	Impact widespread; viability of ecosystems or species affected; permanent major changes

Table 17-2 Likelihood criteria

Level	Probability	Description
1	Rare	The event is conceivable and may occur only in exceptional circumstances
2	Remote	The event could occur but is not anticipated and may occur if certain abnormal circumstances prevail
3	Unlikely	The event is unlikely but could occur if certain circumstances prevail
4	Likely	The event will probably occur in most circumstances
5	Almost certain	The event is expected to occur in most circumstances or is planned to occur

17.3 Existing conditions

The following section outlines the existing conditions of the Project study area in relation to safety.

To assess potential impacts of the Project, an understanding of the surrounding environment was required. To achieve this, the assessment identified existing and reasonably foreseeable population densities, sensitive natural environmental areas, geology and topography within the study area that could potentially be impacted by hazards from the Project. AS/NZS 2885 defines these land use classifications.

The primary land use classifications in the study area were:

- R1 – Rural
- R2 – Rural Residential
- T1 – Residential.

Primary versus secondary location classes

Every point on a pipeline must have a primary location class. AS/NZS 2885 has provision for secondary location classes that draw attention to special locations. The main purpose of location classification is to help the safety management study identify and focus on areas of higher risk and in some cases to require increased risk reduction measures.

The secondary land use classifications in the study area were:

- I – Industrial
- S – Sensitive Use
- C – Crowd
- E – Environmental.

A summary of the classifications based on the total distance of the pipeline is shown in Table 17-3.

17.3.1 Land within the Urban Growth Boundary

A significant portion of the Project falls within the Melbourne Urban Growth Boundary (UGB), including the following sections:

- Plumpton Regulating Station to Melton Highway
- Sunbury Area (approximately KP 12 to KP 15) – note that the proposed route does not actually fall in the Urban Growth Boundary, but is located within the Study Area
- Mickleham Road to Wollert Compressor Station

What is the Urban Growth Boundary?

The urban growth boundary (UGB) is a legislated boundary which acts as the interface between growth areas and metropolitan Melbourne, and a green wedge or rural area.

The primary land use classification for the sections within the UGB is Residential (T1). There were no locations identified where a primary location classification of High Density (T2) applied. There are a number of locations where a secondary location classification Sensitive Use (S) may be applied, on the basis of planning for future educational facilities within developing residential areas.

A Precinct Structure Plan (PSP) for development areas inside the UGB designates areas where particular land can be used for sensitive land uses, such as child care centres or aged care facilities. It does not mean that a developer has to use that land for that specific purpose. Therefore, the scenario for Sensitive Use (S) location is a highly probable scenario. Typically, sensitive user locations are located within residential zoned land but the specific location is only known following planning approval. Hazard risk assessments would be performed for future sensitive uses.

Land currently not developed for residential use is subject to a different classification than areas where residential developments are completed or under construction. Threats associated with major civil works for future residential developments do not apply to areas where residential developments have been constructed. Similarly, they do not apply where the Project is located inside the Outer Metropolitan Ring Public Acquisition Overlay (OMR PAO), and Melbourne Water land, where residential development is prohibited. For this reason, the T1 residential locations were split into developed and undeveloped location classifications to account for the different threats posed depending on development status.

17.3.2 Land outside the Urban Growth Boundary

Approximately 60 per cent of the Project is outside the UGB including the following sections:

- Melton Highway to Sunbury area (KP 3–KP 12)
- Sunbury Area to Mickleham Road (KP 15–KP 27).

The primary location classification outside the Urban Growth Areas is Rural (R1) with some Rural residential (R2) and Residential (T1) (GPA, 2020). This land is primarily used for grazing and cropping.

17.3.3 Other significant features

Other significant features intercepting the Project or in the locality which inform the location class analysis include:

- The Outer Metropolitan Ring Road/E6 Transport Corridor (refer Figure 17-1)
- Existing APA easements (KP 0 to KP 9 and KP 42.2 to KP 51.0). Approximately 34 per cent of the total length of the Project would be co-located with existing APA pipelines
- AusNet High Voltage (HV) Power easement (KP 13 and KP 28). The pipeline alignment for the Project has been selected to avoid running in parallel to HV power lines
- Melbourne Water Kalkallo Retarding Basin (KP 33 to KP 35)
- The Project crosses a conservation zone (Growling Grass Frog) in the existing APA easement around KP 42 and terminates at a conservation area in the Biodiversity Conservation Strategy (BCS) that exists between ~KP 48.6 and ~KP 48.8
- The Wollert Compressor Station (KP 51), which is planned to be upgraded as part of the Project. The facility would be normally unstaffed and operated remotely by the Australian Energy Market Operator (AEMO). There is minimal vegetation located around the existing facility and APA would continue key easement maintenance activities such as vegetation and weed management, and erosion and subsidence monitoring.

What is the Biodiversity Conservation Strategy?

The BCS is the overarching strategy for the protection of biodiversity in the growth corridors. It sets out all the conservation measures required for matters of national environmental and state significance to satisfy the commitments to the Commonwealth Government and to meet state requirements, including *Victoria's Native Vegetation Management: A Framework for Action*.

The final design of the OMR is still not yet complete. Therefore, when there is certainty about the features and population densities, another SMS will be conducted to determine if additional location classifications or further measures are required.

