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HumeLink

Phase 1 Contamination Assessment

EIS Technical Report 10

HumeLink

Technical Report 10 – Phase 1 Contamination Assessment

Transgrid

May 2023

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Executive Summary

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high-voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley.

The main purpose of this report is to assess the potential soil and contamination impacts from construction and operation of the project to support the environmental assessment of the project in accordance with Division 5.2 of the *Environmental Planning and Assessment Act 1979*. This report comprises a preliminary (also referred to as Phase 1) investigation for potential contamination.

The project footprint plus a one kilometre buffer area known as the contamination study area was assessed for soils and contamination aspects through desktop based study of relevant data, previous consultant reports and the field survey of select sites and properties. The desktop study and site survey generated a list of areas of environmental concern (AECs) and a risk rating associated with the level of ground disturbance the project would produce, as well as the soil and contamination aspects identified.

Construction impacts on soils and contamination

Construction activities, including excavation activities, vegetation clearing, stripping and grubbing, vehicle movement and utility work, would cause soil disturbance. If these activities are not properly managed, the disturbance of contaminated soil have the potential to cause harm to sensitive receivers, including flora and fauna, and human health for the construction workers of the project.

To appropriately assess the potential for contamination impacts during construction of the project, a qualitative contamination assessment has been performed in accordance with guidelines made or approved under the Contamination Land Management (CLM) Act.

A qualitative risk ranking was undertaken with the majority of the AECs evaluated as having low risk rankings; however, several areas were identified as having a moderate risk ranking due to historical and present-day land use and activities. The areas with moderate risk ranking include waste facilities sites, substation sites and areas of disturbed land, uncontrolled fill, stockpiling and dumping. The locations of these areas are shown in figures presented in the report.

Unexpected contamination conditions may be encountered due to previously unknown heterogeneities in the subsurface, soil contamination not previously identified or changes in the project scope. The potential risk associated with unexpected contamination finds have not been assessed as this would be managed in accordance with an unexpected contamination finds protocol during construction.

Based on the potential to encounter contamination in AECs during construction, there is a low risk of groundwater contamination from ground disturbance.

Based on information reviewed, it is unlikely that acid sulfate soils or rock would be encountered during construction. This is because the vast majority of the soils in the project footprint are mapped as low probability of encountering acid sulfate soils, along with the project's elevation and surface geology. Any rock excavations would be comparatively minor in nature and have a low risk of encountering acid sulfate rock.

Areas of soil salinity hazard ranging from very low to very high are present across the contamination study area. Moderate to very high-risk areas are located along the banks of O'Briens Creek and Brungle Creek, to the south of the Crookwell town centre and around the town centre of Yass. These areas are within the project footprint. If not managed properly during earthworks, these soils could have the potential to impact on surface water and/or groundwater, soil erosion, and soil structure. Impacts can include localised degradation in soil structure, salt scolding at the surface, distressed vegetation and increased salt mobilisation through runoff or groundwater.

Soil erosion and the associated sediment transportation is a hazard that could occur as a result of the construction of the project. Off-site transportation of sediments and soils could transport entrained or adsorbed contaminants (if present) and may potentially cause the contamination of sensitive receivers (surface water bodies), including local drainage lines and creeks, the Tumut River, the Goodradigbee River, the Yass River, the Lachlan River, the Wollondilly River and the Tarlo River.

Undisturbed naturally occurring asbestos (NOA) is generally well-bound and does not present a risk to human health. However, the disturbance of NOA could potentially result in the exposure of human receivers such as workers or landowners through the inhalation of airborne asbestos fibres, when disturbed. Given that the majority of the contamination study area contains low to no probability of NOA, the overall risk of exposure to NOA is low. Regions of medium and high potential for NOA within the contamination study area have been identified and mapped. The medium potential regions are present to the south of Red Hill and between Sharps Creek and Wondalga while the high potential regions of NOA are present around Red Hill and Gadara.

Waste materials, including potentially contaminated waste, would be produced during construction through excavation of unsuitable material for the project. Any soil removed during construction would require assessment to determine its suitability for re-use within the project or management and/or disposal as a waste to licenced facilities in accordance with the NSW Waste Classification Guidelines 2014 Parts 1-4, Addendum 2016 and any applicable Resource Recovery Orders and Exemptions under the *Protection of the Environment Operations Act 1997* (POEO Act) . Review of Schedule 1 of the POEO Act indicates that an environment protection license (EPL) will not be required for premises or activity based processes.

Operational impacts on soils and contamination

During operation, there would be minimal soil disturbance associated with general maintenance activities. As such, the operation of the project is unlikely to result in exposure of human and environmental receivers to existing potentially contaminated soil or groundwater.

Residual contamination, if identified during construction and is not sufficiently remediated or managed, could have an impact during operation of the project. The impact is likely to be localised.

During operation, changes to the soil profile, increased hardstand areas and ongoing vegetation removal within the transmission line easement and substation construction/modification could impact long-term salinity compared to pre-development conditions. However, the impact would reach an equilibrium over time based on final landform and therefore any impacts associated with salinity would be minor.

During operation, there would be minimal exposed topsoil within proximity to waterways and, therefore, little or no risk of soil erosion and subsequent transport of sediment into nearby receiving waterways.

Soil erosion and associated sediment transportation may occur because of vehicle use on unsealed access tracks for general maintenance of the transmission lines and any minor excavation for replacement of substation equipment and transmission structures as necessary.

Mitigation measures

The key measures proposed to avoid, manage and/or mitigate impacts to soils and contamination include:

- prepare a Construction Environmental Management Plan (CEMP) prior to construction commencing. The CEMP would identify all reasonably foreseeable risks associated with earthworks/ground disturbance during construction of the project. This would include mitigating the risk of generating soil and water contamination, as well as mitigating any human and ecological health risks.
- Given there is identified areas of naturally occurring asbestos (NOA), a site-specific asbestos management plan (AMP) (as a sub plan to the CEMP) is required under Part 8.4 of the NSW Work Health and Safety Regulation 2017 where there is potential for NOA or other asbestos materials to be encountered (i.e. demolition of older farming buildings and structures). The AMP will include specific protocols for separation, handling, monitoring, validation and clearance of asbestos.

- A project specific Erosion and Sediment Control Plan (ESCP) and Soil and Water Management Plan (SWMP) would be prepared as part of the CEMP prior to construction commencing. The ESCP would provide mitigation measures to minimise the risk of erosion and prevent sediment migration, including management during wet weather events. The SWMP would provide mitigation measures to minimise impacts to soils and surface water due to sediment migration, saline soils and incidental spills.
- Waste management guidance during construction would be incorporated within the CEMP. Spoils generated may be reused onsite following an assessment of the suitability of the material. Excess soils or materials unsuitable for reuse will be removed off-site for disposal following a classification as per the *Waste Classification Guidelines* (NSW EPA, 2014).
- During operation of the project, environmental management would be undertaken in accordance with Transgrid's existing environmental policies and internal environmental management system EMS. This includes management of waste, soil erosion, spills and leaks and other associated operational aspects. All wastes generated from routine maintenance, inspections, site staff and operations would be contained, handled, and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).

With the proposed management measures in place, impacts are expected to be minor to low.

Conclusion

Based on the information reviewed and assessed, the contamination study area is not affected by broad-scale contamination, and the risk of soil and groundwater contamination is generally low. Impacts to soil can be managed through mitigation measures to avoid or mitigate impacts. Most of the contamination study area comprises farmlands, forestry, or native vegetation with minimal areas of potential soil contamination identified. Potential groundwater contamination is also considered low, given the absence of groundwater contamination sources and minimal interaction of the project with groundwater.

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Attachments

Attachment A

Unexpected Contamination Finds Protocol (UCFP) flow chart

Figures

Tables

Abbreviations

Abbreviation or term	Description
ACM	Asbestos Containing Material
AEC	Area of environmental concern
NEPM 2013	National Environment Protection (Assessment of Site Contamination) Measure
Aurecon	Aurecon Australasia Pty Ltd
BTEXN	Benzene, Toluene, Ethylbenzene, Xylene and Naphthalene
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Land Management Act 1997*
COPCs	Contaminants of potential concern
DDT	Dichloro-diphenyl-trichloroethane
DSI	Detailed Site Investigation
EC	electrical conductivity
EHC Act	*Environmentally Hazardous Chemicals Act 1985*
EIS	Environmental Impact Statement
ENM	Excavated natural materials
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPL	Environment Protection Licence
ERA	Environmental Risk Assessment
ESCP	Erosion and Sediment Control Plan
FOGO	Food organics garden organics
kV	Kilovolt
LEP	Local Environmental Plan
mAHD	Metres above the Australian Height Datum
mbgl	Metres below ground level
NOA	Naturally occurring asbestos
NEM	National Electricity Market
OCP	Organochlorine pesticide
OPP	Organophosphate pesticides
PACM	Potential asbestos containing material
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyl
PFAS	Per- and Poly-fluorinated Alkyl Substances
pH	Unit of measurement for acidity and alkalinity
POEO Act	*Protection of the Environment Operations Act 1997*
POEO (General) Regulation	Protection of the Environment Operations (General) Regulation 2022
POEO (Waste) Regulation	Protection of the Environment Operations (Waste) Regulation 2014
PPE	Personal protective equipment
PSI	Preliminary Site Investigation
Resilience and Hazards SEPP	State Environmental Planning Policy (Resilience and Hazards) 2021

Abbreviation or term	Description
SEARs	Planning Secretary's Environmental Assessment Requirements
SWMP	Soil and Water Management Plan
TRH	Total Recoverable Hydrocarbons
UXO	Unexploded Ordnance
VENM	Virgin excavated natural materials
WHS Act	*Work Health and Safety Act 2011*
WHS Regulation	Work Health and Safety Regulation 2017
WRP	Water resource plan
WSP	Water sharing plan

Definitions

Term	Description
Bannaby 500 kV substation	The existing 500 kV substation at Bannaby.
Construction compounds	Main construction compounds proposed for construction of the project. Each main construction compound would accommodate a range of facilities which may include (but not limited to): ■ laydown areas ■ site offices ■ amenities ■ construction support facilities such as vehicle and equipment storage, maintenance sheds, chemical/fuel stores and stockpile areas ■ parking.
CEMP	A document which describes how activities undertaken during the construction phase of development will be managed to avoid or mitigate environmental or nuisance impacts, and how those environmental management requirements will be implemented.
Contamination study area	The project footprint plus a one kilometre buffer.
Easement	A legal right attached to a parcel of land that enables the non-exclusive use of the land by a third party other than the owner. For transmission lines, an easement defines the corridor area where the lines are located and that allows access, construction and maintenance work to take place. The easements for the 500 kV transmission lines would typically be 70 metres wide. However, a few locations would require wider easements up to 110 metres wide at transposition locations and up to 130 metres wide where the new transmission line would parallel the relocated section of Line 51. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets.
Friable asbestos	Friable asbestos means asbestos that when dry, or as the result of a work process, may be crumbled, pulverised or reduced to a powder by hand pressure. Friable asbestos is considered high risk, as it releases asbestos fibres into the air when broken down. When these fibres are breathed in, they cause long-term damage to the lungs which can lead to conditions like asbestosis, mesothelioma and lung cancer.
Future Maragle 500 kV substation	The future Maragle 500/330 kV substation that would be built under the approved Snowy 2.0 Transmission Connection Project, which is subject to separate planning approval (reference SS1-9717, EPBC 2018/836).
Landowners	People who own properties/land.
Project	The CSSI project “HumeLink”, which is the subject of this Environmental Impact Statement. The project involves the construction and operation of high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle.
Project footprint	The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
Proposed Gugaa 500 kV substation	The new 500/330 kV substation proposed near Wagga Wagga.
Proponent	The entity seeking approval for the CSSI application, which for the HumeLink project is New South Wales (NSW) Electricity Networks Operations Pty Ltd (referred to as Transgrid).
Telecommunications hut	The proposed optical repeater telecommunications hut as part of HumeLink, which is required to boost the signal in the Optical Fibre Ground Wire.
Transmission line route	The location of the transmission line structures along the middle of the transmission line easement.
Transmission line structures	Proposed free standing structures to support the transmission lines.

Term	Description
Transgrid	The project is proposed to be undertaken by NSW Electricity Networks Operations Pty Ltd (referred to as Transgrid). Transgrid is the operator and manager of the main high voltage transmission network in NSW and the ACT, and is the Authorised Network Operator for the purpose of an electricity transmission or distribution network under the provisions of the *Electricity Network Assets (Authorised Transactions) Act 2015*.
Wagga 330 kV substation	The existing 330/132 kV substation located in Wagga Wagga.

1 Introduction

1.1 Overview

The Australian energy landscape is transitioning to a greater mix of low-emission renewable energy sources, such as wind and solar. To support this transition, meet our future energy demands and connect Australian communities and businesses to these lower cost energy sources, the national electricity grid needs to evolve.

Transgrid proposes to increase the energy network capacity in southern New South Wales (NSW) through the development of around 360 kilometres of new 500 kilovolt (kV) high voltage transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle. This project is collectively referred to as HumeLink. The project would be located across five Local Government Areas (LGAs) including Wagga Wagga City, Snowy Valleys, Cootamundra-Gundagai Regional, Upper Lachlan Shire and Yass Valley. The location of the project is shown on Figure 1-1.

HumeLink would involve construction of a new substation east of Wagga Wagga as well as connection to existing substations at Wagga Wagga and Bannaby and a future substation at Maragle in the Snowy Mountains (referred to as the future Maragle 500 kV substation). The future Maragle 500 kV substation is subject to a separate major project assessment and approval (reference SSI-9717, EPBC 2018/836).

The project would deliver a cheaper, more reliable and more sustainable grid by increasing the amount of renewable energy that can be delivered across the national electricity grid, helping to transition Australia to a low carbon future. It would achieve this by supporting the transfer of energy from existing renewable generation as well as facilitate development of new renewable generation in the Wagga Wagga and Tumut Renewable Energy Zones (REZs). The project would provide the required support for the network in southern NSW, allowing for the increase in transfer capacity between new renewable generation sources and the State's demand centres of Sydney, Newcastle and Wollongong. The project would also improve the efficiency and reliability of the current energy transfer in this part of the network.

Furthermore, HumeLink would form a key part of the transmission line infrastructure that supports the transfer of energy within the National Electricity Market (NEM) by connecting with other major interconnectors. The NEM incorporates around 40,000 kilometres of transmission lines across Queensland (QLD), NSW, Australian Capital Territory (ACT), Victoria (VIC), South Australia (SA) and Tasmania (TAS).

Construction of the project is targeted to commence in 2024, subject to the required planning and regulatory approvals. Once construction has commenced, the project is estimated to take approximately 2.5 years to build and would become operational by the end of 2026.

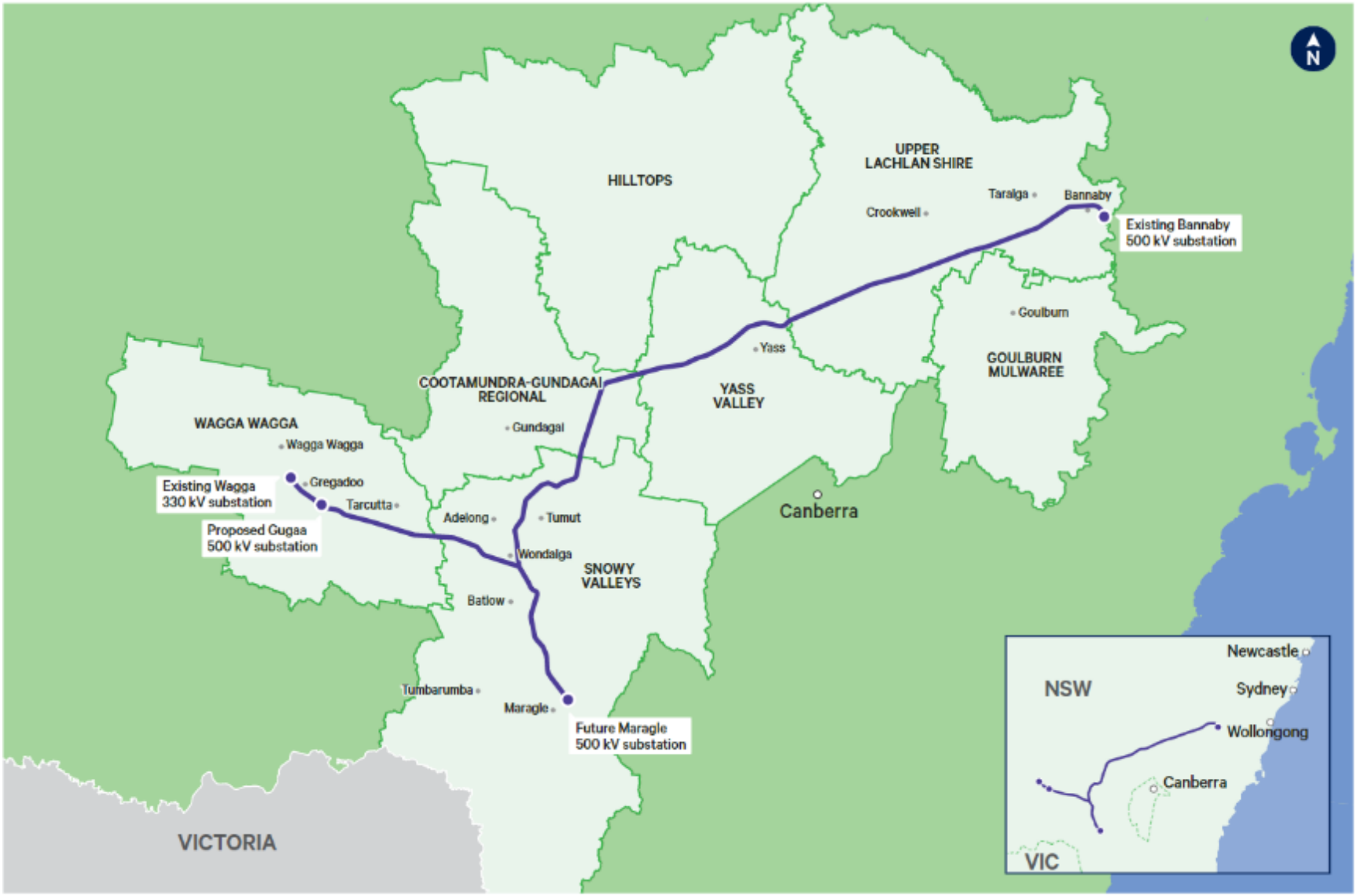
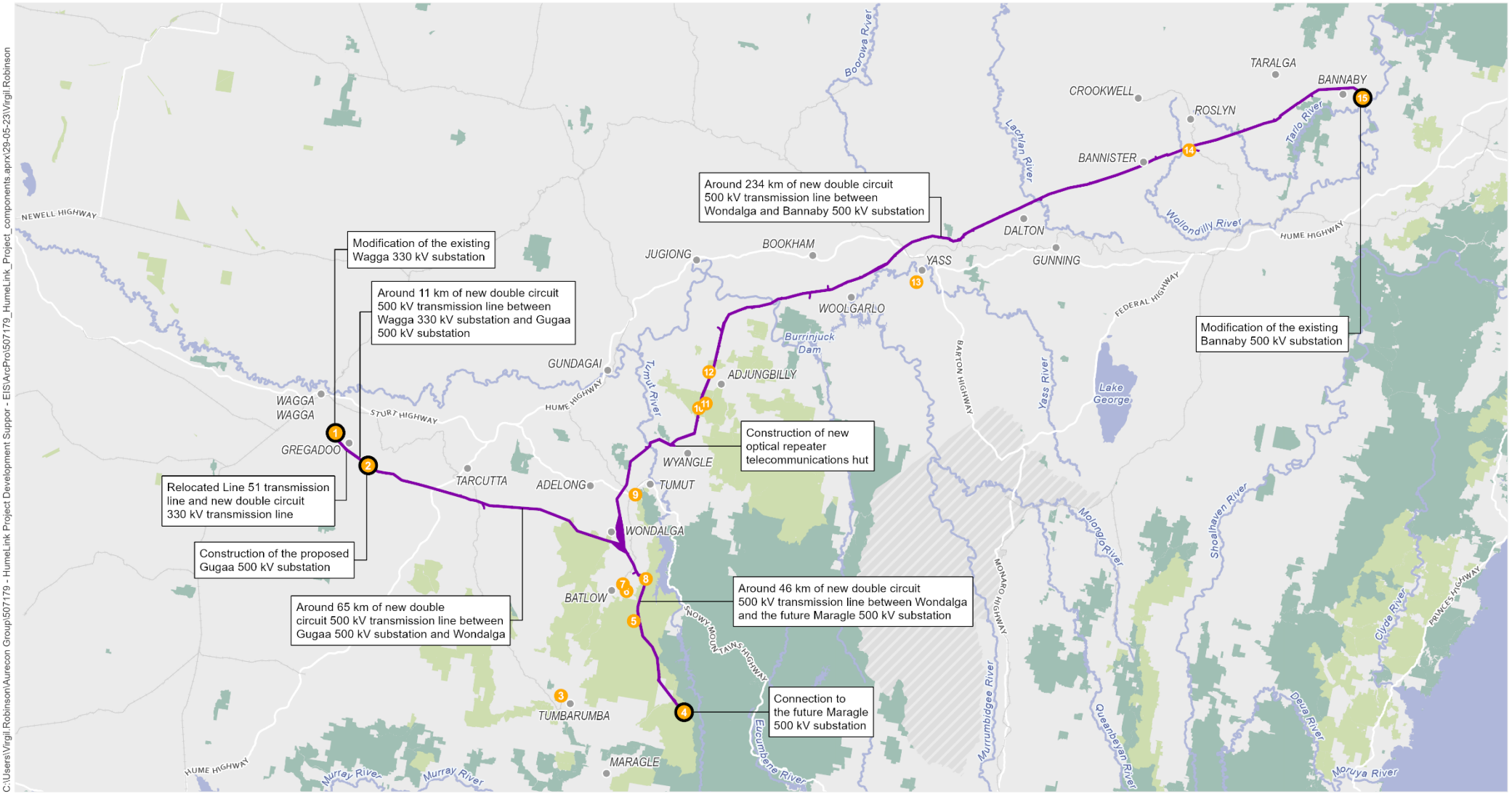


Figure 1-1 Location of the project

1.2 Key components

The project includes the following key components (refer to Figure 1-2):

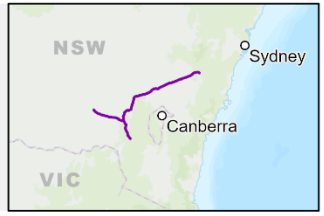
- construction and operation of around 360 kilometres of new double circuit 500 kV transmission lines and associated infrastructure between Wagga Wagga, Bannaby and Maragle
- construction of a new 500/330 kV substation at Gregadoo (Gugaa 500 kV substation) approximately 11 kilometres south-east of the existing Wagga 330/132 kV substation (Wagga 330 kV substation)
- demolition and rebuild of a section of Line 51 (around two kilometres in length) as a double circuit 330 kV transmission line connecting into the Wagga 330 kV substation
- modification of the existing Wagga 330 kV substation and Bannaby 500/330 kV substation (Bannaby 500 kV substation) to accommodate the new transmission line connections
- connection of transmission lines to the future Maragle 500/330 kV substation (Maragle 500 kV substation, approved under the Snowy 2.0 Transmission Connection Project (SSI-9717))
- provision of one optical repeater telecommunications hut and associated connections to existing local electrical infrastructure
- establishment of new and/or upgraded temporary and permanent access tracks
- ancillary work required for construction of the project such as construction compounds, worker accommodation facilities, utility connections and/or relocations, brake and winch sites, and helipad/helicopter support facilities.



Project footprint
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway
Substation location

Construction ancillary facilities

1. Wagga 330 kV substation compound (C01)
2. Gregadoo Road compound (C06)
3. Tumbarumba accommodation facility (AC1)
4. Maragle 500 kV substation compound (C05)
5. Snubba Road compound (C16)
6. Bowmans Lane compound (C15)
7. Memorial Avenue compound (C14)
8. Snubba Road compound (C03)
9. Snowy Mountains Highway compound (C02)
10. Honeysuckle Road compound (C07)
11. Red Hill Road compound (C08)
12. Adjungbilly Road compound (C09)
13. Yass substation compound (C10)
14. Woodhouselee Road compound (C11)
15. Bannaby 500 kV substation compound (C12)



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000
0 20 40km

Projection: GDA 1994 MGA Zone 55

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HumeLink **Soil and Contamination**

FIGURE 1-2: Key components of the project

1.3 Purpose and scope of this report

The main purpose of this report is to assess the potential soil and contamination impacts from construction and operation of the project to support the environmental assessment of the project in accordance with Division 5.2 of the *Environmental Planning and Assessment Act 1979*. This report comprises a preliminary (also referred to as Phase 1) investigation for potential contamination.

1.4 Secretary's environmental assessment requirements

The project specific Planning Secretary's Environmental Assessment Requirements (SEARs) were issued for the project on 14 March 2022. The SEARs provide the technical requirements for the impact assessment of each potential key issue, including the desired performance outcome, requirement and current guidelines.

The assessment has been prepared to fulfil the requirements of the SEARs, which are outlined in Table 1-1.

Table 1-1 Relevant SEARs addressed in this report

Key issues	SEARs to be addressed by the study	Where addressed in this report
Water and soils		
	A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom, 2004a).	Section 6.3.1, Section 7.2.4 and Table 9-1 outline the erosion control measures that would be implemented to mitigate any impacts in accordance with *Managing Urban Stormwater: Soils & Construction* (Landcom, 2004a).
Land		
	An assessment of impacts of the project on soils and land capability of the site and surrounds.	Chapter 6 and Chapter 7 assesses potential impacts of the project on soils and potential contamination. Refer to *Technical Report 4 - Agricultural Impact Assessment* for the assessment of potential impacts on land capability.
	An assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos in the vicinity of the site).	Section 5.2.5 outlines an assessment of the risk of soil contamination and disturbance of land (including naturally occurring asbestos in the vicinity of the site).Section 5.6 to Section 5.10 outlines all other types of soil contamination.
Waste		
	Identify, quantify and classify the likely waste streams to be generated during construction and operation, and describe the measures to be implemented to manage, reuse, recycle and safely dispose of this waste.	Section 6.3.4 outlines the need for waste classification and the management of contaminated material as a waste. Further details around project waste management are included in Chapter 9 of this report in addition to Chapter 23 of the EIS.

1.5 Structure of this report

The structure and content of this report is as follows:

- Chapter 1 – Introduction: outlines the background and need for the project, and the purpose of this report.
- Chapter 2 – Project description summary: provides an overview of the construction and operation of the project.
- Chapter 3 – Legislative and policy context: provides an outline of the key legislative requirements and policy guidelines relating to the project.
- Chapter 4 – Methodology: provides an outline of the methodology used for the preparation of this report.
- Chapter 5 – Existing environment: describes the existing environment with reference to the potential for contaminated land and groundwater.

- Chapter 6 – Assessment of construction impacts: describes the potential construction impacts associated with the project.
- Chapter 7 – Assessment of operational impacts: describes the potential operational impacts associated with the project.
- Chapter 8 – Cumulative impacts: outlines the potential cumulative impacts with respect to other known developments within the vicinity of the project.
- Chapter 9 – Management of impacts: outlines the proposed mitigation measures for the project.
- Chapter 10 – Conclusion: provides a conclusion of the potential impacts of the project with reference to the potential for contaminated land and groundwater.
- Chapter 11 – References: identifies the key information sources (including reports and documents) used to generate this report.

1.6 Key project terms

The assessment in this report uses the following key project terms:

- Project footprint - The area that has been assumed for the purpose of this EIS to be directly affected by the construction and operation of the project. It includes the indicative location of project infrastructure, the area that would be directly disturbed during construction and any easement required during operation.
- Contamination study area - The project footprint plus a one kilometre buffer.

2 Project description summary

The project description in this chapter is based on a concept design and indicative construction methodology for the project. The design and construction methodology would continue to be refined and confirmed during detailed design and construction planning by the construction contractors. Further details on the project are provided in Chapters 3 and 4 of the EIS.

2.1 Summary of key components of the project

Key components of the project are summarised in Table 2-1.

Table 2-1 Summary of key components of the project

Component	Description
Transmission lines and supporting infrastructure	
Transmission lines and structures	The project includes the construction of new 500 kV transmission line sections between: ■ Wagga 330 kV substation and Gugaa 500 kV substation (approximately 11 km) ■ Gugaa 500 kV substation and Wondalga (approximately 65 km) ■ Wondalga and Maragle 500 kV substation (approximately 46 km) ■ Wondalga and Bannaby 500 kV substation (approximately 234 km). The transmission line section between the Wagga 330 kV substation and proposed Gugaa 500 kV substation would operate at 330 kV under HumeLink. The project also includes the rebuild of approximately 2 km of Line 51 as a new 330 kV transmission line between the Wagga 330 kV substation and around Ivydale Road, Gregadoo. This would be adjacent to the new transmission line between the existing Wagga 330 kV and proposed Gugaa 500 kV substations. The 500 kV transmission lines would be supported on a series of free-standing steel lattice structures that would range between around 50 m up to a maximum of 76 m in height and generally spaced between 300 to 600 m apart. The typical transmission line structure height would be around 60 m. Earth wire and communications cables would be co-located on the transmission line structures. The 330 kV structures for the rebuild of Line 51 would range between 24 m and 50 m in height and have a typical height of 40 m. Indicative configurations of transmission line structures that may be used as part of the project are shown in Figure 2-1. The type and arrangement of the structures would be refined during detailed design. The footings of each structure would require an area of 300 m^2 up to 450 m^2, depending on ground conditions and the proposed structure type. Additional disturbance at each structure site may be required to facilitate structure assembly and stringing.
Transmission line easements	The easements for the 500 kV transmission lines are typically 70 m wide. However, a number of locations may require wider easements of up to 110 m wide at transposition locations[1] and up to 130 m wide where the new transmission line would parallel the relocated section of Line 51. The easement provides a right of access to construct, maintain and operate the transmission line and other operational assets. The easement also generally identifies the zone of initial vegetation clearance and ongoing vegetation management to ensure safe electrical clearances during the operation of the lines. Vegetation management beyond the easement may also occur where nearby trees have the potential to fall and breach safety clearances.

[1] Transposition is the periodic swapping of positions of the conductors of a transmission line in order to improve transmission reliability.

Component	Description
Telecommunications huts	Telecommunications huts, which contain optical repeaters, would be required to boost the signal in the optical fibre ground wire (OPGW). One telecommunications hut would be required for the project. The telecommunications hut would be located adjacent to existing transmission line structures. Cables would be installed between the transmission line structure and the local power supply. The telecommunications hut would be surrounded by a security fence. A new easement would be established for the telecommunications hut power connection. The project also involves a telecommunications connection of OPGW between two proposed transmission line structures and the future Rye Park Wind Farm substation (SSD-6693). This removes the need for an additional telecommunications hut in this area of the project.
Substation activities	
Construction of the proposed Gugaa 500 kV substation	A new 500/330 kV substation would be constructed at Gregadoo, about 11 km south-east of the Wagga 330 kV substation. The substation would include seven new 500/330 kV transformers and three 500 kV reactors. The proposed Gugaa 500 kV substation is expected to occupy an area of approximately 22 hectares.
Modification of the existing Bannaby 500 kV substation	The existing Bannaby 500 kV substation on Hanworth Road, Bannaby would be expanded to accommodate connections for new 500 kV transmission line circuits. The modification would include changes to the busbars, line bays, bench and associated earthworks, steelwork, drainage, external fence, internal/external substation roads, secondary containment dams, sediment containment dams, cabling, and secondary systems. All of the work would be restricted to the existing substation property.
Modification of the existing Wagga 330 kV substation	The existing Wagga 330 kV substation on Ashfords Road, Gregadoo would be reconfigured to accommodate new bays for two new 500 kV transmission line circuits within the existing substation property. This would include modifications to the busbars, line bays, existing line connections, bench and associated earthworks, relocation of existing high voltage equipment, drainage, external fence, internal substation roads, steelwork, cabling, and secondary systems.
Connection to the future Maragle 500 kV substation	The project would connect to the future Maragle 500 kV substation approved under the Snowy 2.0 Transmission Connection Project (SS1-9717). Construction of the Maragle substation is proposed to be undertaken between 2023 and 2026. Further detail on the Snowy 2.0 Transmission Connection project is available at the Department of Planning and Environment's Major Projects website: www.planningportal.nsw.gov.au/major-projects/project/10591.
Ancillary facilities	
Access tracks	Access to the transmission line structures and the substations would be required during construction and operation. Wherever possible, existing roads, tracks and other existing disturbed areas would be used to minimise vegetation clearing or disturbance. Upgrades to existing access tracks may be required. In areas where there are no existing roads or tracks, suitable access would be constructed. This may include waterway crossings.
Construction compounds	Construction compounds would be required during construction to support staging and equipment laydown, concrete batching, temporary storage of materials, plant and equipment and worker parking required to construct the various elements of the project. Fourteen potential construction compound locations have been identified. The proposed use of the construction compounds and their proposed boundaries/layout would be refined as the project design develops in consultation with relevant stakeholders and the construction contractors.
Worker accommodation facility	Existing accommodation facilities within towns adjacent to the project would provide temporary accommodation for the majority of the construction workers. However, a potential shortage in accommodation has been identified close to the project footprint. A potential option to provide additional temporary worker accommodation during the construction period is the establishment of a temporary worker accommodation facility at the corner of Courabyra Road and Alfred Street, Tumbarumba to accommodate about 200 construction workers. The worker accommodation facility would consist of demountable cabins and would be connected to existing utilities. All required amenities for the accommodation facility would be provided including services and worker parking for light and heavy vehicles. However, the ultimate delivery of the project may include multiple temporary worker accommodation facilities in various forms, which would be outlined in the Worker Accommodation Strategy for the project. The strategy will be developed in consultation with councils, and other relevant stakeholders. Any new or changed worker accommodation facility would be subject to additional environmental assessment, as required.

Component	Description
Helipad/helicopter facilities	To facilitate construction of the project, helicopters may be used to deliver materials/equipment and transfer personnel to construction areas particularly within high alpine regions. To enable helicopters to operate safely and allow easy access to the site, a helicopter landing pad would be required. The helipad is expected to occupy an area of around 30 m by 30 m and would be remediated after construction. These areas would typically be located on existing disturbed land not subject to inundation and a reasonable distance from waterways, sensitive receivers and drainage lines. Eight locations have been identified and assessed as potential helipad locations. The exact locations to be used would be confirmed during detailed design by the construction contractors. In addition to this, the existing facilities at the Wagga Wagga Airport, and Tumut Airport may be used.
Utility connections, adjustments and protection	The project would require utility connections, adjustments and protection. Such works include interfaces with other transmission lines and connections to existing services for temporary facilities. Potential impacts to existing services and utilities would be confirmed during detailed design and any proposed relocation and/or protection works would be determined in consultation with the relevant asset owners.

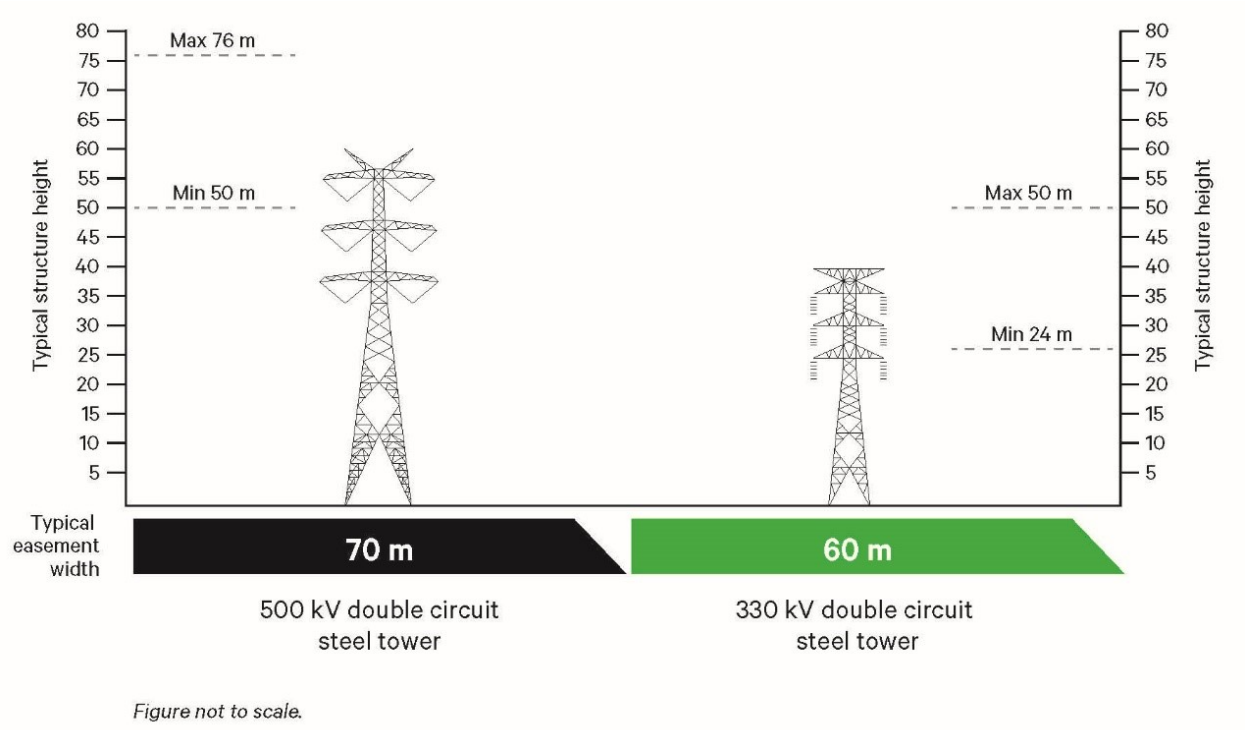


Figure 2-1 Indicative transmission line structures

2.2 Construction of the project

2.2.1 Construction activities

Key construction activities would generally include (but are not limited to):

- site establishment work, such as:
  - clearing of vegetation and topsoil
  - establishment of construction compounds and helipad/helicopter facilities
  - utility relocations and/or adjustments
  - construction of new access tracks and waterway crossings and/or upgrade of existing access tracks to transmission line structures
  - road improvement work
  - establishment of environmental management measures and security fencing
  - construction of temporary worker accommodation
- construction of the transmission lines, including:
  - earthworks and establishment of construction benches and brake and winch sites for each transmission line structure
  - construction of footings and foundation work for the new transmission line structures including boring and/or excavation, steel fabrication works and concrete pours
  - erection of the new transmission line structures
  - stringing of conductors, overhead earth wires and OPGW
  - installation of associated transmission line structure fittings inclusive of all earthing below ground level
- relocation of a section of Line 51, including:
  - demolition of the existing section of Line 51
  - erection of new transmission line structures for the rebuild of Line 51 in a new location
  - stringing of conductors, overhead earth wires and OPGW
  - installation of associated transmission line structure fittings inclusive of all earthing below ground level
- construction of the proposed Gugaa 500 kV substation, including:
  - bulk earthworks to form the substation bench, access roads, drainage and oil containment structures
  - installation of concrete foundations, bund walls, fire walls, noise walls and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment work and associated concrete pits, pipes and tanks including excavation
  - installation of new ancillary and equipment control buildings
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - erection of the substation site boundary security fencing, including site access gates
  - connection of the proposed transmission lines to the substation

- modification of the existing Wagga 330 kV substation to enable the proposed connection and operation of the new transmission lines, including:
  - demolition and removal of redundant electrical equipment, fencing and cabling
  - bulk earthworks to form the extended substation bench and modified drainage structures
  - installation of concrete foundations and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of electrical conduits, electrical trenches, and modified site stormwater drainage including excavation
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - installation of fencing, lighting and other security features
  - testing and commissioning
  - connection of the proposed transmission lines to the substation
- modification of the existing Bannaby 500 kV substation to enable the proposed connection and operation of the new transmission lines, including:
  - bulk earthworks to form the extended substation bench, new access road, modified stormwater drainage, modified oil containment and modified sediment control structures
  - installation of concrete foundations, retaining walls, bund walls, fire walls and kerbs including excavation
  - installation of reinforced concrete and piled foundations for the electrical equipment and associated steel support structures
  - erection of galvanised steel structures to support electrical equipment
  - installation of electrical equipment on foundations and/or steel support structures
  - installation of electrical conduits, electrical trenches, site stormwater drainage, oil containment works and associated concrete pits, pipes and tanks including excavation
  - installation of conductors, cabling, wiring, electrical panels and electrical equipment
  - installation of fencing, lighting and other security features
  - demolish redundant fencing including footings and kerbs
  - testing and commissioning
  - connection of the proposed transmission lines to the substation
- connection of the proposed transmission lines to the future Maragle 500 kV substation, including:
  - stringing conductors between transmission line structures and the future Maragle 500 kV substation gantry (including overhead earth wire (OHEW) and OPGW)
  - installing droppers from the future substation gantry to the switchgear
- construction of the telecommunications hut, including:
  - bulk earthworks to form the pad for the hut
  - excavation and preparation for concrete foundations
  - installation of reinforced concrete and piled foundations
  - excavation and installation of electrical equipment conduits, trenches and general site drainage work

- installation of the building, site wiring and electrical equipment
- installation of security fencing and site access gates

- installation of buried cabling from the 500 kV transmission line structures to Rye Park Wind Farm substation
- testing and commissioning of new electrical infrastructure
- demobilisation and rehabilitation of areas disturbed by construction activities.

A number of activities are expected to commence in accordance with the project conditions of approval before the key construction activities outlined above. These activities are considered pre-construction minor work and would comprise low impact activities that would begin after planning approval but prior to approval of the Construction Environmental Management Plan.

2.2.2 Construction program

Construction of the project is targeted to commence in 2024 and is estimated to take about 2.5 years to complete. The project is expected to be fully operational by the end of 2026 (refer to Figure 2-2).

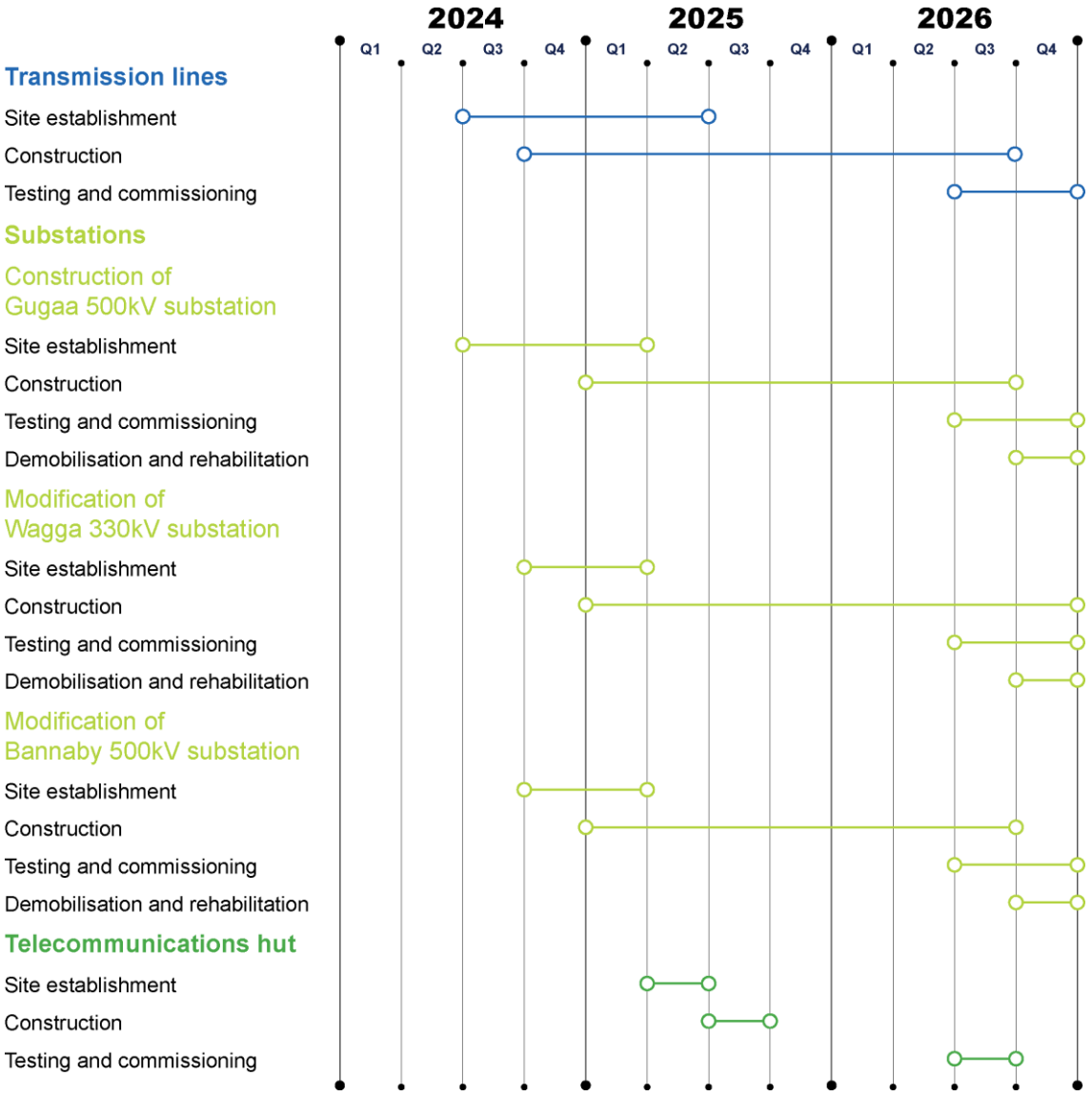


Figure 2-2 HumeLink indicative construction program

2.2.2.1 Indicative duration of construction activities

Construction at each transmission line structure would be intermittent and construction activities would not occur for the full duration at any one location. Durations of any particular construction activity, and inactive/respite periods, may vary for a number of reasons including (but not limited to):

- multiple work fronts
- resource and engineering constraints
- work sequencing and location.

Figure 2-3 presents an indicative duration of construction activities associated with an individual transmission line structure.

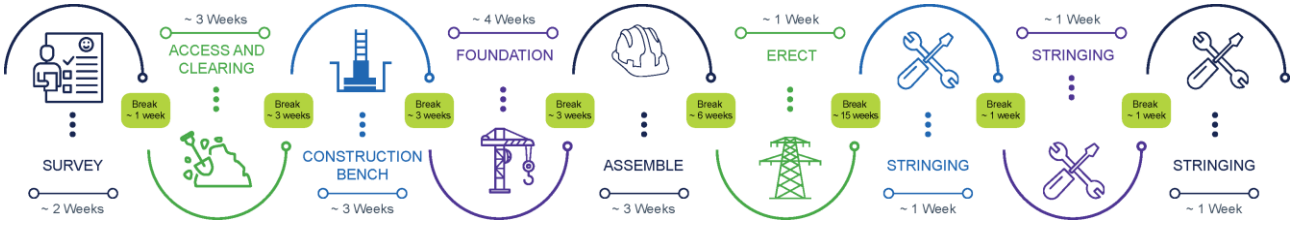


Figure 2-3 Indicative duration and sequence of construction activities for transmission line structures

Construction of the proposed Gugaa 500 kV substation could take up to 2.5 years.

2.2.3 Construction hours

It is expected that construction activities would largely be undertaken during standard construction hours. However, there would be times when working outside of standard construction hours would be required (as defined by the *Interim Construction Noise Guideline* (DECC, 2009)), subject to approval. As the details of construction methodology and project needs are developed, these hours will be refined for certain activities.

Where extended hours are proposed for activities in proximity to sensitive receivers, additional measures would be implemented and the work would be managed through an out-of-hours work protocol.

A series of work outside the standard construction hours is anticipated to include (but is not limited to) the following:

- transmission line construction at crossings of a main road or railway as these locations are expected to have restricted construction hours requiring some night work for activities such as conductor stringing over the crossing(s)
- work where a road occupancy licence (or similar) is required, depending on licence conditions
- transmission line cutover and commissioning
- the delivery of equipment or materials outside standard hours requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- limited substation assembly work (eg oil filling of the transformers)
- connection of the new assets to existing assets under outage conditions (eg modification and/or connection work at Bannaby 500 kV substation, Wagga 330 kV substation and Maragle 500 kV substation), which is likely to require longer working hours
- emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- work timed to correlate with system planning outages
- situations where agreement is reached with affected sensitive receivers
- activities that do not generate noise in excess of the applicable noise management level at any sensitive receiver.

2.2.4 Construction plant and equipment

An indicative list of construction plant and equipment likely to be required during construction is provided below.

- air compressors
- backhoe
- bobcat
- bulldozers
- concrete agitator
- concrete pump
- cranes (various sizes up to 400 tonnes)
- crawler crane with grab attachments
- drill and blast units and associated support plant/equipment
- drones
- dumper trucks
- elevated working platforms
- excavators (various sizes)
- flatbed Hiab trucks
- fuel trucks
- generators
- graders
- helicopter and associated support plant/equipment
- mulchers
- piling rig
- pneumatic jackhammers
- rigid tippers
- rollers (10-15 and 12-15 tonnes)
- semi-trailers
- tilt tray trucks
- trenchers
- transport trucks
- watercarts
- winches.

2.2.5 Construction traffic

Construction vehicle movements would comprise vehicles transporting equipment, waste, materials and spoil, as well as workers' vehicles. A larger number of heavy vehicles would be required during the main civil construction work associated with the substations. Non-standard or oversized loads would also be required for the substation work (eg for transformer transport) and transportation of transmission line structure materials and conductors.

Hume Highway, Sturt Highway, Snowy Mountains Highway, Batlow Road and Gocup Road are the main national and state roads proposed to provide access to the project footprint. These roads would be supported by regional and local roads throughout the Local Government Areas (LGAs) of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional and Upper Lachlan Shire that connect to the project footprint.

2.2.6 Construction workers

The construction worker numbers would vary depending on the stage of construction and associated activities. During peak construction activities, the project could employ up to 1,200 full time equivalent construction workers across multiple work fronts. It is expected that the maximum number of construction workers at any one location would not exceed 200.

2.2.7 Testing and commissioning

Prior to energisation of the infrastructure, a series of pre-commissioning activities would be conducted. This would include testing the new transmission lines and substation earthing, primary and secondary equipment.

2.2.8 Demobilisation and rehabilitation

Demobilisation and site rehabilitation would be undertaken progressively throughout the project footprint and would include the following typical activities:

- demobilisation of construction compounds and worker accommodation facility
- removal of materials, waste and redundant structures not required during operation of the project
- removal of temporary fencing and environmental controls.

2.3 Operation and maintenance of the project

The design life of the project is 50 years, which can be extended to more than 70 years for some assets.

