technical report G

air quality.

Environment Effects Statement | May 2021

western outer ring main

a project of apa

APA VTS (Operations) Pty Ltd

Western Outer Ring Main - Environment Effects Statement
Air Quality Report

May 2021

This Air Quality Report (Report):

1. Has been prepared by GHD Pty Ltd ("GHD") for APA VTS (Operations) Pty Ltd (APA);
2. May only be used for the purpose of informing the Environment Effects Statement and Pipeline Licence Application for the Western Outer Ring Main Project (and must not be used for any other purpose); and
3. May be provided to the Department of Environment, Land, Water and Planning for the purpose of public exhibition as part of the Environment Effects Statement and Pipeline Licence Application for the Western Outer Ring Main Project.

The services undertaken by GHD in connection with preparing this Report were limited to those specifically detailed in section 5 of this Report. The opinions, conclusions and any recommendations in this Report are based on assumptions made by GHD when undertaking services and preparing the Report (Assumptions), as specified in section 1.3 and section 5.7 and throughout this Report. GHD excludes liability for errors in, or omissions from, this Report arising from or in connection with any of the assumptions being incorrect. Subject to the paragraphs in this section of the Report, the opinions, conclusions and any recommendations in this Report are based on conditions encountered and information reviewed at the time of preparation. GHD has not, and accepts no responsibility or obligation to update this Report to account for events or changes occurring subsequent to the date that the Report was signed.

Executive summary

The Western Outer Ring Main Project (the Project) is a buried 600 millimetre nominal diameter high pressure gas transmission pipeline between APA's existing Plumpton Regulating Station (approx. 38 kilometres north west of Melbourne's CBD) and Wollert Compressor Station (approx. 26 kilometres north east of Melbourne's CBD), providing a high pressure connection between the eastern and western pipeline networks of the Victorian Transmission System (VTS).

The Project includes a new buried pipeline, three above-ground mainline valves along the pipeline alignment, and an additional compressor unit and regulating station at the existing APA Wollert Compressor Station.

APA is the proponent for the Project.

On 22 December 2019, the Minister for Planning determined that the Project would require an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (EE Act).

GHD Pty Ltd (GHD) has been engaged by APA Group (APA) to undertake an Air Quality Impact Assessment (AQIA) as part of an Environment Effects Statement (EES) for The Western Outer Ring Main (WORM) gas pipeline project (the Project). This report will inform the applications for project approvals including a Pipeline Licence. The WORM is a proposed 600 millimetre nominal diameter high pressure gas transmission pipeline that will provide a high pressure connection between the eastern and western pipeline networks of the Victorian Transmission System (VTS).

EES scoping requirements

The Minister of Environment has identified key environmental risks that would need to be addressed in the EES. For Air Quality, the scoping requirements include consideration of:

- Potential for project construction or operation to adversely affect local air quality
- Effects of project construction and operation on amenity, including potential air quality effects on nearby sensitive receptors (especially residents)
- An air quality impact assessment undertaken in accordance with SEPP environmental objectives
- Potential and proposed design responses and/or other mitigation measures to avoid, reduce and/or manage any significant effects for sensitive receptors during project construction and operation arising from specified air pollution indicators, including odour
- An environmental management framework with proposed objectives, indicators and monitoring requirements for managing emissions to air, including dust

Assessment methodology

A fully qualitative Air Quality dispersion modelling assessment was undertaken to predict the air quality impacts associated with the construction (i.e. construction of the pipeline) and the operation (i.e. operation of the Wollert Compressor Station) of the Project. A risk-based approach was then applied, based on the dispersion modelling results, to prioritise the key issues for assessment and inform measures to avoid, minimise and offset potential effects.

Impact assessment

Construction

For the construction of the pipeline, the impact assessment predicted the potential worst-case dust (PM_{10}) impacts associated with four project phases:

- Phase 1: Clear and grade
- Phase 2: Open trench construction
- Phase 3: Activities associated with backfilling of the trench (including with the pipeline itself)
- Phase 4: Rehabilitation of the construction corridor

Operation

During the operation of the Project, emissions are expected at the Wollert compressor station and as such worst case predicted pollutant concentrations were assessed within a 2.5 kilometre domain of the compressor station. Two operational scenarios were modelled, namely:

- Existing units 1,2, 4, 5, proposed unit 6 and including the Diesel Engine Alternator (DEA)
- Existing units 1,2, 4, 5, proposed unit 6 and excluding the DEA

It is noted that when undertaking dispersion modelling in relation to a new or modified emission source, the Environment Protection (Scheduled Premises) Regulations 2017 state that gas diesel generators used as standby engines (in this case, the DEA) “is not required” (Clause 10 (1) (b)). However, both scenarios (including and excluding the DEA) have been considered for completeness.

Risk assessment

A risk assessment for the Project was carried out using an approach that is consistent with Australian/New Zealand Standard AS/NZS ISO 31000:2018 Risk Management Process.

This risk assessment was used to identify the issues for assessment and apply a structured approach to the level of assessment and analysis undertaken of potential environmental effects within each technical study. Applying the risk framework facilitated an approach for the EES to identify and then investigate issues with a focus proportionate to the risk, and to consider management measures focused on reducing identified risks. This also informs the EES Scoping Requirements to minimise impact from air pollutants (gases, dust and odour).

Existing conditions

The Project pipeline is proposed to begin at APA’s existing Plumpton Regulating Station (KP 0) and end at the Wollert Compressor Station (KP 50).

The Wollert Compressor Station is located in a farming zone with two rural residences located nearby.

The proposed pipeline construction alignment mostly traverses sparsely populated rural areas and road reserves. It also traverses adjacent to existing and proposed residential areas in Hillside, Fraser Rise and Mickleham. The closest housing in these residential areas were identified approximately 150 m from the construction corridor (at KP 30-32).

The identified receptors are located within the following local planning zones:

Local Planning Zone	Applicable KP (direction from construction corridor)
Urban Growth Zone (multiple schedules)	0 - 3.2
	28 – 33.1(east)
	35.4 – 48
Green Wedge Zone (multiple schedules)	3.3 – 28
	28 – 33.5 (west)
Farming Zone	34 – 35.4 (north)
	49.3 – 51.045 (east)

The majority of the identified receptors have therefore been considered residential or rural-residential for the purposes of this assessment. Isolated rural residences are expected in Farming Zones while a higher density of housing is possible in residential developments in Urban Growth Zones.

The Bureau of Meteorology (BoM) operated automatic weather station (AWS) at Melbourne is considered representative of the Project area due to the weather station's proximity and similar exposure to prevailing winds.

For background air quality concentrations, data from EPA Victoria Footscray Air Quality Monitoring Station was considered representative and utilised in the assessment.

The background concentrations along the pipeline and at the compressor station would potentially be less than those in Footscray due the Project site being in a less urbanised/industrial area; albeit all of Greater Melbourne does experience some days per year where the NEPM dust (particulate matter) standards are exceeded. Hence, the background concentrations adopted have been used as a conservative estimate for the Project area.

Impact assessment

Wollert Compressor Station

Air dispersion modelling was conducted for CO, NO_2, PM_{10}, $PM_{2.5}$, PAHs, SO_2, Benzene, Formaldehyde, Toluene and Xylene which may be emitted by the Wollert Compressor Station under routine operations. The modelling includes emissions from the existing compressors as well as the proposed compressor. Emission rates were developed utilising the site-specific emission monitoring conducted by Ektimo in 2019 of NOx, as NO_2, and CO, at the Wollert Compressor Station. Where site-specific pollutant information was not known (i.e. for all remaining pollutants), the emission factors outlined in the National Pollutant Inventory (NPI) emission estimation technique (EET) manual for Combustion engines (Version 3, June 2008) were used. Dispersion modelling was undertaken using the EPA Victoria regulatory model, AERMOD.

The impact assessment predicted the following:

- Compressor station, including the DEA, excluding background: The impact assessment predicted compliance for all pollutants with the relevant criteria in the SEPP AQM when background is not included.
- Compressor station, including the DEA, including background: When the compressor station impact was assessed for emissions including background concentrations and the DEA (the “worst case scenario”), all pollutants with the exception of NO_2 and $PM_{2.5}$ comply with the relevant criteria as outlined in the SEPP AQM. It is noted that the predicted area of non-compliance for NO_2 and $PM_{2.5}$, when the DEA is operating, is found to be very small in area and largely over the APA owned property which includes the Wollert Compressor Station (i.e. not impacting any sensitive receptor locations).
- Compressor station, excluding the DEA, including background: When the DEA was not modelled (as it is an emergency backup engine), all pollutant impacts complied with the relevant criteria for worst-case normal operations. NO_2 was found to be the highest predicted pollutant with respect to its criterion, with a maximum impact of 74% of the SEPP AQM design ground level concentration. Particulate matter (PM_{10} and $PM_{2.5}$ at 27% and 18% respectively) are the next highest with respect to the SEPP AQM criteria. All other gaseous pollutants are less than 2% of the criteria.

Pipeline construction

Air quality impacts during construction of the pipeline would be predominantly due to dust emissions (PM_{10}) generated via mechanical disturbance (i.e. mobile source such as graders and excavators) and wind erosion (i.e. from disturbed soil surfaces under high wind speeds)

Emission rates were developed in line with the NPI EET Manual for Mining with dispersion modelling undertaken using the EPA Victoria regulatory model, AERMOD.

For the purpose of the air quality assessment, four indicative orientations based on the predominant orientations of the construction corridor were modelled, as follows:

Orientation number	Orientation	Applicable KP
1	North to South	KP 0 to 8 KP 42 to 50
2	East to West	KP 34 to 42
3	East-northeast to West-southwest	KP 8 to 21
4	North-northeast to South-southwest	KP 21 to 34

These orientations are considered typical of the Project sections orientated in the same direction. For each orientation, the dispersion modelling captures the worst-case meteorological conditions in a lateral direction from the construction corridor. As such the predicted model results for a particular orientation are applicable to all sections of the pipeline orientated in the same direction. The constructive phases modelled can be adopted across the pipeline alignment as construction proceeds.

The impact assessment found that operations undertaken during the open trench construction phase of the Project are predicted to have the biggest impact as a greater separation distance is required before dust concentrations are within the assessment criteria level (worst case day). It was found that the required distance to meet the PM_{10} criteria is no more than 75 m (i.e. this assumes that if no standard dust mitigation in place, sensitive receptors located within 75 m of the pipeline may be subject to dust concentrations which exceed the SEPP AAQ criteria). However, it is noted that the model results predicted shorter distances which are applicable based on:

- The orientation (Orientation 1 to 4)
- The side of the construction corridor (e.g. impacts expected to be higher to the east of the pipeline than compared to the west, based on the predominant meteorology)
- Construction phase (e.g. clear and grade typically required a shorter distance to meet the PM_{10} criterion, - i.e. a smaller amount of land (distance) is predicted to exceed the criterion)

A summary of the distances required from the construction corridor to meet the PM_{10} criteria is provided in the table below.

Orientation	Applicable KP	Direction	Distance from edge of construction corridor (m) required to meet the SEPP (AAQ) criterion			
			Clear and grade	Open trench construction	Activities associated with backfilling of trench	Rehabilitation of construction corridor
1	KP 0 to 8 KP 42 to 50	East	35	61	42	35
		West	35	75	49	35
2	KP 34 to 42	North	35	73	48	35
		South	32	74	42	32
3	KP 8 to 21	South-southeast	35	75	45	35
		North-northwest	35	73	45	35
4	KP 21 to 34	East-southeast	35	74	45	35
		West-northwest	35	73	45	35

Of the sensitive receptors identified in section 6.1, a total of:

- zero are located within 35 m of the construction corridor
- six are located within 50 m of the construction corridor
- 15 are located within 75 m of the construction corridor

Where sensitive receptors are located within the distances outlined above, enhanced dust management controls will be required when conducting pipeline construction activities within that impact zone. There are three possible scenarios resulting in differing mitigation responses:

1. No sensitive receptors within the impact zones outlined in the table above

   Impacts to air quality will be negligible with the implementation of standard dust mitigation measures, such as application of dust management controls in the CEMP and dust monitoring.

2. Isolated rural residences within the impact zones

   Additional dust mitigation measures, in addition to standard dust mitigation measures would result in low impact to air quality for sensitive receptors. Additional mitigation measures in this scenario include real-time reactive monitors at the residence within the separation distance and the ability to reduce or suspend work activities in the immediate area for a period, as dictated by local weather conditions.

3. Multiple sensitive receptor locations within the impact zone

   This scenario accounts for multiple sensitive receptors or potential future housing built within 35 m of the constriction corridor. Additional dust mitigation measures, in addition to standard dust mitigation measures would result in low impact to air quality for sensitive receptors. Additional mitigation measures in this scenario include reducing or suspending activities in the immediate area when real-time monitors ‘alarm’, installing a series of monitors at residential properties abutting the construction corridor, gravel treatment of agreed vehicle routes and wind barriers (e.g. shade cloth to slow down wind). There is no current housing abutting or within 35 m of the construction corridor and these additional treatments would only be required if new housing is established prior to construction.

Environmental management framework

The Project has been designed to prevent and minimise air pollutant emissions during construction and operation.

During construction, mitigation measures within the Construction Environment Management Plan (CEMP) supplies the means to control construction dust so that potential adverse social, economic, amenity and land use effects at local (and regional scale if relevant) are minimised. The CEMP has current best practice controls and management practices that have been demonstrated to be effective in preventing and managing offsite impacts.

Enhanced mitigation measures, such as reactive real time dust monitoring and other measures, where there are single or multiple sensitive receptors within the impact zone, are recommended to lower the potential risk of amenity and health related impacts.

The Wollert Compressor Station incorporates modern, efficient design features, such as efficient low-NOx and CO burners and minimum stack heights to ensure adequate dispersion, minimising operational impacts and ensuring best practice is being implemented.

Abbreviations

Abbreviation	Definition
AQIA	Air Quality Impact Assessment
AQMS	Air Quality Monitoring Station
AWS	Automatic Weather Station
BaP	Benzo[a]pyrene
BOM	Bureau of Meteorology
CEMP	Construction Environment Management Plan
CO	Carbon Monoxide
DEA	Diesel Engine Alternator
EES	Environment Effects Statement
EET	Emission Estimation Technique
EPA	Environment Protection Authority
GEA	Gas Engine Alternator
GED	General environmental duty
HDD	Horizontal directional drilling
m	metre
MLV	Mainline valve
MSA	Melbourne Strategic Assessment
NEM	National Energy Marker
NEPM	National Environment Protection Measure
NOx	Oxides of Nitrogen
NO_2	Nitrogen Dioxide
NPI	National Pollutant Inventory
PAHs	Polycyclic aromatic hydrocarbons
PEM	Protocol for Environmental Management
PM	Particulate Matter
$PM_{2.5}$	Atmospheric particulate matter (PM) that have a diameter of less than 2.5 micrometres
PM_{10}	Atmospheric particulate matter (PM) that have a diameter of less than 10 micrometres
RCS	Respirable Crystalline Silicon
SEPP(AAQ)	State Environment Protection Policy (Ambient Air Quality)
SEPP(AQM)	State environment protection policy (Air Quality Management)
SO_2	Sulphur Dioxide
VTS	Victorian Transmission System
VKT	Vehicle Kilometres Travelled
WORM	Western Outer Ring Main

Glossary

Term	Definition
APA	APA VTS (Operations) Pty Ltd, trading as APA Group, the proponent for the Project
AP42 13.2.2 Unpaved Roads	US EPA Compilation of Air Emissions Factors, 13.2.2 Unpaved Roads
Construction corridor	The area required to carry out construction activities associated with the Project. Activities include clear and grade, open trench construction and excavation, backfilling the trench and rehabilitation. The corridor is generally around 30 metres wide.
Environmental management measure	Approaches, requirements or actions to avoid, mitigate or manage potential adverse impacts
Melbourne Strategic Assessment (MSA) area	The area between KP 0−KP 3.2, KP 28.16 to KP 28.57 and KP32 to KP51 is within the area having MSA approvals. This approval is an agreement between the Victorian and Australian governments made under Part 10 of the EPBC Act whereby impacts on Matters of National Environmental Significance that are expected to occur within the Melbourne urban growth boundary are defined and accounted for a priori and can be considered early in the development of a plan, policy or program.
Project	The Western Outer Ring Main Project
Scoping requirements	The EES Scoping requirements for the Project issued by The Minister for Planning in August 2020.

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1. Introduction

1.1 Purpose of this report

The Western Outer Ring Main (WORM) gas pipeline project (the Project) is a proposed 600 millimetre nominal diameter high pressure gas transmission pipeline that will provide a high pressure connection between the eastern and western pipeline networks of the Victorian Transmission System (VTS).

APA is the proponent for the Project. APA is Australia's largest natural gas infrastructure business. In Victoria, the VTS is owned and maintained by APA and consists of some 2,267 kilometres of gas pipelines. The VTS serves a total consumption base of approximately two million residential consumers and approximately 60,000 industrial and commercial users throughout Victoria.

The Project will provide critical infrastructure to support Victoria's high pressure gas supply, network, including distribution, consequent security, efficiency and affordability. The key objectives of the Project are to:

- Improve system resilience and security of gas supply
- Increase the amount of natural gas that can be stored for times of peak demand
- Improve network performance and reliability
- Address potential gas shortages as forecasted by AEMO in the March 2020 Victorian Gas Planning Report update

The Minister for Planning determined on 22 December 2019 that APA and the Western Outer Ring Main (WORM) gas pipeline project requires an Environment Effects Statement (EES) under the *Environment Effects Act 1978* (EE Act). The EES will inform assessment of approvals required for the Project including under the *Pipelines Act 2005, Aboriginal Heritage Act 2006* and *Environment Protection and Biodiversity Conservation Act 1999*.

The purpose of this report is to assess the existing environment, the potential air quality impacts associated with the Project and to define the environmental management measures necessary to meet the EES evaluation objectives.

1.2 Why understanding air quality is important

Air quality impacts must be considered during both the construction and operational phases of the Project in terms of potential impacts to amenity, and to community and environmental health for nearby sensitive receptors.

For the construction phase, dust impacts associated with construction activities are required to be managed consistent with the EPA Victoria Civil Construction, Building and Demolition Guide (EPA Publication 1834)[1] and supporting guidance documents. It is required to establish the risks of construction dust impact on sensitive receptor locations and identify areas that may require a higher level of dust mitigation under certain conditions (such as hot, gusty adverse winds and/or proximity to civil works).

[1] EPA Victoria 2020 "Civil Construction, Building and Demolition Guide" EPA Publication 1834

For the operation phase, an assessment of air quality impacts associated with the upgrade of the Wollert Compressor Station is required to confirm that the upgraded facility will not generate potential exposure of a human community to severe or chronic health hazards over either the short or long term. This is consistent with the requirements of the State Environment Protection Policy (Air Quality Management)(SEPP AQM)[2].

There are limitations as methane (major component of reticulated gas) is not a substance in Schedule A of SEPP AQM.

1.3 Assumptions

- Meteorological data obtained from the Bureau of Meteorology Melbourne Airport weather station is representative of the Project site and surrounding area
- Air quality data obtained from the EPA Victoria Footscray Air Quality Monitoring Station is representative of the Project site and surrounding peri-urban and northern and western suburban areas of Greater Melbourne
- The proposed crossings (road/rail/creek) are expected to have negligible construction dust emissions due to their limited footprint (a 30 m wide construction corridor is not required to be cleared within road and rail reserve boundaries) and also due to limited linear extent of any open trenches and area size of pits for directional drilling
- Access and egress is ad-hoc and over short distances

[2] State Environment Protection Policy (Air Quality Management) (SEPP AQM), State Government of Victoria, December 2001

2. EES scoping requirements

2.1 EES evaluation objectives

The scoping requirements for the EES, released by the Minister for Planning, set out the specific environmental matters to be investigated and documented in the Project's EES, and informs the scope of the EES technical studies. The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the Project.

The following evaluation objectives are relevant to the Air Quality Impact Assessment:

- Minimise potential adverse social, economic, amenity and land use effects at local and regional scales
- Minimise generation of wastes from the Project during construction and operation, and to prevent adverse environmental or health effects from storing, handling, transporting and disposing of waste products

2.2 EES scoping requirements

The scoping requirements relevant to the Air Quality evaluation objectives are shown in Table 1, as well as the location where these items have been addressed in this report.

Table 1 Scoping requirements relevant to Air Quality

Scoping requirement	Section addressed
Key issues: • Potential for project construction or operation to adversely affect local air quality Likely effects: • Predict likely atmospheric concentrations of dust and other air pollution indicators at sensitive receptors along the pipeline corridor, during project construction and operation, using an air quality impact assessment undertaken in accordance with SEPP environmental objectives.	Sections 9 and 10
Existing environment: • Identify dwellings and any other potentially sensitive receptors (e.g. residential, commercial, industrial, recreational areas, etc.) that could be affected by the project's potential effects on air quality, lighting, noise, odour or vibration levels, especially vulnerable receptors including children and the elderly • Monitor and characterise background levels of air quality (e.g. dust), noise and vibration near the project, including established residential areas and other sensitive receptors.	Section 6
Mitigation measures: • Identify potential and proposed design responses and/or other mitigation measures to avoid, reduce and/or manage any significant effects for sensitive receptors during project construction and operation arising from specified air pollution indicators, noise, vibration, odour, traffic and lighting, in the context of applicable policy and standards	Section 10

Scoping requirement	Section addressed
Environmental management framework: The proposed objectives, indicators and monitoring requirements (including parameters, locations and frequency) for managing: • Emissions to air, including dust	Section 10
Existing environment (biodiversity and habitats): • Identify flora and fauna that could be affected by the project's potential effects on air quality	See Technical Report A *Biodiversity*

2.3 Linkages to other reports

This report relies on or informs the technical assessments as indicated in Table 2.

Table 2 Linkages to other technical reports

Specialist report	Relevance to this technical study
Biodiversity	Identifies flora and fauna that could be affected by construction and operational impacts, including the Project's potential effects on air quality. Bioaccumulation Class-2 indicators of SEPP AQM are not emitted by this Project (fluoride and mercury). See Technical Report A *Biodiversity* for further discussion surrounding potential ecological impacts as a result of air quality (including dust impacts) and the relevant mitigation measures.
Social	Assesses social effects as a result of the potential air quality impacts See Technical Report L *Social* for further discussion surrounding potential social impacts as a result of air quality and relevant mitigation measures.
Contaminated soil	Identifies areas of potential risk of contaminated soil producing odour, gases or material attached to dusts. The Contamination report has only identified low risk locations and therefore further assessment in this air quality report (dust) is not required. Odour has been considered – refer Risk AQ5. See Technical Report E *Contamination*

3. Project description

3.1 Project overview

The Project provides a new link between APA's existing Plumpton Regulating Station (approx. 38 kilometres northwest of Melbourne's CBD) and Wollert Compressor Station (approx. 26 kilometres north east of Melbourne's CBD). The Project includes the following key components:

- **A new pipeline**: The pipeline would be approximately 51 kilometres in length. The pipeline would be within a 15 metre wide permanent easement and be buried for its entire length to a minimum depth of cover of 750 millimetres.
- **Mainline valves**: Three mainline valves (MLV) would be located along the pipeline alignment. The area required for mainline valves would be subdivided and acquired by APA to provide ongoing access for any maintenance or inspection activities from the existing roads. The mainline valves would be spaced at intervals of approximately 15 kilometres, and located at approximately KP 6, KP 22 and KP 35.
- The **Wollert Compressor Station upgrade**: The installation of a new Solar Centaur 50 compressor, an end of line scraper station and a pressure regulating station within the existing APA facility at Wollert.

A schematic illustration of the Project context is shown in Figure 1.

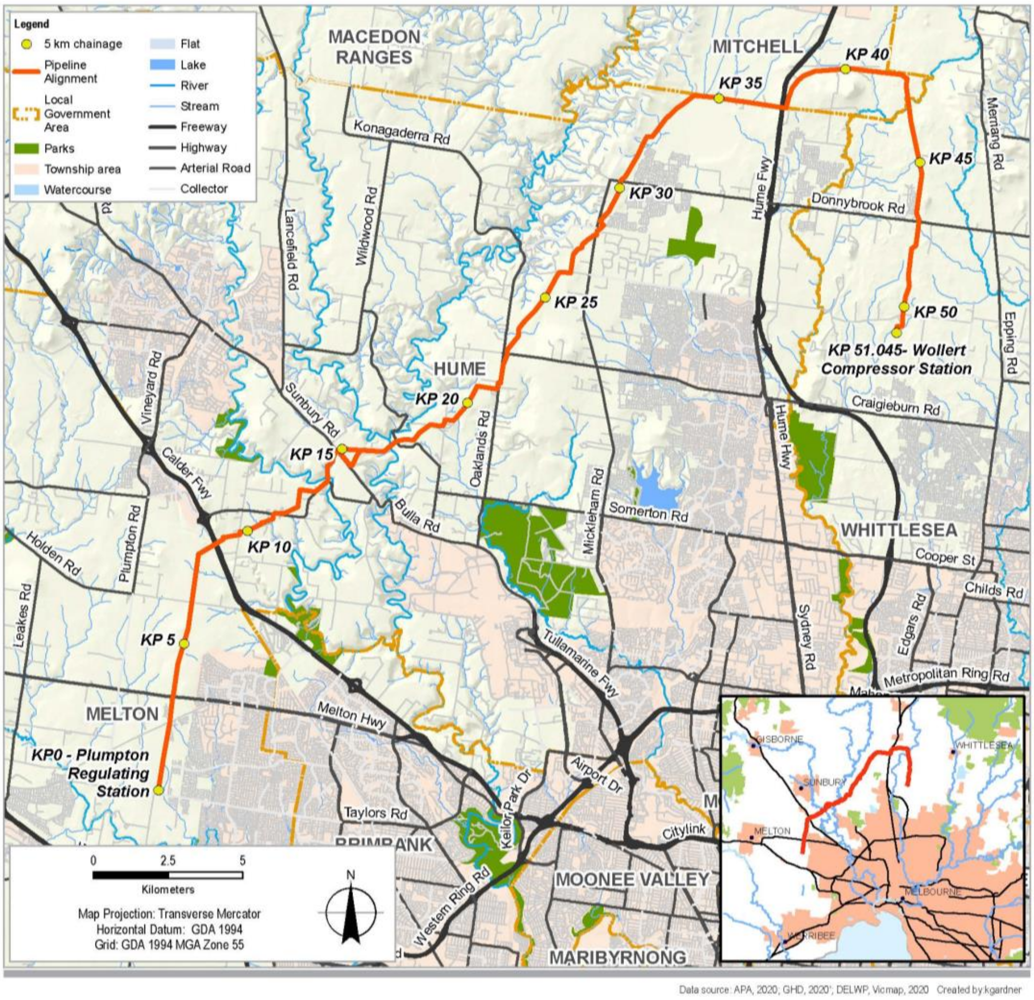


Figure 1 Western Outer Ring Main overview

3.2 Construction

Subject to the staging of the works, construction for the entire Project is expected to take approximately nine months. Key construction activities for the Project include:

- Establishing offsite construction sites, including laydown areas
- Constructing the pipeline
- Constructing three mainline valves
- Construction of upgrades associated with the Wollert compressor station
- Rehabilitation

3.2.1 Construction sites

Two temporary construction sites would be established for construction.

One offsite compound for pipeline works, nominally 200 m x 200 m, including laydown and storage areas. This would be located on a site where the activity is permitted under the relevant Planning Scheme, most likely within an existing industrial area.

The second temporary laydown area and construction offices would be established for the Wollert Compressor Station construction works. The site laydown area and construction offices for the compressor station equipment would be located within the existing compressor site area at Wollert.

3.2.2 Pipeline construction area

The Project would require a construction area for the pipeline, which would typically comprise a 30 metre wide corridor along the pipeline alignment. Most construction activity would be located within this construction area. The activities and facilities within the construction corridor would include access tracks and additional work areas such as vehicle turn around points and additional work spaces for crossings, stockpiling of materials and storage of pipe. Additional work areas up to 50 m x 50 m or 50 m x 100 m (such as for vehicle turn-around points, areas to accommodate horizontal directional drilling (HDD)) would be required in some locations.

3.2.3 Pipeline construction methodology

The techniques used to construct the underground pipeline would include various methods including, open trench construction and alternative techniques at certain locations such as HDD or horizontal boring.

Where crossing watercourses, major roads, rail line reserves or other constraints, the pipeline may be constructed using trenchless construction techniques such as HDD or shallow horizontal boring, to avoid construction disturbance within the sensitive area.

The pipeline construction sequence starts with survey works and continues with site establishment (including laydown area), clearing and grading, pipe stringing, pipe bending, welding and coating, open trench construction, lowering pipe into trench and backfilling, hydrostatic testing, commissioning, and finally rehabilitation.

There would be dedicated access points into the construction corridor with vehicular movements along the Project alignment kept within the construction corridor.

3.2.4 Construction of other facilities

The construction sequence for the Wollert Compressor Station works starts with survey works and continues with site establishment (including laydown area), bulk earthworks, civil works (concrete slab and footings), mechanical works, electrical and instrumentation works, hydrostatic testing, commissioning, and site completion.

Various components of the compressor are assembled offsite. When delivered to site the various components are assembled together in-situ. Cranes are used to lift the compressor into place with all connecting pipework fitted.

3.3 Operation

Following the reinstatement of land as part of the pipeline construction, the land would be generally returned to its previous use. When commissioned, the pipeline would be owned and maintained by APA. The pipeline would be contained within a 15 metre wide permanent easement corridor (within the area that formed the 30 metre construction corridor). Routine corridor inspections would be undertaken in accordance with APA procedures and AS2885 to monitor the pipeline easement for any operational or maintenance issues.

Excavating or erecting permanent structures, buildings, large trees or shrubs over the underground pipeline would be prohibited in accordance with the *Pipelines Act 2005* and pursuant to easement agreements with landowners.

Maintenance and inspections of the MLVs and the Wollert Compressor Station would also be conducted periodically in accordance with APA procedures. The activities usually include vegetation management, valve and compressor operation and corrective maintenance.

The key operation and maintenance phase activities include:

- Easement maintenance (vegetation control, weed management, erosion and subsidence monitoring)
- Pipeline, MLVs and compressor station maintenance
- Specialist pigging operations
- Cathodic protection surveys for mechanical and electrical preventative and corrective maintenance
- Monitoring and routine inspections and surveillance

3.4 Design, construction and operation considerations relevant to Air Quality

During construction:

Clear and Grade: Clearing and grading of the area is undertaken to provide a safe and efficient area for construction activities. Clearing would be required to remove trees, shrubs, surface rocks and groundcover vegetation. Graders, bulldozers and excavators are generally used. Cleared topsoil would be stockpiled on the edge of the construction corridor with breaks left in stockpiles at fence lines, tracks and drainage lines to allow continued access for stock. Temporary access tracks over watercourses and access points to local roads would be constructed during this phase.

Open trench construction: Specialised trenching machines and excavators would be used to excavate the trench to a depth of approximately two metres and approximate width of one metre. Spoil generated during trench excavation would be stockpiled separate from vegetation and topsoil stockpiled earlier in the construction program. Any windrowed material is compacted (by pack rolling) after establishment. Rock breaking processes such as the use of rock saws/hammers and/or (small-scale) blasting is expected to be required to excavate the trench in areas of rock.

Lowering pipe into trench and backfilling: Once the pipe is strung and welded, it is lowered into the trench with suitable bedding and padding material. The trench is backfilled with the previously excavated subsoil material. In areas of rock excavation, imported bedding and padding material may be required where the previously excavated subsoil is unsuitable for use. Care is taken to maintain separation between topsoil and subsoil during this process. The subsoils are compacted to limit settlement of the trench through the operational life of the pipeline. Any excess spoil is removed from the site.

Rehabilitation of the construction corridor: Rehabilitation of the construction area would be undertaken in accordance with the specific Project CEMP and good pipeline construction principles with a view to returning land to its previous use within a reasonable timeframe, subject to seasonal constraints. Key activities would include:

- Re-establishing topsoil cover
- Reinstating roadways and road reserves in accordance with the requirements of local councils
- Reinstating natural drainage patterns
- Application of seed, where appropriate
- Installing any erosion control measures in prone areas
- Reinstating waterways to meeting Catchment Management Authority requirements

During Operation:

The compressor station runs a combination of gas fired engines, including a proposed new 4.5 MW engine (as Unit 6), to pump gas through the VTS as required (by the NEM gas market). The new Unit 6 is proposed to be a Solar Centaur 50 T6102S-C334 with low NOx and CO combustion (using the Caterpillar SoLoNOx™ combustion chamber with 12 fuel injectors)[3]. CO and NO_2 impact is expected to be the highest percentage of relevant design ground level concentration limits. Therefore, the low-NOx and CO burner design (industry sector technology) applies best practice[4] to the management of those emissions. 'Best practice' is the subject of Clause 19 (1) of SEPP AQM in that "*A generator of a new or substantially modified source of emissions must apply best practice to the management of those emissions*". Engine emissions are expected from the discharge points of the existing compressor engines 1 to 5, in addition to the proposed unit 6 to be installed as part of the Project.

[3] Solar ® Turbines Incorporated; A 75-90% reduction in NOx from conventional combustion baseline emission factors for natural gas fuel.

[4] Part IV – Definitions from SEPP AQM: "'best practice' means the best combination of eco-efficient techniques, methods, processes or technology used in an industry sector or activity that demonstrably minimises the environmental impact of a generator of emissions in that industry sector or activity

The engines produce products of combustion emitted through either vents on the Station A building or standalone stacks from each of the three largest engines. Currently as required, a gas fuelled backup generator (Gas Engine Alternator (GEA)) runs when grid power is lost. Moreover, the GEA has a maintenance firing for at least one hour per week (typically lasting 20 minutes) with a following cool down cycle. The GEA is proposed to be replaced with a Diesel Engine Alternator (DEA) which will operate under similar conditions to the GEA (Viz, as an emergency emission source only with regular, weekly, maintenance firing).

4. Legislation, policy and guidelines

4.1 Legislation, policy and guidelines

The EES is prepared under the EE Act and will inform assessment of approvals required for the Project. The legislation relevant to the principal approvals required for the Project is:

- Commonwealth approval under the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act). For the component of the Project that is located outside of the Melbourne Strategic Assessment (MSA) area, the Project requires assessment and approval under the EPBC Act, under the assessment bilateral agreement with Victoria made under section 45 of the EPBC Act. The MSA program is the Victorian Government's approach to managing the impact of urban development in Melbourne's growth areas on significant vegetation communities, plants and animals. Areas within the approved MSA area occur between approximately KP 0 to KP 3.2, KP 28.16 to KP 28.57, and KP 32 to KP 51. Areas outside of the MSA occur approximately between KP 3.2 to KP 28.1, and KP 28.57 to KP 32.
- Pipeline Licence under the *Pipelines Act 2005* (Vic) (Pipelines Act). Pipeline Licence approval is required under the Pipelines Act 2005 (Vic) (Pipelines Act) for the Western Outer Ring Main Project. The Pipeline Licence application is exhibited with the EES.

  Section 49 of the Pipelines Act requires that the following matters be considered before granting a licence:

  (a) the potential environmental, social, economic and safety impacts of the proposed pipeline

  (f) the assessment of the Environment Effects Minister in relation to the proposed pipeline, if an assessment has been made

  (g) any written comments received from the Planning Minister or the relevant responsible authority on the effect of the proposed pipeline on the planning of the area through which it is to pass

  (h) any written comments received from the Water Minister and from the relevant Crown Land Minister on the impact of the proposed pipeline

  Section 3 of the Pipelines Act sets out the objectives of the Act including:

  (a) to facilitate the development of pipelines for the benefit of Victoria

  (e) to protect the public from environmental, health and safety risks resulting from the construction and operation of pipelines

  (f) to ensure that pipelines are constructed and operated in a way that minimises adverse environmental impacts and has regard for the need for sustainable development

  Section 4 of the Pipelines Act sets out the principles of sustainable development to be given regard in implementing the Act including that decision-making should be guided by a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable and an assessment of the risk-weighted consequences of various options.

  Section 54(c) of the Pipelines Act states that conditions on a licence may include conditions concerning the protection of the environment.

- Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006* (Vic) (AH Act). Two CHMPs are currently in progress for the Project (CHMP 16593 and CHMP 16594).

A number of legislative, policy, guidance and standard documents were found to be relevant to this Air Quality impact assessment (AQIA) and are discussed further in this report. The key legislation, policy and guidelines that apply to the AQIA for the Project are summarised in Table 3. Further detail is provided in Section 4.2 to 4.5.

Table 3 Key legislation and policy applicable

Legislation/policy	Relevance to this impact assessment
Environment Protection Act 1970 (the Act)	Creates a legislative framework for the protection of the environment in Victoria. The Act establishes the powers, duties and functions of the EPA.
State Environment Protection Policy (Ambient Air Quality) 2016 (SEPP AAQ)	The SEPP AAQ sets broad air quality objectives and goals for the whole of Victoria by adopting the NEPM AAQ's monitoring and reporting standards. The SEPP AAQ standards do not apply to individual sources but rather to regional air quality
State environment protection policy (Air Quality Management) 2001 (SEPP AQM)	The SEPP AQM sets the requirements for management of sources of pollution such that the air quality objectives of SEPP AAQ are met, air quality improves and the cleanest air possible is achieved.
The Protocol for Environmental Management: Mining and Extractive Industries (Mining PEM)	The Protocol for Environmental Management: Mining and Extractive Industries (Mining PEM) is an incorporated document of the SEPP AQM. It supports the interpretation of SEPP AQM and sets out the statutory requirements for the management of emissions to the air environment from activities undertaken in the operation of mining and extractive sites. This is the most relevant of the available PEM's when assessing area-scale emissions from major construction sites.

4.2 Current EPA legislation

The soon to be repealed *Environment Protection Act 1970* (the Act) creates a legislative framework for the protection of the environment in Victoria. The Act establishes the powers, duties and functions of the EPA which include:

- The administration of the Act and its regulations
- The making and review of State environment protection policies (SEPPs)
- Issuing works approvals, licences, permits, and pollution abatement notices
- Implementing National Environment Protection Measures (NEPMs), through the relevant SEPPs

Of particular importance to this assessment are the SEPP air policies and other subordinate regulations of the EP Act:

- State environment protection policy (Air Quality Management) 2001 (SEPP AQM)
- State Environment Protection Policy (Ambient Air Quality) 2006 (SEPP AAQ)
- Environment Protection (Scheduled Premises) Regulations 2017

4.3 SEPP Air policies

In Victoria, the requirements of the National Environment Protection (Ambient Air Quality) Measure (NEPM AAQ) are adopted into the SEPP AAQ. The SEPP AAQ sets broad air quality objectives and goals for the whole of Victoria by adopting the NEPM AAQ's monitoring and reporting standards. The SEPP AAQ standards do not apply to individual sources but rather to regional air quality. It is noted the Environmental Reference Standard to be implemented on 1 July 2021 and which will supercede the SEPPs, will have largely the same objectives and same criteria as the current SEPP AAQ.

The SEPP AQM sets the requirements for management of sources of pollution such that the air quality objectives of SEPP AAQ are met, air quality improves and the cleanest air possible is achieved. The SEPP AQM (Clause 9) identifies the beneficial uses of the air environment which are to be protected and defines the air quality indicators which must be managed to ensure that the beneficial uses, inclusive of human health and well-being, are protected. Beneficial uses from Clause 9 (1) of the SEPP AQM are:

(a) life, health and well-being of humans

(b) life, health and well-being of other forms of life, including the protection of ecosystems and biodiversity

(c) local amenity and aesthetic enjoyment

(d) visibility

(e) the useful life and aesthetic appearance of buildings, structures, property and materials; and

(f) climate systems that are consistent with human development, the life, health and well-being of humans, and the protection of ecosystems and biodiversity

Design criteria are specified in Schedule A for Class 1, 2, 3 and Unclassified indicators. These Classes are defined as:

- Class 1 means "a substance which is common or widely distributed and is established as an environmental indicator in the State environment protection policy (Ambient Air Quality), and may threaten the beneficial uses of both local and regional air environments"
- Class 2 means "a waste which is a hazardous substance that may threaten the beneficial uses of the air environment by virtue of its toxicity, bio-accumulation or odorous characteristics"
- Class 3 means "a waste which is an extremely hazardous substance that may threaten the beneficial uses of the air environment due to its carcinogenic, mutagenic, teratogenic, highly toxic or highly persistent characteristics"
- Unclassified indicators are those that affect general amenity. Two are identified:
  - General odour and nuisance dust (Total Suspended Particulate (TSP)) from point sources)

Modelling of emissions to air is prescribed by Schedule C of SEPP AQM. The schedule aims to ensure that the potential impact of new or modified sources of emissions to air in Victoria is:

a. Estimated using techniques approved by the Authority to predict the maximum concentration of pollutants

b. Assessed against the design criteria prescribed in Schedule A of the policy

Schedule C states that “where a protocol for environmental management exists for a specific industry sector, proponents for new or modified sources of emissions for that industry should refer to the specific protocol for environmental management for additional information” (Clause 4).

4.3.1 The Stationary Sources PEM

The Protocol for Environmental Management Minimum Control requirements for Stationary Sources[5], (Stationary Sources PEM), has been reviewed and it provides minimum control requirements for stationary sources, i.e. fixed in-stack emission limits.

The operation of a compressor station, is not listed in the Stationary Sources PEM and therefore the design criteria for peak ground level concentrations provided in SEPP AQM Schedule A are applicable, along with the emission limits for new stationary sources in air quality control regions, included in the SEPP AQM Schedule E.

The sources associated with the pipeline construction are not considered stationary sources and therefore this PEM is not applicable to the construction phase of this Project.

4.3.2 The Mining PEM

The Protocol for Environmental Management: Mining and Extractive Industries (Mining PEM) is an incorporated document of the SEPP AQM. It supports the interpretation of SEPP AQM and sets out the statutory requirements for the management of emissions to the air environment from activities undertaken in the operation of mining and extractive sites.