The sections of the pipeline in the OMR PAO have minimum mitigation measure requirements depending on the type of location classification nominated. These criteria are further explained in Section 9.4 of Technical report M *Safety*.

17.3.4 Geology and topography

The majority of the Project is located in areas that comprise near-surface hard volcanic rock (basalt), overlaid by soil which generally varies between 0.5 metres to two metres deep. The soil layer contains large buried and protruding boulders (floaters). APA has conducted geotechnical investigations to confirm the depth of rock along the route.

17.4 APA risk management philosophy

APA has an established integrated health, safety, and environment risk management system that complies with:

- AS/NZS ISO 31000:2018 – Risk management – Principles and guidelines (Standards Australia, 2018)
- AS/NZS ISO 14001:2015 – Environmental management systems (Standards Australia, 2015)
- AS/NZS 4801:2001 – Occupational Health and Safety Management Systems – Specification with guidance for use (Standards Australia, 2001).

The APA Health, Safety and Environment Management System (HSEMS) provides a clear set of health, safety and environment expectations providing a consistent and effective approach across APA's activities and operations. The HSEMS addresses the management of risk associated with high frequency, low consequence events as well as low frequency, high consequence events, which are typically process safety related events. The system is a dynamic tool that is continually updated to ensure it is current and aligned with the APA business.

Additionally, as part of APA's risk management system, APA implements a Health and Safety Management Plan to ensure the effective and continued management of HSE risks throughout the lifecycle of any project.

The Project Health and Safety Management Plan establishes effective health and safety systems to ensure the safety of all those who access the Project site, including direct employees, contractors and visitors involved in the construction phase of the Project. Safety management associated with operations and maintenance activities during the operations phase of the Project is proposed to be done through the integration of the Project into the APA Victorian Transmission System (VTS) Safety Management System.

17.5 Safety Management Study risk assessment

The SMS is a requirement under AS/NZS 2885 and informs the EES assessment. Risks associated with both the construction and operation phases of the Project were considered, and threats imposed by the Project additional to those risks assessed through the Project SMS.

What is the Safety Management Study (SMS)?

The SMS assessment is the primary risk study completed for the Project, where threats and control strategies to mitigate those threats to the Project were identified, and the consequence and likelihood associated with the identified threats were assessed.

17.5.1 Location classes

For each section of the Project, a primary location class is selected based on population density and land use within the Measurement Length. Where appropriate, one or more secondary location classes reflecting special land use were allocated to locations along the proposed alignment. The location classifications were based on the requirements of AS/NZS 2885.6.

A summary of the classifications based on the total distance of the pipeline is shown in Table 17-3.

Table 17-3 Location Class Summary

Location Class	Approximate total kms	% of total pipeline
R1 – Rural	14.4	28.3 %
R2 – Rural Residential	4.09	8.0 %
T1 – Residential	21.3	41.7 %
T1 – Residential C – Crowd	0.0579	0.1%
T1 – Residential S – Sensitive Use	9.31	18.2 %
T1 – Residential S – Sensitive Use C – Crowd	1.87	3.7 %

As indicated in Table 17-3, 64% of the total pipeline length is a residential location classification and the remaining 36% is rural location classification. Based on these classification, specific risk mitigation measures are required to be incorporated into the design, as described in Section 17.5.3.

Where the Project would be located inside the OMR PAO, a secondary location classification of Common Infrastructure Corridor (CIC) was applied.

17.5.2 Historical review of operational threats

A desktop literature review of gas pipeline incidents in Australia was completed to ensure all relevant threats have been identified in both the risk assessment and the SMS for gas pipelines in Australia. The review concluded that the greatest risk to people would be an ignited gas release, through either a hole or a rupture. However, this threat has been reviewed in detail in the SMS, which shows that the nominated mitigation controls for this Project ensures that this threat is controlled so far as is reasonably practicable.

The desktop literature review found that of 17 loss of containment events recorded by the Australia Pipeline incident database² from 2001 to 2018, 51 per cent were a result of third party interference, 28 per cent were from corrosion, 12 per cent from natural events, 7 per cent material or construction defects, and the remaining 2 per cent for other events. The literature review also found that although there has been some damage and loss of containment incidents within the industry there has never been a fatality or injury recorded in connection with damage to a gas pipeline in Australia.

² Database is not available for public access

The hazards associated with a release of gas and ignition tend to arise from the thermal radiation for jet or flash fires and the overpressure effects from a potential explosion of a gas cloud. This includes:

- Jet fires, resulting from the ignition of a continuous high pressure release gas producing a long, stable, high temperature flame. In case of a low-pressure, low-velocity or intermittent release, the resulting fire may be much shorter and less stable than that of a jet fire and generally would not result in equipment damage or injury
- Flash fires, occurring when a cloud of gas is ignited, resulting in a flame travelling through the cloud
- Vapour cloud explosion, occurring when a large cloud of gas is ignited. Vapour cloud explosions associated with lighter-than-air gases (such as natural gas) generally require confinement such as in a building or enclosure for the cloud to accumulate. Because of the requirement for gas to be confined, vapour cloud explosions are not considered credible for a pipeline release.

