Delphi Risk Management Consulting

FRV Services Australia Pty Ltd

Walla Walla Solar Farm, NSW

AS 2885.6 Safety Management Study Workshop & Report

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Revision History

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1. ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APA	APA Group (Pipeline Licensee)
AS	Australian Standard
CDL	Critical Defect Length (mm) is a hole size where a pipeline is likely to rupture
CIC	Common Infrastructure Corridor
Client	FRV Services Australia Pty Ltd and their consultants SMEC, Transgrid and CPP
CMP	Construction Management Plan
CP	Cathodic Protection
CTE	Coal Tar Enamel Pipe Coating
CTMS	Custody Transfer Meter Station
DBYD	Dial Before You Dig
DET	Department of Education & Training
DN	Diameter nominal
DRMC	Delphi Risk Management Consulting – SMS Facilitator
DOC	Depth of Cover
EIP	External Interference Protection
ESV	Energy Safe Victoria
FJC	Field Joint Coating
FRV	Solar Farm Proponent - FRV Services Australia Pty Ltd
GIS	Geographical Information System
GJ/s	Gigajoules per Second (energy release rate)
GPT	General Purpose Teeth (used on excavator buckets)
HDD	Horizontal Directional Drill (used for installation of utilities under existing assets)
km	Kilometre(s)
KP	Kilometre Point
kPag	kiloPascals (gauge)
kW/m2	Kilowatts per metre squared (heat radiation flux)
LOPA	Layers of Protection Analysis (Likelihood/Probability of Failure Calculation)
m	Metre(s)
MAOP	Maximum Allowable Operating Pressure
ML	Measurement Length (4.7 kW/m2 radiation contour in the event of a full-bore rupture of the pipeline, results in 2nd degree burns within 30 sec of exposure at this distance)
MLV	Main Line Valve
PE	Polyethylene plastic gas pipe
PIMP	Pipeline Integrity Management Plan
PL	Pipeline License
PPC	Primary Pressure Control
PPV	Peak Particle Velocity, related to degree of ground movement or vibration
R1	Rural location classification
R2	Rural Residential location classification
ROW	Right of Way
RTP	Resistance to Penetration
S	Sensitive Use location classification
SAOP	Safety and Operating Plan
SMS	Safety Management Study
SMYS	Specified Minimum Yield Stress
SWMS	Safe Work Method Statement
T1	Residential location classification
T2	High Density location classification
TT	Tiger Teeth
TP	Transmission Pipeline
TOR	Terms of Reference
w.r.t.	With Respect To
WT	Wall Thickness

2. EXECUTIVE SUMMARY

2.1 Background

The proposed Walla Walla Solar Farm development is located some 540km south west of Sydney, NSW, positioned ~6km north east of the Walla Walla township. The development has the existing APA Barnawartha-Culcairn Transmission Pressure Gas Pipeline (TP99, PL24) running through the north west corner of the development.

To comply with Australian Standard AS2885.6-2018, land use changes in the immediate vicinity (i.e. Measurement Length, ML) of a high pressure gas pipeline must be subjected to a Safety Management Study (SMS) to review all possible threats to the safe operation and maintenance of the pipeline and ensure that any threats that cannot be mitigated by design or procedures are risk assessed and confirmed to be As Low As Reasonably Practical (ALARP).

Mark Harris from Delphi Risk Management Consulting was engaged by FRV Services Australia Pty Ltd (the Client) in coordination with the project stakeholders: SMEC, Transgrid, CPP and PCL, to facilitate an SMS Workshop for this Development.

This SMS Report captures the findings of the “Land Use Change” (AS2885.6 Table 5.1) SMS Workshop held on the 19th of January 2022. The Development provided for review at the SMS Workshop was sufficient to allow the Workshop to assess all likely risks. The findings from this SMS Report will provide direction to the Client with respect to pipeline licensee approvals and works over and adjacent to the pipeline as the development proceeds.

2.2 Key Findings

The proposed Development land use within the pipeline Measurement Length (ML, 463m) does not include any “Sensitive Use” facilities.

The existing Barnawartha-Culcairn Transmission Pressure Gas Pipeline (TP99, PL24) currently services customers in Dubbo and Tamworth along with a range of smaller users so supply consequences were based on this information when undertaking the risk assessment.

The results of the 37 Threats specifically considered can be summarised as follows: -

Table 1, Risk Assessment Summary

Pipeline	Threats Considered	Threats		Threats Requiring Risk Assessment	Risk Assessment		
		Non-Credible	Credible		Negligible	Low	Intermediate
PL24	37	9	28	7	3	4	-

The workshop results were recorded in the minutes, provided in Appendix H.

2.3 Actions

There were 9 Actions identified during the SMS Workshop and listed in the table below.

Miscellaneous Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
A1	Construction of the Development could damage the pipelines	Developer to facilitate preparation of a Construction Management Plan, for review and comment by APA (pipeline licensee) prior to any third party works.	FRV/APA	Prior to works starting
A2	Contractors may not be familiar with working around TP Gas Pipelines	Engage in a –Third Party Works - Safety Awareness Session, either as a toolbox or zoom meeting	FRV/APA	Prior to works starting
A3	Site fencing restricts APA access to Easement	Provide gates to allow APA access to easement	FRV/APA	Prior to works starting
A4	Pipeline coating/wall defect in the area of the works and the works prevents future repair.	Review recent ILI data and undertake DCVG in the area to identify if there are any known defects in the area of the Works and undertake repair as necessary prior to FRV works proceeding. APA to advise FRV of timeline if any repairs are required	FRV/APA	28/02/2022
A5	Existing slabbed road crossings are old and may not be suitable for loads required by Works	FRV to provide a list of likely vehicle loads on Benambra or Schneider Rd to allow APA to confirm the existing road crossings are capable of managing the loads	FRV/APA	Prior to works starting
Threat Specific Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
ID11	Boring and Driving of Piles for building footings. Vibration from works damages the coating leading to corrosion and failure of the pipe	Undertake test piling to confirm vibration limit at pipe does not exceed 20mm/s. May need to use augering of piles if there is a problem meeting the vibration limit.	PCL/APA	Before any solar farm footings are started
ID19	Road Crossing (access track). Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	Provide acceptable fencing along easement to prevent random use of the easement as an access track by third parties	FRV/APA	prior to completion of works
ID23	CP interference from adjacent, parallel infrastructure or construction works. CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	Electrical Interference Study (AS4853) needs to be completed for APA review (touch potential and CP design assessments)	FRV/APA	prior to completion of design
ID24	Substation current injection testing simulates a fault in the system. CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	APA to arrange access to local CP test point	FRV/APA	prior to completion of works & energisation (2023)

2.4 Outcomes

The SMS undertaken is considered to be a Land Use Change SMS. All actions raised at the SMS will need to be closed out to the satisfaction of APA and all other authorities prior to any works commencing.

Continued liaison between the Client, third Party Utilities and APA should ensure that construction activities and post construction activities pose no significant increase in the operational and maintenance risk to the transmission pipeline running past the Development.

Upon satisfactory close out of the actions raised from this SMS Workshop, it can be confirmed that the requirements of AS2885.6-2018 are met and that the APA assets under review will continue to be in compliance with the SMS requirements of AS2885.6-2018 in the Walla Walla Solar Farm Development area.

3. INTRODUCTION

3.1 WALLA WALLA SOLAR FARM DEVELOPMENT

The Project is a 300 Megawatt (MW) alternating current (AC) photovoltaic (PV) solar farm at Walla Walla, southern NSW (i.e., solar PV modules, inverters, and substation). The 614-hectare (ha) development site is located on freehold rural land approximately 4.3 kilometres (km) north-east of Walla Walla and 9.2 km southwest of Culcairn.

The Project's transmission connection point is to be at the existing TransGrid Jindera to Wagga Wagga 330kV transmission line which runs along the western side of the development site. This

330kV transmission line is part of the electricity distribution network that originates at TransGrid's North Wagga Wagga Substation. The proposed solar farm will connect directly to the transmission line where it crosses the site, with a new substation proposed near this location.

The development site would be accessed from Benambra Road, which runs along the northern boundary and intersects with Olympic Highway (A41). Olympic Highway provides access to the region's transport network.

Figure 1, Overall Development Site (APA Pipeline easement shown in top left corner of Site)

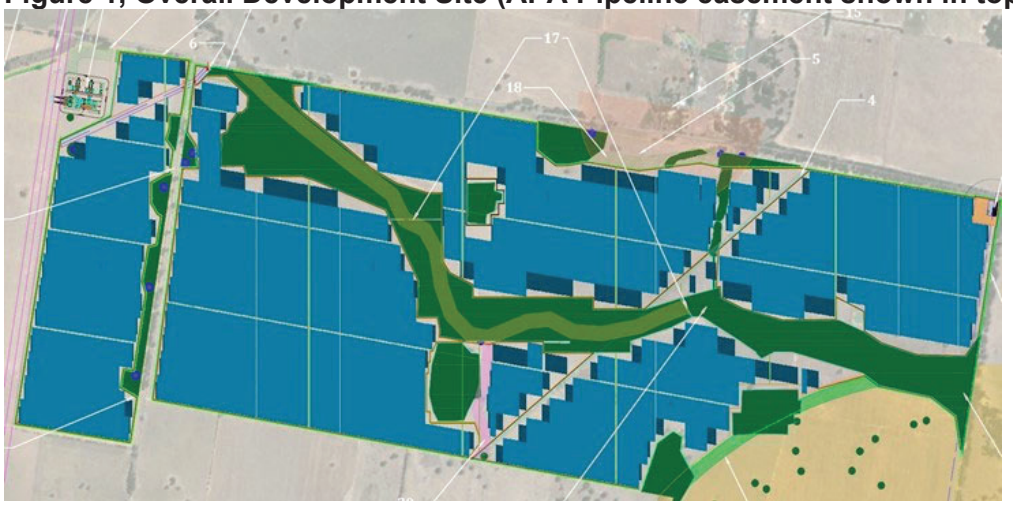
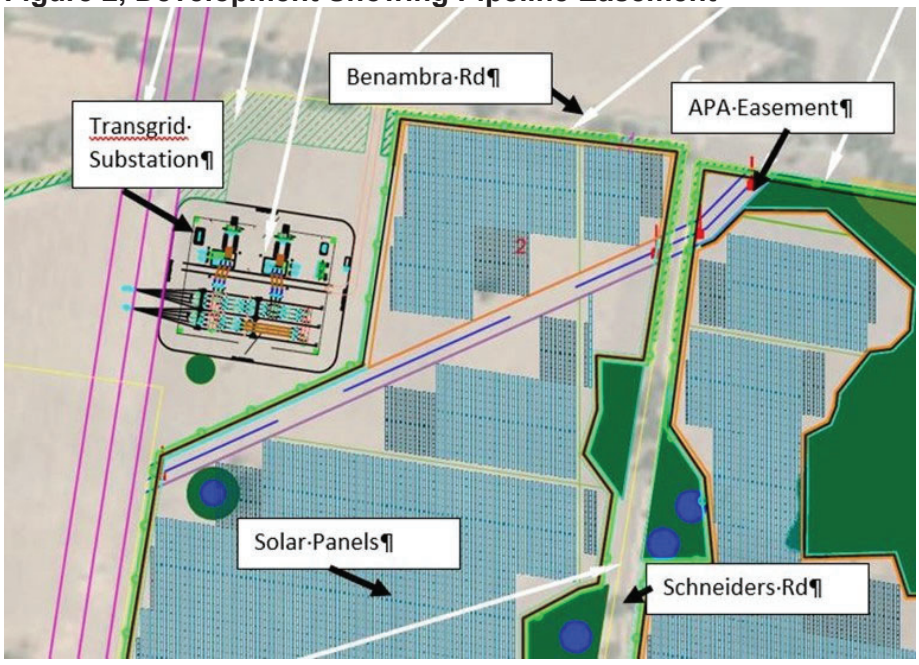


Figure 2, Development Showing Pipeline Easement



3.2 GAS TRANSMISSION INFRASTRUCTURE

The APA Group has advised that the following asset is impacted by the proposed development:

Table 2, Pipeline Details

Pipeline	Pipeline Licence	Easement Width (m)	Pipeline Easement Location	Diameter (mm)	Measurement Length (m)
Barnawartha-Culcairn	T99, PL24	24	8m from North side	450	463
	Note: Measurement Length is applied to either side of the pipeline				

The proposed development has a combined road and utility crossing of the pipeline. The Substation and offices within the measurement length are not permanently staffed and are not considered to be "Sensitive Use". There are no other defined "Sensitive Uses" associated with the Development or within the wider ML of the pipeline at this location.

There is a Cathodic Protection Test point where the pipeline crosses Benambra Rd.

The APA pipeline was built in 1998 and will continue operating for another 40-50 years so it is important to consider the implications for the safe operation and maintenance of the pipeline during construction and for the remaining life of the pipeline.

The SMS Workshop assessed the consequences, likelihoods, and overall risks to the pipeline during construction of the development and throughout the remaining life of the pipeline. The SMS Workshop sought to confirm what, if any, new mitigations will be required to ensure the future risks to the pipeline and the population nearby are ALARP.

4. WORKSHOP PARTICIPANTS

The Safety Management Study Workshop was held on the 19th of January 2022. As the SMS Workshop was undertaken over the internet using Microsoft Teams it was not possible to record a written and signed attendance sheet.

The Workshop was attended by a range of qualified people comprising representatives from the Licensees (APA Group), and the Client. The group included sufficient disciplines, knowledge, and experience to provide confidence that the output of the workshop is soundly based.

The nominated attendees for the workshop are listed below.