The substations and transmission lines would be inspected by field staff and contractors on a regular basis, with other operational activities occurring in the event of an emergency (as required). The project would require about five workers (in addition to Transgrid's existing workers) during operation for ongoing maintenance activities. Likely maintenance activities would include:

- regular inspection (ground and aerial) and maintenance of electrical equipment
- general building, asset protection zone and access road/track
- vegetation clearing/trimming within the easement
- fire detection system inspection and maintenance
- stormwater drainage systems maintenance.

It is expected that these activities would only require light vehicles and/or small to medium plant (depending on the work required).

3 Legislative and policy context

This section discusses the key legislation, policies and guidelines relevant to soil and contamination considerations for the project. Table 3-1 outlines the legislation and policy context regarding soil and contamination, including guidance documents.

Table 3-1 Legislation, policy and guidelines

Legislation/Policy/Guidelines	Brief description and intent	Relevance
Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act provides a framework for environmental planning and assessment in NSW. The project is classified as Critical State Significant Infrastructure (CSSI) in accordance with Division 5.2, Part 5 of the EP&A Act and requires approval from the NSW Minister of Planning (or their delegate).	In accordance with Chapter 5.16 of the EP&A Act, the SEARs were issued for the project on 14 March 2022 with matters to be addressed in the project Environmental Impact Statement (EIS). The SEARs required that the project consider potential impacts to soils, land and waste associated with construction and operation of the project. The SEARs relevant to this assessment are included in Section 1.4.
Contaminated Land Management Act 1997 (CLM Act)	The general objective of the CLM Act is to establish a process for investigating and (where appropriate) remediating land that the NSW Environment Protection Authority (NSW EPA) considers to be contaminated significantly enough to require regulation. Several clauses within the Act relate to accountabilities for the management of contaminated land. These include clause 6 (responsibility for contamination of land) and clause 60 (duty to report contamination to the NSW EPA).	The project may disturb contaminated land during construction and remedial actions may be required. The process for investigation and remediation of land needs to be in accordance with the intent of the Act. These clauses would be adhered to during construction and operation of the project.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act is the key piece of environment protection legislation administered by the NSW EPA. The objects of this Act include to protect, restore and enhance the quality of the environment in NSW, having regard to the need to maintain ecologically sustainable development. Under Part 5.7 of the POEO Act, the NSW EPA must be notified of any pollution incidents that cause or threaten material harm to the environment.	Construction of the project would produce spoil and waste. An Environment Protection Licence (EPL) is required for scheduled activities under Schedule 1 of the POEO Act, which include premises-based activities such as chemical production, chemical storage and electricity generation. The project does not involve scheduled activities listed in Schedule 1 of the POEO Act and therefore an EPL is not expected to be required.
Environmentally Hazardous Chemicals Act 1985 (EHC Act)	Under the EHC Act, a licence is required to carry out a prescribed activity with respect to an environmentally hazardous chemical or a declared chemical waste. The activity must also be carried out in accordance with the relevant chemical control order. Substances that have been declared under this Act include dioxin contaminated waste materials and polychlorinated biphenyl (PCB) wastes.	Construction of the project may disturb hazardous chemicals and remedial actions may be required. Construction impacts are detailed in Chapter 6.

Legislation/Policy/Guidelines	Brief description and intent	Relevance
Protection of the Environment Operations (General) Regulation 2022 (POEO (General) Regulation)	The POEO (General) Regulation provides for the administration of Environmental Protection Licences (EPLs) and establishes the method of calculating licence fees, including load-based licence fees, and environmental protection notice fees.	The project does not involve schedule activities listed in Schedule 1 of the POEO Act and therefore an EPL is not expected to be required.
Protection of the Environment Operations (Waste) Regulation 2014 (POEO (Waste) Regulation)	The POEO (Waste) Regulation allows the NSW EPA to protect human health and the environment and provides a platform for a modern and fair waste industry. It includes strict thresholds for EPLs and outlines the waste levy system. Clause 93 imposes the requirements for resource recovery orders and exemptions in NSW.	The project would generate excavated natural materials (ENM), virgin excavated natural materials (VENM) and contaminated soils as spoil through excavation. The methodology and management of wastes would be in accordance with the Regulation. Resource recovery exemptions and orders are issued under clause 93 and are relevant for spoil reuse for the project.
Work Health and Safety Act 2011 (WHS Act) Work Health and Safety Regulation 2017 (WHS Regulation)	The WHS Act and Regulation (NSW) provides a framework to protect the health, safety and welfare of all workers and others in relation to Commonwealth and NSW workplaces and work activities. The WHS Act and Regulation set out specific requirements for particular hazards and risks, such as noise, machinery, and manual handling.	Protection of health and safety would be achieved through safety in design and the effective management of contamination risks. These have been considered as part of the mitigation measures and remedial actions for the project.
State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP)	The Resilience and Hazards SEPP aims to promote the remediation of contaminated land for the purpose of reducing the risk of harm to human health or any other aspect of the environment. Chapter 4 specifies the consent requirements for remediation activities. Remediation work is distinguished under two categories: ■ Category 1 remediation work: work needing consent (clause 4.8) ■ Category 2 remediation work: work not needing consent (clause 4.11).	Appropriate measures would be put in place during construction should contamination be identified, and all spoil would be waste classified prior to disposal. Any remediation of land required as part of the project due to contamination, would adhere to Chapter 4 of the SEPP, including notifications to consent authorities.
Guidance documents relevant to acid sulfate soils: ■ *Acid Sulfate Soils Manual* (Acid Sulfate Soils Management Advisory Committee, 1998). ■ *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soils Management Advisory Committee, 1998). ■ *Acid Sulfate Soils Laboratory Methods Guidelines* (Queensland Department of Natural Resources, Mines and Energy, 2004).	These documents provide guidance and methodology for the assessment of acid sulfate soils and interpretation of risk mapping and any soil analytical results.	The assessment and interpretation of acid sulfate soil conditions and presence was undertaken in accordance with these guidelines as discussed in Section 5.2.4. The construction impacts of acid sulfate soils and rock are outlined in Section 6.3.1.

Legislation/Policy/Guidelines	Brief description and intent	Relevance
Guidance documents relevant to contaminated land: ■ *Sampling Design Guidelines for Contaminated Land* (NSW EPA, 2020a). ■ *Guidelines for the Assessment and Management of Groundwater Contamination* (NSW EPA, 2007). ■ *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020b) ■ *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2020) ■ *Waste Classification Guidelines - Part 1 (2014) and Addendum (2016) (*NSW EPA*)* ■ *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW EPA, 2015). ■ *Guidelines for the NSW Site Auditor Scheme* (Third Edition) (NSW EPA, 2017a). ■ *National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)* (NEPM 2013).	These documents provide guidance and methodology for the assessment of land contaminated hazards and reporting and remedial requirements.	The assessment and interpretation of potential contamination and severity was undertaken in accordance with these guidelines as discussed in Section 4.2 and Sections 5.6 to 5.10. The construction impacts of encountering contamination and impacts of contamination on construction are outlined in Sections 6.1 to 6.2 .
Guidance documents relevant to soils and salinity: ■ *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004a) and *Volume 2* (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries (DECC, 2008). ■ *Australian Soil and Land Survey Handbook* (CSIRO, 2009). ■ *Soil and Landscape Issues in Environmental Impact Assessment* (DLWC, 2000). ■ *Site investigations for Urban Salinity* (DLWC, 2002b).	These documents provide guidance and methodology for the assessment of erosion and salinity (primarily) and interpretation of soil analytical results.	The assessment and interpretation of soil conditions and severity would be undertaken in accordance with these guidelines.

4 Methodology

4.1 Overview of approach

4.1.1 Assessment methodology

The assessment methodology generally followed the framework for the assessment of site contamination outlined in the NEPM 2013. Schedule A of the NEPM 2013 indicates that a staged site assessment process is usually undertaken for the assessment of site contamination 'due to the complexity of site conditions and of contaminant properties and/or the discovery of unexpected contamination'. The staged process as presented in the NEPM 2013 is as follows:

- A Preliminary Site Investigation (PSI), which includes a desktop study to identify the site characteristics and a site inspection to determine potential contaminants of concern and to identify areas of potential contamination.
- A Detailed Site Investigation (DSI), which is required when the results of the PSI indicate 'that contamination is present or is likely to be present and the information available is insufficient to enable site management strategies to be devised.' A DSI is often required to delineate potential or actual contamination present on the site.
- In the scenario that remediation is required for the site, a Remedial Action Plan which outlines the objectives and process of the remediation is required. Remediation and validation will be undertaken in accordance with the Remedial Action Plan to ensure that the objectives of the Remedial Action Plan have been achieved.

4.1.2 General approach

As this report comprises a preliminary (Phase 1) investigation, the following tasks were carried out as part of this soil and contamination impact assessment:

- a review of relevant legislation, policy and guidelines to address the Planning Secretary's Environmental Assessment Requirements (SEARs) and agency requirements
- a desktop assessment comprising review of existing information, aerial photography and previous ground investigation reports. The review is used to identify current environmental conditions of the study area and potential sources of contamination. Key databases used are listed in Section 4.3.1
- field surveys were carried out from 21 March 2022 to 24 March 2022 and from 2 August 2022 to 3 August 2022 to confirm the findings of the background desktop assessment. The surveys involved the observation and recording of terrain, surface condition, topography, vegetative cover, drainage pathways, contaminated land risk areas and surrounding land uses
- the identification of areas of environmental concern (AEC)
- a qualitative risk ranking to identify the preliminary risk to the project
- the identification of potential construction, operational and cumulative impacts
- the identification of mitigation measures to eliminate or minimise these impacts.

4.2 Assessment approach

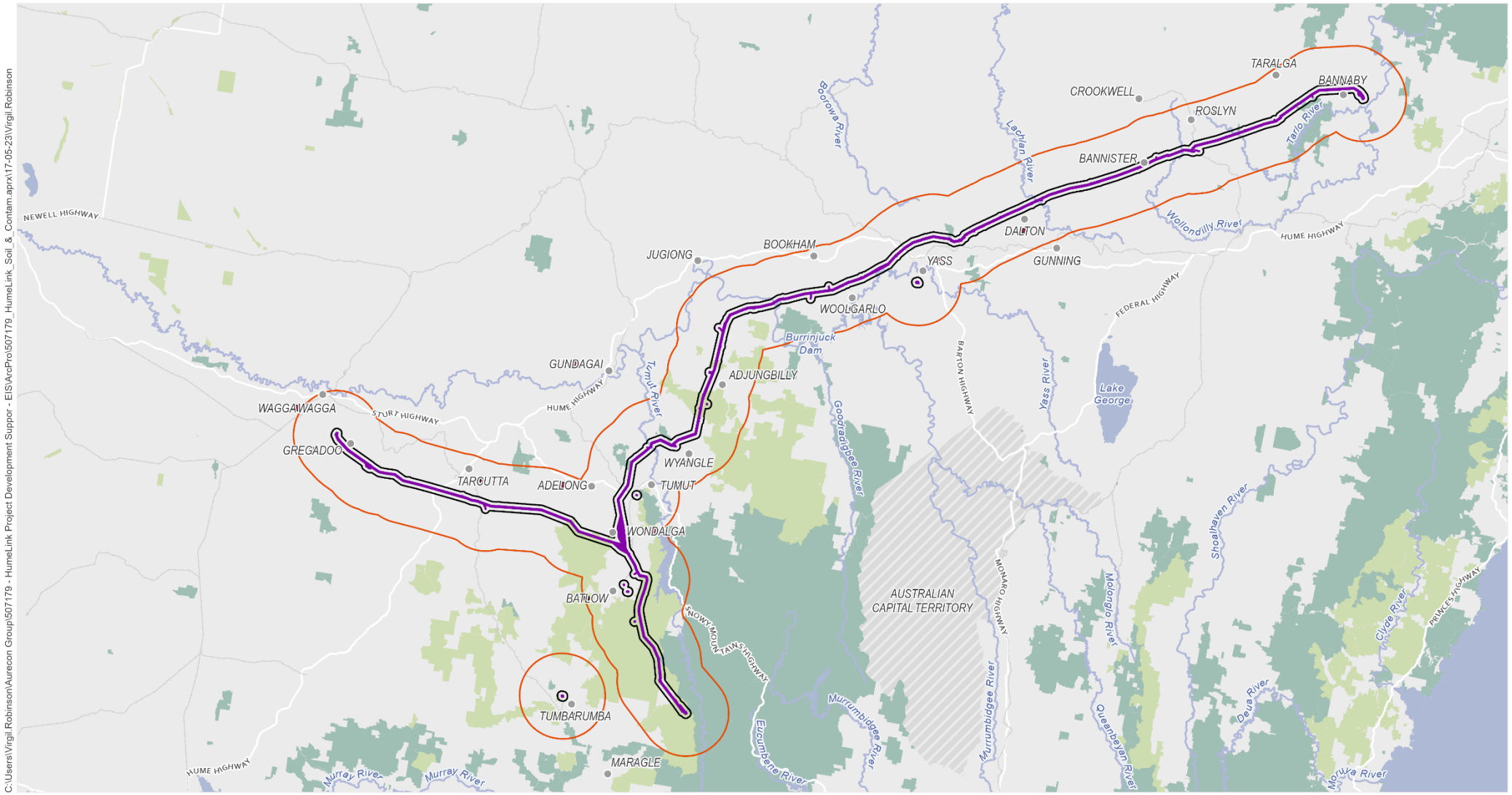
4.2.1 Study area

The contamination study area covers the project footprint plus a one kilometre buffer as shown in Figure 4-1.

The one kilometre buffer was included to capture potential contaminating activities immediately outside of the project footprint. In addition, a 10 kilometre radius around the project footprint was used as a search area for the purpose of the NSW Government per- and poly-fluorinated alkyl substances (PFAS) Investigation Program and Department of Defence Unexploded Ordnance (UXO) desktop searches. The extended 10 kilometre radius is due to the type of contaminants (persistent and can travel long distances) and activities associated with PFAS and UXO residues.

4.2.2 Survey sites

The survey sites comprised a mix of private properties and publicly accessible roadside locations as shown in Figure 4-2. The survey sites were based on locations of potential AECs identified through desktop review. The criteria adopted for the identification of AECs are presented in Section 4.4.1.



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

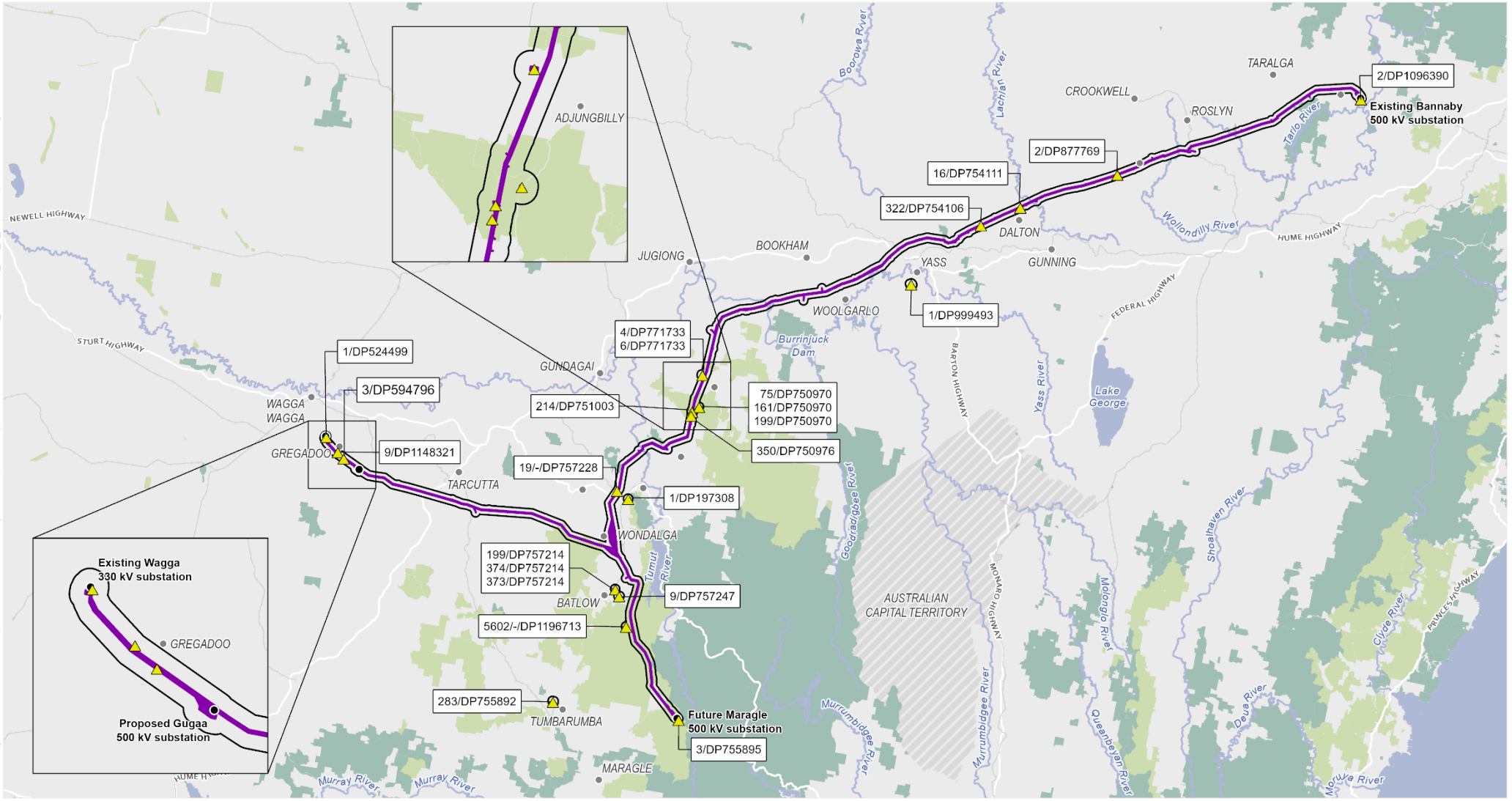
1:925,000

0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

FIGURE 4-1: Contamination study area



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Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:925,000

0 20 40 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

FIGURE 4-2: Contamination survey sites

4.3 Key tasks

4.3.1 Desktop assessment

The desktop assessment involved the collation and review of publicly available information and data relevant to local and regional contamination conditions. Sources include:

- *NSW Seamless Geology Dataset* (Department of Regional NSW, 2022)
- *Australian Soil Resource Information System* (CSIRO, 2021)
- *Hydrogeological Landscapes of NSW and the ACT Dataset* (DPIE, 2016)
- *NSW Heads of Asbestos Coordination Authorities Database for Naturally Occurring Asbestos* (HACA, 2020)
- *Department of Planning, Industry and Environment's NSW Land Use 2013* (DPIE, 2017)
- *NSW Government Planning Portal* (NSW Government, 2022)
- *NSW EPA Register of Notified Contaminated Sites under Section 60 of the CLM Act* (NSW EPA, 2022a)
- *NSW EPA Public Register of Licensed Activities under the POEO Act* (NSW EPA, 2022b)
- *NSW EPA Database for Clean-Up Notices Issued under Section 91 of the POEO Act* (NSW EPA, 2022b)
- *NSW Government Database of Former Gasworks Sites* (NSW EPA, 2021a)
- *NSW EPA Database of Unlicensed Premises* (NSW EPA, 2017b)
- *Department of the Environment and Energy's National Waste Management Database* (Australian Government, 2018)
- *NSW EPA PFAS Investigation Database* (NSW EPA, 2021b)
- *Department of Defence Database for Unexploded Ordnance* (Department of Defence, 2022)
- *Department of Primary Industries Register of Cattle Dip Sites* (DPI, 2022)
- Historical Aerial Photographs from the NSW Government Spatial Services Historical Imagery Viewer (NSW Government, 2022b).

In addition, a number of previous investigations and reports containing information on soil conditions have been reviewed as part of the desktop assessment including:

- *Hazardous Material Inspection Report (Asbestos & Lead), Wagga Wagga Substation, 50 Ashford Road, Gregadoo NSW* (Healthy Buildings International, 2020)
- *The Electricity Commission of NSW., Wagga, 330 kV Substation, Site Investigation* (Coffey and Hollingsworth Consulting Engineers, 1969)
- *Geotechnical Investigation Report, Maragle Substation* (SMEC, 2021)
- *Geotechnical Investigation, Wagga 330/132 kV Substation* (Parsons Brinckerhoff, 2009)
- *Report on Geotechnical Investigation, Proposed 500kV/330kV Substation, Hanworth Road, Bannaby (Via Taralga)* (Douglas Partners, 2007).

Further details of these reports have been summarised in Section 5.9.

4.3.2 Field survey

Field surveys were conducted from 21 March to 24 March 2022 and from 2 August to 3 August 2022. The surveys focused on inspection of the contamination study area; nearby land uses as well as potential AECs. The field surveys were carried out on selected private properties and within publicly accessible areas within the contamination study area as identified in Section 4.2.2. The private properties assessed during the field survey are presented in Table 4-1 and shown on Figure 4-2. Section 5.8 summarises the observations and findings of the field surveys.

Table 4-1 Properties assessed during the contamination field survey

Lot/DP	Address
2/-/DP877769	292 Prices Lane Bannister NSW 2580
2/-/DP1096390	486 Hanworth Road Bannaby NSW 2580
16/-/DP754111	277 Walshs Road Dalton NSW 2581
322/-/DP754106	Dawes Road Broadway NSW 2581
1/-/DP999493	Perry Street Yass NSW 2582
3/-/DP755895	Part Bago State Forest Elliott Way Nurenmerenmong NSW 2649
9/-/DP1148321	993 Gregadoo East Road Gregadoo NSW 2650
3/-/DP594796	818 Gregadoo East Road Gregadoo NSW 2650
1/-/DP524499	50 Ashfords Road Gregadoo NSW 2650
283/-/DP755892	38 Alfred Street Tumbarumba 2653
1/-/DP197308	Lot 1 DP197308 Snowy Mountains Highway Gilmore 2720
5602/-/DP1196713	Part Bago State Forest Batlow Rd Buddong 2720
19/-/DP757228	Gadara Road Gadara 2720
4/-/DP771733	1581 Adjungbilly Road Adjungbilly NSW 2727
6/-/DP771733	1505 Adjungbilly Road Adjungbilly NSW 2727
214/-/DP751003	Part Red Hill State Forest Red Hill Road Adjungbilly NSW 2727
350/-/DP750976	Part Red Hill State Forest Red Hill Road Adjungbilly NSW 2727
199/-/DP757214 374/-/DP757214 373/-/DP757214	14 Memorial Ave Batlow NSW 2730
9/-/DP757247	Keenans Road Batlow 2730
161/-/DP750970	Redhill Road Adjungbilly NSW 2727
199/-/DP750970	Redhill Road Adjungbilly NSW 2727
75/-/DP750970	Redhill Road Adjungbilly NSW 2727

4.4 Criteria adopted

4.4.1 Areas of environmental concern

The potential contamination sources are referred to as AECs.

These AECs have been determined through a review of available site history information, public databases, site inspection and historical aerial photographs, as outlined in Sections 4.3.1 and 4.3.2.

4.4.1.1 Risk rating for AECs

Risk ratings are assigned based on linkages between AECs and sensitive receivers, pathways by which contamination moves through the environment, sensitive receivers and the potential risks of these AECs to the sensitive receivers.

Sensitive receivers include both human and environmental receivers. Human receiver s include current or future site users such as residents or visitors, on- and off-site construction and maintenance workers, groundwater bore users and current or future users of surrounding sites. Environmental receivers include a broad range of flora and fauna, surface water bodies and groundwater.

The risk rating includes consideration of whether the identified AECs are likely to be disturbed by construction and whether they are located near any sensitive receivers that could be impacted by contaminants of potential concern (COPCs) (if present).

Qualitative risk is assessed by estimating the likelihood of each identified potential Source-Pathway-Receiver linkage occurring and the foreseeable consequence of the exposure.

When there are linkages between the AECs and sensitive receivers through exposure pathways (such as exposure of a contaminant in soil to a construction worker via inhalation or contact with skin), there may be potential risks that require risk assessment, management or remediation.

The qualitative risk assessment (Australian/New Zealand ISO standard on risk management (derived from AS/NZS ISO 3100:2009) applies a rating matrix to determine the qualitative contamination impact risk. The risk is assessed by estimating the likelihood of the linkages between AECs and sensitive receivers occurring and the foreseeable consequence of the exposure and therefore, construction and operation impacts.

The likelihood ratings are defined as follows:

- **Rare –** has not occurred in the past five years OR may occur in exceptional circumstances, ie, less than 10 per cent chance of occurring in the next 24 months if the risk is not mitigated.
- **Unlikely –** may have occurred once in the last five years OR has a 10 to 30 per cent chance of occurring in the future if the risk is not mitigated.
- **Possible –** has happened during the past five years but not in every year OR has a 40 to 60 per cent chance of occurring in the next 24 months if the risk is not mitigated.
- **Likely –** has happened at least once in the past year and in each of the previous five years OR has a 60 to 90 per cent chance of occurring in the next 24 months if the risk is not mitigated.
- **Almost Certain –** has happened several times in the past year and in each of the previous five years OR has a greater than 90 per cent chance of occurring in the next 24 months if the risk is not mitigated.

The consequence definitions applicable to human receivers and various environmental receivers (water, ecological, built environment) are shown in Table 4-2.

Table 4-2 Consequence definitions

Classification	Human Health	Ground/Surface Water	Ecological	Built Environment
Severe	Irreversible damage to human health or death	Substantial pollution of sensitive water resources	Major change to the number of one or more species or ecosystems	Irreparable damage to buildings, structures or the environment
Moderate	Non-permanent effects to humans	Substantial pollution of non-sensitive water resources or small-scale pollution	Change to population densities of non-sensitive species	Damage to sensitive buildings, structures or the environment
Mild	Slight short tern health effects to humans	Slight pollution to non-sensitive water resources	Some changes to population densities but with no negative effects on the function of the ecosystem	Easily repairable effects of damage to buildings or structures.
Negligible	No measurable health effects to humans	Insubstantial pollution to non-sensitive water resources	No major changes to population densities in the environment or in any ecosystem	Very slight non-structural damage or cosmetic harm to buildings or structures.

The overall risk ratings are assessed in accordance with Table 4-3.

Table 4-3 Risk ratings matrix

Consequence	Likelihood				
	Rare	Unlikely	Possible	Likely	Almost Certain
Severe	Low	Low to Moderate	Moderate to High	Very High	Very High
Moderate	Negligible to Low	Low	Moderate	Moderate to High	High
Mild	Negligible	Low	Low	Low to Moderate	Moderate
Negligible	Negligible	Negligible	Negligible to Low	Low	Low

Risk ratings are defined as follows:

- **Negligible** – The presence of the identified source does not give rise to the potential to cause major harm.
- **Low** – It is possible that harm could arise to a designated receiver from an identified source, though this is likely to be mild.
- **Moderate** – It is possible that harm could arise to a specific receiver, but it is unlikely that such harm would be major.
- **High** – A designated receiver is likely to experience major harm from an identified source without remedial action.
- **Very High** – There is a high probability that severe harm could arise to a designated receiver from an identified source without appropriate remedial action.

4.4.1.2 Assessment of significance

The significance of impacts is determined by the sensitivity of the environment as well as the magnitude of the expected change. Sensitivity of the environment is based on the existing and proposed land use. For example, a low-density residential land use is more sensitive than an industrial/commercial land use. In a residential land use, there is more potential of exposure to COPCs (if present) as soil is likely to be exposed through residential gardening and the vicinity and duration to human receivers. An industrial setting is less sensitive as it would likely have extensive hardstand, limited occupancy times, security and exclusion and other occupational health and safety controls imposed on the industry to manage risks to employees.

The assessment of significance matrix is shown in Table 4-4.

Table 4-4 Assessment of significance

Magnitude of Impact	Sensitivity of Environmental Values		
	High	Moderate	Low
High	Major	High	Moderate
Moderate	High	Moderate	Low
Low	Moderate	Low	Negligible

The *Sensitivity of Environmental Values* evaluation is influenced by the following criteria:

- Condition of the environmental value, ie, how far is it understood to have already been changed from its original natural form or state?
- How unique or rare is the condition or value or its dependant ecological receivers?
- How sensitive are the dependant receivers to changes? Does the project exacerbate contamination risks to human health from potential existing contamination present?
- How do any available site investigation results (if available) compare against the identified soil quality and contamination criteria?
- Does the project interact with soil and contamination that has a detrimental environmental outcome?

- The *Magnitude of Impact* evaluation is influenced by the following criteria:
  - If a qualitative assessment has been conducted, how do the results compare to the pre-development conditions?
  - How do the results compare against the identified soil quality and contamination criteria?
- For quantitative assessments the following is considered
  - expected duration of impact: temporary vs long-lasting/permanent
  - expected extent of impact: local vs regional/widespread
  - estimated degree of change from pre-development conditions.

4.4.2 Impact assessment

The impact assessment incorporated an assessment of significance and risk rating to assess the impacts for construction and operation and develop the mitigation measures to prevent contamination migration or spread.

The proposed activities associated with the project development were reviewed to identify the activities that had the potential to lead to a disturbance or a change in soils as well as influence contamination conditions. These activities are indicated in Chapter 6 for the construction phase and Chapter 7 for the operational phase of the project.

It is noted that the majority of impacts are expected to occur during the construction phase, associated with the installation of permanent infrastructure of the transmission lines, access tracks and temporary construction compounds.

4.5 Limitations and uncertainty

This report has been written to inform the Environmental Impact Statement (EIS) in regard to the potential for impacts associated with contaminated land and groundwater. Subsurface conditions relevant to future construction work should be assessed by contractors who can make their own interpretation of the factual data provided and perform any additional tests as necessary for their own purposes and determine the suitability of particular techniques and equipment for the conditions.

In preparing the report, Aurecon has relied upon publicly available databases, data, surveys, analyses, designs, plans and other information provided by Transgrid, most of which are referred to in the report (the data). Except as otherwise stated in the report, Aurecon has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Aurecon will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Aurecon.

In accordance with the scope of services, Aurecon has relied upon the data and has not conducted any environmental field testing, sampling or laboratory analyses in the preparation of the report. The conclusions are based upon the data sources included in this report, including field surveys undertaken by Aurecon, and are therefore merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of contaminants or emissions.

Within the limitations imposed by the scope of services, the assessment of the site and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

5 Existing environment

5.1 Topography

The topography of the contamination study area is widely variable, with elevation ranging from approximately 220 metres above the Australian height datum (mAHD) to 1,232 mAHD.

At the west end of the project around Wagga Wagga the topography is relatively flat, with elevation ranging from approximately 220 mAHD to 338 mAHD. Between Tumut and Yass, the topography is considerably hilly, with elevation ranging from approximately 261 mAHD to 768 mAHD. The east end of the project area between Yass and Bannaby has more hills and areas of steep terrain, particularly between Dalton and Bannaby, with elevation ranging between 537 mAHD and 928 mAHD. The area with the highest elevation, ranging between approximately 1,012 mAHD and 1,232 mAHD, is located between Batlow and the Maragle State Forest.

5.2 Soils and geology

5.2.1 Geology

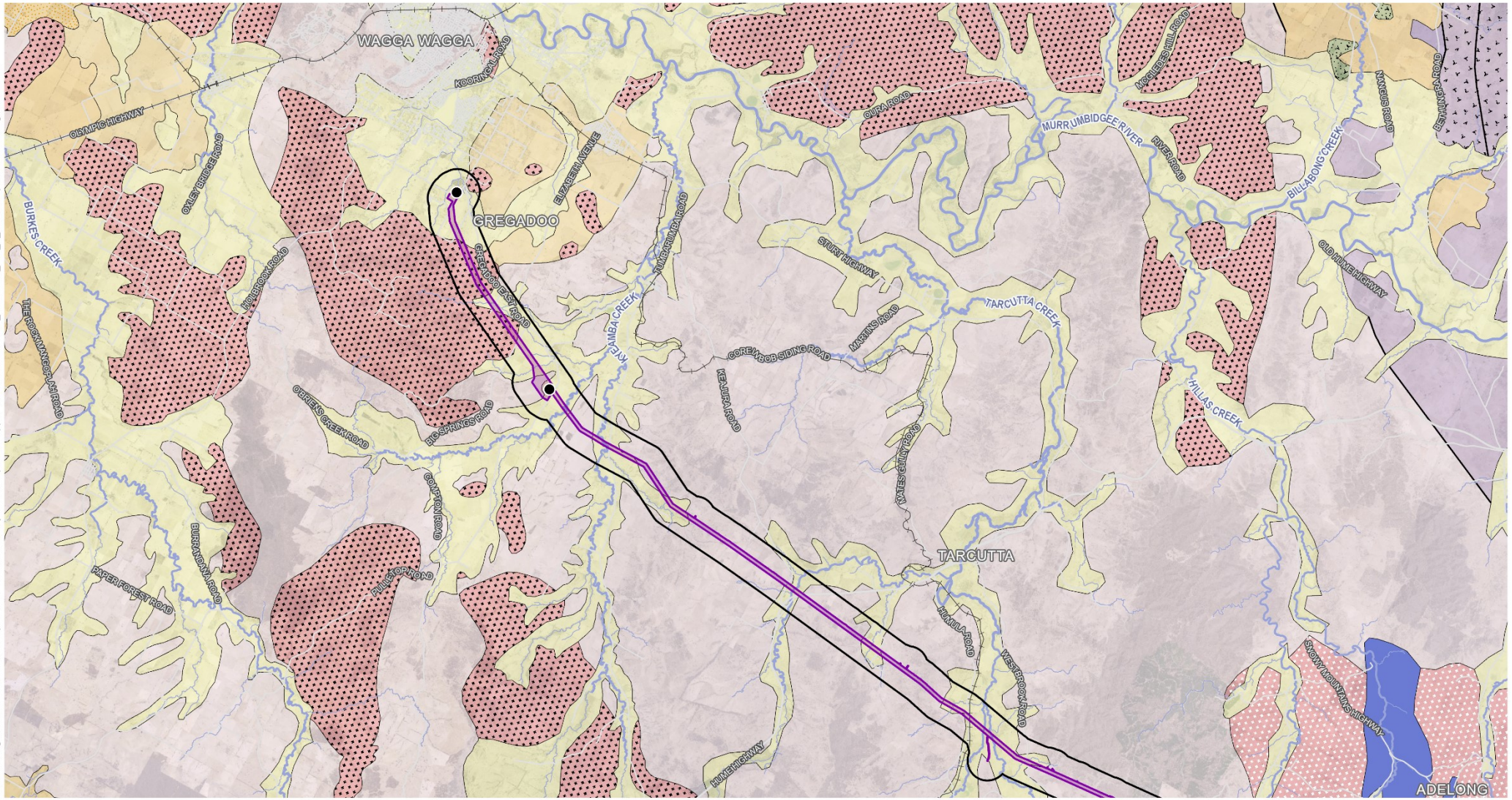
Surface outcrops of geological units within the contamination study area has been determined from a review of the NSW Seamless Geology dataset (Department of Regional NSW, 2022). The contamination study area extends through and across highly variable landscapes and geological history given the scale of the project.

This is reflected in the geology underlying the contamination study area (refer to Table 5-1). Of the 97 formations underlying the study area, Quaternary aged alluvial deposits make up the largest proportion at 7.6 per cent, with other Silurian, Ordovician, and Devonian aged formations making up the larger proportions. There are 83 formations underlying the study area, each with a proportion less than two per cent.

An extract of the Seamless geology map across the contamination study area is presented below in Figure 5-1.

Table 5-1 Dominant regional surface geology within the contamination study area

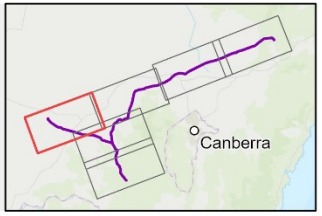
NSW Seamless Geology Description	Geological History	Area (Ha)	Proportion
Ordovician sedimentary rocks	443 to 491 million years old	18741.3	22.134%
Silurian IS transitional-type granite	419 to 443 million years old	13342.3	15.757%
Silurian S-type volcanics rocks	419 to 443 million years old	10323.6	12.192%
Silurian sedimentary rocks	419 to 443 million years old	8259.5	9.755%
Silurian I-type granites	419 to 443 million years old	7935.5	9.372%
Quaternary alluvial deposits	0 to 2 million years old	6165.2	7.281%
Cenozoic mafic volcanic rocks	0 to 66 million years old	5231.3	6.178%
Devonian I-type volcanic rocks	359 to 419 million years old	3496	4.129%
Devonian S-type granites	359 to 419 million years old	2523.9	2.981%
Ordovician igneous mafic volcanic	0 to 0 million years old	2445.9	2.889%
Late Devonian sedimentary rocks	359 to 384 million years old	1210.5	1.43%
Devonian sedimentary rocks	359 to 419 million years old	1026.6	1.212%
Silurian silicic to intermediate intrusives - undifferentiated	419 to 443 million years old	1003.7	1.185%
Palaeozoic ultramafic rocks and serpentinized ultramafic rocks	252 to 541 million years old	693.7	0.819%
Devonian I-type granites	359 to 419 million years old	633.7	0.748%
Devonian sedimentary and volcanic rocks	359 to 419 million years old	619.7	0.732%
Silurian mafic volcanic rocks	419 to 443 million years old	517.6	0.611%
Cenozoic mafic intrusives	0 to 66 million years old	296	0.35%
Carboniferous I-type granites	300 to 359 million years old	203.8	0.241%
Quaternary colluvial deposits	0 to 2 million years old	3.3	0.004%



Project footprint
Contamination study area
Railway
Watercourse
Substation

NSW Simplified Surface Geology (1:1500k)

Fault
Geological boundary
Igneous felsic intrusive (I-type)
Igneous felsic intrusive (S-type)
Igneous mafic volcanic (Ordovician)
Regolith
Igneous silicic to intermediate volcanic (S-type)
Sedimentary & volcanic
Quaternary alluvial deposits
Ordovician sedimentary rocks
Silurian sedimentary and volcanic rocks
Silurian-Devonian sedimentary and volcanic rocks
Ordovician sedimentary and volcanic rocks
Quaternary colluvial deposits
Cenozoic undifferentiated sediments/sedimentary rocks
Silurian silicic to intermediate intrusives



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

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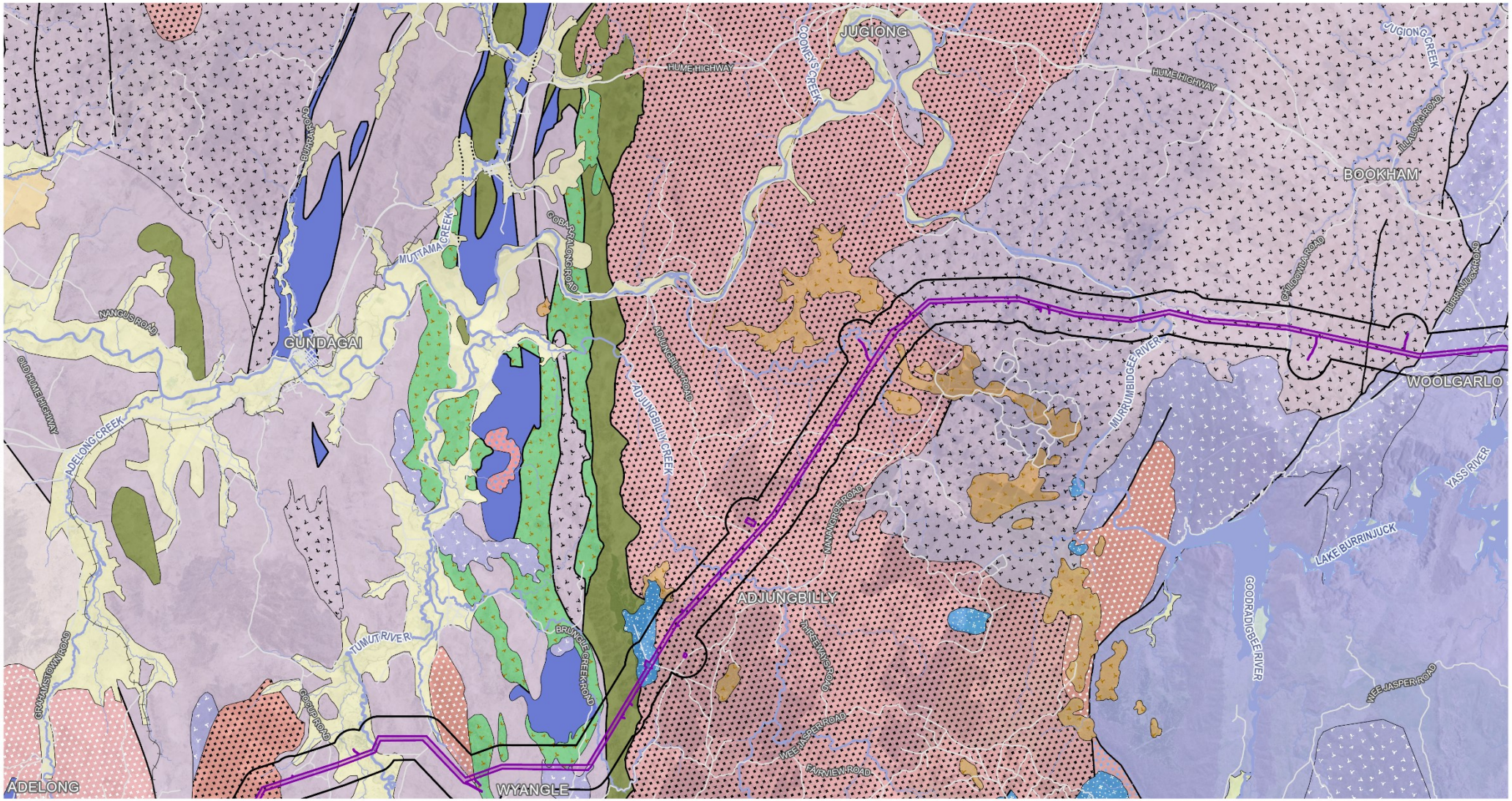
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

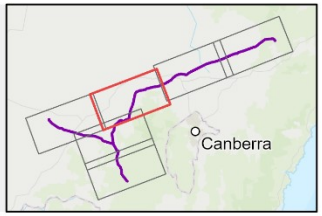
Figure 5-1a: Seamless geology



Project footprint
Contamination study area
Railway
Watercourse
Substation

NSW Simplified Surface Geology (1:1500k)

Dyke or vein
Fault
Fault, concealed
Geological boundary
Shear zone
Shear zone - concealed
Water feature
Igneous felsic intrusive (I-type)
Igneous felsic intrusive (S-type)
Igneous felsic intrusive (undifferentiated)
Igneous mafic volcanic
Igneous mafic volcanic (Ordovician)
Igneous mafic intrusive
Igneous silicic to intermediate volcanic (I-type)
Igneous silicic to intermediate volcanic (S-type)
Quaternary alluvial deposits
Silurian mafic volcanic rocks
Ordovician mafic intrusives
Devonian sedimentary and volcanic rocks
Ordovician sedimentary rocks
Silurian sedimentary and volcanic rocks
Silurian-Devonian sedimentary and volcanic rocks
Cenozoic mafic volcanic rocks
Ordovician sedimentary and volcanic rocks
Palaeozoic ultramafic rocks and serpentinized ultramafic rocks
Cenozoic undifferentiated sediments/sedimentary rocks
Devonian silicic to intermediate intrusives
Silurian silicic to intermediate intrusives
Carboniferous to Ordovician silicic to intermediate intrusives
Water



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

1:200,000
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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-1b: Seamless geology

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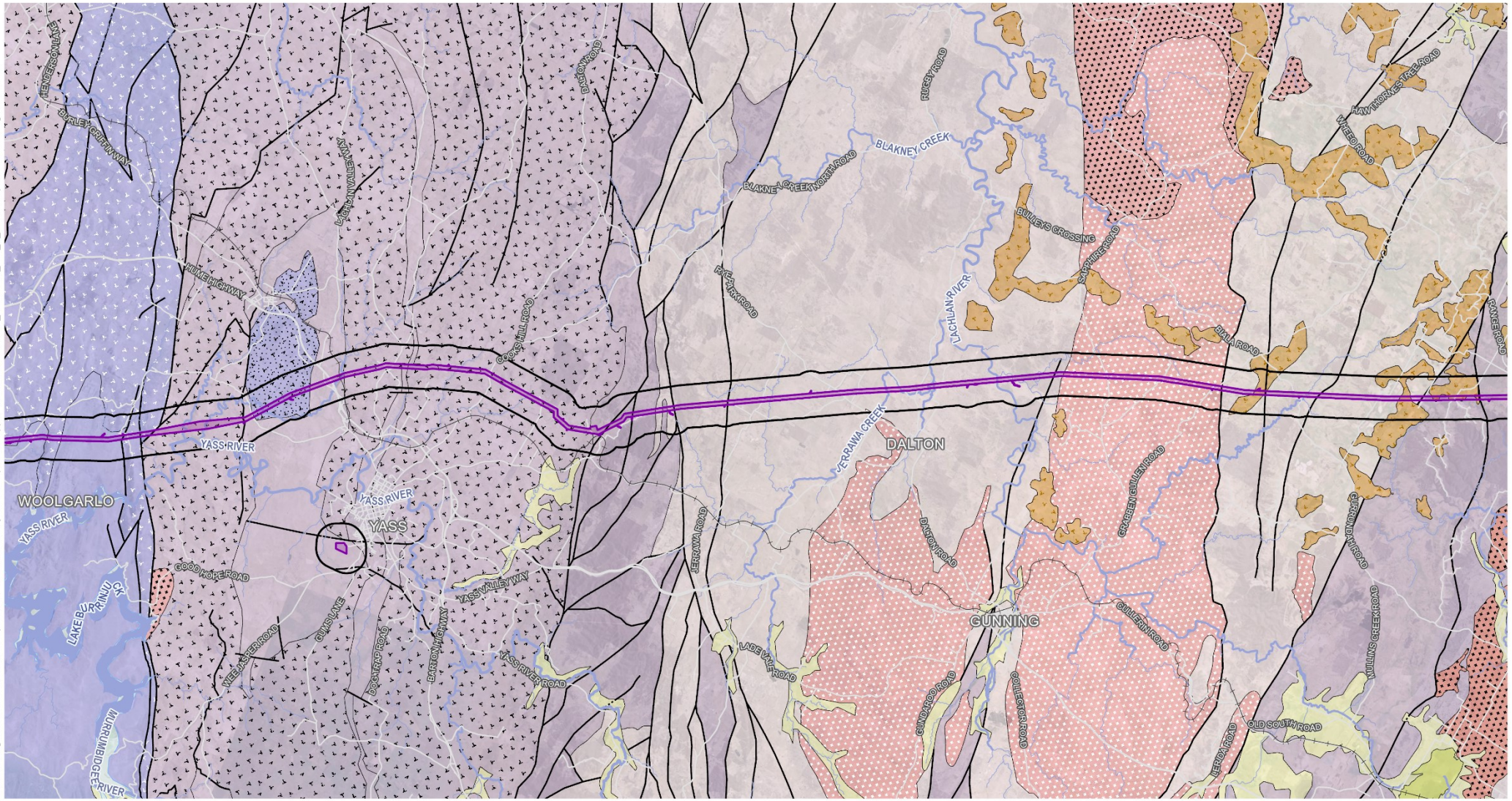

Project footprint
Contamination study area
Railway
Watercourse
Substation

NSW Simplified Surface Geology (1:1500k)

Fault
Fault, concealed
Geological boundary - concealed
Geological boundary
Water feature

Igneous felsic intrusive (I-type)
Igneous felsic intrusive (S-type)
Igneous mafic volcanic
Igneous silicic to intermediate volcanic (I-type)
Igneous silicic to intermediate volcanic (S-type)
Sedimentary & volcanic

Quaternary alluvial deposits
Quaternary lacustrine deposits
Devonian sedimentary and volcanic rocks
Ordovician sedimentary rocks
Silurian sedimentary and volcanic rocks
Cenozoic mafic volcanic rocks

Devonian silicic to intermediate intrusives
Silurian silicic to intermediate intrusives
Water

Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 5-1c: Seamless geology

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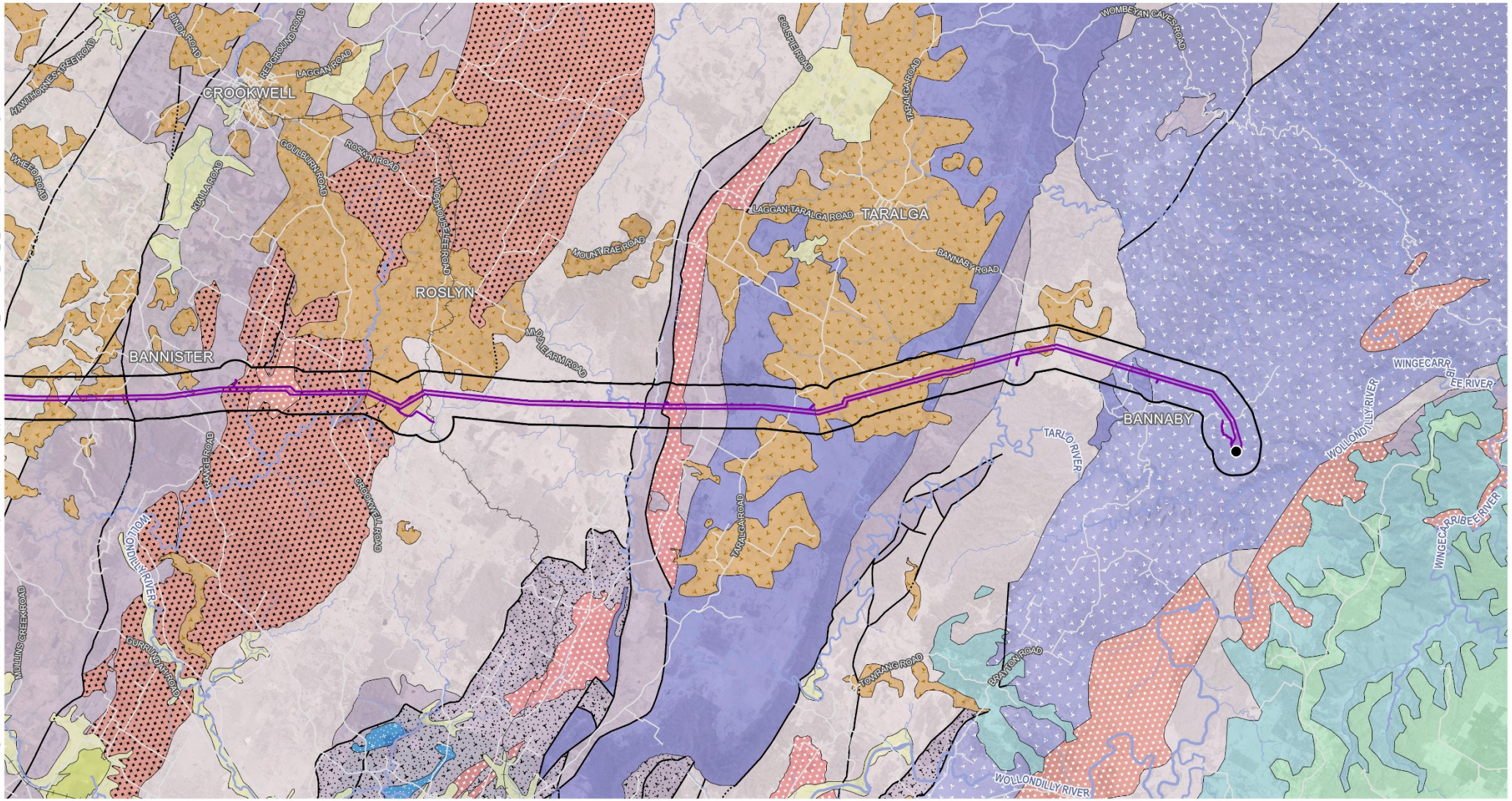
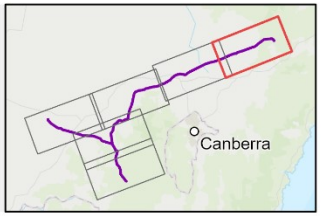