AS/NZS 2885 is the primary standard that would be used as a basis for the design, construction, operation and maintenance of the Project. The standard outlines mandatory requirements for maintaining risk at an acceptable level and outlines the requirements for a pipeline safety management process, which requires multiple independent controls to protect the pipeline from each identified threat, including those that have caused pipeline incidents within the industry.

17.5.3 Threat analysis

Following the desktop literature review, a detailed SMS workshop was conducted to identify threats and to evaluate credible threats as per AS/NZS 2885. This section describes identified threats, risk mitigation measures, and residual risk associated with each threat.

(1) Identified threats

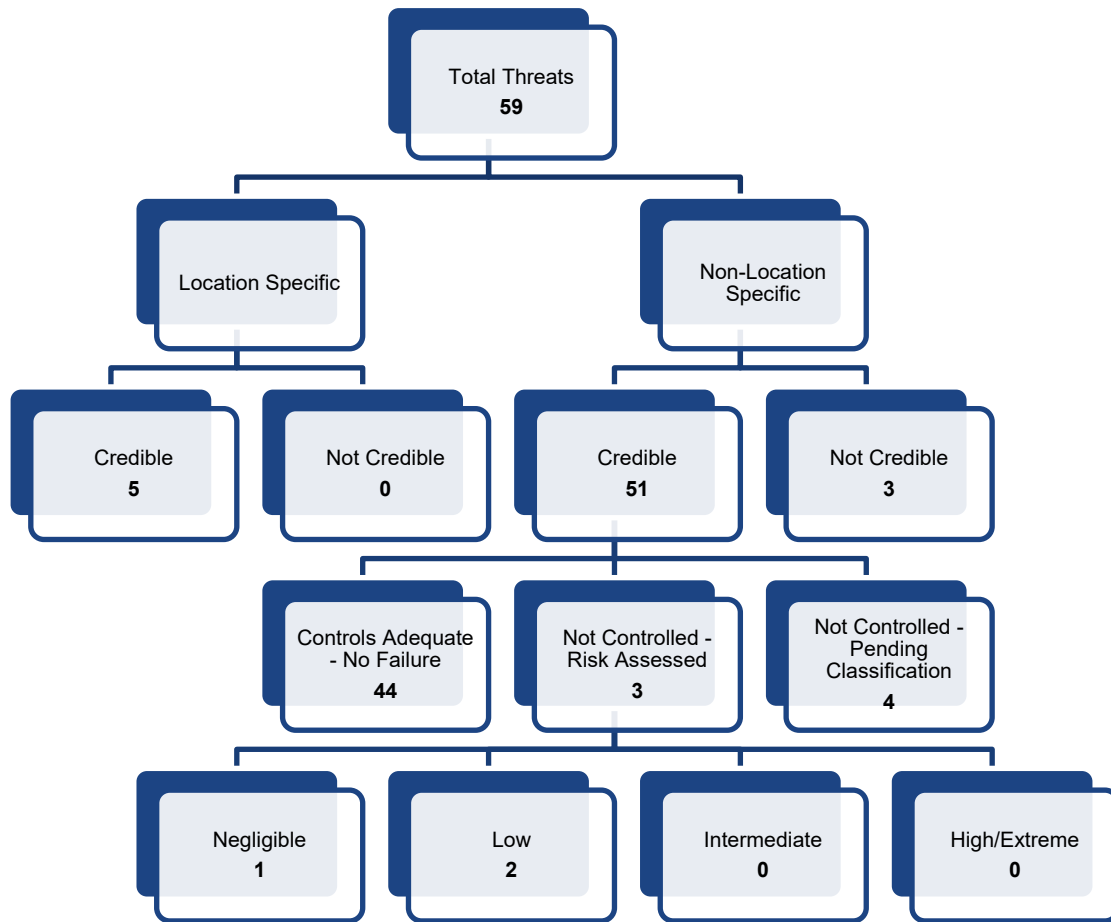
A total of 59 potential threats were identified in the SMS, none of which were evaluated as presenting a high risk or an intermediate risk, with two low risks and one negligible risk.

Figure 17-2 illustrates the types of threats identified from the SMS report.

Note the following definitions as outlined in AS/NZS 2885:

- A controlled threat is where sufficient protective measures have been applied so that the possibility of a failure event due to the identified threat has been removed for all practical purposes
- A non-credible threat is where the likelihood of an occurrence is so low that it does not exist for any practical purpose at the nominated location. The credibility of a threat is characteristic of the threat itself and is assessed independently of any protective or mitigation measures that may be applied.

Figure 17-2 Identified threat summary



Only credible threats were considered for further risk evaluation. Each credible scenario was evaluated to determine if the controls identified are adequate to prevent a failure. The risks identified as 'not controlled' have additional mitigation measures identified for implementation so the risk is reduced so far as is reasonably practicable³. Credible threats that were assessed as being so far as is reasonably practicable were broadly identified under the categories of:

- External interference
- Corrosion
- Natural events and geohazards
- Faults in design, material or construction
- Faults in operations, maintenance and management systems.

³ SFAIRP is a principle adopted from the Pipelines Act.

The seven credible threats that are pending classification are around intentional damage (for example, sabotage, vandalism, terror incident) and external impact from operation of horizontal directional drilling (HDD) and bulk civil works.