Table 3, Participants

Name	Position	Organisation	Attendance
Mark Harris	Facilitator	DRMC	Y
Zach Tariq	Project Manager	FRV	Y
Alan Robinson	Head of Construction	FRV	Y
Vida Kavehei	Project Coordinator	FRV	Y
Rob Hamilton	Project Director	SMEC	PartTime
Nicholas Rudland	Electrical Lead	SMEC	Y
Kym Huddart	Civil Lead	SMEC	Y
Basil Turk	Project Manager	TransGrid	Y
Martin Redhead	Project Engineer	TransGrid	Y
Myra Nolan	Design Review Manager	TransGrid	Y
Josh Caruana	Project Manager	CPP	Y
Ryan O'Connell	Ops Lead PM	PCL	PartTime
Paul Cannington	HSE Mgr	PCL	Y
Brendan Lloyd	Eng. & Commissioning Manager	PCL	Y
Sri Sahaarenghan	Project Manager	PCL	Y
Landon Douglas	Construction PM	PCL	Y
Jeff Ewert	Senior Construction Manager	PCL	PartTime
Nicole Percy	Corridor Technical Officer	APA Group	Y
Paul Walters	Senior Risk Engineer	APA Group	Y
Ian Boyd	Senior Technical Officer	APA Group	Y

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5. APPROACH AND METHODOLOGY

5.1 Approach

The Australian Standard AS 2885.1–2018 & AS2885.6-2018 describes the requirements for pipeline SMS including:

- Threat identification.
- Application of physical, procedural and design controls for each credible threat.
- Review of threat control; and
- Assessment of residual risk from failure threats.

The SMS process focuses on eliminating threats to pipeline integrity from location specific and non-location specific activities, present and future, and conditions foreseeable, including likely land use, during the pipeline operational phase. Where failures are assessed as possible after the application of control measures, risk assessment is undertaken for the relevant threat, and it must be demonstrated that the risks are 'as low as reasonably practicable' (ALARP).

5.2 Methodology

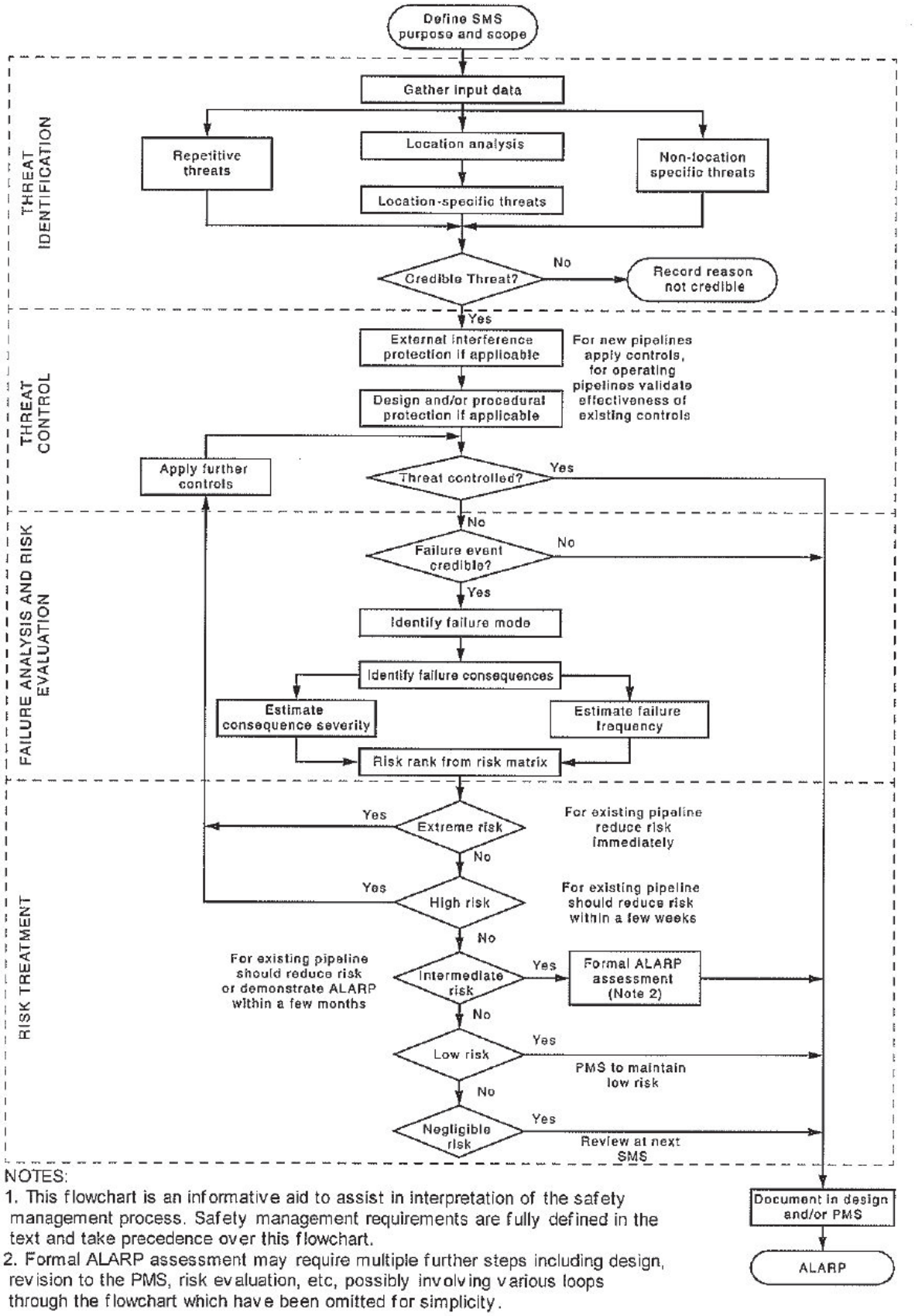
Prior to the SMS workshop being convened, APA, and the Client teams prepared a range of relevant information to be presented to the workshop.

All threats developed prior to the SMS workshop were documented in a spreadsheet and presented to the workshop. Changes or additions to the threats and risk mitigations were recorded directly into the spreadsheet. Additional actions not related to particular threats were also recorded.

A copy of the Walla Walla Solar Farm Development was available to the workshop electronically as were all other documents referenced in the TOR Document.

The SMS study is based on the risk assessment process defined in AS 2885.6–2018 and in particular the Flowchart presented in the Standard and referenced below.

Figure 3 - AS2885.6 Risk Assessment Process



5.3 Location Classification

The AS 2885.6 – 2018 definition of Location Class is “The classification of an area according to its general geographic and demographic characteristics, reflecting both the threats to the pipeline from the land usage and the consequences for the population, should the pipeline suffer a loss of containment”. For the selection of location class, the area along the pipeline route and the surrounding land uses are considered.

Classification of locations is defined in AS 2885.6-2018, Section 2.2.

The primary location class reflects the population density of the area. It is defined based on an analysis of the predominant land use in the broad area traversed by the pipeline/s. There are four primary location classes to select from, as described in, Appendix B. One or more secondary location classes, reflecting special uses, may also apply to an area, as described in, Appendix B. Changes in location class occur when there are changes in land use planning along the route of existing pipelines.

Where this occurs a safety assessment (SMS) shall be undertaken, and additional control measures implemented until it is demonstrated that the risk from loss of containment involving a rupture is As Low As Reasonably Practical “ALARP”.

The assessment shall include analysis of at least the alternatives of the following:

a) MAOP reduction.
b) Pipe replacement (with no rupture pipe).
c) Pipeline relocation.
d) Modification of land use; and
e) Implementing physical and procedural protection measures that are effective in controlling threats capable of causing rupture of the pipeline.

5.4 Threat Identification

The threat identification process seeks to list all location specific and non-location specific threats with the potential to:

- Damage any of the pipelines.
- Cause interruption to service for any of the pipelines.
- Cause release of fluid from any of the pipelines; or
- Cause harm to pipeline operators, the public or the environment.

Prompts are used to aid the team, drawn from the Standard, and include the most commonly identified threats for gas and liquid petroleum pipelines. The threat prompts are provided in Appendix C.

Threats determined to be non-credible are documented, along with the reasoning.

5.5 Threat Control

For each credible threat identified in the previous step, effective controls are listed. Controls are considered effective when failure as a result of that threat has been removed for all practical purposes.

For external interference threats, physical and procedural controls are required, and the minimum number of effective controls required for a threat depends on the location class, as shown in, Appendix C. The categories of physical and procedural are also displayed in Appendix C.

For all other threats, design and/or procedures are required.

To assist in the analysis and in determining if controls are effective (e.g., pipeline wall thickness), pipeline calculations can be completed. The pipeline calculations establish:

- The maximum excavator size and teeth that can be used during construction to ensure the pipelines are not compromised; and
- Radiation contours (distances) of interest for full bore rupture incidents

A radiation of 4.7 kW/m2 will cause injury (at least second-degree burns) after 30 seconds exposure. Therefore, for example, it is preferred that there are no sensitive groups located within range of a pipeline's 4.7 kW/m2 measurement length as these population groups may be unable to be evacuated or to seek shelter.

5.6 Residual Threats Risk Assessment

For threats where failure is still possible despite the control measures, and no further threat controls can be applied, an assessment of the residual risk is undertaken. This is completed by:

- Assessment of the severity of the consequence of a failure event
- Analysis of the frequency of occurrence of the failure event and
- Risk ranking

The results of the risk ranking determine the required treatment action for the threat. Refer to the Risk Matrix in Appendix D.

If the risk of a particular threat cannot be considered to be low or negligible according to recognised industry risk matrix then further investigation of the threat will take place to confirm that the risk is "As Low As Reasonably Practical" (ALARP).

At the end of the Workshop, participants will be required to form an opinion on the quality of the SMS presented for review, and to reach a conclusion as to whether the SMS satisfies the requirements of AS 2885.6.

Actions noted in the minutes during the course of the SMS workshop will fall into two general categories, those requiring close out before the change in land use can proceed and those that will form part of the future Pipeline Integrity Management Plan (PIMP) or equivalent.

An SMS Report (this report) is produced following the workshop to capture proceedings of the workshop and highlight key decisions or issues. It will also contain all the threats and their associated mitigations and/or agreed actions.

5.7 Specific Approach for this Study

Under AS2885, the pipeline under consideration for this study has its own existing pipeline SMS database which covers the existing known threats and controls for the pipeline based on the existing land use for the development site.

The focus of this study is to ensure the safe operation and maintenance of the pipeline under AS2885 when considering the potential new threats or changes to existing threats resulting from construction of, and long-term presence of, the Walla Walla Solar Farm Development proposed at this SMS Workshop.

6. AS 2885 LAND USE REQUIREMENTS

6.1 Measurement Length

The concept of Measurement Length (ML) is a key parameter in assessments of land use changes such as the Walla Walla Solar Farm Development.

The measurement length of a pipeline is defined in AS 2885.6 Appendix B1 as the radius of the 4.7 kW/m2 radiation contour for a full-bore rupture. At this distance it is expected that an able bodied and clothed person is likely to sustain 2nd degree burns within 30 seconds if they were to remain in the area. This is derived from calculations of the heat radiation intensity if a full-bore rupture of the pipeline is ignited.

A related parameter is the radiation contour for a heat radiation intensity of 12.6 kW/m2. At this distance it is expected that an able bodied and clothed person would sustain 3rd degree burns and life-threatening injuries within 30 seconds if they were to remain in the area.

These distances are calculated for each pipeline, and used in the assessment of land uses, both existing and planned for new and operational pipelines. AS2885.6 provides that the assessment of an existing pipeline's Location Class is based on land use within the measurement length.

The practical outcomes of the above are that for land use changes around an existing pipeline, such as the Walla Walla Solar Farm development, the SMS Workshop assesses the population density and proposed activities of the land within the measurement length to determine what risks are present.

The SMS Workshop assesses the level of existing (and possible new) protections required to protect against interference and other threats necessary to keep the pipeline and the people around the pipeline safe.

Sensitive use activities such as places where people congregate, and/or have limited means of escaping from a pipeline incident and fire (shopping centres, sports stadiums, schools, childcare, aged care facilities etc) within the measurement length impose the most stringent protection requirements on the pipeline, to the extent that significant measures are required to ensure that rupture of the pipe is not a credible event.

6.2 AS 2885.6 – Location Class Assessment

AS 2885.6 2018 is the Australian Standard that governs the management of safety & risk around and associated with petroleum pipelines, including transmission pressure (>1050kPag) natural gas pipelines. Within the Standard there are four Primary zones discussed, ranging from R1 – relatively remote, undeveloped land, through R2 (rural residential), and T1 (typical suburban development) to T2, which is intense multi-storey or CBD areas. There are also Secondary zones defined that categorise land use into heavy industrial (HI) or light industrial (I), common infrastructure corridor (CIC), crowds (C), or Sensitive (S) use. A copy of Section 2 of AS2885.6 is included in Appendix B of this document for reference.

A fundamental principle of AS2885.6 is that pipeline safety management and safe operation are on-going imperatives during the life of the pipeline and must be actively supported and documented by the pipeline licensee. This places on-going obligations on a pipeline licensee to operate and maintain robust systems, plans and procedures during the pipeline's operational phase.

A review of any transmission pressure gas pipeline is undertaken as a minimum every 5 years under AS2885 but is also triggered under the standard if there is a change in the design or operation of the pipeline or a change in land use within the Measurement Length of the pipeline that increases the likelihood or consequences of a FAILURE EVENT.

With respect to the Location Class Assessment for the pipeline impacted by the development the existing R1 (Rural) Primary Location Class is still valid given population density within the ML is not considered to be changing as a result of the development.

An additional Secondary Location Class of HI (Heavy Industrial) was discussed and agreed at the SMS to acknowledge the major substation facility within 50m of the pipeline. The substation provides a major source of ignition in the event of a loss of containment and would itself likely be compromised in such an event preventing the generation of power to the local power grid. APA confirmed during the SMS Workshop that by the application of HI, APA would in turn ensure the local area would be treated in equivalent terms as if it was an R2 Primary Location Class.