Since dust will not be emitted from point sources (i.e. a stack) during construction, the SEPP AQM requires a “relevant industry PEM” (first footnote 1 of the table in Schedule A) to be used. As there is no PEM for area-based sources such as roads, the Mining PEM becomes the default protocol.

The Project is also required to comply with the Civil Construction, Building and Demolition Guide (EPA Publication 1834) during the construction phase of the Project. Therefore, the measures proposed in this Guide should be used where appropriate to avoid and minimise impact from such activities during construction.

4.4 Environment Protection Amendment Act 2018

A new legal framework will come into effect on 1 July 2021 that will help drive environmental improvements. The cornerstone of the *Environment Protection Act 2017*, as amended by the *Environment Protection Amendment Act 2018* is the general environmental duty (GED), which requires Victorians to understand and minimise their risks of harm to human health and the environment, from pollution and waste. EPA will work with industry to help them understand how to fulfil their obligations, by providing guidance, advice and other support. Complying with the GED is about taking reasonable proactive steps and employing good environmental work practices.

APA and their contractors will follow good management practices and mitigation measures that would aid compliance with the GED. This will include meeting industry standards, adopting industry better management practices, and following other relevant legislation related to the environment.

[5] EPAV 2002 “Minimum Control requirements for Stationary Sources”. Publication 829, January 2002

4.5 Assessment criteria and guidelines

4.5.1 Operation phase

The relevant design criteria for the operational phase of the Project are specified in SEPP AQM Schedule A, i.e. stack (stationary source) emissions from the Wollert Compressor Station.

The SEPP AQM Schedule A design criteria for all toxic substances are required to be met at all locations (i.e. outside and within the premises boundaries (with the exception inside building envelopes)) (SEPP AQM Schedule C Part C 2(b)).

The pollutants assessed as part of this assessment (discussed further in section 8.1.1) are as follows:

- Carbon Monoxide (CO): An odourless, colourless gas which forms when the carbon in fuels doesn't completely burn. It is usually generated by motor vehicles and industry but can also be formed during bushfires.
- Oxides of Nitrogen (NOx): A mixture of gases that are made up of nitrogen and oxygen gases. They include nitrogen dioxide, nitric oxide, nitrogen oxide and nitrogen monoxide.
- Sulphur Dioxide (SO_2): Industries that carry out activities such as wood pulping, paper manufacturing, petroleum and metal refining and metal smelting, especially of ores containing sulphides, such as lead, silver and zinc, all emit sulphur dioxide into the air. Fossil fuel combustion, such as in coal-burning power plants and less so when natural gas is consumed, also emits sulphur dioxide.
- Particulate Matter (both PM_{10} and $PM_{2.5}$): Atmospheric particulate matter (PM) that have a diameter of less than 2.5 and 10 micrometres, respectively.
- Benzene: The industries where benzene may be used include: rubber, oil, chemicals, footwear and petrol. Because benzene is found in petrol and oil, it can be released into the atmosphere by buses, cars, motorbikes, trains and airplanes. It can be emitted in exhaust fumes, and by evaporation of fuels from machinery, motors and petrol tanks. Only trace amounts are produced during combustion of natural gas.
- Formaldehyde: Generating electricity and manufacturing wood products, such as particleboard, are the largest industrial sources of formaldehyde in Australia. Other sources of formaldehyde emissions may come from mining, making paper, agriculture, forensic, hospital and pathology laboratories. Trace amounts only during combustion of natural gas.
- PAH (as BaP - Benzo[a]pyrene): Are a class of chemicals that occur naturally in coal, crude oil, and gasoline. They also are produced when coal, oil, gas, wood, garbage, and tobacco are burned. Trace amounts only during combustion of natural gas.
- Toluene (odour): Used as a cleaning solvent in the coating, printing and leather industry and in the manufacturing of paints and coatings, inks, adhesives, resins, and pharmaceuticals. It is also used as an intermediate in the production of benzene and toluene diisocyanate, and for gasoline blending. Trace amounts only during combustion of natural gas.
- Xylenes (odour): Used as a solvent in the manufacturing of chemicals, agricultural sprays, adhesives and coatings, as an ingredient in aviation fuel and gasoline. Trace amounts only during combustion of natural gas.

4.5.2 Construction phase

The design criteria outlined in the SEPP AQM Schedule A do not apply to fugitive particulate matter (PM) sources, as per SEPP AQM Schedule A footnote 1 (PM in Schedule A “applies to point sources only”), unless specified in a specific industry PEM (for area-based sources and roads” etc.). Hence, GHD have utilised criteria outlined in the Mining PEM for the construction phase (pipeline construction) of the Project as it is the most relevant guidance. Another relevant guideline is the Civil Construction, Building and Demolition Guide (EPA Publication 1834) – this guideline provides relevant mitigation measures and qualitative benchmarks but does not provide quantitative threshold criteria (see section 4.3.2).

It is noted that recent engagement with EPA Victoria raised the upcoming changes to the legal framework which are due to come into effect on 1 July 2021 as part of the new *Environment Protection Act 2017*, as amended by the *Environment Protection Amendment Act 2018* and the general environmental duty (GED). The proposed Environment Reference Standards (ERS) adopts the same criteria and largely the same objectives to that of the SEPP AAQ. GHD understands that the proposed ERS will apply to Victoria’s ambient air environment. The environmental values apply to the whole state of Victoria, like the environmental values in SEPP AAQ.

With regards to air quality criteria for modelling purposes, GHD understands that EPA Victoria’s preferred standard for comparison of predicted levels is the objective listed in the 2016 SEPP AAQ, as opposed to intervention level which is listed in the SEPP AQM/Mining PEM (e.g. 50 µg/m³ as opposed to 60 µg/m³ for PM_{10}). Further, EPA recommends comparing the predicted levels against **both** SEPP AQM Intervention Levels (and therefore the levels outlined in the Mining PEM) and SEPP AAQ Schedule 2 - Environmental Quality Objectives.

Thus, GHD will compare the predicted air quality levels against both SEPP (AQM)/ Mining PEM and SEPP (AAQ) in this assessment. From experience, PM_{10} is the constraining constituent for dust assessments. If the predicted PM_{10} concentrations comply with the relevant levels, then so too will $PM_{2.5}$ which is otherwise considered a more critical constituent when assessing smaller products of (incomplete) combustion.

Since the open trenching construction phase of the Project will mostly involve trenching through clay-based soils (and no crushing and screening activities), Respirable Crystalline Silicon (RCS) can be safely ignored.

4.5.3 Summary

The following criteria are relevant to the assessment, as summarised in Figure 2:

- Operation phase:
  - Design criteria specified in SEPP AQM Schedule A, i.e. stack (stationary source) emissions from the Wollert Compressor Station
- Construction phase:
  - The design criteria outlined in the SEPP AQM Schedule A do not apply to fugitive particulate matter sources and instead refers to specific industry PEMs. As there is no PEM for area-based sources such as roads (or linear construction projects), the Mining PEM becomes the default protocol.
  - GHD understands that recently, EPA Victoria’s preferred standard for comparison of predicted levels is the objective listed in the 2016 SEPP AAQ, as opposed to intervention level which is listed in the Mining PEM. Further, EPA recommends comparing the predicted levels against **both** the Mining PEM and SEPP AAQ Schedule 2 - Environmental Quality Objectives.
  - Therefore, the applicable criteria are those outlined in the Mining PEM and the SEPP AAQ

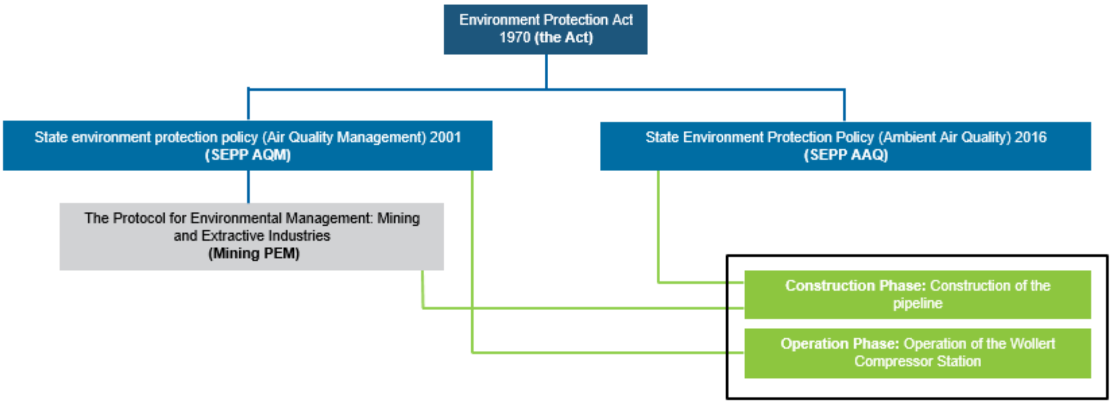


Figure 2 Summary of applicable criteria

The assessment criteria relevant to this assessment are reproduced in Table 4 below.

Table 4 Assessment criteria

Indicator	Criteria ($\mu g/m^3$)	Averaging period	Percentile (%)	Classification reason	Source
Construction phase					
PM_{10}	60	24 hour average	100%	-	SEPP AQM/Mining PEM
	50	24 hour average	100%	-	SEPP AAQ
Operation phase					
CO	29,000	1 hour	99.9%	Class 1 toxic	SEPP AQM
NOx as NO2	190	1 hour	99.9%	Class 1 toxic	SEPP AQM
SO2	450	1 hour	99.9%	Class 1 toxic	SEPP AQM
PM_{10}	80	1 hour	99.9%	Class 1 toxic	SEPP AQM
PM2.5	50	1 hour	99.9%	Class 2 toxic	SEPP AQM
Benzene	53	3 minute	99.9%	Class 3 IARC Group 1 carcinogen	SEPP AQM
Formaldehyde	40	3 minute	99.9%	IARC Group 2A carcinogen	SEPP AQM
PAH (as BaP)	0.73	3 minute	99.9%	IARC Group 2A carcinogen	SEPP AQM
Toluene (odour)	650	3 minute	99.9%	Class 2 odour	SEPP AQM
Xylenes (odour)	350	3 minute	99.9%	Class 2 odour	SEPP AQM

5. Methodology

5.1 Overview of method

This section describes the method that was used to assess the potential impacts of the Project. A risk based approach was applied to prioritise the key issues for assessment and inform measures to avoid, minimise and offset potential effects. Figure 3 shows an overview of the assessment method.

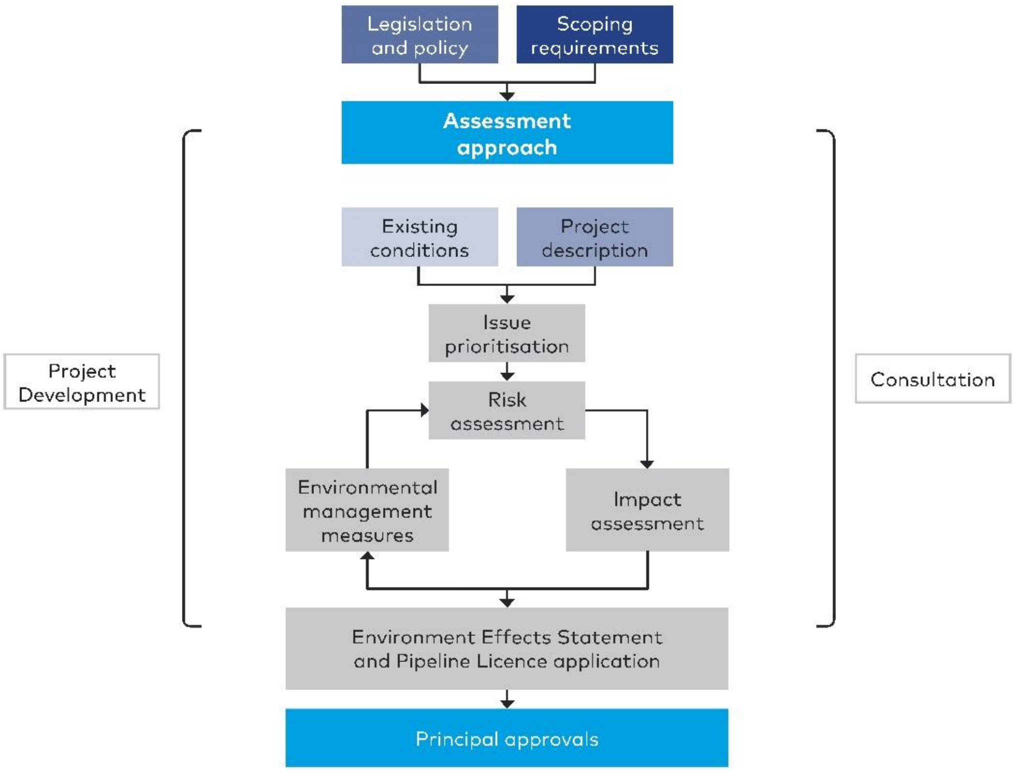


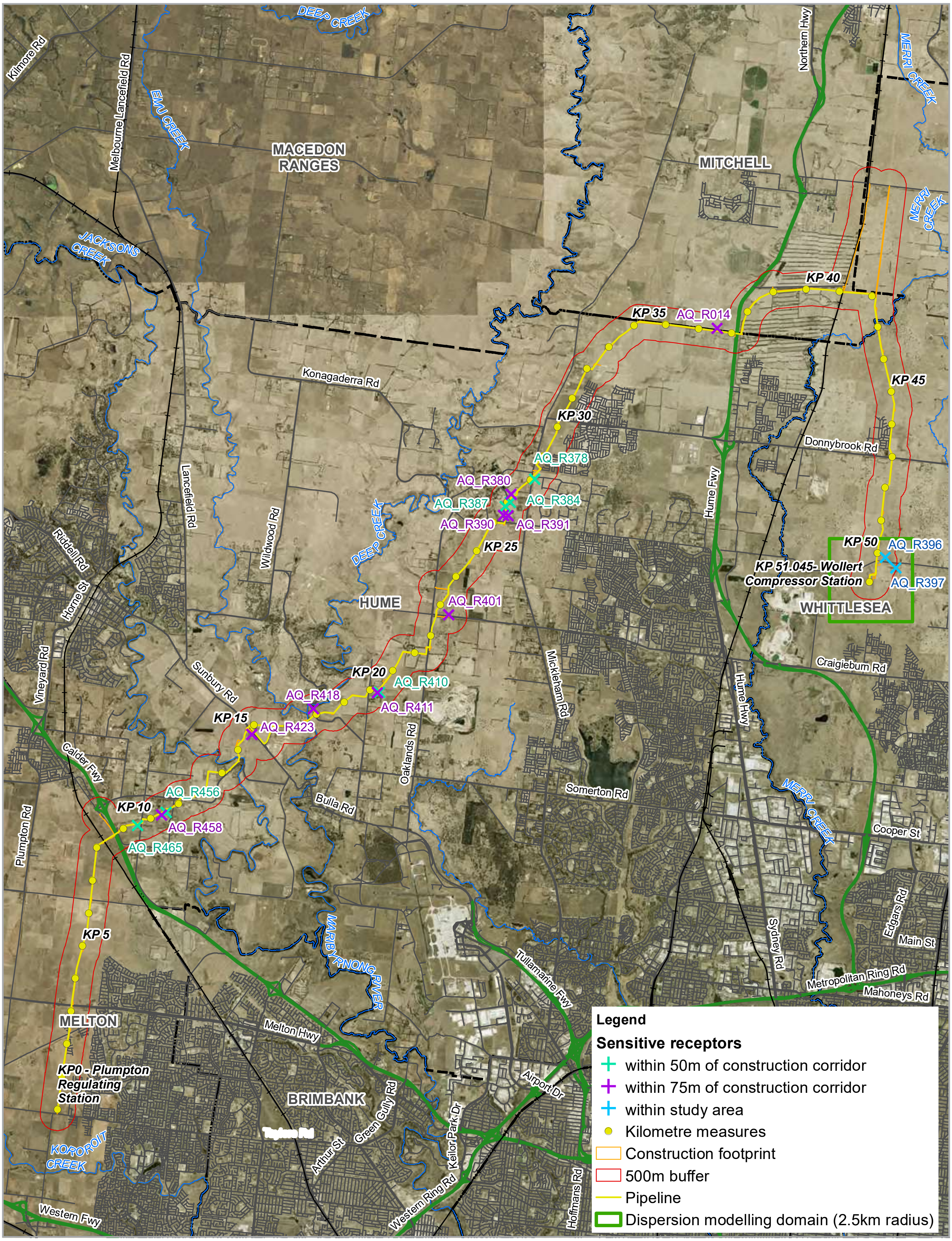
Figure 3 Overview of assessment method

5.2 Study area

During construction projects, potential dust impacts from linear projects emanate from the civil works occurring on the workfront at any given time. While the entire length of the Project is many kilometres long, construction activities will move along indicative workfronts in a staged fashion.

A 500 m study area has been adopted within this assessment to determine any potential worst-case dust impacts predicted around the civil works to occur within the construction corridor. The study area is shown in Figure 4.

For operations, Schedule C Modelling Emissions to Air of SEPP AQM requires definition of a modelling domain such that “grid spacing must be chosen so that the predicted maximum concentration is not significantly underestimated” (Clause 5 (b)). The dispersion modelling domain around the Wollert compressor station extends for 2.5 km.



Paper Size ISO A4

0 1,800 3,600

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

Project No. 12529997
Revision No. F
Date 12/03/2021

Study Area

Figure 4

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Print date: 12 Mar 2021 - 08:23

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery . Created by: kgardner

5.3 Existing conditions method

Schedule C Modelling Emissions to Air of SEPP AQM requires definition of existing conditions, inclusive of:

- Appropriate set of meteorological data for use by the model (Clause 2)
- Background concentrations:
  - "Include background information in the model simulation, except where the proponent can demonstrate to the satisfaction of the Authority that background levels of the pollutant are not significant" (Clause 3 (a)).
  - "When required to include background data, if no appropriate hourly background data exists the 70th percentile of one years observed hourly concentrations must be added as a constant value to the predicted maximum concentration from the model simulation. In cases where a 24-hour averaging time is used in the model, the background data must be based on 24-hour averages" (Clause 3 (b)).
  - "For new or modified sources of emissions adjacent to existing sources of the same pollutant, emissions from the existing sources must be included in the model" (Clause 3 (c)).
  - Receptors must be included in the assessment in order to assess the impact at any nearby sensitive locations such as hospitals, schools or residences (Clause 5 (c)).

A desktop assessment was undertaken to identify sensitive receptors located within 500 m of the construction corridor. A sensitive receptor is defined by the EPA[6] with examples including residential premises, childcare centres, pre-schools, primary schools, education centres or informal outdoor recreation sites.

The approach to meteorological data and establishing background information is outlined further in Section 6.

5.4 Risk assessment method

A risk assessment for the Project was carried out using an approach that is consistent with Australian/New Zealand Standard AS/NZS ISO 31000:2018 Risk Management Process.

This risk assessment was used to identify the issues for assessment and apply a structured approach to the level of assessment and analysis undertaken of potential environmental effects within each technical study. Applying the risk framework facilitated an approach for the EES to identify and then investigate issues with a focus proportionate to the risk, and to consider management measures focused on reducing identified risks.

The risk assessment methodology included:

- Defining the context for the risk assessment based on the existing assets, values and uses (baseline) assessments of each technical area and the proposed Project activities which interact with those existing conditions
- Identifying the risk pathways for the Project based on a specific cause and effect
- Identifying standard management/mitigation measures (including those in guidelines and standards) and whether additional mitigation measures may be required
- Analysing the consequence and likelihood of the identified risk based on a consequence guide developed for each technical area and a likelihood guide
- Defining the risk level based on the risk matrix

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[6] EPA Victoria 2013 "Recommended separation distances for industrial residual air emissions" Publication. 1518, March 2013

The impact assessment then focused on those risks with a medium or higher rating and/or where additional management/mitigation measures may be required.

The identification, analysis and evaluation of risks was conducted within each technical area and across technical areas where there was input or connection across disciplines.

The air quality risk pathways are provided and assessed in Section 7 and Appendix A.

The consequences of an Air Quality risk occurring were assigned using consequence categories from insignificant to severe developed for Air Quality based on the existing conditions and values in the study area. The consequence levels and descriptors are provided in Table 5.

A likelihood rating for each identified risk was assigned ranging from 'almost certain' where the event is expected to occur to 'rare', where the event may occur only in exceptional circumstances. The likelihood levels and descriptors are provided in Table 6.

The risk matrix used to define each risk level is also provided in Table 7.

The risk ratings were revisited during the impact assessment where additional environmental management measures were applied to identify the residual impacts and risks.

Table 5 Consequence approach

Level	Qualitative and/or quantitative description
Insignificant	Undetected changes to ambient air quality, beyond the site boundaries
Minor	Detectable changes to air quality result in amenity impacts on a small number (<5) of sensitive receptors, and no exceedances of SEPP (AQM) beyond site boundaries
Moderate	Detectable localised changes to air quality result in amenity impacts on 5 to 15 sensitive receptors and/or localised (1 sensitive receptor location) exceedances of SEPP (AQM) health based criteria beyond site boundaries.
Major	Detectable widespread changes to air quality result in amenity impacts on a large number (>15 to 100) of sensitive receptors and/or limited (1-5 sensitive receptor locations) exceedances of SEPP (AQM) health based criteria
Severe	Detectable widespread changes to air quality result in amenity impacts on an excessive number (>100) of sensitive receptors and limited (>5 sensitive receptor locations) exceedances of SEPP (AQM) health based criteria

Table 6 Likelihood approach

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

Table 7 Risk matrix

		Consequence rating				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood rating	Almost certain	Low	Medium	High	Very high	Very high
	Likely	Low	Low	Medium	High	Very high
	Unlikely	Negligible	Low	Medium	High	High
	Remote	Negligible	Negligible	Low	Medium	High
	Rare	Negligible	Negligible	Negligible	Low	Medium

5.5 Impact assessment method

The impact assessment was separated into two sections, namely: emissions associated with the Project construction (i.e. dust from pipeline construction) and emissions associated with the Project operation (i.e. emissions associated with the operation of the Wollert Compressor Station). The following methodology was adopted for both sections:

- Identification of relevant emission sources
- Estimation of emissions from relevant emissions sources
- Dispersion modelling of emission sources in AERMOD, with the following inputs:
  - Meteorological data from the site-representative Melbourne Airport weather station
  - Background air quality data from Footscray AQMS
- Comparison of the predicted ground level concentrations (GLCs) against the relevant criteria listed in Table 4

5.5.1 Construction assessment method

As described in section 8.2.3 the following construction scenarios were modelled in this assessment:

- **Clear and Grade:** Clearing and grading of the area is undertaken to provide a safe and efficient area for construction activities. Clearing would be required to remove trees, shrubs, surface rocks and groundcover vegetation. Graders, bulldozers and excavators are generally used. Cleared topsoil would be stockpiled on the edge of the construction corridor with breaks left in stockpiles at fence lines, tracks and drainage lines to allow continued access for stock. Stockpiled material is windrowed and compacted (to minimise dust lift-off). Temporary access tracks over watercourses and access points to local roads would be constructed during this phase.

- **Open trench construction:** Specialised trenching machines and excavators would be used to excavate the trench to a depth of approximately two metres and approximate width of one metre. Spoil generated during trench excavation would be stockpiled separate from vegetation and topsoil stockpiled earlier in the construction program. Rock breaking processes such as the use of rock saws/hammers and/or blasting is expected to be required to excavate the trench in areas of rock.
- **Lowering pipe into trench and backfilling:** The pipe would be lowered into the trench with suitable bedding and padding material. The trench is backfilled with the previously excavated subsoil material. In areas of rock excavation, imported bedding and padding material may be required where the previously excavated subsoil is unsuitable for use. Care is taken to maintain separation between topsoil and subsoil during this process. The subsoils are compacted to limit settlement of the trench through the operational life of the pipeline. Any excess spoil is removed from the site.
- **Rehabilitation of the construction corridor:** Rehabilitation of the construction corridor would be undertaken in accordance with the specific Project CEMP and good pipeline construction principles with a view to returning land to its previous use within a reasonable timeframe, subject to seasonal constraints. Key activities would include:
  - Re-establishing topsoil cover
  - Reinstating roadways and road reserves in accordance with the requirements of local councils
  - Reinstating natural drainage patterns
  - Application of seed, where appropriate
  - Installing any erosion control measures in prone areas
  - Reinstating waterways to meet Catchment Management Authority requirements

The assessment of construction dust impact (emanating from vehicles and material handling) follows the guidance from the Protocol for Environmental Management: Mining and Extractive Industries (EPA Victoria Publication 1191 December 2007). Dust leaving a construction site is no different to crustal dust that would typically be emitted for a mine or quarry. Since dust will not be emitted from point sources during construction, the SEPP AQM requires a “relevant industry PEM” (first footnote 1 of the table in Schedule A) to be used. As there is no PEM for area-based sources such as roads, the Mining PEM becomes the default protocol. Indicative dispersion modelling (see section 5.6) is used to estimate the potential worst-case impacts beyond the site boundary of the construction corridor. It is noted that the dispersion modelling results were not applied to the access track areas of the construction footprint as the dust impact from these areas is expected to be less than the construction scenarios described above.

Due to the relatively short period of construction and the staged progression of works along the pipeline corridor, potential air emissions from construction activities and equipment are temporary.

5.5.2 Operation assessment method

Two operational assessment scenarios at the Wollert Compressor Station were modelled as part of this assessment:

- Including the DEA
- Excluding the DEA

A licensed site that substantially changes the emission profile of air emissions requires an Air Quality Impact Assessment (see section 5.6) to follow Schedule C from SEPP AQM - Modelling Emissions to Air (Clause 1):

- “This schedule aims to ensure that the potential impact of new or modified sources of emissions to air in Victoria is:

  (a) Estimated using techniques approved by the Authority to predict the maximum concentration of pollutants

  (b) Assessed against the design criteria prescribed in Schedule A to this policy”

5.6 Rationale

The Air Quality Assessment methodology (described in section 5.5.1 and 5.5.2) has been informed by legislative requirements under the relevant guidelines and the EP Act as described in Section 4 of this report. Key steps in Schedule C from SEPP AQM - Modelling Emissions to Air are (Part A, Clause 4):

(a) “Details of the source and nature of the emissions

(b) The methodology to be used to estimate the worst case emission rates

(c) A site diagram showing the proposed location of the emissions sources and the site boundary

(d) The source of the meteorological data set to be used

(e) If a currently approved regulatory model is not to be used, justification for selecting an alternative model

(f) Information on background air quality and adjacent sources of the pollutants of interest.”

5.7 Limitations, uncertainties and assumptions

Limitations and assumptions are detailed in section 1.3. Uncertainties relate to the accuracy of the modelling method; however, following the various policy and guidance documents results in the predictions meeting regulatory requirements. As conservative assumptions have been made where uncertainties are the greatest and limitations exist (especially in the application of policy), the assessment errs on the side of caution.

5.8 Stakeholder engagement

Whilst stakeholder and community engagement was undertaken during the preparation of the EES, no community engagement was specifically required to inform this assessment. EES Attachment III Community and Stakeholder Consultation Report provides details of the consultation activities undertaken for the Project more broadly and outcomes from those activities.

Engagement with EPA Victoria has informed the assessment methodology as set out in section 5.

6. Existing conditions

6.1 Sensitive receptors

The definition of a sensitive receptor or sensitive land use is defined by the EPA[7] as:

> *'any land uses which require a particular focus on protecting the beneficial uses of the air environment relating to human health and well-being, local amenity and aesthetic enjoyment, for example residential premises, child care centres, pre-schools, primary schools, education centres or informal outdoor recreation sites'.*

GHD has undertaken a desktop assessment to identify sensitive receptors located within a 500 m study area of the Project construction corridor, as shown in Figure 5, Figure 6, Figure 7 and tabulated in Appendix B.

The identified receptors are located within the local planning zones outlined in Table 8. The majority of the identified receptors are considered residential or rural-residential for the purposes of this assessment. As outlined in detail in the Technical report L *Social*, a number of outdoor recreation sites are also located within 500 m of the construction corridor. As a result of the nature of the majority of identified sensitive receptors, the air quality assessment covers the worst case potential impacts and mitigation, including other less sensitive land uses by default. Particulate matter dust impacts (TSP, PM_{10} and $PM_{2.5}$) in the SEPP AQM relate to amenity and health and not bioaccumulation on ecological pathways.

Table 8 Sensitive receptor zones and applicable KP

Local Planning Zone	Applicable KP (direction from construction corridor)
Urban Growth Zone (multiple schedules)	0 - 3.2
	28 – 33.1(east)
	35.4 – 48
Green Wedge Zone (multiple schedules)	3.3 – 28
	28 – 33.5 (west)
Farming Zone	34 – 35.4 (north)
	49.3 – 51.045 (east)

The Wollert Compressor Station is located in a farming zone with two rural residences (AQ_R396 and AQ_R397) located approximately 700 m to the northeast. The proposed pipeline construction alignment mostly traverses sparsely populated rural areas and road reserves. It also traverses adjacent to existing and proposed residential areas in Hillside, Fraser Rise and Mickleham. The closest housing in these residential areas were identified as located approximately 150 m from the construction corridor (KP 30 – 32). The closest housing to the Project are six houses found in the 35 to 50 m range from the pipeline construction corridor.

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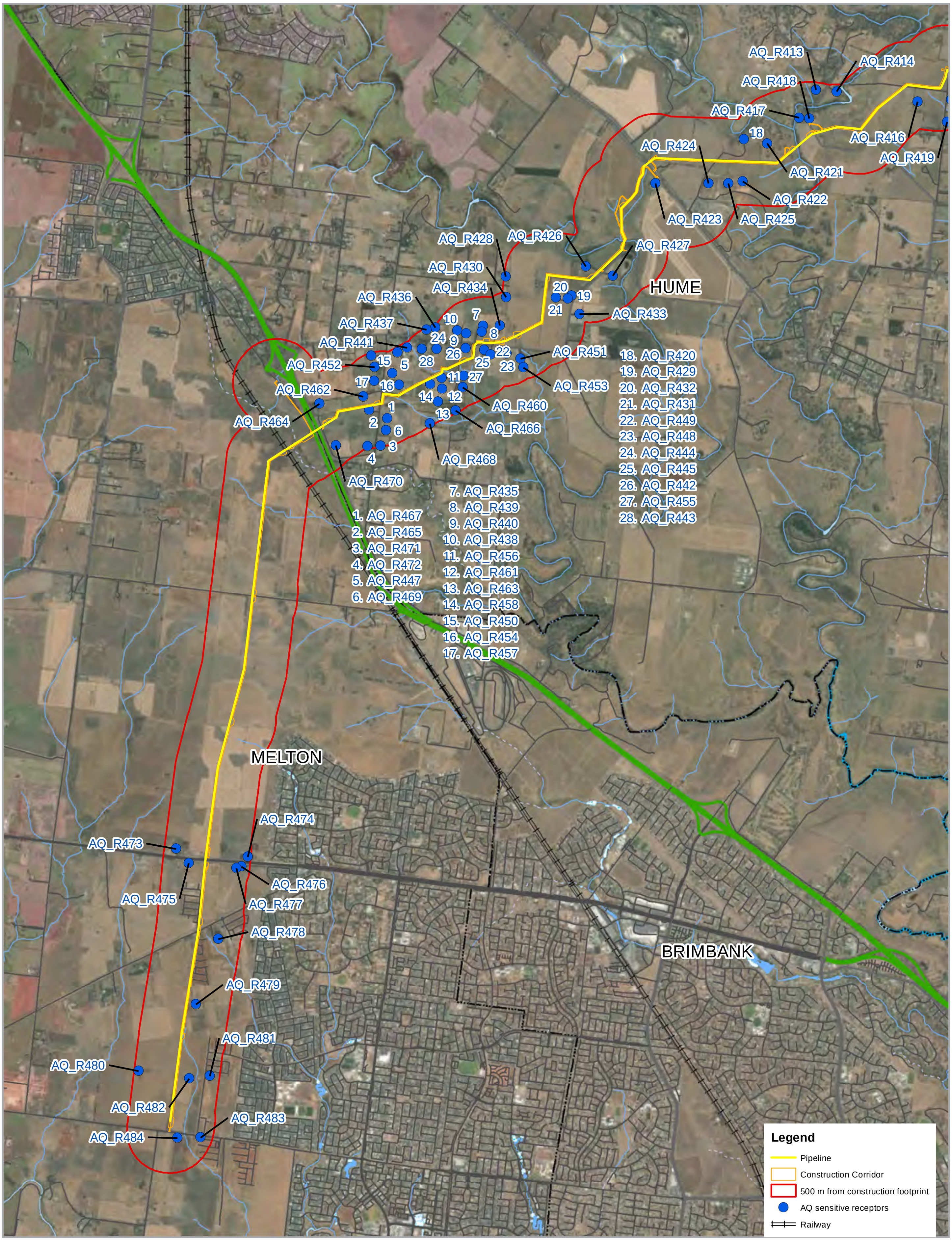
[7] EPA Victoria 2013 "Recommended separation distances for industrial residual air emissions" Publication. 1518, March 2013



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0 0.4 0.8 1.2 1.6

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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Western Outer Ring Main Gas Project

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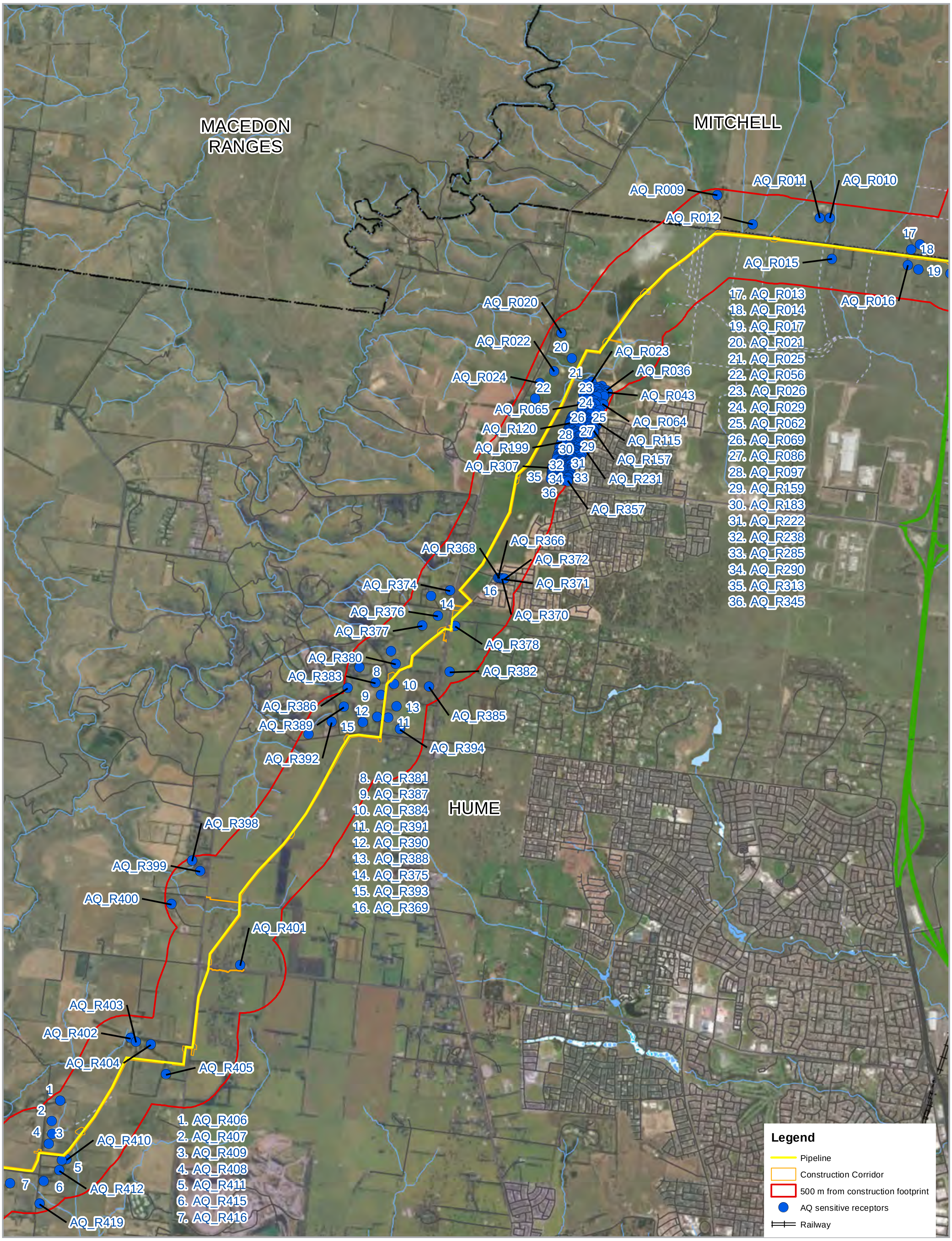
Date 04/03/2021

Identified Sensitive Receptor part 1

Figure **5** page 1 of 3

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Created by: kgardner



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Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

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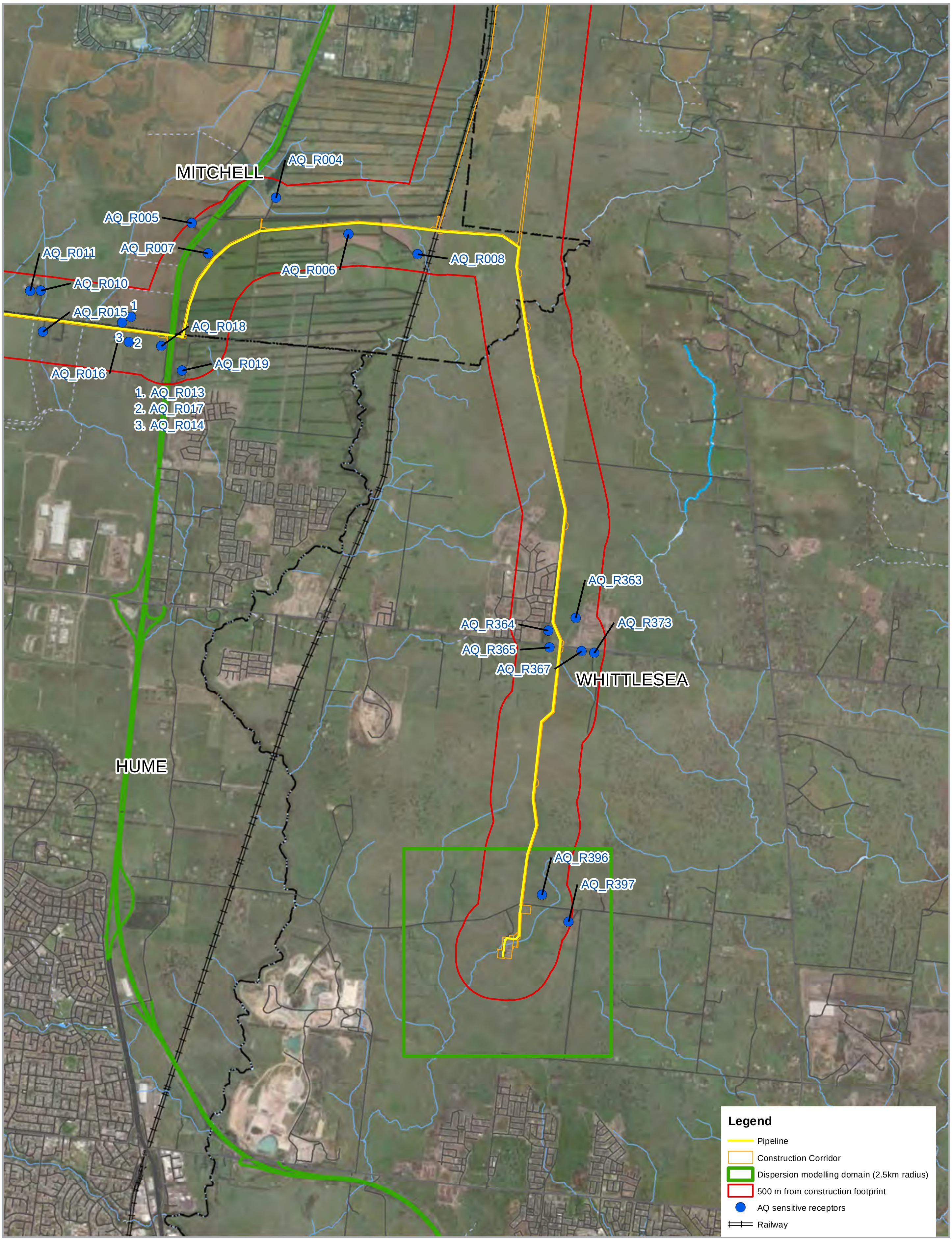
Western Outer Ring Main Gas Project

Project No. 31-12529997
Revision No. D
Date 04/03/2021

Identified Sensitive Receptor part 2

Figure **6** page 2 of 3

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Created by: kgardner



Paper Size ISO A4

0 0.4 0.8 1.2 1.6

Kilometers

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

APA VTS (Operations) Pty Ltd
Western Outer Ring Main Gas Project

Project No. 31-12529997
Revision No. F
Date 12/03/2021

Identified Sensitive Receptor part 3

Figure 7 Page 3 of 3

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Created by: kgardner

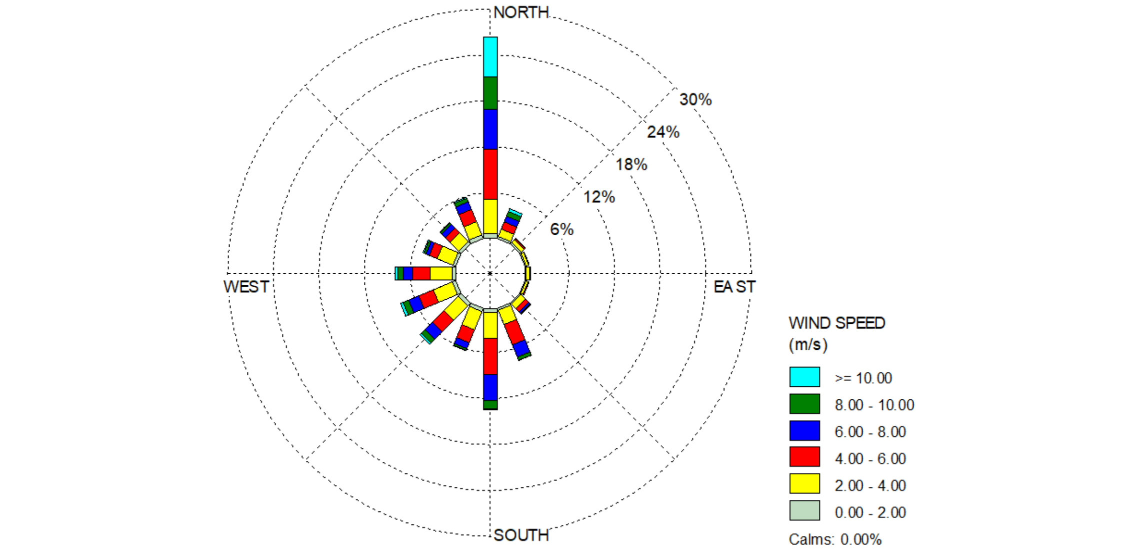
6.2 Meteorology

An analysis of the wind climate at representative locations near the pipeline alignment and the Wollert Compressor Station gives some indication of the potential for off-site exposure to emissions generated during the construction of the pipeline and operation of the Wollert Compressor Station. In particular, the typical distribution of wind speed and wind direction can highlight key issues with regards to dispersion from source to receptor impacts.

