



Safety Management Study

5219 Princes Highway, Traralgon, Victoria

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Hazelwood North Solar Farm
Document No. RCE-22216_HNSF_SMS_Final_12Jan23_Rev(0)
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Safety Management Study

5219 Princes Highway, Traralgon, Victoria

Hazelwood North Solar Farm

Prepared by

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Rev	Date	Remarks	Prepared By	Reviewed By
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Executive Summary

Background

Hazelwood North Solar Farm (HNSF) has been proposed to be developed on farmland between Morwell and Traralgon, Victoria within the Latrobe City area. The proposed site is intersected by a high-pressure gas pipeline which is buried underground.

In the event that a high-pressure gas pipeline is damaged, the consequences can be substantial which could potentially result in injury or fatality to the surrounding community in addition to potential damage and disruption of services. The Latrobe Planning Scheme caters for the risks posed by the presence of gas pipelines by requiring the potential impacts of developments or change of land uses to specifically address how the safety of the gas pipeline will be managed in the form of a Safety Management Study (SMS). Specifically, per the Buffer Area Overlay – Schedule 1 (BAO1) the following are to be addressed as necessary:

- How activities associated with the use of land, and buildings or works, may result in any additional threats to the integrity of licensed pipelines and how these threats will be controlled and minimised.
- Emergency exit routes and external gathering spaces.
- How the activities associated with the use of land, and buildings or works have been designed to reduce risks to human life in the event of pipeline failure.
- How the location and storage of dangerous or explosive goods or chemicals reduces the risk of contributing to the escalation of a pipeline failure.

To ensure that the safety of the gas pipeline has been considered for the HNSF development, Riskcon Engineering Pty Ltd (Riskcon) has been engaged to prepare the SMS for the development.

Conclusions

A review of the proposed development against the Buffer Area Overlay – Schedule 1 was conducted for the Hazelwood North Solar Farm to review the potential threats to the pipeline and determine if there is an increased risk to the pipeline and to life and health in the surrounding community as a result of the development.

The assessment focussed on the credible pipeline failure modes and how the development could influence these failures modes. The analysis conducted identified that the proposed development would have a minimal impact to the pipeline itself as the development is aboveground and doesn't require earthworks. Furthermore, ancillary equipment that could result in impacts to the pipeline is located a substantial distance away and the location of the pipeline underground would prevent such impacts from having an adverse effect on the pipeline itself.

Based upon the review, it is considered that the Development, which includes all components such as solar panels, BESS, inverters, transformers, etc. would not result in a substantial increase in risk of the existing pipeline than that which currently exists; therefore, it is considered that the risk associated with the pipeline would be reduced to ALARP as required.

Recommendations

Notwithstanding the above assessment, the following recommendations have been made:

ID	Recommendation
1	The site induction, for all personnel at site, shall include information regarding the gas pipeline including location and protections to identify the gas pipeline (i.e., marker tape, etc.).
2	All personnel working at the site shall be inducted prior to commencing any work.
3	Appropriate markings shall be provided along the length of the gas pipeline as required to minimise the potential for unauthorised works occurring within the vicinity of the gas pipeline, in conjunction with the Site Induction and relevant site-specific construction management plans.
4	Any work within the vicinity of the pipeline shall be submitted to APA and confirmed prior to commencement.
5	Pipeline is to be marked on site by a representative of APA
6	No work is to be performed within 3 m of pipeline without an APA representative present.
7	No mechanical equipment is to be used for excavation within one (1) metre of the pipeline in any radial direction even after the pipeline location has been visually prove; unless under explicit direction from an APA representative.
8	No mechanical works are allowed within 600 mm in any radial direction of the pipeline visually proving the pipeline location; excavation is to be conducted with hand tools only until the pipeline location has been visually proven.
9	No mechanical equipment is to be used for excavation within 300 mm in any radial direction; excavation is to be conducted with hand tools only.
10	For backfill, suitable padding material (screened spoil or clean sand with particles less than 2.8 mm in size) is required for at least 150 mm around the pipe.
11	A 10 m clearance to the pipeline shall be provided (i.e. to the location of the pipeline itself, not the easement).