Table 4, Pipeline Location Class Details

		Current Location Class		Proposed Location Class			
Pipeline Licensee	**Pipeline Licence**	**Primary Location Class**	**Secondary Location Class**	**Primary Location Class**	**Secondary Location Class**	**KP point (km)**	**Reason for change**
APA	PL24 (Route Plan T99)	R1	-	R1	HI	KP229.3 to KP230.0	Change in land use within ML

7. PHYSICAL AND PROCEDURAL PROTECTION MEASURES

7.1 AS 2885 Requirements

For pipeline Location Class T1, T1/S or T2 the design requirements against External Interference Threats within AS2885 seek to have a minimum of two physical protection measures and two procedural measures wherever possible.

7.1.1 Physical Protection

Physical protection measures comprise:

- Separation of external interference activities from the pipeline – exclusion of activities which may damage the pipeline. Typically, these are excavation activities by third parties, but can also include intensive vibration such as might be employed during the construction of roads and other infrastructure. Typical separation measures include burial, exclusion of the public or third parties from the pipeline alignment or barriers.
- Resistance to penetration, such as adequate wall thickness to resist the identified excavation equipment threats, or again a barrier to penetration.
- Concrete slabbing directly above pipelines is one barrier method that is accepted to provide adequate exclusion as a second physical barrier, particularly where a pipeline is at risk of holing or rupture due to the known threats. The concrete slab usually has a minimum width of the nominal pipeline diameter plus 600 mm either side and shall be placed a minimum of 300 mm above the pipeline. This solution is usually paired with marker tape installed above the concrete slab to warn of what is underneath the slab.
- A Concrete footpath or bike path over the pipeline or buried HDPE slabs can also be acceptable forms of physical protection under certain circumstances when a pipeline is within a linear open space.

7.1.2 Procedural Measures

Procedural mitigation measures which are recognised by AS 2885 comprise:

- Pipeline Awareness activities, such as marker signs, dial-before-you dig service (DBYD), third party liaison programs to inform other parties of the presence of the pipeline and consequences of damage, and activity agreements with other entities.
- External interference detection measures such as pipeline patrolling, planning notification zones and remote intrusion detection. The most common for existing pipelines are the first two. Remote intrusion detection is usually only implemented at pipeline facilities such as valve or city gate stations. APA have a nominated patrol frequency of every weekday in this area

8. PIPELINE TECHNICAL DETAILS

The SMS focused on the section of pipeline within and adjacent to the subject land. The pipeline's technical details and resistance to penetration data in the area can be summarised as follows:

Table 5, APA Group Pipeline PL24 - Technical Details

Substance conveyed	Natural Gas
Pipeline License No.	Lic 24, T99
Measurement Length (ML)	463m (4.7 kW/m2 Heat Radiation Zone)
	283 (12.6 kW/m2 Heat Radiation Zone)
Length of pipeline affected	718 m + 2 x 463m (Total 1644m approx)
Pipeline section under review within PSP	~KP229.3 to 230.0 (Plus ML each end)
Outside Diameter	457 mm
Easement	Permit required within pipeline easement
Wall Thickness	6.8mm & 8.1mm & 9.7mm
Depth Of Cover	0.9-1.2m
Pipe specification	API 5L X70 (with Yellow Jacket Extruded Polyethylene coating)
Max. Allowable Operating Pressure	10200 kPa (MAOP)
Location Class - Primary	R1
Location Class – Secondary	HI (New)
CDL	82mm
Credible hole size for Excavator	30mm (Tiger Teeth)
Credible hole size for Auger	50mm
Hole size & ML based on 10GJ/s release rate	122mm
30mm Hole size ML	50m
50mm Hole size ML	84mm

The pipeline excavator risk can be summarised as follows:

Table 6, Excavator Risk PL24

Max equipment sizes without risk of a leak: -	
Excavator with std bucket	N/A (>55T)
Excavator with Single Tiger Tooth	25T
Excavator with Twin Tiger Tooth	N/A (>55T)
Excavator with Penetration Tooth	Not credible for the area
Max equipment sizes without causing rupture: -	
Excavator with std bucket	N/A (>55T)
Excavator with Single Tiger Tooth	N/A (>55T)
Excavator with Twin Tiger Tooth	N/A (>55T)
Excavator with Penetration Tooth	Not credible for the area

9. WORKSHOP RESULTS

The workshop team reviewed the Development proposed and confirmed that the existing R1 Primary Location Class for the APA pipeline is appropriate. An additional Secondary Location Class of HI (Heavy Industrial) was discussed and agreed at the SMS to acknowledge the major substation facility within 50m of the pipeline.

The workshop facilitator pre-populated an SMS Risk Register prior to the workshop using the threats listed in Appendix C as a guide when considering the Development. Thirty Seven (37) Threats were specifically considered for comments on the day of the Workshop. The other Threats listed in Appendix C were either unaffected or irrelevant to the Development and not expected to change the frequency of these threats occurring.

The results of the 37 Threats specifically considered can be summarised as follows: -

Table 7, Risk Assessment Summary

Pipeline	Threats Considered	Threats		Threats Requiring Risk Assessment	Risk Assessment		
		Non-Credible	Credible		Negligible	Low	Intermediate
PL24	37	9	28	7	3	4	-

The workshop results were recorded in the minutes, provided in Appendix H.

10. DISCUSSION

The following details were provided by APA and the Client to aid in the assessment of the risks and consequences at the SMS Workshop.

1. APA advised that the section of pipeline under review (part of an approximately ~20km isolatable section of pipeline) is a key part of the transmission gas network between Victoria and NSW but is not the only connection and as such if there was to be a loss of containment the shortfall would be able to be made up from other sources under most circumstances will minimal impact on the general public.
2. The Client confirmed that: -
    a. The substation bored piling up to 900mm in diameter and up to 2.4m deep would take place some 50m+ from the pipeline.
    b. They intended to use excavators up to 30T with tiger teeth during the works but confirmed that they would not use tiger teeth over the easement.
    c. Solar panel piling was planned to be a “driven I beam pile” up to 2m deep relatively adjacent to the pipeline easement. Discussion was had with respect to the Client undertaking test piling to determine the likely vibration from such piling so APA can advise whether it is acceptable w.r.t. maintaining the integrity of their pipeline.
    d. They intend to provide temporary fencing of the easement during the works and some form of permanent easement fencing to prevent uncontrolled crossing of the pipeline easement.
    e. They advised that substation works was planned to begin after March 2022. They will advise APA when the solar panel works are going but noted that they can start that work from the eastern side of the development to allow time to demonstrate their construction technique and plan the works more thoroughly when working next to the pipeline easement.

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11. ACTIONS

There were 9 Actions identified during the SMS Workshop and listed in the table below.

APA will require all actions to be documented as they are closed out with a description of what actions were taken and any documented supporting evidence being a plan, calculation, updated drawing etc. All close out material provided by the Client or a third party is to be provided to APA's representative for review and approval/acceptance.

Table 8, Action List

Miscellaneous Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
A1	Construction of the Development could damage the pipelines	Developer to facilitate preparation of a Construction Management Plan, for review and comment by APA (pipeline licensee) prior to any third party works.	FRV/APA	Prior to works starting
A2	Contractors may no be familiar with working around TP Gas Pipelines	Engage in a –Third Party Works - Safety Awareness Session, either as a toolbox or zoom meeting	FRV/APA	Prior to works starting
A3	Site fencing restricts APA access to Easement	Provide gates to allow APA access to easement	FRV/APA	Prior to works starting
A4	Pipeline coating/wall defect in the area of the works and the works prevents future repair.	Review recent ILI data and undertake DCVG in the area to identify if there are any known defects in the area of the Works and undertake repair as necessary prior to FRV works proceeding. APA to advise FRV of timeline if any repairs are required	FRV/APA	28/02/2022
A5	Existing slabbed road crossings are old and may not be suitable for loads required by Works	FRV to provide a list of likely vehicle loads on Benambra or Schneider Rd to allow APA to confirm the existing road crossings are capable of managing the loads	FRV/APA	Prior to works starting
Threat Specific Actions				
No.	**Issue**	**Action**	**By**	**Due Date**
ID11	Boring and Driving of Piles for building footings. Vibration from works damages the coating leading to corrosion and failure of the pipe	Undertake test piling to confirm vibration limit at pipe does not exceed 20mm/s. May need to use augering of piles if there is a problem meeting the vibration limit.	PCL/APA	Before any solar farm footings are started
ID19	Road Crossing (access track). Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	Provide acceptable fencing along easement to prevent random use of the easement as an access track by third parties	FRV/APA	prior to completion of works
ID23	CP interference from adjacent, parallel infrastructure or construction works. CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	Electrical Interference Study (AS4853) needs to be completed for APA review (touch potential and CP design assessments)	FRV/APA	prior to completion of design
ID24	Substation current injection testing simulates a fault in the system. CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	APA to arrange access to local CP test point	FRV/APA	prior to completion of works & energisation (2023)

12. CONCLUSION

A Safety Management Study (SMS) was undertaken to review whether additional protection measures are required to mitigate the risks associated with the Walla Walla Solar Farm Development as per the requirements of the Australian Standard AS2885 for Transmission Pressure Gas Pipelines.

This report summarises the following aspects considered at the SMS:

- The nature of the pipeline in question
- The key land uses proposed by the Development that is located near the pipeline
- Review the Location Classification of the pipeline resulting from the Development
- Review AS2885 requirements for the agreed Location Classification
- Threats requiring a Risk Assessment and the findings of those Assessments
- Actions required to ensure the ongoing safe operation and maintenance of the pipelines in compliance with AS2885
- Implications for preparing the Development.

The review was successfully carried out in accordance with the requirements of AS 2885.6 -2018. The workshop was attended by key operations, maintenance, and engineering personnel. The study team comprised a broad cross-section of responsibility, knowledge and experience with the proposed Development and the affected Pipeline, and therefore possessed sufficient knowledge and experience to carry out an effective workshop review.

The SMS undertaken is considered to be a Land Use Change SMS.

Continuing liaison between the Client, Third Party Utilities and APA should ensure that construction and post construction activities pose no significant increase in the operational and maintenance risk to the transmission pipeline running past the Development.

Upon satisfactory close out of the actions raised from this SMS Workshop and completion of the relevant Project Lifecycle SMS studies required under AS2885.6-5.6, it can be confirmed that the requirements of AS2885.6-2018 are met and that the APA assets under review will continue to be in compliance with the SMS requirements of AS2885.6-2018 in the Development area.

APPENDIX A: Attendance List

Table 9, Participants

Name	Position	Organisation	Attendance
Mark Harris	Facilitator	DRMC	Y
Zach Tariq	Project Manager	FRV	Y
Alan Robinson	Head of Construction	FRV	Y
Vida Kavehei	Project Coordinator	FRV	Y
Rob Hamilton	Project Director	SMEC	PartTime
Nicholas Rudland	Electrical Lead	SMEC	Y
Kym Huddart	Civil Lead	SMEC	Y
Basil Turk	Project Manager	TransGrid	Y
Martin Redhead	Project Engineer	TransGrid	Y
Myra Nolan	Design Review Manager	TransGrid	Y
Josh Caruana	Project Manager	CPP	Y
Ryan O'Connell	Ops Lead PM	PCL	PartTime
Paul Cannington	HSE Mgr	PCL	Y
Brendan Lloyd	Eng. & Commissioning Manager	PCL	Y
Sri Sahaarenghan	Project Manager	PCL	Y
Landon Douglas	Construction PM	PCL	Y
Jeff Ewert	Senior Construction Manager	PCL	PartTime
Nicole Percy	Corridor Technical Officer	APA Group	Y
Paul Walters	Senior Risk Engineer	APA Group	Y
Ian Boyd	Senior Technical Officer	APA Group	Y

APPENDIX B: Classification of Locations

In order to determine the location class, the Standard AS2885 requires that the population, activities, and environment be assessed within a distance described as the "measurement length (ML)" from the centre of the pipeline. For gas pipelines in particular, where the most serious outcome is either injury or fatality due to radiation from an ignited gas leak, the measurement length is deliberately and conservatively defined in AS 2885.1, Cls 4.3.2 as the radius of the 4.7 kW/m2 radiation contour for an ignited full-bore rupture calculated in accordance with Clause 4.10. Clause 4.10 states that the calculation is to assume that the pipeline is at Maximum Allowable Operating Pressure (MAOP) at the time of release. A full-bore rupture is a hole which is equivalent to the diameter of the pipeline.

It is important to understand that the measurement length is used to define the corridor around the pipeline that must be considered to determine location classification, regardless of whether a full-bore rupture at MAOP is credible or not.

As is required by the Standard, consideration has been given to future development along the pipeline route both within and outside the pipeline measurement length when assessing the pipeline classification.

For any given location classification, AS 2885 defines minimum compliance requirements. As the consequence of a pipeline failure increases and location classification changes, the requirements of AS 2885 become more stringent. The various Location Classes under the Standard are outlined below

AS2885.1-2012 gives four primary location classes:

R1 - Rural - Land that is unused, undeveloped or is used for rural activities such as grazing, agriculture and horticulture.

R2 - Rural Residential - Land that is occupied by single residence blocks typically in the range 1 to 5 ha**.**

T1 - Residential - Residential applied where multiple dwellings exist in proximity of other dwellings and are surveyed by common public utilities**.**

T2 - High Density - multi storey dwellings where a large number of people congregate.

In addition, AS2885.1-2018 gives five secondary location classes:

S – Sensitive Use: where consequences of a failure may be increased due to use by a community unable to protect themselves from consequences of pipeline failure. Schools, hospitals, aged care facilities and prisons within the pipeline measured length are examples of this classification. The requirements are as for T2**.**

I – Industrial: Manufacturing, processing, maintenance, storage, or similar activities. These are assigned to any portion of land immediately adjoining the pipeline. The requirements are for T1.