At the time of the SMS workshop, there were credible threats identified still pending classification (as shown in Figure 17-2) and the assessment of these threats would be concluded as part of detailed design. This relates to aspects such as installation of power lines during the construction phase or new third party installation of minor utilities, where the threat of external interference would be confirmed (and assessed).

Upon risk assessment of all threats during detailed design, the SMS methodology would require that all risks are reduced so far as is reasonably practicable and therefore additional mitigation measures would be incorporated into the detailed design as required.

(2) Risk mitigation measures

This section discusses the risk mitigation measures that would be implemented throughout the construction and operation phases of the Project.

To minimise the risk of a gas release, a number of mitigation measures (high level controls) would be implemented through the design of the Project infrastructure and its ongoing management. Engineering controls such as the infrastructure layout and design would be in compliance with relevant codes, technical standards, and industry best practice.

It is noted that the existing Safety Case for the VTS already exists and is approved by the regulator. The new pipeline and equipment being installed as part of the Project would be updated in the Safety Case.

AS/NZS 2885.1 specifies minimum design requirements (for example, wall thickness and depth of cover) based on its location classification, which would be implemented for the Project. The classification scheme allows division of the pipeline design requirements according to whether the pipeline is to be installed in rural, semi-rural, suburban or urban areas (EMM SA1). AS 2885.3:2012 also mandates the integrity of the pipeline is maintained throughout the operation phase of the Project.

What is a Safety Case?

To obtain a licence to operate a facility, operators are required to submit a Safety Case which demonstrates how the facility will be operated safely. The safety case:

- identifies the hazards and risk
- describes how the risks are controlled
- describes the safety management system in place to ensure the controls are effective and reliable.

Potential hazards and risks identified for the Project would continue to be mitigated and reduced so far as is reasonably practicable as the design progresses through the Project phases. Specific safety in design studies would be completed by APA throughout the Project to further identify and mitigate hazards. Any relevant documents and risk registers would be updated to reflect changes to risks and hazards identified throughout the Project.

The total pipeline alignment has been classified using the land classification criteria described in Section 17-5. Minimum mitigation controls are required for Sensitive Use Land (S) and Residential Land (T1 locations including:

- Separation - through appropriate setbacks, Asset Protection Zones (APZ)) and resistance to penetration physical controls. These controls include increased pipeline thickness, concrete protection slabs, bollards and so similar

- Awareness – APA would conduct pipeline awareness programs with landholders of the properties along the pipeline route as well as detection procedural controls (such as landowner liaison, using Dial Before You Dig, patrolling and installation of pipeline marker signs).

For Rural Land (R1 and R2) locations, the following minimum protection controls are required:

- Separation or resistance to penetration physical controls
- Awareness or detection procedural controls.

For T1 threats where only one physical control was identified, or for R1 and R2 threats where a physical control could not be identified for large segments of pipeline, a failure analysis and risk assessment was performed to understand residual risk. Operation of the pipeline for the Project would be monitored using an automated process control system, with the capability of initiating an emergency shutdown if abnormal conditions or parameters are detected (EMM SA2).

For high consequence areas the pipeline would be designed so that rupture is not a credible failure mode. This would be achieved by specifying pipe with a sufficient wall thickness and toughness. Additionally, APA would ensure that the Project's energy release rates are below that prescribed by AS/NZS 2885.1 Clause 4.9.3 and AS/NZS 2885.6 Clause 2.4.

A routine inspection and maintenance program would be implemented during pipeline operation. Inspection of the easement for issues such as erosion, weeds, subsidence, revegetation and third party activity would be undertaken on a regular basis by ground and aerial patrols (EMM SA2). Additionally, Project Traffic Management Plans would be developed to manage risks to both workers and the public on the movement of vehicles on public roads and at site access points during construction (EMM S3).

(3) Residual risk

After the application of the risk mitigation measures including through design and Project environmental management measures, potential hazardous risks during Project construction and operation to people, property and the environment would be reduced so far as is reasonably practicable.

17.5.4 SMS Summary

The SMS methodology has identified and assessed threats to the Project that could lead to safety consequences for nearby personnel, assets or the environment.

Of the threats identified, the majority were determined to be controlled such that failure of the pipeline is not possible by means of the physical, procedure and maintenance controls incorporated into the design and operating philosophy of the Project.

Those risks that were deemed not controlled (such that failure may be possible) were assessed qualitatively and/or would be assessed in more detail as the design is progressed. Subsequent risk assessment during detailed design and operation, and implementation of additional preventative and mitigative controls would be continued to reduce these remaining risks so far as is reasonably practicable.

17.6 Risk assessment for aspects not addressed in the Safety Management Study

A risk assessment for the purpose of the EES was undertaken to identify and assess risks for the Project workforce, nearby operations and public safety during the Project's construction and operation. These aspects were identified in the EES scoping requirements and take into account threats the pipeline may impose to people, environment and assets, while the key focus for the SMS assessment was to look at external threats to the pipeline (refer to Section 17.5).

A summary of these additional risks to meet the EES scoping requirements is presented in Table 17-4. The environmental management measures referenced are in Section 17.8.1.