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Abbreviations

Abbreviation	Description
ALARP	As Low As Reasonably Practicable
BAO1	Buffer Area Overlay – Schedule 1
BESS	Battery Energy Storage System
DGs	Dangerous Goods
EGIG	European Gas Pipeline Incident Data Group
HNSF	Hazelwood North Solar Farm
MOAO	Maximum Allowable Operating Pressure
SMS	Safety Management Study

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1.0 Introduction

1.1 Background

Hazelwood North Solar Farm (HNSF) has been proposed to be developed on farmland between Morwell and Traralgon, Victoria within the Latrobe City area. The proposed site is intersected by a high-pressure gas pipeline which is buried underground.

In the event that a high-pressure gas pipeline is damaged, the consequences can be substantial which could potentially result in injury or fatality to the surrounding community in addition to potential damage and disruption of services. The Latrobe Planning Scheme caters for the risks posed by the presence of gas pipelines by requiring the potential impacts of developments or change of land uses to specifically address how the safety of the gas pipeline will be managed in the form of a Safety Management Study (SMS). Specifically, per the Buffer Area Overlay – Schedule 1 (BAO1) the following are to be addressed as necessary:

- How activities associated with the use of land, and buildings or works, may result in any additional threats to the integrity of licensed pipelines and how these threats will be controlled and minimised.
- Emergency exit routes and external gathering spaces.
- How the activities associated with the use of land, and buildings or works have been designed to reduce risks to human life in the event of pipeline failure.
- How the location and storage of dangerous or explosive goods or chemicals reduces the risk of contributing to the escalation of a pipeline failure.

To ensure that the safety of the gas pipeline has been considered for the HNSF development, Riskcon Engineering Pty Ltd (Riskcon) has been engaged to prepare the SMS for the development.

1.2 Objectives

The objectives of the study are to;

- Identify the location of high-pressure gas pipelines within or in the vicinity of the proposed development,
- Where there is potential for impact of the development on the pipelines, determine how the safeguards will meet the requirements of AS 2885 (Ref. [1]),
- Make recommendations for increased safeguards, where required, to ensure the risks are controlled to As Low As Is Reasonably Practicable (ALARP), and
- Report on the findings of the study in support of the Development Application for the proposed development.

1.3 Scope of Services

The scope of work is for the identification of the high-pressure gas pipeline on or within the vicinity of the proposed HNSF development in order to assess the potential for impacts on the pipeline from the development.

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2.0 Methodology

The methodology used in this assessment is as follows:

- Identify the high-pressure gas pipeline on or within the vicinity of the proposed development using the “dial before you dig” organisation,
- Review the proposed development to identify the potential impacts the development could have on the pipeline to determine the level of threat is posed to the pipeline.
- Make recommendations to ensure the safety of the pipeline is considered and maintained during construction and operation of the HNSF.
- Report on the findings of the assessment including recommendations from operators regarding required safeguards during the Development process.

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3.0 Site Description

3.1 Site Location

The site is located at 5219 Princes Highway, Traralgon which is approximately 6 km west of Morwell which is itself 160 km west of Melbourne. **Figure 3-1** shows the regional location of the site in relation to Morwell.



Figure 3-1: Site Location

3.2 General Description

The proposed solar farm is located on a 1,100 ha property between Morwell and Traralgon. The site is adjacent to the Princes Highway, Firmins Lane, and Hazelwood Road as shown in **Figure 3-2**. The project will consist of a 400 MW photovoltaic energy facility, battery storage, and ancillary infrastructure.

The facility will have a Battery Energy Storage System (BESS) which will have a capacity of 400 MWh and will be located centrally within the site. The location aims to reduce the potential noise impacts on the surrounding area, increase separation distance of the area most likely to have a consequential fail (i.e. fire) and it also maintains separation from the underground gas pipeline infrastructure traversing the site.

The solar panels proposed to be installed are designed to enable agricultural grazing of the land to continue. The panels sit lightly on the ground resulting in minimal disturbance to the grass and provides space to allow the grass to grow and enable livestock to be able to graze.

The panels are installed in 10 blocks ranging from 20 ha to 140 ha. The selection of blocks is based upon the topography of the site including creeks, roads, and existing infrastructure. Access road ways will be developed along with two sub-stations to connect the site to the electricity grid.