HI – Heavy Industrial: Heavy industry or toxic industrial use. Require assessment of any threats to the pipeline or may cause pipeline failure to escalate. Depending on assessment R2, T1 or T2 may apply**.**

CIC – Common Infrastructure Corridor: Multiple infrastructure development within a common easement or reserve or in easements which are in close proximity. A CIC secondary classification places the following requirements on the pipeline owner/operator - To control the activities that take place in the CIC easement some form of agreement should be in place.

APPENDIX C Threats & Controls

Table 10, Threat Identification Prompts

CATEGORY	THREAT
External Interference	Excavation - related to construction
	Excavation - without consent
	Excavation - private landowners post construction (e.g., ploughing, ripping, or trenching)
	Power augers and drilling
	Cable installation ripping & ploughing
	Pipeline access for maintenance activities
	Installation of posts or poles
	Land use development - pavement works, road surfacing &/or grading
	Land use development - landscaping
	Deep ploughing or drilling around pipeline (horizontal)
	Vehicle or vessel impact - during construction
	Vehicle or vessel impact - during ongoing use of the road
	Vehicle or vessel impact - rail
	Vehicle or vessel impact - aircraft crash
	Damage from bogged vehicles or plant
	External loads from backfill or traffic
	Blasting
	Blasting - seismic survey for mining using explosives
	Anchor dropping & dragging
	Other - soil testing with penetrometer
	Other - methane from contaminated land ignited by site works (e.g., welding)
	Other - creeping movement of slope (geotechnical risk)
	Other - loading from the buildings
	Other - Vibration due to piling
Corrosion	External corrosion or erosion due to environmental factors
	Internal corrosion due to contaminants
	Internal erosion
	Environmentally assisted cracking / stress corrosion cracking
	Bacterial corrosion
	Other - stray current corrosion
	Other - CP testing performed incorrectly and potential for corrosion.
	Other - low frequency induction from parallel HV power lines or earthing bed
Natural Events	Earthquake
	Ground movement - land subsidence, soil expansion / contraction
	Ground movement - land subsidence causing breakage of water
	pipelines in region of gas pipe
	Wind and cyclone
	Bushfires
	Lightning
	Flooding or inundation
	Erosion of cover or support
	Other – tsunami or volcanic eruption
CATEGORY	**THREAT**

Operations & Maintenance	Exceeding MAOP of pipeline
	Incorrect operation of pigging
	Incorrect valve operating sequence
	Incorrect operation of control & protective equipment
	Bypass of logic, control or protection equipment followed by incorrect manual operation
	Fatigue from pressure cycling
	Inadequate or incomplete maintenance procedures
	Maintenance actions contrary to procedures
	Incident due to inadequate, incorrect, or out of date operating or maintenance procedures
	Inadequate servicing of equipment
	Other - inaccurate test equipment, leading to incorrect settings
	Other - overpressure control system failure
	Other - pipe vibration (e.g., underground due to road works)
	Other - failure to adequately manage and implement changes to assets
	Other - incident caused due to project records, as built records and installed material records being lost, ignored, or not maintained
	Other - inaccurate measurement equipment or equipment not calibrated
	Other - inadequate emergency management
	Other - live welding
Design Defects	Incorrect material, component, and equipment characteristics
	Incorrect design or engineering analysis
	Failure to define correct range of operating conditions
	Failure of design configuration and equipment features to allow for safe operations & maintenance
	Other - design for corrosion
	Other - stresses in places that are not earth anchored areas
Material Defects	Incorrectly identified components
	Incorrect specification, supply, handling, storage, installation, or testing
	Under-strength pipe
	Manufacturing defect
	Lack of adequate inspection & test procedures
Construction Defects	Undetected of unreported damage to the pipe, coating, or equipment
	Undetected or unreported critical weld defects
	Failure to install the specified materials or equipment
	Failure to install equipment using the correct procedures or materials
	Failure to install equipment in accordance with the design
	Failure to install the pipeline in the specified location or manner
	Inadequate testing of materials for defects prior to handover
Intentional Damage	Sabotage / Terrorism / Malicious Damage / Vandalism
Other - environmental	Soil excavation
	Ground water and soil contamination from fuel and other chemicals used on site during construction
	Escape of liquid fuel to ground water and soil contamination

Table 11, External Interference Protection – Physical Controls

CONTROL	METHODS	EXAMPLES
SEPARATION	BURIAL	
	EXCLUSION	FENCING
	BARRIER	BRIDGE CRASH BARRIERS
RESISTANCE TO PENETRATION	WALL THICKNESS -	
	BARRIER TO PENETRATION	CONCRETE SLABS CONCRETE ENCASEMENT CONCRETE COATING

Table 12, External Interference Protection – Procedural Controls

CONTROL	METHODS	EXAMPLES
PIPELINE AWARENESS -	LANDOWNER	
	THIRD PARTY LIAISON	LIAISON PROGRAM INCLUDING ALL RELEVANT PARTIES
	COMMUNITY AWARENESS PROGRAM	
	ONE-CALL SERVICE	
	MARKING	SIGNAGE
		BURIED MARKER TAPE
	ACTIVITY AGREEMENTS WITH OTHER ENTITIES	
EXTERNAL INTERFERENCE DETECTION	PLANNING NOTIFICATION ZONES	PLANNING NOTIFICATION REQUIRE BY LAW
	PATROLLING	SYSTEMATIC PATROLLING OF THE PIPELINE
	REMOTE INTRUSION MONITORING	DETECTION AND ALARM BEFORE THE PIPELINE IS DAMAGED

APPENDIX D AS2885 Part6 Risk Assessment

The AS2885 Risk Assessment we used to undertake any risk assessments is provided below

TABLE 3.1

SEVERITY CLASSES

Dimension	Severity class				
	Catastrophic	Major	Severe	Minor	Trivial
	Measures of severity				
People	Multiple fatalities result	One or two fatalities; or several people with life-threatening injuries	Injury or illness requiring hospital treatment	Injuries requiring first aid treatment	Minimal impact on health and safety
Supply (see Note)	Widespread or significant societal impact, such as complete loss of supply to a major city for an extended time (more than a few days)	Widespread societal impact such as loss of supply to a major city for a short time (hours to days) or to a localized area for a longer time	Localized societal impact or short-term supply interruption (hours)	Interruption or restriction of supply but shortfall met from other sources	No loss or restriction of pipeline supply
Environment	Impact widespread; viability of ecosystems or species affected; or permanent major changes	Major impact well outside PIPELINE CORRIDOR or site; or long-term severe effects; or rectification difficult	Localized impact, substantially rectified within a year or so	Impact very localized and very short-term (weeks), minimal rectification	No effect; or minor impact rectified rapidly (days) with negligible residual effect

NOTE: Appendix G provides guidance on assessment of consequence severities.

3.5.3 Frequency analysis

A frequency class shall be assigned to each FAILURE SCENARIO. The frequency class shall be selected from Table 3.2.

The contribution of existing controls to the prevention of failure shall be considered in assigning the frequency class.

NOTE: Appendix F provides guidance on estimating frequencies.

TABLE 3.2

FREQUENCY CLASSES

Frequency class	Frequency description
Frequent	Expected to occur once per year or more
Occasional	May occur occasionally in the life of the pipeline
Unlikely	Unlikely to occur within the life of the pipeline, but possible
Remote	Not anticipated for this pipeline at this location
Hypothetical	Theoretically possible but would only occur under extraordinary circumstances

3.5.4 Risk ranking

Table 3.3 shall be used to combine the results of the consequence analysis and the frequency analysis to determine the risk rank.

Use of the risk matrix in Table 3.3 is mandatory for SAFETY MANAGEMENT STUDIES in accordance with this Standard. Other methods such as a corporate risk matrix may be used only in parallel with Table 3.3 or as part of a separate corporate RISK ASSESSMENT.

TABLE 3.3

RISK MATRIX

	Catastrophic	Major	Severe	Minor	Trivial
Frequent	Extreme	Extreme	High	Intermediate	Low
Occasional	Extreme	High	Intermediate	Low	Low
Unlikely	High	High	Intermediate	Low	Negligible
Remote	High	Intermediate	Low	Negligible	Negligible
Hypothetical	Intermediate	Low	Negligible	Negligible	Negligible

NOTE: Comparative studies sponsored by the Energy Pipelines Cooperative Research Centre have shown that for risks ranked as Intermediate, Table 3.3 produces results consistent with both reliability-based analysis (in accordance with Annex O of CSA Z662-07) and quantitative risk assessment. Use of a different risk matrix or method that has not been similarly calibrated may produce invalid results.

3.6 RISK TREATMENT

3.6.1 General

Action to reduce risk shall be taken in accordance with Table 3.4, based on the risk rank determined from Table 3.3.

The action(s) taken and the planned effect on risk shall be documented.

3.6.2 Risk treatment during design

Risk treatment actions at design stage may include the following:

(a) Relocation of the pipeline route.

(b) Modification of the design for any one or more of the following:

  (i) PIPELINE SYSTEM isolation.

  (ii) PHYSICAL CONTROLS for prevention of external interference.

  (iii) PROCEDURAL CONTROLS for prevention of external interference.

  (iv) Corrosion prevention.

  (v) Operational controls.

TABLE 3.4

RISK TREATMENT ACTIONS

Risk rank	Required action
Extreme	Modify the THREAT, the frequency or the consequences so that the risk rank is reduced to Intermediate or lower. For an in-service pipeline, the risk shall be reduced immediately.
High	Modify the THREAT, the frequency or the consequences so that the risk rank is reduced to Intermediate or lower. For an in-service pipeline, the risk shall be reduced as soon as possible. Risk reduction should be completed within a timescale of not more than a few weeks.
Intermediate	Repeat THREAT identification and risk evaluation processes to verify the risk estimation; determine the accuracy and uncertainty of the estimation. Where the risk rank is confirmed to be "intermediate", where reasonably practicable modify the THREAT, the frequency or the consequence to reduce the risk rank to "low" or "negligible". Where it is not reasonably practicable to reduce the risk rank to "low" or "negligible", action shall be taken to— (a) remove THREATS, reduce frequencies and/or reduce severity of consequences to the extent practicable; and (b) formally demonstrate ALARP (see Section 4). For an in-service pipeline, the reduction to "low" or "negligible" or demonstration of ALARP shall be completed as soon as possible. Risk reduction or demonstration of ALARP should be completed within a few months.
Low	Determine the management plan for the THREAT to prevent occurrence and to monitor changes that could affect the classification.
Negligible	Review at the next relevant SMS (for periodic operational review, LAND USE CHANGE, ENCROACHMENT, or change of operating conditions).

3.6.3 Risk treatment during operation and maintenance

Risk treatment actions at operating pipeline stage may include one or more of the following:

(a) Installation of additional or modified PHYSICAL CONTROLS.

(b) Additional or modified PROCEDURAL CONTROLS.

(c) Specific actions in relation to identified activities (e.g. presence of operating personnel during activities on the easement).

(d) Modification to pipeline marking.

(e) Changes to the isolation plan.

(f) Changes to the PIPELINE SYSTEM design or operation to satisfy the requirements of this Standard when there is a change to the LOCATION CLASS of the pipeline.

(g) Specific operational or maintenance procedures.

(h) Repair, remediation or removal of a condition or DEFECT that presents a THREAT.

THREAT treatment for operating PIPELINE SYSTEMS should consider interim control measures (e.g. reduction in operating pressure, access restrictions) to allow time for the implementation of permanent control measures (e.g. repair).

APPENDIX E: Documents and References for Workshop

The documents referenced at the SMS workshop are listed below.

Table 13, Documents & References for Workshop

Document Name	Document Number
General Arrangement Plan	WWSF-SMEC-CW-DWG-001 Rev 01
Transgrid Substation Fencing and Gate Plan and Details	WWSF-SMEC-CW-DWG-011 Rev 01
MV Cable Route Plan Option A Cable Trench	WWSF-SMEC-EL-DWG-020 RevA
MV Cable Route Plan Option B Cable Trench	WWSF-SMEC-EL-DWG-021 RevA
MV Cables Typical Trench Sections Sht1	WWSF-SMEC-EL-DWG-022 RevA
MV Cables Typical Trench Sections Sht2	WWSF-SMEC-EL-DWG-023 RevA
Typical Earth Design Substation	WWSF-SMEC-EL-DWG-024 RevA
Pipeline Penetration Calc	Penetration Resistance Calculation T99
Pipeline Radiation Contour Calc	Heat Radiation Release Calculation T99
Pipeline Route Plan & Longitudinal Section	T99-15/14

The legislative references for this Workshop are listed below: -
Victoria

- Pipelines Act 2005
- Pipelines Regulations 2017

The Industry Standards referenced for this Workshop are listed below: -

- AS 2885.0 :2018 Gas and liquid petroleum General requirements
- AS/NZS 2885.1:2018 Gas and liquid petroleum Design & Construction
- AS2885.3 :2012 Gas and liquid petroleum Operations and Maintenance
- AS/NZS 2885.6:2018 Pipelines - Gas and liquid petroleum - Pipeline safety management

APA Pipeline Management System - Volume 1 Introduction – dated 3/11/16 Section 2 Coverage states that when conflict exists between the various applicable documents, the following order shall apply, in decreasing order of precedence. Where APA requirements are more stringent, they shall take precedence.