Four construction risks were identified and assessed and two construction/operation risks which applied in both phases. Each of the six risks were assigned a low residual risk rating, on the basis of controls/mitigation applied during the risk assessment that were either required by the standards or required by APA management systems.

Risk ID SA1 describes the potential of a fire starting from Project-related activities and spreading offsite in an uncontrolled manner via ignition of vegetation. The likelihood of bushfires being ignited from Project activities during construction and commissioning has been initially assessed as 'rare'. This is because proposed prevention measures would be implemented that reduce the likelihood of fires being ignited from Project activities and the consequence of these. Such measures would be detailed in the Health and Safety Management Plan (EMM SA3) and bushfire management (EMM SA5). With prevention measures implemented, the residual risk of a bushfire igniting from a Project-related activity and impacting on people, property or the biophysical environment during construction and commissioning of the Project is considered to be 'low'.

Risk ID SA2 relates to the risk of a fire starting offsite and burning into the Project area which could impact above ground assets. Fires occur in the area of the Project relatively frequently, therefore, this risk has been given an initial risk rating of 'medium'. However, with the proposed Bushfire Management Plan (EMM SA5) plus the bushfire suppression, early warning and evacuation measures implemented by fire and emergency services during response have led to the likelihood assessment of safety impacts being reduced and the residual risk assessment is considered to be 'low'.

SA3 identifies the risk of blasting activities producing flyrock that could lead to fatalities. The likelihood of multiple human factor errors taking place (for example, incorrect design, overcharging, not sufficiently clearing the site) that could result in impacts on workers or the general public is rare. Prior to undertaking blasting, a detailed blast study and impact management plan would be prepared to confirm blasting impacts and implement any management measures as required (EMM NV3). According, the residual risk of blasting is considered to be 'low'.

Risk ID SA4 discusses the risk of a release involving diesel (used in mobile equipment) during construction due to mechanical damage, corrosion or equipment failure leading to impacts on the local environment. With the implementation of mitigation measures (including EMM SA3), the most credible consequence would be someone experiencing a burn which was selected as a 'minor' consequence. The associated likelihood of this consequence was considered as 'unlikely' as this event could occur if certain circumstances prevail. The residual risk rating is considered to be 'low'.

Risk ID SA5 describes the potential impacts on personnel from open trench construction activities creating unstable ground conditions or land subsidence, leading to injuries requiring hospitalisation. A likelihood of 'remote' was selected as the event could occur but is not anticipated and may occur if certain abnormal circumstances prevail. This results in a residual risk ranking of 'low'.

Risk ID SA6 relates to potential vehicle incidents that could lead to injury or death of workers from an increase in traffic during the construction phase of the Project. Vehicles are required during construction to deliver materials. With the Traffic Management Plans (TMPs) in place the likelihood of experiencing a fatality event is only conceivable in exceptional circumstances, and therefore moving vehicles and an increase in traffic movements presents a low risk to the workforce and the public.

Table 17-4 Risk assessment

Risk ID	Works area	Risk pathway	Initial mitigation measures	Initial risk rating	Additional mitigation measures	Residual risk rating
Construction/Operation						
SA1	All	Fire starts from Project related activities and spreads offsite in an uncontrolled manner from ignition of vegetation, leading to injury or death of workers or public. Sources of ignition include hot work, vehicles moving through long grass etc.	EMM SA3 – Health and Safety Management Plan EMM SA4 – Emergency response plan EMM C6 – Manage chemicals, fuels and hazardous materials EMM SA5 – Bushfire Management Plan	Low	No additional measure identified	Low
SA2	All	Bushfire starting offsite and burning into the Study Area where above ground assets or workers may be, leading to asset damage (coating) or smoke inhalation to workers.	EMM SA3 – Health and Safety Management Plan EMM SA4 – Emergency response plan EMM SA5 – Bushfire Management Plan	Medium	No additional measure identified	Low
Construction						
SA3	Pipeline	Blasting activities produce flyrock impacting workers or public, leading to one to two fatalities.	EMM NV3 – Blast Management Plan	Low	No additional measure identified	Low
SA4	Pipeline	Loss of containment and ignition of flammable liquids eg diesel leading to potential injury or death of workers or public.	EMM SA3 – Health and Safety Management Plan EMM SA4 – Emergency Response Plans EMM C6 – Manage chemicals, fuels and hazardous materials	Low	No additional measure identified	Low

Risk ID	Works area	Risk pathway	Initial mitigation measures	Initial risk rating	Additional mitigation measures	Residual risk rating
SA5	Pipeline	Open trench construction method used for installation of pipeline collapses creating unstable ground conditions while personnel are nearby.	EMM SA4 – Emergency Response Plans APA Excavation Procedure	Low	No additional measure identified	Low
SA6	Pipeline/ MLV/ Compressor	Increased vehicle movements during construction leads to a vehicle incident with potential injury or death of workers or public.	EMM S3 – Develop and implement Traffic Management Plans	Low	No additional measure identified	Low

17.7 Bushfire hazard analysis

This section addresses the risk of a bushfire (which includes grassfires in the context of this analysis) during construction and operations including:

- Fires igniting from a Project-related activity that escalates to a bushfire outside of the Project area
- Fires igniting outside the Project area and impacting on the Project.