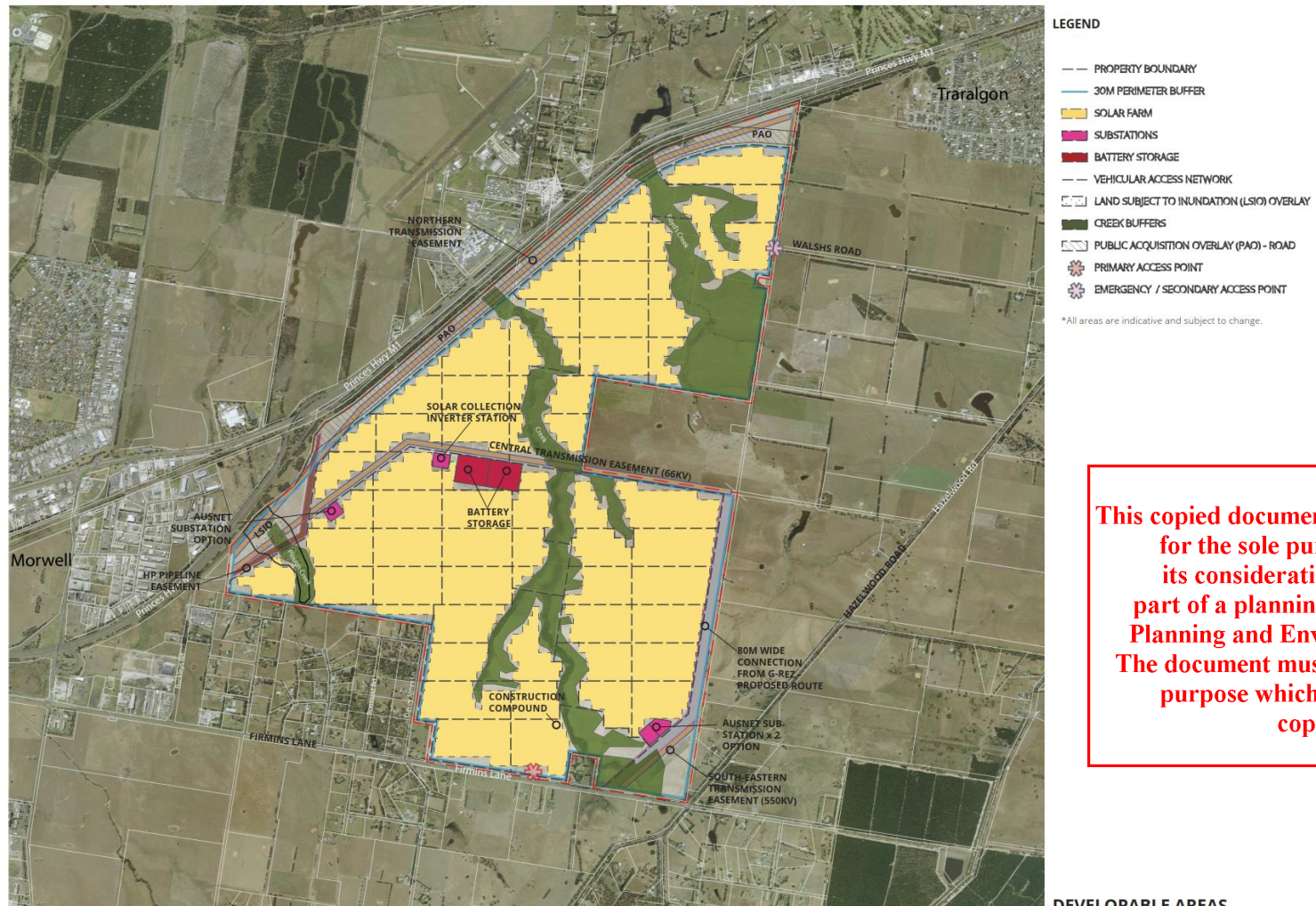
Figure 3-2: Solar Farm Location and Adjacent Areas

3.3 Gas Pipeline

The gas pipeline is located in the southwestern corner of the site as shown in **Figure 3-3**. The pipeline has an internal diameter of 500 mm with a wall thickness 8.2 mm and operates at a Maximum Allowable Operating Pressure (MOAP) of 7,070 kPa.