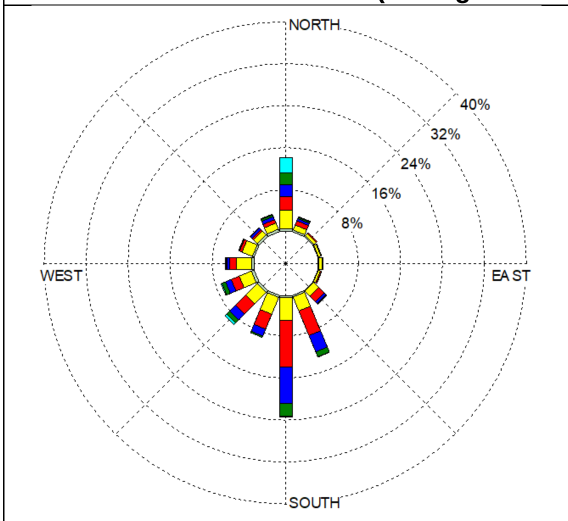
The Bureau of Meteorology (BoM) operated automatic weather station (AWS) at Melbourne Airport (3 to 20 km from the pipeline construction corridor and 17 km from the Wollert Compressor Station) is considered representative of the area due to the weather station’s proximity to the pipeline alignment and a very similar exposure to prevailing winds. The five-year climatology period from 2015 to 2019 inclusive was utilised in this report.

Wind roses for Melbourne Airport, with a seasonal breakdown, are shown in Figure 8. The overall predominant wind direction is from the north, which consists of the highest frequency of strong winds (greater than 10 m/s) and calm to near-calm winds.

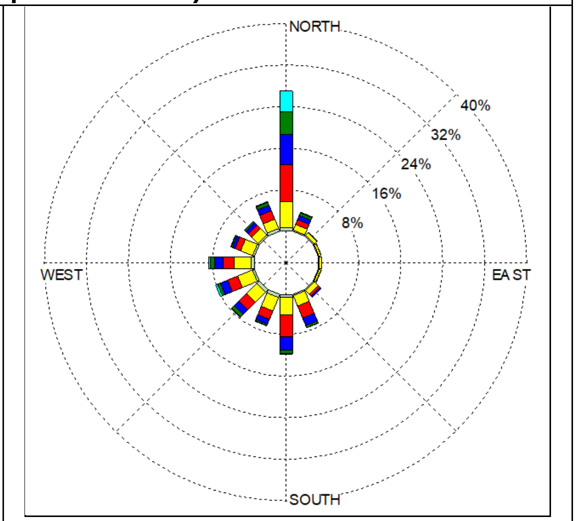
During winter, northerly winds are the most dominant due to pre-frontal northerlies, with a southerly contribution seen in summer. Winter is the windiest season with an average wind speed of 5.7 m/s, while summer and autumn are the calmest seasons with average wind speeds of 5.1 m/s. The average annual wind speed for Melbourne Airport was 5.4 m/s.



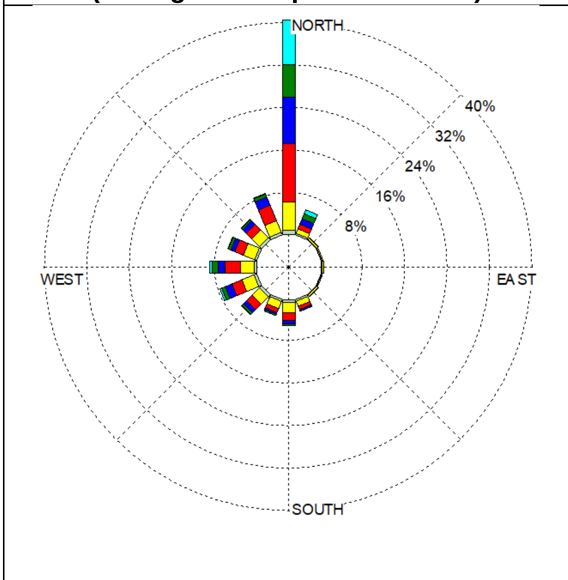
Annual
(average wind speed = 5.4 m/s)



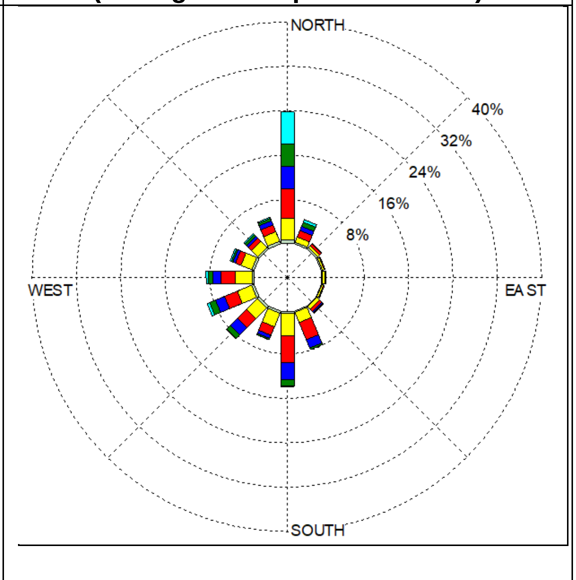
Summer
(average wind speed = 5.1 m/s)



Autumn
(average wind speed = 5.1 m/s)



Winter
(average wind speed = 5.8 m/s)



Spring
(average wind speed = 5.5 m/s)

Figure 8 Wind Roses for Melbourne Airport (annual and seasonal 2015-2019)

6.3 Background air quality

Within the pipeline construction corridor, existing ambient (background) sources of air emissions are expected from agricultural activities, motor vehicles emissions traversing along the main roads, industrial emissions (including from Melbourne Airport), sand and rock quarries, landfills, existing compressor stations and other light industry.

During the construction phase of the Project, dust as particulate matter (PM) is the pollutant of most concern. This applies to all dust generated from construction as the larger particles contribute most to amenity issues while the finer particles are a health issue. From experience, PM_{10} is the constraining constituent for dust assessments of construction projects. If the predicted PM_{10} concentrations comply with the relevant levels, then so too will other constituents.

Vehicle exhaust from mobile plant emissions (apart from particulate matter) during the construction phase have the potential to impact on air quality. However, the impact is likely to be negligible given the limited number of vehicles, the short term construction period at any one location and the low background concentrations of key pollutants including carbon monoxide (CO), nitrogen oxides (NO_x), and volatile organic compounds (VOCs) such as benzene.

During the operational phase, air pollutants of relevance to the Wollert Compressor Station include nitrogen dioxide (NO_2), CO and VOCs.

6.3.1 Application to the assessment

The SEPP AQM provides a method for estimating background dust concentration where no appropriate background data exist[8]. It states that the 70th percentile of one year's observed hourly concentrations may be used as a constant value in numerical modelling. The nearest air quality monitoring to the Project area occurred at Deer Park at an EPA Victoria Air Quality Monitoring Station (AQMS). Monitoring at the Deer Park AQMS ceased in 2015 with EPA Victoria stating that the air quality measured at Deer Park was very similar to the Footscray monitoring station[9] and generally representative of the western and northern suburbs of Greater Melbourne.

A comparison of the average and maximum PM_{10} and NO_2 measured at Deer Park and Footscray is provided in Figure 9. From Figure 9 it can be seen that similar concentrations and trends can be seen across the two sites. The main difference occurs between the 1-hour average NO_2 concentrations, where concentrations at Footscray are consistently higher than at Deer Park. This is likely due to the Footscray AQMS being located closer to industrial emission sources and concentrated road networks with freight corridors. Based on the analysis conducted, GHD considers the ambient air concentrations measured at Footscray to be conservatively representative of the ambient air environment at the Project site. While these are the best available data they are not site-specific and marginally site-representative. Therefore, Clause 3 (b)) of Part B of Schedule C of SEPP AQM has been applied.

[8] EPA Victoria. Clause 3(b), Part B, Schedule C, SEPP (AQM), Victorian Government Gazette, 21 December 2001.

[9] https://www.epa.vic.gov.au/about-epa/news-media-and-updates/news-and-updates/epa-concludes-deer-park-ambient-air-monitoring

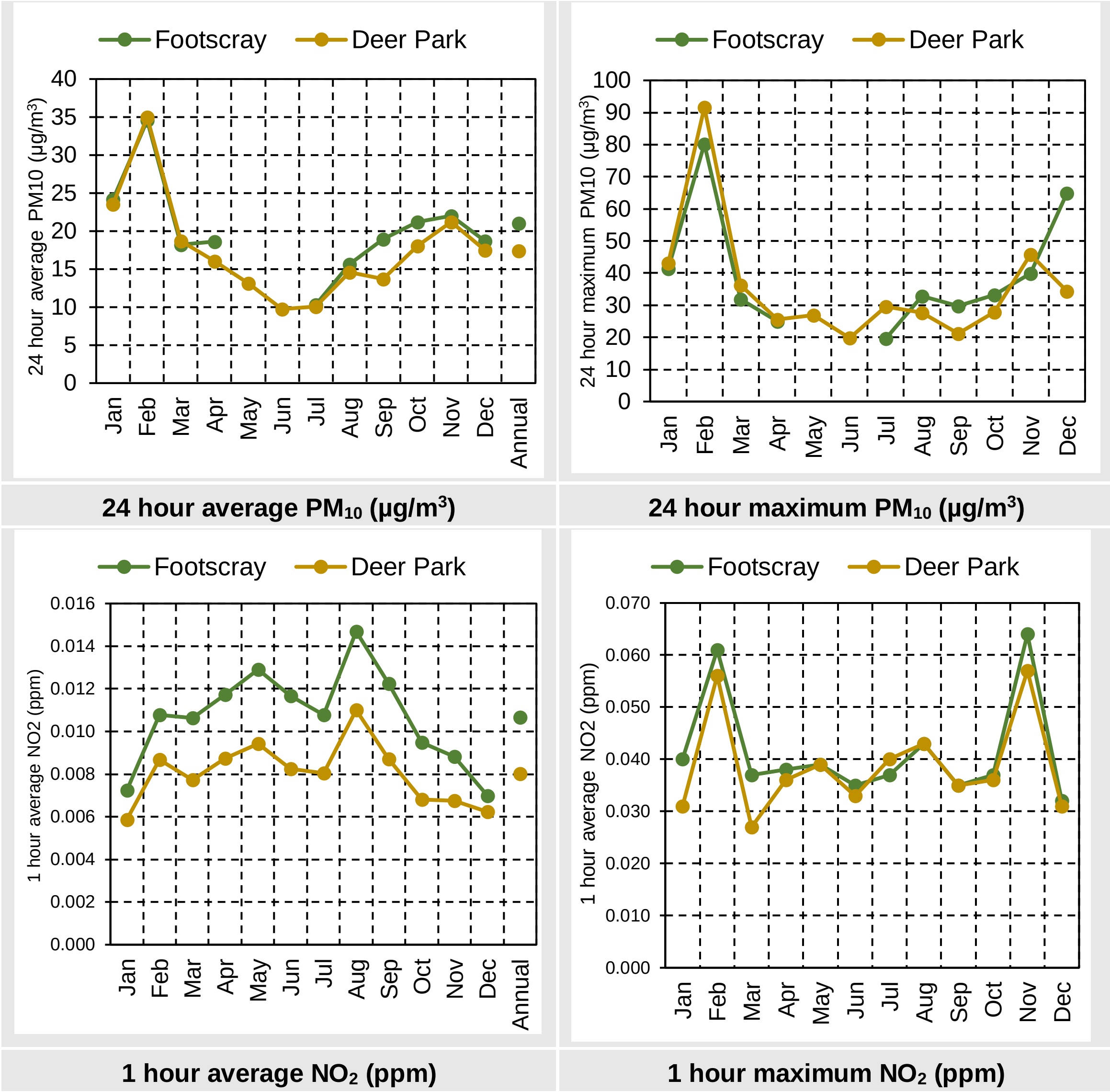


Figure 9 Deer Park and Footscray air monitoring 2014

For background concentrations in relation to the Wollert Compressor Station, GHD has utilised hourly data from Footscray AQMS from 2018 in order to determine the 1-hour 70th percentile values. It is noted that SO_2, Benzene, Formaldehyde, PAHs, Toluene and Xylenes are not measured at Footscray, nor were they formerly measured at Deer Park. The ambient concentrations of these pollutants are expected to be insignificant surrounding the compressor station and therefore a background value of zero has been adopted.

For background concentrations in relation to pipeline construction, GHD has utilised 24-hourly averaged data from Footscray AQMS from 2018 in order to determine the 24-hour 70th percentile values.

The background concentrations along the pipeline and at the compressor station would potentially be less than those in Footscray due the Project site being in a less urbanised/industrial area. Hence, the background concentrations outlined in Table 9 have been used as a conservative estimate for the Project area.

Table 9 Representative background air quality concentrations

Pollutant	Averaging period	Background concentration (70th percentile) ($\mu g/m^3$)	Source
Construction phase			
PM_{10}	24-hour	21.2	24 hour averaged hourly Footscray AQMS data
Operation phase			
CO	1-hour	380	Hourly Footscray AQMS data
NO_2	1-hour	15.1	Hourly Footscray AQMS data
PM_{10}	1-hour	21	Hourly Footscray AQMS data
$PM_{2.5}$	1-hour	8.8	Hourly Footscray AQMS data

7. Risk assessment

A risk assessment of Project activities was performed in accordance with the methodology described in section 5.4. Consequence risk descriptors are described in Table A-2 and likelihood risk descriptors are described in Table A-3 in Appendix A.

The initial risk ratings considered an initial set of mitigation measures (where relevant), which are based on compliance with legislation and standard requirements that are typically incorporated into the delivery of infrastructure projects of similar type, scale and complexity. Risk ratings were applied to each of the identified risk pathways assuming that these mitigation measures were in place.

All risk ratings have been considered as part of the impact assessment. Where the initial risk ratings were categorised as medium or higher, these risks were a focus of the impact assessment and additional management measures were considered (where possible) as part of the impact assessment.

Appropriate implementation of any recommended additional EMMs is considered to reduce the initial risk ratings to the final risk rating's included in the below Additional management measures aimed to achieve 'avoidance' of the impact. Justification is provided if avoidance could not be achieved, as per Section 3.7 of the Scoping Requirements for WORM document (2020).

The recommended EMMs are outlined in more detail in Section 10 of this report.

The risk register showing the risk pathways and findings of the risk assessment for air quality is attached in Appendix A.

Four construction risks were identified and assessed and two operation risks.

A summary of the risk assessment results is presented in Table 10.

Table 10 Risk results

Risk ID	Risk description	Construction/ operation	Pipeline/ MLV/ compressor	Initial risk rating
AQ1	Construction dust from site clearance and rehabilitation activity. Site clearance, construction site establishment and rehabilitation activities result in the generation of dust that deteriorate the existing air quality environment	Construction	Pipeline	Medium
AQ2	Dust from low-impact construction activities result in the generation of dust that deteriorate the existing air quality environment. Low impact can occur when there are no sensitive receptor sites within the calculated impact zone	Construction	Pipeline	Negligible

Risk ID	Risk description	Construction/ operation	Pipeline/ MLV/ compressor	Initial risk rating
AQ3	Dust from high-impact construction activities result in the generation of dust that deteriorate the existing air quality environment. High impact can occur when there are sensitive receptor sites located within the predicted impact zone (e.g. isolated rural residences and any housing built within 35 m of the construction corridor between now and when construction occurs)	Construction	Pipeline	Medium
AQ4	The operation of the Wollert compressor station result in impacts on the air quality environment	Operation	Compressor	Low
AQ5	Odour from construction activities including disturbance of contaminated soil, resulting in amenity impact for nearby residents	Construction	Pipeline	Negligible
AQ6	Odour from operation of the compressor station releases fugitive emissions of natural gas, resulting in amenity impact for nearby residents	Operation	Compressor	Negligible

AQ1 Construction dust from site clearance and rehabilitation activity:

- As bulldozers and graders are involved in site clearance, construction site establishment and rehabilitation, these activities result in dust that can really only be controlled by stopping activity. The emission factors from the NPI manual for mining do not provide any mitigation factor for dozer and bulldozers. This is because wetting the material before movement only adds to clogging the blades of the equipment. The consequences of dust impact from extensive civil works to clear the pipeline construction corridor are rated as moderate as the daily PM_{10} criteria can be exceeded beyond the site boundary.

AQ2 Dust from low-impact construction activities:

- Construction activities including excavation, drilling, pipe stringing and lowering and vehicle movements, result in the generation of dust that deteriorate the existing air quality environment
- Low impact occurs when there are no sensitive receptor sites located within the calculated impact zone. These impact distances, essentially buffer zones, are calculated in the impact assessment (see section 9.2.4).

AQ3 Dust from high-impact construction activities:

- Construction activities with civil works, including vehicle movements, and any housing built within 35 m of the construction corridor between now and when construction occurs and/or near isolated rural residences, will result in the generation of dust that deteriorates the existing air quality environment
- This high impact will occur when there are sensitive receptor sites located within the predicted impact zone (e.g. isolated rural residences and any housing built within 35 m of the construction corridor between now and when construction occurs). With the consequence being rated as moderate, calculating the distances involved so that the likelihood can be reduced from unlikely to remote is critical. This is done in the impact assessment (see section 9.2.4).

AQ4 Operation of compressor station:

- The operation of the Wollert compressor station result in impacts on the air quality environment
- Impacts are assessed in section 9.1.3. While the consequences (above or below the SEPP AQM) are rated as moderate, the likelihood is rated as remote as worst case impacts are compliant with SEPP AQM.

AQ5 Odour - construction

- Odour from construction activities has a rare likelihood as odour generating soils (as a result of contamination or acid sulfate soils) are not expected to be encountered. The low potential for odour generation from soils encountered is dealt with by the soil management protocol. Findings of the Technical Report E *Contamination* indicate odour generating contaminated soils are not expected to be encountered in large volumes, if at all. These would nonetheless be managed by contaminated soil management measures (refer Technical Report E *Contamination)*.

AQ6 Odour - operation

- Fugitive emissions of natural gas, resulting in amenity impact (rated as a minor consequence) for residents located approximately 700 m from the compressor station (see section 6.1) has a rare likelihood

Risk pathways AQ2, AQ5 and AQ6 have initial risk ratings of negligible. The construction related AQ2 pathway has negligible risk due to a lack of sensitive receptor locations within the calculated worst-case impact zones (see section 9.2.4 and Table 23). Risk pathway AQ4 has been assessed as a low initial risk – the standard control measures (equipment choice and stack exit conditions) are sufficient to meet the best practice requirements of EPA Victoria. Risk pathways AQ1 and AQ3 have been assessed as having medium initial risk ratings.

8. Emissions inventory

8.1 Wollert Compressor Station

8.1.1 Emission constituents

Under routine operation, compressor stations emit a range of pollutants to air from variety of sources. Potential pollutants to air that are emitted include:

- Carbon Monoxide (CO)
- Oxides of Nitrogen (NOx) as NO_2
- Particulate Matter 10 µm (PM_{10})
- Particulate Matter 2.5 µm ($PM_{2.5}$)
- Polycyclic aromatic hydrocarbons (PAHs)
- Sulphur dioxide (SO_2)
- Benzene
- Formaldehyde
- Toluene
- Xylene

All of these pollutants have been modelled for the operational phase.

8.1.2 Emission sources

The air exhausted from the compressor engines is expected to be a significant point source of particulate matter (albeit gas being a relatively ‘clean’ fuel) and gaseous emissions. Therefore, engine emissions are expected from the discharge points of the existing compressor engines 1 to 5, in addition to the proposed unit 6 to be installed as part of the Project. The locations of emission sources relevant to this assessment are provided in Figure 10.

Combustion emissions from units 1, 2 and 3 (referred to as Station A) are typically only operated during winter months, with one of the three units (interchangeable) designated as a backup up unit (i.e. under routine operations only two units within Station A operate at any one time). Units 4 and 5 (referred to as Station B) are expected to operate between 100 to 200 days per year with no changes to operating times based on the time of year.

Therefore, GHD has modelled existing Units 1 and 2 as operating for 24 hours a day during winter months, existing Units 4, 5 and proposed Unit 6 as operating for 24 hours a day for the full modelled period – the annual cycle.

Generator emissions

The discharge point of the current GEA (gas engine alternator) backup generator is also an existing emission source. The GEA will be replaced with a DEA – this essentially changes the fuel source from gas to diesel. Therefore, the DEA has been included in the model and GEA has been excluded. Currently the GEA runs (briefly) once a week, or anytime mains power is lost at the site (i.e. emergency scenario) and it is expected the DEA will follow a similar schedule. Since emergency emissions are outside of normal operations, they are excluded from SEPP AQM.

However, APA currently has a scheduled automated maintenance run of the back-up power generator for up to one hour per week (with the typical duration being 20 minutes), with a cool down period taking up the rest of the maintenance hour. Interlock systems activate during non-emergency situations so that non-normal conditions result in reduced, most often to zero, emissions to occur. The scheduled emissions associated with the proposed DEA automated maintenance has therefore been modelled as a scenario.

Fugitive emissions

Units within both Station A and Station B have separate stacks where fugitive emissions are vented (which is separate to the stacks associated with engine exhausts described above). These fugitive vent stacks are typically used for emergency venting and maintenance to reduce pressure in the system and consist mostly of minor methane (natural gas) emissions. Emergency emissions are excluded in the SEPP AQM and moreover, the methane in natural gas is not considered an air pollutant, like carbon dioxide, and is not a listed substance in Schedule A of SEPP AQM. Therefore, GHD has excluded these fugitive stack sources from this assessment, albeit they are considered a minor odour risk.

Summary of emissions modelled

A summary of emissions modelled in this assessment is:

- **Existing combustion engine stack 1: modelled 24 hours a day during winter months**
- **Existing combustion engine stack 2: modelled 24 hours a day during winter months**
- Existing combustion engine stack 3: Back up unit – NOT MODELLED
- **Existing combustion engine stack 4: modelled 24 hours a day**
- **Existing combustion engine stack 5: modelled 24 hours a day**
- **Proposed combustion engine stack 6: modelled 24 hours a day**
- Existing GEA: will be decommissioned – NOT MODELLED
- **Proposed DEA: emissions associated with the two hour scheduled automated maintenance has been modelled.**
- Existing fugitive emissions from Station A and Station B: will consist of natural gas (methane), not combustion emissions - NOT MODELLED

Paper Size ISO A4

0 30 60

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Australian Pipeline Limited
Western Outer Ring Main Gas Project

Wollert Compressor Station
Modelled Emission Sources

Project No. 12529997
Revision No. A
Date 9/09/2020

FIGURE 10

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Print date: 09 Sep 2020 - 12:11

Data source: DELWP, VicMap, 2020; APA, compressot station elements, 2020. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: savenables

Modelled sources

The sources included in the dispersion model is outlined in Table 11 below.

Table 11 Summary of modelled sources

Source ID	Model	Engine power (kW) or diesel consumption (L/h – DEA only)	Modelled hours
Unit 1	Solar Saturn 10 gas turbine T1200	950	Winter only
Unit 2	Solar Saturn 10 gas turbine T1200	950	Winter only
Unit 4	Solar Centaur 50 T6102S-C334	4550	All hours
Unit 5	Solar Centaur 50 T6102S-C334	4550	All hours
Unit 6	Solar Centaur 50 T6102S-C334	4550	All hours
DEA (backup engine)	TBC	100	Assumed[10] 12:00 pm to 2:00 pm every day.

Stack parameters

Table 12 below details the stack parameters utilised in this assessment. A number of sources were used to develop the stack parameters to be input into the dispersion model. The relevant sources used for each parameter are also detailed in Table 12.

Table 12 Discharge characteristics of the exhaust stack

Source ID	Stack height (m) (source)	Exit diameter (m) (source)	Exhaust discharge velocity (m/s) (source)	Exhaust discharge temperature (ºC) (source)
Station A				
Unit 1	11	Length: 2 Width 1	8.4	520
Unit 2	11	Length: 2 Width 1	8.4	520
Station A data source	Calculated based on aerial imagery	Calculated based on aerial imagery	Calculated based on stack testing by Ektimo 2019	Based on equipment specification sheet
Station B				
Unit 4	14	1	44.5	532
Unit 5	14	1	44.5	532
Unit 6	14	1	44.5	532

[10] In order to allow for the worst-case meteorological conditions to be captured, the DEA was modelled as occurring as a scheduled maintenance activity

A sensitivity study indicated that time of day (daylight hours) did not alter the ground level impact concentration levels.

Source ID	Stack height (m) (source)	Exit diameter (m) (source)	Exhaust discharge velocity (m/s) (source)	Exhaust discharge temperature (ºC) (source)
Station B data source	Provided by APA	Provided by APA	Average velocity of Unit 4 and 5 as reported in Ektimo 2019	Average velocity of Unit 4 and 5 as reported in Ektimo 2019
Diesel Engine Alternator (DEA)				
DEA	3.5	0.2	15	346
DEA data source	Provided by APA	Provided by APA	Stack testing by Ektimo 2019	Stack testing by Ektimo 2019

8.1.3 Emission estimation

Site specific emission monitoring was undertaken at the Wollert Compressor Station by Ektimo on 11 and 12 November 2019 (Ektimo 2019). This consisted of emission testing of Compressor Units 1 to 5 as well as the GEA (generator unit) for combustion gases: nitrogen oxides (as NO_2) and carbon monoxide. VOC's C1-C4 were also sampled.

Where site-specific pollutant information is not known, it is common practise to utilise emission factors outlined in the National Pollutant Inventory (NPI) emission estimation technique (EET) manuals. The EET manual relevant to this assessment is the EET manual for Combustion engines (Version 3, June 2008). Emission factors outlined in the manual give an estimate of likely emission rates from each source. In all cases the reasonable worst-case scenario (i.e. the operational scenario likely to result in the highest predicted pollutant concentrations) was used for calculating emission rates so that the actual emissions are unlikely to exceed those predicted by the model.

Where emission rates were provided in Ektimo 2019, they were utilised in the model (i.e. for NOx as NO_2 and CO). For all remaining pollutants the emission factors outlined in Table 51 and Table 50 of the NPI EET Manual for Combustion engines were utilised for all combustion sources and the DEA, respectively. These emission rates are outlined in Table 13.

It is noted that no data is provided for PAHs in table 51 of the NPI EET Manual for Combustion engines. Therefore, PAH emissions from gas-fired combustion engines are expected to be minor and have therefore only been modelled from the DEA.

It is also noted that a reported stack test of NOx as NO_2 does not mean 100% NO_2 is present. Rather all the NOx is converted to NO_2 in the process of measuring it (or calculating) as it is a single molecular mass. Therefore, the results of the emission monitoring undertaken by Ektimo (2019) is not 100% NO_2. Therefore, GHD has utilised the Tier 2 Ambient Ratio Method 2 (ARM2) for conversion of NOx to NO_2 as provided in the AERMOD dispersion model.

Table 13 Wollert Compressor Station modelled emission rates

Source ID	Emission rate (g/s)									
	NOx as NO_2	CO	SO_2	PM_{10}	$PM_{2.5}$	Benzene	Formaldehyde	PAHs	Toluene	Xylenes
Unit 1	0.53	0.17	0.0002	0.0008	0.0008	0.0000049	0.0003	-	0.0001	0.00003
Unit 2	0.53	0.17	0.0002	0.0008	0.0008	0.0000049	0.0003	-	0.0001	0.00003
Unit 4	0.93	0.16	0.0010	0.0037	0.0037	0.000024	0.0014	-	0.0003	0.0001
Unit 5	0.93	0.16	0.0010	0.0037	0.0037	0.000024	0.0014	-	0.0003	0.0001
Unit 6	0.93	0.16	0.0010	0.0037	0.0037	0.000024	0.0014	-	0.0003	0.0001
DEA	1.00	0.05	0.0005	0.1417	0.1383	0.0004	0.0005	0.000000007	0.00019	0.00013

8.2 Pipeline construction

8.2.1 Emission constituents

Air quality impacts during construction of the pipeline would be predominantly due to dust emissions, generated via the following mechanisms:

- Mechanical disturbance: dust emissions created by the operation of clearing and grading, open trench construction, backfilling and rehabilitation which all involve material transport vehicles and equipment
- Wind erosion: dust emissions from exposed, disturbed soil surfaces under high wind speeds

Vehicle exhaust emissions during the construction phase have the potential to impact on air quality; however the impact is likely to be negligible given the limited amount of equipment and the short-term construction period at any one location.

All construction and administrative vehicles should be maintained in a serviceable condition such that exhaust emissions are reduced to manufacturer specified levels.

GHD has modelled dust emissions (particulate matter as PM_{10} during the construction of the pipeline). Ongoing maintenance activities would be limited to accessing the easement for inspection of the pipeline, which is expected to be so rare that it can be ignored for a dust impact assessment Since the open trenching construction phase of the Project will mostly involve trenching through clay-based soils (and no crushing and screening activities), Respirable Crystalline Silicon (RCS) can be safely ignored.

8.2.2 Emission estimation

The general equation used to estimate TSP and PM_{10} emissions from mining activities is described mathematically as:

$$E_i = A \times EF_i \times \left(\frac{100 - CE}{100}\right)$$

Where:

E_i = Emission rate of pollutant *i* (kg per activity)

A = Activity data (units dependent on emission factors)

EF_i = Uncontrolled emissions factor for pollutant *i* (kg per activity)

CE = Control efficiency (%)

Where possible, the activity data and control efficiencies used in the modelling to estimate emissions from the pipeline construction sources were based on the construction methodology and other detailed information provided by APA. Emission factors used to estimate emissions of PM_{10} have been sourced from the National Pollutant Inventory (NPI) Emissions Estimation Technique (EET) Manual for Mining. Emission factors give an estimate of likely dust generation for each type of construction activity. In all cases the reasonable worst-case scenario was used for calculating dust emission rates so that the actual dust emissions are unlikely to exceed those predicted by the model.

8.2.3 Emission sources

Pipeline construction activities will include:

- Surveying
- Site establishment
- Clear and grade
- Pipe stringing and bending
- Welding
- Open trench construction
- Lowering and backfilling
- Testing and commissioning
- Rehabilitation of construction corridor

Of these activities, the following four (4) construction phases have the potential for dust emissions. The other phases (surveying, pipe bending and welding, testing and commissioning etc.) have no or negligible potential to generate dust emissions.

Phase 1: Clear and grade

Clearing will be required to remove trees, shrubs and groundcover vegetation. Graders, bulldozers and excavators are generally used to clear and level the construction corridor.

Cleared vegetation and topsoil material will be stockpiled on one or both sides of the construction corridor. Breaks will be left in stockpiled vegetation where natural drainage lines exist.

The following equipment will likely be present in the clear and grade phase, as outlined in Table 14.

Table 14 Equipment required during clear and grade phase

ID	Equipment	Quantity	Comment
-	Hitachi 30T Excavator	3	Expected only to be used for large rocks associated with minimal dust. Not included in model.
A1.1	Cat 16M Grader	1	-
A1.2	Cat 14M Grader	1	-
A2	Cat D6 Dozer	1	-
A3	Service vehicles (ute 4x4)	3	-
-	Crew cab truck	1	For safety reasons will not be operating in the same construction zone as the heavy equipment. Not included in model.
-	Cat 30T Moxy	1	Will only be used in specific areas on construction corridor such as creek crossings. Not included in model.

Phase 2: Open trench construction

Specialised trenching machines and excavators will be used to excavate the trench. Spoil generated during trench excavation will be stockpiled separate from vegetation and topsoil stockpiled during the clear and grade phase.

The majority of the pipeline alignment will be open trench construction, which will have trench dimensions of nominally 2.0 m deep and 1.0 m wide.

Horizontal boring will occur in some sections of the alignment (e.g. under railway lines, sealed bitumen roads) and the construction footprint is small. Horizontal boring involves excavation of pits either side of the obstacle. The boring machine will be located within the entry pit, which uses a hydraulic ram to jack the pipe section, behind a cutting head, in a straight line through the ground to the receiving pit. The construction of the pits will involve excavation that will be short lived and produce minimal dust.

Horizontal directional drilling (HDD) will occur in some sections of the alignment (e.g. under major transport corridors and waterways). HDD requires excavation of entry and exit pits and will have the following approximate dimensions: 3 m wide, 3 m long and 2 m deep. Such excavation will be short lived and produce minimal dust.

Rock breaking processes such as the use of rock saws/hammers and/or blasting may be required to excavate the trench in areas of near surface rock. It is expected that there will be very limited airborne dust or fumes caused by the explosives cracking of the rock (i.e. blasting) because the explosives charges are very small and embedded deep within the blastholes[11].

[11] Technick Consulting Pty Ltd (2020), WORM Blasting Study

For this assessment, GHD has modelled emissions from open trench construction which will occur for the majority of the pipeline alignment. It is expected that the dust emissions associated with horizontal boring and HDD, and associated minor civil works, will be less than those associated with open trench construction as dust emissions will be localised to the entry and exit pits.

The following equipment will likely be required in the open trench construction phase, as outlined in Table 15.

Table 15 Equipment required during open trenching phase

ID	Equipment	Quantity	Comment
B1	Hitachi 35T Excavator	6	-
B2	Chain trencher/excavator	3	Will be a combination of either an excavator or a chain trencher – depending on ground conditions.
B3	Hiab truck	1	-
B4	Trucks bringing in pipes	1	1 per hour
B5	Service vehicles (ute 4x4)	4	-

Phase 3: Activities associated with installation of the pipe and backfilling of trench

Phase 3 consists of two parts, namely:

- Phase 3a: Lowering in of the pipe and padding
- Phase 3b: Backfilling of trench

The two activities occur as part of the same phase, however, do not occur concurrently. Both involve moving (soil) material and may be within the same one kilometre construction area. Therefore, GHD has calculated the emissions associated with the two activities, and will only model the phase with the higher emission rate. This will result in the worst case emissions of this phase being modelled.

Specialist equipment (side booms) are used to lower the pipe into the trench. The pipe is then covered by fine grain material (padding) to protect the pipeline coating and support the pipe. The trench will be backfilled with the previously excavated subsoil material. The subsoil material will be compacted to limit settlement of the trench through the operational life of the pipeline. The subsoils are compacted to limit settlement of the trench through the operational life of the pipeline.

The following equipment will likely be required in the lowing in and padding phase, as outlined in Table 16.

Table 16 Equipment required during activities associated with backfilling of trench

ID	Equipment	Quantity	Comment
Lowering in of the pipe and padding			
C1.1	Superior 250 Padder	1	-
C1.2	Superior 350 Padder	1	
-	Cat 572 Sideboom	3	Will be used for pre-jeeping pipe and to lower the pipe into the trench. Will not involve the handing of overburden/subsoil and therefore expected to be associated with minimal dust. Not included in model.
-	Cat 583 Sideboom	1	
C2	Hitachi 35T Excavator	2	-
C3	Service vehicles	2	-
Backfilling of trench			
D1	Cat D6 dozer	1	-
D2.1	Cat 16M Grader	1	-
D2.2	Cat 14M Grader	1	-
D3	Cat 930 Loader	1	-
D4	Hitachi 35T Excavator	1	-
D5	Service vehicles	4	-

Phase 4: Rehabilitation of construction corridor

Rehabilitation of the construction corridor including re-establishing topsoil cover with a view to returning land to its previous condition.

The following equipment will likely be required in the rehabilitation phase, as outlined in Table 17.

Table 17 Equipment required during rehabilitation phase

ID	Equipment	Quantity	Comment
-	Hitachi 30T Excavator	3	Expected only to be used for large rocks associated with minimal dust. Not included in model.
E1.1	Cat 16M Grader	1	-
E1.2	Cat 14M Grader	1	-
E2	Cat D6 Dozer	1	-
E3	Service vehicles (ute 4x4)	3	-
-	Crew cab truck	1	For safety reasons will not be operating in the same construction zone as the heavy equipment. Not included in model.
-	Cat 30T Moxy	1	Will only be used in specific areas on construction corridor such as creek crossings. Not included in model.

8.2.4 Emissions not modelled

Fuel burning resulting from mobile plant activities and vehicles can result in emissions of sulphur dioxide (SO_2), carbon monoxide, oxides of nitrogen and other gaseous substances.

The current low sulphur content of Australian diesel fuel (maximum of 10 ppm as per Australian Diesel Fuel Standard), in combination with the equipment spread over many kilometres, makes it unlikely that SO_2 goals will be exceeded off-site or at any identified sensitive receptors. Therefore, sulphur dioxide (SO_2) was not assessed during the construction phases.

Oxides of nitrogen, carbon monoxide and any other potentially harmful gaseous substances were assessed as unlikely to exceed air quality goals off-site, or at identified receptors, due to the comparatively low emission rates (with respect to dust impact) and the distances between significant sources. Accordingly, no further assessment of these emissions has been carried out during the construction phases.

Therefore, the following emissions sources were not modelled in this assessment:

- Diesel combustion from vehicles and equipment
- Light vehicle movements, general movement and employees arriving for work
- Emergency/waste/unplanned gas leak or release

8.2.5 Modelled pipeline orientations

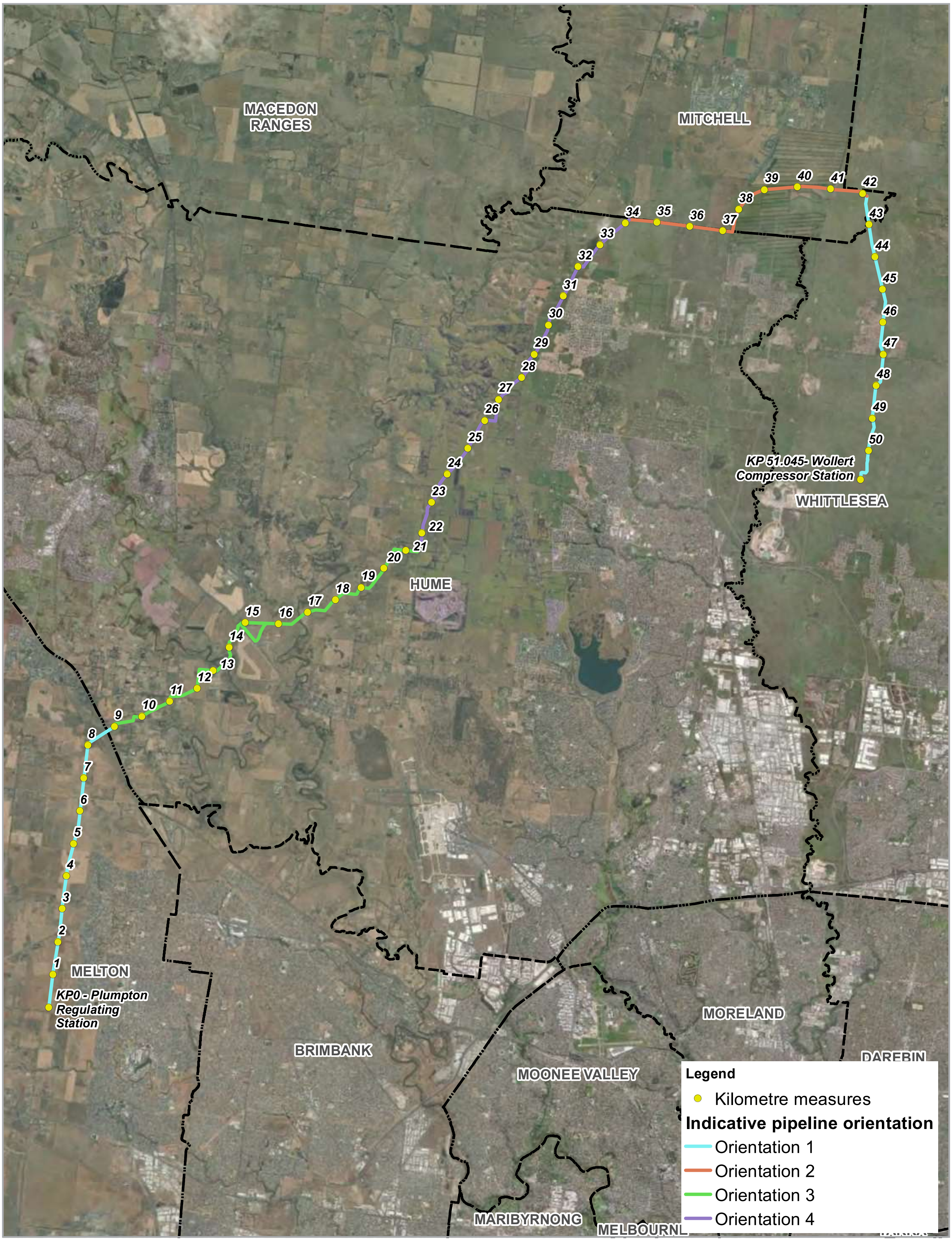
The overall pipeline alignment and general directions is described in Table 18 below. For the purpose of the Air Quality Impact Assessment four indicative orientations, based on the four predominant orientations (directions) of the pipeline route were modelled.