Project footprint
Contamination study area
Railway
Watercourse
Substation

NSW Simplified Surface Geology (1:1500k)

Fault
Fault, concealed
Geological boundary - concealed
Geological boundary
Igneous felsic intrusive (I-type)
Igneous felsic intrusive (S-type)
Igneous mafic volcanic
Igneous mafic intrusive
Igneous silicic to intermediate volcanic (I-type)
Sedimentary & volcanic
Quaternary alluvial deposits
Quaternary lacustrine deposits
Triassic sedimentary rocks
Permian sedimentary rocks
Ordovician mafic intrusives
Devonian sedimentary and volcanic rocks
Late Devonian sedimentary rocks
Ordovician sedimentary rocks
Silurian sedimentary and volcanic rocks
Cenozoic mafic volcanic rocks
Devonian silicic to intermediate intrusives
Carboniferous to Ordovician silicic to intermediate intrusives



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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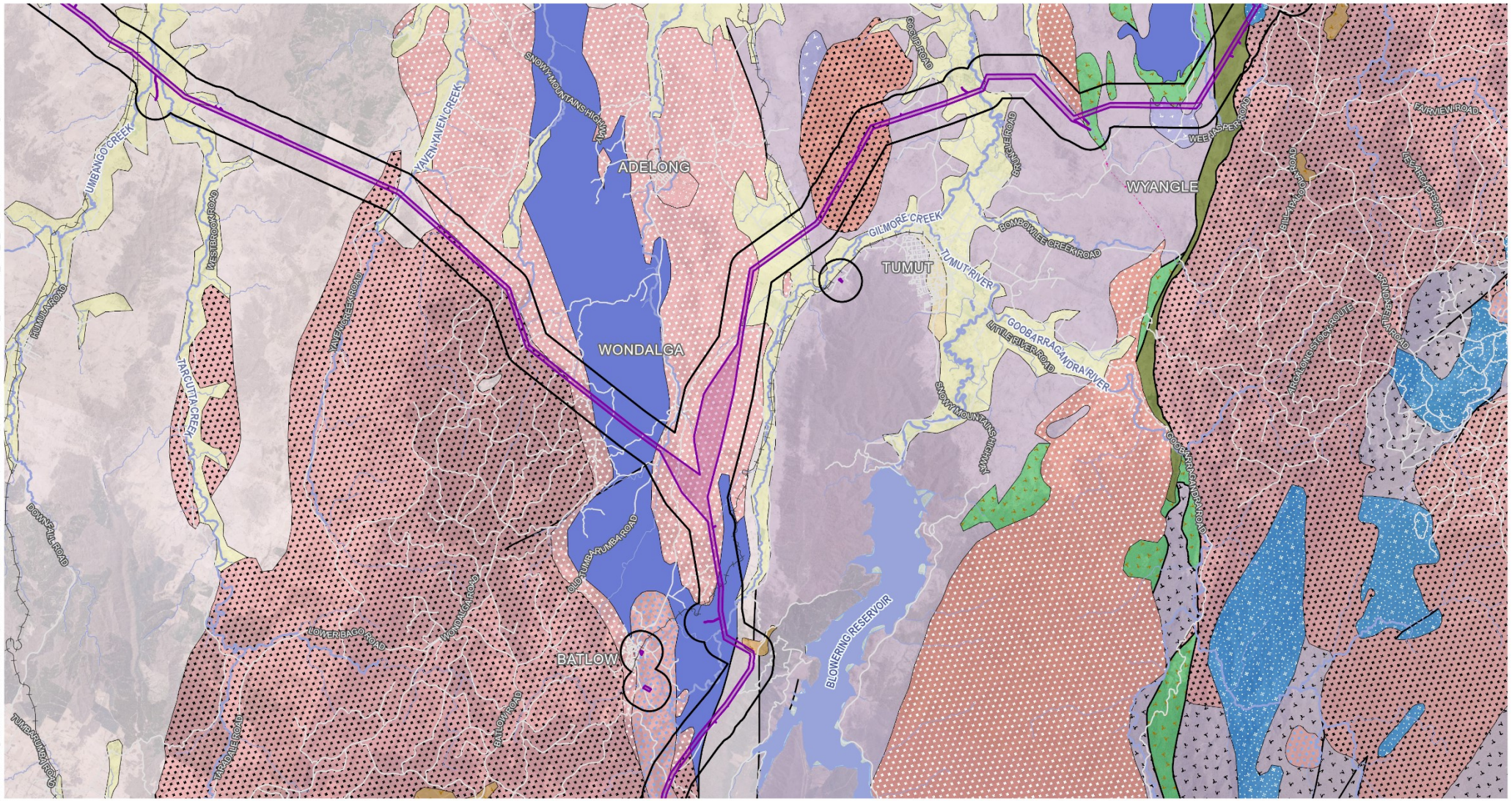
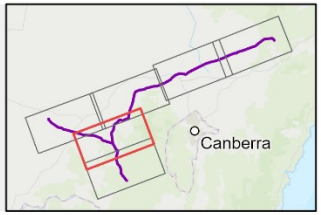
Figure 5-1d: Seamless geology



Project footprint
Contamination study area
Railway
Watercourse
Substation
NSW Simplified Surface Geology (1:1500k)
Dyke or vein
Fault
Fault, concealed
Geological boundary
Water feature
Igneous felsic intrusive (I-type)
Igneous felsic intrusive (S-type)
Igneous felsic intrusive (undifferentiated)
Igneous mafic volcanic
Igneous mafic volcanic (Ordovician)
Igneous mafic intrusive
Igneous silicic to intermediate volcanic (I-type)
Igneous silicic to intermediate volcanic (S-type)
Quaternary alluvial deposits
Silurian mafic volcanic rocks
Ordovician mafic intrusives
Devonian sedimentary and volcanic rocks
Ordovician sedimentary rocks
Silurian sedimentary and volcanic rocks
Cenozoic mafic volcanic rocks
Ordovician sedimentary and volcanic rocks
Palaeozoic ultramafic rocks and serpentinized ultramafic rocks
Quaternary colluvial deposits
Devonian silicic to intermediate intrusives
Silurian silicic to intermediate intrusives
Water



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

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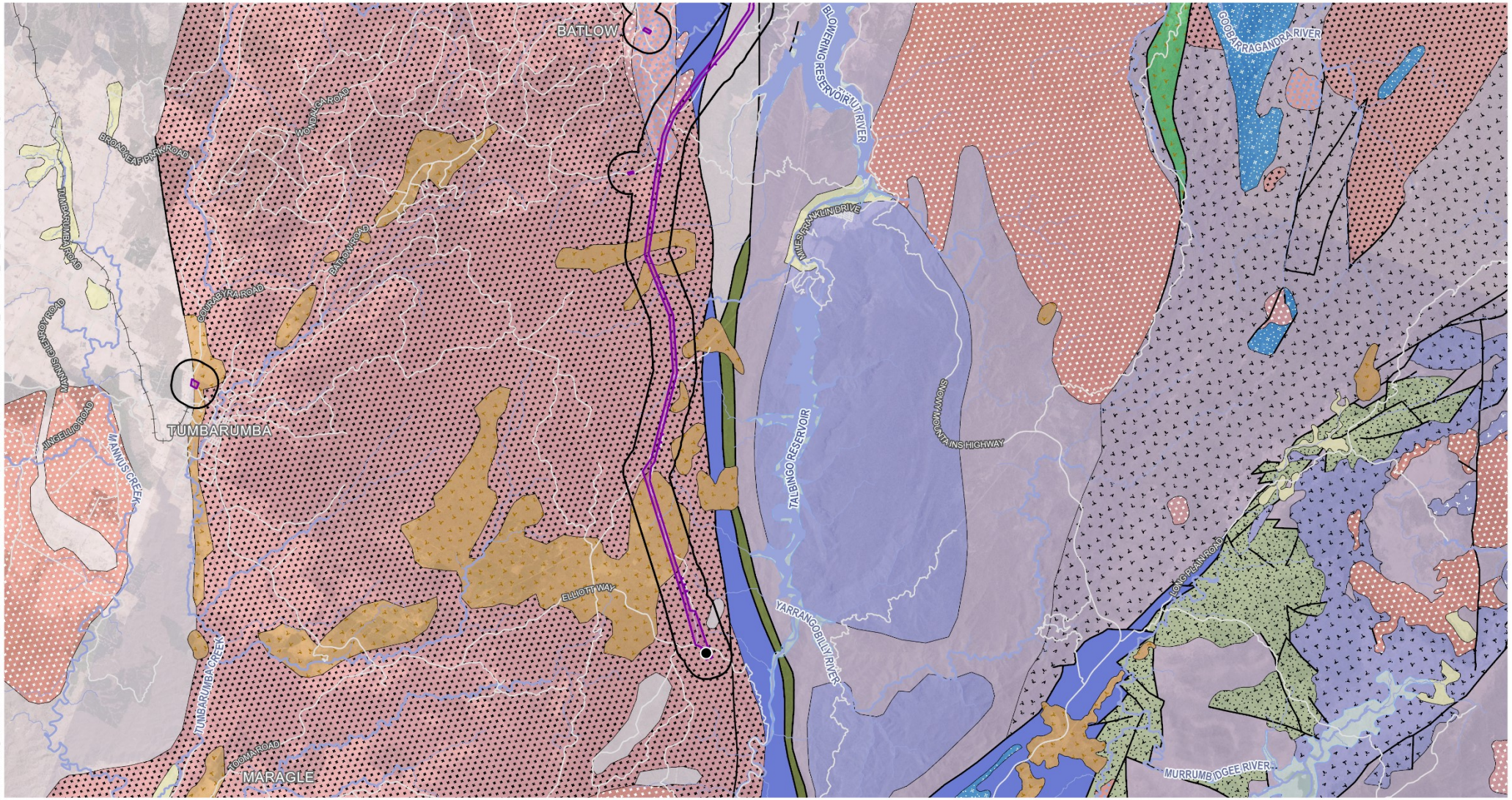
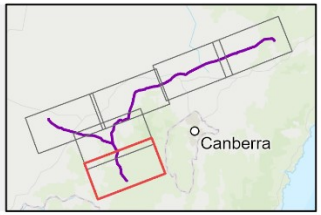
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-1e: Seamless geology



Project footprint
Contamination study area
Railway
Watercourse
Substation
NSW Simplified Surface Geology (1:1500k)
Dyke or vein
Fault
Fault, concealed
Geological boundary
Water feature
Igneous felsic intrusive (I-type)
Igneous felsic intrusive (S-type)
Igneous felsic intrusive (undifferentiated)
Igneous mafic volcanic
Igneous mafic volcanic (Ordovician)
Igneous mafic intrusive
Igneous silicic to intermediate volcanic (I-type)
Igneous silicic to intermediate volcanic (S-type)
Sedimentary & volcanic
Quaternary alluvial deposits
Silurian mafic volcanic rocks
Ordovician mafic intrusives
Devonian sedimentary and volcanic rocks
Ordovician sedimentary rocks
Silurian sedimentary and volcanic rocks
Cenozoic mafic volcanic rocks
Ordovician sedimentary and volcanic rocks
Palaeozoic ultramafic rocks and serpentinized ultramafic rocks
Devonian silicic to intermediate intrusives
Silurian silicic to intermediate intrusives
Water



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

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Figure 5-1f: Seamless geology

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5.2.2 Soil types

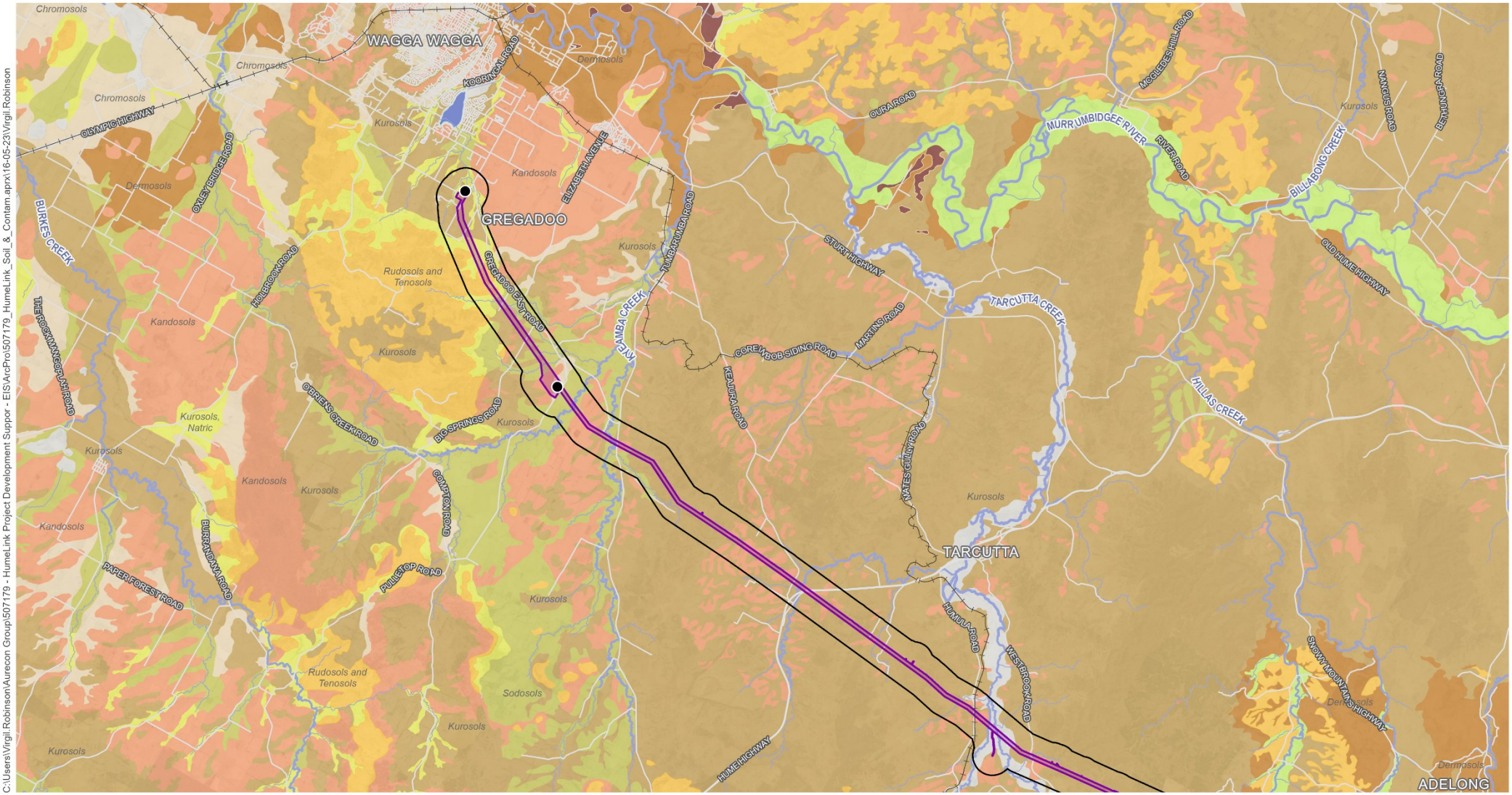
The soil types present within the contamination study area are widely variable. The predominant soils underlying the study area according to the Australian Soil Classification (CSIRO, 2021) include kurosols, rudosols, tenosols, dermosols, and kandosols. The distribution of these soils is presented below in Figure 5-2 with the specific soil types and their characteristics listed in Table 5-2. The predominant soil types across the project are either sand or clay based, or a mixture of the two.

Table 5-2 Summary of Australian Soils Classification soils across the contamination study area

Australian Soil Classification	Characteristic	Area (Ha)	Percentage
Kurosols	Strong texture contrast between the topsoil and strongly acidic subsoils.	26131.1	30.86%
Demosols	Structured subsoils and lacking a strong texture-contrast between the topsoils and subsoils.	15907.6	18.79%
Kandosols	Lack strong texture contrast, have massive or only weakly structured subsoils, and are not calcareous throughout.	12645.3	14.93%
Rudosols and Tenosols	Have little, if any, pedologic organisation.	10454.4	12.35%
Sodosols	Strong texture contrast between the topsoils and sodic subsoils which are not strongly acid.	5078.3	6.00%
Kurosols, Natric	Kurosols in which the majority of the upper 0.2 m of the subsoils are sodic.	4292.3	5.07%
Ferrosols	Subsoils which are high in free iron oxide and lacking a strong texture-contrast between the topsoils and subsoils.	4203	4.96%
Chromosols	Strong texture contrast between the topsoil and subsoils. Subsoils that are not strongly acid and are not sodic.	3142.8	3.71%
Organosols	Dominated by organic materials	1424.8	1.68%
Tenosols (Alluvial)	Generally, only weak pedologic organisation apart from the topsoils, excluding soils that have deep sandy profiles with a field texture of sand, loamy sand or clayey sand in 80% or more of the upper 1.0 m.	676.1	0.80%
Vertosols	Clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular peds.	478.5	0.57%
Hydrosols	A range of seasonally or permanently wet soils. The key criterion is saturation of the major part of the soil profile for prolonged periods (2-3 months) in most years.	124.2	0.15%
Rudosols (Alluvial)	Rudosols of alluvial origin.	41.4	0.05%
Other*		73.3	0.09%

Note:

* Includes Water and unassessed soils



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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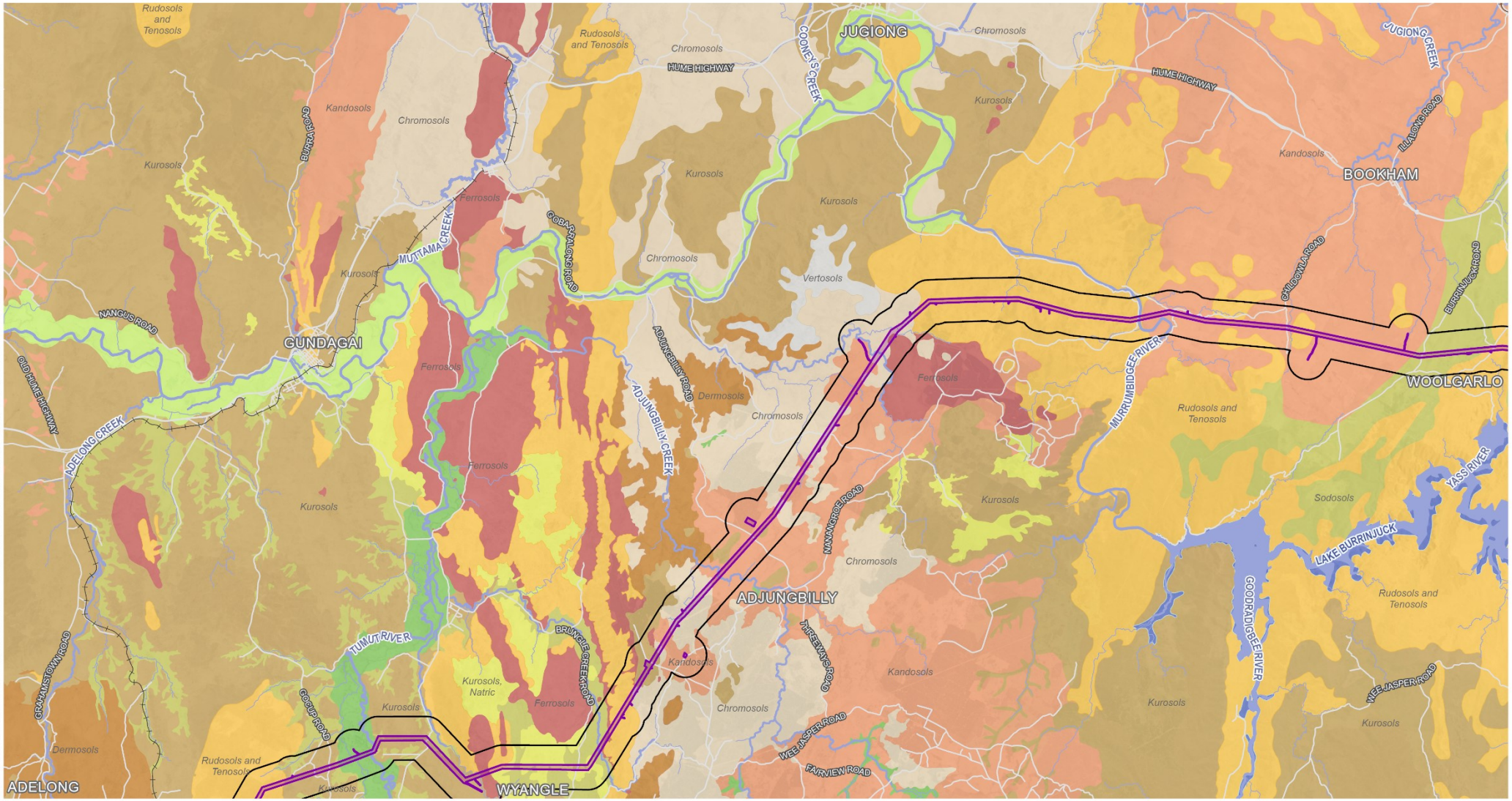
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-2a: Australian soil classification



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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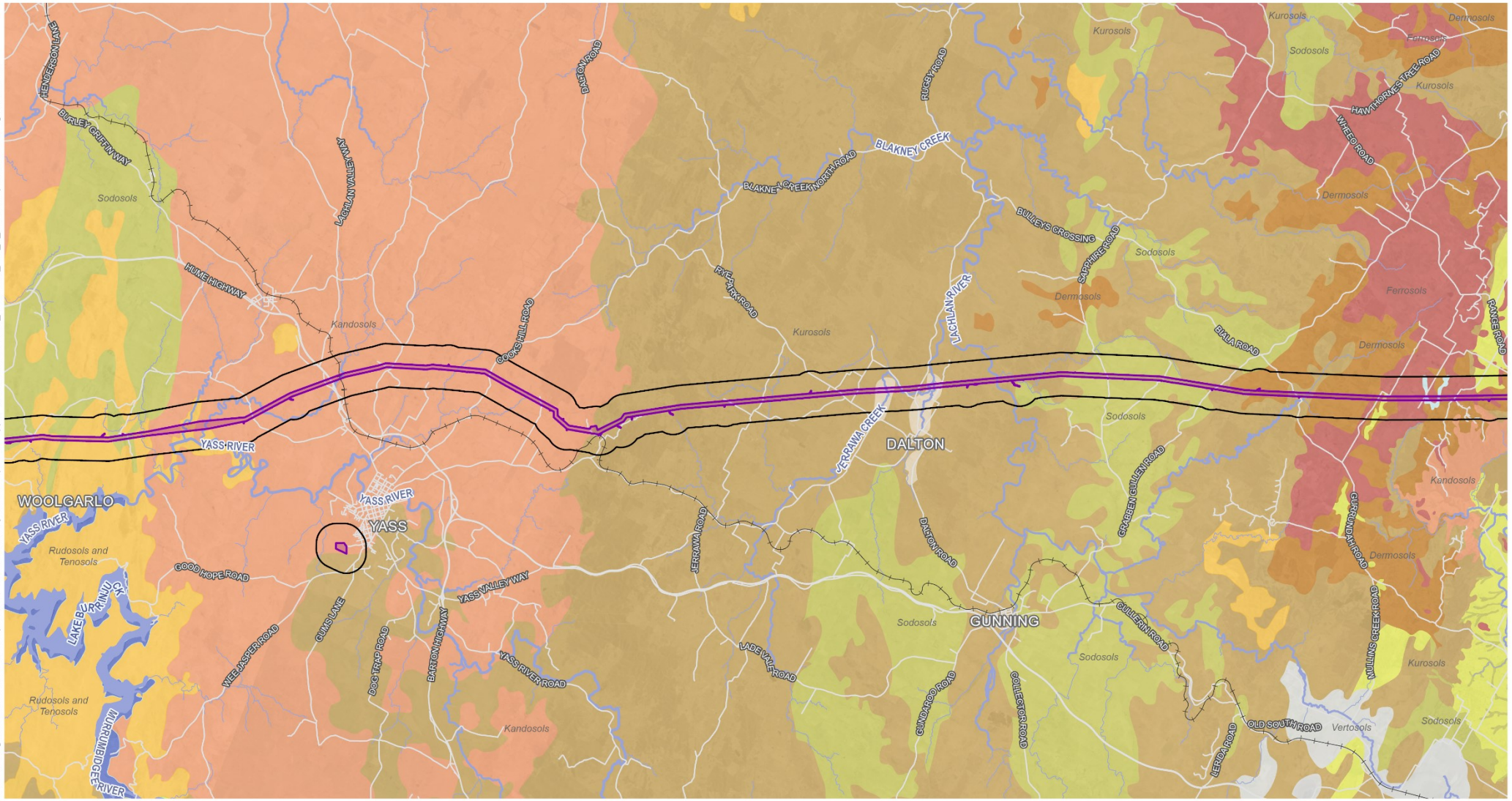
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-2b: Australian soil classification



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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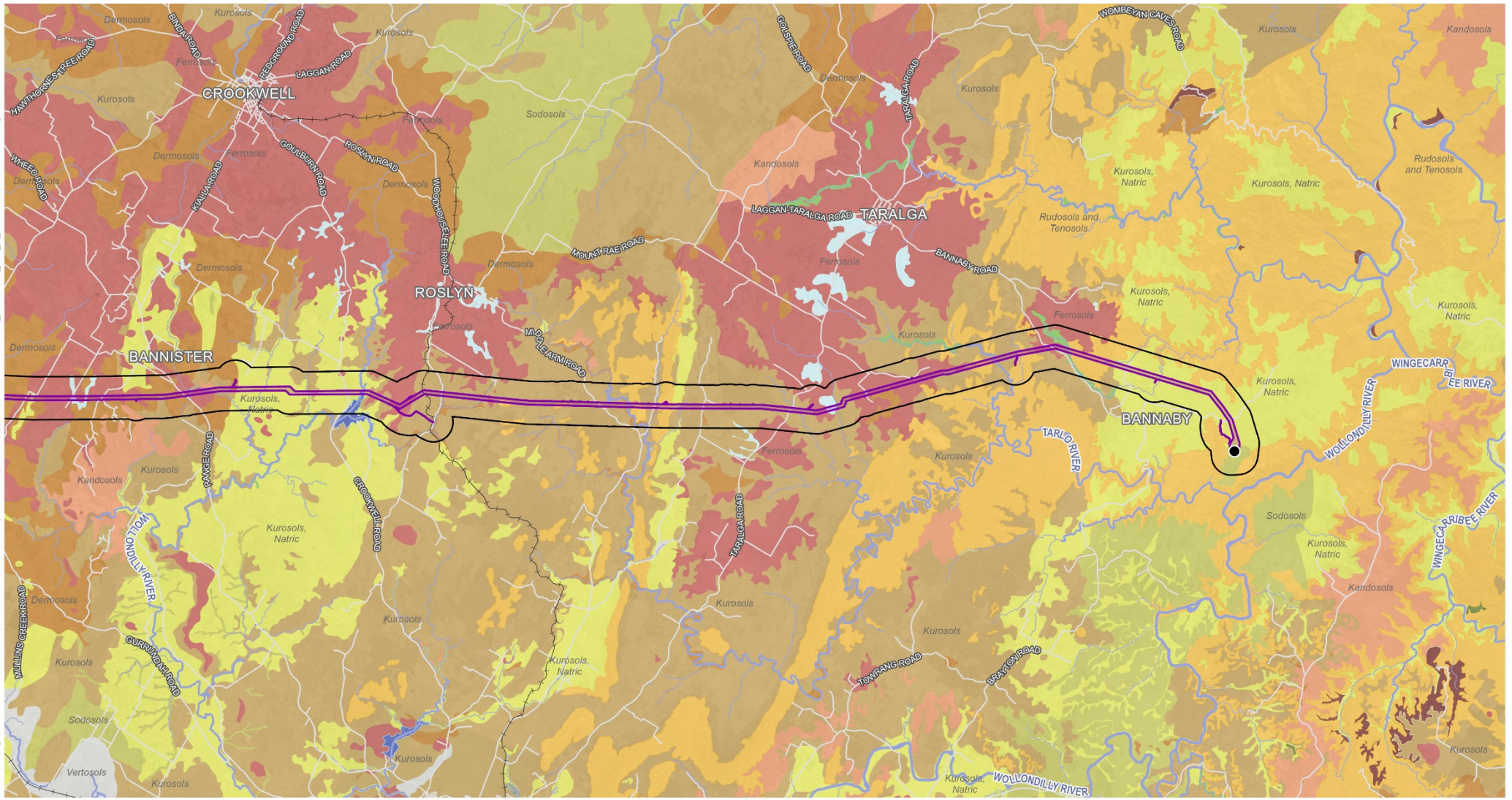
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-2c: Australian soil classification



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

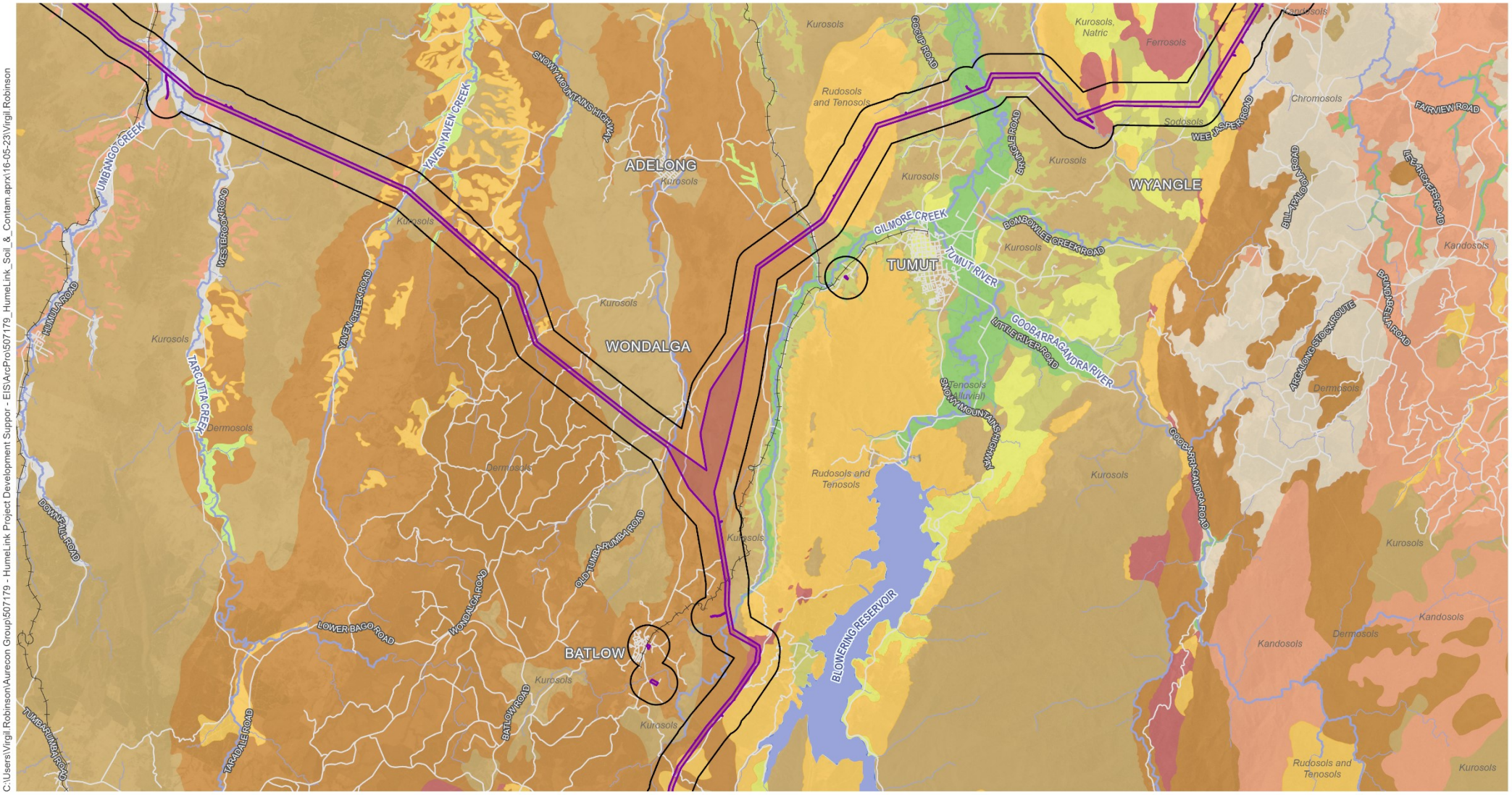
1:200,000

0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-2d: Australian soil classification



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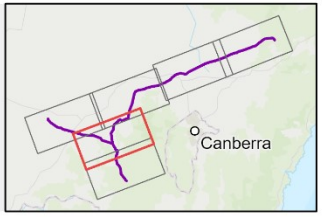
Project footprint
Contamination study area
Railway
Watercourse
Substation

Australian Soil Classification

Chromosols
Dermosols
Ferrosols
Hydrosols
Kandosols
Kurosols
Kurosols, Natric
Organosols
Rudosols
Rudosols (Alluvial)
Rudosols and Tenosols
Sodosols
Tenosols
Tenosols (Alluvial)
Vertosols
Water



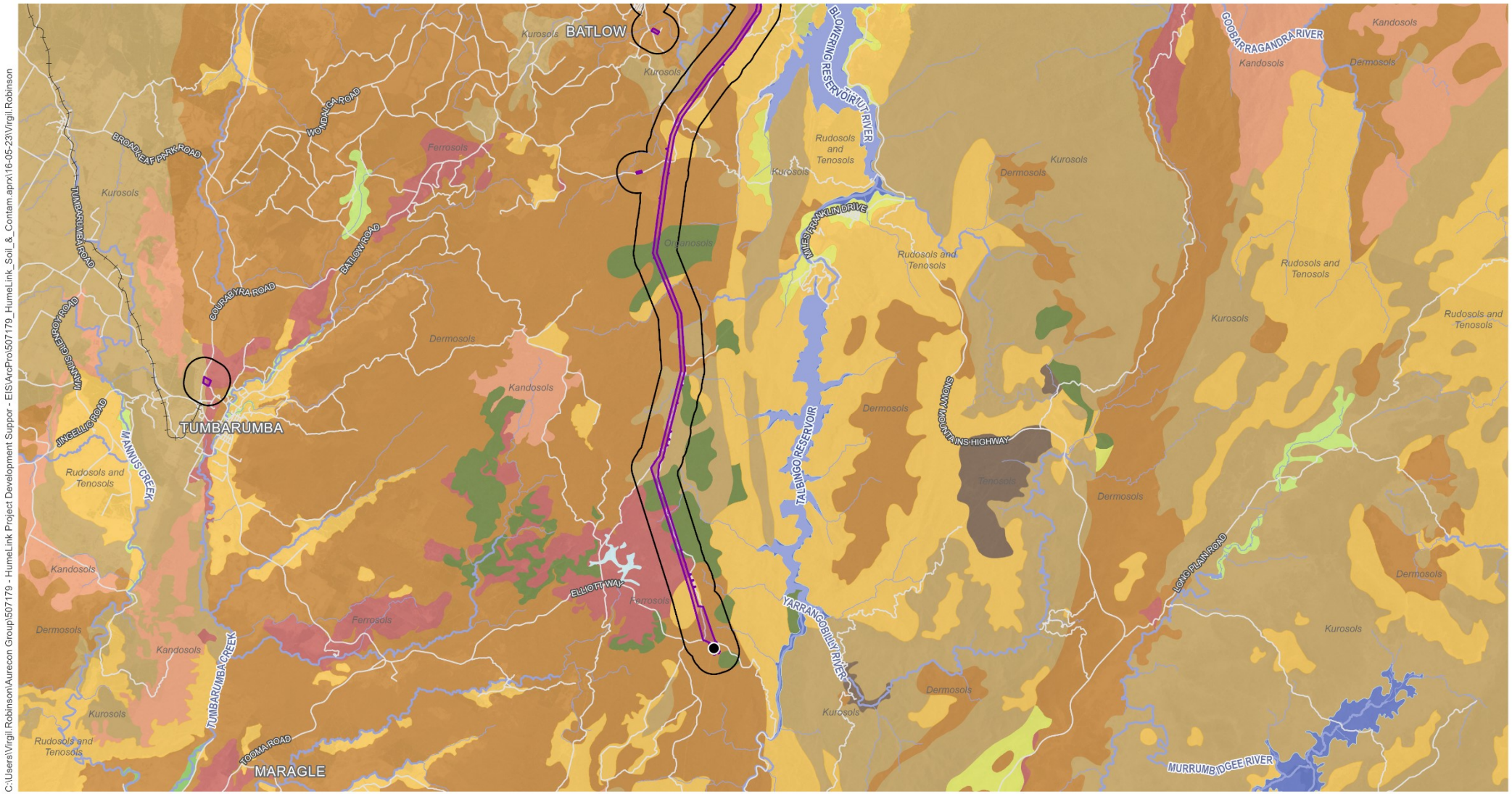
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-2e: Australian soil classification



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Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

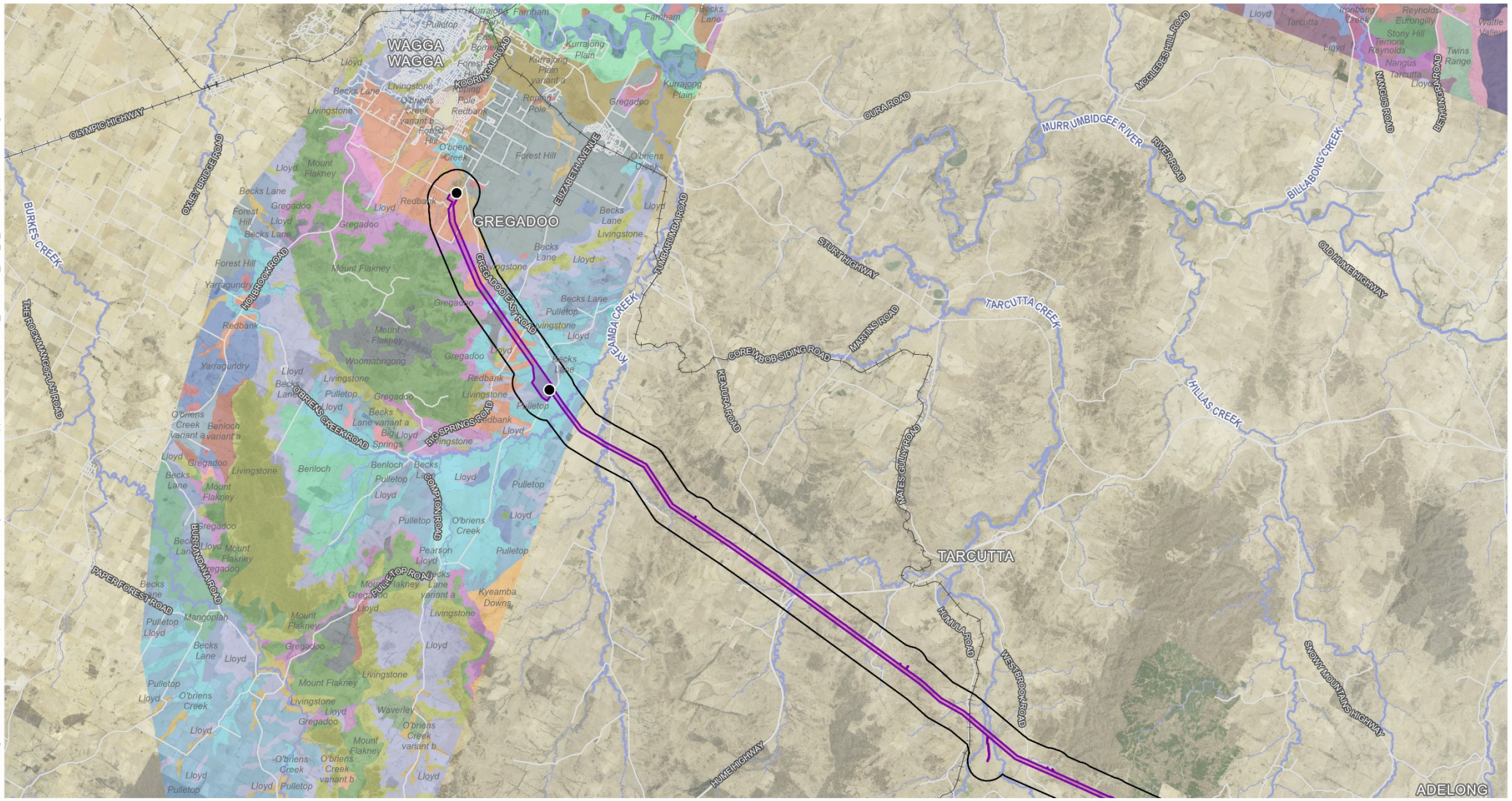
Figure 5-2f: Australian soil classification

A review of soil landscape information available through the NSW Government eSPADE 2.2 web application (https://www.environment.nsw.gov.au/eSpade2Webapp/) (DPE, 2023) indicates that data is not available for the majority of the contamination study area. Of the areas with data, the contamination study area is mainly underlain by the Midgee, Binalong and Blakney Creek soil landscapes. These soil landscapes are typically comprised of loamy sand, sandy clay loam and clay loam. The distribution of these soil landscapes is presented below in Figure 5-3 with the specific soil types and their characteristics is listed in Table 5-3. Due to the number of soil landscapes identified, only the characteristic of the soil landscapes comprising of one per cent or more of the contamination study area is presented below.

Table 5-3 Summary of soil landscapes across the contamination study area

Land Zoning	Characteristic	Area (Ha)	Percentage
Midgee	Rolling low hills and hills. Fixed, shallow erosional stream channels, closely to very widely spaced, form a non-directional or convergent integrated tributary network. There is widespread minor to moderate sheet erosion. Gullying of drainage lines also occurs.	6166.6	7.28%
Binalong	Undulating low hills between Yass and Boorowa. Weakly to moderately structured soils occur on crests and side slopes. Permanent erosional stream or convergent integrated tributary pattern. Some gullying of drainage lines. Sheet and wind erosion are significant following dry periods.	5197	6.14%
Blakney Creek	Particular valleys within undulating low hills. Closely to very widely spaced permanent erosional stream channels, form non-directional or convergent integrated tributary pattern. Moderate to severe gullying and moderate sheet erosion occur extensively. Saline areas on many valley flats, in particular around Nerrimunga Creek and near Rugby.	4970.8	5.87%
Oak Creek	Shallow soils formed on steep hills and rolling to steep hills formed on Silurian volcanics. Minor to moderate sheet erosion, soil creep, gullying and stream bank erosion occur. Other limitations include salinity hazard on lower slopes, high run-on, low wet bearing strength topsoil and non-cohesive topsoil.	3499.2	4.13%
Garland	Undulating rises and valleys formed from granitic parent material. Permanent erosional stream channels form a non-directional, integrated or interrupted tributary pattern. Following prolonged rain, springs occur on sideslopes. Gullying of drainage lines is the most frequent form of soil erosion. Where gullies are allowed to progress unchecked, they can often reach depths of >3 m. Sheet erosion occurs only in very dry years or following bushfires. Occasional salting in low-lying areas.	3145.5	3.72%
Taralga	Plateaux or valleys of gently undulating to undulating rises. Drainage plains rather than incised stream channels. Sheet erosion occurs where soils are cleared for cultivation. It also occurs on steep gradients where there is soil creep and occasionally slumping.	2434.1	2.88%
Macalister	This soil landscape is an incised plateau. Undulating to rolling low hills are typical landform patterns. Little erosion occurs on the fertile soils formed on the basalt remnants. Some gully and sheet erosion are present on other soil types.	2374.7	2.81%
Cockatoo	Rolling low hills and hills. Permanent erosional stream patterns closely to very widely spaced form a non-directional tributary pattern. Minor sheet erosion particularly following dry periods. Very little gully erosion was observed.	2220.4	2.62%
Lickinghole	Very steep hills. Closely spaced, permanent erosional stream channels form a non-directional and diverging tributary network. Minor to moderate sheet erosion, soil creep, gullying and stream bank erosion occur.	1799.8	2.13%

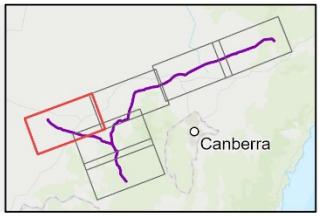
Land Zoning	Characteristic	Area (Ha)	Percentage
Conroys Creek	Occurs as a valley extending north-westerly from Burrinjuck Dam to Dunderalligo Creek. Gentle to very steep slopes, typically with permanent erosional stream channels, closely to very widely spaced, which form a non-directional or convergent integrated tributary pattern. Gullying of drainage lines is extensive. Sheet erosion significant following dry periods. The topsoils have poor water-holding capacities and dry out quickly.	1096.7	1.30%
Murringo	Undulating to rolling low hills formed on Silurian granodiorite. Sheet and rill erosion occur on cultivated lands. Moderately severe gully erosion occurs along concentrated flowlines. Gully erosion restricts access locally. Salinity outbreaks are present in many areas, particularly in drainage depressions Other limitations of this soil landscape include low wet bearing strength surface soil, sodicity and high erodibility in the subsoil and acidity in the topsoil.	1086.3	1.28%
Coppabella Creek	Rolling hills and valleys. The Murrumbidgee River and Coppabella Creek flow through sections of the landscape. Permanent shallow erosional stream channels, closely to very widely spaced, form a convergent integrated tributary network. Sheet and gully erosion present at the time of the assessment due to bushfires.	913.6	1.08%
O'Briens Creek	Gently undulating plains of alluvial sediments. Extensive sloping plains adjacent to hillslopes, river channels and narrow drainage lines. Moderate to severe gully erosion (up to 3 m deep, usually not to bedrock) and streambank erosion along some drainage lines and creeks. Moderate sheet erosion commonly occurs on steeper parts near hillslopes. Waterlogging occurs locally at some low-lying places.	909.4	1.07%
No data available		42722.2	50.46%
Others	Other soil landscapes comprising of less than 1% within the contamination study area.	6137	7.25%



Project footprint
Contamination study area
Railway
Watercourse
Substation

Soil Landscapes

Becks Lane
Becks Lane variant a
Benloch
Benloch variant a
Bethungra
Big Springs
Currajong
Currawarna
East Bomen
Eurongilly
Farnham
Forest Hill
Glenmornon
Gregadoo
Gregadoo variant a
Ironbong Creek
Ironbong Creek variant a
Kurrajong Plain
Kurrajong Plain variant a
Kyeamba Downs
Livingstone
Lloyd
Mangoplah
Mount Flakney
Mount Flakney variant a
Nangus
O'briens Creek
O'briens Creek variant a
O'briens Creek variant b
Pearson
Pulletop
Redbank
Reynolds
Roping Pole
Stony Hill
Tarcutta
Temora
Temora variant a
Twins Range
Twins Range variant a
Wattle Valley
Waverley
Woomabrigong
Yarragundry



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-3a: Soil Landscapes

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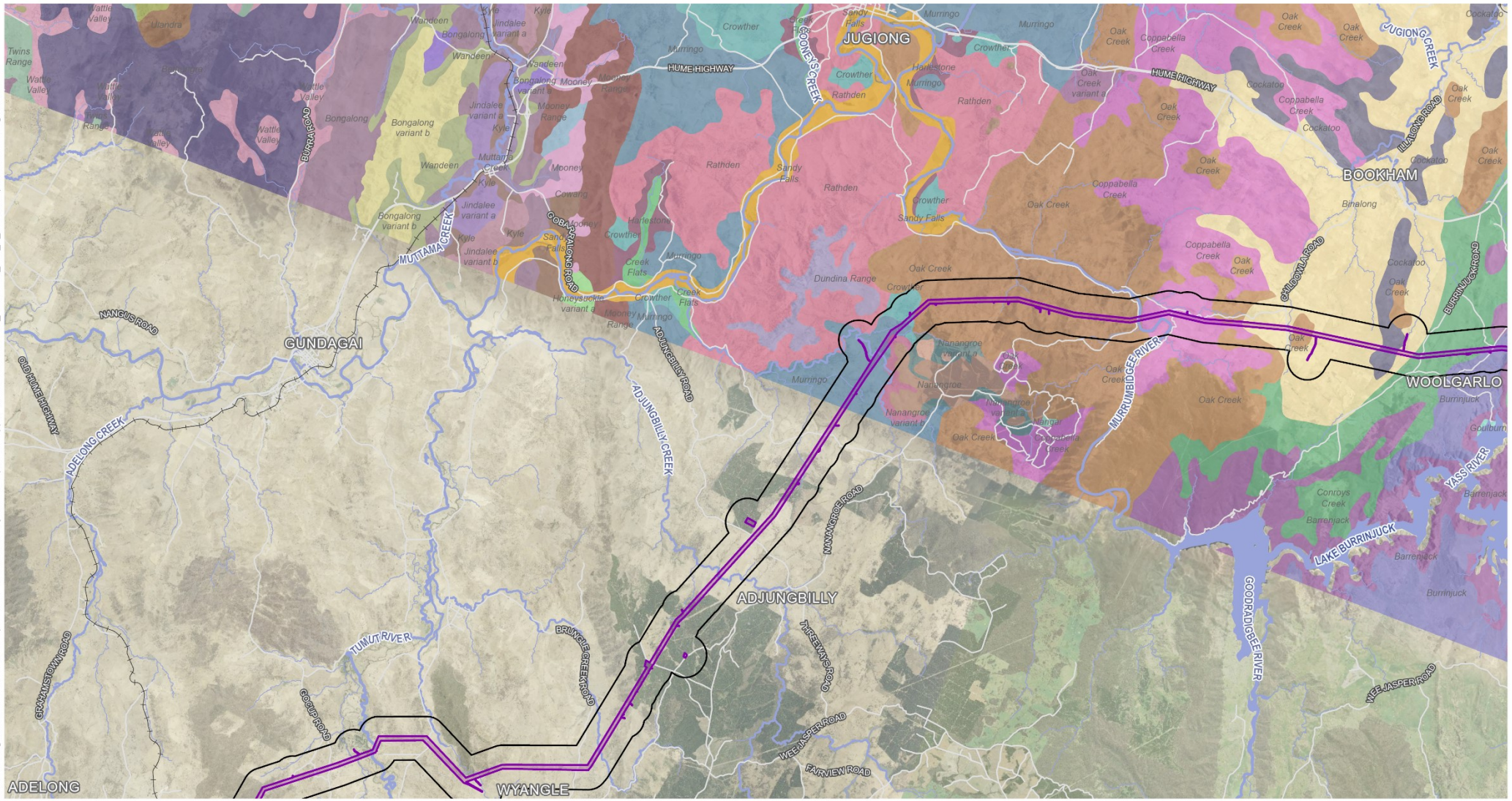

Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-3b: Soil Landscapes

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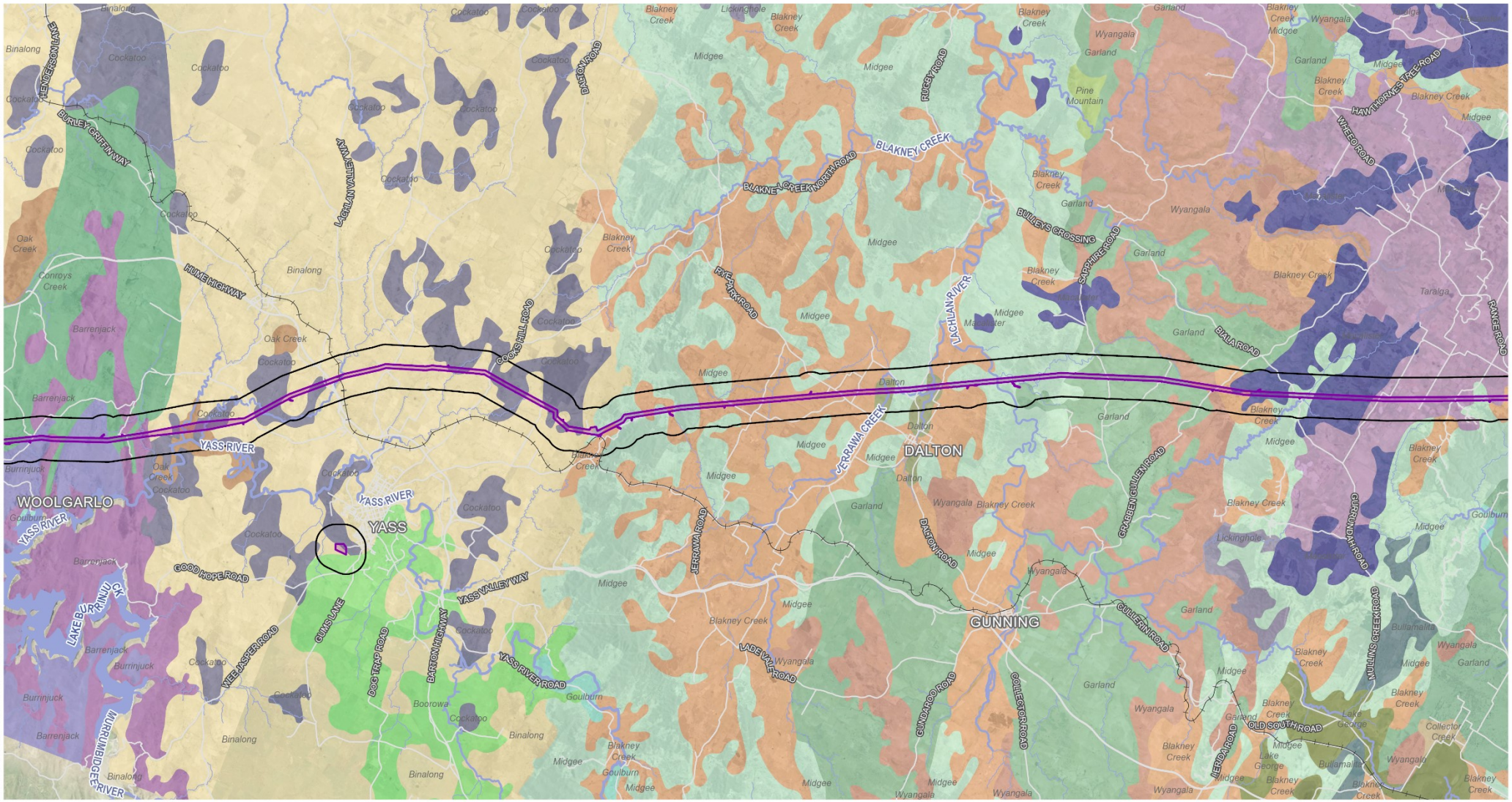


Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

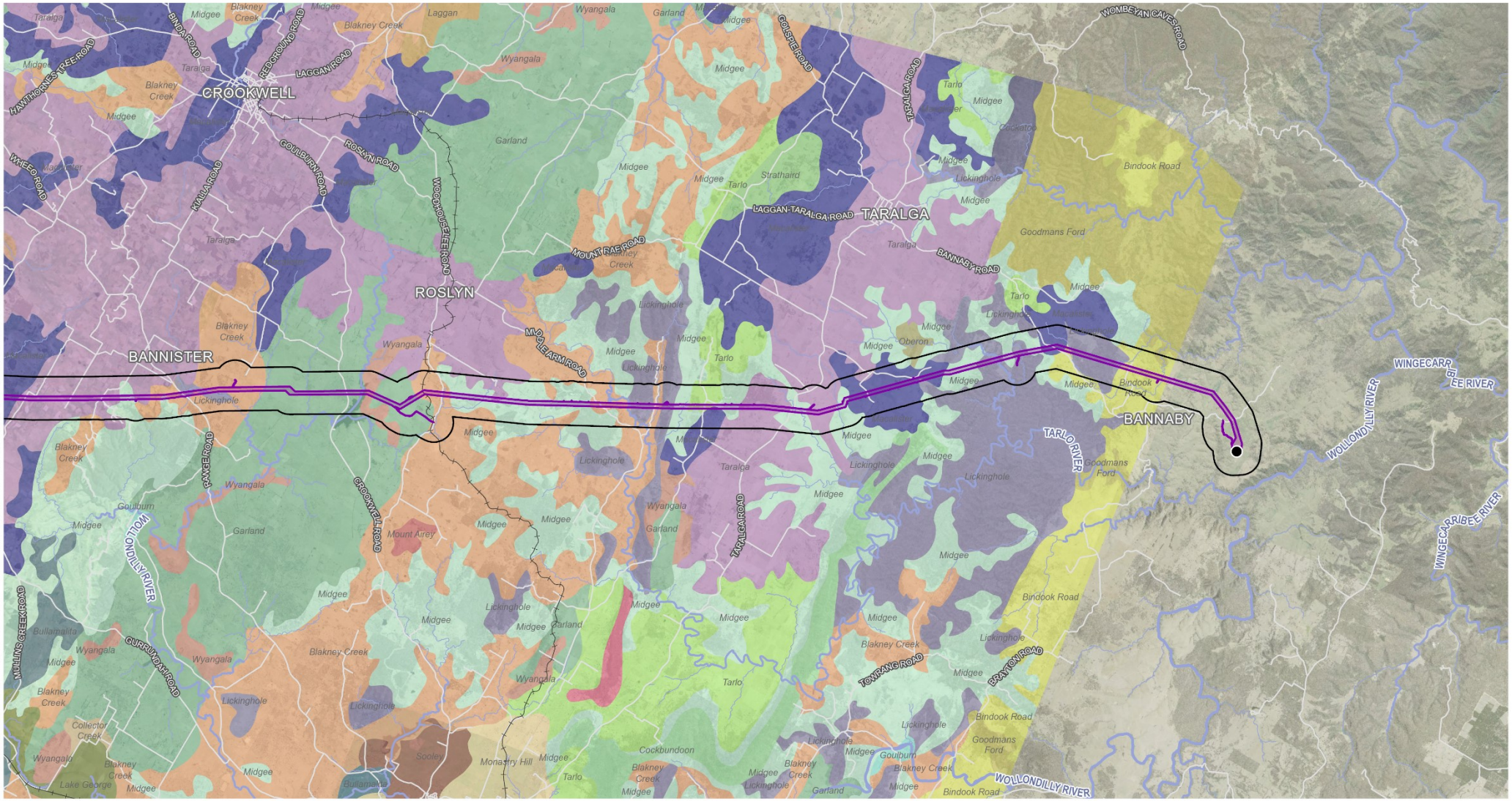
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

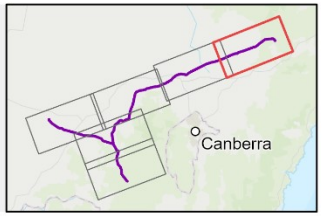
Figure 5-3c: Soil Landscapes



Project footprint
Contamination study area
Railway
Watercourse
Substation

Soil Landscapes

Bindook Road
Blakney Creek
Bullamalita
Cockatoo
Cockbundoon
Collector Creek
Copperhannia
Garland
Goodmans Ford
Goulburn
Laggan
Lake George
Lickinghole
Macalister
Midgee
Monastry Hill
Mount Airey
Oberon
Sooley
Strathaird
Taralga
Tarlo
Wyangala



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-3d: Soil Landscapes

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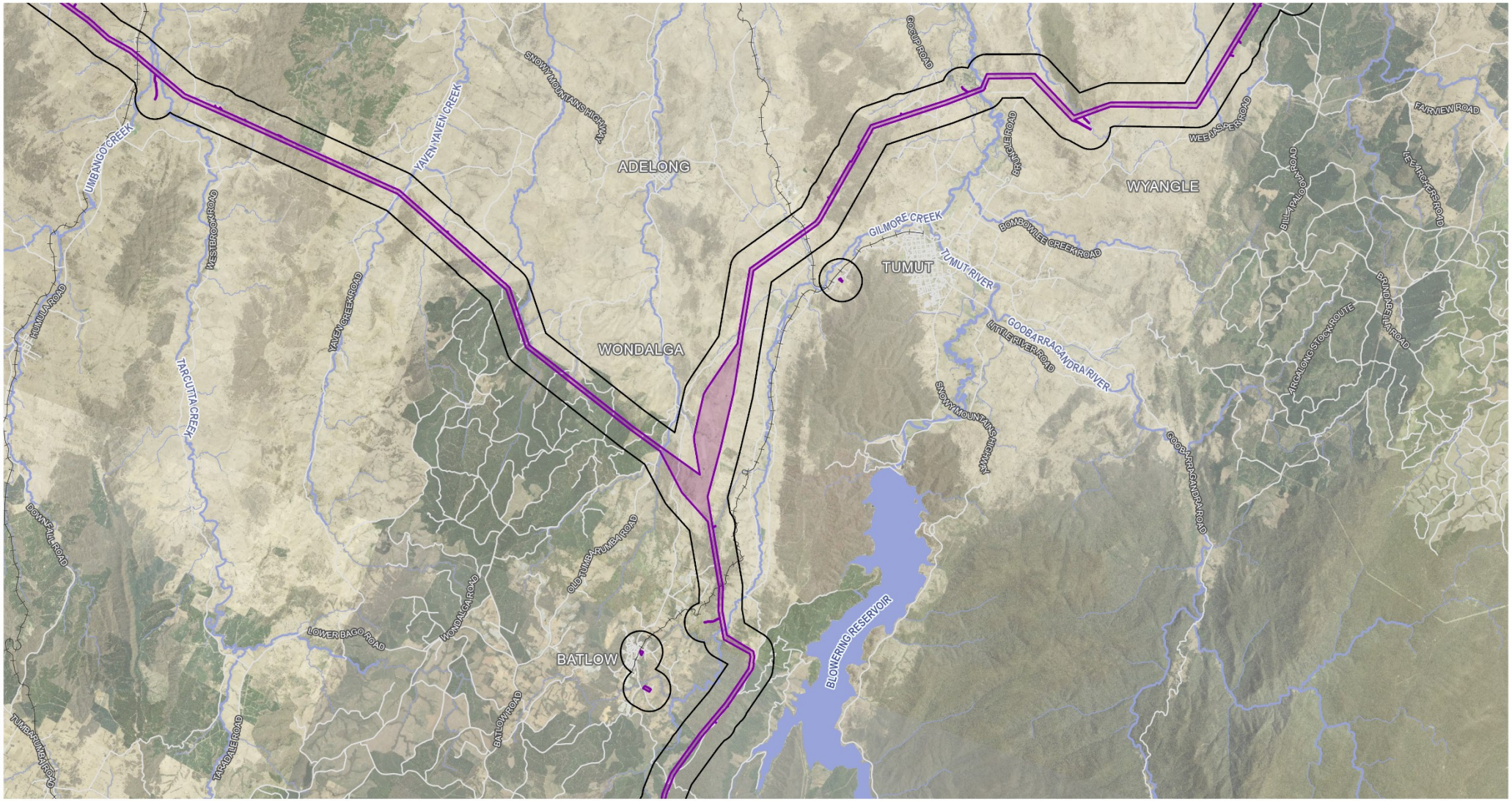

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Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

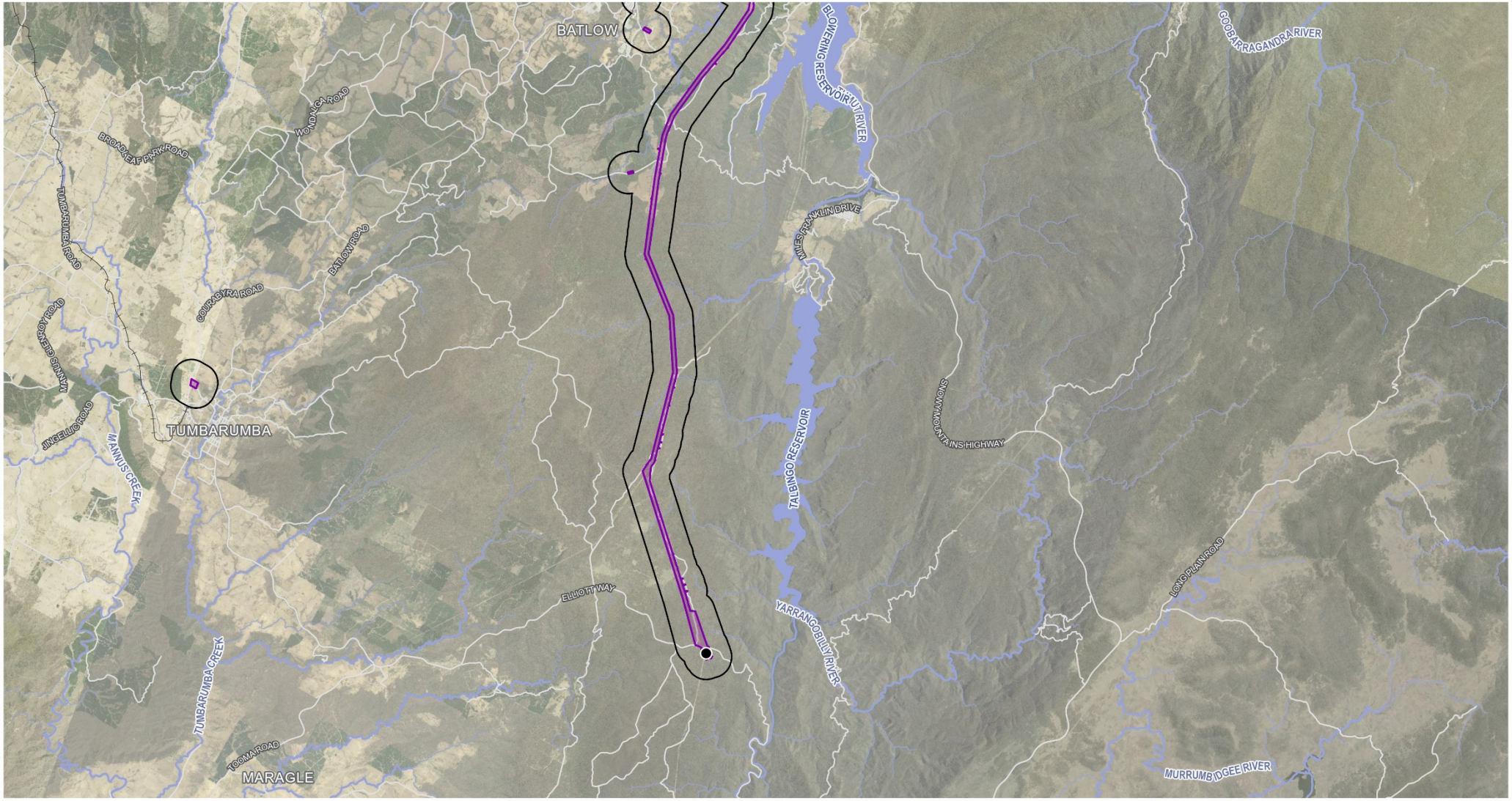
1:200,000

0 4 8 km

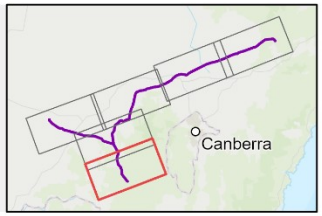
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-3e: Soil Landscapes



Project footprint
Contamination study area
Railway
Watercourse
Substation



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-3f: Soil Landscapes

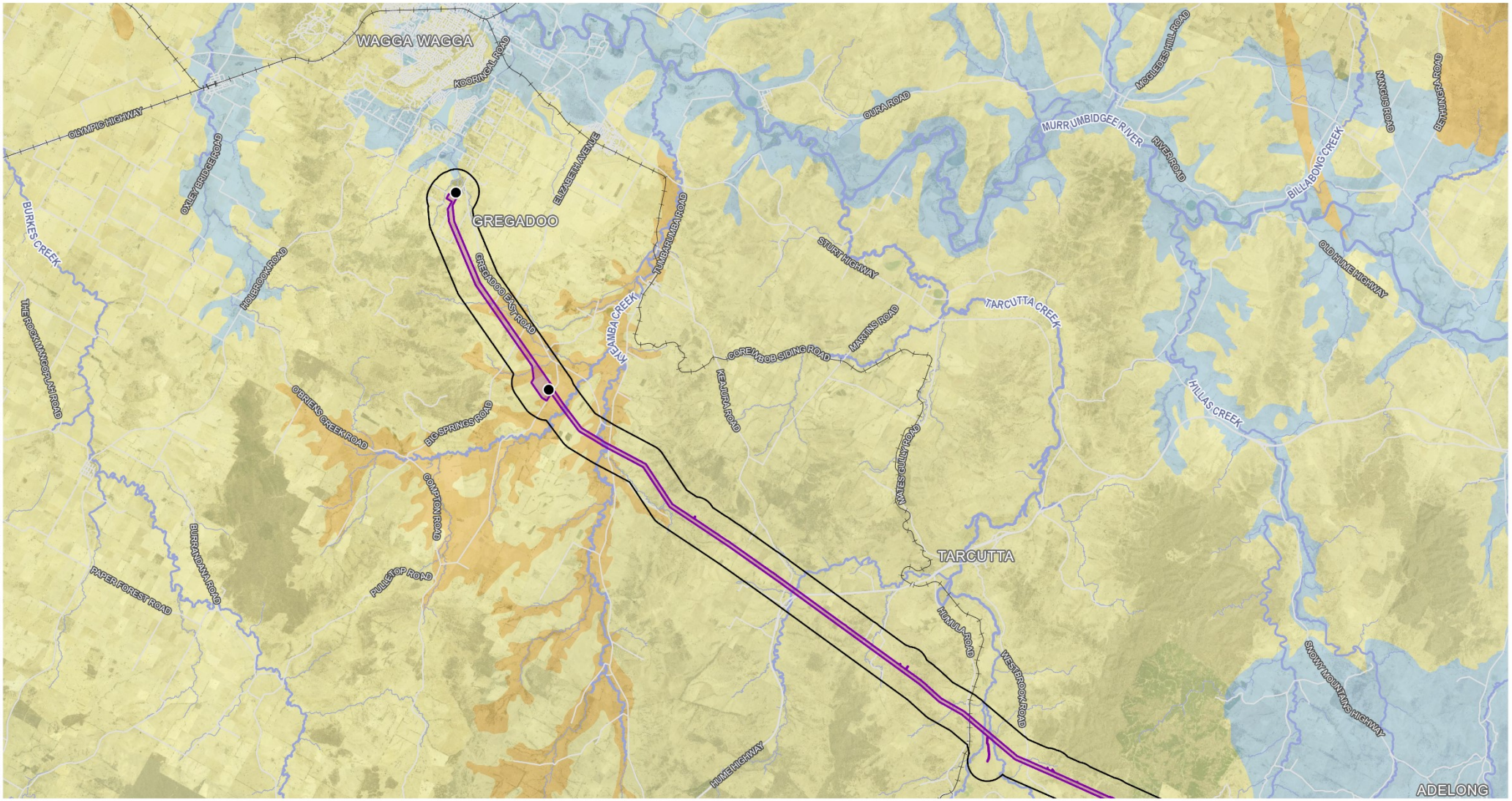
5.2.3 Salinity hazard

The accumulation of salts in the soil surface and groundwater in non-irrigated areas is known as dryland salinity. Dryland salinity is commonly caused by the mobilisation of salts in the soil profile by surface water or groundwater through groundwater recharge (or deep drainage), groundwater movement or groundwater discharge. Dryland salinity is also potentially caused by the exposure of naturally saline soils, including hypersaline clays. Similarly, soils with an exchangeable sodium percentage greater than six per cent, referred to as sodic soils, are also associated with dryland salinity.

A review of the Hydrogeological Landscapes of NSW and the ACT dataset (DPE, 2022) revealed that the contamination study area is mapped as having salinity hazard ranging from very low to very high as presented in Figure 5-4.

Areas of high overall salinity hazard are located along the banks of O'Briens Creek and Brungle Creek and areas to the south of the Crookwell town centre, between Crookwell Road and Middle Arm Road.

The project footprint passes through areas of very high overall salinity hazard around the town centre of Yass between Washpen Creek to Range Road.



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-4a: Salinity hazard

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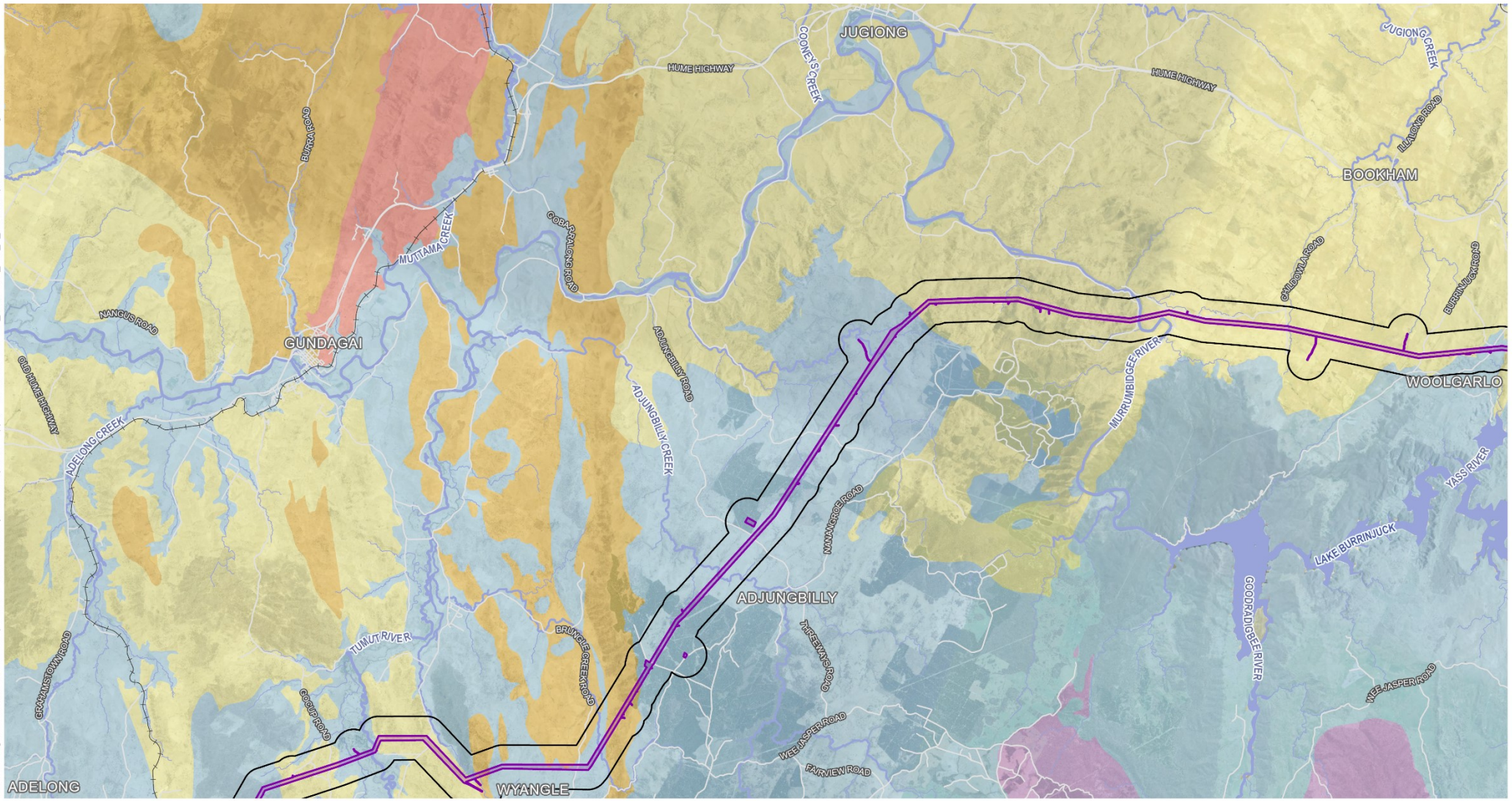

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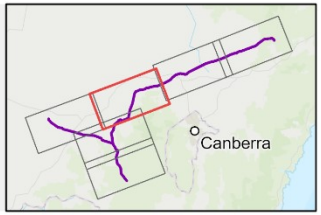
Project footprint
Contamination study area
Railway
Watercourse
Substation

Overall salinity hazard

Very High
High
Moderate
Low
Very Low



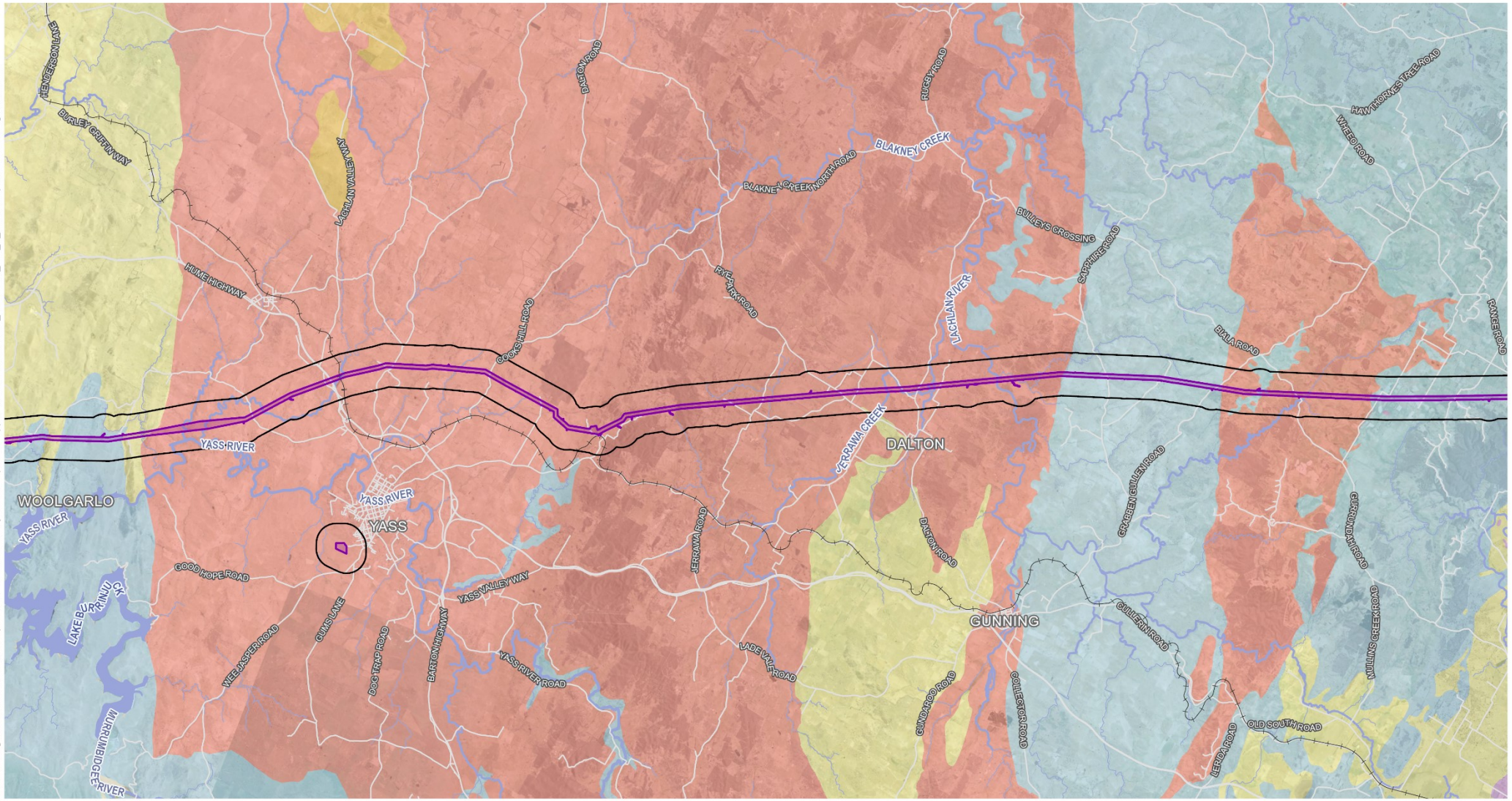
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-4b: Salinity hazard



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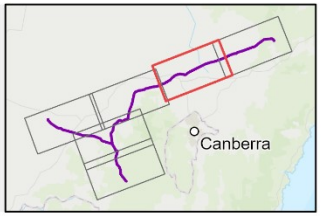
Project footprint
Contamination study area
Railway
Watercourse
Substation

Overall salinity hazard

Very High
High
Moderate
Low
Very Low



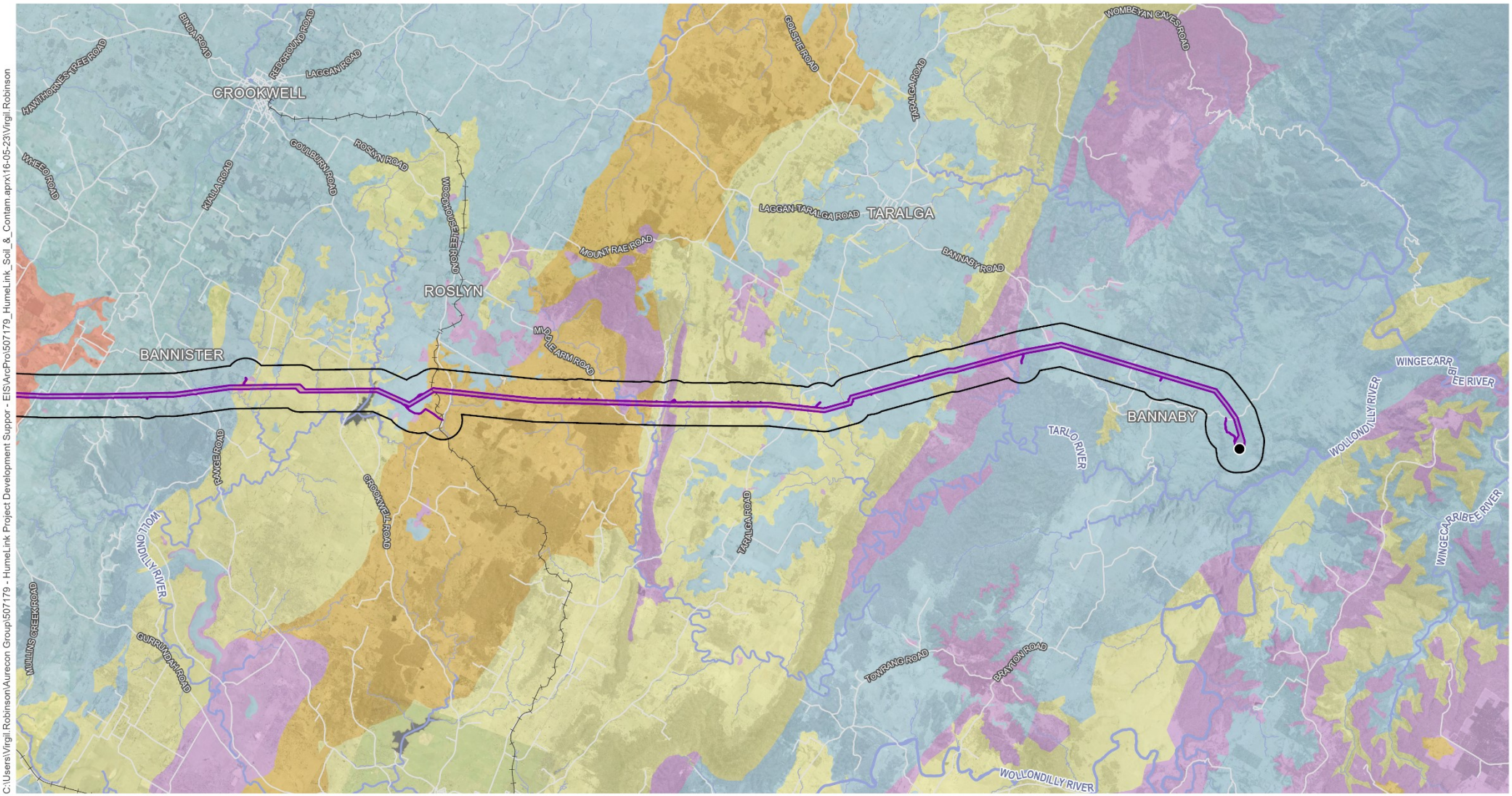
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-4c: Salinity hazard



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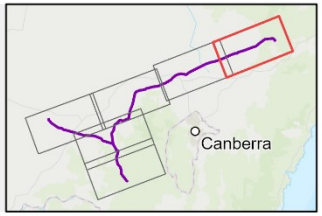
Project footprint
Contamination study area
Railway
Watercourse
Substation

Overall salinity hazard

Very High
High
Moderate
Low
Very Low



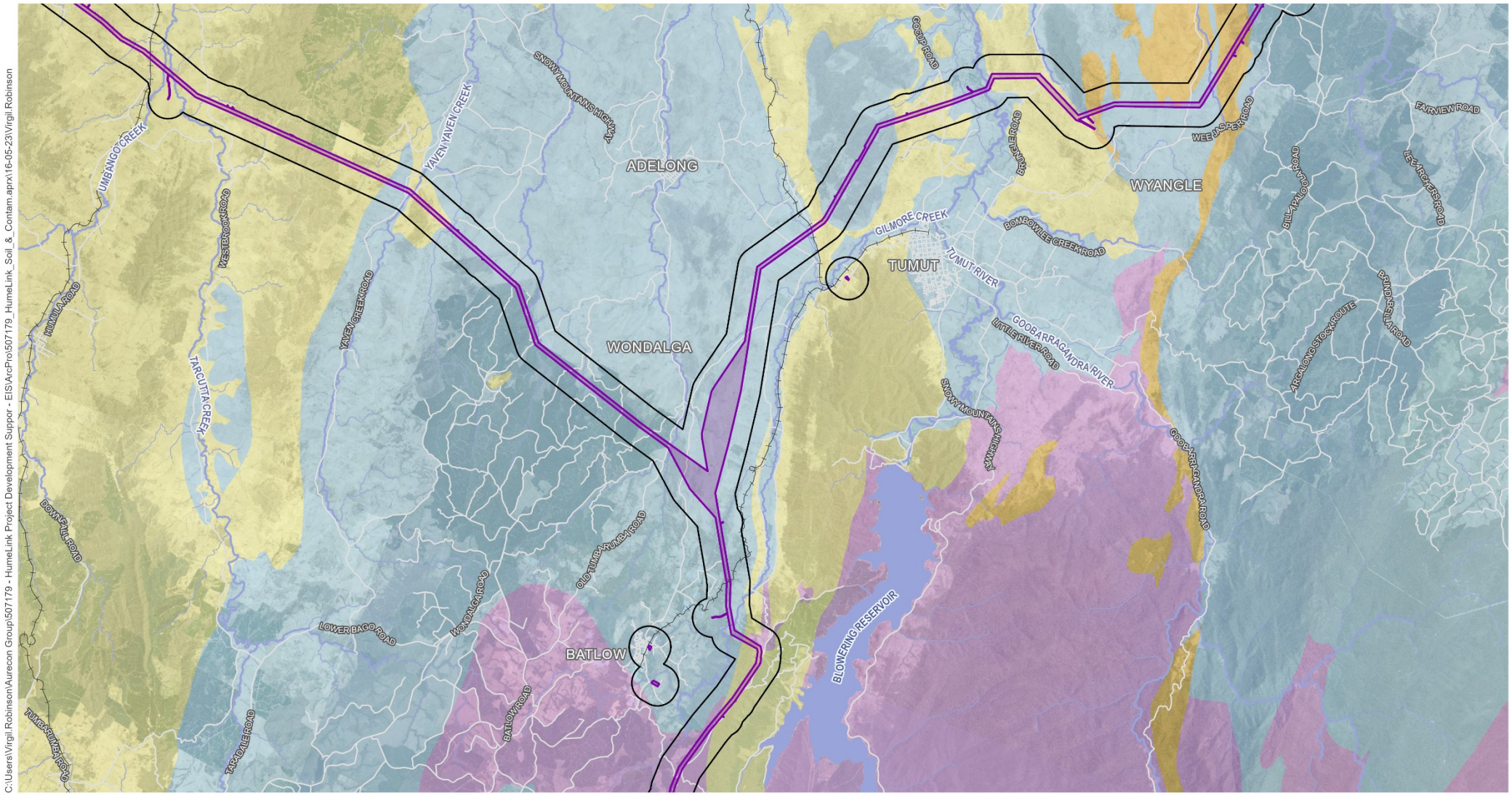
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-4d: Salinity hazard



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

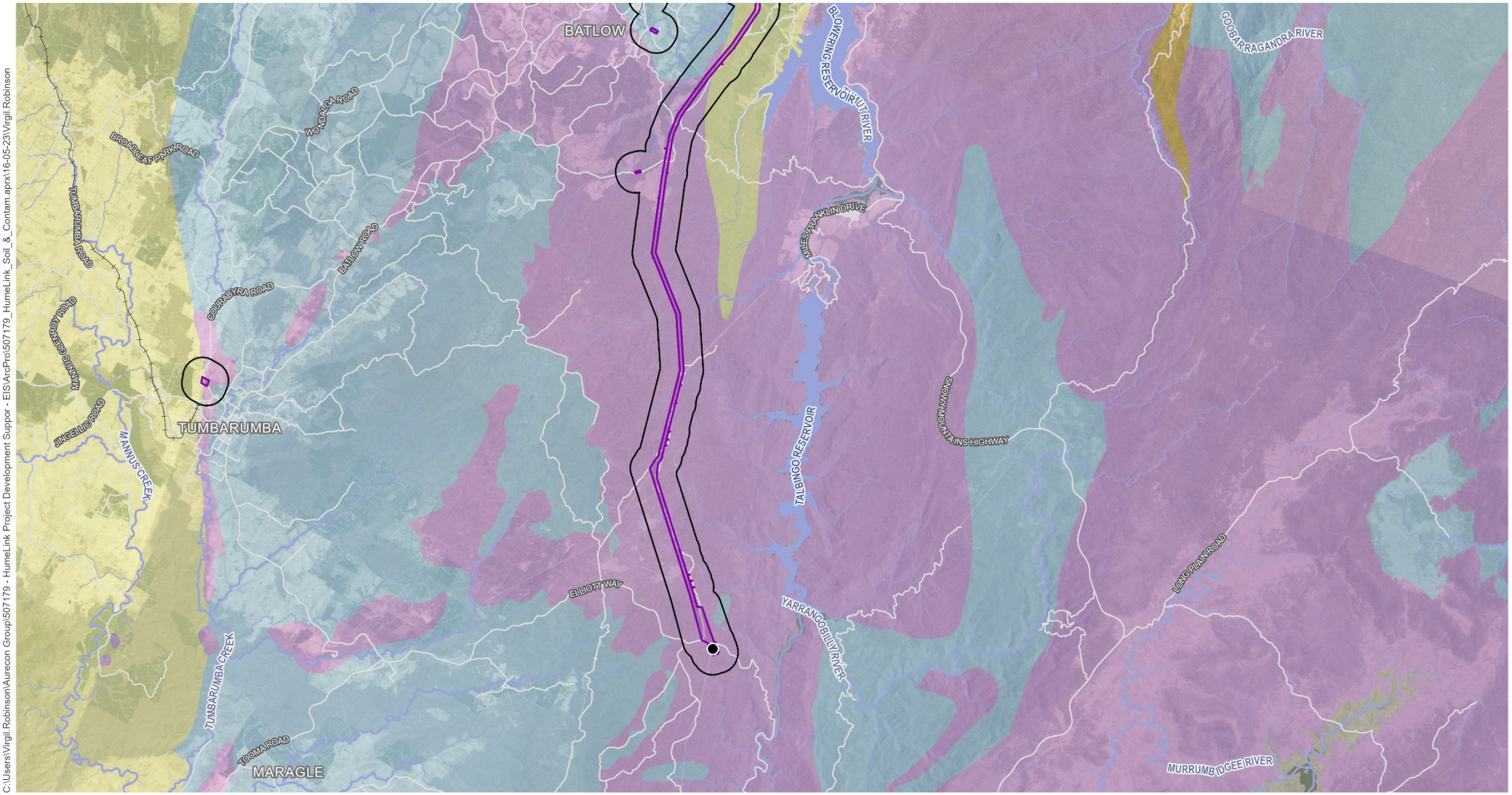
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-4e: Salinity hazard



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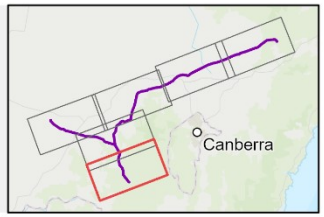
Project footprint
Contamination study area
Railway
Watercourse
Substation

Overall salinity hazard
High
Moderate
Low
Very Low



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

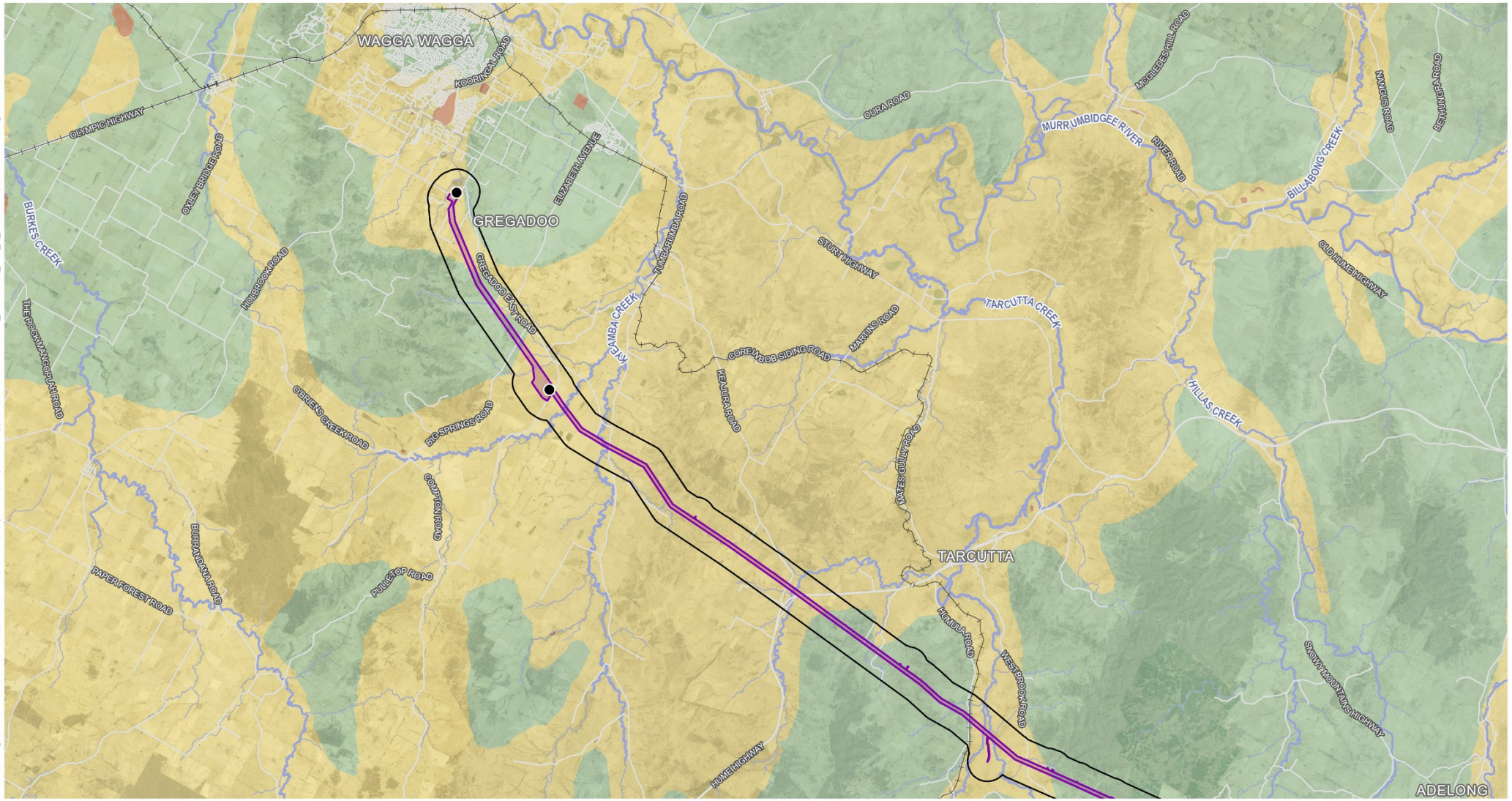
Figure 5-4f: Salinity hazard

5.2.4 Acid sulfate soils and acid sulfate rocks

Acid sulfate soils and potential acid sulfate soils are naturally occurring soils that contain iron sulfides. On exposure to air, iron sulfides oxidise and create sulfuric acid resulting in the mobilisation of aluminium, iron and manganese from the soils. Acid sulfate soils typically occur in coastal environments at elevations less than 10 mAHD (DLWC,1998). Inland acid sulfate soils can be formed in extended periods of drought in inland riverine systems but require very specific climatic factors and sources of sulfate, with their presence limited to the lower levels of the river channel and bottom sediments.

The Australian Soil Resource Information System (CSIRO, 2014) indicates that for the contamination study area, there is low or extremely low probability of acid sulfate soils. Acid sulfate soils probability mapping is present in Figure 5-5.

Similarly, acid sulfate rocks are unweathered rocks that contain metal sulfide minerals, which can generate acid when exposed to both oxygen and water. It is noted that the geological landscape of the contamination study area may contain naturally occurring pyrite veins and dykes which when disturbed through excavation may generate acidity when wet. As the veins and dykes are likely to contain macro-sized pyrite inclusions, generation of significant acidity from the host rock is considered unlikely. As veins and dykes are common across the geological profile of the contamination study area, these have not been mapped in detail.