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HAZELWOOD NORTH SOLAR FARM - PRELIMINARY CONCEPT REV 07

15 November 2022 UrbanFold cogency R.O.B.E.R.T. CONSULTANTS Project Management

DEVELOPABLE AREAS

Figure 3-3: BESS Locations

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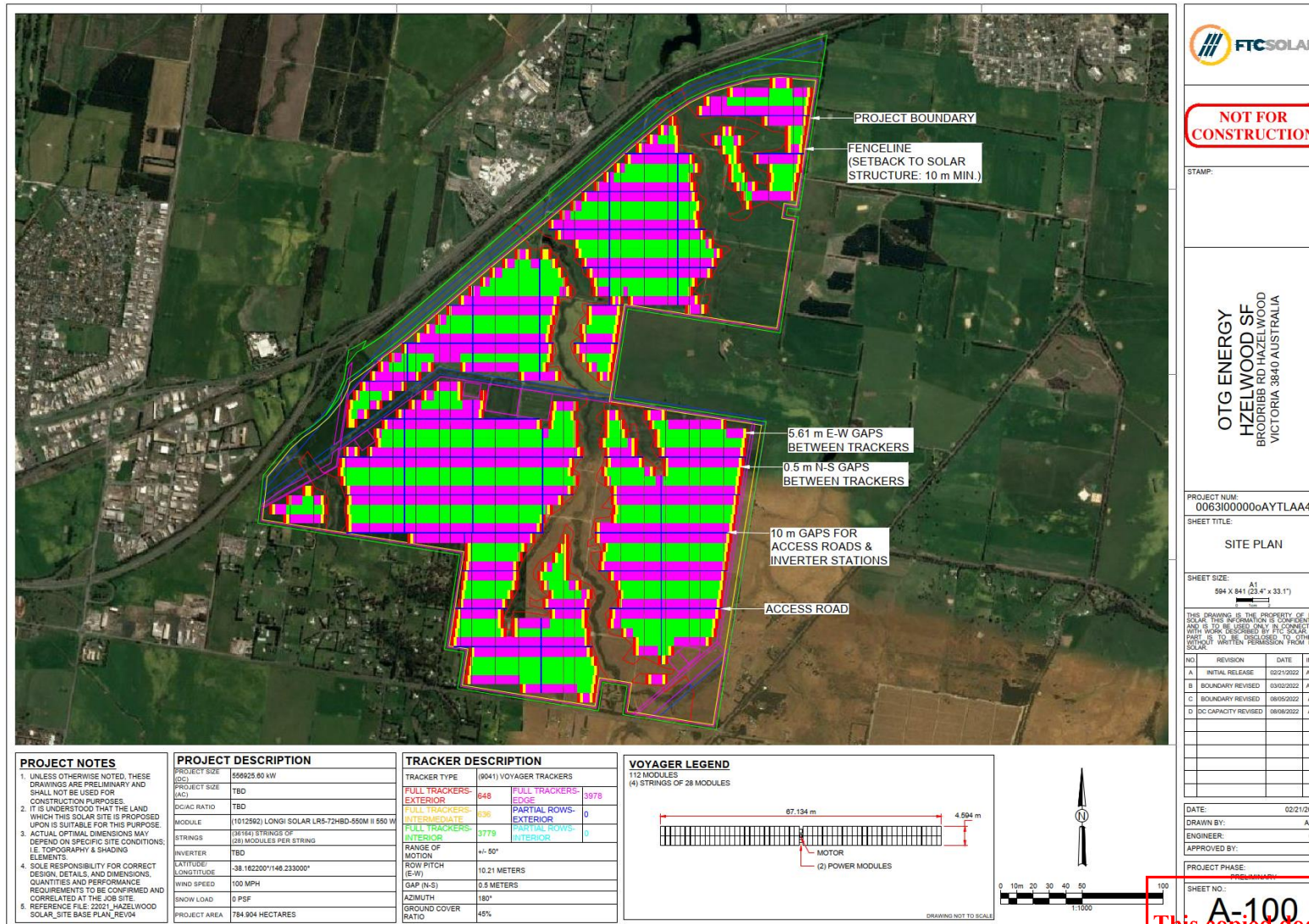


Figure 3-4: Solar Panel Layout

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4.0 Hazard Identification

4.1 Introduction

It is necessary to understand the threats and risks posed by the development on the pipeline and the subsequent effects should the gas pipeline become damaged. A detailed hazard identification table has been prepared in **Appendix A** which has been discussed in further detail in the following section.

4.2 Gas Pipeline

A review of the surrounding area indicates there is a buried gas pipeline running through the site in the southwestern corner of the proposed development. During the construction phase excavation work around the pipeline is not expected as only solar panels will be installed on the surface at a distance of at least 10 m from the pipeline. Therefore, the risk of gas pipeline being disturbed and damaged is incredibly low and spontaneous failure of the pipeline is an incredibly unlikely event.