These orientations are considered to represent typical directions of the overall Project alignment, which are orientated in the same direction. For each orientation (as outlined in Table 18), the dispersion modelling captures the worst-case meteorological conditions in a lateral direction from the construction corridor (which differs for each orientation). As such the predicted model results for a particular orientation are applicable to all sections of the pipeline orientated in the same direction. The constructive phases modelled can be adopted across the pipeline alignment as construction proceeds.

The orientations representative of each KP of the pipeline is described Table 18 and shown in Figure 11.

Table 18 Indicative pipeline orientations

Orientation number	Orientation (direction of pipeline)	Applicable KP
1	North to South	KP 0 to 8 KP 42 to 50
2	East to West	KP 34 to 42
3	East-northeast to West-southwest	KP 8 to 21
4	North-northeast to South-southwest	KP 21 to 34



Paper Size ISO A4

0 1,800 3,600

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

GHD

Australian Pipeline Limited
Western Outer Ring Main Gas Project

Project No. 12529997
Revision No. D
Date 3/4/2021

Indicative Pipeline Orientations

FIGURE 11

\\ghdnet\ghd\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_019_Indicative_Alignment_A4P_revD.mxd
Print date: 04 Mar 2021 - 11:37

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: kgardner

8.2.6 Modelled conditions

Hour of day

Construction activities will typically occur for up to 11 - 12 hours per day, seven days a week, typically between 6: 00 am and 6:00 pm. Construction sites typically have a start-up and shut-down phase each work day and with work breaks at times (lunch etc). The nine hours per day modelled is based on equipment operating hours, provided by APA spread over the Project time frame. GHD has modelled all mobile emission sources (i.e. graders, excavators, etc) as occurring continuously between 8:00 am to 5:00 pm. All remaining sources (i.e. the wind erosion sources) were modelled as occurring for all hours of the year.

Precipitation

The U.S. EPA Compilation of Air Emissions Factors - AP42 - 13.2.2 Unpaved Roads states that all roads are subject to some natural mitigation because of rainfall and other precipitation. GHD has obtained the mean number of rain days at Melbourne Airport (138 rain days), based on BoM measurements dating back to 1970. Therefore, a 62% emission reduction was applied, as calculated using a formula in the AP-42 documentation, to all mobile sources between May and August (inclusive) in order to account for the natural mitigation present during these months.

Wind speed

The calculation of particulate emissions associated with wind erosion from a surface is a function of:

- Silt content
- The number of days per year when the rainfall is greater than 0.25 mm
- The percentage of the time when the wind speed is greater than 5.4 m/s at the mean height of a stockpile

As the silt content of the soil is not known and the rainfall has been taken into consideration as outlined above, GHD has applied an emission rate of zero g/s for all wind erosion source when the wind speed is less than 5.2 m/s[12]. It is expected that minimal dust/particulate emissions will lift off the exposed construction corridor when the wind speed is less than this amount.

8.2.7 Activity data

For the dust emission sources identified, activity data is defined as either:

- The amount of material moved
- The total distance of a vehicle travelled (Vehicle Kilometres Travelled (VKT))
- The amount of time a unit of equipment is operational or
- The amount of area exposed for wind erosion

A summary of activity data for each phase of the Project for all identified emission sources is presented in Table 19. The emission sources outlined in Table 19 are based on the equipment information as discussed in 8.2.3. In addition to the equipment emission sources, each project construction phase includes a wind erosion source which quantifies the dust emissions resulting from wind removing soil from the exposed ground and stockpiles.

[12] 5.2 m/s was selected instead of 5.4 m/s as 5.2 m/s is the pre-set value selected by AERMOD. It is considered more conservative than 5.4 m/s.

Table 19 Emission source activity data for construction activity

Source ID	Source name	Source type (NPI)	Emission factor TSP	Emission factor PM10	Emission factor units	Number modelled	Activity data	Activity data units	Justification
Phase 1: Clear and grade									
A1	Cat 16M Grader and Cat 14M Grader	Graders	0.19	0.085	kg/VKT	2	5	VKT/hour	Assuming the graders will travel at 5 km/h speed as outlined in the NPI EET Manual for Mining; for all worked hours
A2	Cat D6 Dozer	Bulldozer on material other than coal	17	4.1	kg/h	1	1	hour/hour	Assuming the dozer will operate for 8.5 hours each day.
A3	Service vehicles (ute 4x4)	Wheel generated dust from unpaved roads (used by light duty vehicles)	0.94	0.33	kg/VKT	3	4.4	VKT/hour	It has been assumed that 25% of the kilometres travelled by each service vehicle (as provided by APA) will take place at the Project site
A4	Exposed construction corridor	Wind erosion	0.4	0.2	kg/ha	1	3	ha/hour	Assumes the area encompassing the width of the construction corridor (30 m) and a nominal modelled 1 km length will be exposed to wind erosion.
Phase 2: Open trenching construction									
B1	Hitachi 35T Excavator	Excavators/Shovels/Front-end loaders (on overburden)	0.025	0.012	kg/t	2	141	t/hour	Approximately 2 m^3 of soil will be trenched/excavated for every 1 m of alignment traversed. It is expected that approximately 800 m of the alignment length will be trenched per day (during open cut operations). GHD have assumed that the excavator will handle 70% of the throughput and the chain trencher will handle 30%. It has also been assumed that the chain trenchers will not operate within 1 km of each other and that two excavators will be associated with each chain trencher.
B2	Chain trencher/excavator	Excavators/Shovels/Front-end loaders (on overburden)	0.025	0.012	kg/t	1	61	t/hour	
B3	Hiab truck	Wheel generated dust from unpaved roads at industrial sites	4.23	1.25	kg/VKT	1	2	VKT/hour	It has been assumed that the Hiab truck will travel once up and once back (i.e. round trip) the construction corridor once per hour. A 5 tonne mass (loaded) has been assumed.
B4	Trucks bringing in pipes	Wheel generated dust from unpaved roads at industrial sites	4.23	1.25	kg/VKT	1	2	VKT/hour	It has been assumed that a truck bringing in pipes will travel once up and once back (i.e. round trip) the construction corridor once per hour. A 12 tonne mass has been assumed.
B5	Service vehicles (ute 4x4)	Wheel generated dust from unpaved roads (used by light duty vehicles)	0.94	0.33	kg/VKT	4	4.4	VKT/hour	It has been assumed that 25% of the kilometres travelled by each service vehicle (as provided by APA) will take place at the Project site
B6	Exposed construction corridor	Wind erosion	0.4	0.2	kg/ha	1	3	ha/hour	Assumes the area encompassing the width of the construction corridor (30 m) and a nominal modelled 1 km length will be exposed to wind erosion.
Phase 3: Activities associated with backfilling of trench									
Phase 3a: Lowering in and padding									
C1.1	Superior 250 Padder and Superior 350 Padder	Excavators/Shovels/Front-end loaders (on overburden)	0.025	0.012	kg/t	2	182	t/hour	The padder equipment is associated with two emission sources, namely the belted conveyor and the backfilling into the trench. Therefore, the source has been separated into two emission sources: equivalent of excavators/shovels/front-end loaders and trucks dumping, respectively.
C1.2	Superior 250 Padder and Superior 350 Padder	Trucks (dumping overburden)	0.012	0.0043	kg/t	2	182	t/hour	It has been assumed that the same volume of material excavated during the open trenching construction will be placed back into the trench during backfill operations, minus the volume of the pipe (DN600).

Source ID	Source name	Source type (NPI)	Emission factor TSP	Emission factor PM10	Emission factor units	Number modelled	Activity data	Activity data units	Justification
C2	Hitachi 35T Excavator	Excavators/Shovels/Front-end loaders (on overburden)	0.025	0.012	kg/t	2	18	t/hour	It has been assumed that excavator throughputs will be 10% of the padder throughputs.
C3	Service vehicles	Wheel generated dust from unpaved roads (used by light duty vehicles)	0.94	0.33	kg/VKT	2	4.4	t/hour	It has been assumed that 25% of the kilometres travelled by each service vehicle (as provided by APA) will take place at the Project site
C4	Exposed construction corridor	Wind erosion	0.4	0.2	kg/ha	1	3	ha/hour	Assumes the area encompassing the width of the construction corridor (30 m) and a nominal modelled 1 km length will be exposed to wind erosion.
Phase 3b: Backfilling									
D1	Cat D6 dozer	Bulldozer on material other than coal	17	4.1	kg/h	1	1	hour/hour	Assuming the dozer will operate for 8.5 hours each day.
D2	Cat 16M Grader and Cat 14M Grader	Graders	0.19	0.085	kg/VKT	2	5	VKT/hour	Assuming the graders will travel at 5 km/h speed as outlined in the NPI EET Manual for Mining for all worked hours
D3	Cat 930 Loader	Excavators/Shovels/Front-end loaders (on overburden)	0.025	0.012	kg/t	1	18	t/hour	It has been assumed that excavator throughputs will be 10% of the total backfilling throughput.
D4	Hitachi 35T Excavator	Excavators/Shovels/Front-end loaders (on overburden)	0.025	0.012	kg/t	1	18	t/hour	It has been assumed that excavator throughputs will be 10% of the total backfilling throughput.
D5	Service vehicles	Wheel generated dust from unpaved roads (used by light duty vehicles)	0.94	0.33	kg/VKT	4	4.4	t/hour	It has been assumed that 25% of the kilometres travelled by each service vehicle (as provided by APA) will take place at the Project site
D6	Exposed construction corridor	Wind erosion	0.4	0.2	kg/ha	1	3	ha/hour	Assumes the area encompassing the width of the construction corridor (30 m) and a nominal modelled 1 km length will be exposed to wind erosion.
Phase 4: Rehabilitation of construction corridor									
E1	Cat 16M Grader and Cat 14M Grader	Graders	0.19	0.085	kg/VKT	2	5	VKT/hour	Assuming the graders will travel at 5 km/h speed as outlined in the NPI EET Manual for Mining; for all worked hours
E2	Cat D6 Dozer	Bulldozer on material other than coal	17	4.1	kg/h	1	1	hour/hour	Assuming the dozer will operate for 8.5 hours each day.
E3	Service vehicles (ute 4x4)	Wheel generated dust from unpaved roads (used by light duty vehicles)	0.94	0.33	kg/VKT	3	4.4	VKT/hour	It has been assumed that 25% of the kilometres travelled by each service vehicle (as provided by APA) will take place at the Project site
E4	Exposed construction corridor	Wind erosion	0.4	0.2	kg/ha	1	3	ha/hour	Assumes the area encompassing the width of the construction corridor (30 m) and a nominal modelled 1 km length will be exposed to wind erosion.

8.2.8 Emission rates summary

The modelled emission rates for each source is provided in Table 20. As stated in section 8.2.3, Phase 3 consists of Phase 3a: Lowering in of the pipe and padding and Phase 3b: Backfilling of trench. The two activities occur as part of the same phase, however, do not occur concurrently. They may however be within the same one kilometre long indicative construction area. Therefore, GHD has calculated the emissions associated with the two activities, and has only modelled the phase with the higher emission rate. From Table 20 it can be seen that the sum of emission rates are 3.2 g/s and 3.3 g/s for lowering in of the pipe/padding and backfilling of trench, respectively. Therefore, only emissions associated with backfilling of trench (i.e. Phase 3b) have been modelled.

It is noted that Table 20 presents the cumulative emission rates, meaning the individual emission rate, if there are multiple modelled sources within the source type, is the cumulative emission rate divided by the number of modelled sources, for that source.

Where modelled operational hours and model conditions have been included, these are also outlined in Table 20. A summary of the cumulative emission rates for each construction phase is provided in Figure 12. From Figure 12 it can be seen that the emissions are greatest during the open trenching construction phase. This is followed by activities associated with backfilling of the trench.

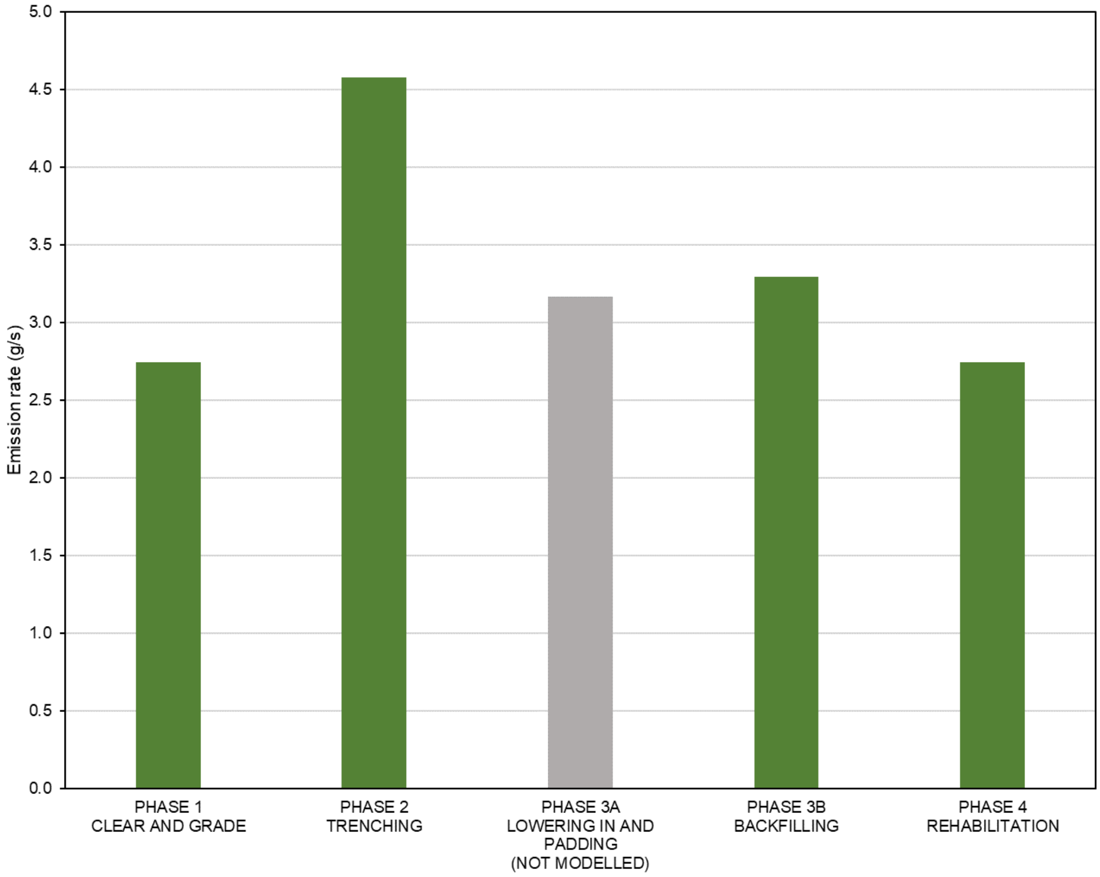


Figure 12 Cumulative emission rates for each construction phase

Table 20 Emission rates during construction phases

Source ID	Source name	Source type (NPI)	Number modelled	PM_{10} emission rate (g/s)	Modelled hours	Modelled conditions
Phase 1: Clear and grade						
A1	Cat 16M Grader and Cat 14M Grader	Graders	2	0.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
A2	Cat D6 Dozer	Bulldozer on material other than coal	1	1.1	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
A3	Service vehicles (ute 4x4)	Wheel generated dust from unpaved roads (used by light duty vehicles)	3	1.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
A4	Exposed construction corridor	Wind erosion	1	0.2	All	Only modelled when wind speed greater than 5.2 m/s
SUM				**2.7**	**-**	**-**
Phase 2: Open trenching construction						
B1	Hitachi 35T Excavator	Excavators/Shovels/Front-end loaders (on overburden)	2	1.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
B2	Chain trencher/excavator	Excavators/Shovels/Front-end loaders (on overburden)	1	0.3	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
B3	Hiab truck	Wheel generated dust from unpaved roads at industrial sites	1	0.7	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
B4	Trucks bringing in pipes	Wheel generated dust from unpaved roads at industrial sites	1	0.7	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
B5	Service vehicles (ute 4x4)	Wheel generated dust from unpaved roads (used by light duty vehicles)	4	1.6	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
B6	Exposed construction corridor	Wind erosion	1	0.2	All	Only modelled when wind speed greater than 5.2 m/s
SUM				**4.6**	**-**	**-**
Phase 3: Activities associated with installation of the pipe and backfilling of trench						
Phase 3a: Lowering in pipe and padding (NOT MODELLED)						
C1.1	Superior 250 Padder and Superior 350 Padder	Excavators/Shovels/Front-end loaders (on overburden)	2	1.5	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
C1.2	Superior 250 Padder and Superior 350 Padder	Trucks (dumping overburden)	2	0.5	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
C2	Hitachi 35T Excavator	Excavators/Shovels/Front-end loaders (on overburden)	2	0.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
C3	Service vehicles	Wheel generated dust from unpaved roads (used by light duty vehicles)	2	0.8	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
C4	Exposed construction corridor	Wind erosion	1	0.2	All	Only modelled when wind speed greater than 5.2 m/s
SUM				**3.2**	**-**	**-**
Phase 3b: Backfilling						
D1	Cat D6 dozer	Bulldozer on material other than coal	1	1.1	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
D2	Cat 16M Grader and Cat 14M Grader	Graders	2	0.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
D3	Cat 930 Loader	Excavators/Shovels/Front-end loaders (on overburden)	1	0.1	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)

Source ID	Source name	Source type (NPI)	Number modelled	PM_{10} emission rate (g/s)	Modelled hours	Modelled conditions
D4	Hitachi 35T Excavator	Excavators/Shovels/Front-end loaders (on overburden)	1	0.1	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
D5	Service vehicles	Wheel generated dust from unpaved roads (used by light duty vehicles)	4	1.6	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
D6	Exposed construction corridor	Wind erosion	1	0.2	All	Only modelled when wind speed greater than 5.2 m/s
SUM				**3.3**	**-**	**-**
Phase 4: Rehabilitation of construction corridor						
E1	Cat 16M Grader and Cat 14M Grader	Graders	2	0.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
E2	Cat D6 Dozer	Bulldozer on material other than coal	1	1.1	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
E3	Service vehicles (ute 4x4)	Wheel generated dust from unpaved roads (used by light duty vehicles)	3	1.2	8:00 am to 5:00 pm	62% reduction between May and August (inclusive)
E4	Exposed construction corridor	Wind erosion	1	0.2	All	Only modelled when wind speed greater than 5.2 m/s
SUM				**2.7**	**-**	**-**

9. Impact assessment

9.1 Wollert Compressor Station operation emissions

Schedule C of SEPP AQM concerns a modelling procedure with reference to the design criteria of Schedule A: “These criteria are to be used in the assessment of the design of new or expanded sources of emissions such as industrial premises”. Therefore, ‘stationary sources’ of the engine (stack) vents are assessed with the exclusion of fugitive and emergency emissions. Risk AQ4 is assessed in this section. The risk of operational odour impacts are negligible and rare enough so as to not be included in this assessment.

9.1.1 Model configuration

AERMOD was configured using site-representative meteorological data (see section 6.2) and in accordance with EPA Victoria’s AERMOD modelling guidance (publications 1550[13] and 1551[14]).

Key components of the model configuration are summarised below:

- Five year meteorological data file was created using the methodology outlined in section 6.2 for the years 2015 – 2019
- Discharge points from units 1, 2, 4, 5, 6 and DEA were modelled[15]
- Building wake effects from the Station A building were modelled
- Two scenarios were modelled:
  - Including the DEA
  - Excluding the DEA
- Emissions were modelled to occur during:
  - Units 1, 2: all hours in winter months
  - Units 4, 5, 6: all hours
  - DEA: 12:00 pm to 2:00 pm every day[16]
- The 99.9th percentile predicted ground level concentrations were modelled

9.1.2 Source emission characterisation

Within the framework of the AERMOD Gaussian regulatory modelling program, three types of emission characterisations are possible. These are:

- Point source emissions, where a substance is emitted into the atmosphere from a free standing or building wake affected stack with a finite diameter. The substance is emitted with both vertical momentum and thermal buoyancy.
- Area source emissions, where a substance is emitted into the atmosphere from a flat planar surface. The emitted substance has zero momentum and is neutrally buoyant. AERMOD also has the capability to characterise irregularly shaped area sources.

[13] EPA Victoria 2014 “Construction of input meteorological data files for EPA Victoria's regulatory air pollution model (AERMOD)” Publication 1550 Revision 3, September 2014

[14] EPA Victoria 2014 “Guidance Notes for using AERMOD” Publication 1551 Revision 4, November 2014

[15] The smaller units of ‘Station A’ run as an N+1 configuration with one engine being on standby or maintenance. Therefore only two of the units run at one time – for convenience Units 1 and 2.

[16] It is noted that the DEA is expected to operate for up to one hour on a set day and time of the week (i.e. once per week), however it has been modelled as occurring every day of the week in order to capture the worst case meteorological conditions.

- Volume source emissions, where a substance is emitted from a single point located in space (pseudo stack), above ground level, where the initial vertical and horizontal spread of the plume is based on a geometric length and height of the emitting source. Line volume source emissions can also be selected to represent a haul road.

All emission sources for the compressor station were modelled as point sources with units within the Station A building having wake effected plumes.

9.1.3 Results

A summary of the Wollert Compressor station dispersion modelling results is provided in Table 21, with contour plots provided in Appendix C and Appendix D, including and excluding the DEA, respectively. It is noted that when undertaking dispersion modelling for assessment against the SEPP-AQM[17] for a site, the Environment Protection (Scheduled Premises) Regulations 2017 state that gas diesel generators used as standby engines "is not required" (Clause 10 (1) (b)). However, both scenarios have been considered for completeness.

The predicted results are as follows:

- Compressor station, including the DEA, excluding background: The impact assessment predicted compliance for all pollutants with the relevant criteria in the SEPP AQM when background is not included.
- Compressor station, including the DEA, including background: When the compressor station impact was assessed for emissions including background concentrations and the DEA (the "worst case scenario"), all pollutants with the exception of NO_2 and $PM_{2.5}$ comply with the relevant criteria as outlined in the SEPP AQM.
- Compressor station, excluding the DEA, including background: When the DEA was not modelled (as it is an emergency backup engine), all pollutants complied with the relevant criteria for worst-case normal operations. NO_2 was found to be the highest predicted pollutant with respect to its criterion, with a maximum impact of 74% of the SEPP AQM design ground level concentration. Particulate matter (PM_{10} and $PM_{2.5}$ at 27% and 18% respectively) are the next highest with respect to the SEPP AQM criteria. All other gaseous pollutants are less than 2% of the criteria. It is noted that the predicted area of non-compliance for NO_2 and $PM_{2.5}$, when the DEA is operating, is found to be very small in area and largely over the APA owned property which includes the Wollert Compressor Station (i.e. not impacting any sensitive receptor locations).

9.1.4 Finding on residual impacts

The results, based on the proposed design for the facilities operating at a worst-case normal scenario excluding the DEA, show that the Project would meet relevant criteria outlined in the SEPP AQM. When the DEA is included the area of exceedance is predicted to be very small and largely over the APA owned property which includes the Wollert Compressor Station (i.e. not impacting any sensitive receptor locations).

The impacts are therefore considered to be low and no additional mitigation, apart from the existing and proposed design features (low-NOx and CO technology and modelled stack heights), is therefore recommended.

[17] Most often performed when in relation to the development of an EPA licence via a Works Approval Application, or if a site is classified as exempt from a Works Approval..

Table 21 Wollert Compressor station results

Pollutant	Criteria ($\mu g/m^3$)	Averaging period	Percentile	Background ($\mu g/m^3$)	Results including the DEA			Results excluding the DEA		
					Comment	Maximum predicted GLC % of SEPP AQM criterion	Comply with SEPP AQM?	Comment	Maximum predicted GLC % of SEPP AQM criterion	Comply with SEPP AQM?
NO_2	190	1 hour	99.9%	15.1	Contours extend in the north-south direction and to the northeast. The maximum predicted GLC is 201.4 $\mu g/m^3$ including background.	106%	X	Contours extend to the northwest, south and easterly directions. The maximum predicted GLC is 141 $\mu g/m^3$ including background.	74%	✓
CO	29,000	1 hour	99.9%	380	Contours extend in the north-south direction and to the northeast. The maximum predicted GLC is 435.8 $\mu g/m^3$ including background.	1%	✓	Contours extend in the north-south direction and to the northeast. The maximum predicted GLC is 436 $\mu g/m^3$ including background.	1.5%	✓
SO_2	450	1 hour	99.9%	0	Contours extend in the north-south direction and to the northeast. The maximum predicted GLC is 0.1 $\mu g/m^3$ (background not modelled)	0.03%	✓	Contours extend in the north-south direction and to the northeast. The maximum predicted GLC is 0.04 $\mu g/m^3$ (background not modelled)	0%	✓
PM_{10}	80	1 hour	99.9%	21	Contours are oval in shape, with slight extensions to the north and south The maximum predicted GLC is 73.8 $\mu g/m^3$ including background.	92%	✓	Contours extend to the north, east and south, with a retraction to the west The maximum predicted GLC is 21.3 $\mu g/m^3$ including background.	27%	✓
$PM_{2.5}$	50	1 hour	99.9%	8.8	Contours are oval in shape, with slight extensions to the north and south The maximum predicted GLC is 60.8 $\mu g/m^3$ including background.	121%	X	Contours extend to the north, east and south, with a retraction to the west The maximum predicted GLC is 9.1 $\mu g/m^3$ including background.	18%	✓
Benzene	53	3 minute	99.9%	0	Contours are oval in shape, with slight extensions to the north and south The maximum predicted GLC is 0.3 $\mu g/m^3$ (background not modelled)	0.5%	✓	Contours extend to the northwest, east and south, with a retraction to the west The maximum predicted GLC is 0.003 $\mu g/m^3$ (background not included)	0.01%	✓
Formaldehyde	40	3 minute	99.9%	0	Contours extend to the north, south and slightly to the east. The maximum predicted GLC is 0.3 $\mu g/m^3$ (background not modelled)	0.8%	✓	Contours extend to the northwest, east and southwest, with a retraction to the west The maximum predicted GLC is 0.2 $\mu g/m^3$ (background not included)	0.4%	✓
PAH (as BaP)	0.73	3 minute	99.9%	0	Emission rates were so low that the maximum predicted GLC was not detectable.	0%	✓	Emission rates were so low that the maximum predicted GLC was not detectable	0%	✓
Toluene (odour)	650	3 minute	99.9%	0	Contours extend to the northwest, southwest and east. The maximum predicted GLC is 0.1 $\mu g/m^3$ (background not modelled)	0.02%	✓	Contours extend to the northwest, east and southwest, with a retraction to the west The maximum predicted GLC is 0.1 $\mu g/m^3$ (background not included)	0.01%	✓
Xylenes (odour)	350	3 minute	99.9%	0	Contours are oval in shape, with extensions to the northwest, east and south. The maximum predicted GLC is 0.1 $\mu g/m^3$ (background not modelled)	0.03%	✓	Contours extend to the northwest, east and southwest, with a retraction to the west The maximum predicted GLC is 0.02 $\mu g/m^3$ (background not included)	0.01%	✓

9.2 Pipeline construction

The impacts of construction dust includes civil works inclusive of material transfer (moving soil around) generate particulate matter (dusts) similar to what occurs in mining and extractive industries. The guidance of the Mining PEM (in addition to the SEPP AAQ as per recent advice from EPA Victoria) is used – with emphasis on the PM_{10} fraction of particulate matter. Construction dust risk, as described in section 7, (AQ1 to AQ3 – construction dust from construction activities) is assessed in this section as these risks concern construction dusts generated by civil works activities. The modelling methodology quantifies the demarcation distances (impact zones). Odour is not included, as the risk assessment identified this as a negligible risk (AQ5).

9.2.1 Model configuration

There is potential for dust generation from on-site construction activities to have impacts off-site. These are most likely to occur during dry periods; with the highest probability of occurrence during the summer and warmer periods of the year, however a run of dry days can occur at any time of the year. Dispersion modelling was undertaken using the EPA Victoria regulatory model AERMOD to identify worst-case conditions and to give an indication of the distance of influence from construction activities to potential sensitive receptors. The aim of the modelling was to predict indicative transect dispersion plots of maximum predicted construction impact. This activity impact is an indicative 'foot-print' used to assess various phases of construction and identifies the extent of expected maximum impact away from the construction corridor. The majority of construction activities for the Pipeline works are expected to occur in a progressive linear manner.

AERMOD was configured using site-representative meteorological data and in accordance with EPA Victoria's AERMOD modelling guidance (publications 1550 and 1551).

Key components of the model configuration are summarised below:

- Five year meteorological data file was created using the methodology outlined in section 6.2 for the years 2015 – 2019
- Four 1,000 m x 30 m indicative orientations (directions) of the pipeline were modelled based on the four predominant pipeline orientations
- Discrete receptors were set at 2, 5, 7, 10, 20, 30, 40, 50, 60, 75, 100 and 200 metre intervals in a lateral direction away from both sides of the Project's construction zone
- Construction activities were modelled to occur from 8:00 am to 5:00 pm, with wind erosion sources modelled as occurring for all hours
- The maximum (rank 1) predicted 24-hour average concentration impact was selected

9.2.2 Source emission characterisation

Within the framework of the AERMOD Gaussian regulatory modelling program, three types of emission characterisations are possible. These are:

- Point source emissions, where a substance is emitted into the atmosphere from a free standing or building wake affected stack with a finite diameter. The substance is emitted with both vertical momentum and thermal buoyancy.
- Area source emissions, where a substance is emitted into the atmosphere from a flat planar surface. The emitted substance has zero momentum and is neutrally buoyant. AERMOD also has the capability to characterise irregularly shaped area sources.

- Volume source emissions, where a substance is emitted from a single point located in space (pseudo stack), above ground level, where the initial vertical and horizontal spread of the plume is based on a geometric length and height of the emitting source. Line volume source emissions can also be selected to represent a haul road.

All mobile emission sources were modelled as line volume sources with the exception of wind erosion sources which were modelled as area sources.

9.2.3 Application of the modelling results

The following provides a description on the steps that should be followed when interpreting the results outlined in the section below and specifically Table 22 and Table 23.

For a particular section of the pipeline:

1. Determine which orientation number is representative of the pipeline section/KP of interest
2. Determine the relevant construction phase (e.g. Clear and grade, Open trenching construction, Activities associated with installation of the pipe and backfilling of trench, Rehabilitation of construction corridor)
3. Look up the relevant distance in Table 22 based on the orientation number and construction phase determined above
4. Determine if there are any sensitive receptors located within the relevant distance outlined in Table 22, as measured from the edge of the construction corridor
5. If there are sensitive receptors located within the relevant distance, then refer to the mitigation responses outlined in section 10

When there is potential for significant impacts on sensitive receptors within the impact footprint ‘zones’ identified in Table 22 and Table 23 then enhanced dust management controls will be required (so as to protect the beneficial uses of the air environment).

9.2.4 Results

The results of the air quality (dust) dispersion modelling assessment for the four orientations are provided in Table 22 and shown visually in Table 23. The predicted GLCs, are also shown with greater detail in Appendix E (graphically) and Appendix F (on aerial imagery).

The results show that works undertaken during the open trenching construction phase of the Project are predicted to have the biggest impact during that phase - where a greater separation distance occurs before dust concentrations are within the assessment criteria level (worst case day). From Table 22 it can be seen that the required distance to meet the two PM_{10} levels is no more than 75 m (i.e. this assumes that if no standard dust mitigation are put in place during construction, sensitive receptors located within 75 m of the construction corridor may be subject to dust concentrations which exceed the SEPP AAQ criteria). However, it is noted that the model results predicted shorter distances which are applicable based on:

- The orientation/direction (Orientation 1 to 4)
- The side of the construction corridor (e.g. impacts expected to be higher to the east of the construction corridor than compared to the west, based on the predominant meteorological conditions)
- Construction phase (e.g. Phase 1: Clear and Grade and Phase 4: Rehabilitation require a shorter distance to meet the PM_{10} criterion, - i.e. a smaller amount of land (distance) is predicted to exceed the criterion)

Table 22 Summary of pipeline construction results with respect to criteria

Orientation	Applicable KP	Applicable orientation/direction	Distance from edge of construction corridor (m) required to meet the SEPP (AAQ) criterion			
			Phase 1; Clear and grade	Phase 2: Open trenching construction	Phase 3: Activities associated with backfilling of trench	Phase 4: Rehabilitation of construction corridor
1	KP 0 to 8 KP 42 to 51	East	35	61	42	35
		West	35	75	49	35
2	KP 34 to 42	North	35	73	48	35
		South	32	74	42	32
3	KP 8 to 21	South-southeast	35	75	45	35
		North-northwest	35	73	45	35
4	KP 21 to 34	East-southeast	35	74	45	35
		West-northwest	35	73	45	35

Of the sensitive receptors identified in section 6.1, a total of:

- 0 are located within 35 m of the construction corridor
- 6 are located within 50 m of the construction corridor
- 15 are located within 75 m of the construction corridor

This is shown in Figure 13, below, which shows the cumulative number of receptors on the y-axis, located within the distance from the construction corridor specified on the x-axis. The specific sensitive receptor ID located within these distances can be identified in Appendix B (tabulated sensitive receptor IDs sorted by minimum distance to the construction corridor) and Appendix F (visually displayed on aerial imagery).

Where sensitive receptors are located within the zones outlined in Table 22, enhanced dust management controls (described in section 10) will be required when conducting pipeline construction activities within that impact zone, in order to reduce potential dust effects to an acceptable level. These dust management controls will be determined and included in the Construction Environment Management Plan.

These 'other measures' include the use of instruments to provide further information on conditions to enhance the physical observation of dust emissions and incorporating controls that assist in reducing dust emission factors (via reducing wind erosion for example). There are three possible scenarios resulting in differing mitigation responses, as outlined further at Section 9.2.5:

1. No sensitive receptors located within the impact zones of Table 22 and Table 23.
2. Isolated rural residences located within the impact zones.
3. Multiple sensitive receptor locations within the impact zone.

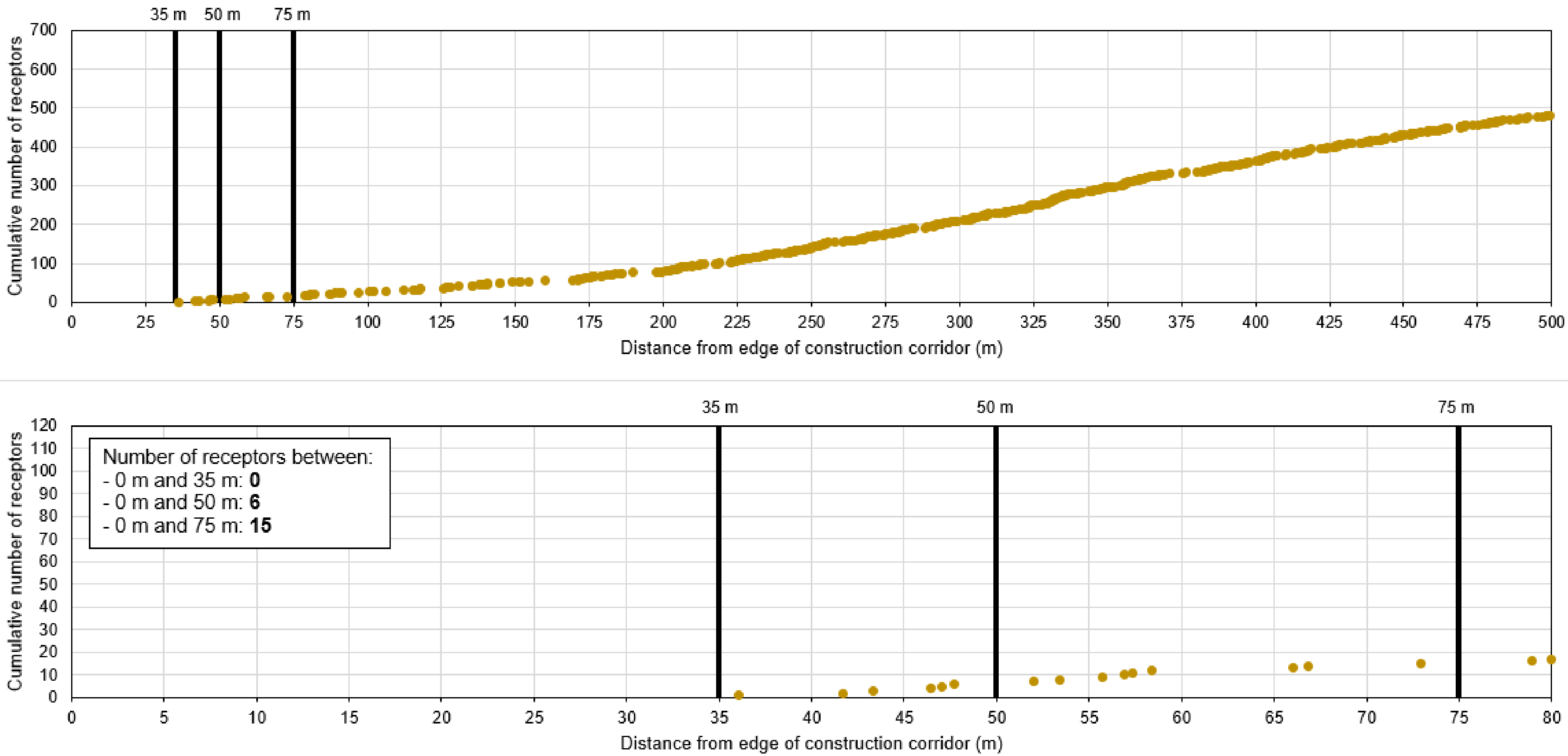


Figure 13 Identified sensitive receptors located within 35 m, 50 m and 75 m from the construction corridor – full extent (top) and zoomed in to 80 m (bottom)

9.2.5 Mitigation measures

Scenario 1 (no sensitive receptors located within the impact zone) corresponds to the low-impact AQ2 risk pathway. Scenario 2 (isolated rural residences within the impact zone) and Scenario 3 (multiple sensitive receptors within the impact zone) present the higher risk of the AQ3 risk pathway. Therefore, enhanced construction dust mitigation is required when sensitive receptors are within the impact footprint, which is discussed in section 10.

In the case of scenario 2, the mitigation measures that could reduce the likelihood, intensity or extent of dust effects would be a real-time reactive monitor at the isolated rural residence (this changes as the workfront advances) and the ability for them to reduce effects is that works are modified (reduced and even suspended) for a period (usually adverse weather – gusty and dry winds).

In the case of scenario 3, the mitigation measures that could reduce the likelihood, intensity and extent of dust effects would be reduced and even suspending of works when the real-time monitors 'alarm'. A series of instruments (suggest three – two ends and a mid-point) would need to be deployed where a row of housing backs onto the construction corridor boundary. Moreover, the higher density sensitive receiver zones would require a gravel treatment of vehicle routes and a wind barrier (for example, shade cloth to slow down winds) on the upwind construction corridor boundary.

The reactive measures are also able to mitigate impacts if any of the potential cumulative impact projects are within the impact footprints at the same time. The real-time monitors do not distinguish what the source of the dust is (could be extreme due to a dust storm for example) and simply alert the contractor when to reduce emissions.

9.2.6 Finding on residual impacts

With the recommended mitigation measures, including enhanced reactive protocols, the potential effects would be contained to the construction area and therefore effects on sensitive receptors would be low. When sensitive receptors are within the impact footprints (scenarios 2 and 3) ambient dust levels are minimised. This therefore protects the beneficial uses of the air environment as required by Clause 9 of SEPP AQM.

The Project residual impacts are not completely eliminated (as there is always some background dust load) but off-site dust concentrations are most often contained below the National Environment Protection (Ambient Air Quality) Measure goal for PM_{10} (24-hour average of 50 $\mu g/m^3$). Therefore, the extent, magnitude and duration of the residual impacts, while not eliminated, are not considered significant for all segments of the environment (amenity, health and ecological) given the beneficial uses of the air environment is protected (Clause 9 of SEPP AQM). When it comes to dust, the most significant air quality impact from a construction project involving civil works and material transfer, the most significant impact comes from the background PM_{10} load and a lesser extent from dust. The background dust is beyond the control of the Project except for the timing of construction activity is altered so that when background levels are elevated (and potentially above policy levels), then the Project is not contributing more dust. Moreover, residual impacts for when construction occurs is not enough to elevate impacts beyond where the beneficial use of the air environment are protected.

9.3 Cumulative impact assessment

Consideration of cumulative air quality impacts was assessed for the Project.

For the purposes of this air quality impact assessment, cumulative impacts refer to the combined effect on background concentrations that take into account potential future background concentrations (such as the effect of potential future projects in the region) and predicted air quality impacts during construction and operation of the Project.

Potential future projects in the same region may include road, rail and major water supply infrastructure, such as the Outer Metropolitan Ring Road, Sunbury Road Upgrade and Melbourne Water's Bald Hill to Yan Yean pipeline. Of these known nearby construction projects, only the Melbourne Water project may have a concurrent construction period. In the case of concurrent construction activity due to the Yan Yean – Bald-hill Pipeline, sensitive receptors are not highly concentrated in this area.