These potential ignitions would need to coincide with a period of elevated fire danger (such as a hot dry windy day), dry elevated fuel conditions (such as cured high grass sward and/or fine vegetation fuel with low fuel moisture) and occur despite proposed mitigation measures. A wide range of physical environmental factors can influence bushfire risk including:

- Vegetation/fuels
- Spotting and ember attack potential of vegetation
- Land management practices on adjoining land
- Topography and access within and surrounding the site
- Potential ignition sources within the site
- Detection of new ignitions
- Initial and sustained attack capacity.

The study area and surrounding landscapes contain large areas of near-contiguous woodland or grassland vegetation cover that could potentially support large, fast moving grass or bushfires. A fire starting within the study area has a higher risk of becoming a large landscape level fire, where continuous landscape vegetation cover is located nearby (such as a wet winter/spring following a drought period when a tall contiguous grass cover may develop simultaneously with reduced grazing pressure) coinciding when adverse fire weather (hot north to westerly wind).

The fuel hazard risk in the surrounding landscape is the responsibility of the land managers such as Department of Environment, Land, Water and Planning, Parks Victoria, local land services and private landholders. Most of the land is freehold and therefore the majority of fuel management activities and implementation of firebreaks surrounding the Project infrastructure will need to be done by private landowners.

It is not necessary to assess the vegetation and topography through most of the Project area as the gas pipeline would be located underground to a minimum depth of 750 mm. At this depth, an intense bushfire would have no impact on the underground pipeline. However, it is necessary to classify the vegetation and slope at the Project locations above ground as required by AS/NZS 3959:2018 Construction of Buildings in Bushfire Prone Areas. These locations are the Wollert Compressor Station and the three mainline valves (MLV) as shown in Table 17-5.

The desktop assessment concluded that the three MLV sites are located within grassland on land with gentle topography. The Wollert Compressor Station site (KP 51) has been assessed as located within open woodland on land with gentle topography. The Project would provide appropriate setbacks and Asset Protection Zones (APZs) in accordance with AS/NZS 3959. The widths of the APZs have been determined by reference to Table 2.4 in AS/NZS 3959. The minimum width of the APZ at each asset site is detailed in Table 17-5.

In the case of the MLVs, the above-ground components would be constructed from steel. AS/NZS 3959 is principally concerned with preventing ignition of combustible building materials (either by flame contact, radiant heat exposure or ember attack) and failure of non-combustible building materials when exposed to bushfire attack. It does not explicitly address structures such as steel risers/pipework and valves. The principles of AS/NZS 3959 have been applied in considering the extent to which steel may fail during exposure to bushfire.

To mitigate the risk of bushfire from the Project, APA would implement their HSEMS prior to the commencement of construction and during the operation phase (EMM SA3). Additionally, APA would adopt further risk mitigation measures such as the following:

- Review, and if necessary, update, their existing Emergency Response Plans and Bushfire Action Plans, in consultation with the APA bushfire working group (EMM SA4 and EMM SA5)
- The APA Hot Works Permit system would be implemented for the Project to ensure hot works are not conducted during adverse fire weather conditions, and that appropriate controls to prevent fire ignition are applied at other times
- Open fires, including open barbeques, billy fires, and brush burning, would not be permitted on site
- The Project would be designed, constructed and operated in accordance with AS/NZS 2885 Pipeline – Gas and Liquid Petroleum and APZs would be established and maintained as detailed in Table 17-5 (EMM SA1)
- Additional mitigation measures during the construction phase would include:
 - Water trailer on site where needed to wet down surrounding areas
 - Cleared area around machinery of 10 metres during construction
 - No hot works during Total Fire Ban days unless a permit is in place from CFA, MFB or DELWP on Total Fire Ban Days
 - Vehicles are fitted with an efficient silencing device (for example, muffler) that removes the exhaust from the engine through the silencing device.

Table 17-5 Project locations on bushfire prone land

ID	KP	Access	Bushfire prone land/ category	Slope attributed (assessment)	APZ minimum width from asset (all directions)
MLV 1	KP 6	Holden Road, Diggers Rest	Bushfire prone/ vegetation "G" – grassland (managed)	>0–5° (Flat assessed)	7 m
MLV 2	KP 22	Oaklands Road, Oakland Junction	Bushfire prone/ vegetation "G" – grassland (managed)	>0–5° (1–3° assessed)	7 m
MLV 3	KP 35	Gunns Valley Road, Beveridge	Bushfire prone/ vegetation "G" – grassland (managed)	>0–5° (Flat assessed)	7 m
Wollert Compressor	KP 51	Summerhill Road, Wollert	Bushfire prone/ vegetation "G" – grassland (low open woodland)	>0–5° (1–3° assessed)	15 m

The risk of fires from the Project to surrounding people, property and biophysical environment has been assessed as medium pre-mitigation. This was based on the level of consequence that could occur if a bushfire were to escalate outside the Project area being rated as major. However, the potential for fires to start and escalate within the Project area was considered to be rare based on the mitigation measures that would be implemented by the Project (EMM SA3 and EMM SA5). The proposed additional mitigation measures would reduce the risk to low.