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Source: *Aurecon, Transgrid, CSIRO, Spatial Services (DCS), ESRI Basemap*

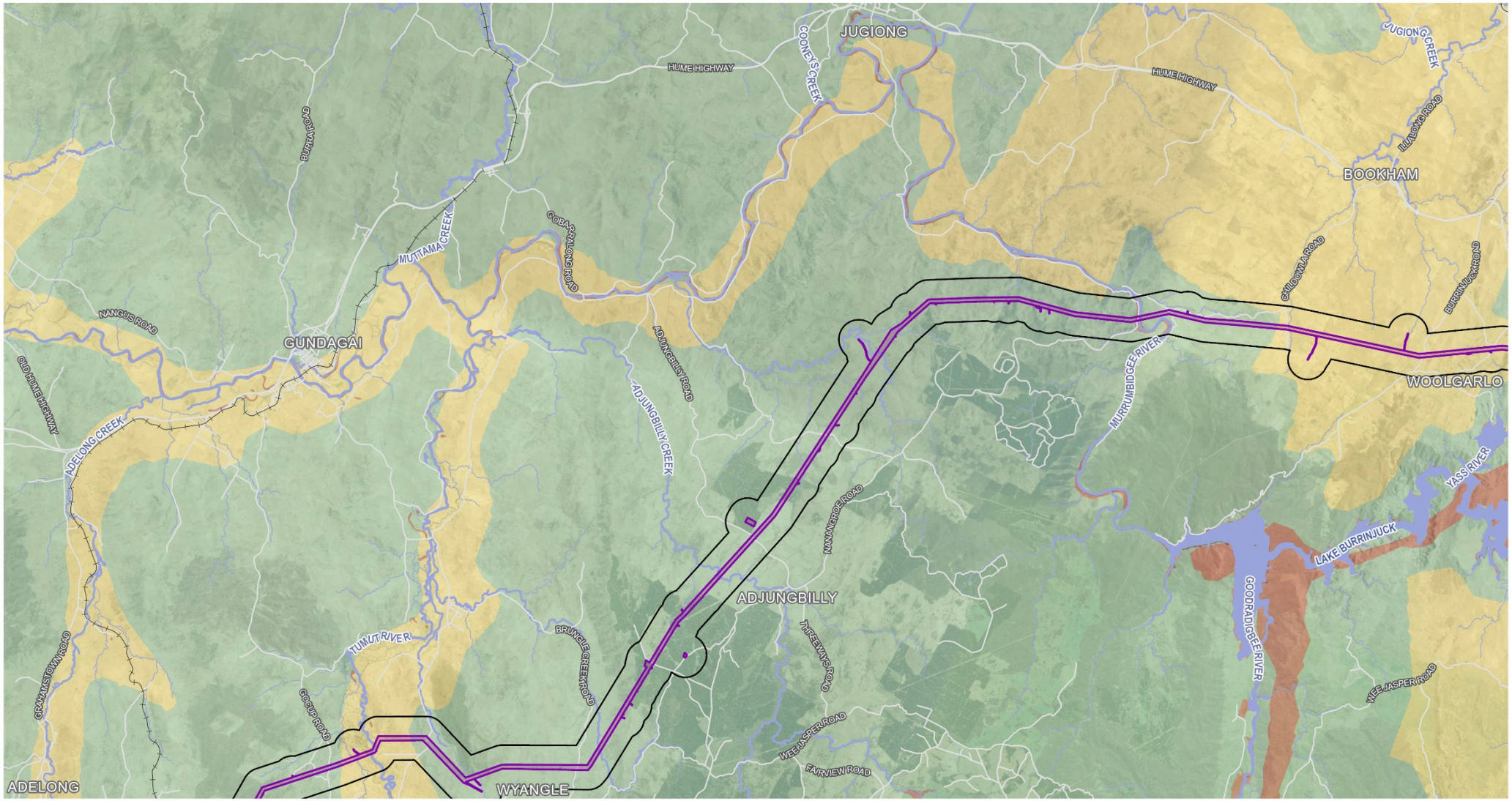
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-5a: Acid sulfate soils



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Source: *Aurecon, Transgrid, CSIRO, Spatial Services (DCS), ESRI Basemap*

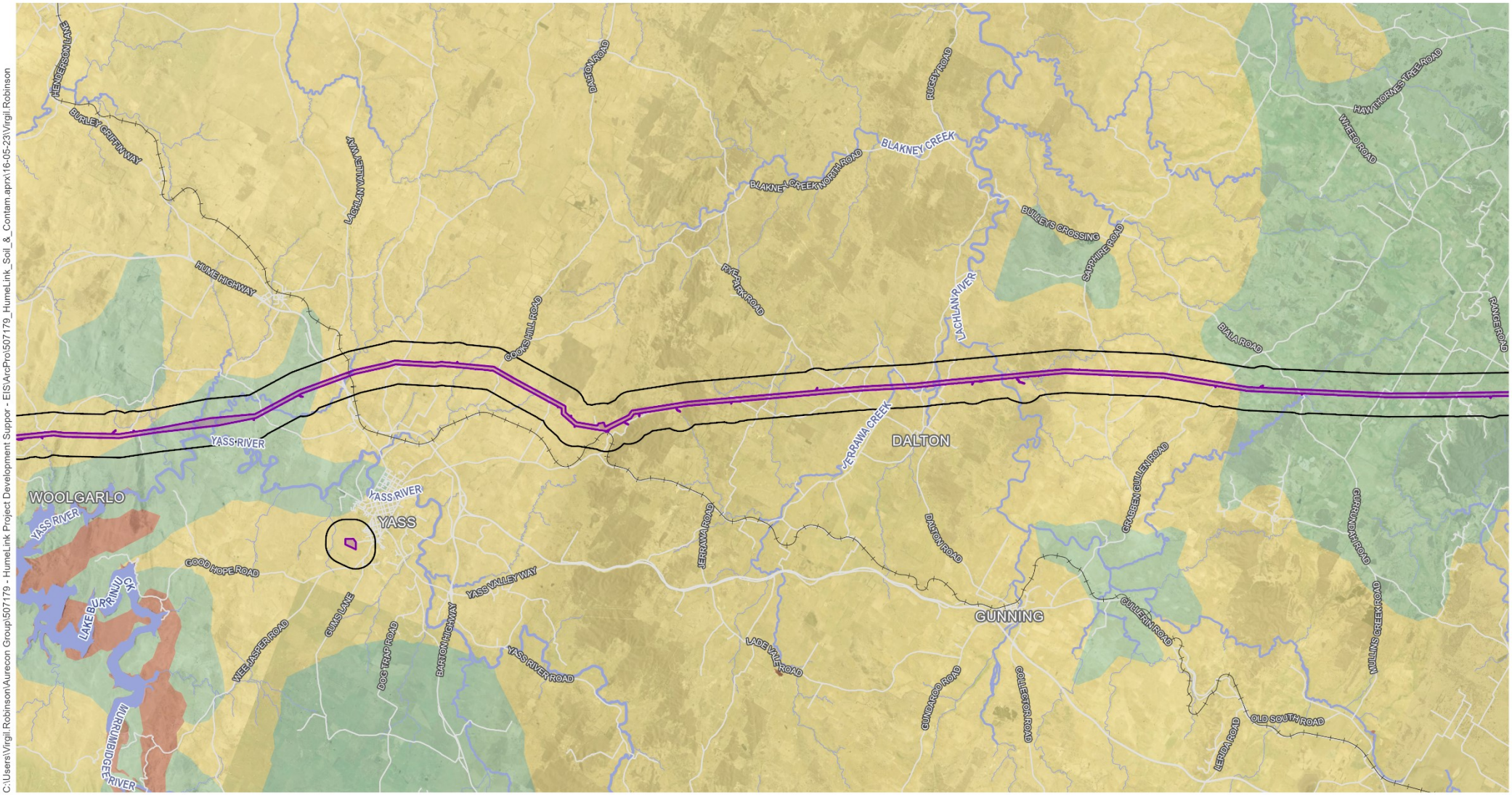
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-5b: Acid sulfate soils



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Project footprint

Contamination study area

Railway

Watercourse

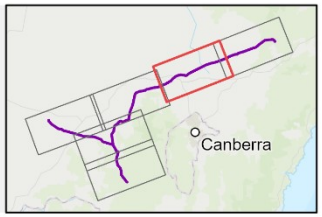
Substation

National Acid Sulfate Soils Atlas

High Probability/Very Low Confidence

Low Probability/Very Low Confidence

Extremely Low Probability/Very Low Confidence



Source: *Aurecon, Transgrid, CSIRO, Spatial Services (DCS), ESRI Basemap*

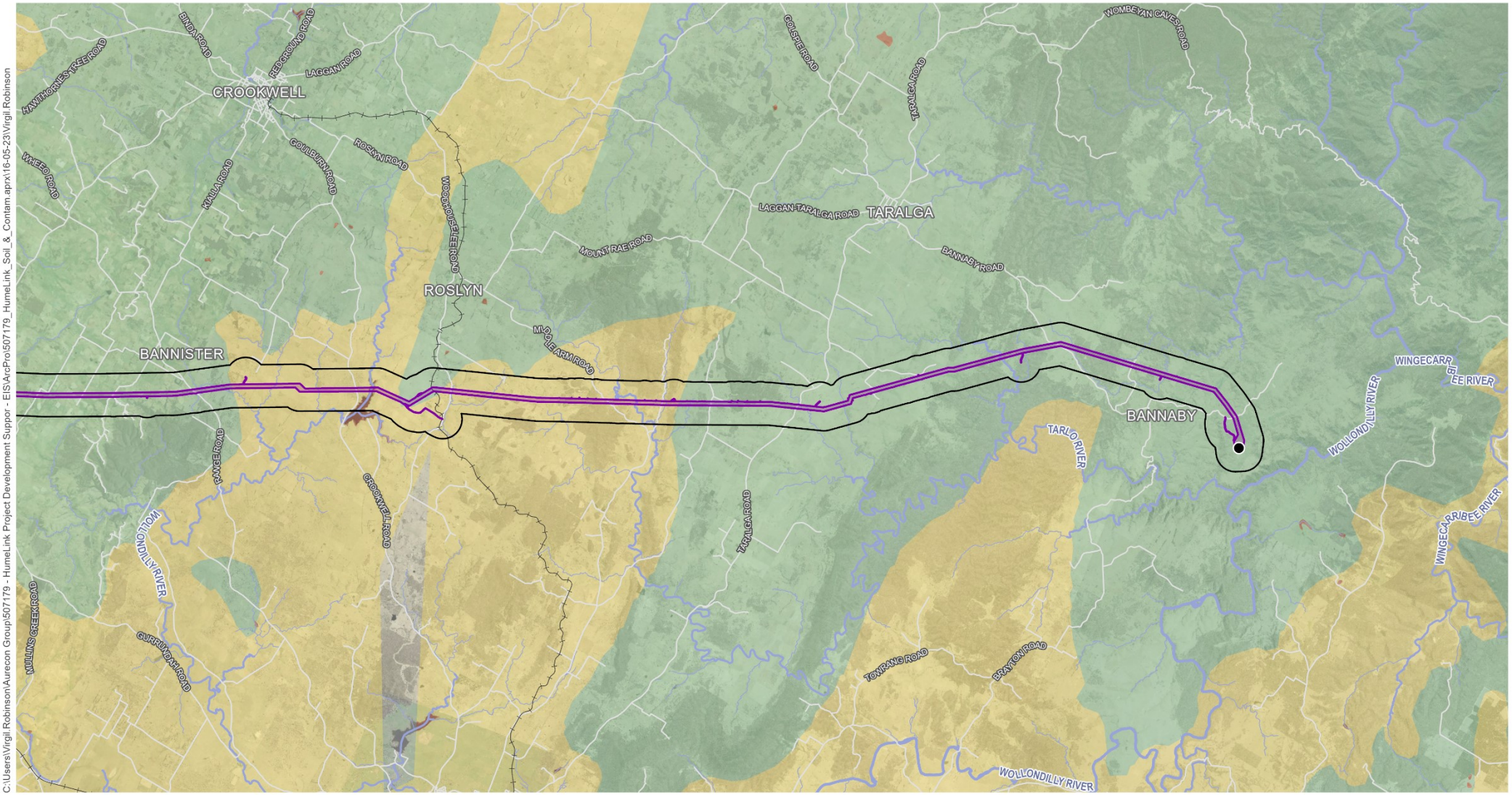
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-5c: Acid sulfate soils



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Source: *Aurecon, Transgrid, CSIRO, Spatial Services (DCS), ESRI Basemap*

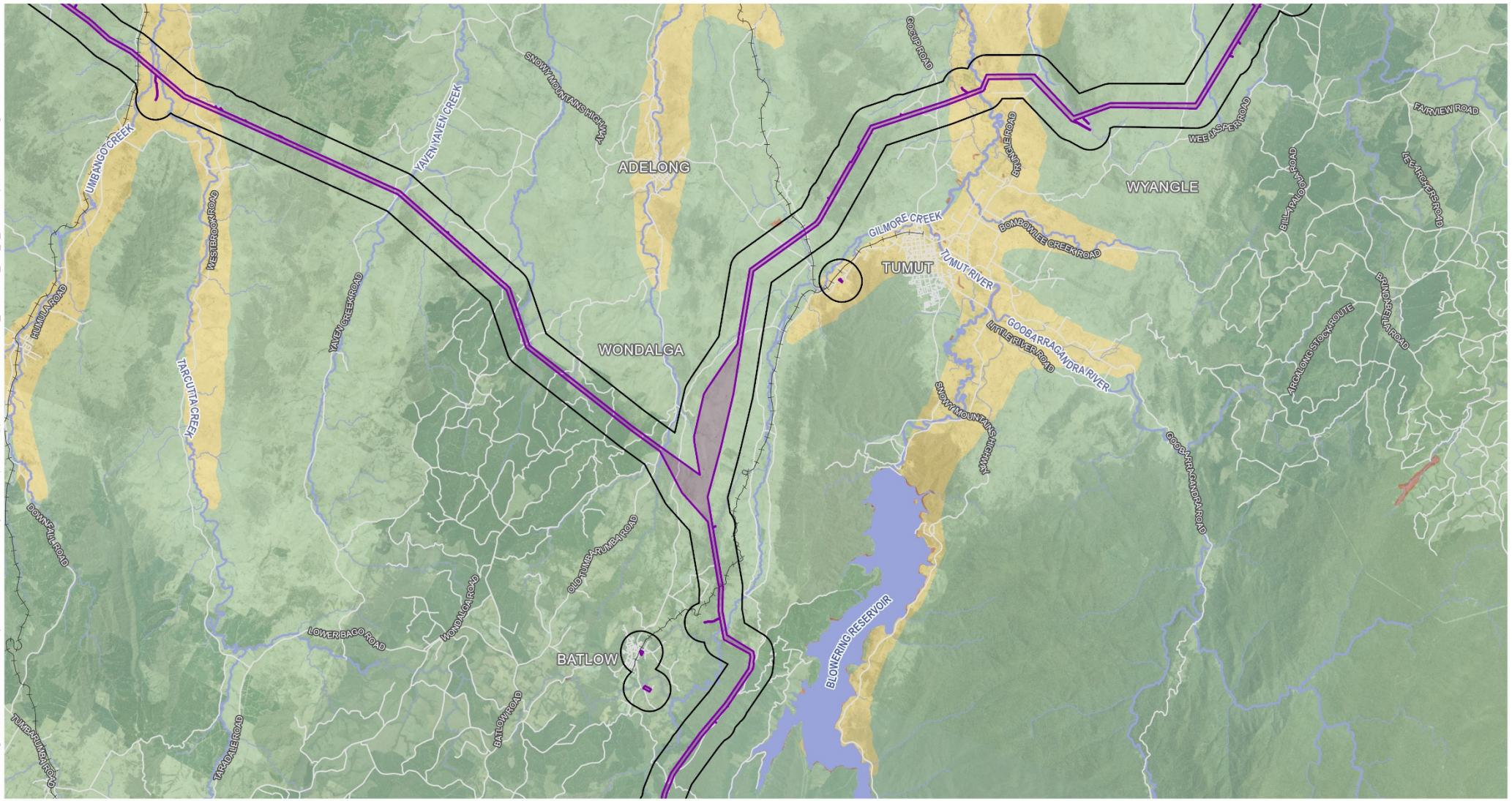
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

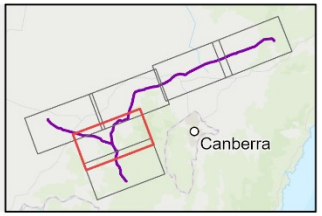
Figure 5-5d: Acid sulfate soils



Project footprint
Contamination study area
Railway
Watercourse
Substation

National Acid Sulfate Soils Atlas

High Probability/Very Low Confidence
Low Probability/Very Low Confidence
Extremely Low Probability/Very Low Confidence



Source: *Aurecon, Transgrid, CSIRO, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-5e: Acid sulfate soils

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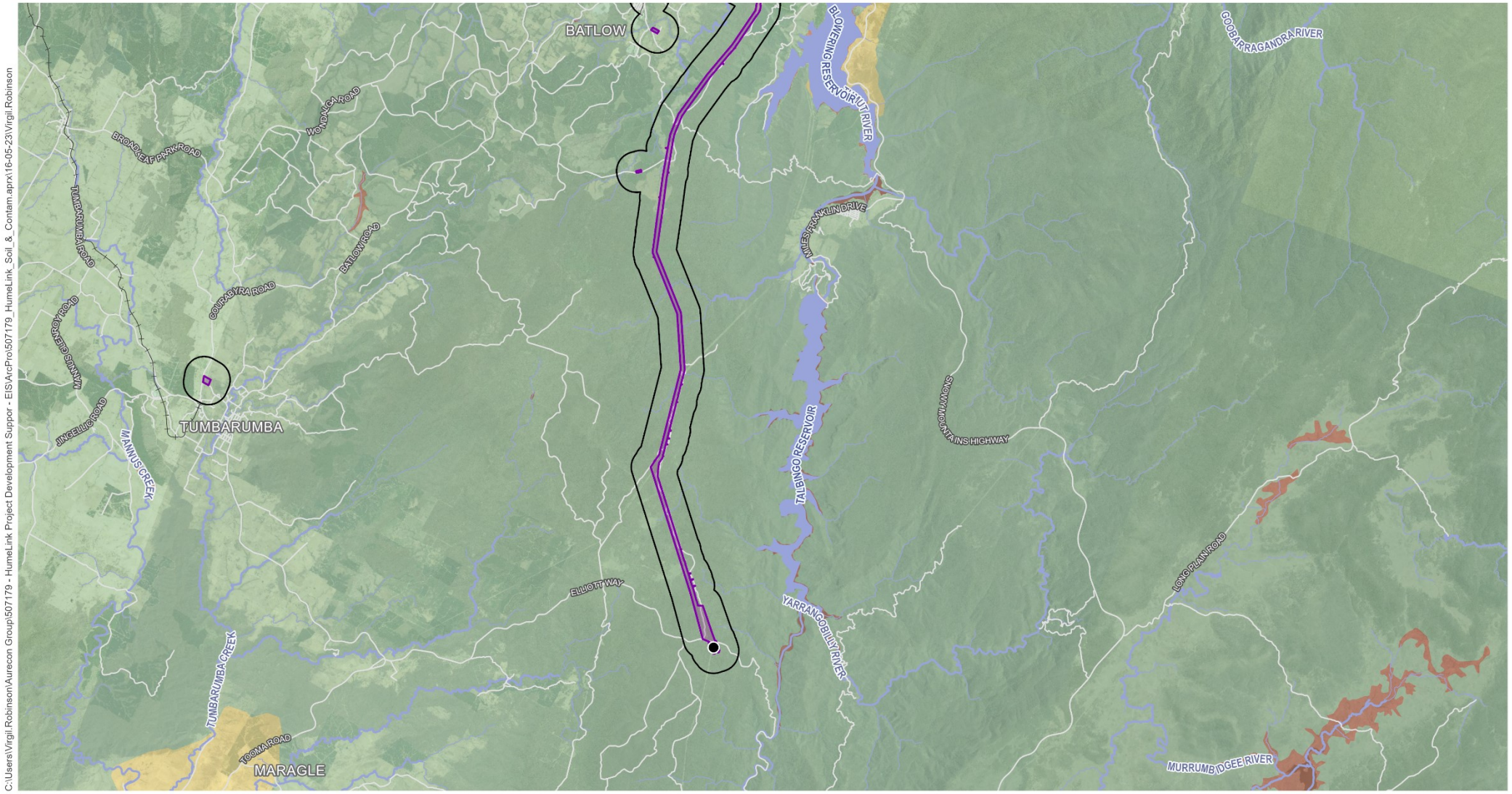
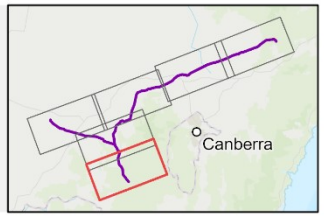


Project footprint
Contamination study area
Railway
Watercourse
Substation

National Acid Sulfate Soils Atlas

High Probability/Very Low Confidence
Low Probability/Very Low Confidence
Extremely Low Probability/Very Low Confidence



Source: *Aurecon, Transgrid, CSIRO, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-5f: Acid sulfate soils

5.2.5 Naturally occurring asbestos

Naturally occurring asbestos (NOA) refers to the mineral that occurs as a natural component of soils or rock formations, as opposed to asbestos present in commercial products, mining or processing operations. NOA can be released from soil or rocks by routine human activities, including construction, or through natural processes such as weathering. Asbestos is a commercial and industrial term describing a group of silicate minerals that form bundles of long, very thin mineral fibres called asbestiform. Winchite and richterite are also asbestiform and present in soils and rocks, although they are not technically classified as asbestos. Asbestos is most commonly found in three rock types: serpentines, altered ultramafic rocks and some mafic rocks.

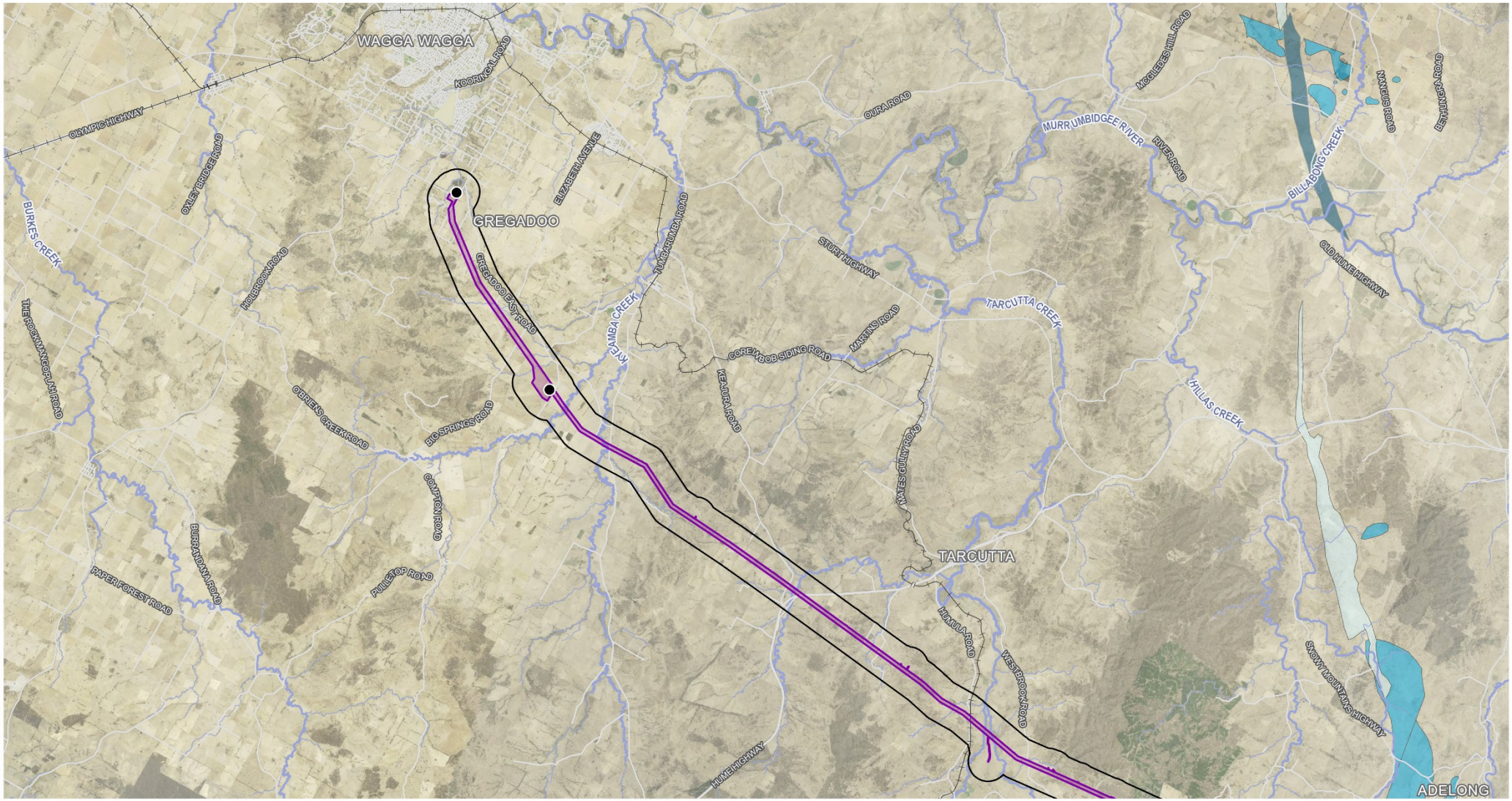
The NSW Government's online environmental data portal[2] has mapped the probability of NOA being present as low, medium or high potential regions (DRNSW, 2015). A review of the database indicates that NOA is not mapped in the majority of the contamination study area.

Low, medium and high potential regions are mapped in the following locations as shown in Figure 5-6:

- low potential regions - from Red Hill to Gilmore
- medium potential regions - south of Red Hill and between Sharps Creek and Wondalga
- high potential regions - around Red Hill and Gadara.

Given the presence of low, medium and high potential areas of NOA, there is a risk of disturbing soil or rock containing NOA during the construction phase of this project at these locations.

[2] https://geo.seed.nsw.gov.au/



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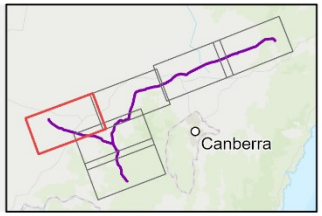
Project footprint
Contamination study area
Railway
Watercourse
Substation

Naturally Occurring Asbestos Potential

High Asbestos Potential
Medium Asbestos Potential
Low Asbestos Potential



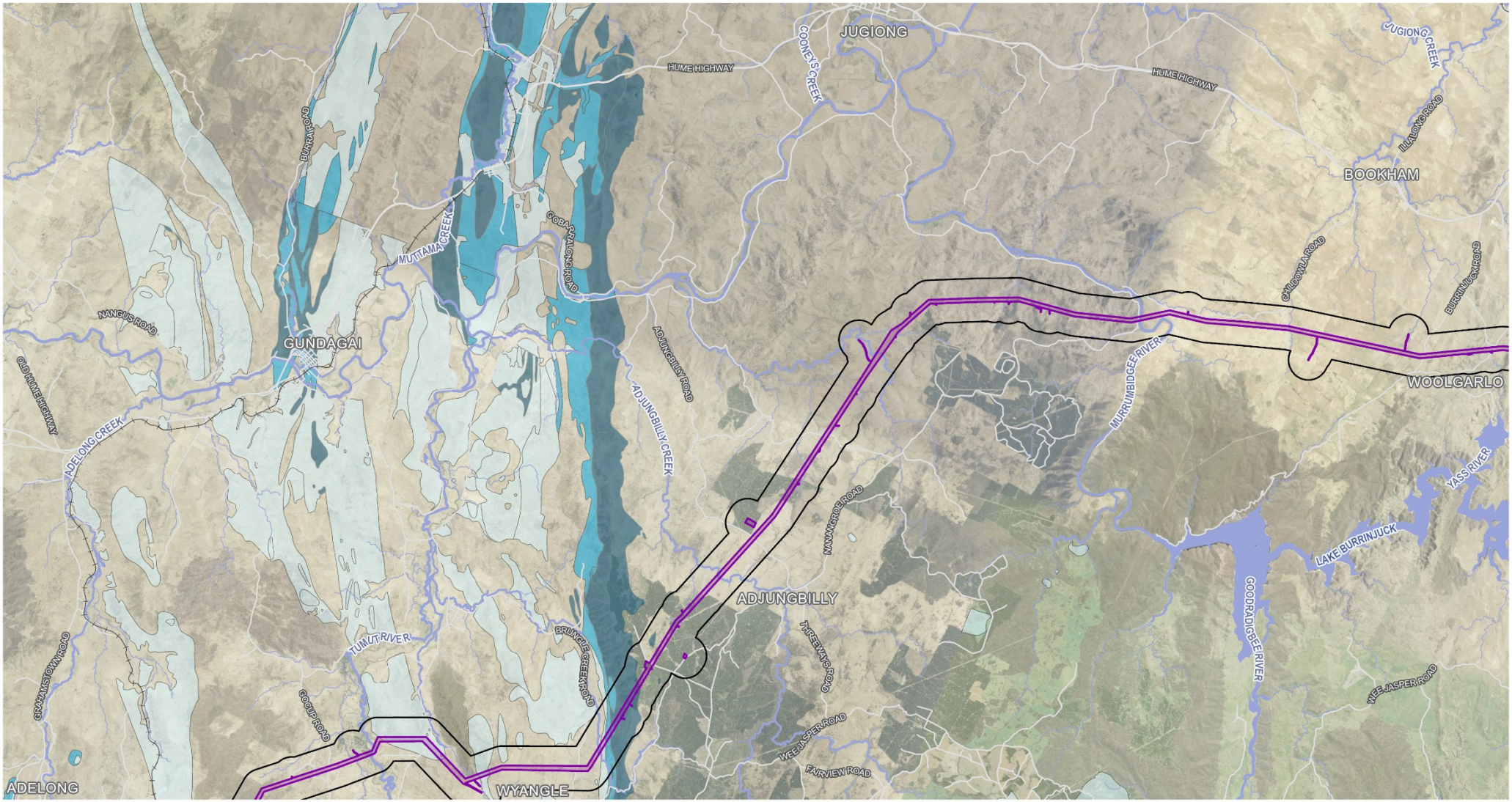
Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-6a: Naturally occurring asbestos



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

1:200,000

0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-6b: Naturally occurring asbestos

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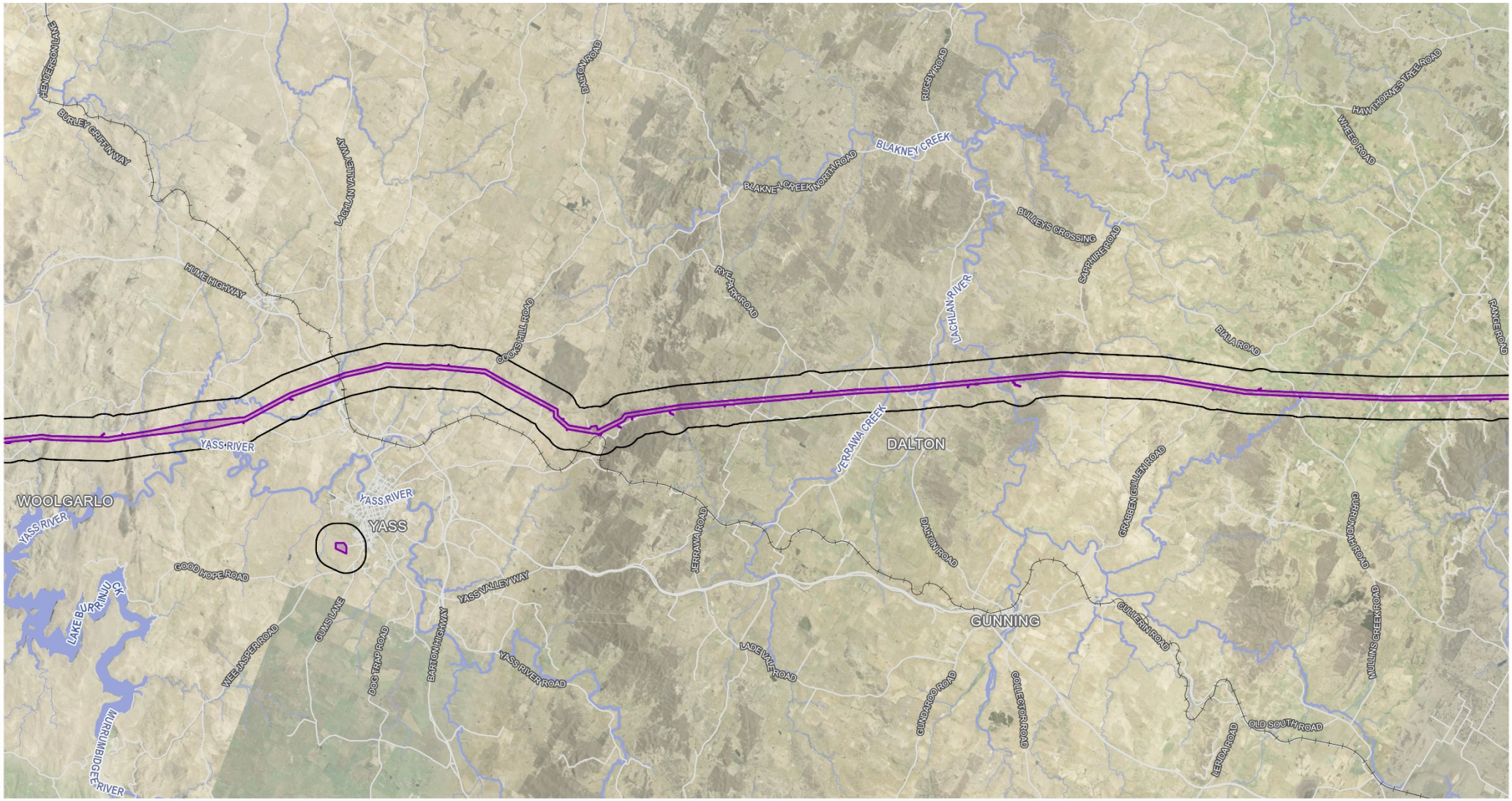

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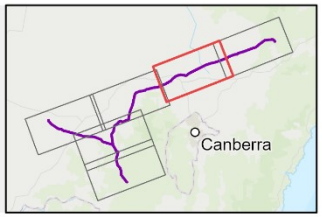
Project footprint

Contamination study area

Railway

Watercourse

Substation



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

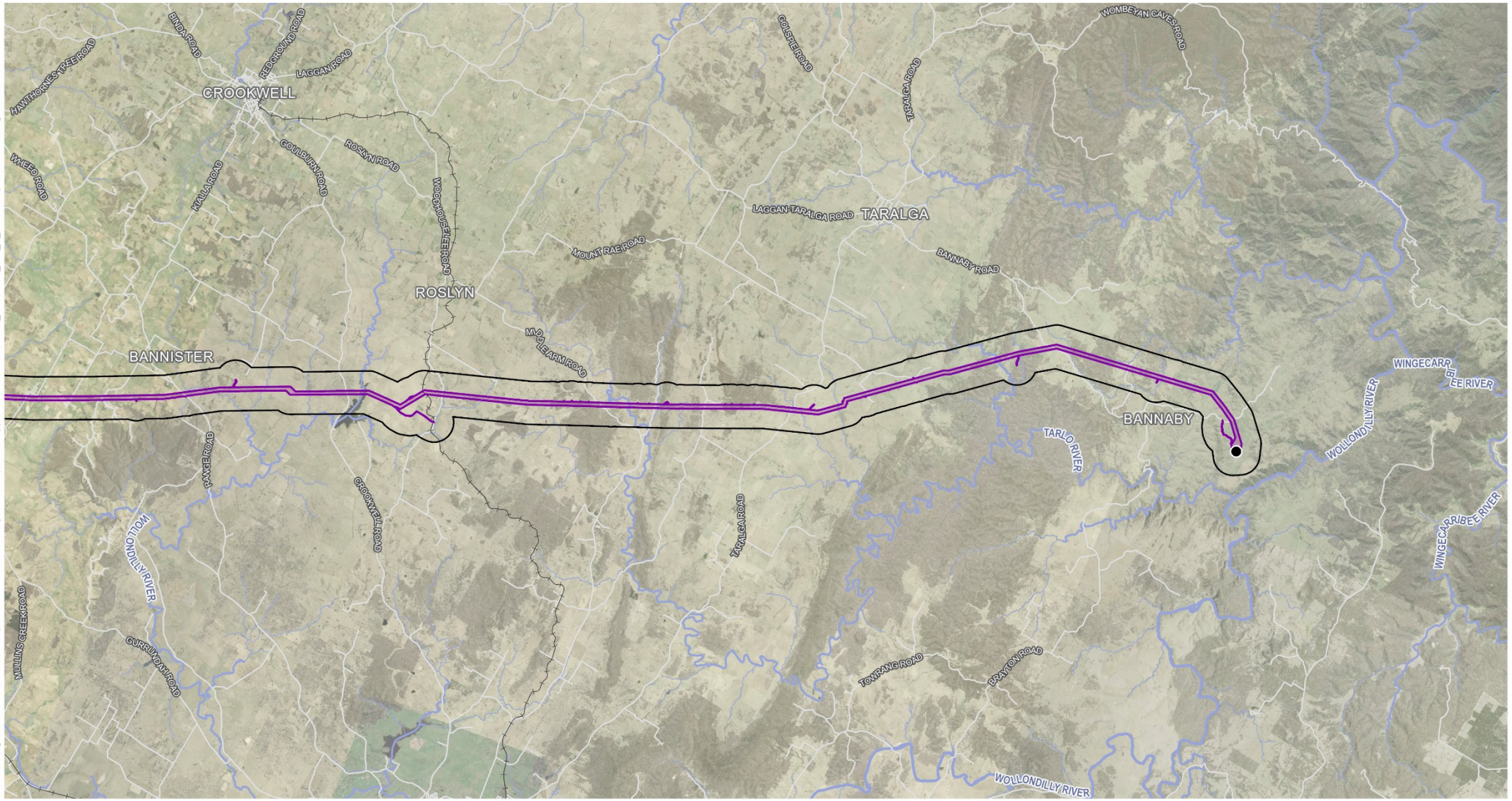
1:200,000

0 4 8 km

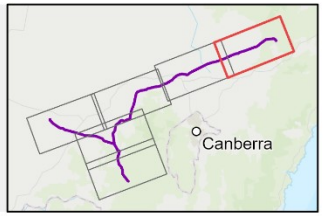
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-6c: Naturally occurring asbestos



Project footprint
Contamination study area
Railway
Watercourse
Substation



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-6d: Naturally occurring asbestos

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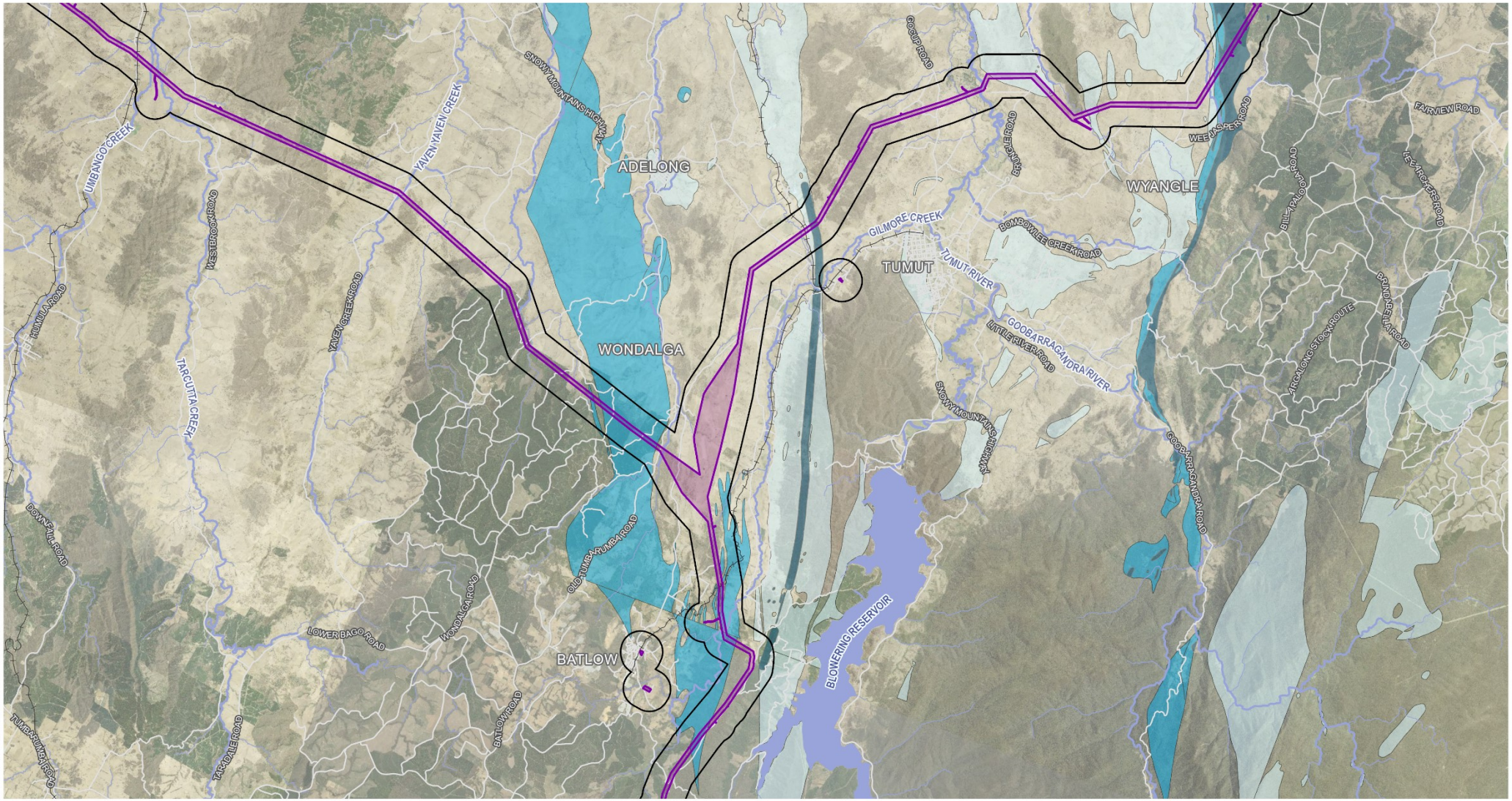
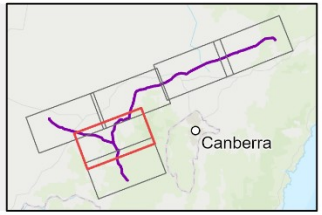


Project footprint
Contamination study area
Railway
Watercourse
Substation

Naturally Occurring Asbestos Potential

High Asbestos Potential
Medium Asbestos Potential
Low Asbestos Potential



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-6e: Naturally occurring asbestos

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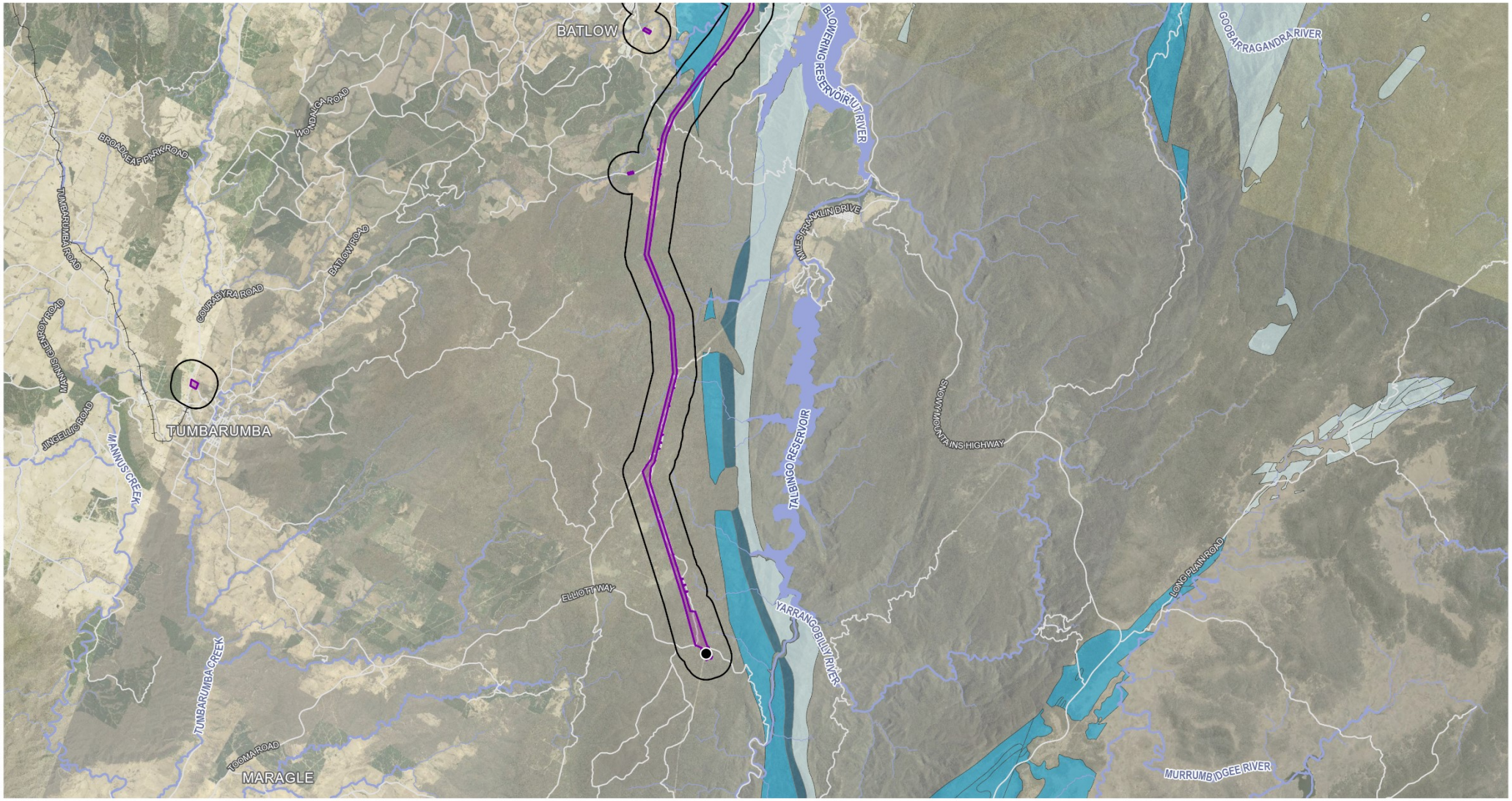

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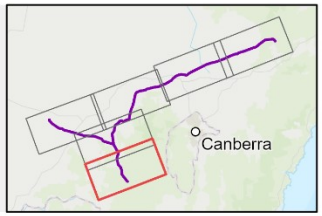
Project footprint
Contamination study area
Railway
Watercourse
Substation
Naturally Occurring Asbestos Potential
High Asbestos Potential
Medium Asbestos Potential
Low Asbestos Potential



Source: *Aurecon, Transgrid, Department of Regional New South Wales, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-6f: Naturally occurring asbestos

5.3 Hydrogeology

Refer to *Technical Report 12 - Surface Water and Groundwater Impact Assessment* for detailed descriptions and information relating to groundwater presence, quality and levels throughout the project. Summary information has been provided here for background and understanding.

The project intercepts numerous water resource plans (WRPs) and water sharing plans (WSPs). While the WRPs are not in force at the time of this assessment, their documentation provides insight into the regional characteristics. The WRPs and WSPs, divided by their groundwater source, are shown in Table 5-4.

Table 5-4 Groundwater sources

Groundwater Source	Name of Plan
Kyeamba Alluvial Groundwater Source	Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources Order 2020
Gundagai Alluvial Groundwater Source	Water Sharing Plan for the Murrumbidgee Alluvial Groundwater Sources Order 2020
Mid Murrumbidgee Alluvium (GS31)	Murrumbidgee Alluvium Water Resource Plan (submitted April 2020 but withdrawn August 2021 and is pending resubmission)
Lachlan Fold Belt MDB Groundwater Source	Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources Order 2020
Yass Catchment Fractured Rock Groundwater Sources	Water Sharing Plan for the Murray Alluvial Groundwater Sources Order 2020
Lachlan Fold Belt (GS20)	NSW Murray–Darling Basin Fractured Rock Water Resource Plan
Goulburn Fractured Rock Groundwater Source	Water Sharing Plan for the Greater Metropolitan Region Groundwater Sources 2011

Information regarding groundwater quality within the contamination study area was obtained from relevant regional studies and available local information (such as registered bores). No groundwater quality samples were collected during any investigations.

One measure of quality most relevant to the end use is the level of salt present in groundwater, or groundwater salinity. This is determined by measuring the electrical conductivity (EC) and is generally reported in microsiemens per centimetre (µS/cm), whereby water with an EC of 1,000 µS/cm has a salt concentration of about 640 mg/L.

In NSW, groundwater salinity levels can range from that of rainwater (<250 µS/cm) to greater than that of sea water (~60,000 µS/cm). Groundwater with salinity suitable for a range of productive uses is generally found in the large unconsolidated alluvial systems associated with the major westward draining rivers.

It should be noted that the groundwater quality data presented below is based on regions greater than the contamination study area and provide a regional assessment of quality.

5.3.1.1 Mid Murrumbidgee Alluvium

Across the Mid Murrumbidgee Alluvium, salinity ranged generally from 150 µS/cm close to the rivers to about 950 µS/cm in the deep aquifer. However, salinity readings of greater than 1,500 µS/cm have been recorded in the western area towards Narrandera. The quality in the shallow aquifer is variable but is generally below 1,660 µS/cm and fresh adjacent to the Murrumbidgee River. Overall, those values remain those of fresh water (in most places) to slightly brackish water.

5.3.1.2 Lachlan Fold Belt

Water quality within the Lachlan Fold Belt varies largely based on rock type, fracture density, aquifer depth, and climate. Salinity ranges across all beneficial use classes from fresh to saline. The Lachlan Fold Belt is the host rock for a number of ore bodies and so the background trace metal chemistry of the groundwater is heavily influenced by these deposits.

Analysis of groundwater quality data sampled from bores in the Yass Catchment groundwater source indicates there is a broad range of groundwater salinities throughout the catchment, ranging from 300 to 6,100 µS/cm. Water quality results for NSW Government monitoring bores located in the Murrumbateman area shows a neutral pH, a salinity range of between 800 and 5,360 µS/cm with an average of 1,940 µS/cm. Sodium is the dominant cation, while bicarbonate and chloride being the dominant anion, which is considered to reflect the volcanic geology.

5.3.1.3 Goulburn Fractured Rock

There is no published regional water quality information.

5.4 General land use

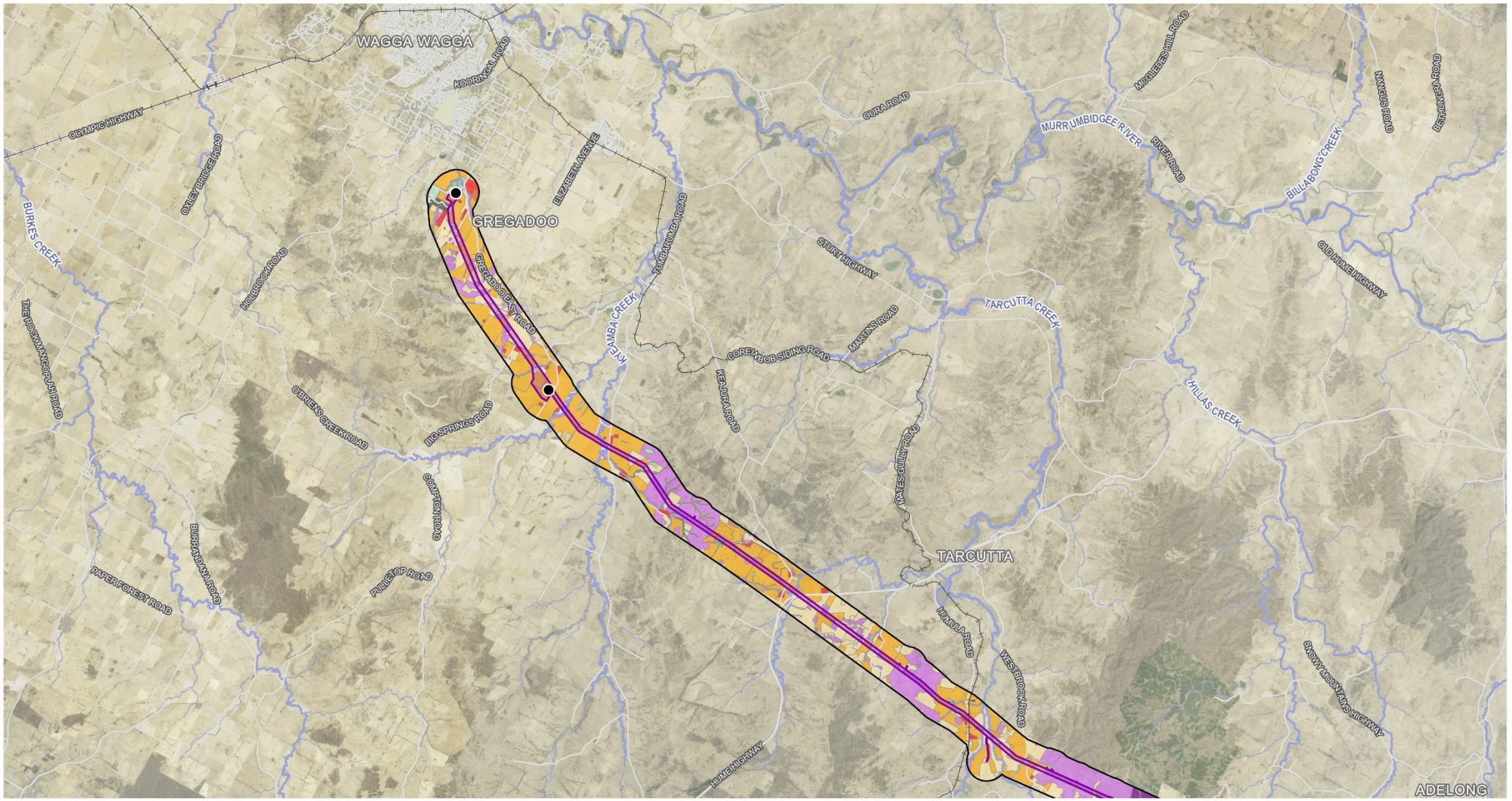
Some land uses have a higher risk of contamination due to their impacts on soil and water such as commercial, industrial and mining uses, when compared to grazing, forestry and residential land uses. Most of the contamination study area and surrounding areas are used for grazing, including native vegetation and modified pastures (NSW OEH, 2013). Grazing of goats, cattle and sheep (for wool and meat) is common. Other land uses within the contamination study area include cropping or production forestry, utilities, dams, mining, and industrial land uses, refer to *Technical Report 5 – Land Use and Property Impact Assessment*.