Other large scale projects likely to generate construction dust include development of potential and planned Precinct Structure Plans (PSPs). Timing of PSP construction activities is unknown and the presence and location of new sensitive receptors would be unknown, given PSP construction is likely to occur in stages.

Construction activity from two or more separate projects is unlikely to occur at the same time and same location. However, there is a low probability that construction corridors may be adjacent to each other for short periods (noting that the pipeline construction activity can move rapidly over many hundreds of metres on any given day). Regardless of specific projects, where another project is generating dust nearby the Project construction activity, any dust being added to the Project's construction dust can be considered as elevated background levels. The trigger levels being monitored as part of Risk ID's AQ1, AQ2 and AQ3 will detect if cumulative dust levels are becoming excessive such that additional mitigation measures (most often altering or ceasing construction activities) are to be considered.

Table 23 Visual representation of the pipeline construction results (mitigation)

<table>
<tr><th>Orientation 1
Applicable to KP 0 to 8 and KP 42 to 50</th><th>Orientation 2
Applicable to KP 34 to 42</th></tr>
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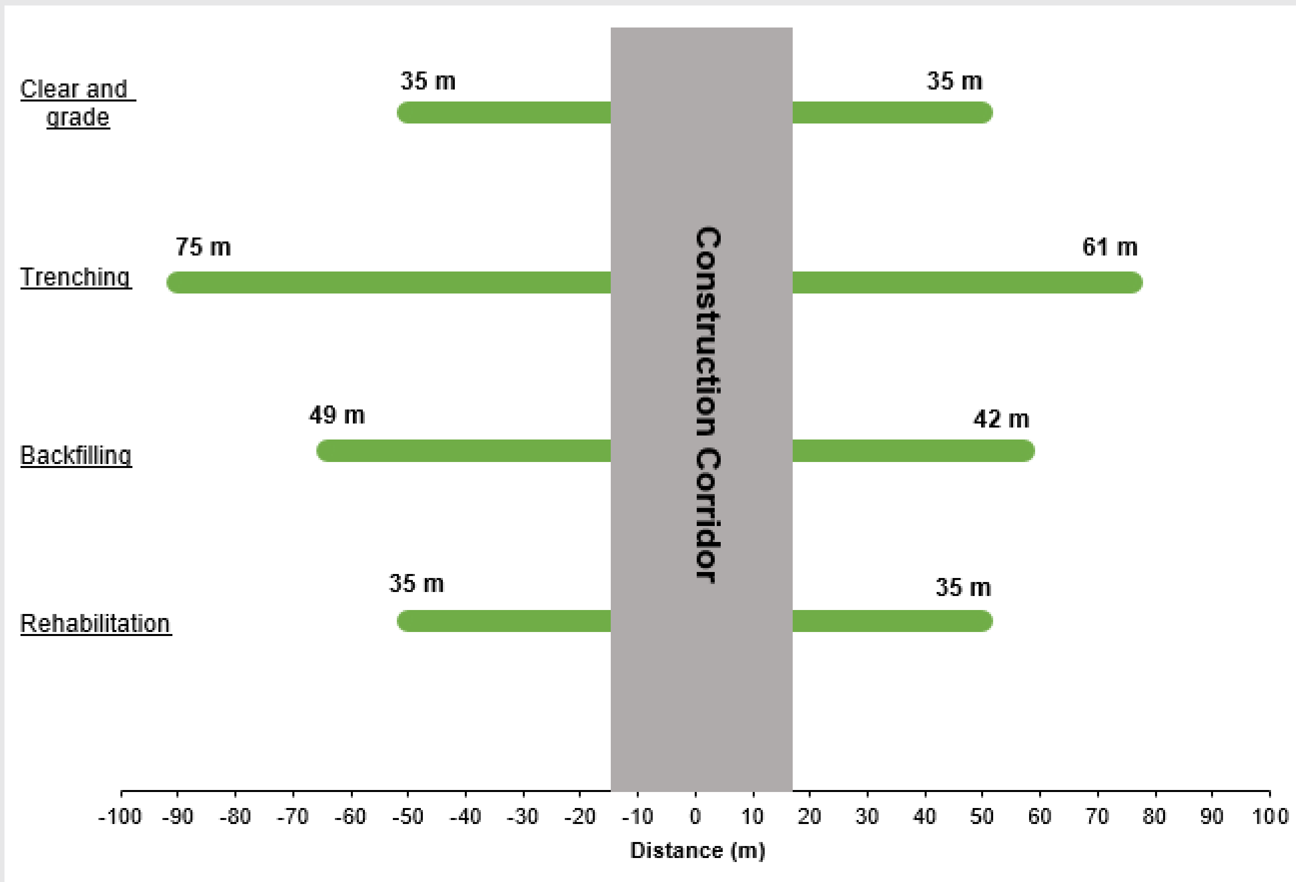
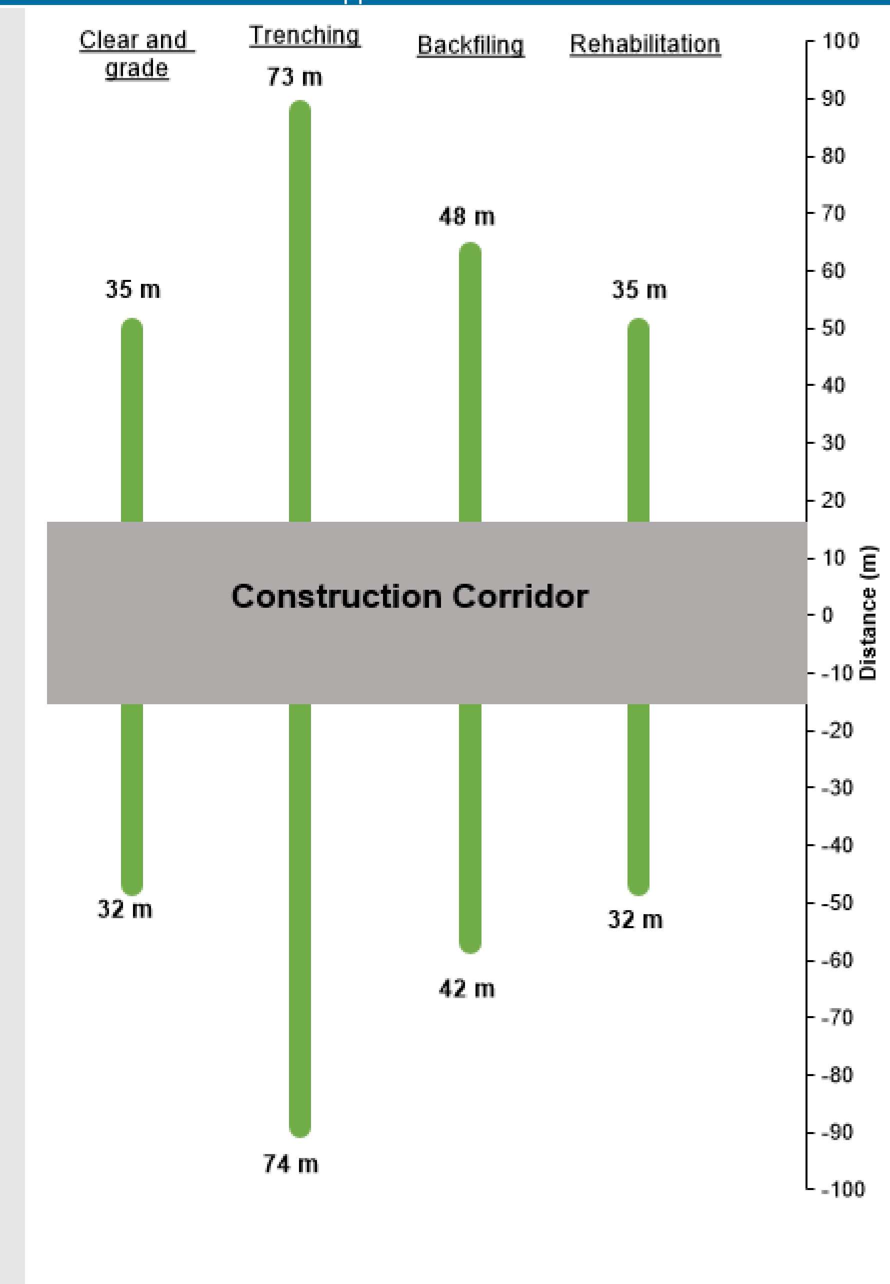
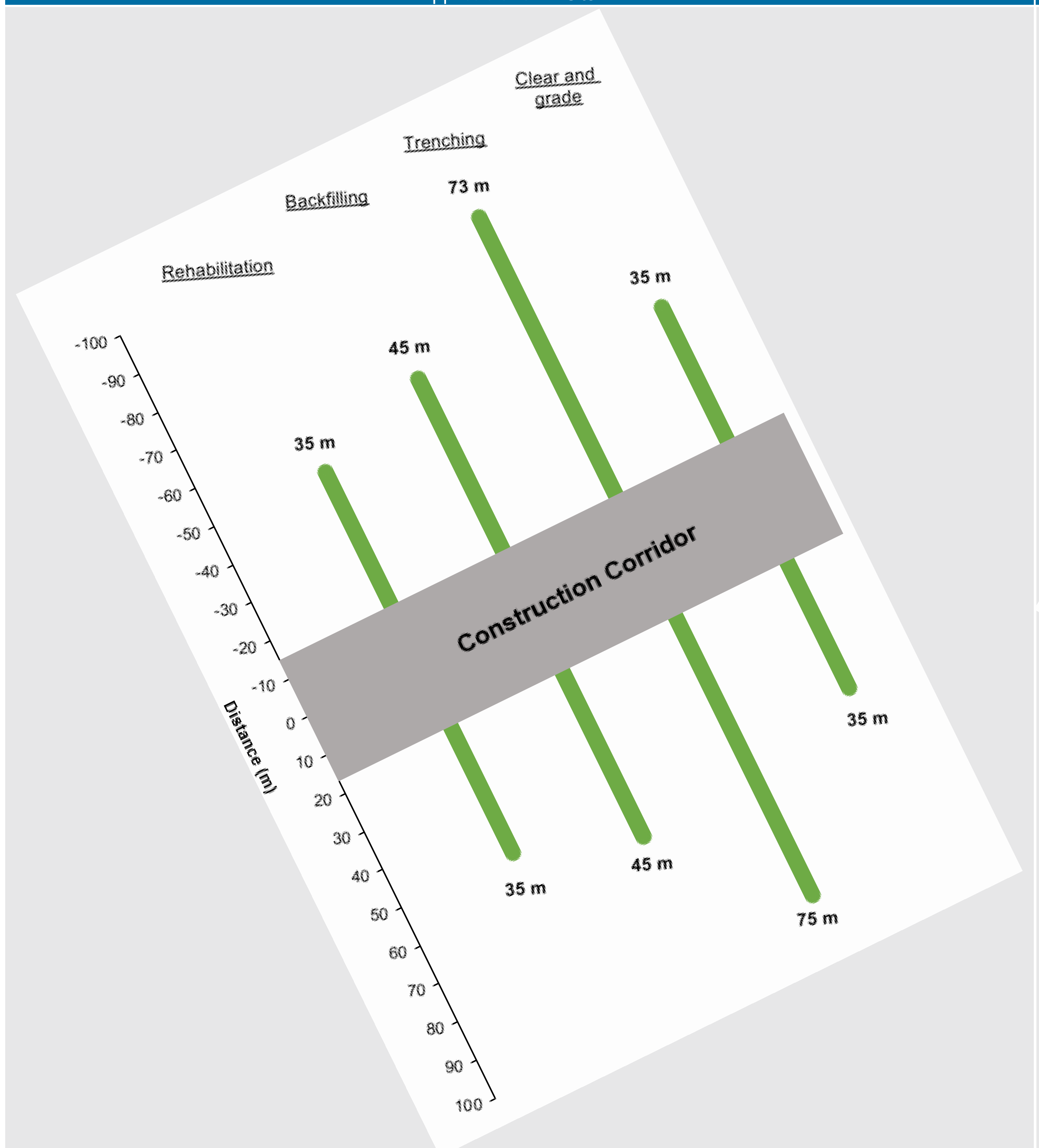
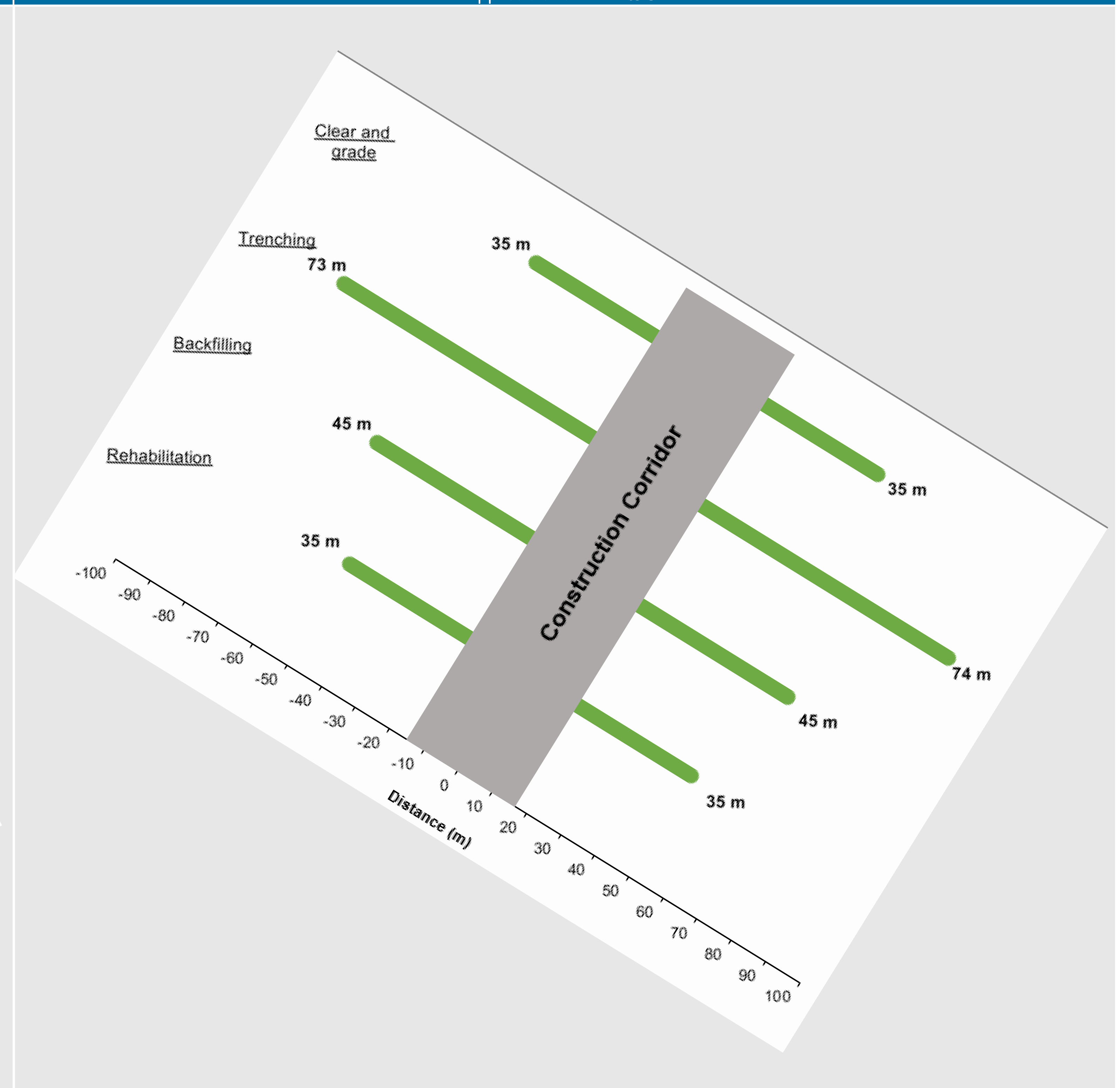


</td><td>


</td></tr>
</table>

Orientation 3 Applicable to KP 8 to 21	Orientation 4 Applicable to KP 21 to 34
	

10. Environmental Management Measures

10.1 Recommended environmental management measures

Table 24 provides a summary of the recommended environmental management measures relevant to the air quality assessment. In addition to the air quality environmental management measures, there are other relevant environmental management measures which will also contribute to mitigation of air quality impacts including EMM S6 (Consultation Plan) which has been included below. While cumulative impacts are not anticipated as set out in Section 9.3, EMM NV9 would provide for liaison with proponents on other major projects where combined construction impacts can be further managed.

In developing the environmental management measures, the air quality assessment adhered to the mitigation hierarchy that is, an obligation to first avoid, minimise, and then restore the residual impacts that remain.

According to the Waste Hierarchy of SEPP AQM (Clause 8), avoidance is the first choice. This is possible for operation where technology choice ('best practice') can be applied. Alignment selection has increased the distance to sensitive receptors in some locations, avoiding potential construction dust impacts. In instances where construction dust impacts to sensitive receptors cannot be avoided, the minimisation strategy is then linked to treatment and containment of the waste hierarchy by mitigation measures to minimise dust generation.

Table 24 Recommended environmental management measures

EMM #	Environmental Management Measure	Stage
AQ1	**Construction dust management** Implement management and control measures during construction activities to minimise dust including: • Water carts to be used on unsealed work areas as required • Crushed rock to be placed on existing permanent unsealed access tracks where agreed with relevant stakeholders – especially in areas where housing abuts, or may abut by the time construction occurs, the construction corridor • Water spray units to be used, where required, on soil stockpiles and during the loading and unloading of dust generating materials, i.e. Soil/sand/fill and aggregates • Vehicle loads to be covered when carrying dust (or litter) generating material • Vehicle speed within the construction area must be restricted to 30 km/hr • Dust suppression activities must consider weather patterns, ground cover, ground conditions e.g. type and moisture content of soil present, and type of activities being conducted as well as proximity to sensitive receptor locations • Undertake a sufficient level of compaction on stockpile surfaces to minimise dust. If all available methods of dust stabilisation fail to suppress dust and dust emissions are evident beyond the site boundary at identified sensitive receptor locations (as identified by real-time reactive monitoring, as required), the contractor must temporarily modify or suspend dust generating activities until conditions subside.	Construction

EMM #	Environmental Management Measure	Stage
	Additional controls must be implemented if dust is observed to be causing a hazard (such as a wind barrier where directly impacted residences are located immediately adjacent to the construction corridor). If dust levels cannot be contained, works must be modified or stopped until the dust hazard is reduced to a manageable level such that it can be controlled using standard measures. **Construction dust monitoring** Reactive dust monitoring instruments must be used during construction where isolated rural residences or rows of housing that abut the construction corridor are within the impact 'footprint' distances identified in Table 23 of Technical Report G Air Quality. Instruments must be consistent with those detailed in the Protocol for Environmental Management: Mining and Extractive Industries and be capable of sending a SMS text message to the contractor. These instruments must be deployed for each work day subject to where the daily workfront is in relation to the specific areas where sensitive receptors are located.	
AQ2	**Air quality associated with operation of compressor station** Emissions of products of combustion (engines burning natural gas) during operation of the compressor station from the stacks must be in compliance with SEPP (Air Quality Management). Key design and operation measures must include: • Compressor on a concrete area and surrounded by crushed rock hardstand • Above ground oily water separator with triple interceptor and underground overflow pit with level sensors, serviced annually • Residents notified prior to weed spraying (annual) • Annual stack test monitoring and servicing of compressors • Proposed compressor discharge point to be installed to achieve the SEPP AQM requirements.	Design Operation
AQ3	**Odorous soils management** In the event that odorous soils (as a result of contamination or acid sulfate soils) are uncovered during construction, standard soil management measures must be undertaken, as outlined in EMM C1 (Implement spoil management measures).	Construction
AQ4	**Operational odour management** Implement the VTS Pipeline Integrity Management Plan during operation. The VTS Pipeline Integrity Management Plan details the activities that will be taken to ensure the integrity of the VTS pipelines, including avoiding leaks of odours during operation. These are considered measures to minimise fugitive gas emissions. Measures that must be implemented include: • Regular pipeline inspections and patrols • Pipelines to be constructed as per AS2885 or standards at time of construction • The pipeline to be identified in the ground via danger marker tape and above ground via pipeline marker sign on the easement	Operation

EMM #	Environmental Management Measure	Stage
	• Cathodic protection system to be installed for corrosion resistance, with 24/7 monitoring and 12 month detail survey • Insulation of a series of sacrificial anodes along the pipe for corrosion resistance • Remote SCADA monitoring • Third party engagement i.e. when working around pipeline, emergency services, government, civil contractors • In line integrity pigging as determined by Pipeline Risk Assessments. Design and construct the Wollert Compressor Station to include a stack that is capable of venting emergency or routine maintenance gas (unburnt natural gas) higher into the atmosphere than simply allowing fugitive emissions at ground level. The existing emergency flaring stack must be used for this purpose.	
S6	Develop and implement a Project Consultation Plan to facilitate ongoing consultation with relevant stakeholders throughout the Project's planning and construction. The Plan must include: • The approach to communicating and engaging with the community and potentially affected stakeholders in relation to: – The likely timing and nature of the Project's construction activities and potential impacts. – Changes to transport conditions. • The mechanisms and timing for communicating Project updates for all stakeholders through multiple channels (website, newsletters, local media) • The approach for communicating and engaging with vulnerable groups, including community groups and residents that who do not speak English. Translation services will be promoted where appropriate for specific project communications. • Measures to evaluate the effectiveness of the communication and engagement under the Plan. • Arrangements for receipt and management of feedback and complaints, including timeframes for responding to complaints.	Construction

10.2 Recommended Performance criteria and management

Construction

A Construction Environment Management Plan including dust management measures is required for construction works. The dust management mitigation measure includes a two-step process, which is a function of number and proximity of sensitive receptors to the dust generating activities.

Operation

Annual stack testing of the discharge points, as is currently done for the existing facility, will be undertaken.

11. Conclusion

The purpose of this technical report is to provide an Air Quality Impact Assessment to inform the preparation of the EES required for the Project.

A summary of the key assets, values or uses potentially affected by the Project, and the associated impact assessment are summarised below.

Assessment methodology

A fully qualitative Air Quality dispersion modelling assessment was undertaken to predict the air quality impacts associated with the construction (i.e. construction of the pipeline) and the operation (i.e. operation of the Wollert Compressor Station) of the Project. A risk based approach was then applied, based on the dispersion modelling results, to prioritise the key issues for assessment and inform measures to avoid, minimise and offset potential effects.

Existing conditions

The Wollert Compressor Station is located in a farming zone with two rural residences located nearby.

The proposed pipeline construction alignment mostly traverses sparsely populated rural areas and road reserves. It also traverses adjacent to existing and proposed residential areas in Hillside, Fraser Rise and Mickleham. The closest housing in these residential areas were identified approximately 150 m from the construction corridor. The closest housing to the Project are six houses located within 35 to 50 m of the construction corridor. This may change by the time construction starts.

The Bureau of Meteorology (BoM) operated automatic weather station (AWS) at Melbourne Airport is considered representative of the Project area due to the weather station's proximity and similar exposure to prevailing winds.

For background air quality concentrations, data from EPA Victoria Footscray Air Quality Monitoring Station was considered representative and utilised in the assessment.

Impact assessment

Wollert Compressor Station

Air dispersion modelling was conducted for CO, NO_2, PM_{10}, $PM_{2.5}$, PAHs, SO_2, Benzene, Formaldehyde, Toluene and Xylene which may be emitted by the Wollert Compressor Station under routine operations. The impact assessment predicated compliance for all pollutants with the relevant criteria in the SEPP AQM when background is not included. When the impact was assessed for emissions from site plus background, all pollutants with the exception of NO_2 and $PM_{2.5}$ (including the DEA) comply with the relevant criteria as outlined in the SEPP AQM.

When the DEA was not modelled – an exclusion allowed for in the Environment Protection (Scheduled Premises) Regulations 2017, all pollutants complied with the relevant criteria for worst-case normal operations. It is noted that the predicted area of non-compliance for NO_2 and $PM_{2.5}$, when the standby engine is operating, is found to be very small in area and largely over the Wollert Compressor Station (i.e. not impacting any sensitive receptor locations).

The effects are considered acceptable and no additional mitigation is recommended.

Pipeline construction

Air quality impacts during construction of the pipeline would be predominantly due to dust emissions (PM_{10}) generated via mechanical disturbance (i.e. mobile source such as graders and excavators) and wind erosion (i.e. from disturbed soil surfaces under high wind speeds)

The impact assessment found that operations undertaken during the open trenching construction phase of the Project are predicted to have the biggest impact as a greater separation distance is required before dust concentrations are within the assessment criteria level (worst case day). It was found that the required distance to meet the PM_{10} criteria is no more than 75 m (i.e. this assumes that if no standard dust mitigation in place, sensitive receptors located within 75 m of the pipeline may be subject to dust concentrations which exceed the criterion). A total of 15 sensitive receptors are located within 75 m of the corridor. However, it is noted that the model results predicted shorter distances are applicable under some scenarios.

For example, the backfilling phase requires a separation distance of no more than 50 m and clearing and site rehabilitation phases require no more than 35 m, before dust emissions would potentially exceed the SEPP AAQ criteria. No sensitive receptors are located within 35 m of the construction corridor. Six sensitive receptors are within 50 m of the corridor. Therefore, the clearing and rehabilitation phases will not affect any current sensitive receptors, while backfilling potentially affects a few and open trenching construction affecting the most (up to 15).

Activities undertaken during site clearance and rehabilitation have the potential to result in a minor air quality impact to sensitive receptors when standard dust mitigation is in place (Risk ID AQ1). Standard dust mitigation includes measures outlined in the Construction Environment Management Plan (CEMP) and via appropriate dust monitoring measures (EMM AQ1). The use of additional mitigation measures where residences are adjacent, such as a wind barrier (e.g. shade cloth to slow down winds), can assist in lowering the risk of adverse impact. Where control measures do not successfully stabilise dust, an additional control is also to reduce or suspend works for a period (e.g. during adverse weather events, such as gusty and dry winds when sensitive receptor locations are downwind).

Of the sensitive receptors identified in section 6.1, a total of:

- 0 are located within 35 m of the construction corridor
- 6 are located within 50 m of the construction corridor
- 15 are located within 75 m of the construction corridor

Where sensitive receptors are located within the distances outlined above, dust management controls will be required when conducting pipeline construction activities within that impact zone. There are three possible scenarios resulting in differing mitigation responses:

1. No sensitive receptors located within the impact zones.

   In a scenario where no sensitive receptors are within the separation distances required to meet SEPP AAQ criteria (Risk ID AQ2), impacts to air quality as a result of construction activities are considered to be negligible when standard dust mitigation is in place (including implementation of the CEMP and dust monitoring (EMM AQ1)).

2. Isolated rural residences located within the impact zones

   Using standard dust mitigation measures (EMM AQ1), medium air quality impacts are expected when isolated rural residences are located within the separation distances (Risk ID AQ3). The implementation of additional mitigation measures would reduce the likelihood, intensity or extent of dust effects and would result in low impact to air quality for sensitive receptors in this scenario. Additional mitigation measures would include a real-time reactive monitor at the isolated rural residences within the separation distance and the ability to reduce or suspend work activities in the immediate area for a period (e.g. during adverse weather events, such as gusty and dry winds and the monitor exceeds pre-set trigger levels).

3. Multiple sensitive receptor locations within the impact zone

   With the use of standard dust control measures (EMM AQ1), medium air quality impacts are expected when multiple sensitive receptors or potential future housing built within 35 m of the construction corridor are located within the separation distances (Risk ID AQ3). Additional mitigation measures in this scenario that would result in low impacts to air quality include reducing or suspending work activities in the immediate area when real-time monitors ‘alarm’ and installing a series of instruments where a row of housing backs onto the construction corridor boundary. In higher density sensitive receptor areas, a gravel treatment of vehicle routes and a wind barrier (for example, shade cloth to slow down wind) on the upwind construction corridor boundary would also assist to reduce dust. There is no current housing abutting or within 35 m of the construction corridor and these additional treatments would only be required if new housing is established prior to construction.

Environmental management framework

Mitigation measures within the Construction Environment Management Plan (CEMP) supplies the means to control construction dust so that potential adverse social, economic, amenity and land use effects at local scales are minimised.

Other mitigation measures, such as reactive real time dust monitoring and other measures, where there are single or multiple sensitive receptors within the impact zone, are recommended to manage potential impacts from dust during construction to lower any potential risks of amenity and health related impacts.

The best combination of “techniques, methods, processes or technology used in an industry sector” (SEPP AQM Definitions) is a way to demonstrate ‘best practice’, as would be required for an EPA Victoria licence. Design features such as efficient lox-NOx and CO burners and stack heights assist in minimising operational impacts, to conform with best practice requirements.

12. References

EPA Victoria, Recommended separation distances for industrial residual air emissions Publication. 1518, March 2013

EPA Victoria, Civil Construction, Building and Demolition Guide Publication 1834, November 2020

Environment Protection (Scheduled Premises) Regulations 2017

National Environment Protection (Ambient Air Quality) Measure (NEPM AAQ)

National Pollutant Inventory (NPI) emission estimation technique (EET) Manual for Combustion engines (Version 3, June 2008)

National Pollutant Inventory (NPI) emission estimation technique (EET) Manual for Mining (Version 3.1, January 2012)

The Protocol for Environmental Management Minimum Control requirements for Stationary Sources, January 2002, (Stationary Sources PEM)

The Protocol for Environmental Management: Mining and Extractive Industries (Mining PEM)

State environment protection policy (Ambient Air Quality) 1999 (SEPP AAQ), as updated: State Environment Protection Policy (Ambient Air Quality) 2016

State environment protection policy (Air Quality Management) 2001 (SEPP AQM)

U.S. EPA, AP42 - 13.2.2 Unpaved Roads, November 2016

Appendices

Appendix A – Risk assessment

The scoping requirements require a risk-based approach to be adopted during the design of EES studies, so that a greater level of effort is directed at investigating and managing those matters that pose relatively higher risk of adverse effects.

The risk assessment as part of the assessment framework for the EES, is described in Chapter 5 *Evaluation and assessment framework*.

The risk pathways define the cause and effect topics relevant to [technical area] based on an understanding of the existing conditions and the Project activities. The risk pathways are provided in Table A1.

The consequence of the risk occurring were assigned using a consequence guide specific for each technical discipline. The consequence guide is provided in Table A2.

The likelihood was assigned using a likelihood guide applied to all technical disciplines. The likelihood guide is provided in Table A3.

The risk rating was determined using the risk matrix developed for this EES. The risk matrix is shown in Table A4.

Each pathway was assessed with the results in Table A5. This shows the initial risk rating based on standard management measures, and a residual risk rating based on additional management measures (if required) recommended through the impact assessment process.

Table A1 Risk pathways

Risk ID	Risk description	Construction/ operation	Pipeline/ MLV/ compressor
AQ1	Construction dust from site clearance and rehabilitation activity Site clearance, construction site establishment and rehabilitation activities result in the generation of dust that deteriorate the existing air quality environment	Construction	Pipeline
AQ2	Dust from low-impact construction activities result in the generation of dust that deteriorate the existing air quality environment. Low impact can occur when no sensitive receptor sites are within the calculated impact zone	Construction	Pipeline
AQ3	Dust from high-impact construction activities. High impact can occur when sensitive receptor sites associated with isolated rural residences (and any new residences built prior to construction) are within the calculated impact zone	Construction	Pipeline
AQ4	The operation of the Wollert compressor station result in impacts on the air quality environment	Operation	Compressor
AQ5	Odour from construction activities including disturbance of contaminated soil, resulting in amenity impact for nearby residents	Construction	Pipeline
AQ6	Odour from operation of the compressor station releases fugitive emissions of natural gas, resulting in amenity impact for nearby residents	Operation	Compressor

Table A2 Consequence approach

Level	Qualitative and/or quantitative description
Insignificant	Undetected changes to ambient air quality, beyond the site boundaries
Minor	Detectable changes to air quality result in amenity impacts on a small number (<5) of sensitive receptors, and no exceedances of SEPP (AQM) beyond site boundaries
Moderate	Detectable localised changes to air quality result in amenity impacts on 5 to 15 sensitive receptors and/or localised (1 sensitive receptor location) exceedances of SEPP (AQM) health based criteria beyond site boundaries.
Major	Detectable widespread changes to air quality result in amenity impacts on a large number (>15 to 100) of sensitive receptors and/or limited (1-5 sensitive receptor locations) exceedances of SEPP (AQM) health based criteria
Severe	Detectable widespread changes to air quality result in amenity impacts on an excessive number (>100) of sensitive receptors and limited (>5 sensitive receptor locations) exceedances of SEPP (AQM) health based criteria

Table A3 Likelihood approach

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

Table A4 Risk matrix

		Consequence rating				
		Insignificant	Minor	Moderate	Major	Severe
Likelihood rating	Almost certain	Low	Medium	High	Very high	Very high
	Likely	Low	Low	Medium	High	Very high
	Unlikely	Negligible	Low	Medium	High	High
	Remote	Negligible	Negligible	Low	Medium	High
	Rare	Negligible	Negligible	Negligible	Low	Medium

Table A5 Risk assessment

Risk ID	Description	Pipeline/ MLV/ compressor	Initial risk			Mitigation measure	Residual risk		
			C	L	Risk		C	L	Risk
Construction									
AQ1	**Construction dust from site clearance and rehabilitation activity** Site clearance, construction site establishment and rehabilitation activities result in the generation of dust that deteriorate the existing air quality environment.	Pipeline	Moderate	Unlikely	Medium	Wind barrier (such as shade cloth to slow down winds) as outlined in EPA Publication 1834 along upwind boundary when next to residences. Rapid response to community raised complaints.	Moderate	Remote	Low
AQ2	**Dust from low-impact construction activities** Construction activities including excavation, drilling, pipe stringing and lowering and vehicle movements, result in the generation of dust that deteriorate the existing air quality environment.	Pipeline	Minor	Remote	Negligible				Negligible
AQ3	**Dust from high-impact construction activities** Construction activities including trench excavation, drilling and backfilling, with vehicle movements, abutting a residential zone and/or near isolated rural residences, result in the generation of dust that deteriorate the existing air quality environment.	Pipeline	Moderate	Unlikely	Medium	Wind barrier (such as a shade cloth to slow down winds) as outlined in EPA Publication 1834 along upwind boundary when next to residences. Rapid response to community raised complaints. Timing activity abutting residential locations to be during the wetter winter months.	Moderate	Remote	Low

Risk ID	Description	Pipeline/ MLV/ compressor	Initial risk			Mitigation measure	Residual risk		
			C	L	Risk		C	L	Risk
AQ5	**Odour - construction** Odour from construction activities including disturbance of contaminated soil, resulting in amenity impact for nearby residents."	Pipeline	Minor	Rare	Negligible				Negligible
Operation									
AQ4	**Operation of compressor station** The operation of the Wollert compressor station result in impacts on the air quality environment	Compressor	Moderate	Remote	Low				Low
AQ6	**Odour - operation** Odour from operation of the compressor station releases fugitive emissions of natural gas, resulting in amenity impact for nearby residents	Compressor	Minor	Rare	Negligible				Negligible

Appendix B – Identified sensitive receptors sorted by minimum distance to the construction corridor

ID	X	Y	Distance
AQ_R378	312724	5842037	36
AQ_R465	300756.5	5831600	42
AQ_R387	311833.9	5841206	43
AQ_R456	301629.4	5831987	46
AQ_R410	308044.3	5835611	47
AQ_R384	311990.2	5841337	48
AQ_R391	311916.9	5840928	52
AQ_R458	301492.4	5831912	53
AQ_R418	306056.9	5835113	56
AQ_R401	310135	5837951	57
AQ_R390	311787.9	5840940	57
AQ_R411	307990.5	5835596	58
AQ_R423	304204.9	5834334	66
AQ_R014	318219.8	5846575	67
AQ_R380	312009.4	5841579	73
AQ_R445	302144.7	5832325	79
AQ_R364	323355	5842860	80
AQ_R007	319256.4	5847406	80
AQ_R442	301920.1	5832347	81
AQ_R018	318695.3	5846289	82
AQ_R424	304842.5	5834334	87
AQ_R439	302113.2	5832547	88
AQ_R459	301115.3	5831905	89
AQ_R016	318179.3	5846392	90
AQ_R479	298666.7	5824441	91
AQ_R409	307830.4	5835796	97
AQ_R374	312667.7	5842465	101
AQ_R462	300687.5	5831765	102
AQ_R021	314131.1	5845267	106
AQ_R365	323369.2	5842658	112
AQ_R426	303367	5833334	116
AQ_R006	320950.7	5847639	116
AQ_R484	298445.4	5822830	117
AQ_R448	302413.3	5832279	118
AQ_R431	303006.1	5832956	118
AQ_R421	305549.4	5834814	126
AQ_R383	311767.2	5841352	127
AQ_R017	318305.1	5846338	127
AQ_R012	316313.7	5846881	128
AQ_R427	303691.5	5833220	128
AQ_R449	302219	5832272	131
AQ_R417	305934	5835125	135
AQ_R015	317266.5	5846464	135
AQ_R393	311614.2	5840874	138
AQ_R482	298586.1	5823545	139
AQ_R405	309243.1	5836636	140
AQ_R388	312022.9	5841069	140
AQ_R376	312518.7	5842159	141
AQ_R013	318329.2	5846640	145
AQ_R446	301736.1	5832302	145
AQ_R434	302331	5832622	149
AQ_R440	301922.6	5832525	151
AQ_R455	301893.4	5832009	152
AQ_R435	302129.6	5832618	154
AQ_R025	314312.8	5844958	160
AQ_R457	300815.8	5831948	169
AQ_R461	301636.3	5831851	171
AQ_R093	314130.2	5844542	171
AQ_R087	314143	5844564	172
AQ_R089	314137.7	5844554	172
AQ_R102	314120.6	5844522	173

ID	X	Y	Distance
AQ_R107	314115.3	5844511	173
AQ_R416	307362.7	5835319	174
AQ_R404	309058.9	5836994	175
AQ_R047	314271.3	5844827	176
AQ_R114	314111.1	5844497	177
AQ_R412	307958	5835478	179
AQ_R120	314107	5844484	179
AQ_R464	300159.3	5831678	181
AQ_R415	307769.7	5835342	182
AQ_R467	300974.9	5831497	183
AQ_R377	312332.3	5842043	184
AQ_R403	308881.6	5837024	185
AQ_R396	323279.2	5839675	185
AQ_R475	298582.4	5826143	186
AQ_R128	314108.5	5844464	190
AQ_R183	314038.3	5844322	198
AQ_R050	314290.4	5844813	199
AQ_R429	303193	5832984	200
AQ_R148	314095.1	5844418	201
AQ_R037	314322.8	5844878	202
AQ_R186	314027.8	5844293	202
AQ_R152	314089.8	5844404	203
AQ_R190	314022.5	5844282	203
AQ_R023	314373.1	5844985	204
AQ_R158	314084.6	5844391	204
AQ_R166	314075	5844373	205
AQ_R029	314342.7	5844915	205
AQ_R177	314055.7	5844337	205
AQ_R065	314254.9	5844716	206
AQ_R203	314006.6	5844245	207
AQ_R199	314013	5844255	208
AQ_R206	314002.4	5844233	209
AQ_R220	313978.9	5844190	209
AQ_R095	314174.8	5844538	212
AQ_R394	312061.6	5840793	212
AQ_R054	314300.6	5844803	212
AQ_R105	314165.2	5844517	214
AQ_R408	307871.7	5835913	217
AQ_R121	314151.5	5844483	218
AQ_R422	305256.3	5834357	219
AQ_R444	301566.5	5832338	223
AQ_R402	308817.9	5837069	223
AQ_R167	314095	5844372	223
AQ_R392	311238.4	5840877	224
AQ_R034	314353.2	5844891	224
AQ_R137	314136.8	5844444	225
AQ_R221	313991.3	5844181	225
AQ_R097	314185.8	5844529	226
AQ_R108	314175.4	5844509	227
AQ_R027	314371.3	5844926	227
AQ_R040	314346.2	5844867	228
AQ_R367	323757.7	5842615	228
AQ_R085	314221.5	5844587	229
AQ_R086	314211.3	5844566	230
AQ_R058	314305.8	5844769	231
AQ_R022	313918	5845110	232
AQ_R073	314263.5	5844669	233
AQ_R379	311956.9	5841734	234
AQ_R478	298939.7	5825226	234
AQ_R153	314125.5	5844403	234
AQ_R077	314254	5844644	235