- Acts of law or other legislation
- Government licenses and permits
- APA Engineering Standards. This will be covered by documented practices and any specific inputs from APA risk assessments
- Local engineering standards

APPENDIX F: SMS Terms Of Reference

Delphi Risk Management Consulting

FRV Services Australia Pty Ltd

Walla Walla Solar Farm, NSW

SMS Workshop Terms of Reference

DRMC Ref Number: 2021-0008-REP-001

Current Revision

Revision:	Reason for Revision:	Revision Date: 7/12/2021	
Rev No.0	Issued for SMS workshop		
Prepared By:	Mark Harris	Signature:	
Approved By:	Mark Harris	Signature:	

Revision History

Rev	Revision Date	Reason for Revision	Prepared By	Approved By
0	7/12/2021	Issued for Use	MAH	MAH

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ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APA	APA Group (Pipeline Licensee)
AS	Australian Standard
CDL	Critical Defect Length
CIC	Common Infrastructure Corridor
CMP	Construction Management Plan
CTE	Coal Tar Enamel
DBYD	Dial Before You Dig
DET	Department of Education & Training
DRMC	Delphi Risk Management Consulting – SMS Facilitator
DN	Diameter nominal
DOC	Depth of Cover
EIP	External Interference Protection
FRV	Project Developer
GIS	Geographical Information System
GJ/s	Gigajoules per Second (energy release rate)
HDD	Horizontal Directional Drill (used for installation of utilities under existing assets)
km	Kilometre(s)
KP	Kilometre Point
kW/m2	Kilowatts per metre squared (heat radiation flux)
LC	Location Class
LOPA	Layers of Protection Analysis
m	Metre(s)
MAOP	Maximum Allowable Operating Pressure
ML	Measurement Length (4.7 kW/m2 radiation contour in the event of a full-bore rupture of the pipeline)
MLV	Main Line Valve
PIMP	Pipeline Integrity Management Plan
PL	Pipeline License
PPV	Peak Particle Velocity, related to degree of ground movement or vibration.
R1	Rural location classification
R2	Rural Residential location classification
ROW	Right of Way
RTP	Resistance to Penetration
S	Sensitive Use location classification
SAOP	Safety and Operating Plan
SLC	Secondary Location Class
SMS	Safety Management Study
SMYS	Specified Minimum Yield Stress
T1	Residential location classification
T2	High Density location classification
TP	Transmission Pipeline
TOR	Terms of Reference
WT	Wall Thickness

1 INTRODUCTION

Delphi Risk Management Consulting (DRMC) is pleased to support FRV Services Australia Pty Ltd (FRV) (and their contractors SMEC and Transgrid) in facilitating a Safety Management Study for the proposed Walla Walla Solar Farm development in Walla Walla, NSW, some 540km south west of Sydney.

The proposed development is positioned ~6km north east of Walla Walla township and has the Barnawartha-Culcairn Transmission Pressure Gas Pipeline (TP99, PL24) running through the north east corner of the development.

To comply with Australian Standard AS/NZS 2885.1:2018, any Development works in the immediate vicinity of a Transmission Pressure Gas Pipeline licensed under AS2885 in Australia must be subjected to a Safety Management Study (SMS) to review all possible threats to the safe operation and maintenance of the pipeline and ensure that any threats that cannot be mitigated by design or procedures are risk assessed and confirmed to be As Low As Reasonably Practical.

This document outlines the Terms of Reference for the SMS Workshop

Walla Walla Solar Farm Development

The Project is a 300 Megawatt (MW) alternating current (AC) photovoltaic (PV) solar farm at Walla Walla, southern NSW (i.e., solar PV modules, inverters, and substation). The 614-hectare (ha) development site is located on freehold rural land approximately 4.3 kilometres (km) north-east of Walla Walla and 9.2 km southwest of Culcairn.

The Project's transmission connection point is to be at the existing TransGrid Jindera to Wagga Wagga 330kV transmission line which runs along the western side of the development site. This

330kV transmission line is part of the electricity distribution network that originates at TransGrid's North Wagga Wagga Substation. The proposed solar farm will connect directly to the transmission line where it crosses the site, with a new substation proposed near this location.

The development site would be accessed from Benambra Road, which runs along the northern boundary and intersects with Olympic Highway (A41). Olympic Highway provides access to the region's transport network.

Figure 1, Overall Development Site (APA Pipeline easement shown in top left corner of Site)

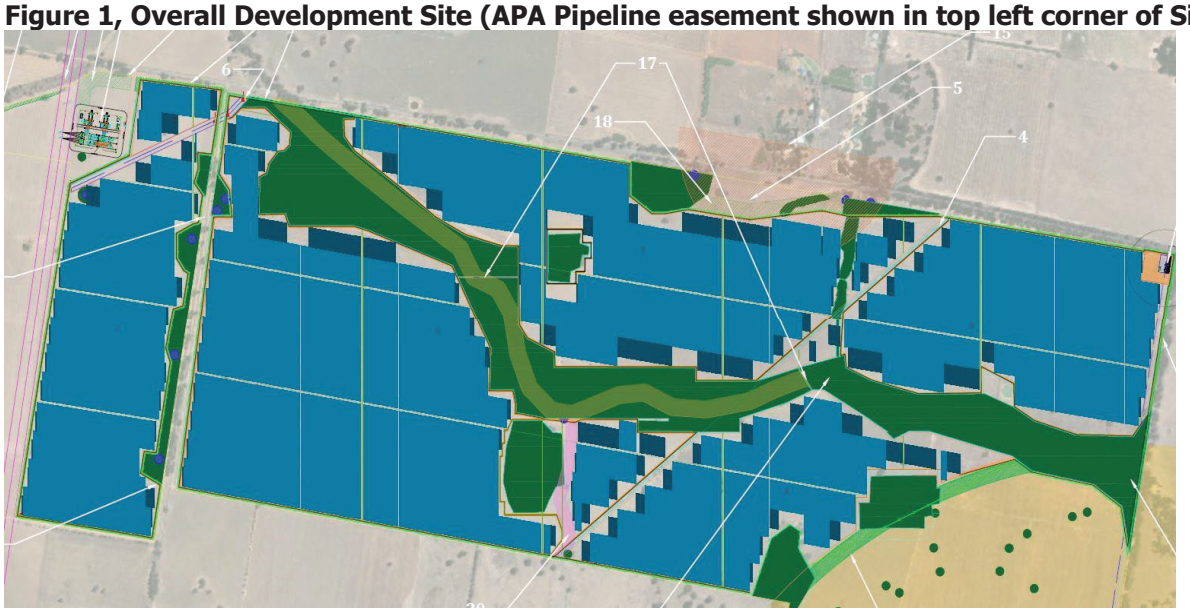
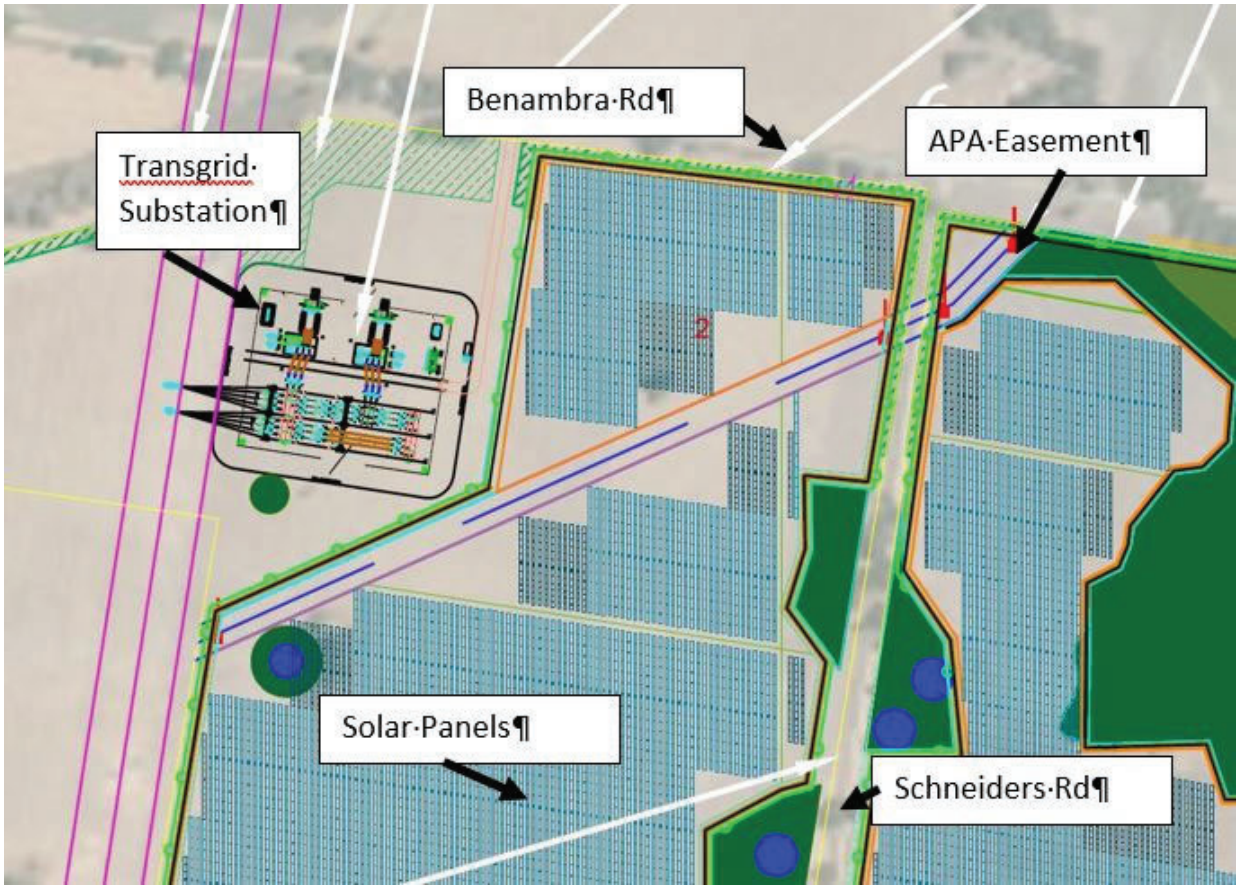


Figure 2, Development Showing Pipeline Easement



Gas Transmission Infrastructure

The APA Group has advised that the following asset is impacted by the proposed development:

Table 1, Pipeline Details

Pipeline	Pipeline Licence	Easement Width (m)	Pipeline Easement Location	Diameter (mm)	Measurement Length (m)
Barnawartha-Culcairn	T99, PL24	24	8m from North side	450	463
	Note: Measurement Length is applied to either side of the pipeline				

There is also a Cathodic Protection Test point where the pipeline crosses Benambra Rd.

The APA pipeline was built in 1998 and will continue operating for another 40-50 years so it is important to consider the implications for the safe operation and maintenance of the pipeline during construction and for the remaining life of the pipeline.

The proposed development has a combined road and utility crossing of the pipeline. Apart from the Substation and offices within the measurement length, there are no defined "Sensitive Uses" associated with the Development

The crossing designs are currently being developed and will be made available in draft form for APA review ahead of the SMS

The SMS Workshop will assess the consequences, likelihoods, and overall risks to the pipeline during construction and throughout the remaining life of the pipeline. The SMS Workshop will confirm what if any new mitigations will be required to ensure the future risks to the pipeline and the population nearby are (ALARP).

2 SCOPE OF SMS

The SMS will focus on the section of pipeline immediately impacted by the Development plus where the ML extends beyond the Development. The pipeline has been divided into the following sections:

Table 2, Pipeline sections

Section ID	Distance	Current Land Use	Description	Measurement Length	Proposed Location Class	Secondary Location - Class	SMS Section
1	~718m (plus 2 x 463m (ML)	R1	6.8mm & 8.1mm Wall Thickness 450mm DN diameter 7390 kPa Yellow Jacket coating 900-1200mm DOC	463m from pipeline	R1	HI	**N/A**

In addition to the sections identified in the table above, the SMS will focus on the following aspects of the design:

- Non-Location Specific Threats (e.g., corrosion, coating damage).
- Standard Crossing Designs (e.g., minor roads).
- Location Specific Crossing Designs will be considered as they appear during the meter-by-meter pipeline risk assessment.
- Slabbing requirements to mitigate risks to the development from third party strikes
- Review of the design calculations or reports which form the basis of the design presented (e.g., wall thickness calculation, fracture control plan etc.).
- There are no above ground pipeline facilities within the area being considered during this SMS.

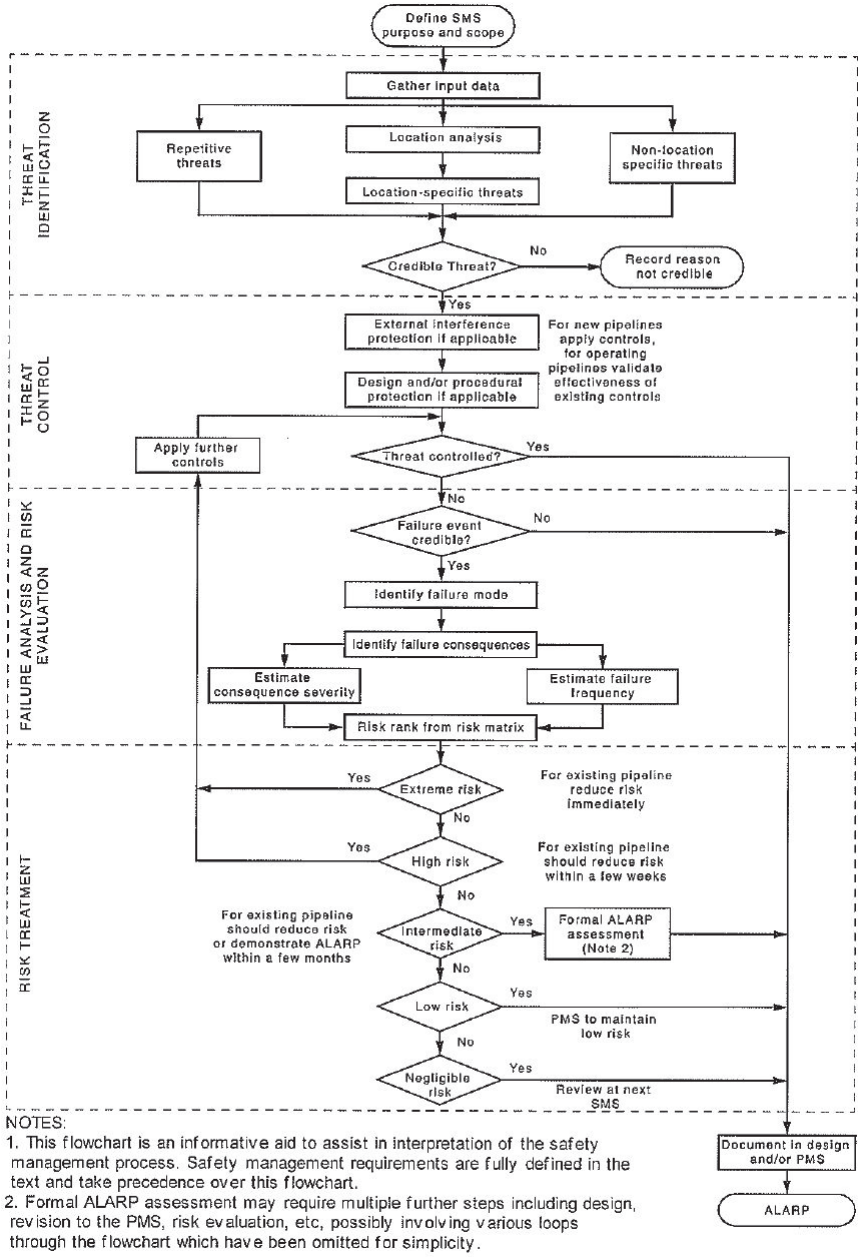
3 OBJECTIVE AND METHODOLOGY

Prior to the SMS workshop being convened APA and the Client teams have prepared a range of relevant information to be presented to the workshop (refer to Section 5 below for the list of Documents). The information available includes the results from previous SMS workshops held for the existing pipelines.