A map of land use across the contamination study area is presented in Figure 5-7. A summary of the land use across the contamination study area is presented in Table 5-5. It is noted that the numbers listed within the 'Land Use' column are used as part of the identification for the land use under the Australian Land Use and Management Classification. Table 5-5 uses the contamination study area buffer and proportions. It is noted that the land use and property study area for *Technical Report 5 – Land Use and Property Impact Assessment* comprises the five LGAs that the project footprint is located in, which is larger than the contamination study area used in this report.

Table 5-5 Summary of land use in contamination study area

Land Use	Area (Ha)	Proportion
3.2.0 Grazing modified pastures	34,695	40.98%
2.1.0 Grazing native vegetation	21,984.5	25.96%
2.2.0 Production forestry	11,543.7	13.63%
3.3.0 Cropping	6,069.3	7.17%
1.3.0 Other minimal use	5,037.8	5.95%
5.4.0 Residential and farm infrastructure	1,507.5	1.78%
6.3.0 River	1,124.7	1.33%
1.1.0 Nature conservation	887.8	1.05%
3.1.0 Plantation forestry	434.2	0.51%
5.7.0 Transport and communication	335.6	0.40%
1.2.0 Managed resource protection	326.8	0.39%
5.5.0 Services	258.4	0.31%
6.2.0 Reservoir/dam	88	0.10%
4.3.0 Irrigated cropping	80.7	0.10%
5.8.0 Mining	73.5	0.09%
3.4.0 Perennial horticulture	66.6	0.08%

Land Use	Area (Ha)	Proportion
6.5.0 Marsh/wetland	59.3	0.07%
5.3.0 Manufacturing and industrial	50.9	0.06%
5.6.0 Utilities	38.3	0.05%
4.4.0 Irrigated perennial horticulture	9.7	0.01%
4.2.0 Grazing irrigated modified pastures	0.9	0.001%



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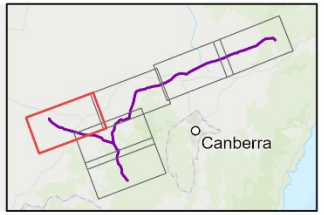
Project footprint
Contamination study area
Railway
Substation

Land Use 2017

- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 3.1.0 Plantation forests
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 3.4.0 Perennial horticulture
- 5.2.0 Intensive animal production
- 5.4.0 Residential and farm infrastructure
- 5.5.0 Services
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 6.2.0 Reservoir/dam
- 6.3.0 River
- 6.5.0 Marsh/wetland



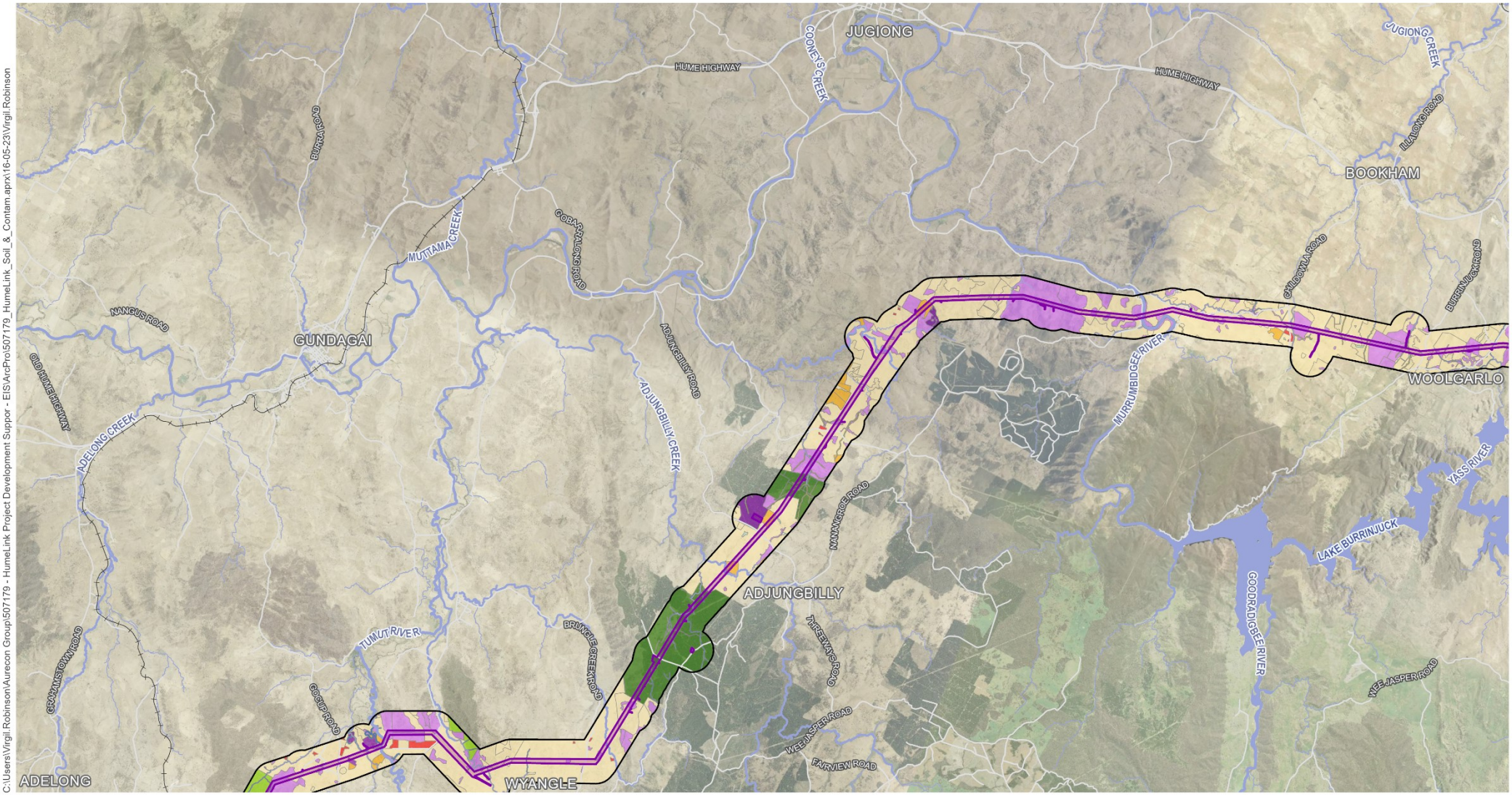
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-7a: Land Use 2017



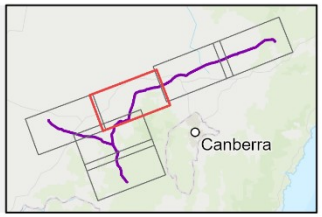
Project footprint

Contamination study area

Railway

Land Use 2017

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
- 3.1.0 Plantation forests
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.4.0 Residential and farm infrastructure
- 5.7.0 Transport and communication
- 6.3.0 River
- 6.5.0 Marsh/wetland



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

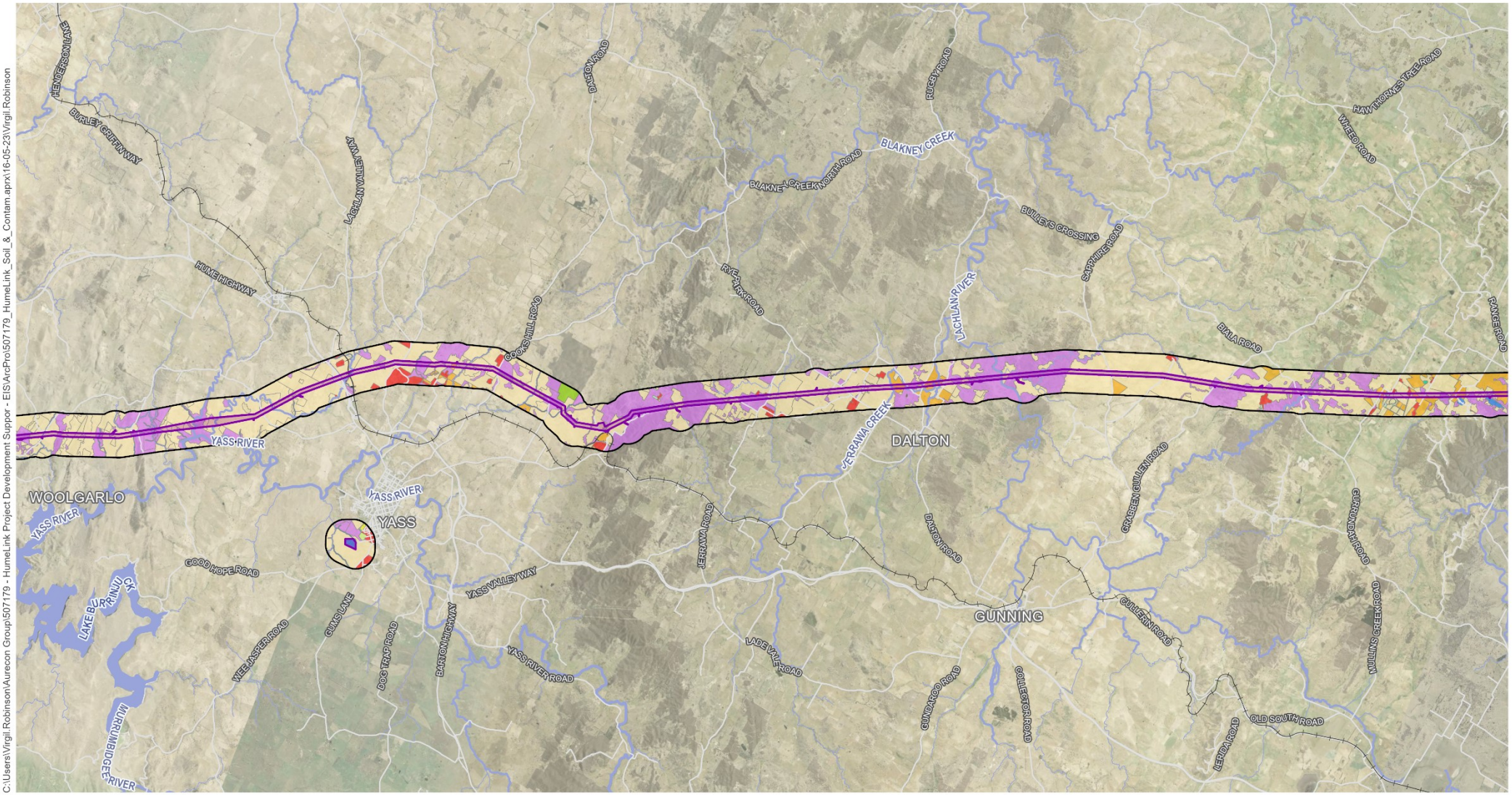
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-7b: Land Use 2017



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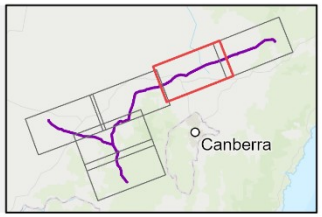
Project footprint
Contamination study area
Railway

Land Use 2017

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 2.1.0 Grazing native vegetation
- 3.1.0 Plantation forests
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 5.4.0 Residential and farm infrastructure
- 5.5.0 Services
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.8.0 Mining
- 5.9.0 Waste treatment and disposal
- 6.2.0 Reservoir/dam
- 6.3.0 River



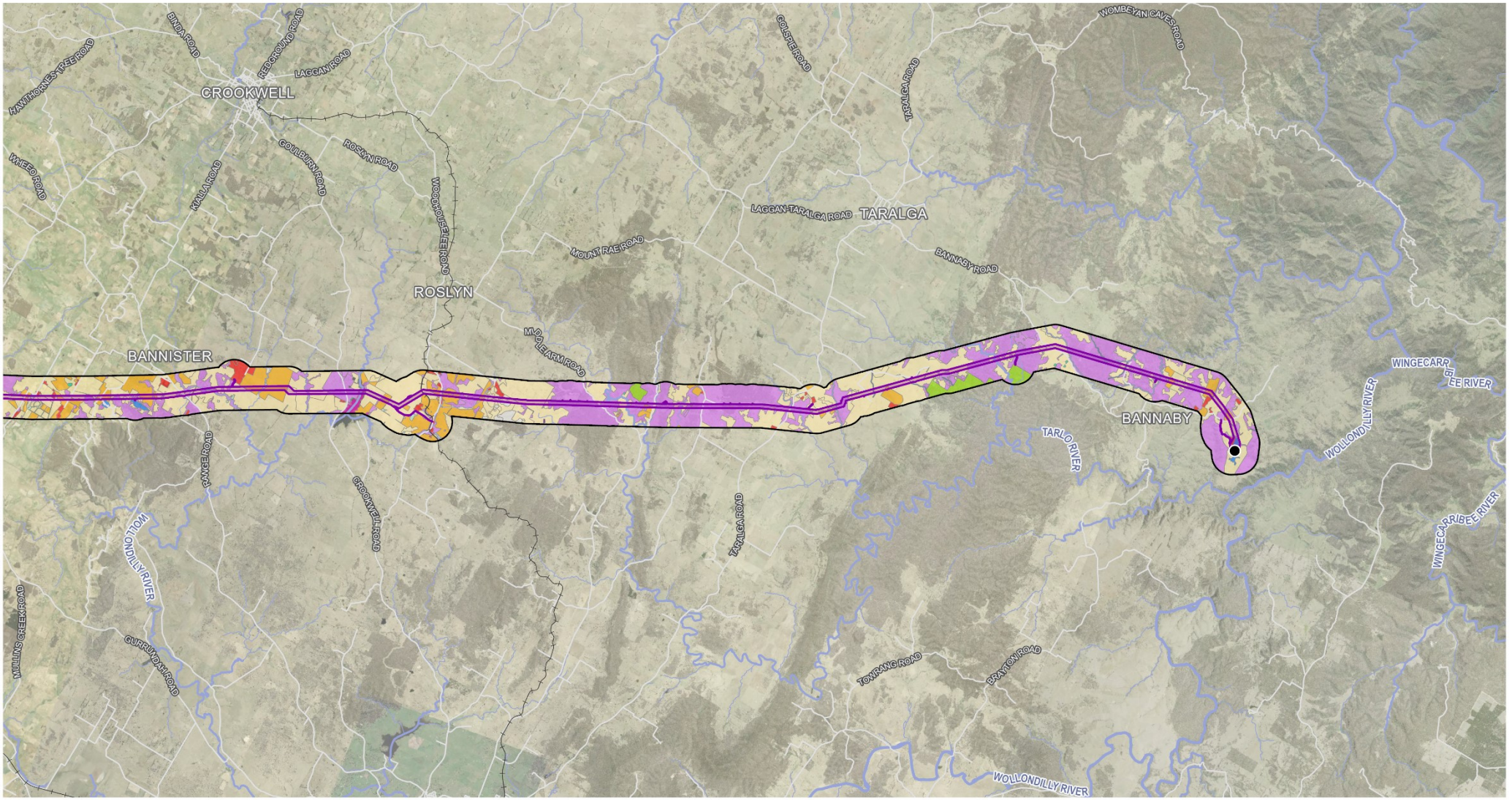
Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-7c: Land Use 2017



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Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

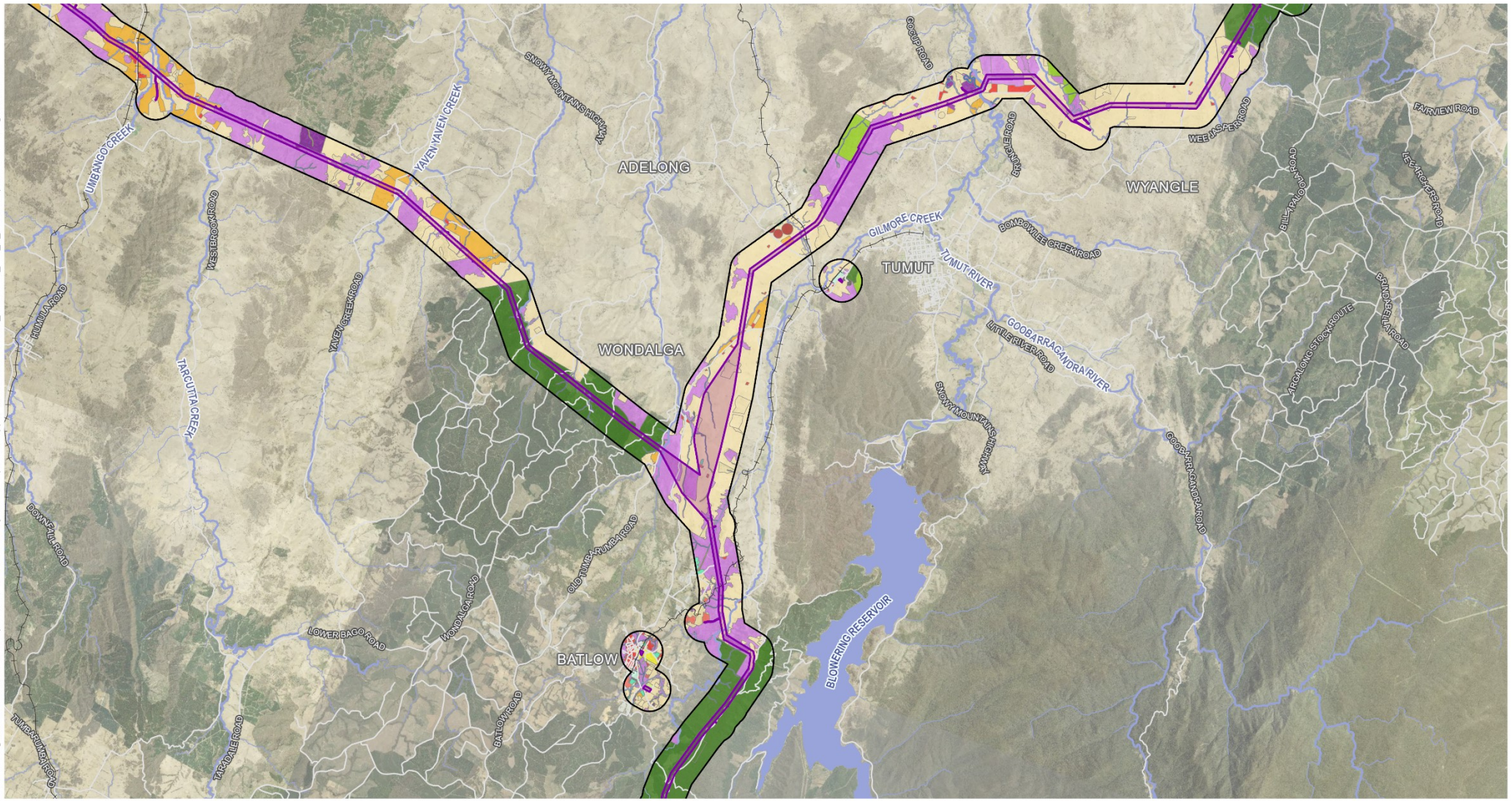
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-7d: Land Use 2017



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Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

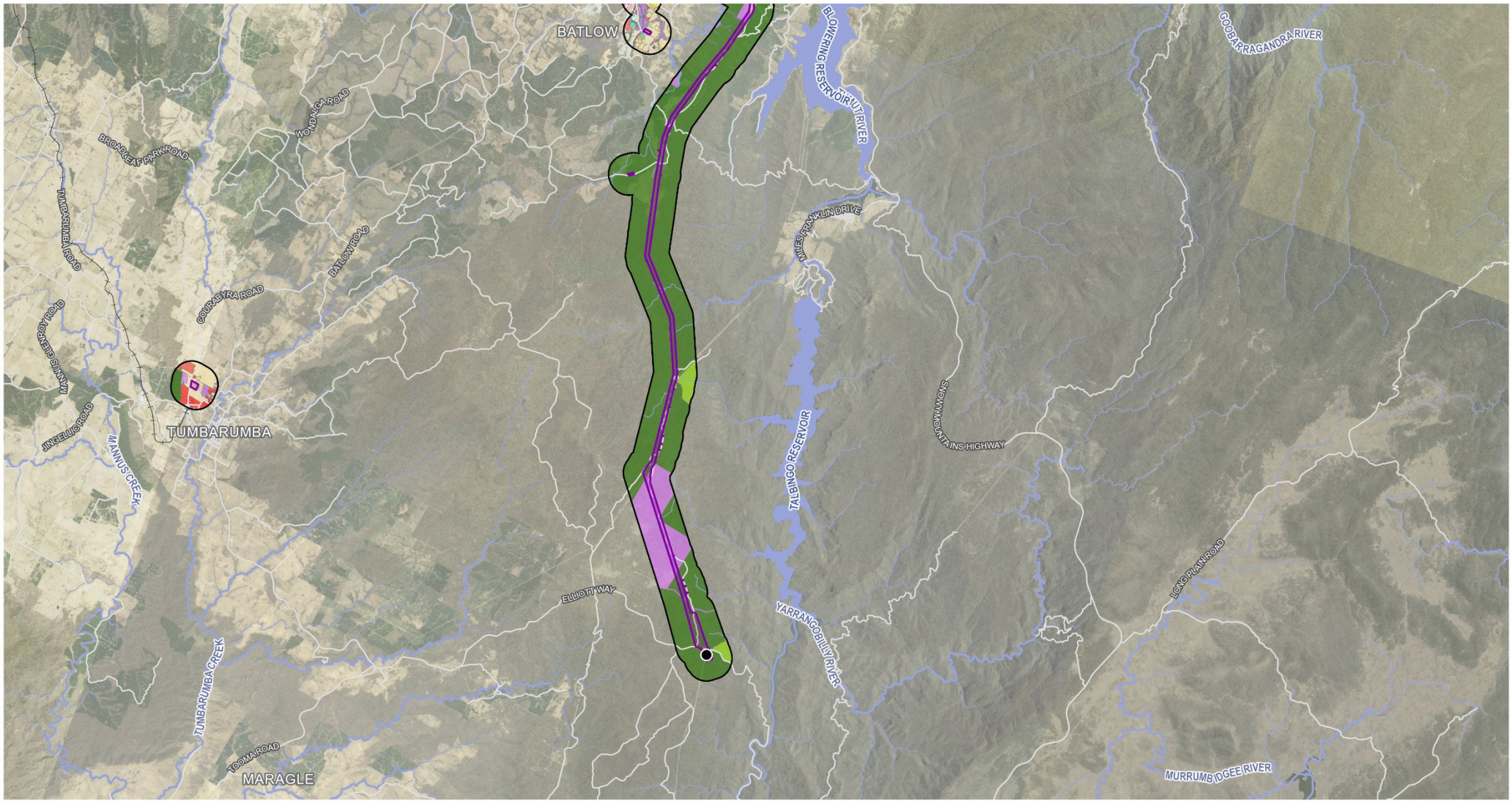
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

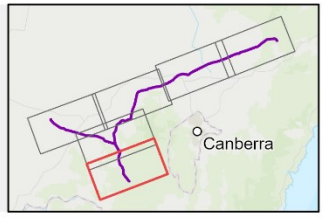
Figure 5-7e: Land Use 2017



Project footprint
Contamination study area
Railway
Substation

Land Use 2017

- 1.1.0 Nature conservation
- 1.2.0 Managed resource protection
- 1.3.0 Other minimal use
- 2.1.0 Grazing native vegetation
- 2.2.0 Production native forestry
- 3.2.0 Grazing modified pastures
- 3.3.0 Cropping
- 3.4.0 Perennial horticulture
- 3.6.0 Land in transition
- 4.4.0 Irrigated perennial horticulture
- 5.3.0 Manufacturing and industrial
- 5.4.0 Residential and farm infrastructure
- 5.5.0 Services
- 5.6.0 Utilities
- 5.7.0 Transport and communication
- 5.9.0 Waste treatment and disposal
- 6.2.0 Reservoir/dam
- 6.3.0 River



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-7f: Land Use 2017

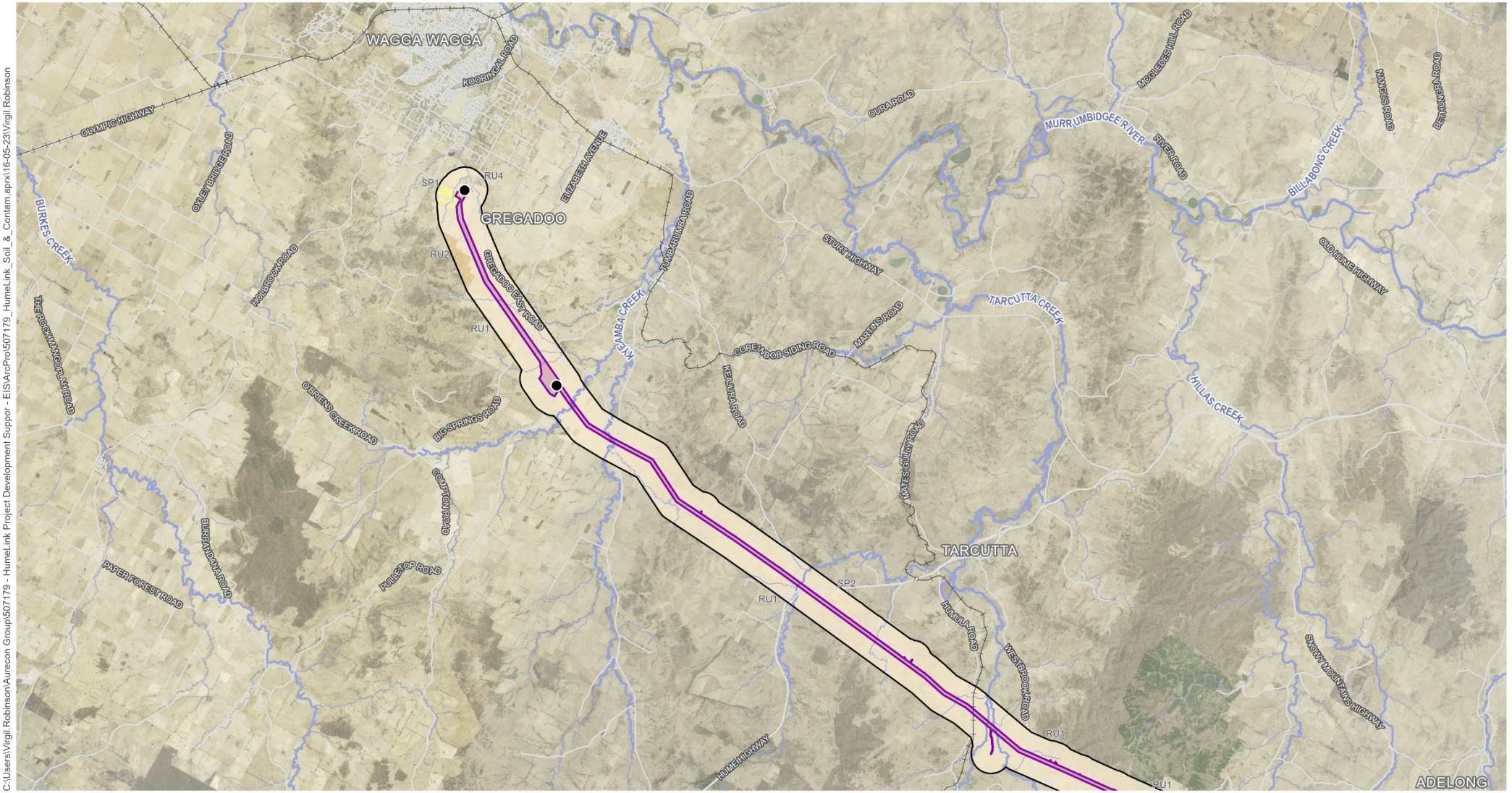
5.5 Land use zoning

Some types of land zoning have a higher risk of contamination due to the type of land uses that are permitted within that zone. For example industrial, commercial and even agricultural zones are more likely tor impact on soil and water, when compared to environmental conservation, national parks and large lot residential zonings. The contamination study area is predominantly zoned RU1 Primary Production and RU2 Rural Landscape. There are also zones of E1 National Parks and Nature Reserves, E3 Environmental Management, RU3 Forestry and SP2 Infrastructure. A map of land zoning across the contamination study area has been presented in Figure 5-8.

Areas close to major town centres such as Tumbarumba, Batlow, Yass and Wagga Wagga include a variety of zonings such as RE1 Public Recreation, R1 General Residential and R5 Large Lot Residential.

The contamination study area is zoned under the following Local Environmental Plans (LEPs):

- Wagga Wagga LEP 2010
- Gundagai LEP 2011
- Tumut LEP 2012
- Yass Valley LEP 2013
- Upper Lachlan LEP 2010
- Tumbarumba LEP 2010.



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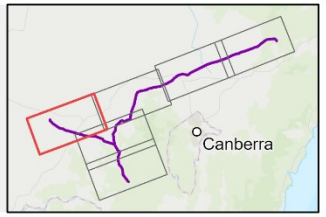
Project footprint
Contamination study area
Railway
Watercourse
Substation

Land Zoning

RU1 Primary Production
RU2 Rural Landscape
SP1 Special Activities
SP2 Infrastructure



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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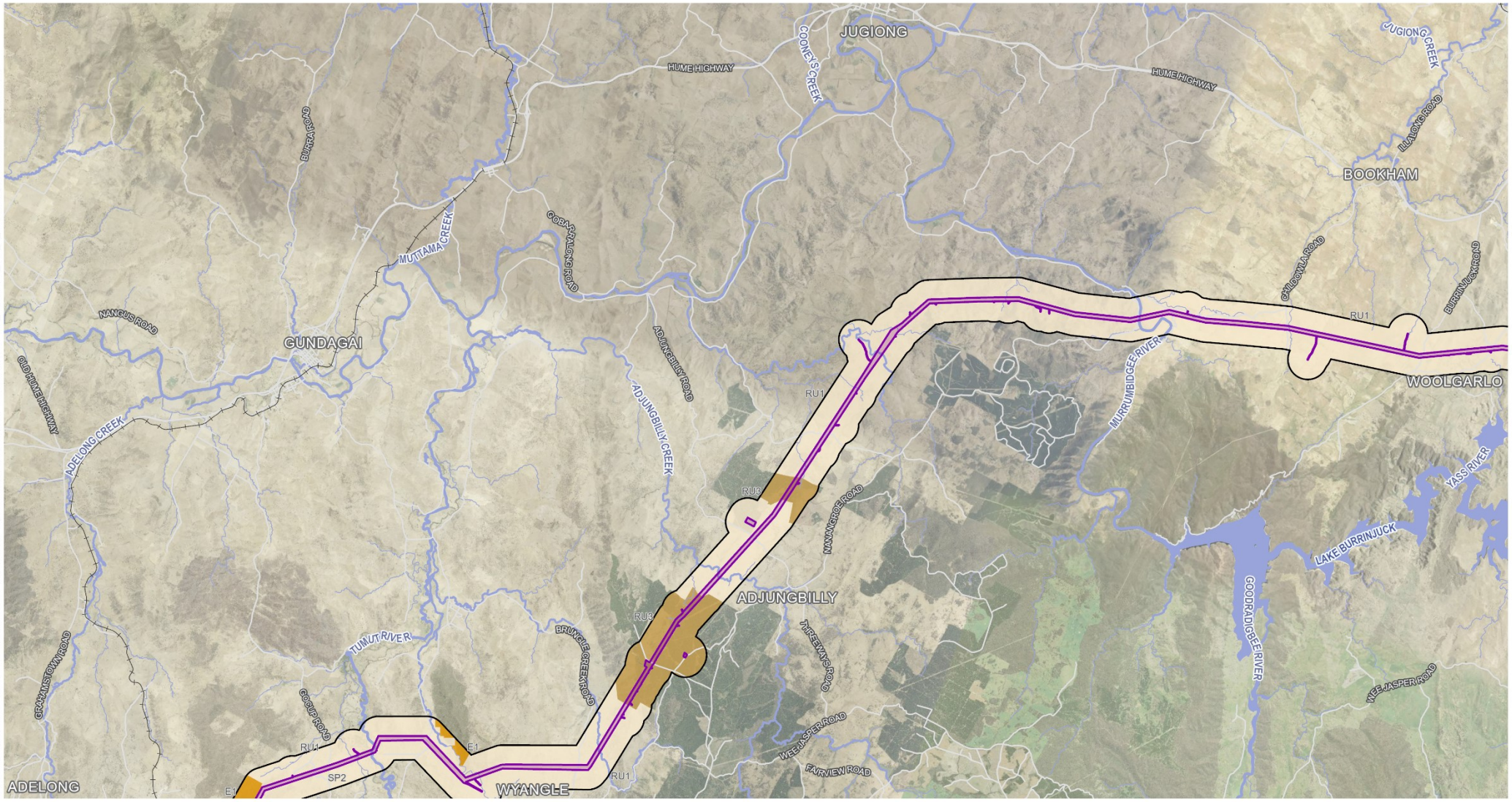
Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

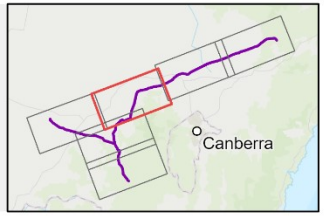
Figure 5-8a: Land Zoning



Project footprint
Contamination study area
Railway
Watercourse
Substation

Land Zoning

E1 National Parks and Nature Reserves
RU1 Primary Production
RU3 Forestry
SP2 Infrastructure



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-8b: Land Zoning

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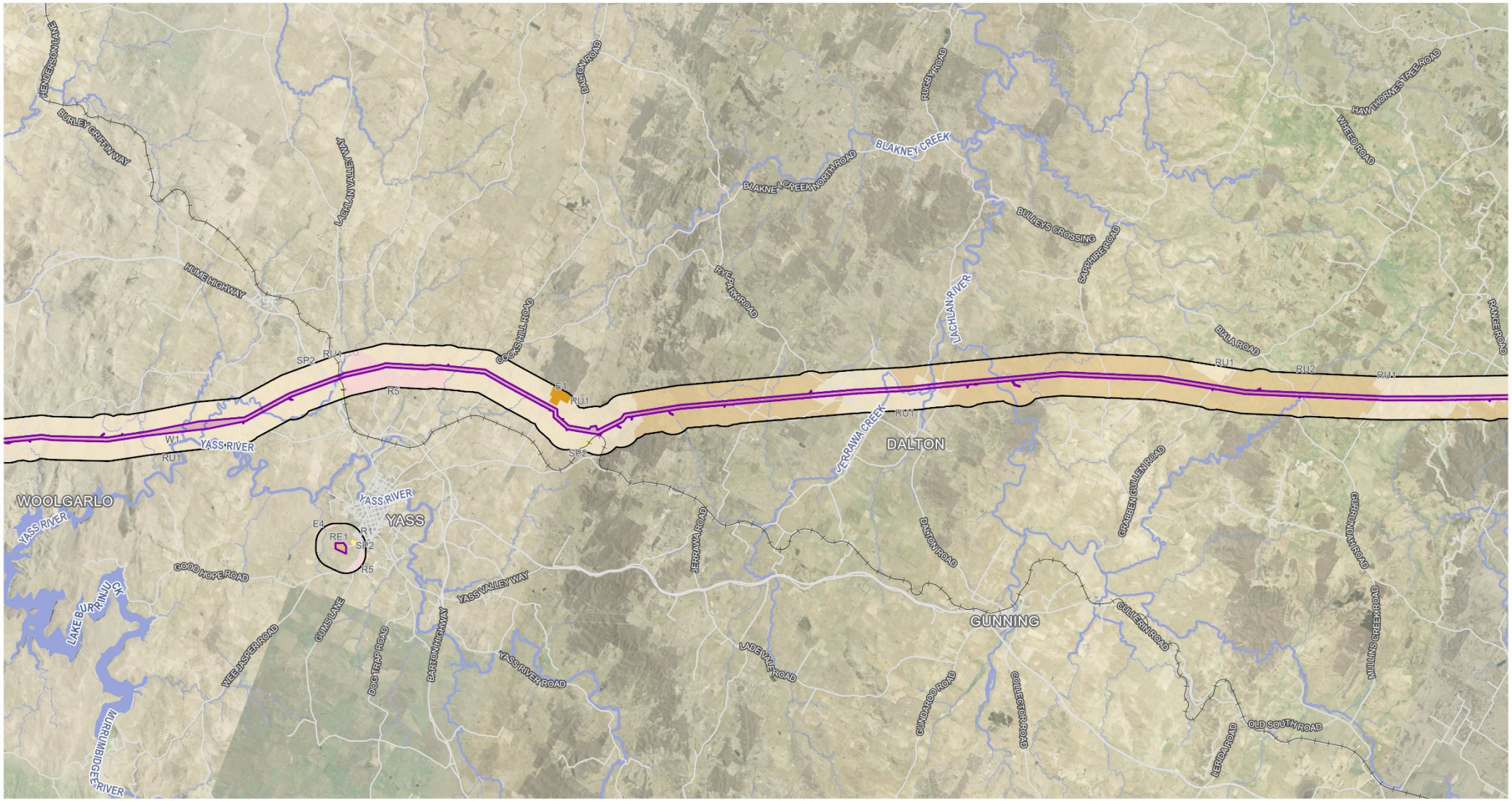
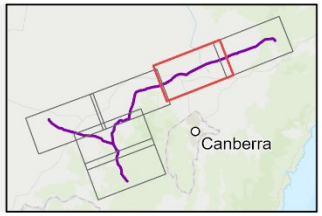


Project footprint
Contamination study area
Railway
Watercourse
Substation

Land Zoning

E1 National Parks and Nature Reserves
R5 Large Lot Residential
RU1 Primary Production
RU2 Rural Landscape
SP2 Infrastructure
W1 Natural Waterways



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-8c: Land Zoning

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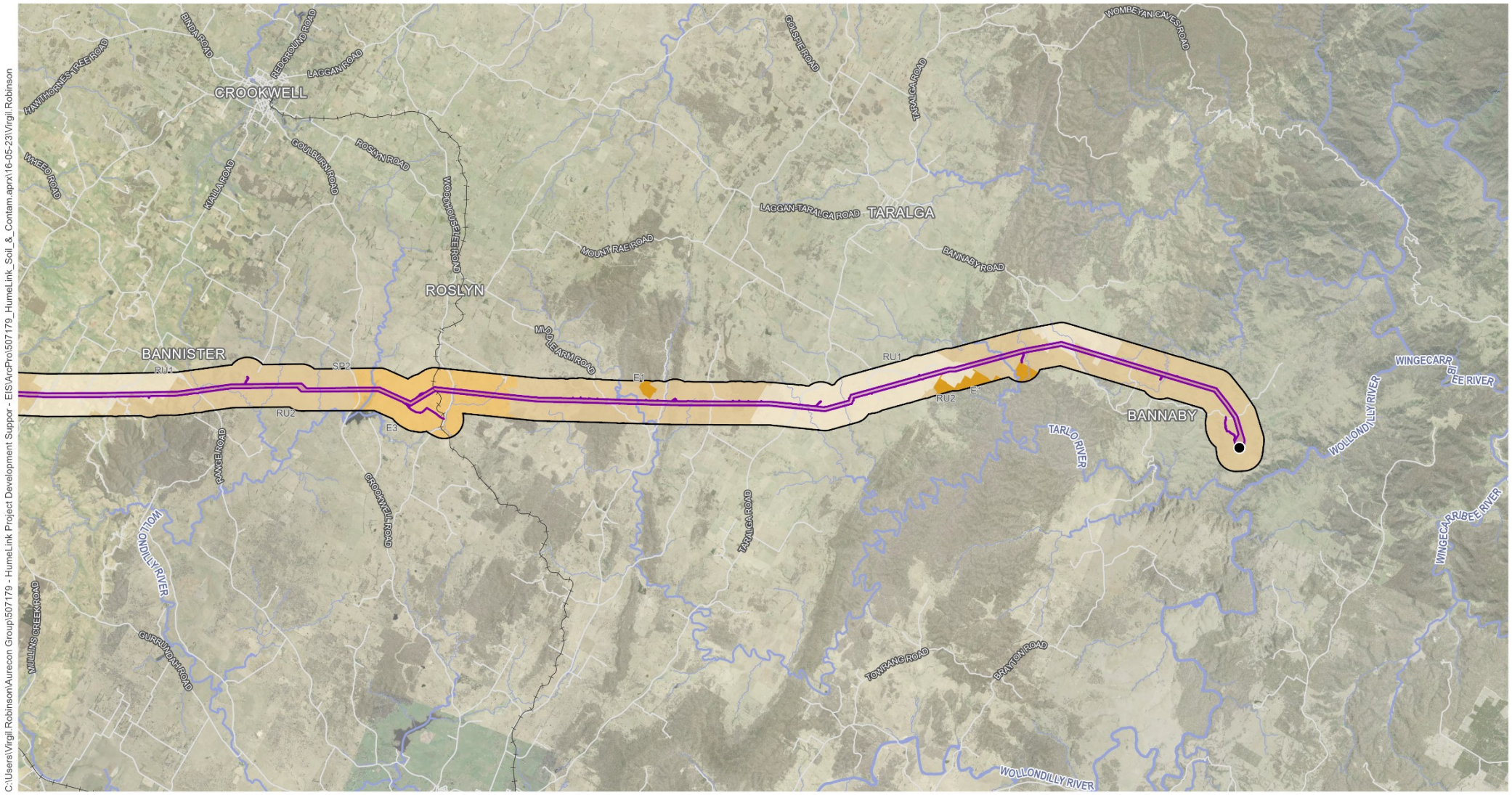
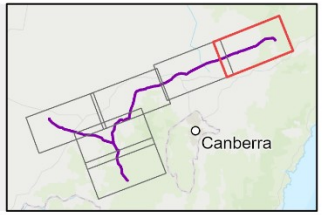


Project footprint
Contamination study area
Railway
Watercourse
Substation

Land Zoning

E1 National Parks and Nature Reserves
E3 Environmental Management
RU1 Primary Production
RU2 Rural Landscape
SP2 Infrastructure



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-8d: Land Zoning

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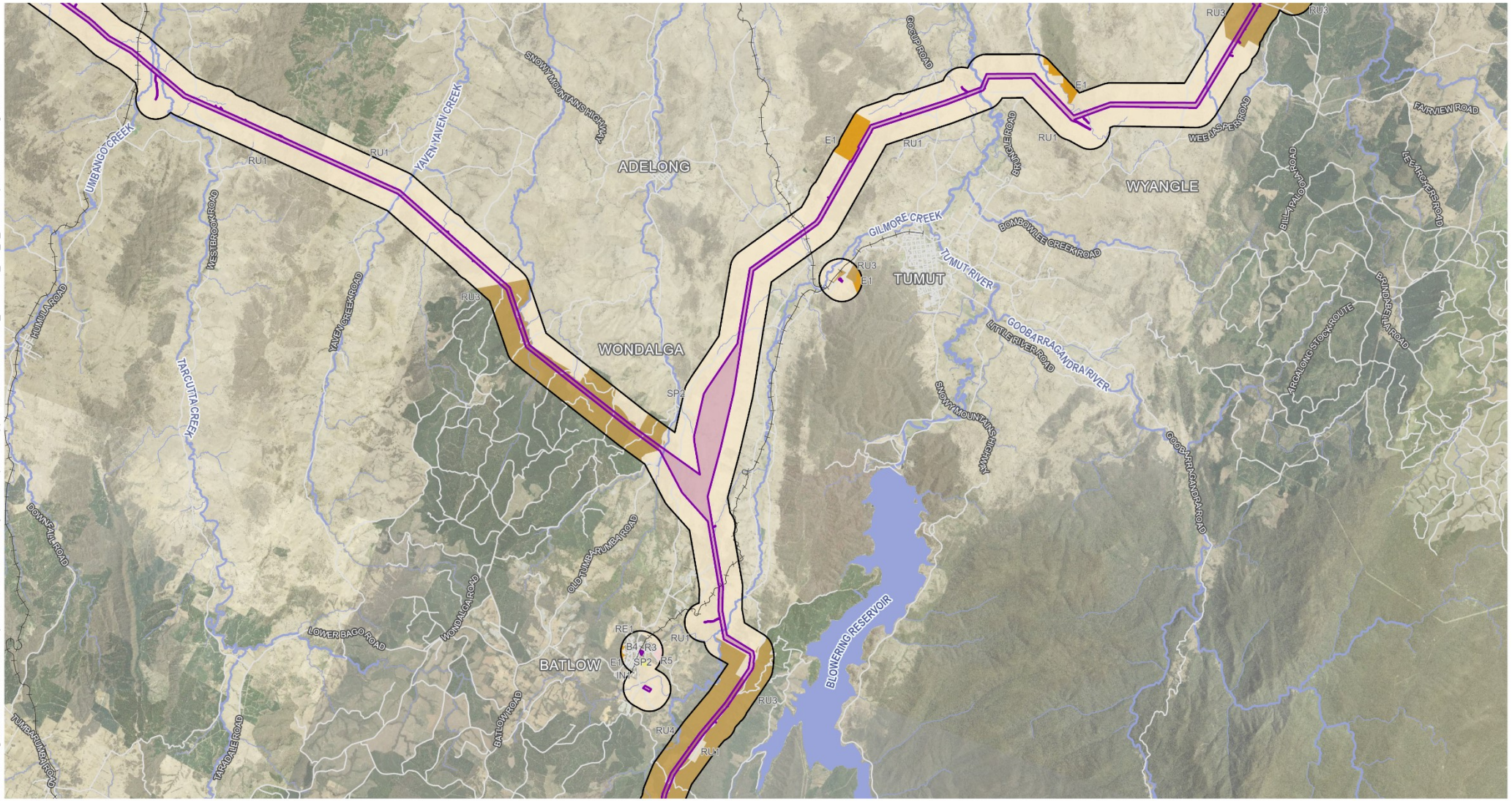
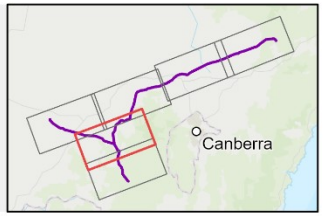


Project footprint
Contamination study area
Railway
Watercourse
Substation

Land Zoning

E1 National Parks and Nature Reserves
R5 Large Lot Residential
RU1 Primary Production
RU3 Forestry
SP2 Infrastructure



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-8e: Land Zoning

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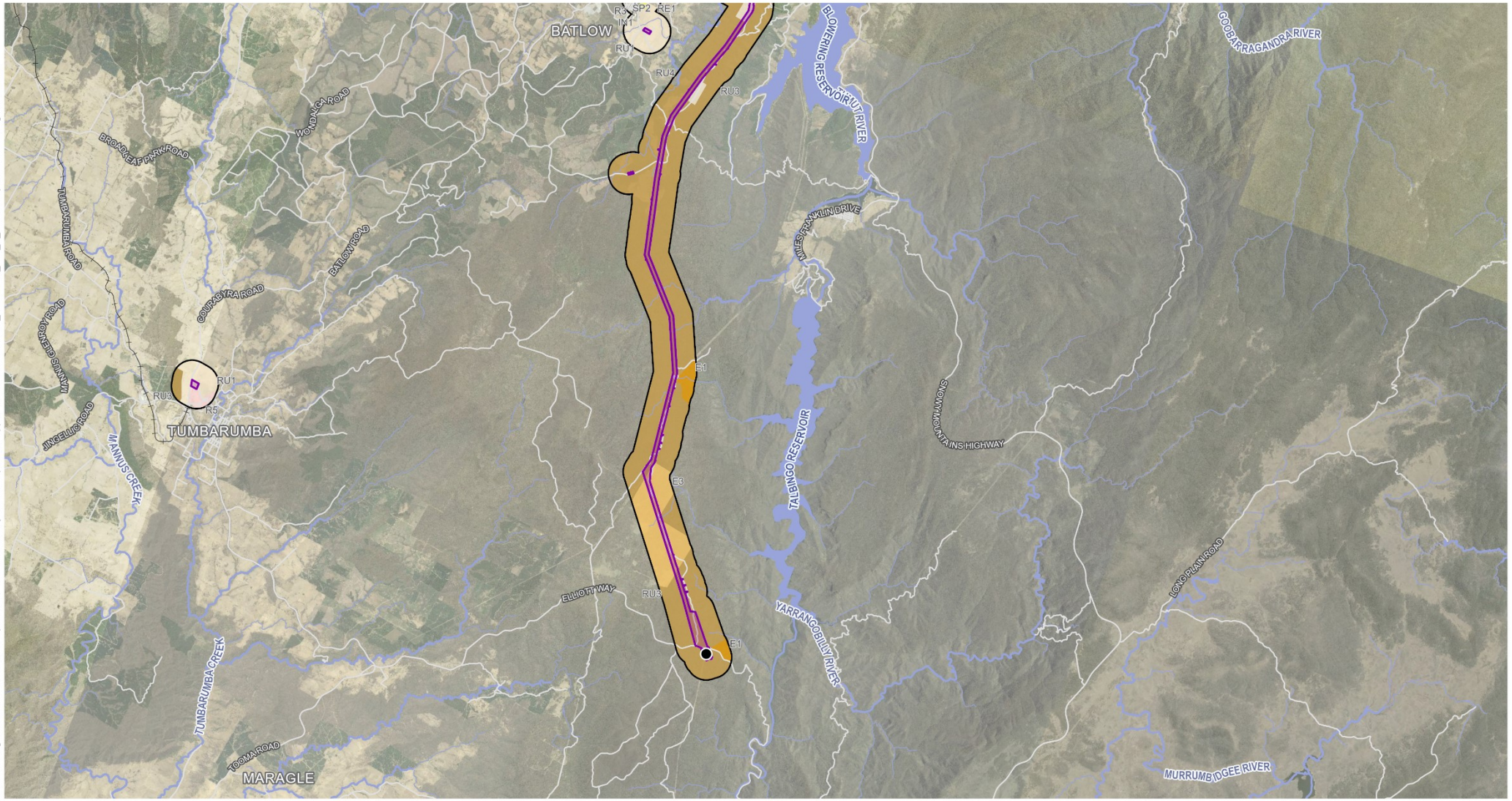

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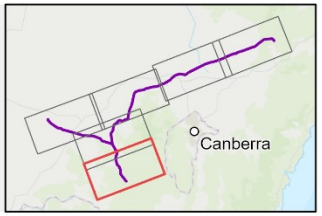
Project footprint
Contamination study area
Railway
Watercourse
Substation

Land Zoning

E1 National Parks and Nature Reserves
E3 Environmental Management
R5 Large Lot Residential
RU1 Primary Production
RU3 Forestry
SP2 Infrastructure



Source: *Aurecon, Transgrid, DPE, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-8f: Land Zoning

5.6 Potential current and former contaminant sources

5.6.1 Contaminated sites notified to the NSW EPA

Under Section 60 of the CLM Act, a person whose activities has contaminated land, or a landowner whose land has been contaminated, is required to notify the NSW EPA when they become aware of the contamination and if certain conditions are met.