ID	X	Y	Distance
AQ_R243	313968.3	5844117	236
AQ_R237	313978	5844132	237
AQ_R180	314088.2	5844330	237
AQ_R366	313243.2	5842618	239
AQ_R110	314190	5844505	241
AQ_R185	314080.9	5844306	243
AQ_R257	313954.7	5844078	243
AQ_R432	303145.6	5832946	243
AQ_R454	301037.5	5832041	244
AQ_R060	314317.8	5844763	244
AQ_R088	314224.5	5844561	244
AQ_R187	314076.8	5844292	246
AQ_R296	313906.8	5843982	247
AQ_R191	314072.6	5844280	248
AQ_R195	314064.1	5844264	248
AQ_R451	302577.5	5832221	249
AQ_R204	314054.5	5844244	250
AQ_R267	313948.6	5844053	250
AQ_R127	314177.5	5844464	250
AQ_R155	314140.1	5844397	250
AQ_R179	314103.7	5844330	251
AQ_R425	305083	5834331	251
AQ_R302	313903.8	5843967	252
AQ_R363	323688.2	5843015	253
AQ_R368	313259.1	5842615	253
AQ_R261	313964.8	5844074	254
AQ_R438	301816.3	5832561	254
AQ_R170	314126.3	5844364	254
AQ_R100	314215.1	5844524	254
AQ_R208	314051.5	5844228	255
AQ_R307	313895.4	5843945	255
AQ_R112	314202.3	5844499	255
AQ_R215	314042	5844204	258
AQ_R420	305270.4	5834866	261
AQ_R246	313993	5844108	262
AQ_R238	314006.9	5844131	263
AQ_R313	313894.7	5843927	263
AQ_R139	314178.2	5844435	265
AQ_R369	313276	5842614	266
AQ_R224	314033.8	5844172	266
AQ_R031	314403.8	5844899	267
AQ_R030	314409.2	5844911	267
AQ_R263	313977.2	5844067	268
AQ_R103	314228.6	5844520	268
AQ_R116	314214.7	5844495	268
AQ_R375	312436.3	5842396	269
AQ_R038	314394.4	5844871	270
AQ_R318	313895	5843912	271
AQ_R460	301882.1	5831873	271
AQ_R188	314105.8	5844290	272
AQ_R055	314357.6	5844779	274
AQ_R250	314004.3	5844102	275
AQ_R470	300357.5	5831174	275
AQ_R049	314376.2	5844818	275
AQ_R196	314093.1	5844260	276
AQ_R144	314188.3	5844428	277
AQ_R326	313888.9	5843888	277
AQ_R264	313987.3	5844063	278
AQ_R069	314329.8	5844704	280
AQ_R071	314320.9	5844683	280
AQ_R370	313289.9	5842609	280

ID	X	Y	Distance
AQ_R066	314335.8	5844715	281
AQ_R184	314126.5	5844310	281
AQ_R160	314169.3	5844386	281
AQ_R463	301585	5831703	282
AQ_R133	314207.8	5844453	282
AQ_R212	314074.2	5844209	284
AQ_R226	314050.6	5844167	284
AQ_R172	314158.7	5844359	285
AQ_R057	314369.7	5844771	289
AQ_R333	313890.4	5843867	289
AQ_R052	314388.9	5844811	290
AQ_R371	313303.5	5842608	291
AQ_R301	313950.4	5843970	291
AQ_R147	314200.7	5844422	291
AQ_R117	314238.2	5844488	292
AQ_R078	314316.7	5844644	292
AQ_R242	314033.9	5844119	292
AQ_R337	313887.4	5843853	293
AQ_R091	314274.7	5844549	294
AQ_R163	314181.6	5844379	295
AQ_R056	313693.5	5844778	295
AQ_R305	313944.2	5843949	296
AQ_R028	314446.5	5844923	296
AQ_R109	314255.5	5844508	297
AQ_R008	321784	5847397	299
AQ_R033	314437.1	5844896	299
AQ_R059	314382.3	5844767	302
AQ_R232	314065.3	5844156	302
AQ_R345	313882.5	5843825	303
AQ_R011	317117	5846956	304
AQ_R277	313998.1	5844030	304
AQ_R372	313318.4	5842606	304
AQ_R150	314213.1	5844416	305
AQ_R407	307868.5	5836071	305
AQ_R004	320077	5848079	305
AQ_R312	313944.7	5843931	305
AQ_R092	314284.8	5844542	306
AQ_R138	314231.4	5844443	308
AQ_R350	313879.5	5843809	309
AQ_R122	314253.9	5844482	309
AQ_R399	309653.4	5839084	309
AQ_R164	314196.2	5844377	309
AQ_R072	314348.7	5844672	310
AQ_R270	314016.5	5844051	310
AQ_R176	314179.1	5844344	310
AQ_R253	314039.1	5844087	312
AQ_R113	314268	5844497	313
AQ_R469	300957.8	5831359	315
AQ_R385	312409	5841309	315
AQ_R443	301391.6	5832338	316
AQ_R279	314008.3	5844022	317
AQ_R090	314305	5844554	318
AQ_R081	314328.3	5844605	318
AQ_R298	313985.9	5843978	318
AQ_R328	313933.5	5843883	319
AQ_R194	314149.6	5844270	320
AQ_R070	314370.2	5844693	321
AQ_R254	314049.2	5844084	322
AQ_R273	314027.8	5844045	323
AQ_R198	314146.5	5844258	323
AQ_R010	317243	5846960	323

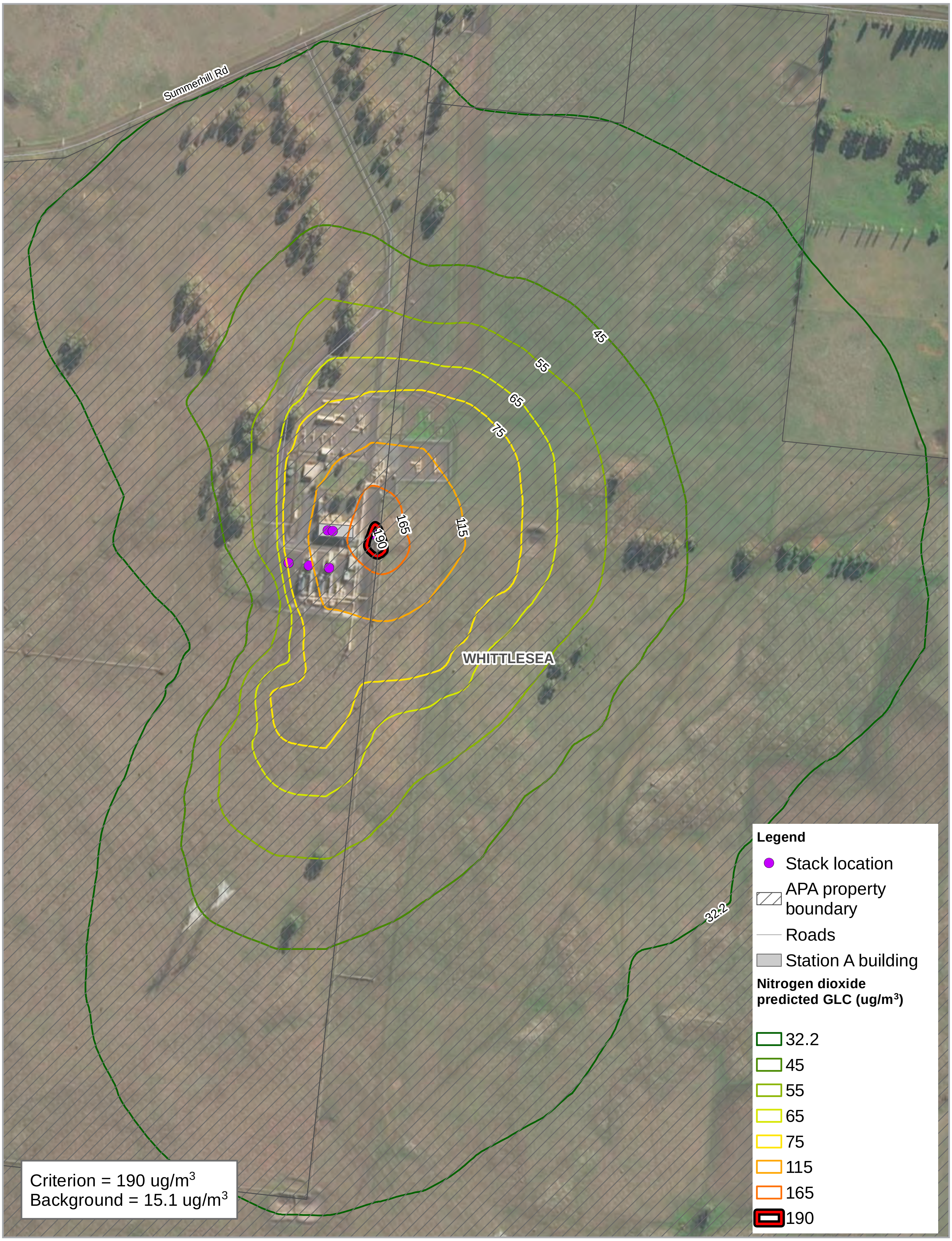
ID	X	Y	Distance
AQ_R124	314266.3	5844473	324
AQ_R452	300821.9	5832120	324
AQ_R079	314345.8	5844631	324
AQ_R168	314208.6	5844369	324
AQ_R096	314301.7	5844536	324
AQ_R202	314142.3	5844246	326
AQ_R304	313980.9	5843953	326
AQ_R061	314406.4	5844756	328
AQ_R143	314248.4	5844431	328
AQ_R214	314124.3	5844205	330
AQ_R389	311385.4	5841064	330
AQ_R299	313997.1	5843974	330
AQ_R334	313936.1	5843864	330
AQ_R236	314090.2	5844141	331
AQ_R207	314140.4	5844232	331
AQ_R083	314339.1	5844598	331
AQ_R210	314134	5844219	331
AQ_R283	314022.8	5844018	331
AQ_R311	313975.8	5843933	331
AQ_R024	313746.5	5844969	331
AQ_R044	314449.6	5844843	332
AQ_R218	314121.3	5844194	332
AQ_R248	314072.1	5844104	333
AQ_R041	314460.4	5844865	333
AQ_R053	314434.7	5844807	333
AQ_R026	314492.1	5844933	334
AQ_R316	313972.7	5843922	334
AQ_R032	314476.6	5844897	334
AQ_R222	314116	5844179	335
AQ_R230	314108.5	5844165	335
AQ_R074	314373.3	5844664	336
AQ_R258	314061.5	5844078	336
AQ_R339	313935.3	5843850	336
AQ_R119	314289.5	5844485	338
AQ_R063	314404.6	5844724	339
AQ_R099	314314.1	5844526	340
AQ_R341	313933.4	5843839	340
AQ_R319	313973	5843909	340
AQ_R145	314260.7	5844427	341
AQ_R171	314224.3	5844361	341
AQ_R477	299158.2	5826079	343
AQ_R322	313969.9	5843895	345
AQ_R084	314352.3	5844594	345
AQ_R189	314188.2	5844287	345
AQ_R346	313932.6	5843825	346
AQ_R260	314071.6	5844075	346
AQ_R181	314211.8	5844326	348
AQ_R193	314182.9	5844273	348
AQ_R352	313926.2	5843809	348
AQ_R327	313969	5843886	349
AQ_R197	314176.5	5844259	349
AQ_R101	314325.3	5844524	351
AQ_R094	314335.3	5844541	352
AQ_R200	314175.6	5844251	352
AQ_R286	314043.1	5844007	354
AQ_R130	314295.5	5844462	355
AQ_R331	313968.3	5843870	355
AQ_R211	314159.7	5844215	355
AQ_R381	311571.5	5841540	356
AQ_R274	314060.3	5844036	356
AQ_R216	314152.3	5844201	356

ID	X	Y	Distance
AQ_R174	314237.8	5844355	356
AQ_R020	314006.3	5845573	357
AQ_R048	314468.2	5844824	357
AQ_R351	313936.3	5843809	357
AQ_R046	314473.6	5844835	357
AQ_R251	314092.4	5844090	358
AQ_R473	298428	5826314	359
AQ_R068	314419.4	5844709	359
AQ_R182	314224.1	5844323	360
AQ_R035	314499.5	5844884	361
AQ_R039	314493.5	5844871	361
AQ_R225	314140.7	5844169	361
AQ_R223	314146.1	5844177	362
AQ_R483	298726.6	5822835	362
AQ_R239	314120.5	5844129	363
AQ_R453	302616.6	5832111	363
AQ_R075	314398.7	5844652	364
AQ_R287	314053.2	5844005	364
AQ_R233	314137.7	5844155	366
AQ_R252	314102.5	5844088	367
AQ_R353	313947.4	5843808	367
AQ_R382	312659.9	5841486	367
AQ_R080	314387.6	5844615	368
AQ_R104	314343.2	5844518	369
AQ_R278	314070.5	5844026	369
AQ_R310	314022.4	5843936	371
AQ_R154	314283.6	5844397	376
AQ_R265	314098.6	5844063	376
AQ_R354	313956.4	5843806	376
AQ_R019	318941	5845993	380
AQ_R192	314223	5844274	382
AQ_R373	323909.8	5842591	382
AQ_R280	314082.8	5844021	383
AQ_R290	314067.9	5843993	383
AQ_R481	298838.2	5823578	385
AQ_R306	314044.4	5843947	385
AQ_R162	314285.1	5844380	385
AQ_R205	314207	5844239	385
AQ_R123	314340.5	5844478	386
AQ_R355	313966.4	5843803	386
AQ_R201	314213.5	5844247	387
AQ_R209	314200.7	5844223	387
AQ_R266	314109.8	5844058	388
AQ_R098	314371.9	5844529	390
AQ_R129	314337.7	5844463	391
AQ_R255	314127.1	5844082	392
AQ_R217	314193.4	5844201	392
AQ_R406	307969.9	5836314	393
AQ_R282	314095.1	5844018	395
AQ_R292	314080.2	5843990	395
AQ_R106	314371.2	5844514	396
AQ_R332	314015	5843870	396
AQ_R175	314280.3	5844348	397
AQ_R135	314336.8	5844449	397
AQ_R244	314152	5844115	398
AQ_R308	314056.8	5843942	398
AQ_R229	314183.1	5844166	400
AQ_R235	314170.3	5844142	400
AQ_R234	314177.8	5844153	402
AQ_R268	314122.2	5844052	402
AQ_R062	314474.1	5844727	402

ID	X	Y	Distance
AQ_R476	299219.4	5826102	402
AQ_R141	314333.4	5844432	402
AQ_R419	307717.4	5835073	403
AQ_R045	314525	5844837	403
AQ_R042	314535.7	5844860	404
AQ_R315	314052.8	5843922	404
AQ_R293	314089.2	5843987	404
AQ_R240	314167.3	5844128	405
AQ_R036	314548.4	5844883	406
AQ_R284	314107.4	5844017	406
AQ_R259	314141.7	5844077	407
AQ_R051	314518	5844812	407
AQ_R309	314068	5843938	410
AQ_R433	303291	5832760	410
AQ_R413	306141.4	5835461	411
AQ_R321	314050.9	5843906	411
AQ_R344	314011.5	5843829	413
AQ_R414	306388.2	5835440	414
AQ_R272	314134.5	5844047	415
AQ_R245	314169.9	5844109	416
AQ_R295	314100.4	5843983	416
AQ_R082	314434.9	5844603	417
AQ_R324	314051.2	5843893	417
AQ_R126	314370.8	5844468	417
AQ_R395	310959.3	5840731	418
AQ_R356	313999.9	5843798	418
AQ_R349	314010.6	5843817	418
AQ_R285	314117.6	5844009	419
AQ_R262	314154.1	5844069	422
AQ_R329	314049.4	5843876	423
AQ_R134	314368.1	5844450	424
AQ_R213	314233.1	5844206	424
AQ_R009	315883.7	5847233	426
AQ_R219	314229	5844193	427
AQ_R400	309309.9	5838688	427
AQ_R064	314499.4	5844720	428
AQ_R297	314112.7	5843981	428
AQ_R358	314010	5843796	428
AQ_R076	314466.6	5844644	429
AQ_R247	314182.7	5844106	429
AQ_R430	302408.1	5832960	430
AQ_R140	314367.2	5844434	431
AQ_R043	314565.9	5844857	433
AQ_R146	314365.6	5844422	435
AQ_R289	314132.3	5844000	436
AQ_R111	314410.9	5844500	437
AQ_R447	301095.9	5832295	438
AQ_R342	314045.8	5843838	439
AQ_R151	314363.3	5844411	439
AQ_R441	301211.1	5832353	440
AQ_R314	314097.6	5843925	442
AQ_R156	314359.3	5844396	442
AQ_R359	314025.6	5843793	443
AQ_R269	314170	5844052	444
AQ_R118	314410.5	5844486	444
AQ_R347	314043.8	5843824	444
AQ_R480	297978.1	5823640	446
AQ_R067	314515.9	5844710	447
AQ_R249	314201.6	5844102	447
AQ_R159	314359.5	5844386	447
AQ_R125	314409	5844473	448

ID	X	Y	Distance
AQ_R320	314094.7	5843906	449
AQ_R275	314164.9	5844032	449
AQ_R165	314356	5844373	450
AQ_R361	314035.7	5843792	452
AQ_R323	314092.7	5843895	452
AQ_R386	311432.2	5841293	452
AQ_R131	314406.7	5844460	453
AQ_R291	314147	5843990	454
AQ_R288	314154.5	5844003	454
AQ_R136	314403.3	5844448	456
AQ_R317	314111	5843920	456
AQ_R173	314355.1	5844356	458
AQ_R300	314142.9	5843973	458
AQ_R303	314138.7	5843963	459
AQ_R398	309557.2	5839211	460
AQ_R360	314046.8	5843792	462
AQ_R474	299294.1	5826218	463
AQ_R335	314087.8	5843862	464
AQ_R178	314351.2	5844337	464
AQ_R142	314403.6	5844431	464
AQ_R115	314439.2	5844495	465
AQ_R450	300782.8	5832256	465
AQ_R472	300738.1	5831163	469
AQ_R149	314402	5844418	469
AQ_R338	314088.1	5843851	469
AQ_R466	301797.1	5831596	471
AQ_R468	301486.1	5831437	471
AQ_R397	323597.5	5839352	471
AQ_R343	314085.1	5843837	474
AQ_R325	314115.1	5843888	475
AQ_R157	314398.2	5844394	477
AQ_R227	314272.3	5844166	478
AQ_R348	314083.2	5843823	479
AQ_R132	314435	5844457	479
AQ_R436	301553.4	5832597	480
AQ_R437	301448.8	5832571	480
AQ_R005	319060.9	5847771	481
AQ_R161	314396	5844381	481
AQ_R330	314115.4	5843874	482
AQ_R428	302400.3	5833211	483
AQ_R336	314109	5843860	483
AQ_R241	314257.5	5844123	486
AQ_R169	314395.6	5844367	488
AQ_R228	314284.2	5844166	488
AQ_R471	300891.8	5831170	489
AQ_R340	314108.3	5843843	491
AQ_R256	314240.3	5844080	491
AQ_R357	314083.4	5843796	492
AQ_R271	314226.6	5844048	495
AQ_R294	314194.2	5843986	497
AQ_R276	314220.1	5844032	497
AQ_R362	314082.6	5843782	498
AQ_R281	314214.1	5844018	499
AQ_R231	314294.9	5844162	500

Appendix C – Wollert Compressor Station predicted GLCs including the DEA



Paper Size ISO A4

0 60 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

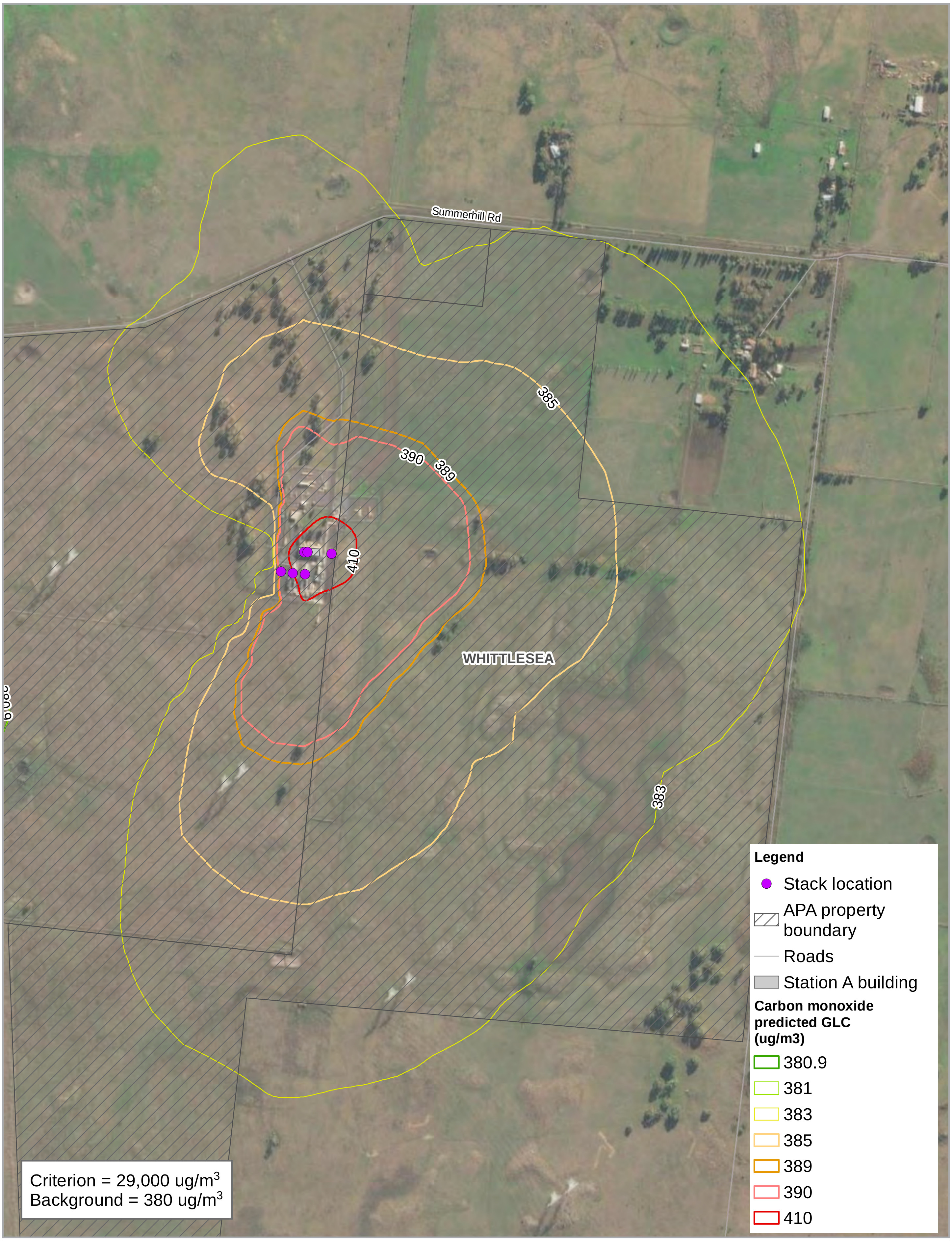
1 hour 99.9%
NO_2 predicted GLC
including the DEA

Project No. 12529997
Revision No. A
Date 17/08/2020

FIGURE 17

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_017_1hour99_9predictedrank_NO2_including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:08

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 100 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

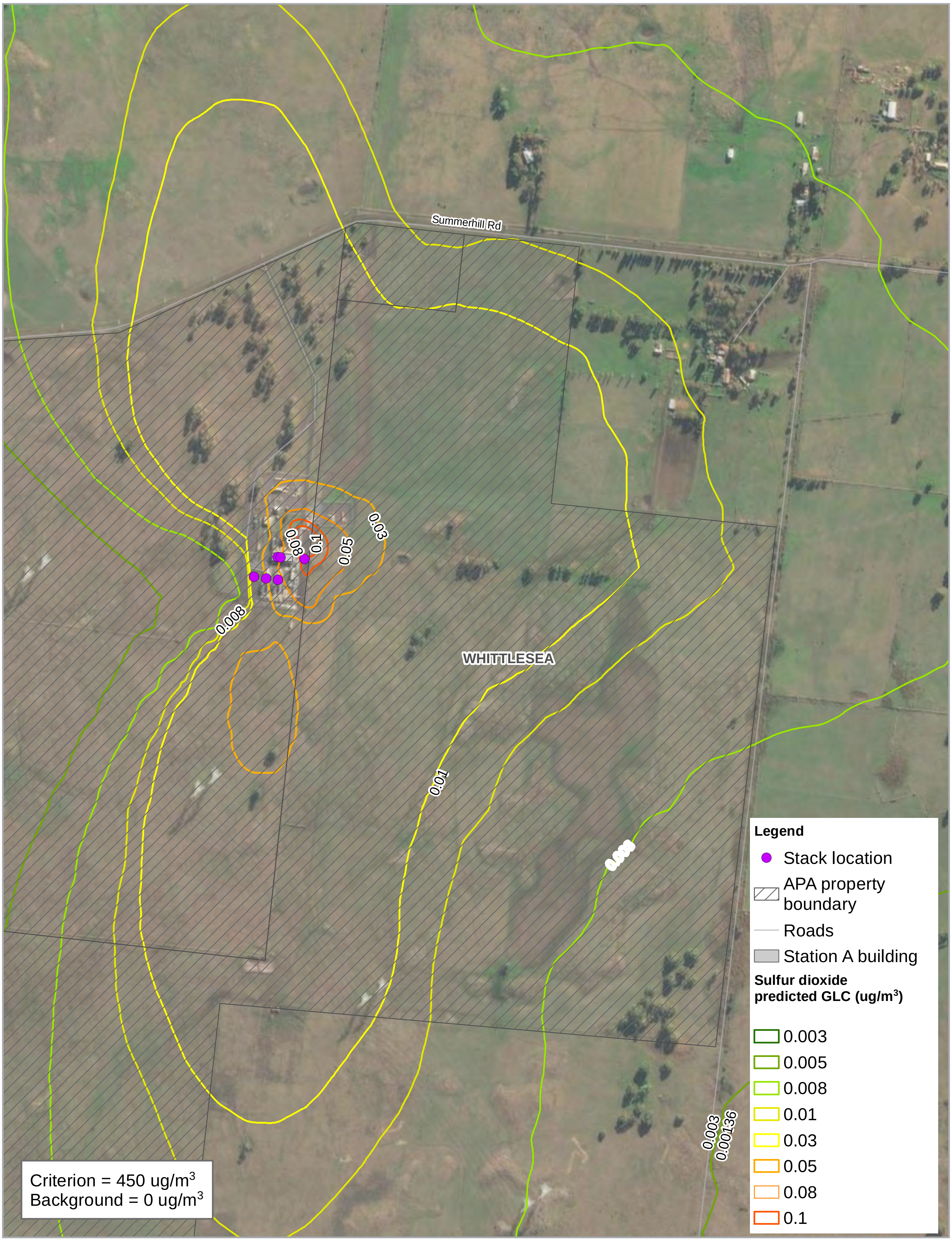
1 hour 99.9%
carbon monoxide predicted GLC
including background – including the DEA

Project No. **12529997**
Revision No. **A**
Date **19/08/2020**

FIGURE B2

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_001_1hour99_9predictedrank_including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:17

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 100 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

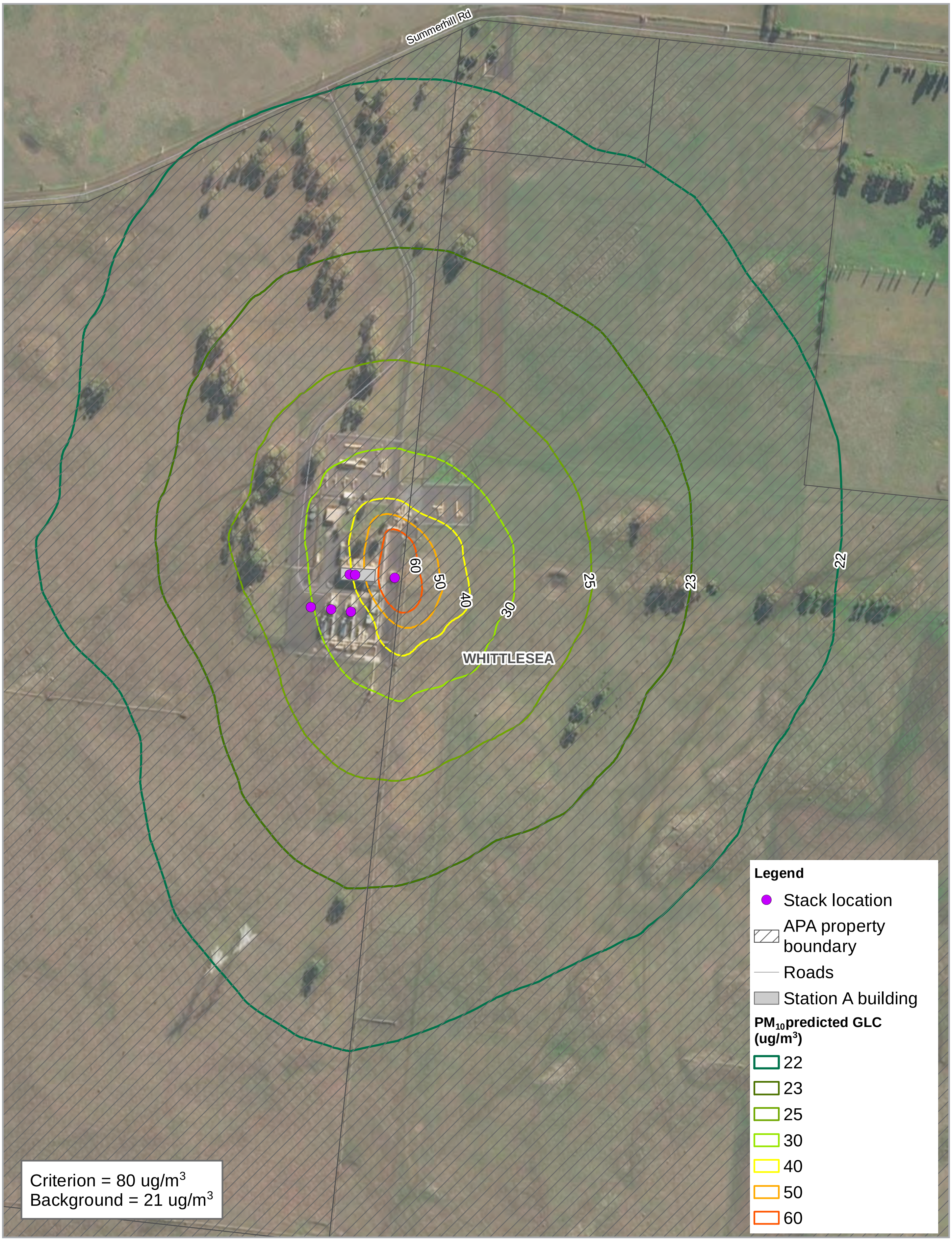
1 hour 99.9%
sulfur dioxide predicted GLC
– including the DEA

Project No. **12529997**
Revision No. **A**
Date **19/08/2020**

FIGURE B3

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_003_1hour99_9predictedrank_So2_Including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:19

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 60 120

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

GHD

Australian Pipeline Limited
Western Outer Ring Main Gas Project

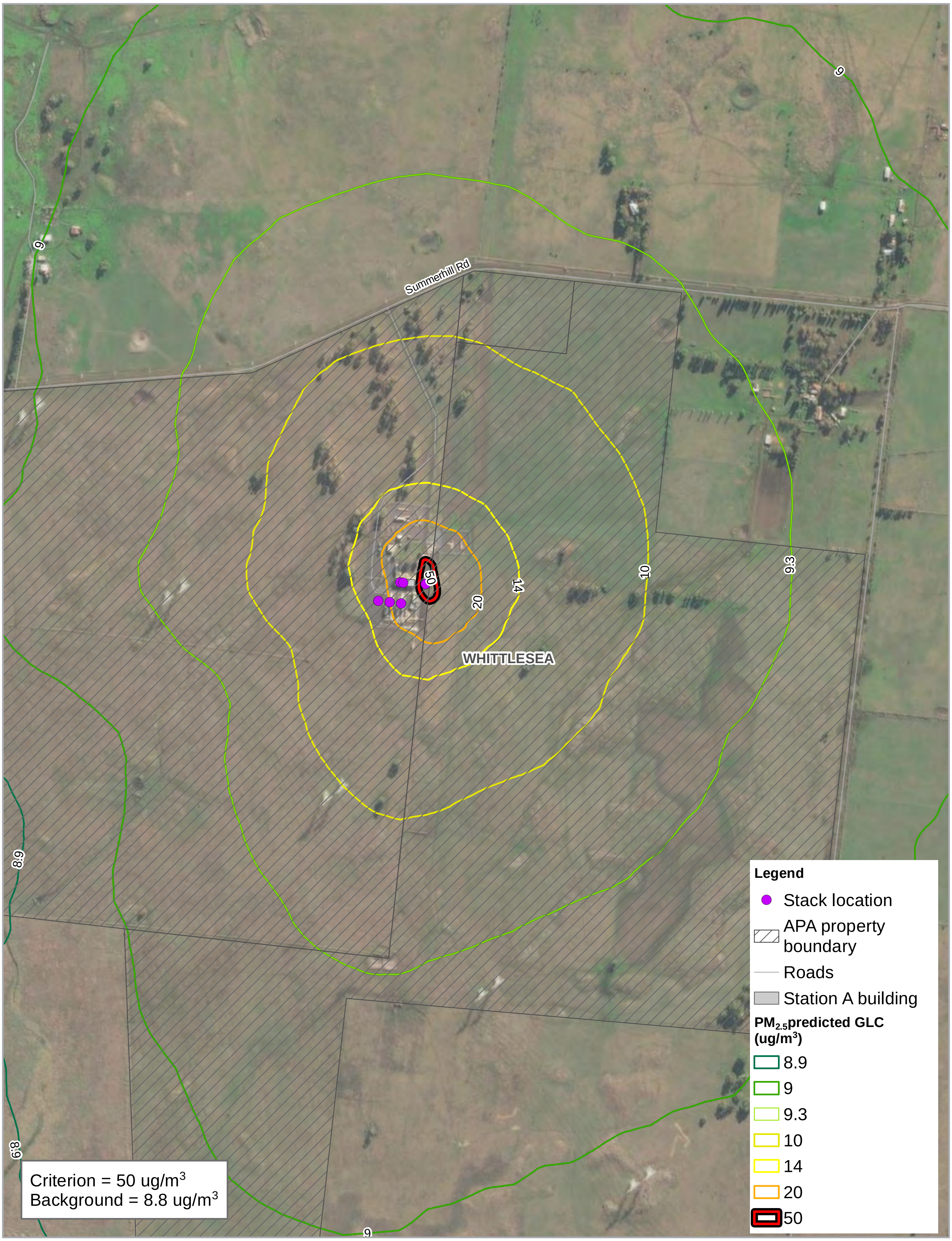
1 hour 99.9%
PM_{10} predicted GLC
including background – including the DEA

Project No.	**12529997**
Revision No.	**A**
Date	**19/08/2020**

FIGURE B4

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_005_1hour99_9predictedrank_PM10_including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:24

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

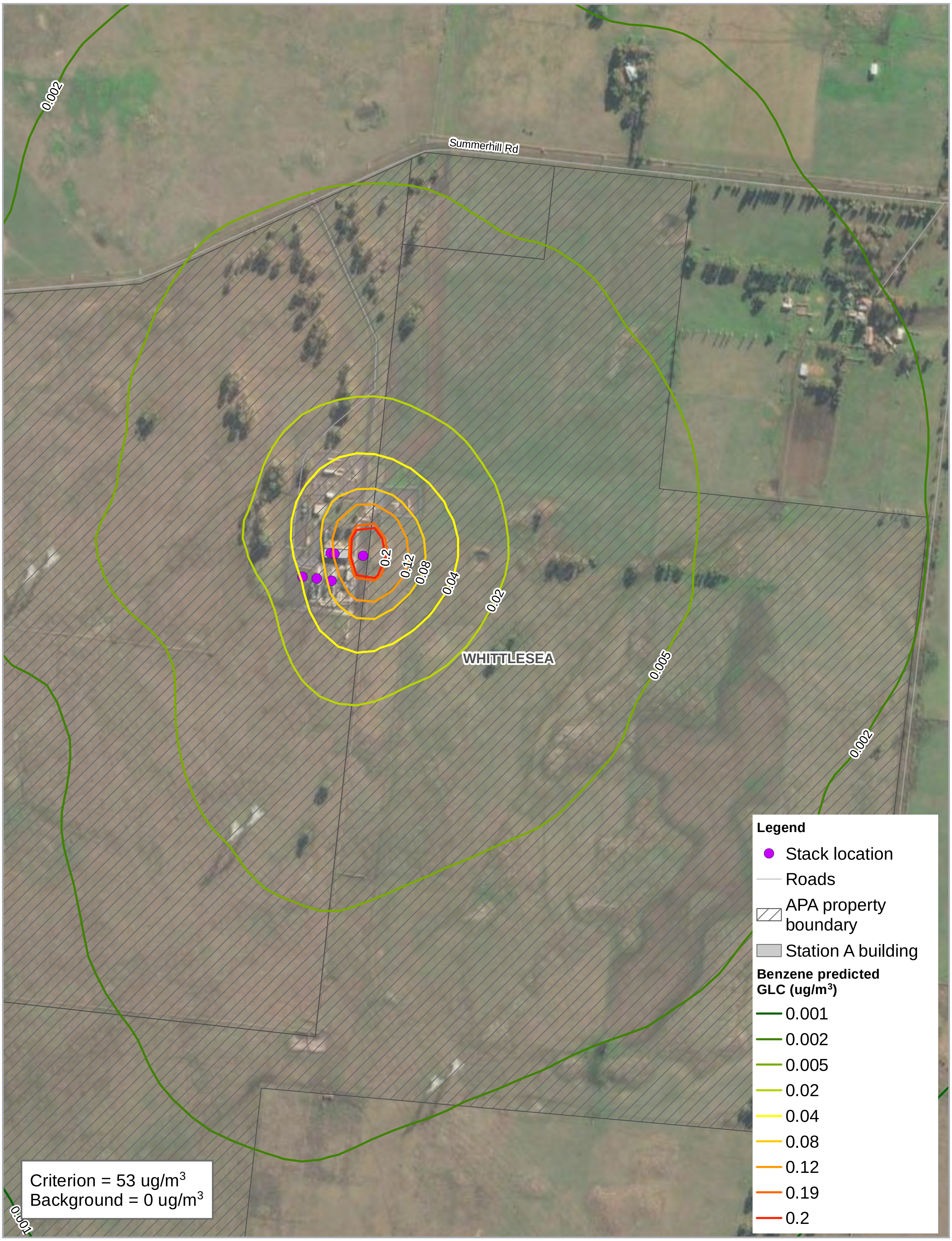
1 hour 99.9%
$PM_{2.5}$ predicted GLC
including background– including the DEA

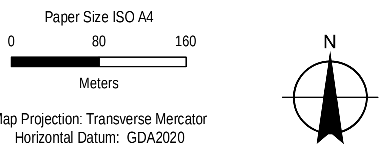
Project No. **12529997**
Revision No. **A**
Date **19/08/2020**

FIGURE B5

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_007_1hour99_9predictedrank_PM2_5_including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:28

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo





Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

Australian Pipeline Limited
Western Outer Ring Main Gas Project

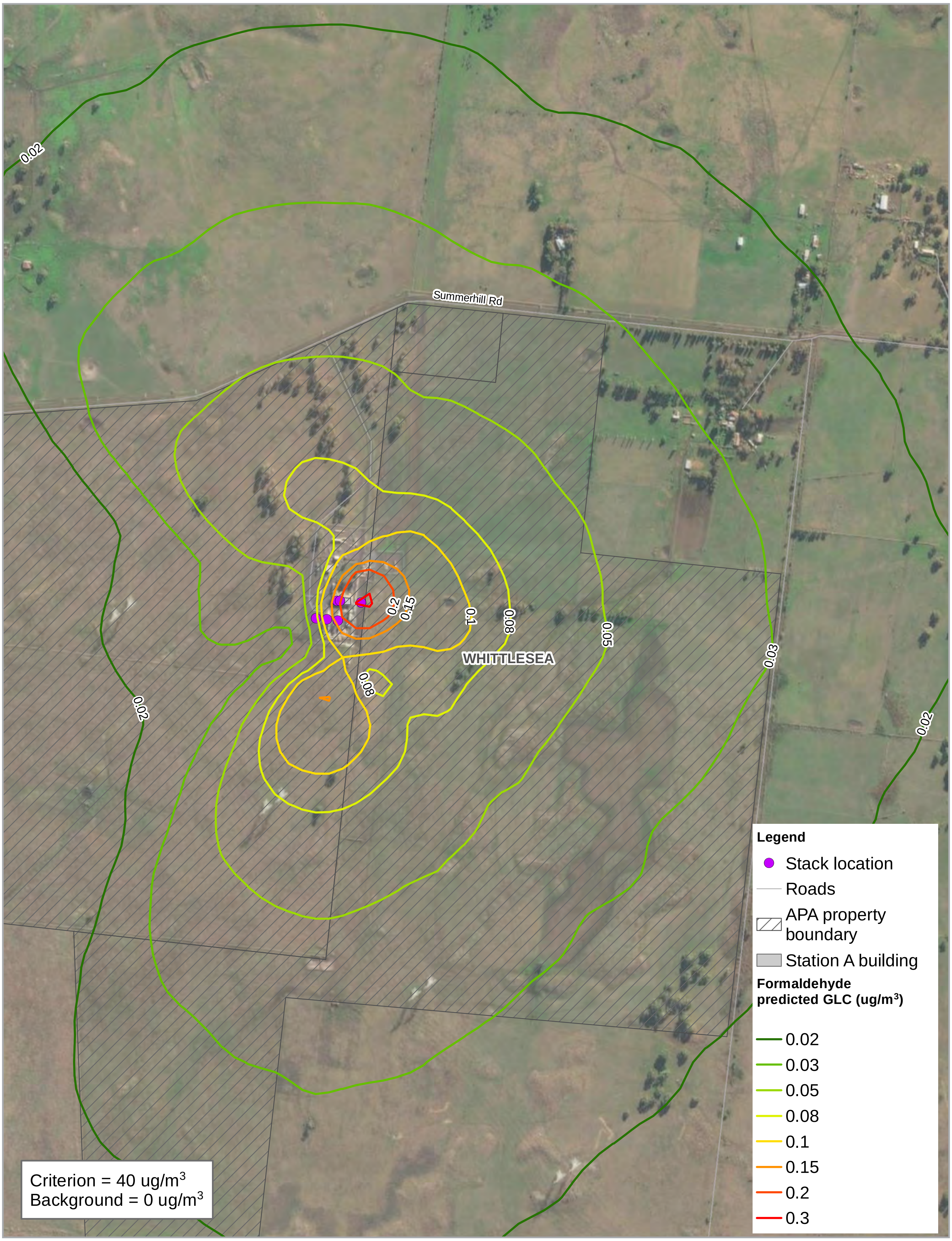
3 minute 99.9% benzene predicted GLC including the DEA