In addition, the pipeline has several typical protection systems to protect it in the event that excavation work is required. Typical protection systems around pipelines include “dial before you did” to identify the location of pipelines, marker signs and marker tape, buried pipeline such that mechanical excavation can’t impact the pipeline without multiple actions, restrictions on mechanical works within 3 m of the pipeline.

The location of the pipeline is already known; hence, there is a low potential for excavation work to occur around the pipeline. In the event of a site error resulting in excavation along the pipeline, the marker tape should be identified prior to impact; however, this may only be the case if the operator is aware of what the marker tape means. It is noted that such an activity would only occur with the presence of a representative of the gas pipeline. Assuming, the protection systems work as intended, the potential damage to the gas pipeline should be minimised preventing damage and potential incident escalation.

It is noted, the protection of the gas pipeline relies on personnel working in the area to be aware of the gas pipeline and the protections associated with it. Therefore, to improve site personnel knowledge, the following recommendations have been made:

- The site induction shall include information regarding the gas pipeline including location and protections to identify the gas pipeline (i.e., marker tape, etc.).
- All personnel working at the site shall be inducted prior to commencing any work.
- Appropriate markings shall be provided along the length of the gas pipeline as required to minimise the potential for unauthorised works occurring within the vicinity of the gas pipeline, in conjunction with the Site Induction and relevant site-specific construction management plans.
- Any work within the vicinity of the pipeline shall be submitted to APA and confirmed prior to commencement.

Notwithstanding the low risk of damage to the pipeline based upon the protection systems in place, this incident has been carried forward for further analysis to conceptually understand the risk posed by the pipeline on the development and vice versa.

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5.0 Hazard Assessment

5.1 Introduction

An additional analysis has been conducted regarding the types of incidents and events that may impact a buried gas pipeline in order to confirm such incidents and events, as a result of the proposed Development, cannot cause impact to the pipeline.

The European Gas Pipeline Incident Data Group (EGIG) collects and publishes a range of data in relation to high pressure gas pipelines. The EGIG comprises a group of major gas pipeline operators and related organisations in Europe and has collected data in relation to gas pipelines (operations, failures, etc.) over a 50-year period with over 4 million km.yr exposure to operation of gas pipelines. Hence, based on the vast experience available within this organisation, incidents that may affect the Jemena pipeline from the proposed Development have been selected for review.

The EGIG (Ref. [2]) reports on the types of events that result in pipeline failure leading to loss of gas containment from the pipeline. The list of events have been extracted from the EGIG report (Ref. [2]) as follows:

- External interference
- Hot-tap by error
- Corrosion
- Ground movement
- Construction defect
- Material defect
- Other incidents

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Each of these have been assessed in further detail in the following sections.

5.2 External Interference

External interference is the primary source of damage to pipelines which result in fire or explosion. Therefore, if damage can be prevented the risk of a pipeline loss of containment is drastically reduced. While excavation along or near the pipeline is not expected, in the event that it is, the following restrictions shall be imposed.

- Pipeline is to be marked on site by a representative of APA
- No work is to be performed within 3 m of pipeline without an APA representative present.
- No mechanical equipment is to be used for excavation within one (1) metre of the pipeline in any radial direction even after the pipeline location has been visually prove; unless under explicit direction from an APA representative.
- No mechanical works are allowed within 600 mm in any radial direction of the pipeline visually proving the pipeline location; excavation is to be conducted with hand tools only until the pipeline location has been visually proven.
- No mechanical equipment is to be used for excavation within 300 mm in any radial direction; excavation is to be conducted with hand tools only.

- For backfill, suitable padding material (screened spoil or clean sand with particles less than 2.8 mm in size) is required for at least 150 mm around the pipe.

The above restrictions are shown graphically in **Figure 5-1**.