The SMS workshop objective is to re-validate the APA pipeline design under AS/NZS 2885.1:2018 against the proposed new land use plans.

The risk assessment process is broadly described in Figure 2 below.

Figure 3 – AS/NZS 2885.6:2018 Risk Assessment Process



The focus of the SMS workshop is on the safe operation and maintenance of the pipeline including consideration of the risks of the construction of the development and on the safe operation and maintenance of the pipeline into the future.

Where the SMS workshop considers that a design proposed is inadequate to reduce a particular identified threat to a level of accepted risk, it will identify additional controls which if implemented, would achieve that objective.

If further controls cannot fully mitigate the threat, then the SMS workshop will risk assess the residual threat against a recognised industry risk matrix to determine the residual level of risk. If the risk of a particular threat cannot be considered to be low or negligible according to recognised industry risk matrix then further investigation of the threat will take place to confirm that the risk is "As Low As Reasonably Practical" (ALARP).

At the end of the Workshop, participants will be required to form an opinion on whether there are any other threats not already considered prior to closing the Workshop.

Actions minuted during the course of the SMS workshop will fall into two general categories, those requiring close out before the change in land use can proceed and those that will form part of the future Pipeline Integrity Management Plan (PIMP).

All threats developed prior to the SMS workshop have been documented in a spreadsheet that will be projected on a screen and referred to in the workshop. Changes or additions to the threats and risk mitigations will be recorded directly into the spreadsheet. Additional actions not related to particular threats will also be recorded.

A copy of the Development Plan will be available at the workshop along with all other relevant documents.

An SMS Report will be produced following the workshop to capture proceedings of the workshop and highlight key decisions or issues. It will also contain all the threats and their associated mitigations and/or agreed actions.

4 DOCUMENTS AND REFERENCES FOR WORKSHOP

The documents required for the SMS workshop are referenced below.

Table 3, Documents

Document Name	Document Number
General Layout	WAL-LAY-001 Rev4
Crossing Drawings	(To be provided closer to the SMS)
Pipeline Penetration Calc	Penetration Resistance Calculation T99
Pipeline Radiation Contour Calc	Heat Radiation Release Calculation T99
Pipeline Route Plan & Longitudinal Section	T99-15/14

The Industry Standards referenced for this Workshop are listed below: -

- AS 2885.0 – 2018 Gas and liquid petroleum General requirements
- AS/NZS 2885.1 – 2018 Gas and liquid petroleum Design & Construction
- AS2 885.3 – 2012 Gas and liquid petroleum Operations and Maintenance
- AS/NZS 2885.6:2018 Pipelines - Gas and liquid petroleum - Pipeline safety management

APA Pipeline Management System - Volume 1 Introduction – dated 3/11/16 Section 2 Coverage states that when conflict exists between the various applicable documents, the following order shall apply, in decreasing order of precedence. Where APA requirements are more stringent, they shall take precedence.

- Acts of law or other legislation
- Government licenses and permits.
- APA Engineering Standards. This will be covered by documented practices and any specific inputs from APA risk assessments.
- Local engineering standards

Note the following advice from the APA SMS Technical Guide for Localised Urban Developments: -

- There is no requirement to redo-calculations if the calculations provided by APA have already been completed.
- If there are threats that are new i.e., not captured by the existing Pipeline SMS and it needs supporting calculations, then the Facilitator can raise this with APA where it can leave it to APA to perform the calculations or have an external provider produce the calculations that will be issued to APA for review and approval.
- The facilitator can identify any aspects of the calculations that need to be updated but it is not their responsibility to perform any peer reviews on the existing APA calculations.
- The facilitator is to conduct a threat assessment pertaining to the development in question before the commencement of the SMS Workshop (unlike a HAZOP which requires the risk assessment to be done during the workshop). That is revisit the

existing threat controls even if they have already been captured in the existing SMS Database.

- The workshop is to validate the location class and all the threats have been captured and the necessary control measures are documented covering construction activities and future threats.

5 WORKSHOP PARTICIPANTS

The Workshop will comprise representatives from the Licensee (APA Group) and Client.

Workshop participants will have appropriate experience and authority to present the opinion of the segment that he/she represents.

The integrity of the SMS Workshop is based not only on a detailed assessment of all the relevant data but also the continuous attendance of the various experts during the Workshop.

The 4-6 hours allocated will require fulltime attendance or nomination of an appropriately experienced replacement. The nominated attendees for the workshop are listed below.

Table 4, Participants

Name	Position	Organisation
Mark Harris	Facilitator	DRMC
Zach Tariq	Project Manager	FRV
Alan Robinson	Head of Construction	FRV
Antonius Widjaja	Technical Coordinator	FRV
Vida Kavehei	Project Coordinator	FRV
Rob Hamilton	Project Director	SMEC
Nicholas Rudland	Electrical Lead	SMEC
Hayden Tunbridge	Civil Lead	SMEC
Basil Turk	Project Manager	TransGrid
Martin Redhead	Project Engineer	TransGrid
Myra Nolan	Design Review Manager	TransGrid
Josh Caruana	Project Manager	CPP
James Warr	Primary Design Manager	CPP
Omar Ashour	Project Development Engineer	APA Group
Nicole Percy	Corridor Technical Officer	APA Group
Paul Walters	Senior Risk Engineer	APA Group
Ian Boyd	Senior Technical Officer	APA Group
Bilal Hamid (optional invite)	Corrosion Engineer	APA Group
Oliver Day (optional invite)	Risk Engineer	APA Group

6 WORKSHOP RULES

The workshop will be governed by the following rules as a minimum:

- The Owner of the pipeline (APA Group) along with the Client will, to the extent practicable, present the pipeline design and Development Plan respectively in a manner that provides participants with sufficient understanding for them to reach an informed opinion as to whether the threats are properly identified, whether the controls applied adequately control the threats, and where risk assessment is required, to reach a conclusion on the risk.
- The opinion of each participant is equally important and relevant and must be heard and assessed.
- Each participant will conduct themselves in a manner that contributes to the best outcome from the workshop and active participation is compulsory.
- The facilitator will manage the workshop to allow all relevant opinions to be presented, discussed and that each discussion reaches a conclusion.
- Please be prompt at the start of each day and when returning from breaks.
- Mobile phones are to be switched off or on silent, any important calls may be taken outside the workshop room. Laptops/tablets are not to be used unless specifically required to access data relevant to the SMS or take notes from the Workshop.

7 SMS WORKSHOP LOGISTICS

The Safety Management Assessment Workshop will be held on TEAMS on Wednesday the 19th of January 2022. A separate TEAMS Meeting Request will be issued.

The SMS agenda proposed in Section 8 is indicative only. It should be noted that the integrity of the SMS process will take priority over meeting particular time commitments.

The workshop will commence at 9:00am sharp (AEST) and will end at approximately 3:30pm.

(Note: - it is far more important to properly consider all the risks rather than try and rush to meet a deadline and so I ask all participants to be flexible as the workshop will finish anywhere between 3:00 and 5:00pm on the day).

Breaks during the day will typically be taken at the following times:

- Morning tea will be taken at ~10:30am for 10 minutes.
- Lunch will be taken at ~12:30pm for 30 minutes.

Copies of the documents will be shared at the Workshop. Electronic copies of the relevant documents can be printed by participants prior to the meeting.

8 PROPOSED AGENDA

Table 5, SMS agenda

	Agenda Items	Time (AEDT)	Presenter
1	**Welcome/Introductions**	9am	Facilitator/All
2	**Workshop Overview and Objectives**	9:05am	Facilitator
3	**Pipeline Design Review/ Operating Approach** · Wall Thicknesses · Rupture and puncture · Radiation contours · Location Classes · Interface agreements with corridor users · Other relevant items	9:10am	Facilitator/APA
4	**Development Review**	9:40am	Client
5	**Morning Tea Break**	10:20am	All
6	**Non-Location Specific Threats Review** · Review identified non-location specific threats not covered during crossing design review (both during Construction and Post Construction) · Review external interference controls applied and assess adequacy. · Review design controls applied and assess adequacy · Risk assess Threat if found not to be fully mitigated	10:30am	All
7	**Lunch Break**	12:30pm	All
8	**Complete any other outstanding Non-Location Specific Threats** · Review identified non-location specific threats not covered during crossing design review (both during Construction and Post Construction) · Review external interference controls applied and assess adequacy. · Review design controls applied and assess adequacy · Risk assess Threat if found not to be fully mitigated	1:30pm	All
9	**Review All Actions Raised for Consistency and Responsibility** · Review the threats found not to be mitigated during the threat review process and undertake a risk assessment to determine the level of residual risk. Proposed Risk Matrix is included in Appendix A.	2:00pm	All
10	**Workshop Close**	3:00pm	

Note: if any Risks are found to be Intermediate and require an ALARP or LOPA Assessment then these assessments may require specific information which may not be available at the SMS Workshop and as such will need to be assessed post the workshop and presented to the relevant Parties for acceptance at a later date.

APPENDIX A - AS2885 Risk Matrix

The AS2885.6.2108 Risk Matrix we will use to undertake any risk assessments.
Please refer to Tables 3.1/3.2/3.3 in the Standard. Excerpt of the Risk Matrix from the Standard is below.

AS2885.6 Section 3.5

3.5 QUALITATIVE RISK ASSESSMENT

3.5.1 General

RISK ASSESSMENT of FAILURE SCENARIOS shall be undertaken in accordance with the qualitative method described in this Clause 3.5.

NOTE: This qualitative risk evaluation method is consistent with the process defined within AS/NZS ISO 31000.

There are circumstances where risk estimation using quantitative (numerical) methods may be useful to enable comparison of alternative mitigation measures as a basis for demonstration of ALARP, and in some jurisdictions, to satisfy planning criteria. Purely quantitative methods are not permitted as a substitute for the qualitative assessment required by this Standard, although quantitative estimates may be used to assist with estimating frequency and consequences as part of the qualitative method required by this Standard.

NOTE: Quantitative RISK ASSESSMENT methods need to be used with great care. Classical quantitative RISK ASSESSMENT using historical. failure rates is not valid for determining the absolute risk level of Australian and New Zealand pipelines due to the lack of relevant statistical data. The failure rate of Australian pipelines has been assessed to be at least an order of magnitude lower than pipelines in other parts of the world so use of historical :failure rates from overseas will generate unrealistically conservative results. Reliability-based analysis such as permitted by Canadian Standard CSA Z662 may have more validity.

3.5.2 Severity analysis

The consequences of each FAILURE SCENARIO shall be described, assessed and documented.

A severity class shall be assigned to each FAILURE SCENARIO based on the consequences at the location of the failure. The severity class shall be selected from Table 3.1.

NOTE: Appendix G provides guidance on estimating consequences.

TABLE 3.1

SEVERITY CLASSES

Dimension	Severity class				
	Catastrophic	Major	Severe	Minor	Trivial
	Measures of severity				
People	Multiple fatalitiesresult	One or two fatalities; or severalpeople with life-threatening injuries	Injury or illness requiring hospital treatment	Injuries requiring first aid treatment	Minimal impact on health and safety
Supply (see Note)	Widespread or significant societalimpact, such as complete loss of supply to a major city for an extended time (more than a fewdays)	Widespread societal impact such as loss of supply to a major city for a short time(hours to days) or toa localized area for a longer time	Localized societal impactor short-term supply interruption (hours)	Interruption or restriction of supply but shortfall met from other sources	No loss or restriction of pipeline supply
Environment	Impact widespread; viability of ecosystems or species affected;or permanent major changes	Major impact well outside PIPELINE CORRIDOR or site; or long-term severe effects; or rectification difficult	Localized impact, substantially rectified within a year or so	Impact very localized and very short-term (weeks), minimal rectification	No effect: or minor impact rectified rapidly (days) with negligible residual effect

NOTE: Appendix G provides guidance on assessment of consequence severities.

3.5.3 Frequency analysis

A frequency class shall be assigned to each FAILURE SCENARIO. The frequency class shall be selected from Table 3.2.

The contribution of existing controls to the prevention of failure shall be considered in assigning the frequency class.

NOTE: Appendix F provides guidance on estimating frequencies.

TABLE 3.2

FREQUENCY CLASSES

Frequency class	Frequency description
Frequent	Expected to occur once per year or more
Occasional	May occur occasionally in the life of the pipeline
Unlikely	Unlikely to occur within the life of the pipeline, but possible
Remote	Not anticipated for this pipeline at this location
Hypothetical	Theoretically possible but would only occur under extraordinary circumstances

3.5.4 Risk ranking

Table 3.3 shall be used to combine the results of the consequence analysis and the frequency analysis to determine the risk rank.