Project No.	12529997
Revision No.	A
Date	17/08/2020

FIGURE 9

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_009_3min99_9predictedrank_Benzene_including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:31

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

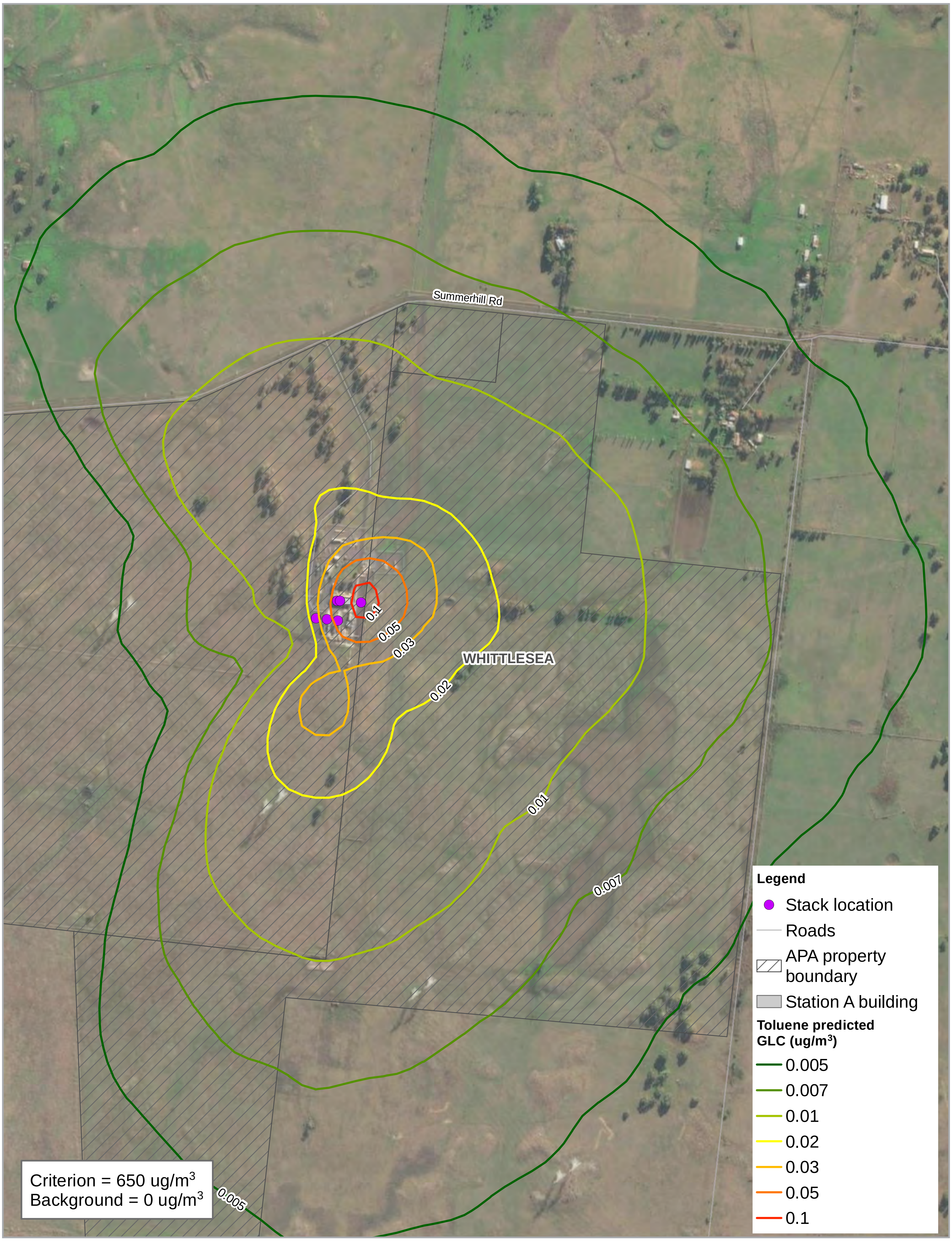
3 minute 99.9%
Formaldehyde predicted GLC
including the DEA

Project No. 12529997
Revision No. A
Date 17/08/2020

FIGURE 11

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_011_3min99_9predictedrank_Formaldehyde_including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:34

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

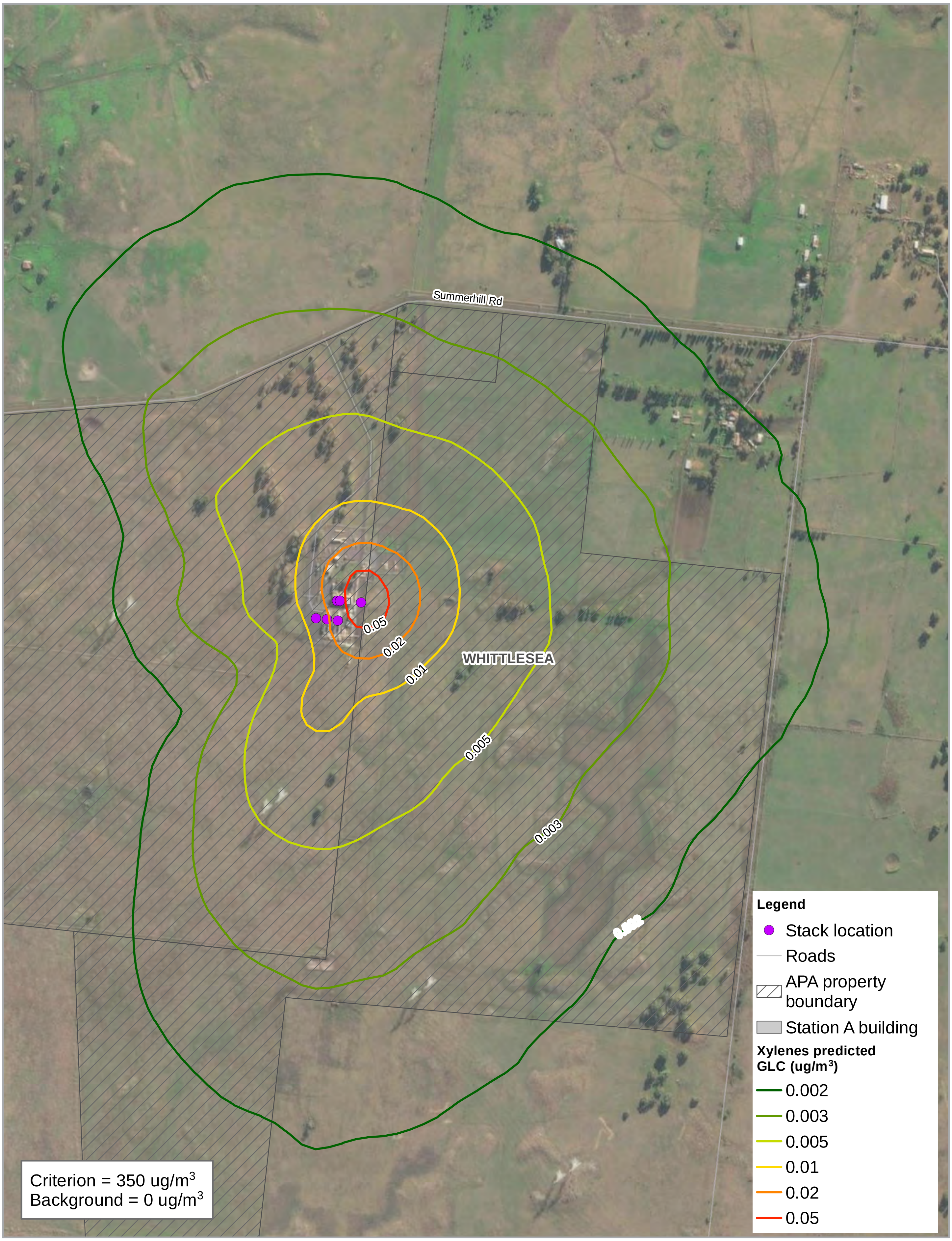
3 minute 99.9%
Toluene predicted GLC
including the DEA

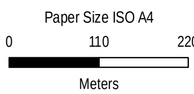
Project No. 12529997
Revision No. A
Date 17/08/2020

FIGURE 13

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_013_3min99_9predictedrank_Toluene_Including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:37

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo





Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

3 minute 99.9%
Xylene predicted GLC
including the DEA

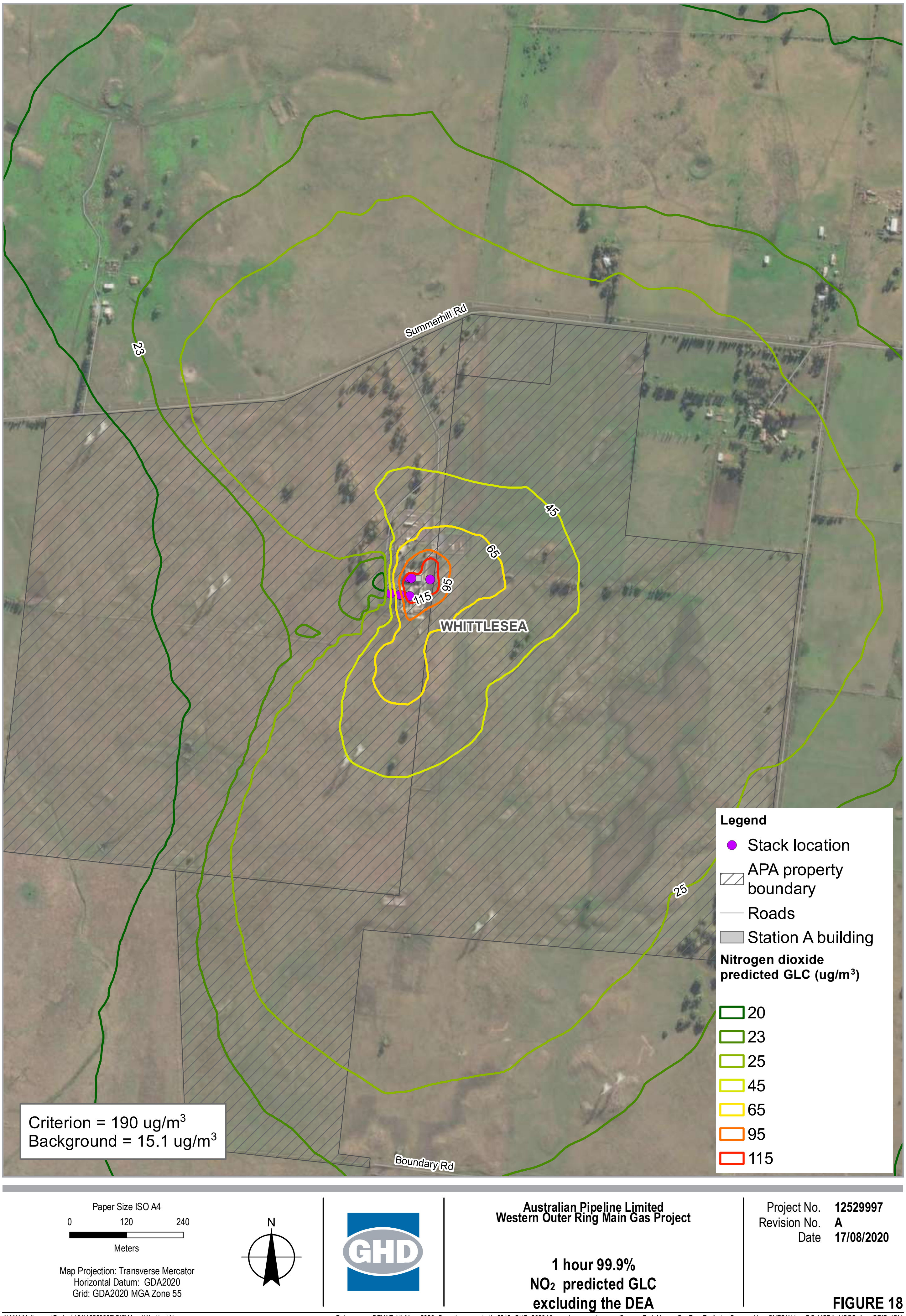
Project No.	12529997
Revision No.	A
Date	17/08/2020

FIGURE 15

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_015_3min99_9predictedrank_Xylenes_Including_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:41

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo

Appendix D – Wollert Compressor Station predicted GLCs excluding the DEA



Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

Australian Pipeline Limited
Western Outer Ring Main Gas Project

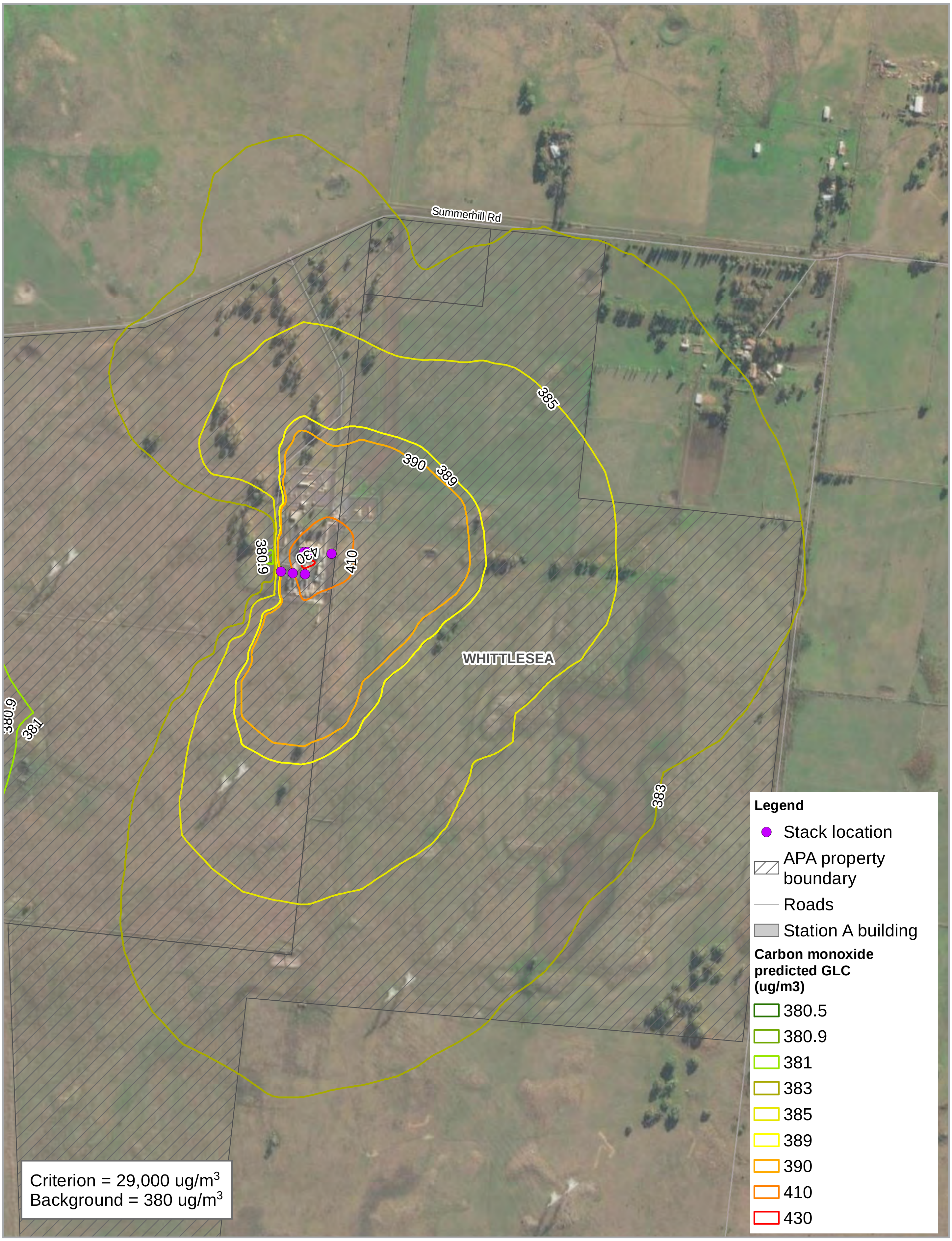
1 hour 99.9%
NO_2 predicted GLC
excluding the DEA

Project No. 12529997
Revision No. A
Date 17/08/2020

FIGURE 18

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_018_1hour99_9predictedrank_NO2_excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:43

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 100 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

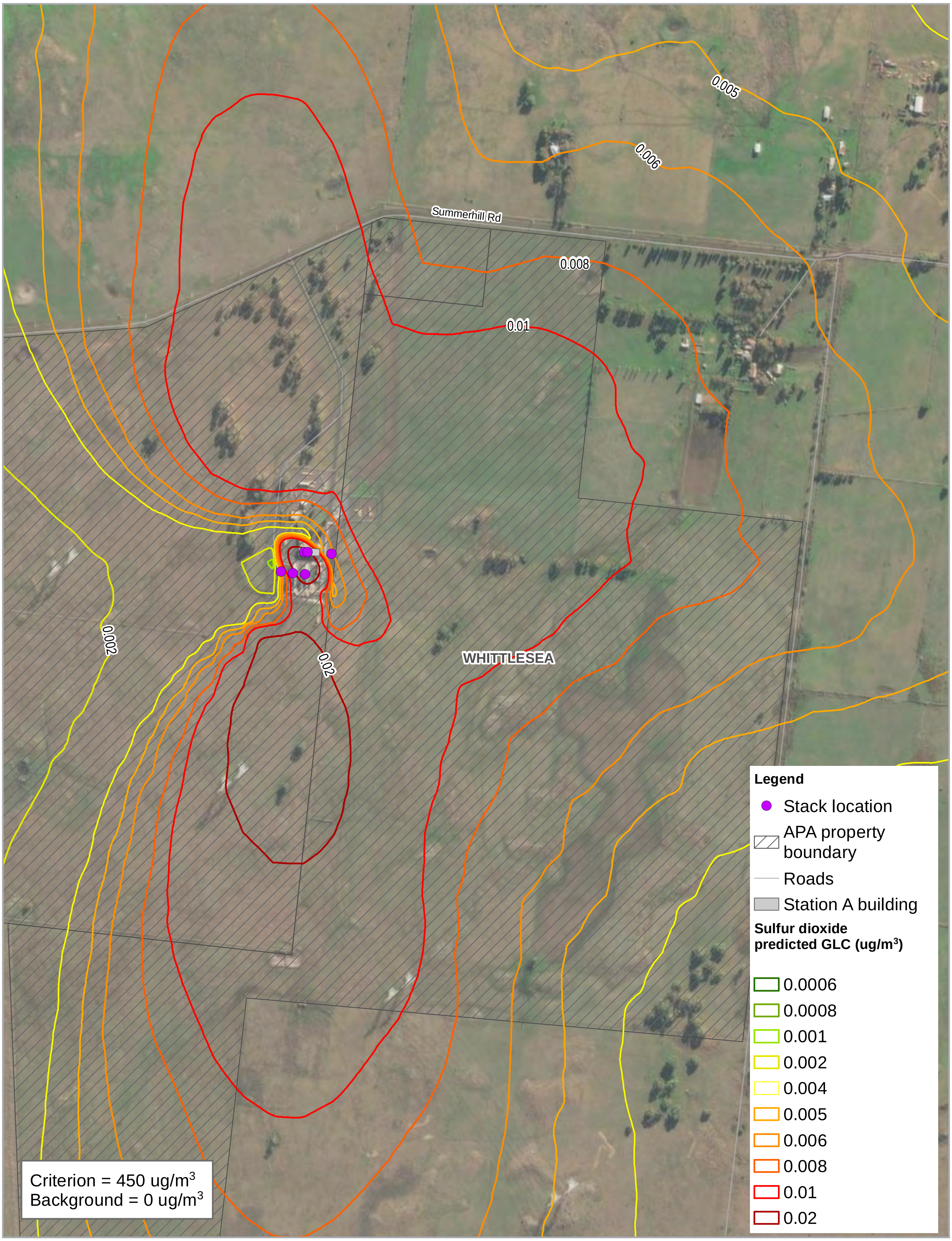
1 hour 99.9%
carbon monoxide predicted GLC
including background – excluding the DEA

Project No. **12529997**
Revision No. **A**
Date **19/08/2020**

FIGURE C2

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_002_1hour99_9predictedrank_Excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:46

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 100 200

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

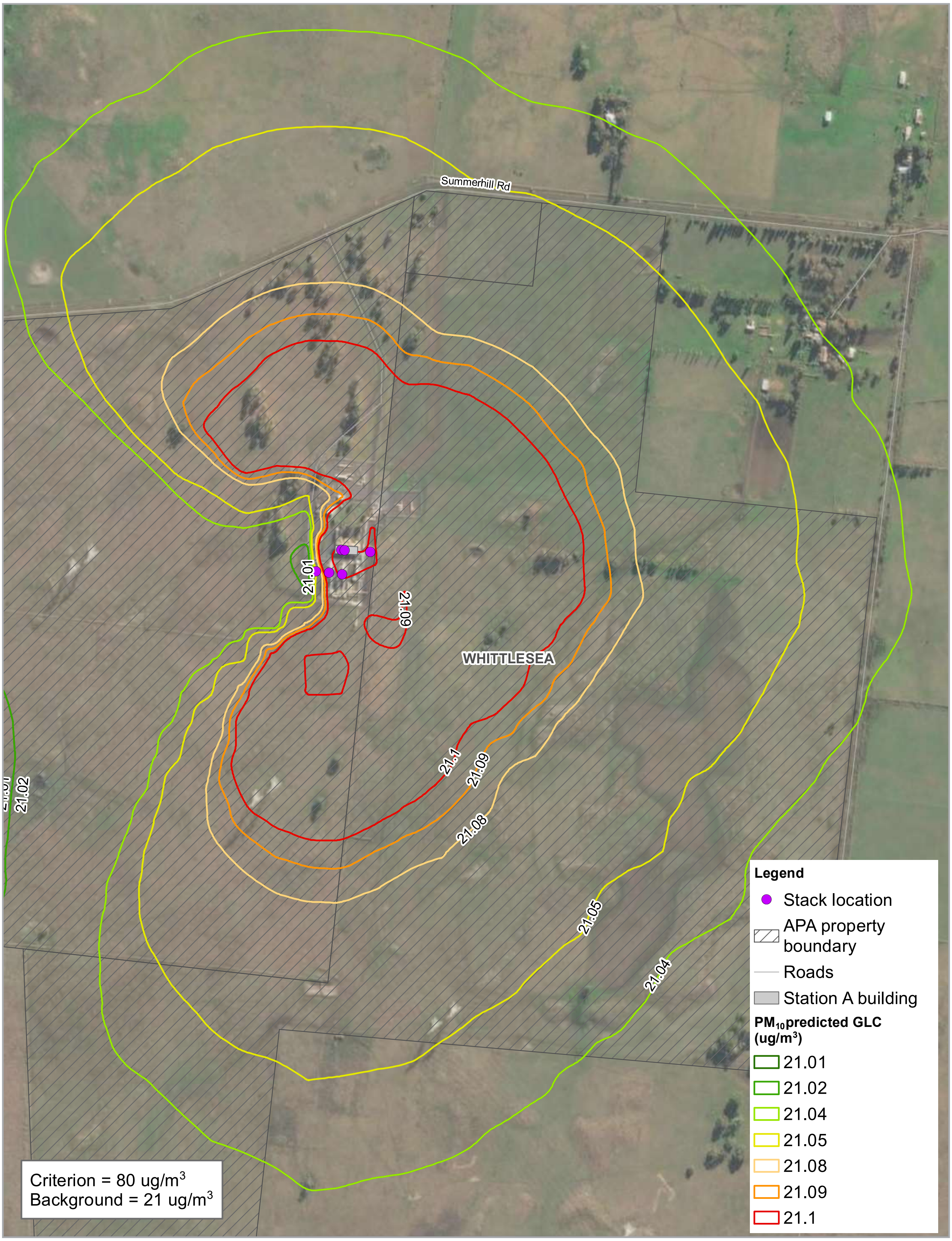
1 hour 99.9%
sulfur dioxide predicted GLC
– excluding the DEA

Project No. **12529997**
Revision No. **A**
Date **19/08/2020**

FIGURE C3

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_004_1hour99_9predictedrank_So2_excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:48

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 90 180

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

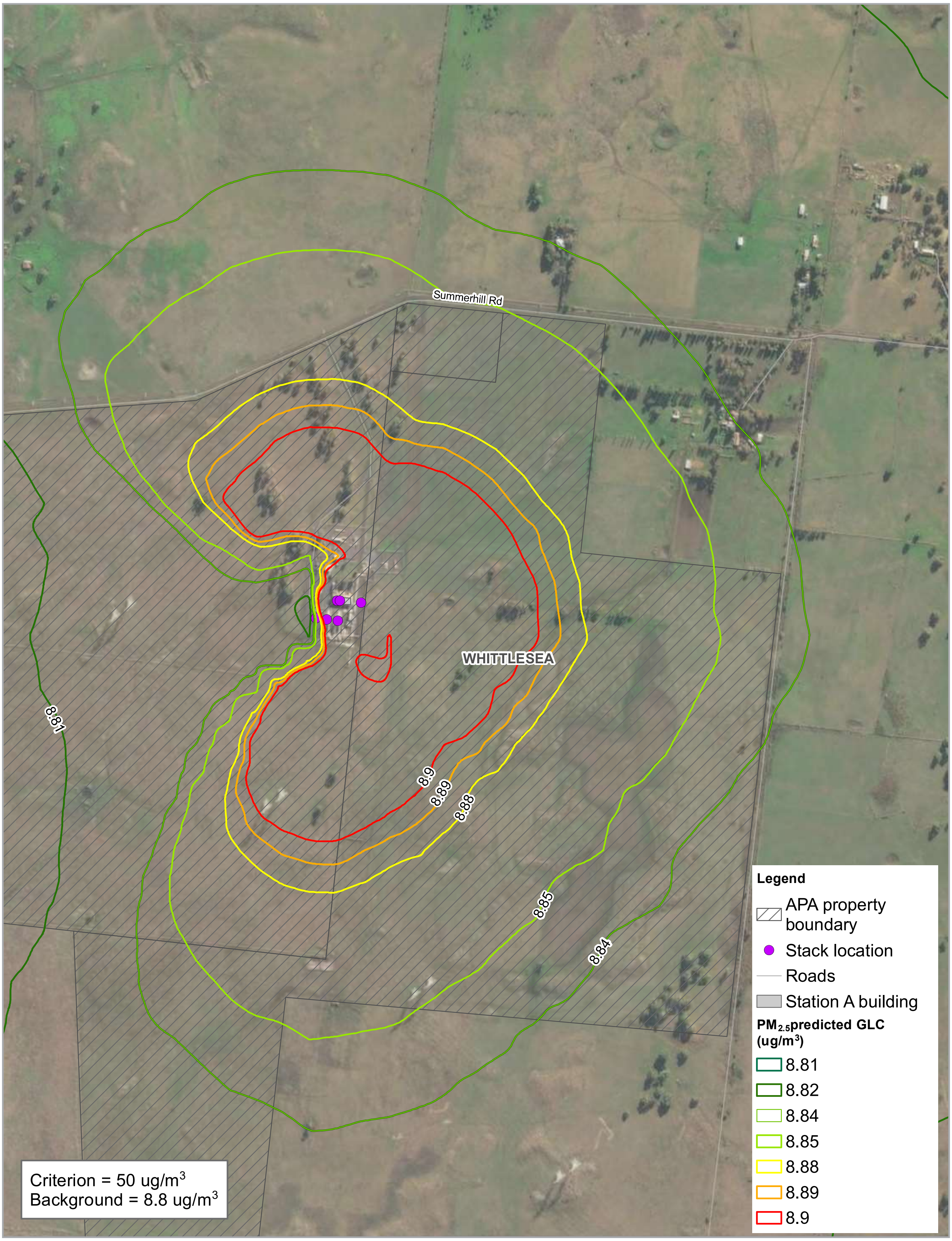
1 hour 99.9%
PM_{10} predicted GLC
including background– excluding the DEA

Project No. **12529997**
Revision No. **A**
Date **19/08/2020**

FIGURE C4

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_006_1hour99_9predictedrank_PM10_excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:52

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

GHD

Australian Pipeline Limited
Western Outer Ring Main Gas Project

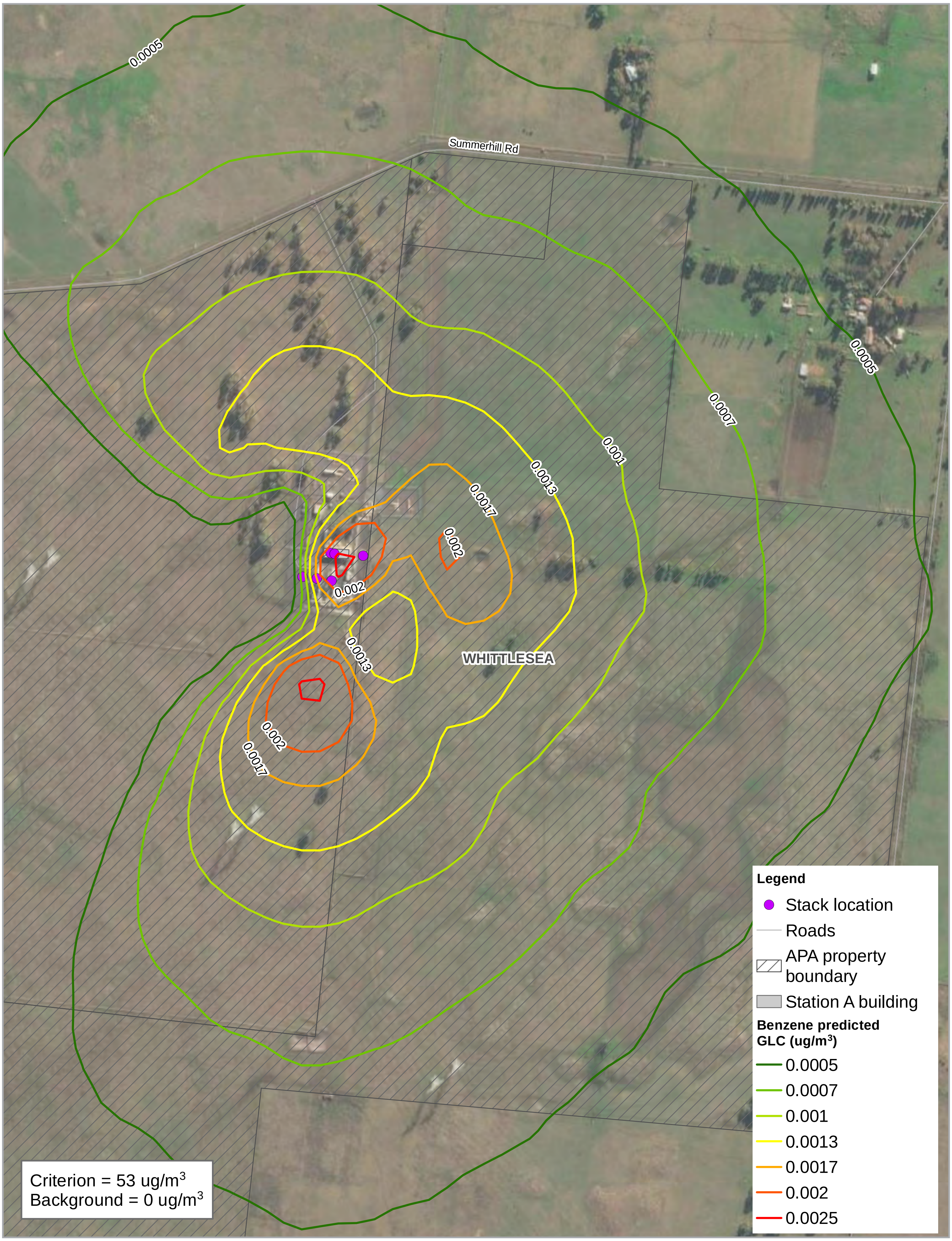
1 hour 99.9%
$PM_{2.5}$ predicted GLC
including background– excluding the DEA

Project No. 12529997
Revision No. A
Date 19/08/2020

FIGURE C5

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_008_1hour99_9predictedrank_PM2_5_excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:55

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 80 160

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

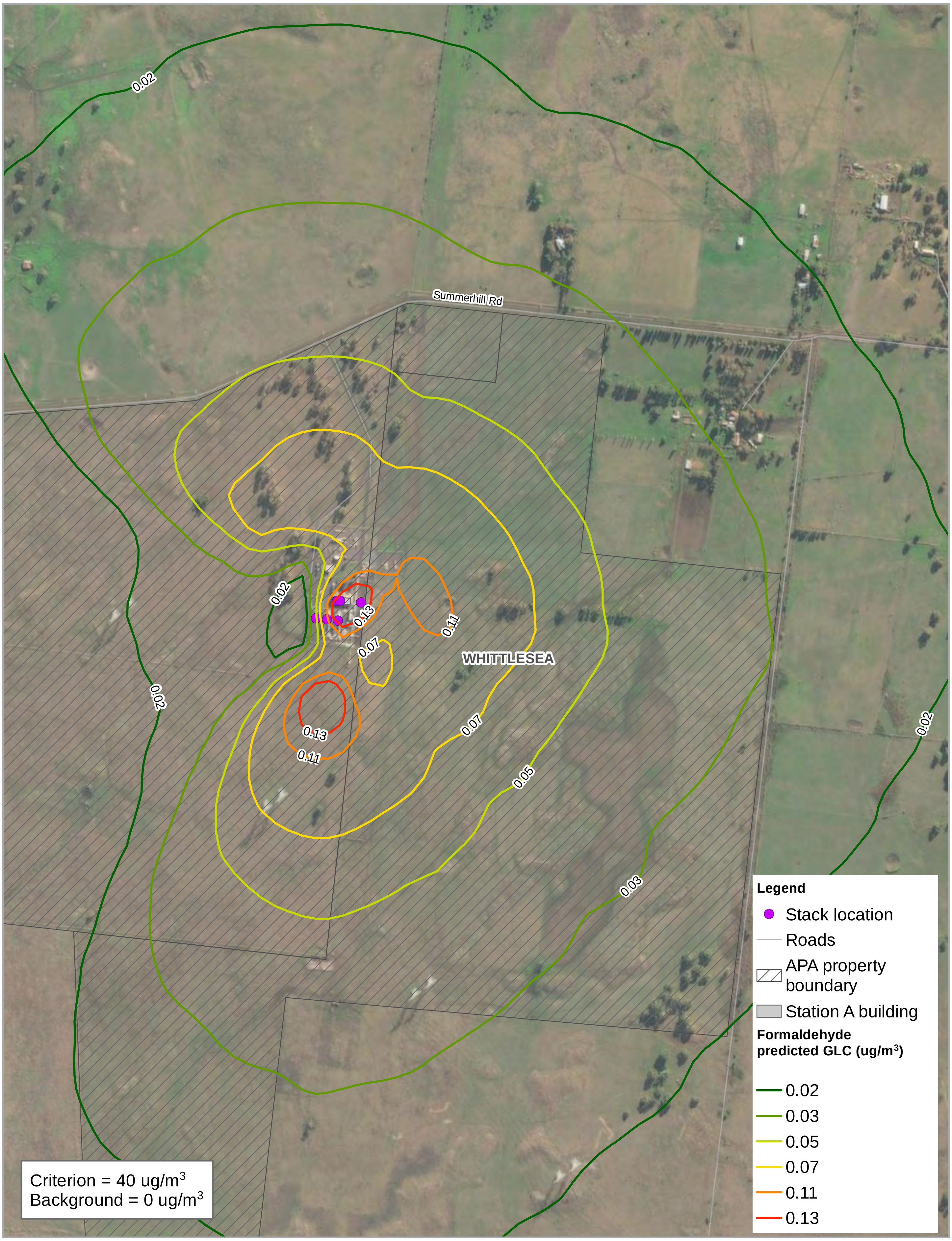
3 minute 99.9%
benzene predicted GLC
excluding the DEA

Project No.	12529997
Revision No.	A
Date	17/08/2020

FIGURE 10

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_010_3min99_9predictedrank_Benzene_excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 15:58

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

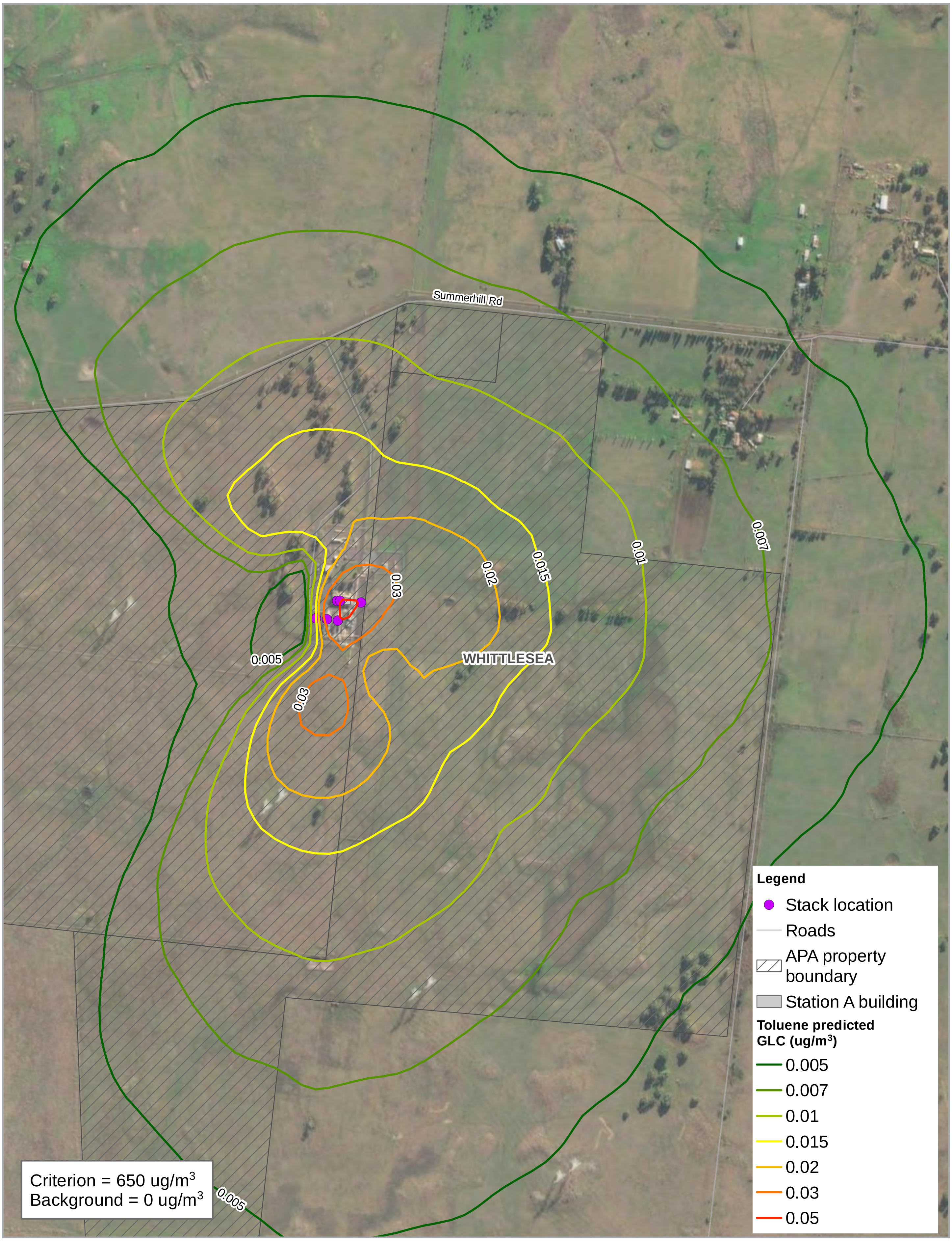
3 minute 99.9%
Formaldehyde predicted GLC
excluding the DEA

Project No. 12529997
Revision No. A
Date 17/08/2020

FIGURE 12

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_012_3min99_9predictedrank_Formaldehyde_excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 16:02