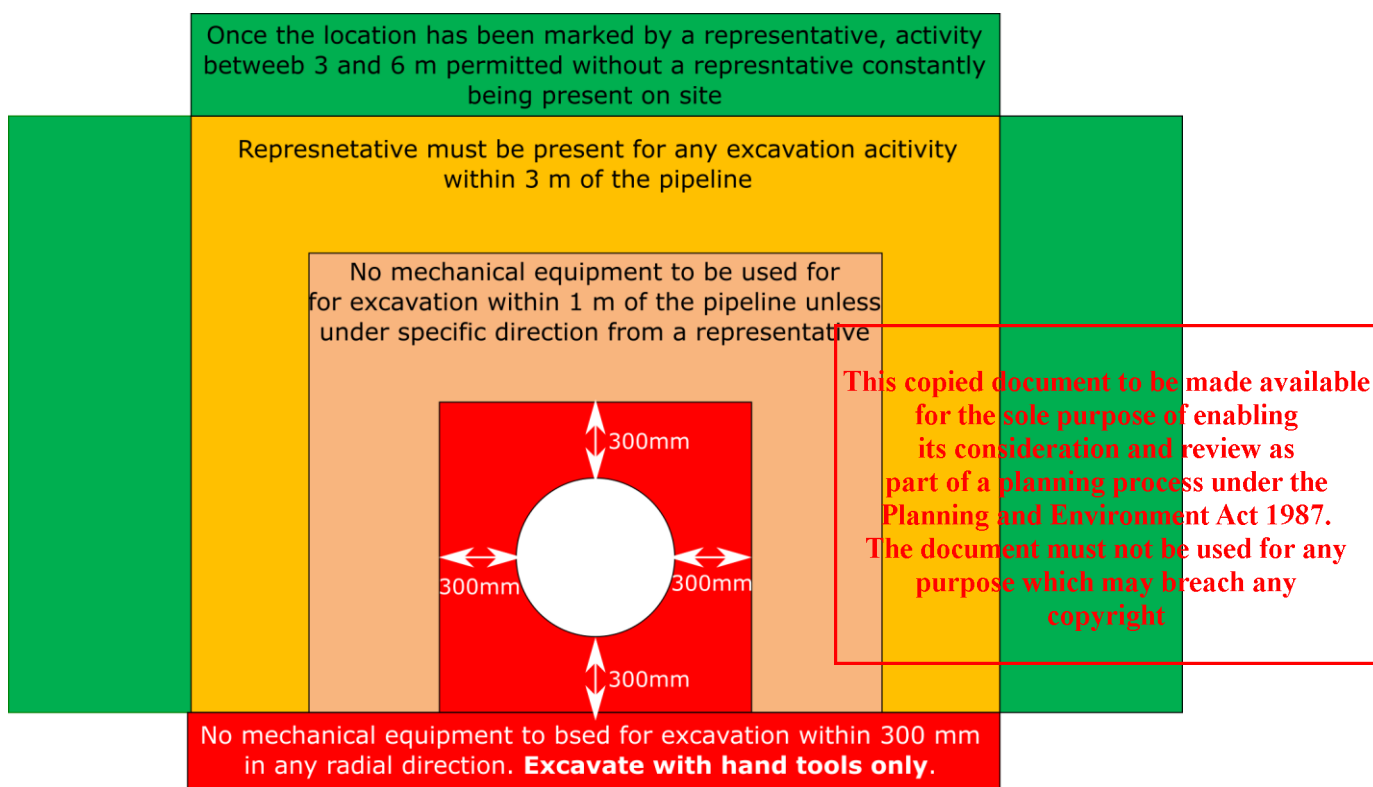


Figure 5-1: Graphical Presentation of Exclusion Zones Around Pipeline

5.3 Hot-Tap by Error

Work on adjacent pipelines in the same pipeline corridor resulting in identification of the wrong pipeline and hot tap to the gas pipeline. The development will not access the pipeline, nor are there adjacent pipelines that would require work; hence, hot-tap errors are not expected to occur.

5.4 Corrosion

External or internal corrosion resulting in loss of pipeline thickness can ultimately lead to pipeline failure. The construction operations at the Development will have no impact on pipeline internal/external corrosion. Notwithstanding this, it is known that standard procedure for pipelines involves ‘pigging’ the pipeline internally with an intelligent “pig” that performs corrosion detection along with a number of other condition monitoring functions.

5.5 Ground Movement

Subsidence as a result of earthquake or excavations close by causing ground collapse around the pipeline can result in pipeline failure and loss of containment. Earthquakes may have an impact on the pipeline; however, the proposed Development has no influence on earthquake in the Latrobe area.

Excavation in close proximity to the pipeline may lead to land subsidence adjacent to the pipeline resulting in exposure of the pipeline and loss of pipeline support. A review of the proposed

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construction activities at the Development indicates that excavation work is not intended to occur, hence, subsidence from adjacent excavations are not expected.

As noted, should excavations be required, the restrictions discussed in Section 5.2 would be imposed which would dramatically reduce the potential impact to the pipeline. Therefore, ground movement is not expected to be an issue for the development.