Use of the risk matrix in Table 3.3 is mandatory for SAFETY MANAGEMENT STUDIES in accordance with this Standard. Other methods such as a corporate risk matrix may be used only in parallel with Table 3.3 or as part of a separate corporate RISK ASSESSMENT.

TABLE 3.3
RISK MATRIX

	Catastrophic	Major	Severe	Minor	Trivial
Frequent	Extreme	Extreme	High	Intermediate	Low
Occasional	Extreme	High	Intermediate	Low	Low
Unlikely	High	High	Intermediate	Low	Negligible
Remote	High	Intermediate	Low	. Negligible	Negligible
Hypothetical	Intermediate	Low	Negligible	Negligible	Negligible

NOTE: Comparative studies sponsored by the Energy Pipelines Cooperative Research Centre have shown that for risks ranked as Intermediate, Table 3.3 produces results consistent with both reliability-based analysis (in accordance with Annex O of CSA Z662-07) and quantitative risk assessment. Use of a different risk matrix or method that has not been similarly calibrated may produce invalid results.

APPENDIX G: SMS Technical Presentation

AS 2885.1 SMS Workshop
Walla Walla Solar Farm Development

Technical Information

January 2022

Facilitator:- Mark Harris
Delphi Risk Management Consulting
Ph 0438890968
markharris@delphirisk.com.au

APA Barnawartha-Culcairn Pipeline T99 Licence No. PL24 (1998)
Design Information

Substance conveyed	Natural Gas
Length of pipeline affected	718m + 2 x 463m (Total 1644m approx)
Pipeline section under review within PSP	~KP229277 to 229.995 (Plus ML each end)
Outside diameter	457 mm
Wall Thickness	6.8mm & 8.1mm & 9.7mm
Depth Of Cover	0.9m
Pipe specification	API 5L X70 (with Yellow Jacket Extruded Polyethylene coating)
Max. Allowable Operating Pressure	10200 kPa (MAOP)
Current Location Class - Primary	R1
Current Location Class – Secondary	None
New Location Class - Primary	R1
New Location Class – Secondary	HI (R2 equivalent)
CDL	82mm (@ 6.8mm WT)
Credible Excavator Size in the area	30T with Tiger Teeth
Credible Hole Size from Excavator	30mm (for Tiger teeth)
Credible Hole Size from Auger	50mm
Measurement Length (ML)	463m (4.7 kW/m2 Heat Radiation Zone, Q 51GJ/s)
	283m (12.6 kW/m2 Heat Radiation Zone)
Hole size based on 10 GJ/s release rate	122mm
50mm hole ML	84m
30mm hole ML	50m

APA Barnawartha-Culcairn Pipeline T99 Licence No. PL24 (1998) Design Information

Credible Excavator Size	30T with Tiger Teeth
Max equipment sizes without risk of a leak(B Factor 0.75, 6.8mm WT)	
• Excavator with General Purpose Teeth	>55T
• Excavator with Tiger Teeth (Single Point Penetration)	25T
• Excavator with Twin Tiger Teeth (both Points Penetration)	>55T
• Excavator with Penetration Teeth	Non Credible for area
•	
Max equipment sizes without causing risk of Rupture(B Factor 0.75, 6.8mm WT)	
• Excavator with General Purpose Teeth	>55T
• Excavator with Tiger Teeth (Single Point Penetration)	>55T
• Excavator with Twin Tiger Teeth (both Points Penetration)	>55T
• Excavator with Penetration Teeth	Non Credible for area

Generic Protections – By APA

Patrolling :
Ground patrol – Quarterly
Aerial patrol – Monthly

Liaison with land users – annually

Marker signs, max. spacing
T1 100m, T1,S 50m, R1 250m

Buried Marker Tape (300mm above pipe) – Yes (TBC)

Pipeline Awareness Programs, D.B.Y.D, Landholder Liaison - Yes

Depth Of Cover :
0.9m

Bollards and Fencing for above ground facilities

Land Use (both during Construction & Existing land use?)

Nominate in general the types of activities expected from land users over the length of the pipeline. (e.g. Farmers, Council, Constructors etc.)

Existing Excavator Use: Credible Excavator Size 30T with Tiger teeth

During Construction: (Developer to Advise)

Water Crossing Design	No
Boring and Open Cut	Yes
Blade Ploughing	Yes - Road Crossing Construction
Ripping	No
Excavators	30T with tiger teeth (No TT within easement works)
Bulldozers (use of Rippers)	Yes
Boring rigs (pole augers/piling or HDD)	Yes – Panel Footing & Fencing
Heavy Vehicles	Yes - Non road legal

APPENDIX H: SMS Workshop Minutes

Walla Walla Solar Farm - Safety Management Study
Wednesday, 19 January 2022

Name	Position	Organisation	Attendance
Mark Harris	Facilitator	DRMC	Y
Zach Tariq	Project Manager	FRV	Y
Alan Robinson	Head of Construction	FRV	Y
Vida Kavehei	Project Coordinator	FRV	Y
Rob Hamilton	Project Director	SMEC	PartTime
Nicholas Rudland	Electrical Lead	SMEC	Y
Kym Huddart	Civil Lead	SMEC	Y
Basil Turk	Project Manager	TransGrid	Y
Martin Redhead	Project Engineer	TransGrid	Y
Myra Nolan	Design Review Manager	TransGrid	Y
Josh Caruana	Project Manager	CPP	Y
Ryan o'Connell	Ops Lead PM	PCL	PartTime
Paul Cannington	HSE Mgr	PCL	Y
Brendan Lloyd	Eng & Commissioning Mgr	PCL	Y
Sri Sahaarenghan	PM	PCL	Y
Landon Douglas	Construction PM	PCL	Y
Jeff Ewert	Senior Construction Manager	PCL	PartTime
Nicole Percy	Corridor Technical Officer	APA Group	Y
Paul Walters	Senior Risk Engineer	APA Group	Y
Ian Boyd	Senior Technical Officer	APA Group	Y

TEAMS Meeting Summary

Total Number of P	24
Meeting Title	Mark Harris's Teams Meeting
Meeting Start Tim	19/01/2022, 09:29:54
Meeting End Time	19/01/2022, 16:30:25
Meeting Id	08a83655-adc7-4f52-bdd4-1525b33b0f6a

Full Name	Join Time	Leave Time	Duration	Email	Role	Participant ID (UPN)
Basil (Guest)	19/01/2022, 09:31:22	19/01/2022, 16:30:25	6h 59m		Presenter	
Day, Oliver	19/01/2022, 09:37:30	19/01/2022, 09:42:50	5m 19s	Oliver.Day@apa.com.au	Presenter	oliver.day@apa.com.au
Vida Kavehei	19/01/2022, 09:56:16	19/01/2022, 15:04:32	5h 8m	vida.kavehei@frv.com	Presenter	vida.kavehei@frv.com
Boyd, Ian	19/01/2022, 09:56:37	19/01/2022, 15:04:31	5h 7m	Ian.Boyd@apa.com.au	Presenter	Ian.Boyd@apa.com.au
Paul Cannington	19/01/2022, 09:57:53	19/01/2022, 15:04:34	5h 6m	PCannington@pcl.com	Presenter	PCannington@pcl.com
Mark Harris	19/01/2022, 09:29:54	19/01/2022, 15:04:37	5h 34m	admin@DelphiRiskMana	Organiser	admin@DelphiRiskManagementConsult.onmicrosoft.com
Zach Tariq	19/01/2022, 09:30:05	19/01/2022, 15:04:34	5h 34m	zach.tariq@frv.com	Presenter	zach.tariq@frv.com
Walters, Paul	19/01/2022, 09:30:05	19/01/2022, 15:04:35	5h 34m	Paul.Walters@apa.com.	Presenter	Paul.Walters@apa.com.au
Brendan Lloyd	19/01/2022, 09:30:05	19/01/2022, 15:04:30	5h 34m	BLloyd@pcl.com	Presenter	BLloyd@pcl.com
Sri Sahaarenghan	19/01/2022, 09:30:40	19/01/2022, 15:04:30	5h 33m	SSriRenganathan@pcl.c	Presenter	SSriRenganathan@pcl.com
Myra Nolan - Tran	19/01/2022, 09:30:52	19/01/2022, 15:04:33	5h 33m		Presenter	
Kym HUDDART	19/01/2022, 09:31:03	19/01/2022, 15:04:33	5h 33m	Kym.Huddart@smec.cor	Presenter	Kym.Huddart@smec.com
Martin (Guest)	19/01/2022, 09:31:20	19/01/2022, 15:04:40	5h 33m		Presenter	
Caruana, Josh	19/01/2022, 09:32:16	19/01/2022, 15:04:30	5h 32m	jcaruana@conpower.cor	Presenter	jcaruana@quantaservices.com
Alan Robinson	19/01/2022, 09:32:30	19/01/2022, 15:04:33	5h 32m	alan.robinson@frv.com	Presenter	alan.robinson@frv.com
Percy, Nicole	19/01/2022, 09:32:46	19/01/2022, 15:04:30	5h 31m	Nicole.Percy@apa.com.	Presenter	Nicole.Percy@apa.com.au
Landon Douglas	19/01/2022, 09:30:30	19/01/2022, 12:50:15	3h 19m	LPDouglas@pcl.com	Presenter	LPDouglas@pcl.com
Rob HAMILTON	19/01/2022, 09:30:05	19/01/2022, 12:42:39	3h 12m	Rob.Hamilton@smec.co	Presenter	Rob.Hamilton@smec.com
Ryan O'Connell	19/01/2022, 09:31:20	19/01/2022, 11:38:38	2h 7m	ROConnell@pcl.com	Presenter	ROConnell@pcl.com
Basil	19/01/2022, 12:57:47	19/01/2022, 15:04:31	2h 6m		Presenter	
Basil	19/01/2022, 09:30:39	19/01/2022, 12:28:53	2h 58m		Presenter	
Jeff Ewert	19/01/2022, 11:21:13	19/01/2022, 14:04:54	2h 43m	JEwert@pcl.com	Presenter	jewert@pcl.com
Nicholas RUDLAN	19/01/2022, 09:32:04	19/01/2022, 12:12:34	2h 40m	Nicholas.Rudland@sme	Presenter	Nicholas.Rudland@smec.com
Nicholas RUDLAN	19/01/2022, 12:33:20	19/01/2022, 15:04:30	2h 31m	Nicholas.Rudland@sme	Presenter	Nicholas.Rudland@smec.com
Rob HAMILTON	19/01/2022, 12:44:54	19/01/2022, 15:04:32	2h 19m	Rob.Hamilton@smec.co	Presenter	Rob.Hamilton@smec.com
Warr, James	19/01/2022, 09:31:28	19/01/2022, 09:33:08	1m 39s	jwarr@conpower.com.au	Presenter	JWarr@quantaservices.com
Ryan O'Connell	19/01/2022, 13:09:42	19/01/2022, 15:03:18	1h 53m	ROConnell@pcl.com	Presenter	ROConnell@pcl.com

Walla Walla Solar Farm - Safety Management Study

Wednesday, 19 January 2022

Barnawartha-Culcairn Pipeline T99 Licence No. PL24 (1998)
~KP229277 to 229.995 (Plus ML each end)

Threat ID	Threats	Consequence	Credible Risk (Y/N)	Reasons this threat is not a credible risk?	Physical Protection Measures	Procedural Protection Measures	Is Risk Mitigated as per AS2885? (If No then Risk Assess)	Comments	Frequency (AS2885.1 Model)	Consequence (AS2885.1 Model)	Pipeline Risk	Considerations which lead to assessment of Risk	Actions
1	**Excavator use over easement (up to 30T)**	Damage to coating & or gouge to pipe requiring dig up and repair and temporary loss of supply.	Y		Depth of Cover, WT	DBYD, Patrolling, PTW, signage, ILI	No		Remote	Minor	Negligible	**Threat Consequence - Supply** Minor as loss of supply can be made up by other sources; **Threat Likelihood - Remote**, as pipeline impact is not anticipated because of procedures and highly controlled environment during works	
2	**Excavator use over easement (up to 30T)**	Pipe Damage resulting in a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) 30mm leading to a 50m radiation contour	Y		Depth of Cover, WT	DBYD, Patrolling, PTW, signage	No		Hypothetical	Major	Low	**Threat Consequence** - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities) **Supply** Minor (Refer Threat ID1) **Threat Likelihood** - Hypothetical as in a highly controlled environment	
3	**Excavator use over easement (up to 30T) - During Development**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to**rupture**	N	Requires an excavator >55T to rupture and this size excavator is not being used during works									
4	**Excavator use over easement (up to 30T) - Post Development**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to**rupture**.	N	Requires an excavator >55T to rupture and this size excavator is not being used in the area ever									
5	**Augering of Piles for footings or fences**	Auger impacts pipeline damaging the coating and denting or gouging the pipeline which could require reducing the MAOP or replacement of a section. Potential loss of supply.	Y		WT	DBYD, Patrolling, PTW, signage, ILI	No		Remote	Minor	Negligible	**Threat Consequence** - **Supply** Minor as loss of supply can be made up by other sources; **Threat Likelihood - Remote**, as pipeline impact is not anticipated because of procedures and highly controlled environment during works	
6	**Augering of Piles for street light pole footings or fences**	Auger impacts pipeline causing a hole in the pipe (~50mm leading to a 84m ML) which would require replacement of a section. Potential loss of supply and serious injury to auger operator if gas ignited (2% chance for a gas leak)	Y		WT	DBYD, Patrolling, PTW, signage	No		Hypothetical	Major	Low	**Threat Consequence** - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities). **Supply** Minor (Refer Threat ID1). **Threat Likelihood** - Hypothetical as in a highly controlled environment	
7	**Augering of Piles for street light pole footings or fences**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to rupture	N	Augers have a 50mm drill bit on the tip and so the likely hole size from an auger is up to 50mm which is well below the CDL and so the pipeline cannot rupture from this threat									
8	**Use of HDD to install Utilities across pipeline easement (220mm Dia)**	Damage to coating & or gouge to pipe requiring dig up and repair and temporary loss of supply.	Y		WT	DBYD, Patrolling, PTW, signage + APA procedure for monitoring of HDD crossing including use of slit trenches to positively identify horizontal trenching	No		Remote	Minor	Negligible	**Threat Consequence** - **Supply** Minor as loss of supply can be made up by other sources; **Threat Likelihood** - **Remote**, as pipeline impact is not anticipated because of procedures and highly controlled environment during works	
9	**Use of HDD to install Utilities across pipeline easement**	Pipe Damage resulting in a hole causing loss of containment. Hole is max credible hole size of 50mm, any more and an operator would know this issue and stop drilling.	Y		WT	DBYD, Patrolling, PTW, signage+ APA procedure for monitoring of HDD crossing including use of slit trenches to positively identify horizontal trenching	No		Hypothetical	Major	Low	**Threat Consequence** - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities). **Supply** Minor (ReferThreat ID1). **Threat Likelihood** - Hypothetical as in a highly controlled environment	
10	**Use of HDD to install Utilities across pipeline easement**	Pipe Damage resulting in a hole causing loss of containment. Hole is greater than critical defect length leading to rupture	N	HDD cannot cause the pipeline to rupture, assume the HDD pilot might cause a 50mm hole only but not rupture unless the HDD was left uncontrolled for an extended period of time?									
11	**Boring and Driving of Piles for building footings**	Vibration from works damages the coating leading to corrosion and failure of the pipe	Y		WT	DBYD, Patrolling, PTW, signage+ APA procedure for monitoring of piling	Yes						Undertake test piling to confirm vibration limit at pipe does not exceed 20mm/s. May need to use augering of piles if there is a problem meeting the vibration limit.
12	**Boring and Driving of Piles for building footings**	Gouge to pipe or holing or rupturing the pipeline.	Y		WT, Separation	DBYD, Patrolling, PTW, signage+ APA procedure for monitoring of piling Temporary fencing of the easement	Yes						