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

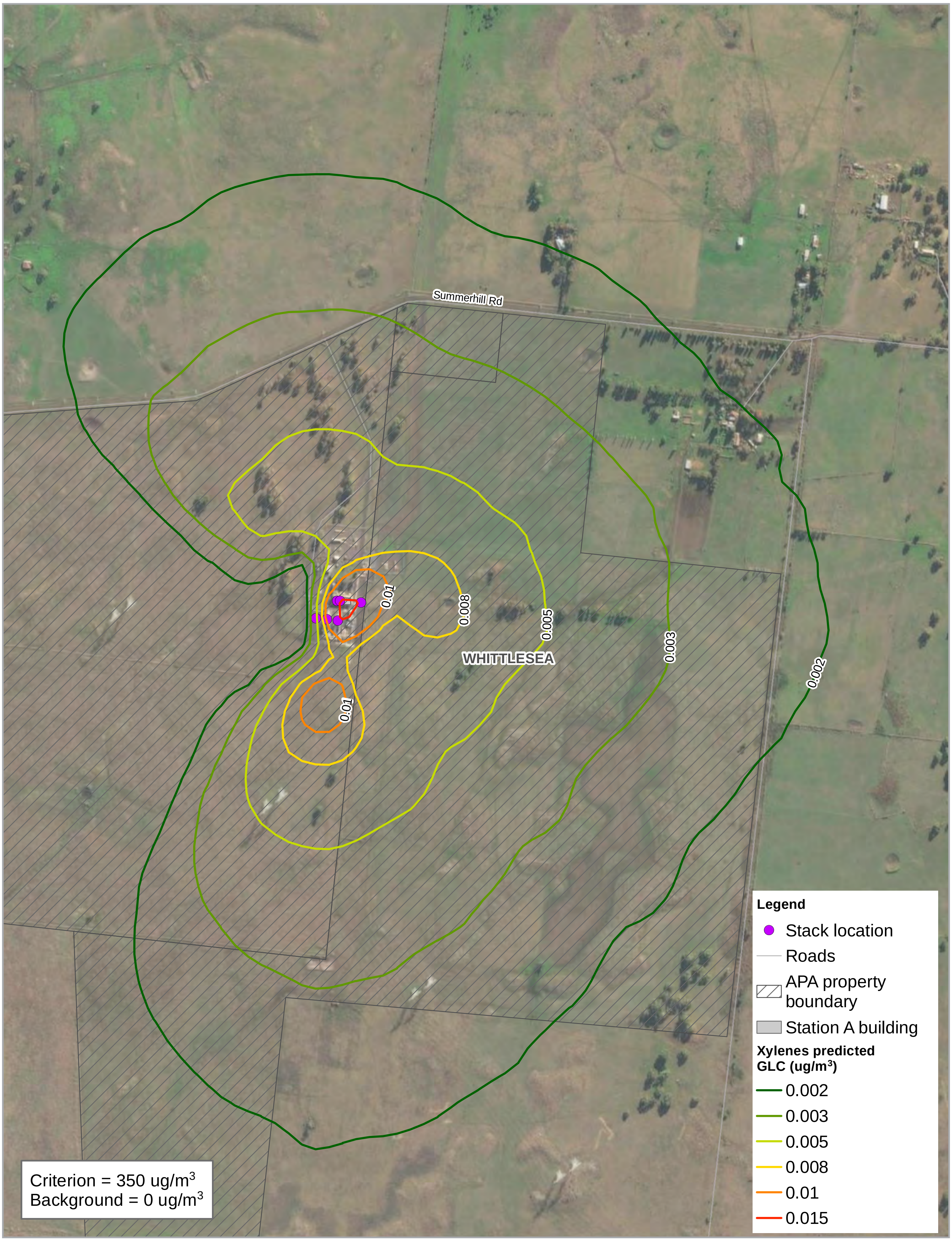
3 minute 99.9%
Toluene predicted GLC
excluding the DEA

Project No.	12529997
Revision No.	A
Date	17/08/2020

FIGURE 14

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_014_3min99_9predictedrank_Toluene_Excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 16:01

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo



Paper Size ISO A4

0 110 220

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

N

Australian Pipeline Limited
Western Outer Ring Main Gas Project

3 minute 99.9%
Xylenes predicted GLC
excluding the DEA

Project No.	12529997
Revision No.	A
Date	17/08/2020

FIGURE 16

N:\AU\Melbourne\Projects\31\12529997\GIS\Maps\Working\Air quality\12529997_016_3min99_9predictedrank_Xylenes_Excluding_A4P_revA.mxd
Print date: 09 Nov 2020 - 16:02

Data source: DELWP, VicMap, 2020; Geoscience australia 2012, GHD, 2020,Vicmap basemap imagery Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: sacevedo

Appendix E – Pipeline construction orientation graphs

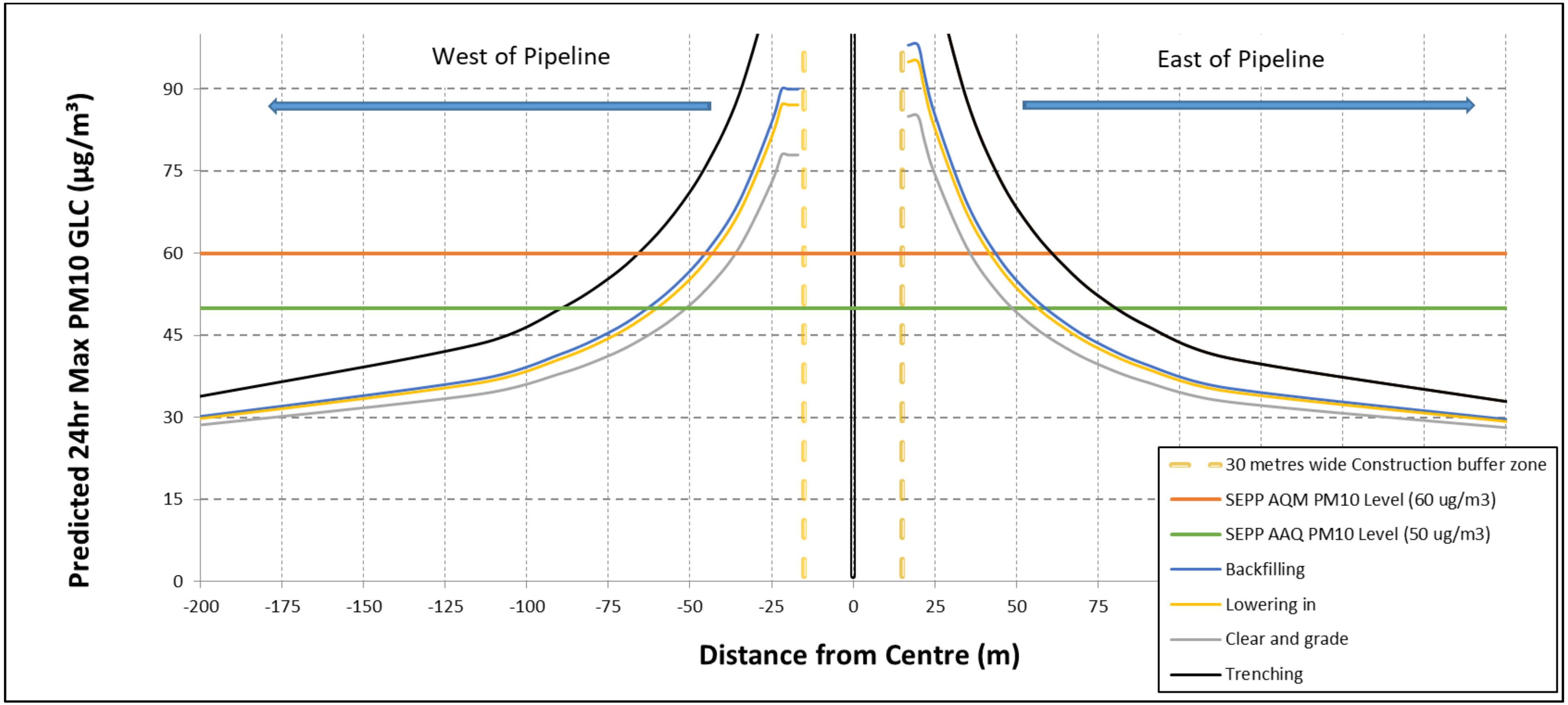


Figure 14 ORIENTATION 1 - Maximum 24 hour PM_{10} construction dust impact – including background

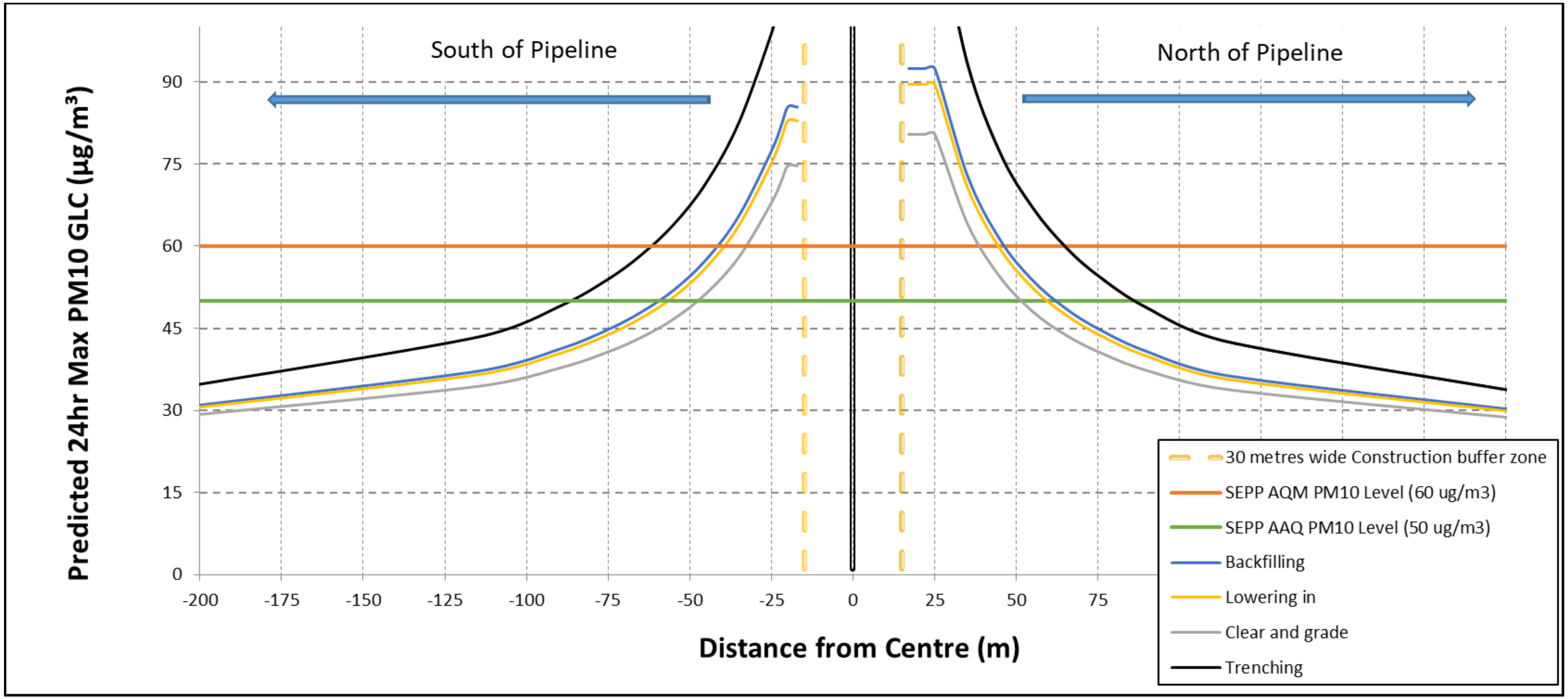


Figure 15 ORIENTATION 2 - Maximum 24 hour PM_{10} construction dust impact – including background

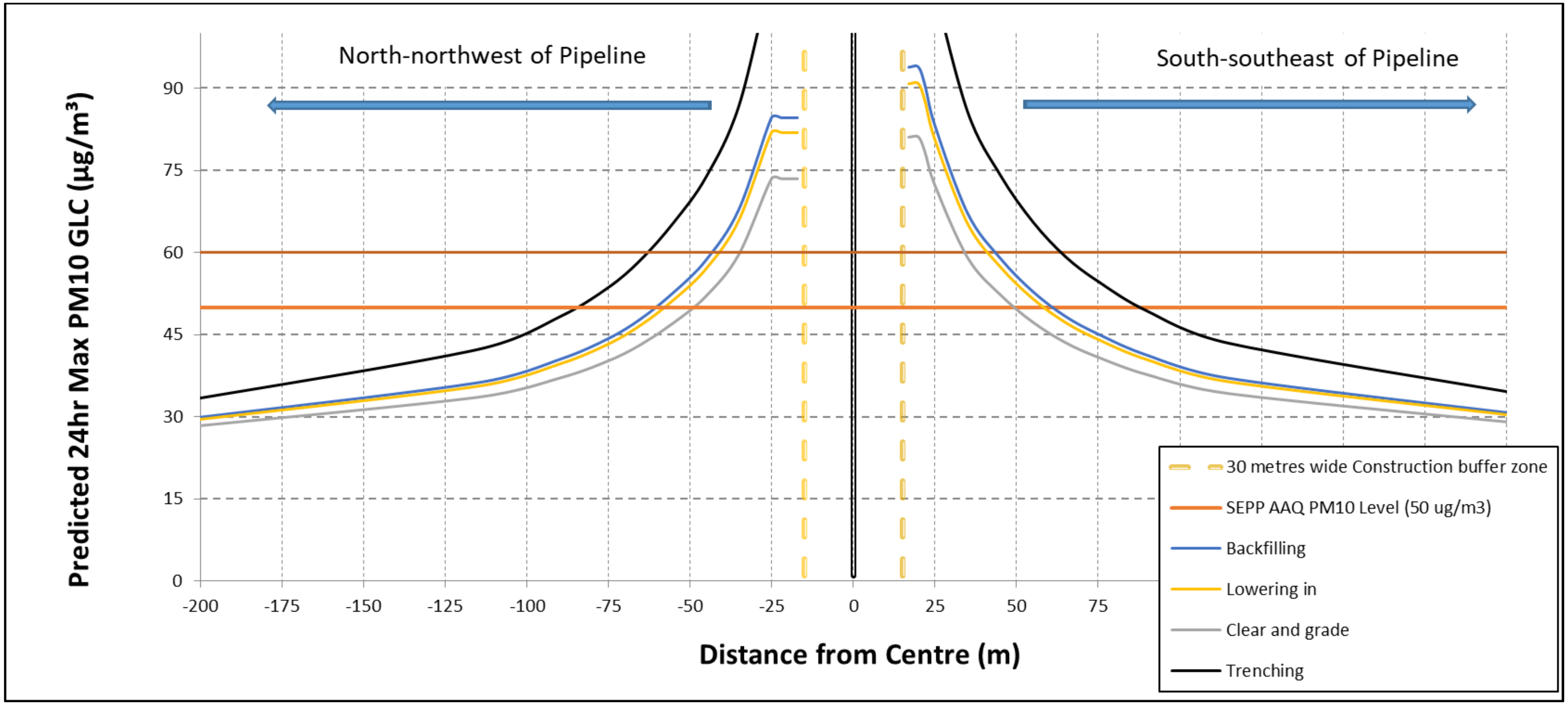


Figure 16 ORIENTATION 3 - Maximum 24 hour PM_{10} construction dust impact – including background

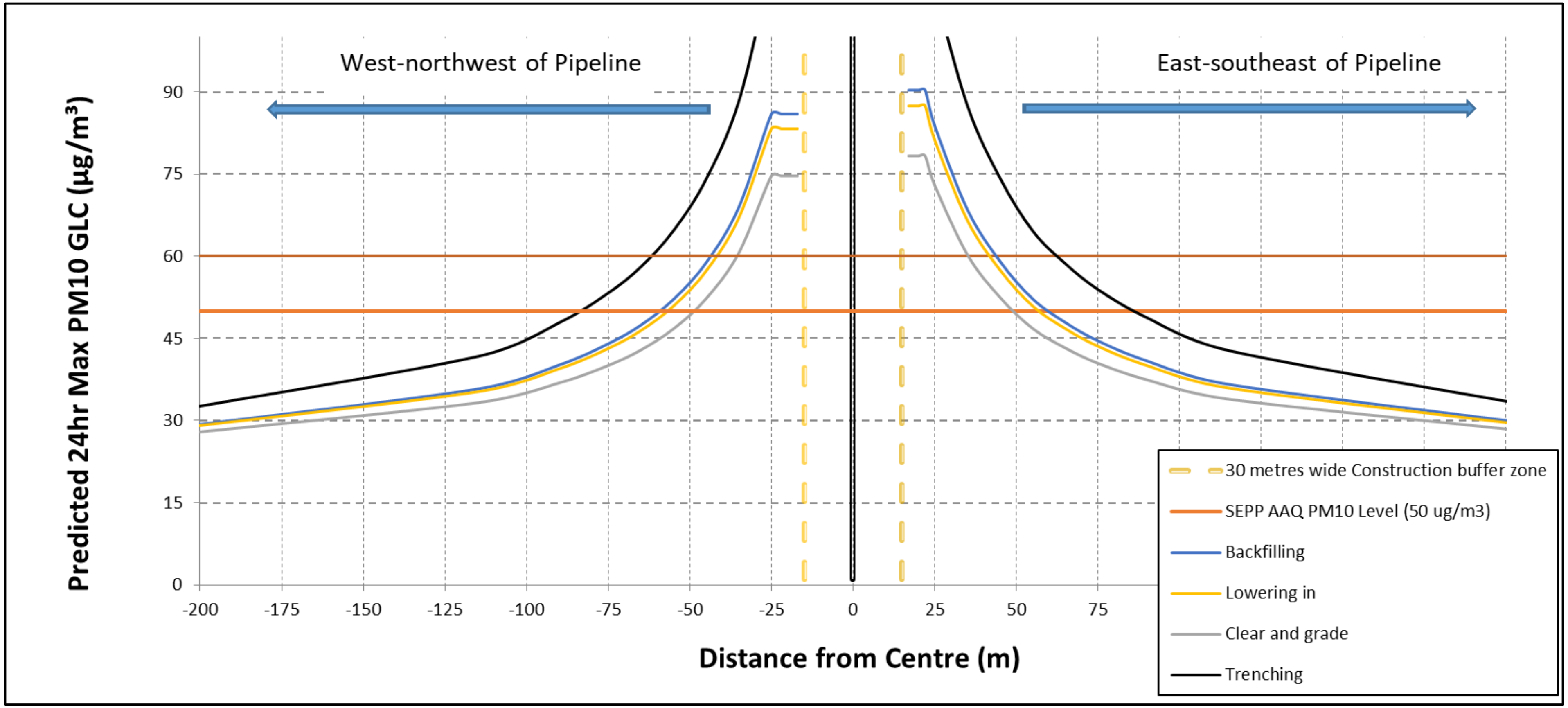
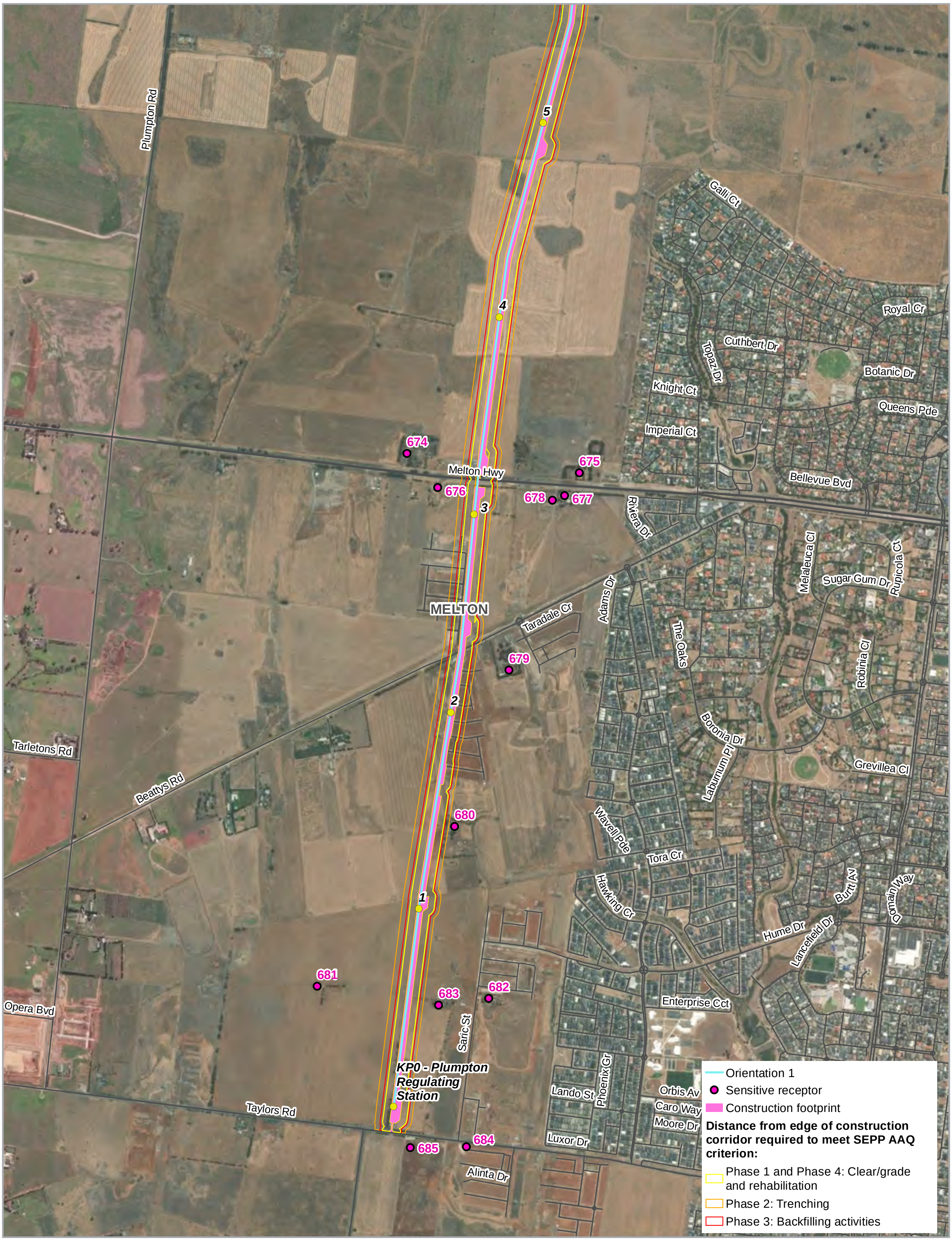


Figure 17 ORIENTATION 4 - Maximum 24 hour PM_{10} construction dust impact – including background

Appendix F – Pipeline construction results displayed on aerial imagery



Paper Size ISO A4

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Meters

N

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

Australian Pipeline Limited
Western Outer Ring Main Gas Project

Construction PM_{10} Dispersion Modelling Results

Project No. 12529997
Revision No. E
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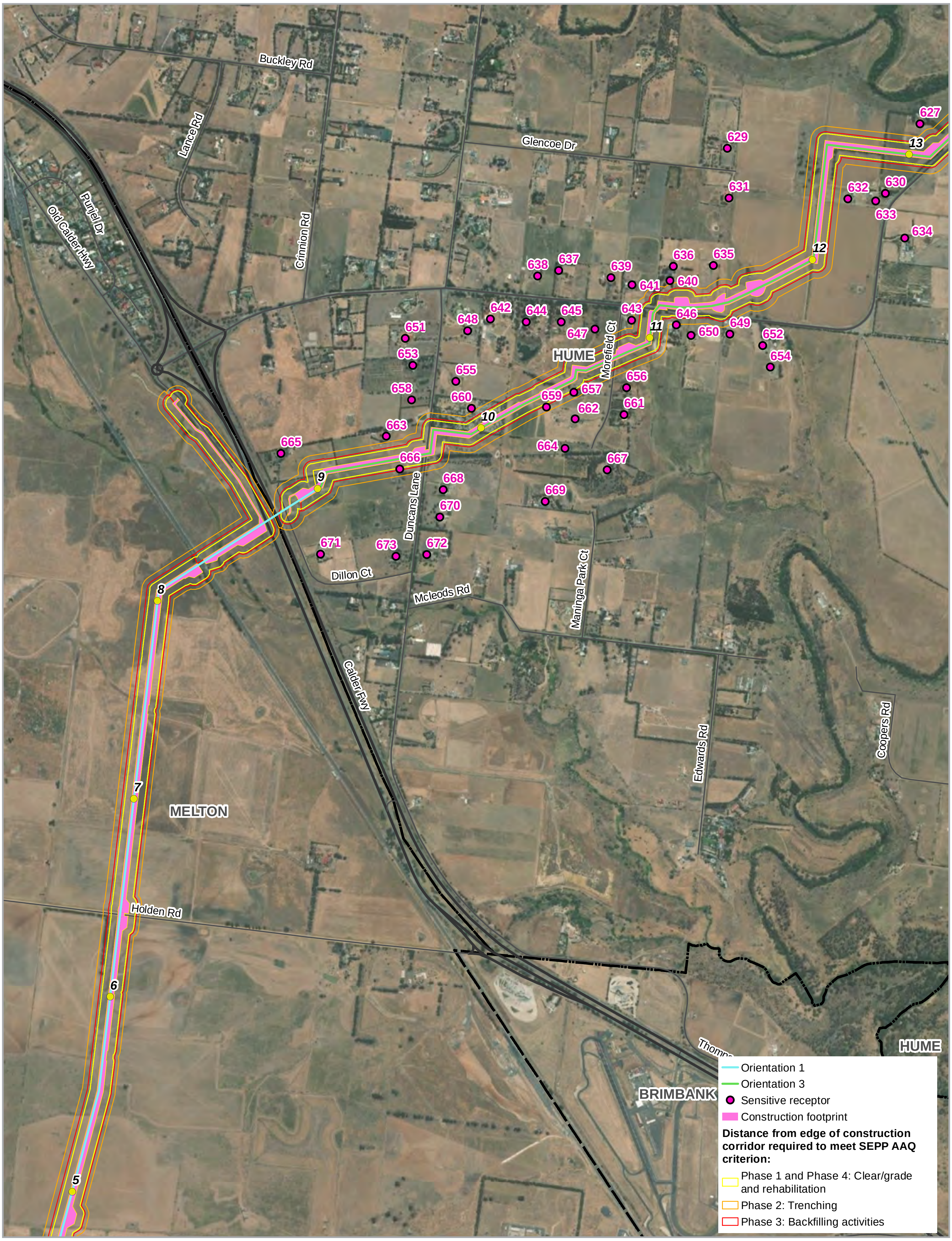
Print date: 12 Mar 2021 - 08:30

Data source: DELWP, VicMap, 2020; APA, Alignment details, 2020; GHD, buffers, 2020. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: kgardner



Paper Size ISO A4

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Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Australian Pipeline Limited
Western Outer Ring Main Gas Project

Construction PM_{10} Dispersion Modelling Results

Project No. 12529997
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Date 12/03/2021

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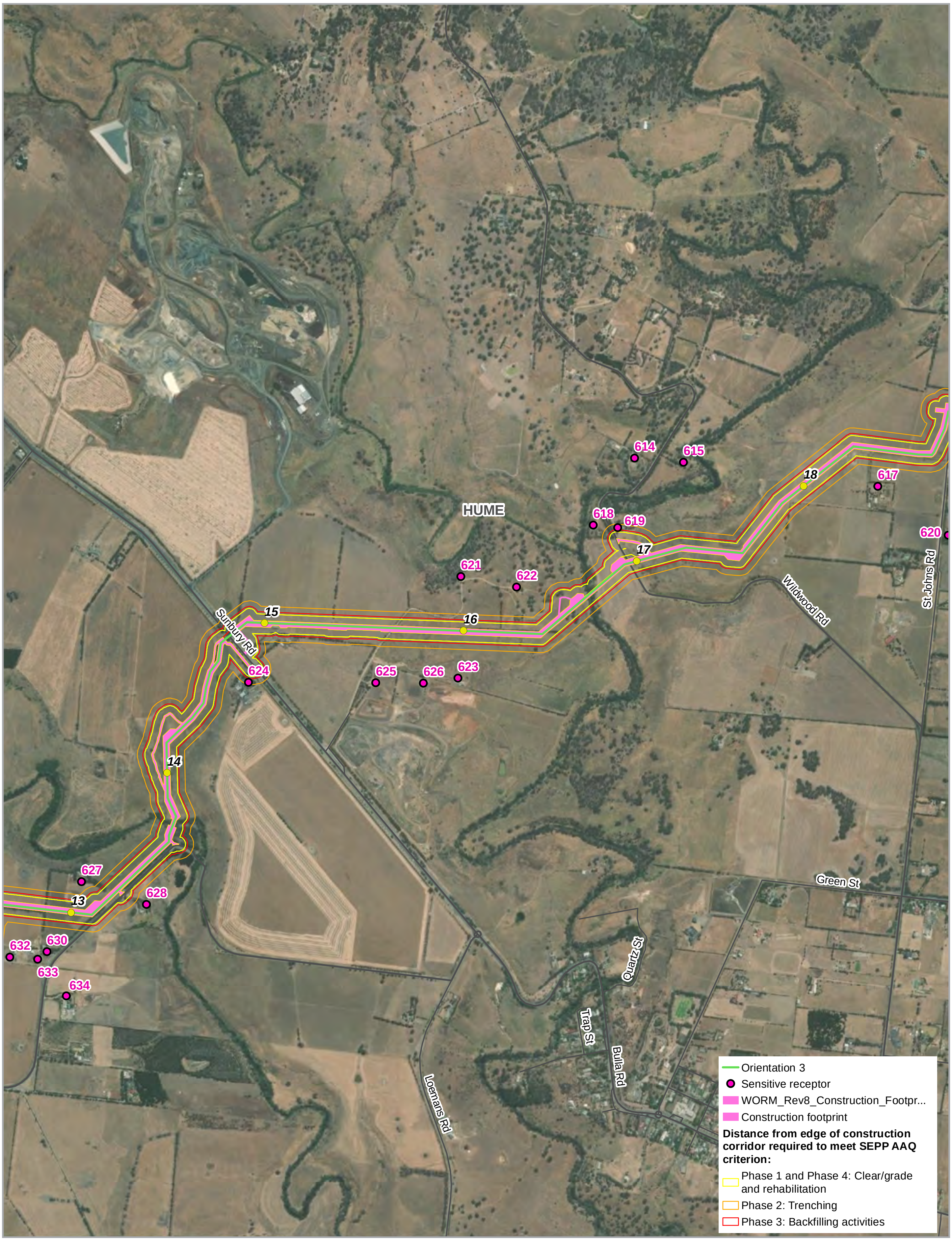
Print date: 12 Mar 2021 - 08:30

Data source: DELWP, VicMap, 2020; APA, Alignment details, 2020; GHD, buffers, 2020. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. Created by: kgardner



Paper Size ISO A4

0 375 750

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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GHD

Australian Pipeline Limited
Western Outer Ring Main Gas Project

Construction PM_{10} Dispersion Modelling Results

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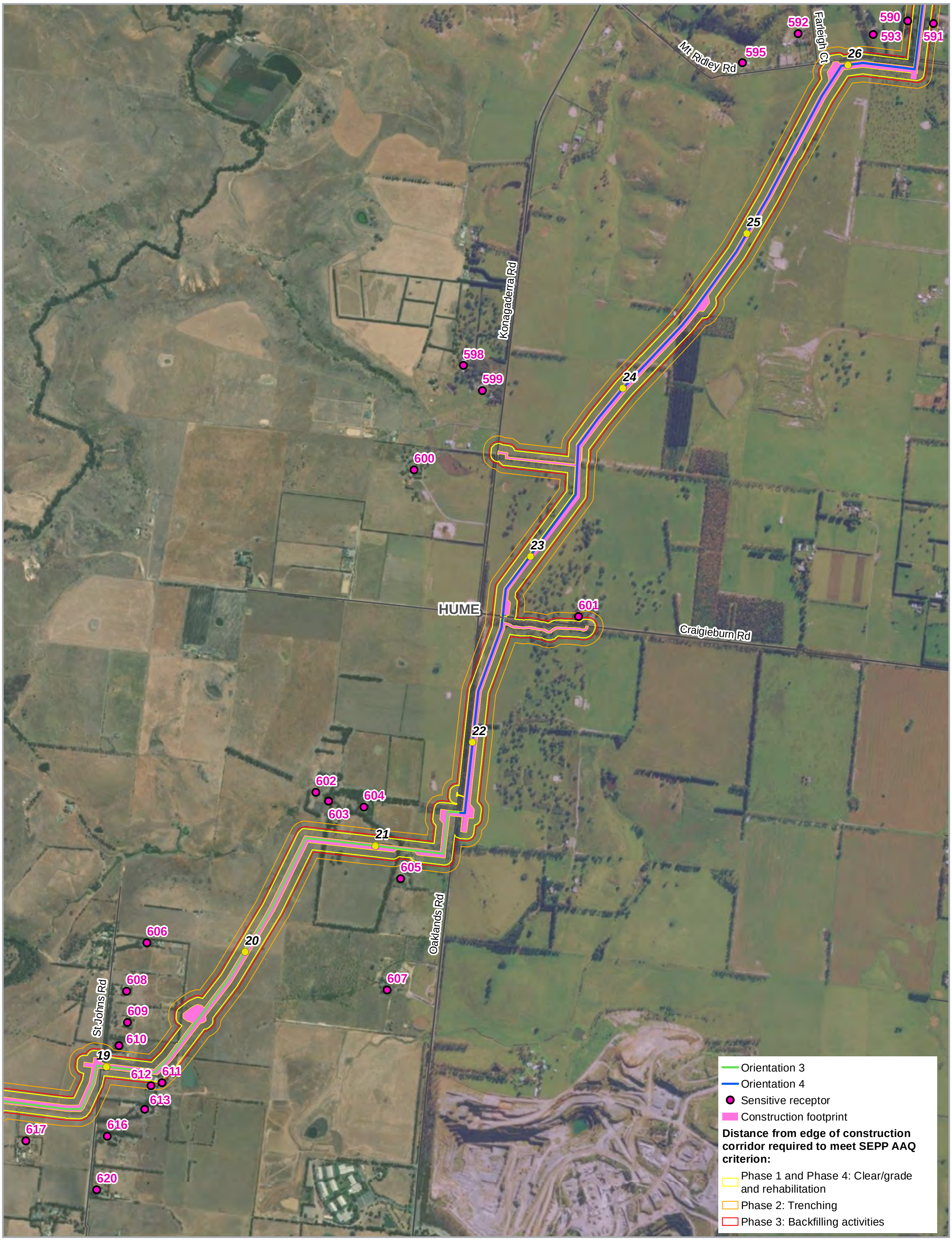

Paper Size ISO A4

0 375 750

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Australian Pipeline Limited
Western Outer Ring Main Gas Project

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Date 12/03/2021

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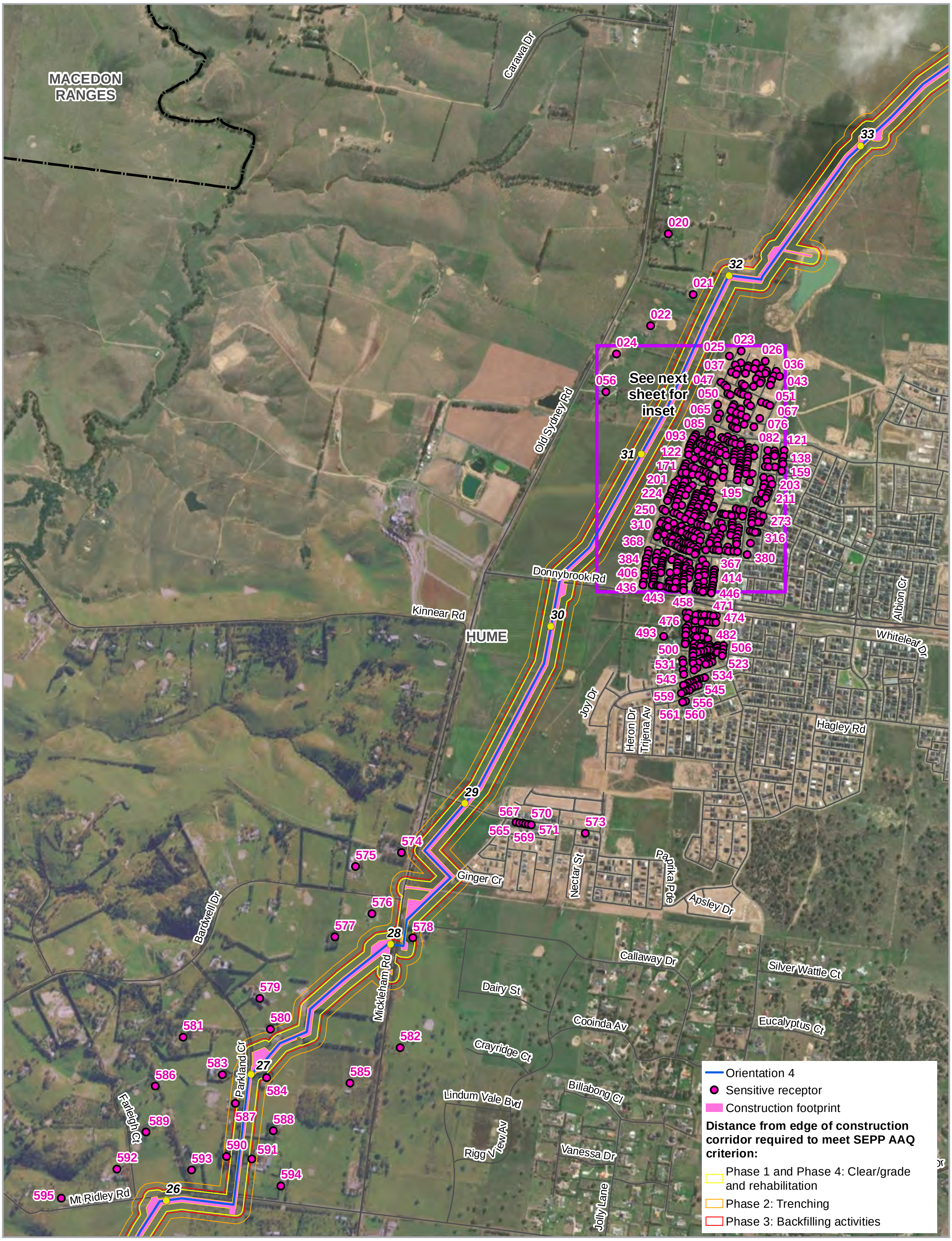

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Western Outer Ring Main Gas Project

Construction PM_{10} Dispersion Modelling Results

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Paper Size ISO A4

0 70 140

Meters

Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Construction PM_{10} Dispersion Modelling Results

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Date 12/03/2021

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Paper Size ISO A4

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Project No. 12529997
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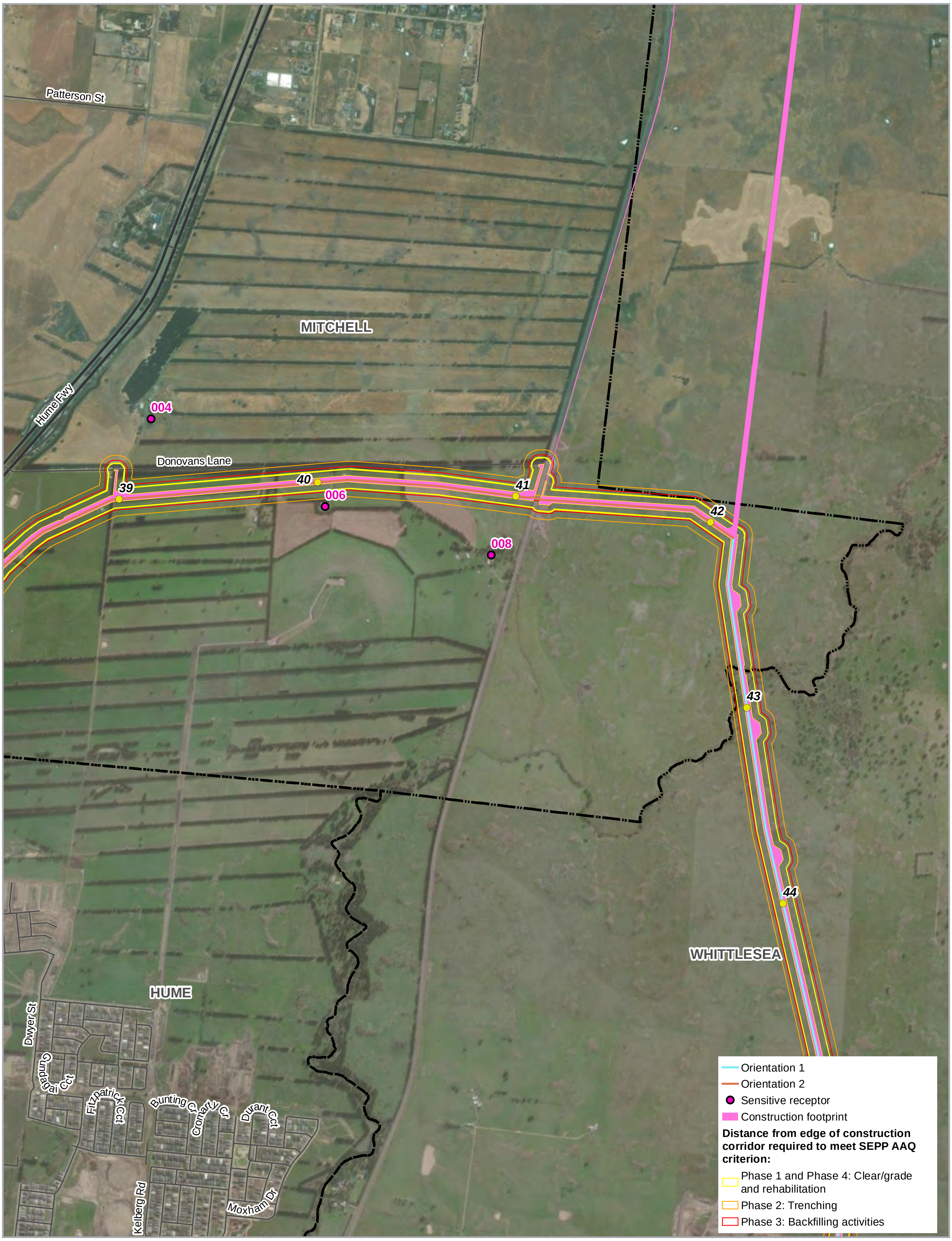

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Map Projection: Transverse Mercator
Horizontal Datum: GDA2020
Grid: GDA2020 MGA Zone 55

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Western Outer Ring Main Gas Project

Construction PM_{10} Dispersion Modelling Results

Project No. 12529997
Revision No. E
Date 12/03/2021

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Construction PM_{10} Dispersion Modelling Results

Project No. 12529997
Revision No. E
Date 12/03/2021

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Print date: 12 Mar 2021 - 08:31

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12529997-95114-522/https://projectsportal.ghd.com/sites/pp17_01/environmentaleffects/ProjectDocs/12529997-REP_Air_Quality_Assessment V2.docx

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
0	S Materia	B Cook	B Cook	M Shaw	M Shaw	15/04/2021

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