5.6 Construction Defect

Incorrect weld installation (weld failure), poor ground preparation (i.e. pipeline bed contains rocks which damage the external corrosion protection) or poor overfill preparation (rocks in the overfill impacting the external corrosion protection). The proposed Development has no influence over construction defects that may have occurred when the pipeline was constructed.

5.7 Material Defect

Incorrect pipeline material selected for the specific application or poor material qualities not detected at time of pipeline section manufacture (i.e. poor-quality metallurgical assurance). The proposed Development has no influence over pipeline material selection or manufacture that may have occurred when the pipeline was constructed.

5.8 Other Incidents

5.8.1 Lightning

Lightning impacts to the pipeline causing materials failure or maintenance induced failures (e.g. work on the pipeline leads to loss of containment during the project or after work is complete due to failure to complete the work correctly). The proposed Development has no influence over lightning impact or maintenance activities associated with the pipeline.

5.8.2 BESS

The BESS is composed of lithium-ion batteries which can fail resulting in fire. In the event of a fire there is the potential for radiant heat to impact a pipeline resulting in damage. The pipeline is buried under ground which provide shielding to the pipeline which would prevent any radiant heat damage in the event of a fire. Furthermore, the BESS is located centrally within the site which is away from the underground pipeline thereby eliminating the negative effects of the BESS on the pipeline.

5.8.3 Substations

Two additional substations are proposed to be developed on the site to enable connection to the electricity grid. Substations contain transformers that can explode or catch fire if arcing occurs within the transformer oils resulting in pressure rise and failure of the transformer shell. Such outcomes are relatively rare especially for modern equipment.

However, in the event of such an incident, the overpressure wave will propagate laterally and vertically rebounding from the ground and hard surfaces. As the pipeline is buried under ground, this would provide protection from any overpressure waves thereby protecting the pipeline. In addition, the transformers are not located within close proximity to the pipeline; hence, the separation distance will further reduce the overpressure experience by the pipeline.

In the event of a fire, radiant heat will be generated which as noted previously could result in damage to the pipeline if exposed. Again, as the pipeline is located underground it will be protected

from direct radiant heat and the distance of the transformers would result in attenuation of the radiant heat prior to impacting the area where the pipeline is located.

5.8.4 Agri-Solar

The area is proposed to be used for grazing of livestock. The area is currently used for grazing so the inclusion of the solar farm and equipment along with the continued grazing by livestock is not anticipated to result in an increased risk to the pipeline.

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6.0 Buffer Area Overlay – Schedule 1 Review

6.1 Introduction

The Buffer Area Overlay – Schedule 1 requires several aspects of the project and site to be reviewed to identify potential threats to the pipeline. A review of each of the items has been conducted in the following section.

6.2 BAO1 Assessment

Provided in **Table 6-1** is a review of each of the BAO1 requirements. The result of the analysis indicates that the potential threats posed by the development on the pipeline are minimal to the point of negligibility.

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Table 6-1: BAO1 Assessment

ID	BAO1 Requirement	Assessment
1	How activities associated with the use of land, and buildings or works, may result in any additional threats to the integrity of licensed pipelines and how these threats will be controlled and minimised.	A review of the development has been conducted in Sections 4.0 and Section 5.0 based upon the failure modes that occur with pipelines. The review indicated that there were minimal threats from the development.
2	<p>Emergency exit routes and external gathering spaces.</p> <div data-bbox="418 456 958 798" style="border: 2px solid red; padding: 10px; text-align: center;"> <p>This copied document to be made available for the sole purpose of enabling its consideration and review as part of a planning process under the Planning and Environment Act 1987. The document must not be used for any purpose which may breach any copyright</p> </div>	<p>During construction, any work conducted near the pipeline would be done so under direction of the pipeline operator incorporating controls to minimise the potential to damage the pipeline. Furthermore, excavation work near the pipeline is not expected to be required. Therefore, the potential for an incident to occur that would require evacuation is considered negligible.</p> <p>Furthermore, in the event that an incident did occur, the site is open land hence, clear evacuation routes would not be required as personnel can escape the hazard in any direction.</p> <p>Once operational, the site will be minimally staffed; hence, the potential threat on personnel from the pipeline is negligible. Furthermore, during operation the risk to the pipeline is not expected to be any different to prior to development.</p>
3	How the activities associated with the use of land, and buildings or works have been designed to reduce risks to human life in the event of pipeline failure.	<p>The site does not result in the development of the land in a manner that increases worker densities; hence, the immediate threat of the pipeline upon working populations at the site is not a credible threat.</p> <p>With respect to the wider community, the development itself is minimal invasive in that the infrastructure is all above ground and has minimal impact on the ground. As the pipeline is buried underground, the above ground works are unlikely to have a substantial impact as identified in Sections 4.0 and Section 5.0. Therefore, the potential risk to human health from the development and the interaction with the pipeline are considered to be minimal and are unlikely to result in increased risk compared to the pre-development risk profile.</p>
4	How the location and storage of dangerous or explosive goods or chemicals reduces the risk of contributing to the escalation of a pipeline failure.	The only dangerous goods stored at the site consist of Class 9 batteries in the BESS and the transformer oils. A review conducted in Section 5.0 identified that the potential consequences of these storages would not have a substantial impact on the pipeline as the pipeline is underground and the infrastructure containing the BESS and the transformers is located in a different area of the development providing distance to attenuate any