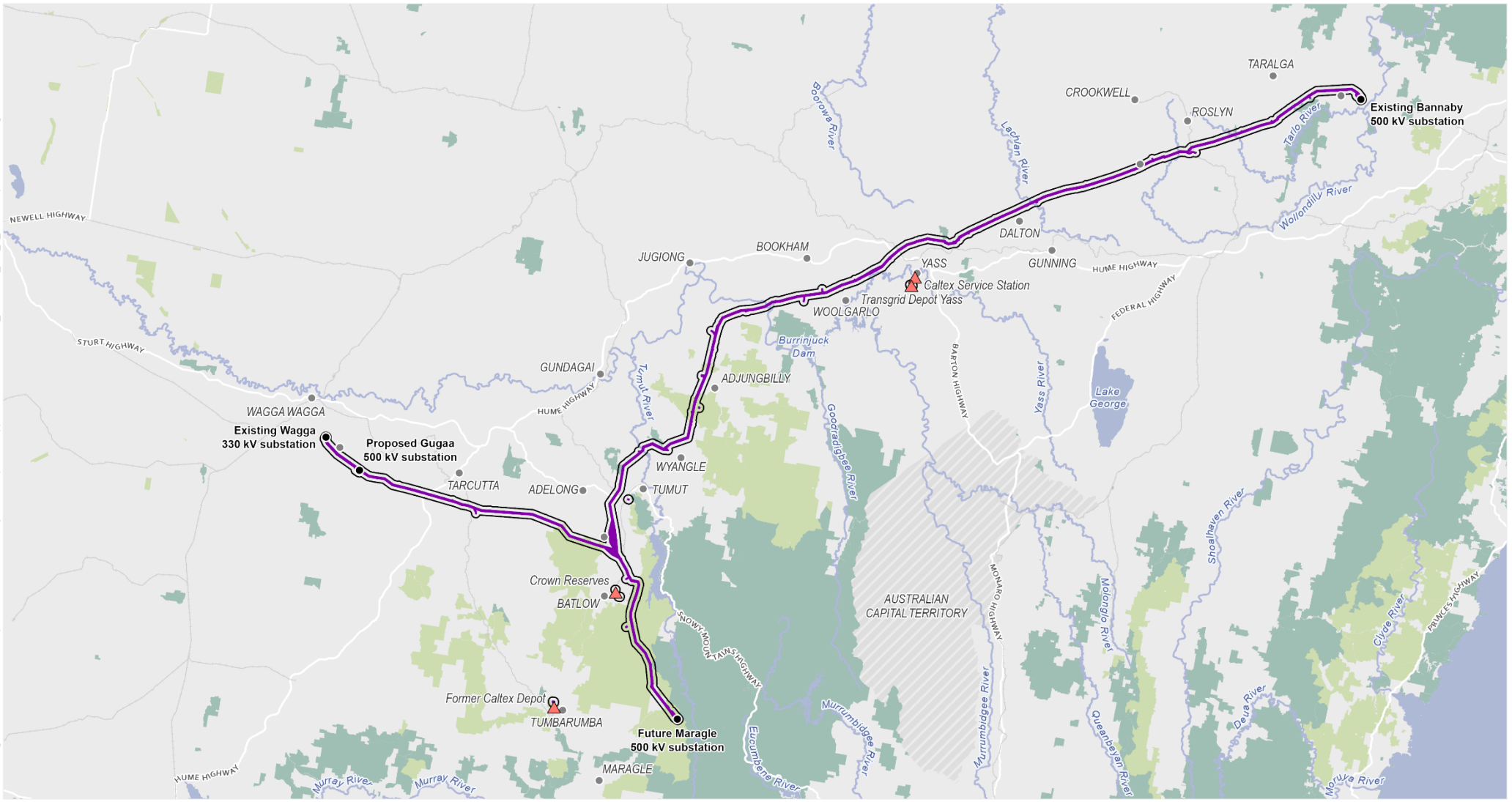
Many contaminated sites remain unreported to the NSW EPA. For example, the below scenarios may not be required to be reported to the NSW EPA:

- if people have not been exposed to or are unlikely to be exposed to contaminants
- if concentrations in groundwater or surface water are unlikely to remain at elevated concentrations
- if threshold criteria are not available for the contaminant in question.

A search of the NSW EPA public register (notified sites and the contaminated land record) of contaminated sites (NSW EPA, 2023a) identified three sites within the contamination study area. These are:

- the Yass substation compound (C10), which is a notified site currently under assessment
- a former Caltex Depot at 150 Albury Street, Tumbarumba, approximately 890 metres south of the Tumbarumba Accommodation Facility (AC1), which is categorised as an 'Other Petroleum' and is not required to be regulated under the CLM Act
- Crown Reserves located on Mill Road, Batlow about 185 metres south of the Memorial Avenue compound (C14), which is categorised as an 'Other Industry' and is not required to be regulated under the CLM Act.

A map of contaminated sites notified to NSW EPA within the contamination study area has been included as Figure 5-9.



Source: *Aurecon, Transgrid, EPA, Spatial Services (DCS), ESRI Basemap*

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Projection: GDA 1994 MGA Zone 55

HumeLink

FIGURE 5-9: Contaminated Sites notified to the NSW EPA

5.6.2 NSW EPA licensed activities

A review of the EPLs issued by the NSW EPA under the POEO Act (NSW EPA, 2022b) identified a number of sites were identified within the contamination study area and are summarised in Table 5-6.

Table 5-6 EPLs within the contamination study area

Licence Number	Licensee	Premises	Status	Scheduled activities	Distance to project footprint
21535	Rye Park Renewable Energy Pty Ltd	Rye Park Wind Farm Flakney Creek Road, Rye Park, NSW, 2586	Issued	Crushing, grinding or separating, Electricity work (wind farms)	The project footprint passes through this site. The project is proposed to connect to the Rye Park Wind Farm substation, which is currently still under construction.
21601	Crookwell 3 Development Pty Ltd	Crookwell 3 Wind Farm 794 Woodhouselee Road, Woodhouselee, NSW, 2580	Issued	Crushing, grinding or separating, Electricity work (wind farms)	The project footprint is approximately 300 m north of this site. It is noted that this project is still under development.
20980	Ertech Pty Ltd	Halfway Hill and Doctors Hill, Gocup Road MR 279 – Halfway Hill and Doctors Hill, Gocup Road, Tumut, NSW, 2720	Surrendered	Land-based extractive activity (including Road Construction)	The project footprint passes through this site.
20596	Tumut Waste Pty Ltd	Bellette Landfill Gilmore Snowy Mountains Highway, Gilmore, NSW, 2720	Issued	Waste disposal by application to land	This site is approximately 350 m from the Snowy Mountains Highway compound (C02).
10232	Visy Pulp and Paper Pty Ltd	Visy Pulp & Paper Pty Ltd 436 Gadara Road, Tumut, NSW, 2720	Issued	Paper or pulp production	The project footprint passes through the Visy owned land. The portion of Visy land used for irrigation is 400 m west of the project footprint and the pulp and paper mill is 1.6 km to the west of the project footprint
13035	CPB Contractors Pty Limited	Zones 1 To 4 Hume Highway Duplication Hume Highway, Tarcutta, NSW, 2652	Surrendered	Road construction	The project footprint is presumed to either run through or is in close proximity to these upgraded sections of Hume Highway Construction Zones 1 To 4.
11998	Gillian Bannatyne	Carbon Mate Organic Recycling 132 Ashford Road, Wagga Wagga, NSW, 2650	Issued	Composting	The project footprint crosses into the site. However, composting activities are undertaken approximately 500 m to the west of the project footprint.
11366	Transgrid	Wagga 330 kV Substation Cnr Ashford Road and Boiling Down Road, Gregadoo, NSW, 2650	No longer in force	Hazardous, Industrial or Group A Waste Generation or Storage	This site is located within the project footprint.
6671	Wagga Wagga City Council	Gregadoo Waste Management Centre 132 Ashford Road, Wagga Wagga, NSW, 2650	Issued	Waste storage – waste tyres, Waste disposal by application to land	The project footprint crosses into the site. However, waste activities are taken approximately 700 m to the west of the project footprint.

Licence Number	Licensee	Premises	Status	Scheduled activities	Distance to project footprint
1774	Snowy Valleys Council	Batlow Sewage Treatment Plant Boggamilla Road, Batlow, NSW 2730	Issued	Sewage treatment processing by small plants	The lot formally known as the Batlow Sewage Treatment Plant is located approximately 100 metres south-east of the Memorial Avenue Compound (C14). The operating plant is located approximately 215 m south-east of this construction compound.

5.6.3 Clean-up notices

A review of clean-up notices issued by the NSW EPA under Section 91 of the POEO Act (NSW EPA, 2023b) did not identify any notices issued to sites within the contamination study area.

5.6.4 Former gasworks sites

Gas manufacturing plants, known as gasworks, were formerly used to produce town gas for heating, lighting and cooking. Gas was generated by heating coal then captured, piped off and used as fuel.

Most NSW gasworks commenced operation in the late 1800s. With the introduction of alternative fuel sources, many began to be phased out in the 1960s. The last known operating gasworks in NSW was decommissioned in the mid-1980s.

The operation of gasworks throughout NSW has left a legacy of soil and groundwater contamination at their former sites, in some cases extending to adjoining sites. The major contaminants include tars, oils, hydrocarbon sludges, spent oxide wastes, ash and ammoniacal recovery wastes. While many of these materials were recycled or reused, it was common for some to be buried on or near the gasworks site (for instance in underground tar wells, liquor wells, pipes and purifier beds) and not removed when the gasworks were decommissioned.

Some of these contaminants are carcinogenic to humans and toxic to aquatic ecosystems and therefore may pose a risk to human health and the environment. As a result, many former gasworks sites would require remediation before they are suitable for sensitive land uses, such as housing.

According to information available to the NSW EPA (2021a), there are more than 60 former gasworks sites in NSW. The study was commissioned by the Environmental Trust and the Local Government and Shires Associations of NSW to provide an inventory of former sites and to assist the NSW EPA and local councils in their decisions on actions required to address human health and/or environmental impacts.

A search of the publicly available former gasworks database (NSW EPA, 2021a) indicated that no former gasworks sites were identified within the contamination study area.

5.6.5 Unlicensed premises regulated by the NSW EPA

The NSW EPA is still the Appropriate Regulatory Authority for a number of premises that are no longer required to be licenced under the POEO Act.

A search of the database of unlicensed premises regulated by the NSW EPA (NSW EPA, 2017b) identified two unlicensed premises within the contamination study area, which are summarised in Table 5-7.

Table 5-7 Unlicensed premises regulated by the NSW EPA within the contamination study area

Name	Address	Fee-Based Activity	Distance from project footprint
Yass 330 kV Substation	Perry Street, Yass NSW 2582	Hazardous, Industrial or Group A Waste Generation or Storage	Within the project footprint. Yass substation compound (C10) is on this site.
Wagga 330 kV Substation	Corner Ashford Road and Boiling down Road, Gregadoo 2651	Hazardous, Industrial or Group A Waste Generation or Storage	Within the project footprint.

5.6.6 National Waste Management Site Database

The Waste Management Facilities Database presents the spatial locations of Australia's known landfills, waste transfer stations and a large number of waste reprocessing facilities. The data are a compilation of Australian, jurisdictional government, council and industry databases.

A search of the database (Orr and Gordon, 2017) identified four waste sites within the contamination study area which are summarised in Table 5-8.

Table 5-8 National Waste Management sites within the contamination study area

Name	Class	Address	Distance from project footprint
Bellette Landfill	Landfill – Operational	10 Killarney Road, Gilmore	The Snowy Mountains Highway compound (C02) is located directly adjacent to this site.
Tumut Resource Recovery Centre	Transfer Station – Operational	Killarney Road, Gilmore NSW	The Snowy Mountains Highway compound (C02) is located directly adjacento this site.
Gregadoo Waste Management Centre	Landfill – Operational	102 Ashfords Road, Lake Albert NSW	The project footprint crosses into the site. However, waste activities are taken approximately 700 m to the west of the project footprint.
Batlow Landfill	Landfill – Operational	496 Keenans Road, Batlow NSW	Directly to the north of the Bowmans Lane compound (C15).

5.6.7 NSW Government PFAS Investigation Program

The environmental and potential human health impacts from exposure to PFAS are of increasing concern worldwide. Environmental legislation in many jurisdictions includes obligations and duties to prevent environmental harm, nuisances and contamination. PFAS contamination can be environmentally major due to its persistence and potential for bioaccumulation.

The PFAS National Environmental Management Plan was designed to regulate PFAS in the environment. The NSW EPA is currently undertaking a state-wide PFAS investigation program to identify the use and impacts of legacy PFAS.

A search of the program (NSW EPA, 2021b) identified two PFAS investigation sites within a 10 kilometre radius of the contamination study area and summarised below.

5.6.7.1 Wagga Wagga RAAF Base at Sturt Highway, Wagga Wagga NSW 2650

The Department of Defence has undertaken detailed investigations into PFAS contamination stemming from the historical use of fire-fighting foams at Wagga Wagga RAAF Base, located 6.3 kilometres north-east of the project footprint.

These investigations have included an Environmental Risk Assessment (ERA) and a Human Health and Ecological Risk Assessment to assess potential risks to human health and the environment. This included sampling of surface water, groundwater, sediment, soil and produce both on and off the RAAF Base. Investigations have found PFAS in biota, soil, surface and groundwater both on and offsite.

The overall PFAS contamination risk is considered to be low due to the distance from the site to the contamination study area.

5.6.7.2 Kapooka, Blamey Barracks at Kapooka Drive, Kapooka NSW 2661

The Department of Defence has undertaken detailed investigations into PFAS contamination stemming from the historical use of fire-fighting foams at Kapooka, Blamey Barracks, located 9.5 kilometres north-west of the project footprint.

The Department of Defence has completed a PSI and a DSI at the site. These investigations have determined that PFAS is present in both on and off-site locations, and the pathways through which PFAS is migrating. The detection of PFAS is not unexpected due to the historical use of PFAS-containing fire-fighting foams at the site.

The overall PFAS contamination risk is considered to be low due to the distance from the site to the project footprint and contamination study area.

5.6.8 Department of Defence Unexploded Ordnance

UXO refers to ammunition which has been fired but has not functioned as designed and could be dangerous as they may easily become functioning with little handling. The Department of Defence maintains a record of sites confirmed as or suspected of being contaminated with UXO (Department of Defence, 2023).

A search of the database (Department of Defence, 2023) indicated that the Defence Controlled Area RAAF Base Wagga Wagga (NSW) is located 6.3 kilometres north-east of the project footprint while the Defence Controlled Area Blamey Barracks (NSW) is located 9.5 kilometres north-west of the project footprint. No other UXO sites were identified within a 10 kilometre radius of the project footprint. As such, it is unlikely that any UXOs would be encountered during the work. It is recommended however, that an unexpected contamination finds protocol (UCFP) is employed for incidental finds during earthworks and construction.

5.6.9 Cattle dips

Cattle dips are potential contamination sites due to past use of arsenic and dichloro-diphenyl-trichloroethane (DDT). Arsenic was used as the tickicide in the dip solutions for cattle until 1955 when the ticks became resistant to it. DDT, an organochlorine pesticide (OCP) was then used until it too became ineffective in 1962. Since 1962. other much less persistent tickicides have been used to dip cattle. The use of DDT was banned in 1985.

Arsenic and DDT can still be found at high levels in the soil beside many dip baths as well as within the immediate dip area today because they are very persistent compounds and do not degrade readily.

The publicly available cattle dip site locator database (DPI, 2023) contains historical information regarding cattle dip sites in the Northern Rivers region that the NSW Government was involved with. As the database only covers the Northern Rivers region, the contamination study area which is located in southern and central NSW is not captured in this database. Given the historical land uses across the contamination study areas, cattle dips and livestock dips are likely to be present even though no mapping data exists.

5.7 Historical aerial photography review

A review of historical aerial photographs of selected portions of the contamination study area was conducted by viewing approximately one aerial photograph per decade where available.

The historical aerial photography review focussed on built up areas and areas containing potential for current and former contaminant sources. The review indicated that the contamination study area has remained largely rural since the 1980s with minimal filling or earthworks identified. There have been minor increases in rural living properties over the years.

Key points of interest and potentially contaminating activities identified were:

- The Wagga 330 kV substation was constructed between 1966 and 1980.
- The Gregadoo Waste Management Facility was established between 1980 and 1998, with stockpiles and fill visible.
- The quarries at 818 and 993 Gregadoo East Road, Gregadoo were present at current day extent in 1980.
- Disturbed earth was present at 1951 Batlow Road, Wondalga since 1961, which may have been a quarry.
- An area of fill or disturbed soils was present adjacent to 5000 Batlow Road, Wondalga in 1986.
- Areas of fill were observed to the west and north-east of the Snowy Mountains Highway compound (C02) in 1971.
- Gilmore Creek, present to the west of the Snowy Mountains Highway compound (C02), appeared to have been straightened and diverted between 1971 and 2008.
- The filling of several farm dams was observed on several lots over the years.
- The Yass substation and the quarry to the north-east of the Yass substation were present from 1973.

- Slightly exposed soils are present at 713 and 999 Burrinjuck Road, Woolgarlo in 1983. The extent of exposed soils increased at 999 Burrinjuck Road in 1994. It appeared to be used as a quarry in 2008 due to the photo evidence of exposed soil.
- The Bannaby 500 kV substation was established between 1987 and 2013.
- Potential fill was present in the location of the Red Hill Road compound (C08) in 1980. Potential fill was also noted to the west of this construction compound.
- In 1994, an area of disturbed earth was present at the intersection of Hume Highway and Yass Valley Way. This area was filled in by 2008.

5.8 Field surveys

Field surveys of selected areas within the contamination study area, as identified in Section 4.3.2, were undertaken from the 21 March to 24 March 2022 and on 2 August to 3 August 2022 to assess the potential risk of subsurface contamination. The main observations from the field survey findings are presented in Table 5-9.

Table 5-9 Field survey summary

Project infrastructure/ survey location	Field survey notes and observed ground conditions
Wagga 330 kV substation compound (C01)	■ Hardstand areas were present around the substation infrastructure located within the centre of the site. The rest of the site is covered in grass with little to no exposed soils visible. ■ What appeared to be a stockpile covered in grass was present on the southern side of the site.
Snowy Mountains Highway compound (C02)	■ The site was overgrown with grass, with the exception of the hardstand around the Tumut Waste and Recycling Centre. ■ A Tumut Waste and Recycling Centre representative indicated that a landfill handling inert waste was present to the east of the site. ■ A representative indicated that the grassed site was historically used for cattle grazing. An Aboriginal study previously undertaken on the site identified residual soils. No fill material was identified. ■ An operating forestry and timber processing company (AKD Softwoods) was located to the west of the construction compound.
Maragle 500 kV substation compound (C05)	■ An access road with gravelly clay surface ran along the western border of the construction compound site. ■ Signs on the access road indicated the presence of poison baiting for pests. The site was a declared hunting area. ■ Residual soils were observed along the border of the site in select areas.
Gregadoo Road compound (C06)	■ This site was inspected from the road corridor. It appeared to be located within a grassed, rural lot, adjacent to an unpaved road. ■ A farm dam with fill present around the edge of the dam was present to the south of the construction compound site. ■ Lots to the east of the site appeared to be rural lots used for agricultural purposes as exposed, dark brown soils were observed.
Honeysuckle Road compound (C07)	■ The construction compound site is located within an area observed to be covered with dense, overgrown grass and blackberry bushes. ■ A sign on the fence around the site indicated that weed spraying (herbicide) was in progress and cautioned to not eat blackberries.
Red Hill Road compound (C08)	■ Due to the presence of wasps or bees on site, all observations were made from within the vehicle. ■ The site was mostly covered in overgrown grass and blackberry shrubs with trees present along the border of the site. ■ Three stockpiles containing potentially timber and rocks were observed within the tall grass. ■ A shed composed of potentially corrugated steel sheeting and timber was present on the northern end of the site.
Adjungbilly Road compound (C09)	■ A sign was present on the gates leading into the construction compound site noted that weed spraying (herbicide) was in progress and cautioned to not eat blackberries. ■ The construction compound site appeared to be used for pine tree plantations. ■ Minor fill material similar to the gravelly sand present on the access roads were observed around the boundary of the site. Residual soils were also observed in areas without grass cover.

Project infrastructure/ survey location	Field survey notes and observed ground conditions
Yass substation compound (C10)	■ A Transgrid representative indicated that a quarry is present to the north-east of the substation. ■ Hardstand areas were present around the substation infrastructure and a number of buildings spread across the site. ■ Construction was being undertaken on the south-eastern extent of the site, between the substation infrastructure and the office buildings on site. No access was available in this section. ■ Building materials such as pallets and metal fences were stored in two locations. ■ A tank containing used, untreated oil was present on site within a concrete bunded area. Drums containing Nytro Libra Naphthenic uninhibited transformer oil are present around the tank within the bunded area. Black substance was observed on the outside of an unlabelled, rusted drum and around the foot of the drum within the bunded area. ■ A building was labelled as a 'PCB Contaminated Material Storage Area' while another was labelled a 'Fire Pump House'. ■ A number of stockpiles were present in the north-eastern extent of the site. One stockpile contained asphalt slabs which appeared to have been removed from the road while another stockpile was comprised of concrete pipes and pieces. The other stockpiles were predominantly composed of road base and gravels. Construction and demolition waste such as concrete, PVC pipe, timber, plastic, fabric, black plastic tubing and metal sheeting were observed on the surface of a stockpile.
Bannaby 500 kV substation compound (C12)	■ The substation was located on a hilly, grassed terrain. ■ Substation infrastructure was fenced off and surrounded by hardstand. The rest of the site appeared to be undisturbed and covered in grass.
Memorial Avenue compound (C14)	■ The majority of the site was covered in asphalt. A former NSW Forestry Corporation depot, including a warehouse, an old washdown station and two sheds were present on the site. The buildings were comprised predominantly of corrugated iron or steel sheets. ■ A number of wooden crates were present on the site. ■ Three stockpiles were present on the site. – One stockpile appeared to be comprised of clayey gravel and gravelly clay and was overgrown with grass. Minor construction objects including timber stakes, metal wires and a piece of unidentified, rusted machinery part were observed on the surface of the stockpile. – The second stockpile appeared to be comprised of mulch and soft organics mixed with gravels and minor glass inclusions. Organic smell was present. These two stockpiles are located towards the middle of the site, adjacent to each other. – An additional small stockpile comprised of gravelly clay was present adjacent to the shed located on the southern portion of the site. Approximately 20 tyres were located adjacent to the shed.
Bowmans Lane compound (C15)	■ The site was used for timber processing at the time of the inspection. Access into the site was limited due to active heavy machinery. ■ The site appeared to be heavily vegetated with residual silty clay when viewed from the north-eastern corner of the site. ■ A representative from Snowy Valleys Council indicated that the site was previously used as a pine plantation which was destroyed during a bushfire. ■ The Batlow Resource Recovery Centre was located to the north of the site. The representative indicated that the Resource Recovery Centre was historically used to be a landfill for inert waste, such as plastics. There were no records of leaching. In addition, routine groundwater testing was undertaken at a number of sampling points around the site as per NSW EPA requirements. The representative indicated that the Resource Recovery Centre was being used as a transfer station at the time of the site inspection. ■ The representative noted that illegal dumping of soil and construction waste was a common occurrence along the eastern border of the Resource Recovery Centre site.

Project infrastructure/ survey location	Field survey notes and observed ground conditions
Snubba Road compound (C16)	■ The site was located within the Bago State Forest. ■ The site appeared to have been used for pine plantation. At the time of the inspection, the trees on the site were removed. ■ The site was highly disturbed at the time of the inspection. Heavy vehicle tracks were visible across the site. ■ Minor surficial fill comprised of gravelly clay was present close to Snubba Road. ■ Residual soil comprised of silty clay appeared to be present beneath the surficial fill across the site.
Tumbarumba Accommodation Facility (AC1)	■ All observations for this site were made from the road corridor. ■ The site appeared to be undeveloped, rural land with scattered trees present. ■ Overhead power lines were present on the western side of the site.
Transmission line corridor – Dawes Road, Broadway	■ Rundown cars were scattered across the western extent of the site. ■ Of the cars observed, it was noted that the fuel tanks were opened. The tyres of several cars were also missing. ■ Minor anthropogenic wastes such as bottle caps, glass shards and paint flecks were present on the ground surface in the areas surveyed. ■ Car tyres and unidentified metal structures, potentially car parts were scattered around the cars. ■ The soils on site appeared to be residual soils comprised of gravelly clay.
Transmission line corridor – 132 Ashfords Road, Gregadoo	■ All observations for this site were made from the road corridor. ■ The site belonged to the Gregadoo Waste Management Centre and was predominantly covered with grass with scattered trees present. ■ Cut and fill activities appeared to have been undertaken for a farm dam on the northern side of the site. ■ An 'RRR Shop' was present on the site. It appeared to be a commercial recycling store. Stockpiles and domestic objects such as bikes and chairs were visible around this shop. ■ Stockpiles were also observed near the entrance of the main Gregadoo Waste Management Centre. ■ An area of raised land was visible within the site which may indicate cut and/or fill activities. The site was overall flat.
Transmission line corridor – 993 Gregadoo East Road, Gregadoo	■ The site was used for rural living and predominantly covered in grass. ■ An old quarry was present on the southern border of the site. ■ Several bodies of water were present within the quarry. Areas around waterbodies were generally vegetated with grass. A rainbow sheen was observed across the surface of two of the bodies of water. ■ A pile of construction materials was present near the quarry. Materials included bricks, metal sheeting, barbed wire, rusty metal poles and concrete blocks.
Transmission line corridor – 818 Gregadoo East Road, Gregadoo	■ The site was largely covered in overgrown grass. ■ The western extent of the site appeared to be used for sheep grazing, as several sheep, including carcasses, were observed. ■ An old quarry was present on the western border of the site. ■ The surface around the quarry was predominantly comprised of gravels of igneous origin covered sparsely with native grass. ■ Several concrete pipes were present at the quarry.

Project infrastructure/ survey location	Field survey notes and observed ground conditions
Transmission line corridor – 277 Walsh Road, Dalton	■ The property on the western side of Walshs Road appeared to be used for rural living. ■ Several stockpiles were observed around the front of the property and appeared to be comprised of clay and gravelly sand. ■ Farm use equipment and construction and demolition materials were scattered across the site. Materials and equipment observed include rusted metal pieces, rusted metal drums, metal wire, metal concrete pipe, corrugated metal sheeting, tiles, timber, pallets, wheelchairs, motors or engines and foam. ■ A weathered corrugated plastic sheeting which appeared to be comprised of synthetic mineral ■ fibres/corrugated fibreglass materials was observed on the ground within the property. ■ A field survey was also taken of the property on the eastern side of Walshs Road. The site appeared to be generally unused and was covered in grass. Exposed soil was visible near the entrance to the site and along an access road running east towards a farm dam. ■ Storage of assorted domestic items and construction and demolition materials were present on site. Items identified included pallets, a jerry can, tyres, rope, corrugated metal sheeting, gas tanks, a skip bin, concrete pipes, ceramic fragments, wooden boards, timber, rusted metal sheeting, bricks, concrete slabs, metal wire, an electrical circuit board, a washing machine, rusted metal farm equipment, a television, a lawnmower, a barbeque grill and a truck. ■ Several fragments containing strands of fibrous material were noted next to the items on site, roughly 70 m east of Walshs Road. The materials are considered to be a mixture of fragments of fibre glass and synthetic mineral fibres (SMF) and fragments of potential asbestos containing materials. Testing would need to be undertaken to confirm presence or absence of asbestos as the fragments were covered in soil at the time of observation. ■ Several stockpiles of bricks, domestic waste and gravelly clay were present on the site. ■ A shed containing several drums, including synthetic lubricant, were noted on site.
Transmission line corridor – 292 Prices Lane, Bannister	■ The site was surrounded by rural lots. ■ The site appeared to be used for rural or agricultural purposes as hay bales were observed on site. The site was largely covered in overgrown grass. ■ Stockpiles of timber and gravel were present near the entrance of the site. ■ A number of tractors, cars, construction materials and shipping containers are present on the western extent of the site.
Transmission line corridor – Road corridors (Days Road, Burrinjuck Road, Kileys Creek Road, Stewarts Road, Humula Road, Livingstone Gully Road)	■ The areas of the corridor inspected predominantly ran through rural lots with grass cover present. Areas around Red Hill contained pine trees. ■ Rock outcrops were observed on Kileys Creek Road in Red Hill, located to the south of the Honeysuckle Road compound (C07). The rocks were noted to potentially contain naturally occurring asbestos based on risk mapping. An Aurecon licenced asbestos assessor noted that the rocks may contain minor serpentine or amphibolite which can contain trace asbestos minerals. Testing would need to be undertaken to confirm presence or absence of asbestos.

5.9 Previous investigations

This section provides a summary of previous geotechnical and hazardous material investigations undertaken within the contamination study area. The following reports have been reviewed and are discussed further in the sections which follow:

- *Hazardous Material Inspection Report (Asbestos & Lead): Wagga Wagga Substation, 50 Ashford Road, Gregadoo NSW* (Healthy Buildings International, 2020)
- *The Electrical Commission of NSW, Wagga, 330 kV Substation, Site Investigation* (Coffey and Hollingsworth Consulting Engineers, 1969)
- *Geotechnical Investigation Report: Maragle Substation* (SMEC, 2021)
- *Geotechnical Investigation: Wagga 330/132 kV substation* (Parsons Brinckerhoff, 2009)
- *Report on Geotechnical Investigation: Proposed 500 kV/330 kV Substation, Hanworth Road, Bannaby (Via Taralga)* (Douglas Partners, 2007).

5.9.1 *Hazardous Material Inspection Report (Asbestos & Lead), Wagga Wagga Substation* (Healthy Buildings International, 2020)

In January 2020, Healthy Buildings International undertook a Hazardous Material Inspection of the Wagga 330 kV substation located at 50 Ashford Road, Gregadoo NSW. The project proposes to place a construction laydown area, the proposed Wagga 330 kV substation compound (C01), immediately to the south of this substation.

The inspection was undertaken to confirm the status of previously identified Asbestos Containing Materials (ACMs), suspected ACMs and newly identified lead containing paint present on site.

The investigation indicated that the Exterior - Switchyard - 415V outlet housing - Opening - Rope seal had a moderate risk rating due to its friable nature and it was recommended to have it removed as soon as possible. All other materials identified as containing asbestos have a low or a very low risk rating as they were not friable and unlikely to release fibre under normal circumstances. It was noted that the condition of a number of ACMs within the Control Building and Switchyard were not assessed due to electrical hazards.

The investigation also indicated that the lead paint was identified but this was identified as having a very low risk rating.

5.9.2 *The Electrical Commission of NSW, Wagga 330 kV Substation, Site Investigation* (Coffey and Hollingsworth Consulting Engineers, 1969)

Coffey and Hollingsworth Consulting Engineers undertook a geotechnical investigation for the Wagga 330 kV substation, located at 50 Ashford Road, Gregadoo. The project proposes to place a construction laydown area, the proposed Wagga 330 kV substation compound(C01), immediately to the south of this substation. A number of test pits and boreholes were undertaken across the site and the nearby public road. Natural material consisting predominantly of silt and silty clay material transitioning to stiff clay was present across the site. Standing water level across the site ranged from 1.37 metres below ground level (mbgl) to 2.1 mbgl.

5.9.3 *Geotechnical Investigation, Wagga 330/132 kv substation* (Parsons Brinckerhoff, 2009)

Parsons Brinckerhoff undertook a geotechnical investigation at the Wagga 330 kV substation at the intersection of Boiling Down Road and Ashfords Road. The investigation was undertaken to provide information for the design and construction of work relating to transformer replacement and associated work within the existing substation. The project proposes to place a construction laydown area, the proposed Wagga 330 kV substation compound (C01), immediately to the south of this substation. The investigation consisted of the drilling of 17 boreholes.

Geology across the site consisted of clayey silty topsoil overlaying silty clay of alluvium origin. Groundwater was encountered in two boreholes at depths of 4.5 mbgl and 5.0 mbgl. The soils were considered non-aggressive to concrete and steel piles based on laboratory testing.

5.9.4 *Geotechnical Investigation Report, Maragle Substation* (SMEC, 2021)

SMEC undertook a geotechnical investigation for the proposed Maragle substation compound (C05) in the Maragle State Forest. The investigation consisted of drilling of 17 boreholes and excavation of seven test pits.

Topsoil and residual material consisting of clayey silt, silt and silty clay were present across the site to depth of 5.5 mbgl. Extremely weathered granite and weathered granite was present beneath the residual soils. No fill material was encountered. Groundwater was encountered at depths between 6.1 mbgl and 11 mbgl across the site. The soils were considered non-aggressive to concrete and steel piles based on laboratory testing.

5.9.5 *Report on Geotechnical Investigation, Proposed 500kV/330kV Substation* (Douglas Partners, 2007)

Douglas Partners undertook a geotechnical investigation of the Bannaby 500 kV substation at Hanworth Road, Bannaby to identify subsurface condition. This site is located adjacent to the proposed Bannaby 500 kV substation compound (C12). The investigation consisted of drilling of 27 boreholes and excavation of 30 test pits. A site inspection undertaken as part of the investigation noted that fill on the site appeared to be limited to a shallow platform near a shearing shed and around road culverts, contour drains and farm dams. No visible evidence of contamination was identified.

Geology across the site typically consisted of a thin layer of clayey silt topsoil, followed by residual clays overlaying a granite bedrock. It was noted that 0.3 metres of fill was encountered at one location at the platform near the shearing shed.

Three groundwater monitoring wells were installed across the site, with groundwater encountered at depths between 4.1 mbgl and 8.47 mbgl. Groundwater measurements were also taken from four boreholes which were ‘plugged at the surface following drilling but not cased or purged’. Groundwater levels across these four boreholes ranged from being dry to 5.1 mbgl to 7.2 mbgl. It was noted that groundwater levels within these four boreholes may represent drilling water not drained or which seeped back into the hole.

Laboratory analysis on four soil samples indicated that the samples were weakly basic to weakly acidic with low concentrations of chloride and sulfate.

5.10 Areas of environmental concern

Several AECs were identified qualitatively from both desktop assessment and field survey. These AECs related to activities/observations such as existing infrastructure, potentially dumped wastes (including potential asbestos containing material (PACM)), stored materials, landfilling activities, stockpiled material, NOAs, and areas with potential historical uncontrolled filling or ground disturbance.

These AECs were identified as having the potential to cause harm to human health or ecological receivers during construction activity (land disturbance) and operation of the project, without mitigation measures in place.

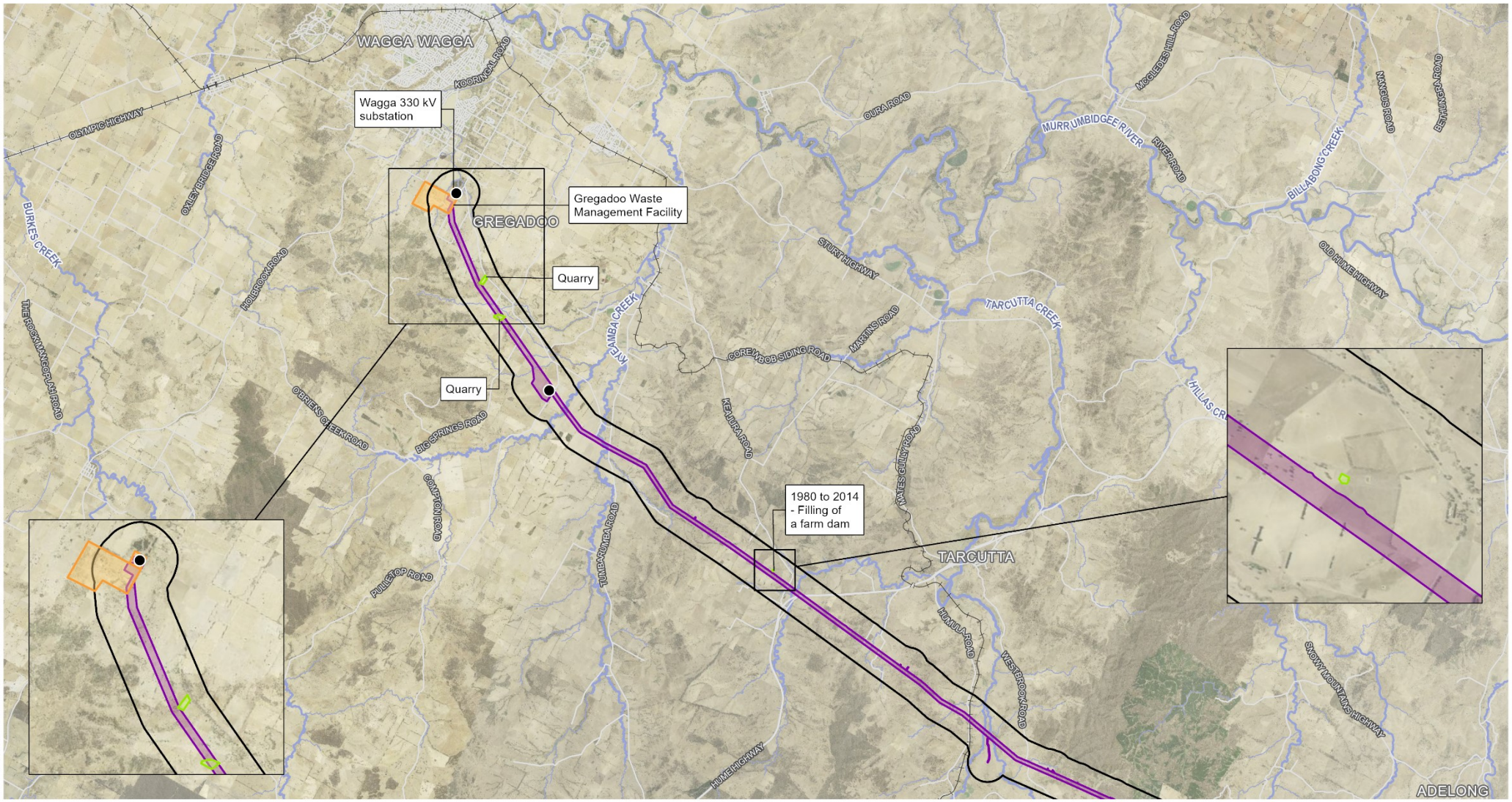
Identified AECs and the potential human health and ecological hazards for the project are summarised in Table 5-10 (in accordance with the risk rating matrix described in Section 4.1.1) and shown in Figure 5-10.

Table 5-10 Identified areas of environmental concern within the contamination study area

AECs Rationale for concern		Within or outside project footprint?	Confirmed location (based on aerial imagery)	Sensitive receivers	Potential contaminants of concern	Risk rating
▪ Bannaby 500 kV substation ▪ Wagga 330 kV substation ▪ Gullen Range Wind Farm substation ▪ Yass 330 kV substation.	Onsite spills and leaks from maintenance activities, asbestos, lead paints and/or PCBs on existing substation structures	Within Within Outside Within	▪ 34.441°S, 150.051°E ▪ 35°12'01.9"S 147°23'38.2"E ▪ 34°36'50.4"S,149°27'29.0"E ▪ 34°51'45.1"S 148°54'19.6"E.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ PCBs ▪ Benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN) ▪ Total recoverable hydrocarbons (TRH) ▪ heavy metals ▪ asbestos.	Moderate (localised)
Existing transmission line infrastructure	Onsite spills and leaks from maintenance activities, asbestos and/or lead paints on transmission line structures	Within	Portions of the contamination study area.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ BTEXN ▪ TRH ▪ asbestos ▪ heavy metals.	Low
Farm dams (open or infilled)	Areas of potential contaminant sediment build-up (sink)	Variable, refer to Figure 5-10.	Multiple locations within the contamination study area.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ heavy metals ▪ OCP ▪ Organophosphate pesticides (OPP) ▪ elevated nutrient concentrations ▪ pathogens (Escherichia coli).	Low
Cleared improved agricultural land (including cropping and irrigated land)	Historical use of pesticides, herbicides and fertilisers, large scale land clearance and heavy machinery use	Variable, refer to Figure 5-10. Majority of land has been cleared/improved	Portions of the contamination study area.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ heavy metals ▪ OCP ▪ OPP.	Low
Areas with pesticide use, including Hume Forest and Forestry owned land	Ongoing use of pesticides, including for pine forests	Within and outside	Portions of the contamination study area, including but not limited to: ▪ Around 35°08'25.4"S 148°20'35.4"E ▪ Around 35°03'30.5"S 148°22'11.0"E.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ OCP ▪ OPP.	Low

AECs Rationale for concern		Within or outside project footprint?	Confirmed location (based on aerial imagery)	Sensitive receivers	Potential contaminants of concern	Risk rating
Designated hunting grounds	Lead bullets uses within hunting grounds	Within	Around 35°47'31.6"S 148°18'45.1"E	■ terrestrial fauna/flora ■ surface water features ■ present and future site users ■ construction and maintenance workers.	■ Lead.	Low
Areas of disturbed land, fill, stockpiling and dumping	Areas with historical and existing stockpiles, filling and dumping, including dumped cars and the presence of potential asbestos containing materials.	Variable, refer to Figure 5-10.	Portions of the contamination study area, including: ■ 35°12'29.6"S 147°23'35.2"E ■ 34°44'03.0"S 149°04'55.5"E ■ 35°25'01.5"S 148°07'17.0"E ■ 35°25'16.1"S 148°07'42.7"E ■ 34°52'56.0"S 148°41'06.8"E ■ 34°41'38.5"S 149°11'02.8"E ■ 34°37'09.2"S 149°25'44.5"E ■ 34°31'54.2"S 149°41'47.1"E.	■ terrestrial fauna/flora ■ surface water features ■ present and future site users ■ construction and maintenance workers.	■ BTEXN ■ TRH ■ asbestos ■ heavy metals ■ PCBs ■ Polycyclic Aromatic Hydrocarbons (PAH) ■ OCP ■ OPP.	Moderate
Built-up areas, including rural residences	Historical uncontrolled earthworks and building structures previously demolished/ degraded. The building structure may contain asbestos and/or lead paints.	Variable, refer to Figure 5-10.	Portions of the contamination study area.	■ terrestrial fauna/flora ■ surface water features ■ present and future site users ■ construction and maintenance workers.	■ BTEXN ■ TRH ■ asbestos ■ heavy metals ■ PCBs ■ PAH ■ OCP ■ OPP.	Low
Bellette landfill & Tumut Resource Recovery Centre	Operating as a waste transfer station. Tumut Community Recycling Centre is located adjacent to the Bellette Landfill	Outside	■ Approximately 35°19'37.6"S 148°10'51.8"E ■ 35°32'01.6"S 148°09'37.2"E.	■ terrestrial fauna/flora ■ surface water features ■ present and future site users ■ construction and maintenance workers.	■ BTEXN ■ TRH ■ asbestos ■ heavy metals ■ PCBs ■ PAH ■ OCP ■ OPP ■ PFAS.	Moderate (localised)

AECs Rationale for concern		Within or outside project footprint?	Confirmed location (based on aerial imagery)	Sensitive receivers	Potential contaminants of concern	Risk rating
Gregadoo Waste Management Centre Batlow Landfill	Operating as a landfill at the Gregadoo site. Composting activities also operating on the site. Historical landfill activities at the Batlow site.	Within	▪ Approximately 35°12'28.2"S 147°23'27.9"E ▪ 35°32'01.6"S 148°09'37.2"E.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ BTEXN ▪ TRH ▪ asbestos ▪ heavy metals ▪ PCBs ▪ PAH ▪ OCP ▪ OPP ▪ PFAS.	Moderate
Quarries	Historical spills and leaks from the use of machinery at historical and existing quarries	Variable, refer to Figure 5-10.	▪ 35°14'49.7"S 147°26'26.9"E ▪ 35°13'58.7"S 147°25'33.1"E ▪ 34°51'29.5"S 148°54'38.8"E.	▪ terrestrial fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ BTEXN ▪ TRH ▪ heavy metals ▪ PAH.	Low
Areas with potential for NOA	Mapped with potential for NOA	Variable, refer to Figure 5-6.	Portions of the contamination study area.	▪ present site users ▪ construction workers.	▪ asbestos fibres.	Moderate (localised)
Biosolids applied to land for farming and crops, often tilled into the surface soils	Historical application of resource recovery and biosolids from wastewater treatment systems	Variable, refer to Figure 5-10.	No confirmed locations, broad historical use of biosolids in surface soils.	▪ terrestrial fauna/flora ▪ aquatic fauna/flora ▪ surface water features ▪ present and future site users ▪ construction and maintenance workers.	▪ PFAS ▪ biosolid residues applied to land.	Low
Areas with potential for soil and groundwater salinity	Mapped with potential for soil salinity	Variable, refer to Figure 5-4.	Portions of the contamination study area.	▪ terrestrial fauna/flora ▪ future and existing infrastructure.	▪ soil salinity.	Low to moderate (varies within project footprint)
Visy Pulp and Paper	Operating as a paper mill.	Outside	35°17'50.0"S 148°08'15.0"E. (limited to surface water within creek crossing the contamination study area).	▪ aquatic fauna/flora ▪ surface water features.	▪ PFAS. ▪ solvents ▪ heavy metals ▪ nutrients (nitrogen and phosphorus).	Low



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Project footprint

Contamination study area

Watercourse

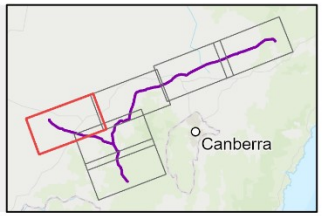
Substation

Areas of Environmental Concern

Risk Rating

Low

Moderate



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

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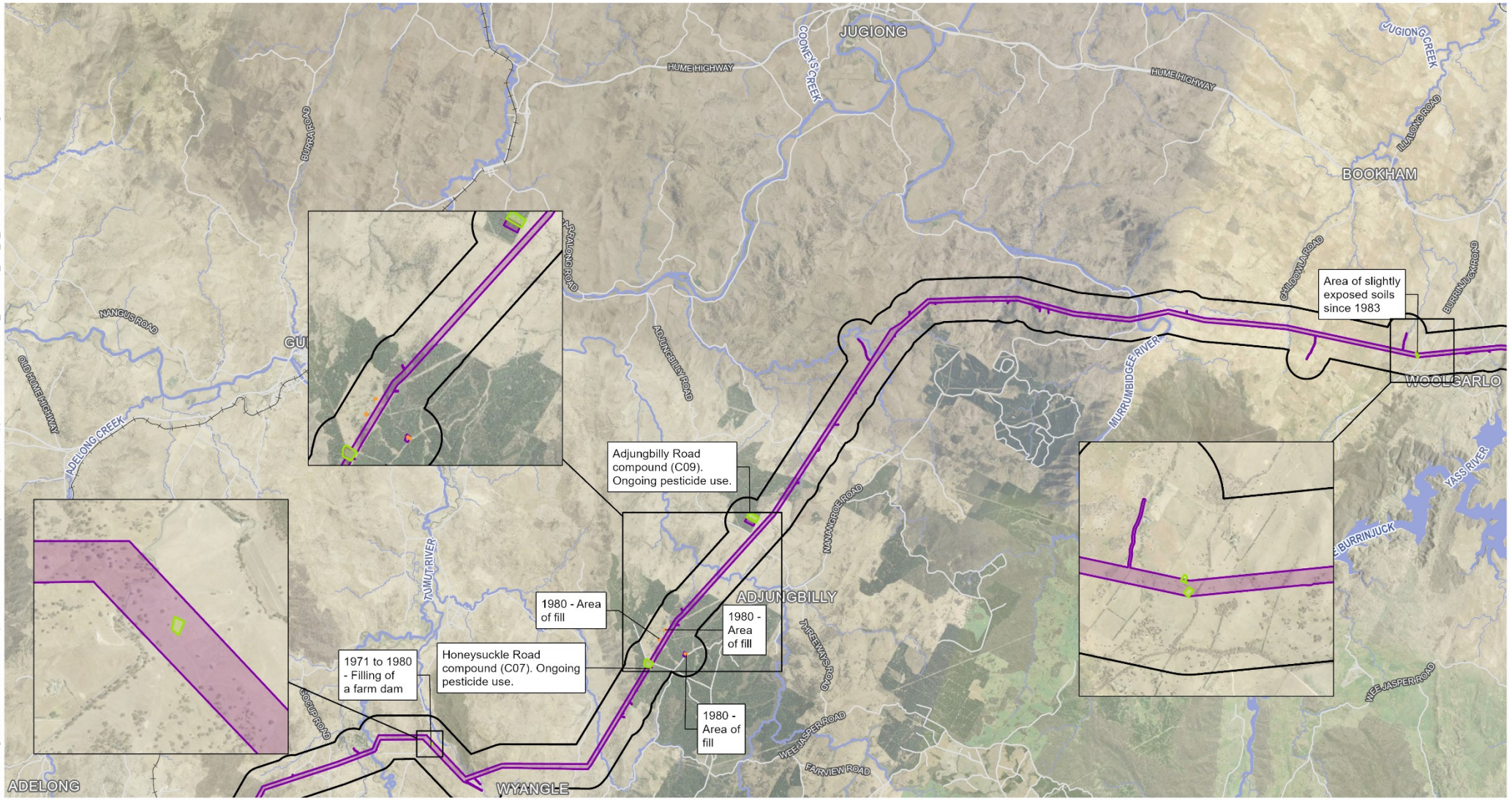
0 4 8 km