13	**Open cut Utilities installation (Water/Power/Comms) over or under the pipeline**	Pipe impacted during utility installation resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 30mm hole leading to a ML 50m.	**Y**		Depth of Cover, WT	DBYD, Patrolling, PTW, signage, holiday testing to check coating post work. Temp barrier placed over exposed pipe during works	**No**	The PTW and DBYD are critical at installation as there is no additional slabbing protection.	**Hypothetical**	**Major**	**Low**	**Threat Consequence** - **People** Major as potential work crew and onlookers could be seriously injured or killed (1-2 fatalities). **Supply** Minor (ReferThreat ID1). **Threat Likelihood** - Hypothetical as in a highly controlled environment	
14	**Open cut maintenance of Utilities (Water/Power/Comms) over pipeline**	Pipe impacted during utility maintenance resulting in damage or a hole causing loss of containment. Hole is less than critical defect length or max credible hole size (whichever is the smaller) Maximum credible hole size for a 30T excavator 70mm hole leading to a ML 98m.	**Y**		Depth of Cover, WT, Concrete Slabbing	DBYD, Patrolling, PTW, signage, marker tape	**Yes**	Standard design has a concrete slab and marker tape under the utility but over the pipeline stopping utility operator from impacting the pipeline whilst digging down to reach the utility					
15	**Use of Bored or Jacked crossing to install Utilities under pipeline easement (e.g. Sewer pipe)**	Damage to coating, or gouge or a hole or **rupture** of the pipeline requiring dig up and repair and significant loss of supply.	**N**	Not required as part of SOW									
16	**Threat - Deep ripping activities impacts the pipe and causes a loss of containment - leak but not rupture**	Pipeline damage, leak or rupture	**Y**	Lime stabilisation within Substation foot print but to no deeper than 500m	WT, Separation, DOC	DBYD, Patrolling, PTW, signage	**Yes**						
17	**Rock Saw/Hammer used in Development construction**	Causes pipeline to rupture	**N**	No requirement for SOW									
18	**Road Crossing (road legal vehicles).**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT, concrete slabbing	Properly considered road design/Patrolling	**Yes**						
19	**Road Crossing (access track).**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT	Patrolling	**Yes**					Need to prevent vehicle access to pipeline easement	Provide acceptable fencing along easement to prevent random use of the easement as an access track by third parties
20	**Heavy vehicle access track to works (non road legal vehicles).**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT, Fencing (temp & Permanent), Concrete slabbing	Patrolling, PTW + APA approval of design and the final Construction Management Plan	**Yes**	Bespoke crossing will be installed and used for all future heavy vehicle crossing. No other temp crossings required.					
21	**Increased DOC due to landscaping or pavement build-up or placement of Spoil?**	Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	**Y**		Depth of Cover, WT, Fencing (temp)	Patrolling, PTW + APA approval of design and the final Construction Management Plan	**Yes**						
22	**Heavy lift cranes straddling pipeline. Use of excavator only near or over pipeline**	Over stressing the pipe resulting in pipe deformation (out of round), which could require replacement of a section to allow for future integrity works. Coating could also be damaged. Potential loss of supply for perhaps up to a month.	**Y**		Depth of Cover, WT, Fencing (temp)	Patrolling, PTW + APA approval of the Construction Management Plan and Lifting Plan	**Yes**						
23	**Excavator heavy lift over easement/ gas pipeline to install third party pipe crossing**	Heavy components falls on the gas pipeline resulting in localised overstressing or damage of coating or gouging pipeline leading to corrosion and a leak only. Potential for lifting of piping over/near gas pipe while installing third party utility crossing	**Y**		Depth of Cover, WT, Fencing (temp)	Patrolling, PTW + APA approval of the Construction Management Plan and Lifting Plan	**Yes**						
24	**CP interference from adjacent, parallel infrastructure or construction works.**	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	**Y**			CPU inspected monthly, CP test points checked 6 monthly.	**Yes**						Electrical Interference Study (AS4853) needs to be completed for APA review (touch potential and CP design assessments)
25	**Substation current injection testing simulates a fault in the system**	CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	**Y**			CPU inspected monthly, CP test points checked 6 monthly.	**Yes**						APA to arrange access to local CP test point
26	**Pipeline equipment exposed during crossing works potentially being inundated with stormwater compromising its operation.**	Pipe coating damaged if pipe trench left open during open cut crossing works. Leading to corrosion and a leak only	**Y**		WT	DBYD, Patrolling, PTW	**Yes**	Steel plate or silt fencing and possible blankets/ sand bags to prevent damage required as part of PTW					
27	**Threat - Vehicle collision with exposed pipeline during construction activities resulting in pipeline dent or gouge.**	Pipe coating damaged if pipe trench left open during open cut crossing works	**Y**		WT	Patrolling, PTW + APA approval of the Construction Management Plan. (Use of steel plate or fencing etc.. To protect open trench from equipment egress)	**Yes**						

28	**Threat - Vibration due to compaction**	Pipe coating damaged due to vibration could lead to corrosion and leak if uncontrolled	**Y**		Depth of Cover, WT	Patrolling, PTW + APA approval of the Construction Management Plan. CMP to comply with APA Standard (580-POL-L-0001)	**Yes**	Static rollers to be used immediately over the pipeline easement					
29	**Threat - Excavation next to edge of easement**	Causing easement profile to diminish reducing DOC.	**N**	No deep excavation required adjacent to the easement									
30	**Blasting.**	Uncontrolled blasting creates damage to coating and potential over stressing of the pipeline. Leading to loss of containment	**N**	No Blasting required for Project									
31	**Potholing to locate pipe.**	Damage to pipe coating in process of locating pipe resulting in coating failure and possible corrosion to pipe.	**Y**		WT	APA's approved potholing procedure as part of TPWG.	**Yes**						
32	**Tree removal adjacent to the pipeline.**	Ripping of trees where roots are in contact with pipe could damage coating, leading to corrosion damage and requiring repair.	**Y**			Any removal of trees to be identified in the CMP. Trees to be cut off at the base rather than ripped from the ground	**Yes**						
33	**Maintenance - Inadequate servicing of equipment**	APA cannot access easement/meter/reg assets due to new development	**Y**	No facilities impacted	Separation (fencing maintains access for APA)	Patrolling, PTW	**Yes**	Easement is generally accessible .					
34	**Threat - New building footings located on edge of easement**	New building footing may present an additional stress to the pipeline, resulting in coating damage and eventual corrosion, leading to a leak.	**N**	No significant buildings immediately adjacent to easement. Properties likely to be fronting the easement with plenty of setback and no load transferred to the pipeline.									
35	**Intentional Damage - Sabotage, Terrorism or Malicious Damage**	coating damage or loss of containment leading to corrosion and a leak only	**Y**		Depth of Cover, WT	Patrolling	**Yes**	No significant change from current risk level as a result of the Development					
36	**Inappropriate choice of vegetation within easement**	Blocking line of site between marker signs or roots damaging pipeline coating.	**Y**		DOC, WT	Patrolling, PTW, Project specific weed control plan	**Yes**						
37	**Natural Events - Floods (Erosion, impact damage) Scouring of pipe trench, change in watercourse conditions during or after works.**	Stormwater scour as a result of the design of the stormwater management as part of the Development. Leading to loss of DOC and impact on pipe coating leading to corrosion and a leak only	**Y**		Depth of Cover, WT	Patrolling, APA review of Development Hydrology study & drainage design, easement inspection post major rain event.	**Yes**						
38													
39													
40													
41													

Walla Walla Solar Farm - Safety Management Study
Wednesday, 19 January 2022
Miscellaneous Actions

No.	Issue	Action	Responsibility	Due Date	Close Out Comments	Close Out Date
A1	Construction of the Development could damage the pipelines	Developer to facilitate preparation of a Construction Management Plan, for review and comment by APA (pipeline licensee) prior to any third party works.	FRV/APA	Prior to works starting		
A2	Contractors may no be familiar with working around TP Gas Pipelines	Engage in a –Third Party Works - Safety Awareness Session, either as a toolbox or zoom meeting	FRV/APA	Prior to works starting		
A3	Site fencing restricts APA access to Easement	Provide gates to allow APA access to easement	FRV/APA	Prior to works starting		
A4	Pipeline coating/wall defect in the area of the works and the works prevents future repair.	Review recent ILI data and undertake DCVG in the area to identify if there are any known defects in the area of the Works and undertake repair as necessary prior to FRV works proceeding. APA to advise FRV of timeline if any repairs are required	FRV/APA	28/02/2022		
A5	Existing slabbed road crossings are old and may not be suitable for loads required by Works	FRV to provide a list of likely vehicle loads on Benambra or Schneider Rd to allow APA to confirm the existing road crossings are capable of the managing the loads	FRV/APA	Prior to works starting		
Threat Specific Actions						
11	Boring and Driving of Piles for building footings. Vibration from works damages the coating leading to corrosion and failure of the pipe	Undertake test piling to confirm vibration limit at pipe does not exceed 20mm/s. May need to use augering of piles if there is a problem meeting the vibration limit.	PCL/APA	Before any solar farm footings are started		
19	Road Crossing (access track). Over stressing the pipe resulting in pipe deformation (out of round), which could require reducing the MAOP or replacement of a section to allow for future integrity works. Potential loss of supply.	Provide acceptable fencing along easement to prevent random use of the easement as an access track by third parties	FRV/APA	prior to completion of works		
24	CP interference from adjacent, parallel infrastructure or construction works. CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	Electrical Interference Study (AS4853) needs to be completed for APA review (touch potential and CP design assessments)	FRV/APA	prior to completion of design		
25	Substation current injection testing simulates a fault in the system. CP is damaged or compromised during works resulting in long term corrosion potential leading to leak only	APA to arrange access to local CP test point	FRV/APA	prior to completion of works & energisation (2023)		

AS2885.6 Risk Matrix

	Severity Class				
	Catastrophic	**Major**	**Severe**	**Minor**	**Trivial**
Dimension	***Measures of Severity***				
People	Multiple fatalities result	One or two fatalities or several people with life-threatening injuries	Injury or illness requiring hospital treatment	Injuries requiring first aid treatment	Minimal impact on health and safety
Supply	Widespread or significant societal impact, such as complete loss of supply to a major city for an extended time (more than a few days)	Widespread societal impact such as loss of supply to a major city for a short time (hours to days) or to a localized area for a longer time	Localised societal impact or short-termsupply interruption (hours)	Interruption or restriction of supply but shortfall met from other sources	No impact or restriction of pipeline supply
Environment	Impact widespread; viability of ecosystems or species affected or permanent major changes	Major impact well outside PIPELINE CORRIDOR or site; or long-term severe effects; or rectification difficult	localised impact substantially rectified within a year or so	Impact very localized and very short-term (weeks), minimal rectification	No effect; minor impact rectified rapidly (days) with negligible residual effect
	Catastrophic	**Major**	**Severe**	**Minor**	**Trivial**
Frequent Expected to occur typically once per year or more. Event > 1 year	**Extreme**	**Extreme**	**High**	**Intermediate**	**Low**
Occasional May occur occasionally in the life of the pipeline. 1 Year > Event> 1/10 Years	**Extreme**	**High**	**Intermediate**	**Low**	**Low**
Unlikely Unlikely to occur within the life of the pipeline, but possible. 1/10 years > Event > 1/1000	**High**	**High**	**Intermediate**	**Low**	**Negligible**
Remote Not anticipated for this pipeline at this location. 1/1000 years > Event > 1/100,000 years	**High**	**Intermediate**	**Low**	**Negligible**	**Negligible**
Hypothetical Theoretically possible, but would only occur under extraordinary circumstances 1/100,000 year > Event	**Intermediate**	**Low**	**Negligible**	**Negligible**	**Negligible**