The risk of bushfires originating outside the Project area impacting the Project were not considered to be significant with regards to the Project design and operations. However, the same consequences of injury or fatality is possible for Project personnel as with the public, particularly through the construction phase with the workforce on site.

Despite comprehensive existing and Project-specific mitigation measures, APA is unable to influence the worst case consequence of a grass or bushfire event, which is fatalities and/or severe irreversible disability. However, mitigation actions to reduce the likelihood of impact would include implementation of the Bushfire Management Plan (EMM SA5) plus the bushfire suppression, early warning and evacuation measures implemented by fire and emergency services. The residual risk would be low.

17.8 Environmental management

17.8.1 Environmental management measures

Table 17-6 lists the recommended environmental management measures (EMMs) relevant to safety.

In developing the environmental management measures, the assessment adhered to the mitigation hierarchy, that is, an obligation to first avoid the risk, followed by minimising risk. Rehabilitation and offsetting are not considered relevant for safety. The mitigation hierarchy is consistent with APA's risk management philosophy and systems where a prioritised order of control types is applied to manage a specific risk and to use the hierarchy to reduce the risk so far as is reasonably practicable.

The hierarchy of hazard control is first to eliminate or avoid the hazard, followed by substitution (also a form of avoidance), followed by controls to minimise risk through isolation, engineering controls and administrative controls.

Application of the mitigation hierarchy for each environmental management measure is identified in the mitigation hierarchy column in Table 17-6.

Table 17-6 Safety environmental management measures

EMM #	Environmental Management Measure	Stage	Mitigation hierarchy
SA1	<p>Pipeline, MLV and compressor works safety standards</p> <p>Design, construct and operate the pipeline, MLV and compressor works in accordance with AS/NZS 2885, including:</p> <ul style="list-style-type: none"> • Completion of identification/assessment of threats and mitigating strategies as part of detailed design • Maintenance and inspections of the pipeline in accordance with APA procedures and AS/NZS 2885 <p>Maintain and inspect the MLVs and the Wollert compressor station at a frequency in accordance with APA's monitoring regime and procedures. This must include vegetation management, valve and compressor operation and corrective maintenance.</p>	Design, construction and operation	Avoidance
SA2	<p>Process control system and automated emergency shutdown systems</p> <p>Monitor the operation of the WORM using an automated process control system, with the capability of initiating an emergency shutdown, local alarms and remote alarms. Ensure the shutdown systems are fail-safe and designed with redundancies.</p> <p>Provide training to personnel, in field and in the control room.</p>	Design and operation	Avoidance/minimisation
SA3	<p>Fire protection</p> <p>Develop and implement a Health and Safety Management Plan that requires:</p> <ul style="list-style-type: none"> • Provision of fire detection for liquid fires in the turbine enclosure • Storage of diesel in storage tanks in accordance with AS 1940:2017 and provision of foam for firefighting purposes at diesel stations and implementation of routine monitoring to manage the risk of any fire events. <p>Manage diesel in accordance with the HSEMS, including the creation of Emergency Response Plan(s).</p>	Construction and operation	Minimisation
SA4	<p>Emergency response plans</p> <p>Develop and implement emergency response plans, such as for spills, for both the construction and operations phases of the Project.</p>	Construction and operation	Minimisation
SA5	<p>Bushfire Management Plan</p> <p>Review and update the existing APA Bushfire Management Plan to consider the new infrastructure introduced by the WORM Project in consultation with relevant stakeholders including the Country Fire Authority and Fire Rescue Victoria.</p>	Construction and operation	Minimisation
SA6	<p>Traffic Management Plans</p> <p>Develop and implement Traffic Management Plans to manage risks to both workers and the public on the movement of vehicles on public roads and at site access points as per EMM S3.</p>	Construction and operation	Minimisation

EMM #	Environmental Management Measure	Stage	Mitigation hierarchy
C6	<p>Manage chemicals, fuels and hazardous materials</p> <p>The spoil management measures must include requirements for management of chemicals, fuels and hazardous materials including to:</p> <ul style="list-style-type: none"> • Minimise chemical and fuel storage on site and store hazardous materials and dangerous goods in accordance with the relevant guidelines and requirements. • Comply with the Victorian WorkCover Authority and Australian Standard AS1940 Storage Handling of Flammable and Combustible Liquids and EPA Victoria publications 1834 Civil construction, building and demolition guide and Publication 1698: Liquid storage and handling guidelines – EPA Victoria. • Develop and implement management measures for dangerous substances, including: <ul style="list-style-type: none"> – Creating and maintaining a dangerous goods register – Disposing of any hazardous materials, including asbestos, in accordance with Industrial Waste Management Policies, regulations and relevant guidelines – Implementing requirements for the installation of bunds and precautions to reduce the risk of spills. • Develop and implement contingency and emergency response procedures to handle fuel and chemical spills, including availability of on-site hydrocarbon spill kits • Make spill kits available at all locations where machinery/plant are operating, refuelling points and fuel and chemical storage locations. • Limit the type and volume of liquid material (fuel, oil, lubricant) stored on-site for construction activities is to be limited to only that which is required. Liquid material must not be stored within 50 metres of waterways. 	Construction	Avoidance/ Minimisation
NV3	<p>Blast Management Plan –</p> <p>Develop a detailed blast study and impact management plan in accordance with AS 2187.2 – 2006 Explosives – storage and use and other relevant documents to confirm blasting impacts and implement any further management measures required.</p>	Construction	Minimisation
S3	<p>Community and residential access and connectivity:</p> <p>The following must be implemented to manage potential impacts to local access roads during construction:</p> <ol style="list-style-type: none"> a Approved Traffic Management Plans (TMPs) to mitigate risks to workers and the public arising from the movement of construction vehicles on public roads and at site access points b Stakeholder and communications arrangements in accordance with the Project Consultation Plan (Refer to EMM S6) c Measures to prevent impacts to emergency services access. 	Construction	Avoidance/ Minimisation