ID	BAO1 Requirement	Assessment
		consequence impacts. Therefore, the potential risk to the pipeline from DG storages is considered minimal.

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7.0 Conclusion and Recommendations

7.1 Conclusions

A review of the proposed development against the Buffer Area Overlay – Schedule 1 was conducted for the Hazelwood North Solar Farm to review the potential threats to the pipeline and determine if there is an increased risk to the pipeline and to life and health in the surrounding community as a result of the development.

The assessment focussed on the credible pipeline failure modes and how the development could influence these failure modes. The analysis conducted identified that the proposed development would have a minimal impact to the pipeline itself as the development is aboveground and doesn't require earthworks. Furthermore, ancillary equipment that could result in impacts to the pipeline is located a substantial distance away and the location of the pipeline underground would prevent such impacts from having an adverse effect on the pipeline itself.

Based upon the review, it is considered that the Development, which includes all components such as solar panels, BESS, inverters, transformers, etc. would not result in a substantial increase in risk of the existing pipeline than that which currently exists; therefore, it is considered that the risk associated with the pipeline would be reduced to ALARP as required.

7.2 Recommendations

Notwithstanding the above assessment, the following recommendations have been made:

ID	Recommendation
1	The site induction, for all personnel at site, shall include information regarding the gas pipeline including location and protections to identify the gas pipeline (i.e., marker tape, etc.).
2	All personnel working at the site shall be inducted prior to commencing any work.
3	Appropriate markings shall be provided along the length of the gas pipeline as required to minimise the potential for unauthorised works occurring within the vicinity of the gas pipeline, in conjunction with the Site Induction and relevant site-specific construction management plans.
4	Any work within the vicinity of the pipeline shall be submitted to APA and confirmed prior to commencement.
5	Pipeline is to be marked on site by a representative of APA
6	No work is to be performed within 3 m of pipeline without an APA representative present.
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9	No mechanical equipment is to be used for excavation within 300 mm in any radial direction; excavation is to be conducted with hand tools only.
10	For backfill, suitable padding material (screened spoil or clean sand with particles less than 2.8 mm in size) is required for at least 150 mm around the pipe.
11	A 10 m clearance to the pipeline shall be provided (i.e. to the location of the pipeline itself, not the easement).

8.0 References

- [1] Standards Australia, "AS 2885 Series – Pipelines – Gas and Liquid Petroleum," Standards Australia, Sydney.
- [2] European Gas Pipeline Incident Data Group, "10th Report of the European Gas Pipeline Incident Data Group (period 1970 – 2016), Document No. VA 17.R.0395," European Gas Pipeline Incident Data Group, March 2018.

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Appendix A

Hazard Identification Table

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A1. Hazard Identification Table

Area/Operation	Hazard Cause	Hazard Consequence	Safeguards
Gas pipeline	<ul style="list-style-type: none"> • Damage to pipeline during construction • Fire from solar farm equipment impacts pipeline • Disruption from livestock 	<ul style="list-style-type: none"> • Failure of pipeline and loss of containment and fire, vapour cloud explosion, jet fire, flash fire 	<ul style="list-style-type: none"> • Underground pipeline protects against damage / radiant heat • Marker tape, marker signs • Dial before you dig • Known location of pipeline • Deep trenching to avoid impact AS 2885 • Yellow jacketed pipeline (anti-corrosion and impact protection) • Bed of sand in the trench to prevent rocks

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