17.8.2 Monitoring

Under AS/NZS 2885.6 demonstration of the So Far as is Reasonably Practicable approach includes development of performance standards to ensure the effectiveness of controls to minimise the risk of a major incident. To manage and monitor performance in accordance with the environmental management measures described above, APA would implement an effective management system that included a monitoring, auditing, review and improvement cycle. As outlined in Section 17.4, the Project Health and Safety Management Plan establishes effective health and safety systems for the construction phase of the Project. For the operation phase, the Project would be integrated into the APA Victorian Transmission System (VTS) Safety Management System which has been endorsed by Energy Safe Victoria through the approved Safety Case.

The management system for the operation phase would include:

- Routine inspections of assets such as aerial or ground patrol, monitoring of mainline valves and scraper stations and cathodic protection surveys
- Document control system to enable routine review and update of all standards, procedures, Safe Work Method Statement and work instructions
- A training management system to identify and track training requirements of all personnel, including refresher training programs
- APA permit to work process to monitor and control specific higher risk activities
- A change management system to assess the impacts of changes made
- A communication strategy to notify all relevant personnel of changes made.

APA would extend existing audit programs to include the Project to confirm compliance with the health and safety legislative requirements and company/operations-specific processes and procedures.

Bushfire mitigation measures would include the following monitoring activities:

- Monitoring daily fire danger ratings during the declared bush fire danger period, and disseminate these to staff and contractors to enable them to adjust their activities.

17.9 Conclusion

This chapter has identified and assessed existing conditions, risks and mitigation to safety for the Project.

A location analysis was completed within the SMS, which used location classes based on population density and the existing and reasonably foreseeable land uses to determine current land use. This was used to assist in the risk assessment and appropriate engineering and procedural control measures to mitigate any potential threats.

Approximately 40 per cent of the Project is in the Urban Growth Boundary and related sensitive uses, with the primary location classification being Residential (T1). The remaining approximately 60 per cent of the Project is located outside of the Urban Growth Boundary on land primarily used for grazing and cropping, which has a location classification of Rural (R1), with some Rural residential (R2) and Residential (T1). There are number of locations where a secondary location classification (Sensitive Use (S)) applies to the study area, on the basis of zoning for educational facilities.

Significant features within the study area included the Outer Metropolitan Ring (OMR), although its potential to introduce higher population densities in close proximity to the pipeline is not known at the current stage of the OMR planning. There are also existing APA easements, high voltage power easements and Melbourne Water land for the Kalkallo Retarding Basin.

Both the SMS and additional risk assessment used to inform the EES determined that all safety hazards have a residual risk rating of low or below. The mitigation controls planned to be implemented by APA were identified and additional mitigation recommendations have been introduced to further reduce the risks so far as is reasonably practicable. Additional risk mitigation measures would continue to be identified by APA and implemented through design and operation to continue reducing risks to so far as is reasonably practicable.

The key risk identified in the construction phase is fire risk from fire starting either within or outside the construction corridor. The likelihood of multiple human factor errors taking place in the management of blasting activities resulting in impacts on workers or the general public is rare and therefore the residual risk is low.

The residual risks during construction would be controlled using appropriate emergency response plans that are developed by the construction contractor with specific controls for risks such as bushfires, and other low likelihood construction related risks associated with the management of hazardous materials, blasting and vehicle movement. A blast management plan would provide a detailed approach to blasting including impact and exclusion zones based on the contractor's methodology.

The key credible threats in the operation phase relate to external impact, natural events and geohazards, intentional damage and external impact from operation of horizontal directional drilling (HDD) and bulk civil works. Bushfire is also a risk in the operation phase.

The risk of gas release and/or ignition through rupture is not a credible threat as the pipeline would be designed to meet the requirements in AS/NZS 2885.1 (for example, wall thickness and depth of cover) and engineering controls would be implemented such as the layout and design of the infrastructure in compliance with the relevant codes, technical standards, and industry best practice.

The residual bushfire risks would be managed by APA's emergency response procedures and Bushfire Management Action Plan.

The mitigation measures and controls identified throughout the safety assessment would be monitored and validated using the assurance activities established and approved within APA's Safety Case regime.

After the application of the mitigation measures including through design and Project environmental management measures, potential hazardous risks during Project construction and operation to people, property and the environment would be reduced so far as is reasonably practicable and the Project would be compliant with the energy release rate limits within AS/NZS 2885.1.

In response to the EES evaluation objective described at the beginning of this chapter, effects of the Project on safety have been assessed and environmental management measures have been identified to minimise or avoid impacts on people, property and community infrastructure.