Projection: GDA 1994 MGA Zone 55

Figure 5-10a: Potential areas of environmental concern for contamination



Project footprint

Contamination study area

Watercourse

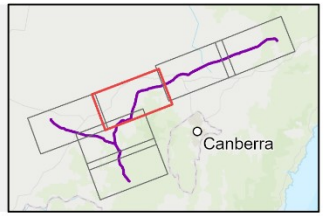
Substation

Areas of Environmental Concern

Risk Rating

Low

Moderate



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

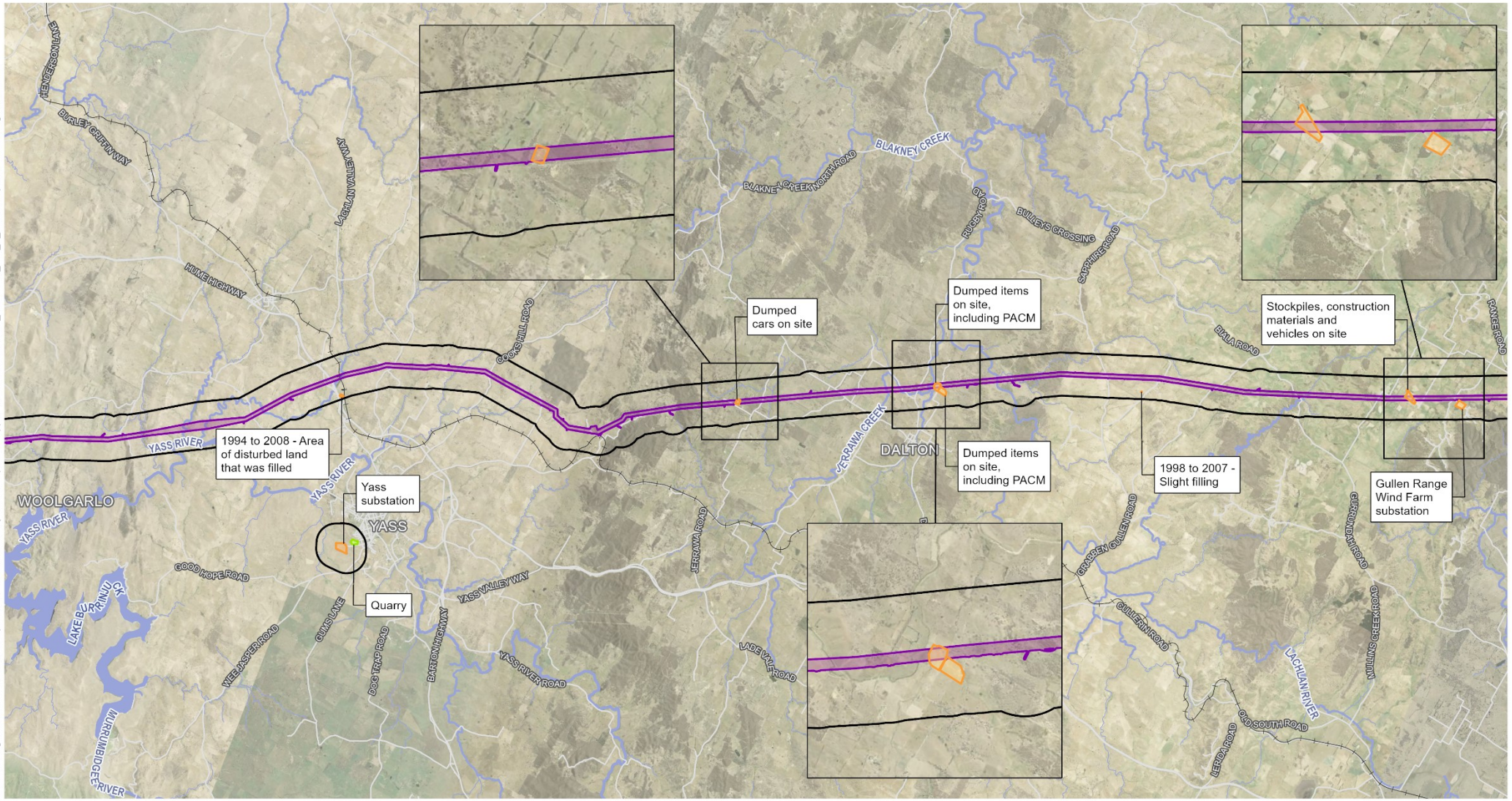
1:200,000

0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-10b: Potential areas of environmental concern for contamination



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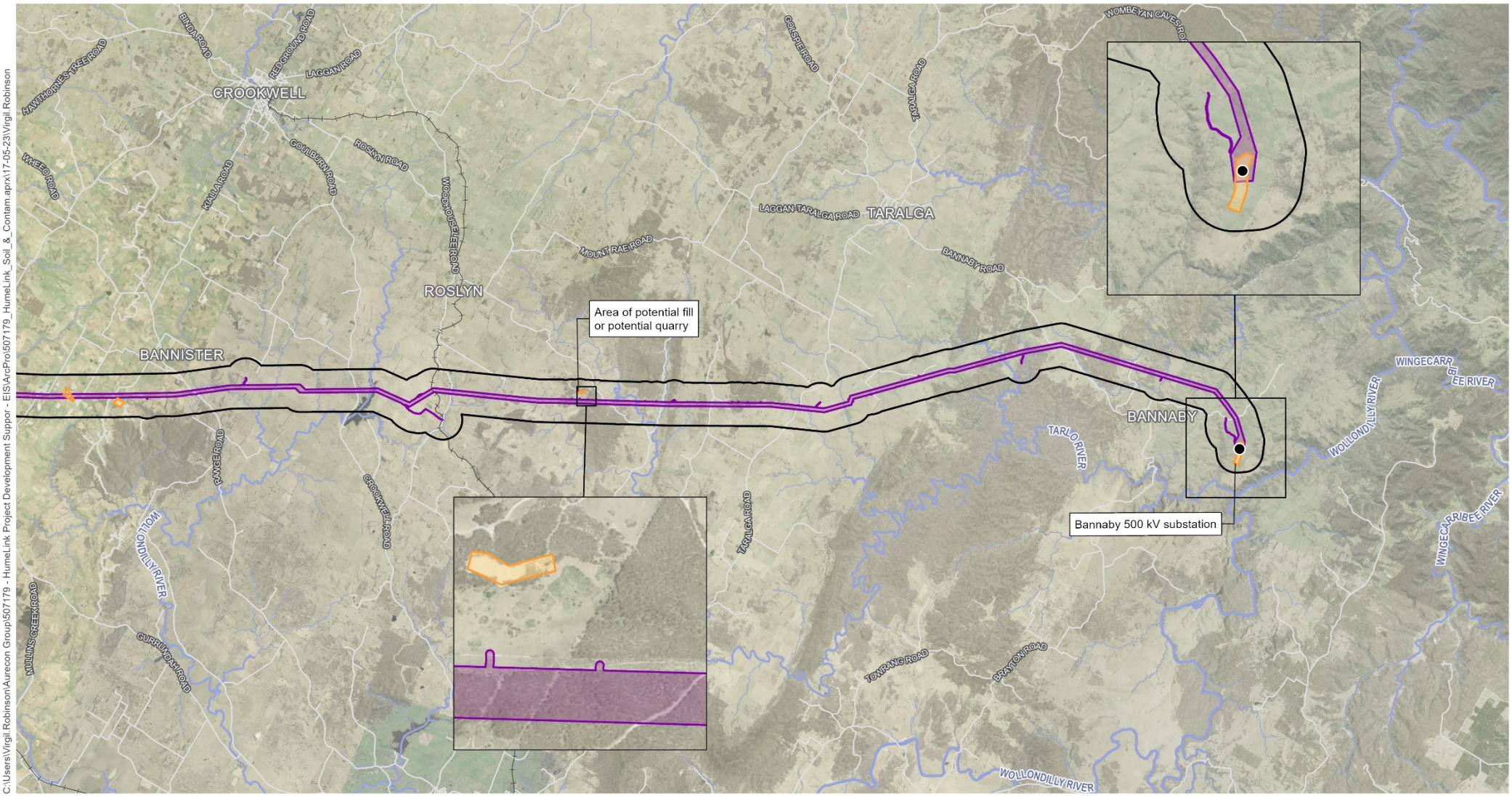
Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:200,000

0 4 8km

Projection: GDA 1994 MGA Zone 55

Figure 5-10c: Potential areas of environmental concern for contamination



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:200,000
0 4 8 km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-10d: Potential areas of environmental concern for contamination

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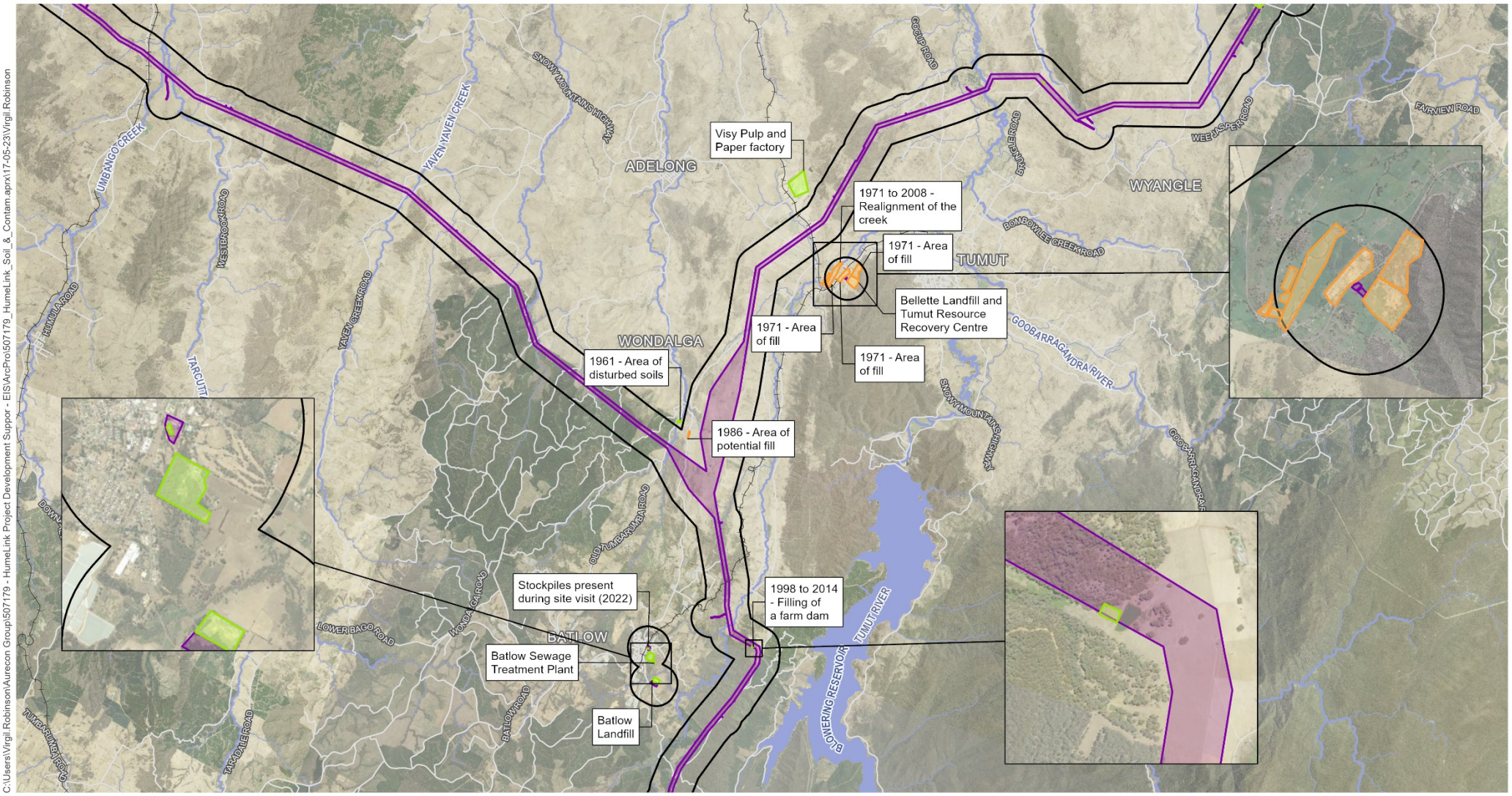

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Project footprint

Contamination study area

Watercourse

Substation

Areas of Environmental Concern

Risk Rating

Low

Moderate

Canberra

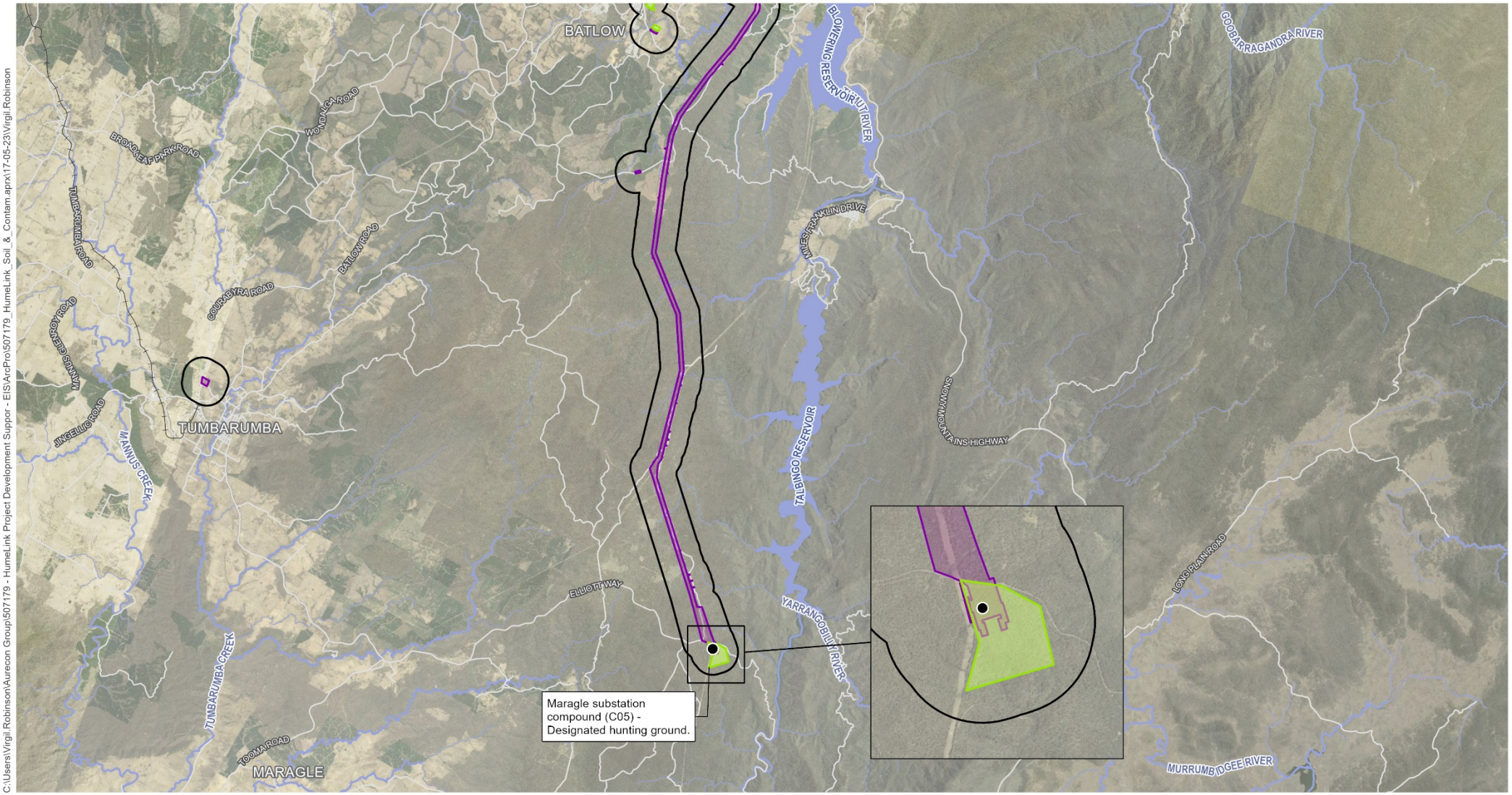
Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:200,000

0 4 8km

Projection: GDA 1994 MGA Zone 55

Figure 5-10e: Potential areas of environmental concern for contamination



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Project footprint

Contamination study area

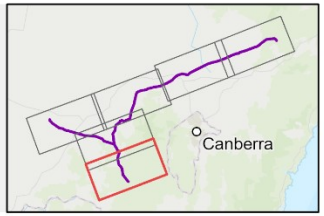
Watercourse

Substation

Areas of Environmental Concern

Risk Rating

Low



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

1:200,000

0 4 8km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

Figure 5-10f: Potential areas of environmental concern for contamination

6 Construction impacts

6.1 Potential to encounter contamination

A number of AECs, which could potentially be encountered during construction have been identified (refer to Table 5-10) and shown in Figure 5-10.

During construction of the project there is the potential to:

- disturb existing contamination via construction activities or generate erosion of soils via removal of vegetation
- mobilise contaminants and sediments which may impact adjacent soils, surface water and groundwater
- increase the migration of contaminants into surrounding areas via leaching, overland flow and/or subsurface flow (water and/or vapour) or dust, which could potentially impact major receiving environments including the Tumut River, Murrumbidgee River and Wollondilly River, and other minor receiving environments (streams and minor waterways) present in the contamination study area
- impact sensitive receiverrs such as flora and fauna through the mobilisation and migration of contaminants thereby degrading existing environmental conditions
- increase the risk of exposure to contaminants, either through direct or indirect exposure, to site workers, landowners, as well as the local community.

Depending on the extent of contamination and work undertaken, the risk of disturbing or encountering contaminated material during construction varies. Hence, based on the information available, a risk rating has been assigned to each land use activity based on the potential for contamination to be caused or soil impacts. The risk rating criteria is based on those outlined in Section 4.4. This is summarised and presented in Table 6-1.

Table 6-1 Preliminary contamination risk ranking

Area of interest	Construction activity	Potential construction impact	Likelihood for COPCs to be present and encountered	Complete source, pathway, receiver linkage?	Preliminary risk evaluation
▪ Bannaby 500 kV substation ▪ Wagga 330 kV substation ▪ Gullen Range Wind Farm substation ▪ Yass 330 kV substation.	Construction involving excavation, vegetation clearance, stripping and grubbing, stockpiling, utility work and vehicle movement at and near substations	Common COPCs associated with electrical substations include PCBs and hydrocarbons. In addition, ACM and lead containing paint are often present on existing, older infrastructure assets built pre 1990s. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Moderate potential for COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Moderate (localised)
	Pile construction and de-watering	Common COPCs associated with electrical substations include PCBs and hydrocarbons. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Expected groundwater depth to be 1.37 (Coffey and Hollingsworth Consulting Engineers, 1969) to 5.0 mbgl (Parsons Brinckerhoff, 2009) at the Wagga 330 kV substation. Anticipated groundwater depth to be >5 mbgl at all other substations. Low potential for COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
Existing transmission line infrastructure	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	Common COPCs associated with existing transmission line infrastructure include pesticides, herbicides, and hydrocarbons, which are typically associated with maintenance activities within the easement. In addition, ACMs and lead containing paint may be present on existing infrastructures. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low potential for COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
	Pile construction and de-watering	Common COPCs associated with transmission line infrastructure include pesticides, herbicides, and hydrocarbons. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Anticipated groundwater depth to be > 5 mbgl. Very low potential for COPCs to be present and encountered. Piling is localised and groundwater interception is recalibrated via placement of concrete and steel piles.	Linkage complete during construction phase (without appropriate controls being implemented).	Negligible

Area of interest	Construction activity	Potential construction impact	Likelihood for COPCs to be present and encountered	Complete source, pathway, receiver linkage?	Preliminary risk evaluation
Near farm dams and bottom sediments within dams (existing or historical and infilled)	Excavation activities	Historical farm dams which are now filled could contain uncontrolled fill and residual sediment at the bottom of the dam. Common COPCs associated with farm dam sediments includes heavy metals, nutrients, herbicides and pesticides. If managed incorrectly, disturbance of sediments within the farm dam has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low to moderate potential for accumulation of contaminants within dam sediments.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
	Pile construction and de-watering	If managed incorrectly, de-watering during the construction phase could lead to receivers encountering potentially contaminated dam water, and potentially draw-down surface water from the farm dam. Both of these activities could potentially impact human health and/or the environment through: ■ direct contact by construction workers ■ incidental discharge into the receiving environment.	Dams are not likely to be disturbed during construction phase.	It is not known whether the dam surface water has a hydraulic connection with groundwater.	Low
Cleared improved agricultural land (including cropping and irrigated land)	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	Common COPCs associated with agricultural activities include pesticides, herbicides, nutrients and heavy metals. If managed incorrectly, disturbance of contaminated soil from agricultural activities has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low potential for agricultural COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
	Pile construction and de-watering	Common COPCs associated with agricultural activity include pesticides, herbicides, nutrients and heavy metals. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Anticipated groundwater depth to be > 5 mbgl. Low potential for agricultural COPCs to be present and encountered due to low mobility and surface of near surface usage.	Linkage complete during construction phase (without appropriate controls being implemented).	Low

Area of interest	Construction activity	Potential construction impact	Likelihood for COPCs to be present and encountered	Complete source, pathway, receiver linkage?	Preliminary risk evaluation
Areas with pesticide use, including Hume Forest owned land	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement	Common COPCs associated with pesticide use includes OCPs and OPPs. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low potential for OCPs and OPPs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
Designated hunting ground	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement	Common COPCs associated with designated hunting ground includes lead from lead bullet uses. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low potential for lead to be present and encountered	Linkage complete during construction phase (without appropriate controls being implemented).	Low
Areas of localised disturbed land, uncontrolled fill, stockpiling and dumping as identified in Figure 5-10	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	Fill material and illegal dumping can contain a range of COPCs, including asbestos, heavy metals, pesticides, herbicides, PCBs and hydrocarbons. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Moderate potential for COPCs to be present. Cars, drums containing chemicals and potential asbestos were identified in the field survey.	Linkage complete during construction phase (without appropriate controls being implemented).	Moderate
	Pile construction and de-watering	Fill material and dumping can contain a range of COPCs, including asbestos, heavy metals, pesticides, herbicides, PCBs and hydrocarbons. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Anticipated groundwater depth to be > 5 mbgl. Low risk of COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
Built-up areas, including rural residences	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	COPCs associated with rural living areas include minor spills or leaks of hydrocarbons, heavy metals, pesticides, building fabric (hazardous materials such as ACM and lead paints) and asbestos impacted fill material. No major filling was evident from aerial photographs and the field survey. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low potential for COPCs to be present and encountered. In addition, built-up areas are unlikely to be disturbed during construction.	Linkage complete during construction phase (without appropriate controls being implemented).	Low

Area of interest	Construction activity	Potential construction impact	Likelihood for COPCs to be present and encountered	Complete source, pathway, receiver linkage?	Preliminary risk evaluation
Bellette landfill & Tumut Resource Recovery Centre Gregadoo Waste Management Centre Batlow Landfill	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	Landfill and waste transfer stations can contain a range of COPCs, including asbestos, heavy metals, pesticides, herbicides, PCBs and hydrocarbons. If managed incorrectly, disturbance of contaminated soil has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Moderate potential for COPCs to be present. While the project footprint is outside of the area within the Gregadoo Waste Management Centre where waste activities are being taken (>500 m), impacted surface water and dust may have migrated over time. Similarly, impacted surface water and dust may have migrated over time from the Gilmore and Batlow sites to the proposed adjacent construction compound sites (Snowy Mountains Highway compound (C02) and the Bowmans Lane compound (C15)).	Linkage complete during construction phase (without appropriate controls being implemented).	Moderate (localised)
	Pile construction and de-watering	Landfill and waste transfer stations can contain a range of COPCs, including asbestos, heavy metals, pesticides, herbicides, PCBs and hydrocarbons. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Anticipated groundwater depth to be > 5 mbgl. Low COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
Quarries	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	Common COPCs associated with quarry activities includes hydrocarbons and heavy metals. If managed incorrectly, disturbance of contaminated soil and surface water has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Moderate potential for COPCs to be present. A potential oil slick was noted on the surface of a body of water at one of the quarries surveyed. However, existing quarries are unlikely to be disturbed during construction greatly minimising likelihood. As such, the potential for COPCs to be encountered is low.	Linkage complete during construction phase (without appropriate controls being implemented).	Low

Area of interest	Construction activity	Potential construction impact	Likelihood for COPCs to be present and encountered	Complete source, pathway, receiver linkage?	Preliminary risk evaluation
	Pile construction and de-watering	Common COPCs associated with quarry activities includes hydrocarbons and heavy metals. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Anticipated groundwater depth to be > 5 mbgl. Low potential for COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low
Areas with potential for Naturally Occurring Asbestos (NOA)	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	If managed incorrectly, disturbance of NOA in rock and weathered rock and surrounding soils has the potential to result in the following situations that could impact human health: ■ direct contact and inhalation by construction workers, current and future land users, and future maintenance workers ■ risk of dust exposure to construction workers, current and future land users, and future maintenance workers.	Moderate potential for NOA to be present. The likelihood of encountering NOAs is localised to areas where rocks containing asbestos would be disturbed during construction. This is a small portion of the contamination study area (0.883% for high NOA potential, 2.714% for medium NOA potential and 1.152% for low NOA potential).	Linkage complete during construction phase (without appropriate controls being implemented).	Moderate (localised)
Visy Pulp and Paper	Excavation activities, vegetation clearance, stripping and grubbing, stock piling, utility work and vehicle movement.	Common COPCs associated with paper mills includes PFAS, nutrients, solvents and heavy metals from the manufacturing process. If managed incorrectly, disturbance of contaminated soil and surface water has the potential to result in the impacts listed in Section 6.1, that could impact human health and/or the environment.	Low potential for COPCs to be present and encountered due to the distance from the land used for irrigation by Visy and the pulp and paper mill. Surface water migration via creek/drainage line the most likely potential source of COPC traversing the contamination study area.	Linkage complete during construction phase (without appropriate controls being implemented). Limited to the unnamed creek and sediments that traverses the contamination study area.	Low
	Pile construction and de-watering	Common COPCs associated with paper mills includes PFAS. If managed incorrectly, de-watering during the construction phase could potentially encounter contaminated groundwater, which could potentially result in the impacts listed in Section 6.1 for human health and/or the environment.	Anticipated groundwater depth to be > 5 mbgl. Low potential for COPCs to be present and encountered.	Linkage complete during construction phase (without appropriate controls being implemented).	Low

6.2 Potential impacts of contamination on the project

6.2.1 Soil contamination

Construction activities, including excavation activities, vegetation clearing, stripping and grubbing, vehicle movement and utility work, would cause soil disturbance. If these activities are not properly managed, the disturbance of contaminated soil have the potential to cause harm to sensitive receivers, including flora and fauna, and human health for the construction workers.

To appropriately assess the potential for contamination impacts during the construction phase of the project, a qualitative contamination assessment has been performed in accordance with guidelines made or approved under the CLM Act.

A qualitative risk ranking was undertaken, as presented in Table 6-1. The majority of the AECs were evaluated as having low risk rankings; however, several areas were identified as having a moderate risk ranking due to historical and present-day land use and activities. The areas with moderate risk ranking include waste facilities sites, substation sites and areas of disturbed land, uncontrolled fill, stockpiling and dumping. The locations of these areas are shown in Figure 5-10.

Unexpected contamination conditions may be encountered due to previously unknown heterogeneities in the subsurface, soil contamination not previously identified or changes in the project scope. The potential risk associated with unexpected contamination finds have not been assessed as this would be managed in accordance with an unexpected contamination finds protocol during construction (refer to Attachment A).

The risk of encountering contaminated soil would be minimised through the implementation of mitigation measures detailed in Chapter 9.

6.2.2 Groundwater contamination

Based on the potential to encounter contamination in AECs during construction (refer to Table 6-1), there is a low risk of groundwater contamination from ground disturbance. This is due to minimal and localised interaction with groundwater during construction. Proposed excavations would typically be up to five metres in depth with some deeper localised excavations for piling. Where groundwater is shallow, alternative construction methodologies and designs would be implemented (such as boring) to limit interaction with groundwater. Typical transmission line structure piling depth would be generally up to 27 metres below ground level and would depend on ground conditions (eg greater piling depths would be required where soft soil types are present).

In the event that groundwater dewatering is required during construction, additional investigations would be required to confirm the contaminant levels in the groundwater, and assess whether this would have an impact on the environment (including through testing for COPCs). If contaminated, groundwater would not be permitted to be released into the surrounding environment.

6.3 Potential impacts of the project on contamination

Construction activities have the potential to introduce contamination to the environment within the project footprint.

Construction compounds would be used to store construction materials, plant and equipment as well as hazardous and dangerous goods such as liquid petroleum gas, diesel fuel, paints and concrete. Construction compounds have the potential to contaminate surrounding soil and water through spills and leaks of hazardous and dangerous goods.

Construction of the transmission line, modification of the substations, construction of proposed Gugaa 500 kV substation and construction/upgrade of access tracks would involve excavation. The excavated materials would be stockpiled and used for backfilling around the areas from which it was excavated (where practicable and suitable).

If the excavated material is not properly managed, there is the potential to expose human receivers (construction workers) and the environment (such as nearby waterways and flora and fauna) to materials that are potentially contaminated. Additionally, there is potential to spread contaminated soils and materials to differing parts of the project (via construction vehicles and plant) if materials management procedures are not followed appropriately.

It is noted that there is an increased risk in areas in close proximity to sensitive environmental receivers, such as waterways and areas zoned as C1 National Parks and Nature Reserves, C2 Environmental Conservation and C3 Environmental Management.

Potential impacts would be minimised through the implementation of mitigation measures provided in Chapter 9.

6.3.1 Acid sulfate soils and acid rock

Based on information presented in Section 5.2.4, it is unlikely that acid sulfate soils would be encountered during the construction phase. This is because the vast majority of the soils in the project footprint is mapped as low probability of encountering acid sulfate soils, along with the project's elevation and surface geology.

In regions where foundation structures are expected to be founded in rock, there is potential occurrence of pyrite rich veins which can be acidic when exposed to atmospheric oxygen and water. Similar to acid sulfate soils, this exposure can generate sulfuric acid which can result in acidification of soil, sediment, rock, surface water and groundwater. The acidic leachate can also dissolve and mobilise a number of metals from the soil and sediments. Both the acid and mobilised metals can negatively impact the environment, through affecting soil and water quality.

Impacts from exposure to acidic soils and water on human and terrestrial fauna health include skin and eye irritation and health risks from drinking water with a high acidity or high concentrations of metals.

It should be noted that rock, with potential pyrite rich veins, are typically discrete and are of minor risk when associated with intrusions, dykes and veins (within the greater rock mass). Localised rock disturbance such as pile socket excavation into rock or rock ripping for deeper localised excavations is unlikely to generate environmental risk associated acid generation. This is due to the macro nature of the pyrite within the dykes and veins and minor volumes expected to be excavated within acid generating rock materials.

6.3.2 Salinity

Salinity in the landscape occurs when dissolved salts naturally present in soil or groundwater are concentrated at the surface or in shallow soils. This generally occurs through rising groundwater levels associated with the broadacre removal of deep-rooted vegetation, or other activities which could raise the groundwater table above normal seasonal levels.

Salinity has the potential to make soils unsuitable for reuse, prevent vegetation growth and affect landscaping. Saline soil and water also have the potential to damage concrete and metal structures, including transmission line structure foundations. In saturated conditions, salt may interact with the concrete physically and/or chemically to expand the concrete, causing cracking and removal of the effective concrete cover. This may lead to exposure of the steel reinforcement, potentially resulting in corrosion.

Based on the information reviewed, areas of soil salinity hazard ranging from very low to very high are present across the contamination study area as shown in Figure 5-4. Moderate to very high-risk areas are located along the banks of O'Briens Creek and Brungle Creek, to the south of the Crookwell town centre and around the town centre of Yass. These areas are within the project footprint. If not managed properly during earthworks, these soils could have the potential to impact on surface water and/or groundwater, soil erosion, and soil structure. Impacts can include localised degradation in soil structure, salt scolding at the surface, distressed vegetation and increased salt mobilisation through runoff or groundwater. The main impact from construction is the excavation of saline subsoils for access tracks, easements, and infrastructure.

The project impacts during construction are assessed to be localised (associated with creeks, floodplains and drainage lines) and limited in nature. This is due to shallow ground and extent of soil excavations, as well as the lack of significant changes to hydrological regimes from excavation within the project footprint.

Although considered localised and a low risk as outlined above, construction activities could generate secondary salinisation. Secondary salinisation involves changes in landscape salt movement over time through processes such as the removal of vegetation, altering hydrology, general land use changes, increased hardstand and disturbance of groundwater. Construction activities have the potential to result in very localised secondary salinisation near creeks, floodplains and drainage lines. Similarly, depending on salt distribution, some areas of soil may become more saline and potentially sodic, which in turn could lead to an increase in soil pH, erosion and loss of groundcover.

Any localised, shallow soil impacts from the project would reach an equilibrium over time and are considered to be a low risk, with negligible potential salinity impacts to surface waters and sensitive receivers. The project impacts are therefore assessed to be localised and limited in nature due to the level of ground disturbance proposed.

6.3.3 Soil erosion and sediment transport

During construction, there is potential for soil erosion to occur, particularly associated with the disturbance of soils on existing slopes. It is expected that a total of 382,434 m^3 of cut and 302,575 m^3 of fill would be required across the substation sites. The earthworks associated with the proposed Gugaa 500 kV substation would generate a larger footprint and associated potential impacts on soil and erosion compared to the modifications of the other substations. Slopes are present across the contamination study area, with topography ranging from approximately 220 mAHD to 1,232 mAHD across the project footprint. In addition, parts of the project footprint are underlain by sodic and/or sand-based soils including sodosols, kurosols and rudosols, which are susceptible to erosion.

Soil erosion and the associated sediment transportation is a hazard that could occur as a result of the construction of the project. Off-site transportation of sediments and soils could transport entrained or adsorbed contaminants (if present) and may potentially cause the contamination of sensitive receivers (surface water bodies), including local drainage lines and creeks, the Tumut River, the Goodradigbee River, the Yass River, the Lachlan River, the Wollondilly River and the Tarlo River.

Erosion and sediment transport could result from the following construction activities:

- excavation – earthworks required to excavate materials for the construction phase that could result in the erosion of disturbed soils that have not stabilised
- vegetation removal – vegetation removal would expose soils to weathering processes, increasing the risk of erosion and sediment transportation
- stockpiling – excavated material would require stockpiling before being reused on the project or disposal. if stockpiles are not adequately stabilised, material could erode during high rainfall or windy events
- vehicle, plant and equipment movements – the use of heavy machinery could disturb the soil surface, increasing the potential for erosion
- landscaping – minor earthworks are required during revegetation and rehabilitation activities that could result in the erosion of disturbed soils that have not stabilised. These impacts would be temporary as stabilisation and revegetation would act to resist future soil erosion.

Spoil generated from the construction activities will have its suitability assessed for reuse within the project footprint or be managed in accordance with Section 6.3.5.

6.3.4 Naturally occurring asbestos

Undisturbed NOA is generally well-bound and does not present a risk to human health. However, the disturbance of NOA could potentially result in the exposure of human receivers such as workers or landowners through the inhalation of airborne asbestos fibres, when disturbed. Given that the majority of the contamination study area contains low to no probability of NOA, the overall risk of exposure to NOA is low. Regions of medium and high potential for NOA within the contamination study area have been identified, as detailed in Section 5.2.5. The medium potential regions are present to the south of Red Hill and between Sharps Creek and Wondalga while the high potential regions of NOA are present around Red Hill and Gadara. In these areas, excavation work could result in the mobilisation of asbestos fibres if NOA is disturbed, improperly stockpiled or mismanaged.

6.3.5 Waste management

Waste materials, including potentially contaminated waste, would be produced during construction through excavation of unsuitable material for the project. Any soil removed during construction would require assessment to determine its suitability for re-use within the project or management and/or disposal as a waste to licenced facilities in accordance with the NSW Waste Classification Guidelines 2014 Parts 1-4, Addendum 2016 and any applicable Resource Recovery Orders and Exemptions under the POEO Act. Review of Schedule 1 of the POEO Act indicates that an environment protection license (EPL) would not be required for premises or activity based processes.

A small portion of Line 51 would be demolished and rebuilt as part of the project construction. All demolition wastes associated with the work would be assessed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).

Additionally, contaminated soils could migrate outside of the work sites, resulting in increased exposure risks and potential for additional waste disposal requirements.

This is generally expected to pose a low risk to the surrounding environment, however spoil wastes produced in the AECs shown in Table 6-1 present a moderate risk to the surrounding environment. Measures to manage waste are included in Chapter 9.

7 Operational impacts

7.1 Potential impacts of contamination on the project

During operation, there would be minimal soil disturbance associated with general maintenance activities. As such, the operation of the project is unlikely to result in exposure of human and environmental receivers to existing potentially contaminated soil or groundwater.

Residual contamination, if identified during construction and is not sufficiently remediated or managed, could have an impact during operation of the project. The impact is likely to be localised.

7.2 Potential impacts of the project on contamination

7.2.1 Soil contamination

Without the appropriate management measures, the storage and use of chemicals during operation and maintenance of the project has the potential to cause soil and groundwater contamination. Potential operational impacts may result from:

- chemical leaks and spills, including of hydrocarbons (eg diesel, oils), into the soil, surface water and groundwater arising from incidents such as vehicle accidents
- runoff (which may contain low to medium levels of hydrocarbons, metals and suspended sediments resulting from the operation of vehicles and machinery) into the soil, surface water and groundwater.

Any spills or leaks would typically be temporary in nature but could lead to localised contamination. The magnitude of impact would be governed by the local sensitive receivers and distance to the source of impact. For example, there is an increased risk in areas in proximity to sensitive receivers, such as waterways and areas zoned as C1 National Parks and Nature Reserves, C2 Environmental Conservation and C3 Environmental Management.

Spill containment facilities (such as bunded containers, designated fill points, and spill kits) would be present at substations or carried by maintenance workers when accessing transmission lines. Furthermore, incident response procedures would be developed and implemented to manage the risk from these occurrences. These incident response procedures would be developed for the proposed Gugaa 500 kV substation and are already in place for existing substations. Procedures for existing substations would be updated as appropriate.

7.2.2 Groundwater contamination

Potential operational impacts to groundwater include contamination of groundwater arising from incidents involving vehicle accidents, leaks and spills of hydrocarbons onto soil and surface water seeping into the ground. Spill volumes from such incidents are expected to be minor; however, the potential for hydrocarbon fuel to migrate off-site cannot be discounted. Spill containment facilities (such as bunded containers, designated fill points, and spill kits) would be used on maintenance work sites and at substations. Furthermore, the operator would implement and develop incident response procedures to manage the risk from these occurrences as part of their overarching environmental management system. These incident response procedures would be developed for the proposed Gugaa 500 kV substation and are already in place for existing substations. Procedures for existing substations would be updated as appropriate.

7.2.3 Salinity

During operation, changes to the soil profile, increased hardstand areas and ongoing vegetation removal within the transmission line easement and substation construction/modification could impact long term salinity compared to pre-development conditions. However, the impact would reach an equilibrium over time based on final landform and therefore any impacts associated with salinity would be minor.

7.2.4 Soil erosion and sediment transport

During operation, there would be minimal exposed topsoil within close proximity to waterways and, therefore, little or no risk of soil erosion and subsequent transport of sediment into nearby receiving waterways.

Soil erosion and associated sediment transportation may occur as a result of vehicle use on unsealed access tracks for general maintenance of the transmission lines and any minor excavation for replacement of substation equipment and transmission structures as necessary.

8 Cumulative impacts

Assessing cumulative impacts involves the consideration of the proposed impact in the context of soil and contamination. The assessment of cumulative impacts also considers projects that are currently under development, or at the planning state that may also influence the assessment of this project's potential impacts. Cumulative impacts can potentially arise from the interaction of the construction and operation activities of the project and other future projects nearby.

The cumulative impact assessment was prepared in accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPE, 2022). Projects with the potential for cumulative impacts with the project were identified through a review of publicly available information and environmental impact assessments from the following databases in March 2023:

- DPE's Major Projects register
- NSW Government's Southern Regional Planning Panel project register
- NSW Independent Planning Commission project register
- EPBC Act Public Portal
- Transport for NSW Projects Map.

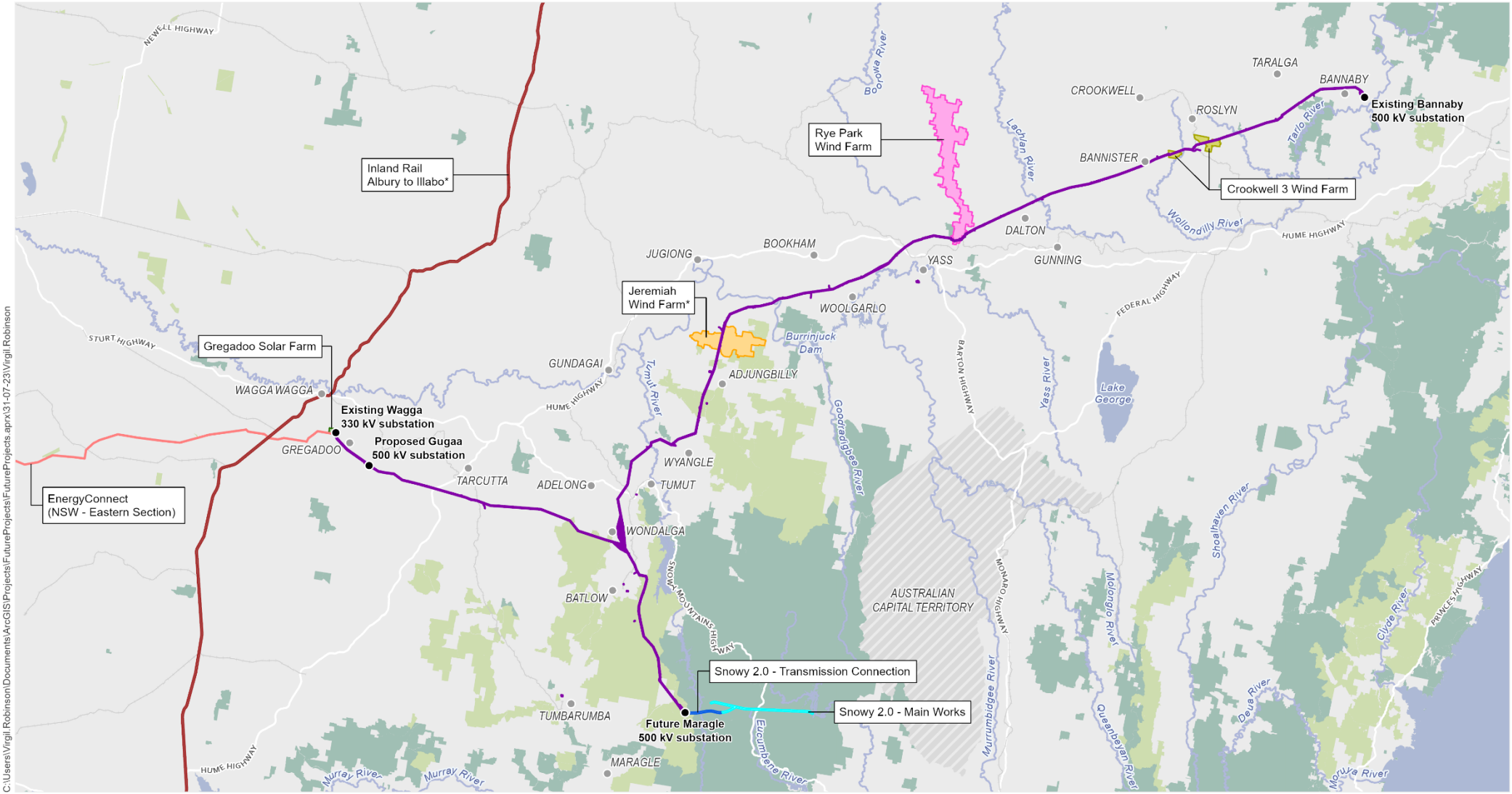
Searches were limited to the LGAs of Wagga Wagga City, Snowy Valleys, Yass Valley, Cootamundra-Gundagai Regional Upper Lachlan Shire, Goulburn-Mulwaree, and Hilltops.

Based on the above searches, the following projects are to be considered in the cumulative impact assessment for each of the key matters:

- EnergyConnect (NSW – Eastern Section)
- Gregadoo Solar Farm
- Jeremiah Wind Farm
- Rye Park Wind Farm
- Victoria to NSW Interconnector West (VNI West)
- Snowy 2.0 – Transmission Connection
- Snowy 2.0 – Main Works
- Inland Rail – Albury to Illabo
- Crookwell 3 Wind Farm.

Further details of each project are provided in Table 8-1.

Figure 8-1 shows the location of relevant future projects with respect to HumeLink's project footprint. Based on the information reviewed and summarised in Table 8-1, there do not appear to be any major cumulative impacts as the potential impacts of each project are expected to be managed with the implementation of appropriate controls as well as environmental management and monitoring measures.



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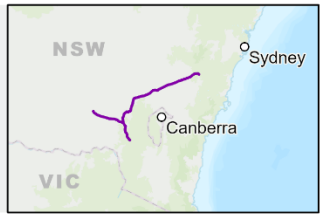
Project footprint
National park and reserve
State forest
Waterbody
Waterway
Major road
Railway
Substation

Relevant future projects

Crookwell 3 Wind Farm
EnergyConnect (NSW - Eastern Section)
Gregadoo Solar Farm
Inland Rail Albury to Illabo*
Jeremiah Wind Farm*
Rye Park Wind Farm
Snowy 2.0 - Main Works
Snowy 2.0 - Transmission Connection

*Note: Subject to approval



Source: *Aurecon, Transgrid, Spatial Services (DCS), ESRI Basemap*

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0 20 40km

Projection: GDA 1994 MGA Zone 55

HumeLink **Soil and Contamination**

FIGURE 8-1: Relevant future projects

Table 8-1 Proposed major projects in proximity to the project

Project	Details	Distance/ Interface	Cumulative impacts
EnergyConnect (NSW – Eastern Section) (Transgrid, 2021a)	■ The project includes a new transmission line connecting the existing Buronga 220 kV substation and existing Wagga 330 kV substation, and construction of the new Dinawan 330kV substation (170 km west of Wagga Wagga). ■ The project also involves associated infrastructure (optical repeater structures), new and/or upgrade of access tracks as required and ancillary work to support construction. ■ Project timing expected from early 2023 to late 2024.	■ HumeLink and EnergyConnect (NSW – Eastern Section) both require upgrades of the existing Wagga 330 kV substation.	■ The EIS, prepared by WSP in 2021 on behalf of Transgrid, noted that in general, the risk of contamination across the study area was low, with the exception of areas of cleared agricultural land and a potential quarry which were assigned a moderate risk. Dryland salinity and acid sulfate soils were also identified as posing a potential issue to the project. ■ During the operation phase of the project, the main impacts would be potential hydrocarbon contamination of soil, surface water and groundwater due to spills. ■ The EIS concluded that risks associated with the project were considered low subject to the implementation of mitigation measures. ■ Based on this, the cumulative risk from this project is considered to be low.
Gregadoo Solar Farm (NGH Environmental, 2018)	■ The project is for the construction and operation of a proposed 47 Megawatt (MW) photovoltaic (PV) solar farm at Gregadoo, Wagga Wagga. ■ Construction expected to commence mid-2023 and take 9 months to construct.	■ On land adjacent the existing Wagga 330 kV substation.	■ The soil survey report undertaken for the EIS, prepared by NGH Environmental for Gregadoo Solar Farm Pty Ltd in 2018, indicated that the risk for contamination associated with agricultural activities was very low. ■ The main risks associated with construction and operation were erosion and sedimentation, spills and runoffs. ■ The EIS concluded that the overall risk of these would be low. ■ Based on this, the cumulative risk from this project is considered to be low.
Jeremiah Wind Farm (CWP Renewable, 2021)	■ The project is located approximately 29 km east of Gundagai around the Adjungbilly area. ■ The project proposes a 65 turbine wind farm with a maximum tip height of 300 m, battery energy storage system and associated ancillary infrastructure. ■ Project approval expected in and construction is expected to take 24 to 30 months.	■ HumeLink project footprint would intercept the Jeremiah Wind Farm development area.	■ An EIS is currently under preparation for the project. ■ The issued SEARs indicate that the project could be impacted by NOA and soil erosion. ■ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ■ Based on this, the cumulative risk from this project is considered to be low.

Project	Details	Distance/ Interface	Cumulative impacts
Rye Park Wind Farm (Rye Park Wind Farm, 2014)	▪ The project is located to the west of Rye Park, to the north-west of Yass and south-east of Boorowa. ▪ The project includes a maximum of 80 wind turbines with a maximum tip height of 200 m. The project also includes construction of associated infrastructure (substations, operation and maintenance facilities) and upgrades to local roads. ▪ Under construction since December 2021 with commissioning scheduled for June 2023.	▪ HumeLink project footprint would intercept the southern end of the wind farm project boundary at Bango (near Bango Nature Reserve).	▪ The project was not predicted to have any significant adverse environmental impacts on the site or its surrounds, geology or soils as the overall surface disturbance is relatively small in size and manner'. ▪ The main risks associated with the project included water pollution and contamination from spills and sedimentation from stockpiles. Soil contamination may also be present from past land use. ▪ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ▪ Based on this, the cumulative risk from this project is considered to be low.
Victoria to NSW Interconnector West (VNI West) (Transgrid, 2023)	▪ The project would involve targeted interconnector expansion between Victoria and NSW to address transmission network limitations and improve supply reliability. ▪ Construction proposed to commence in 2026 with commissioning by 2028.	▪ VNI West may require connection at existing Wagga 330 kV substation (depending on preferred option).	▪ No information is provided on potential impacts at the time of reporting. ▪ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ▪ Based on this, the cumulative risk from this project is considered to be low.
Snowy 2.0 - Transmission Connection (Transgrid, 2021b)	▪ New transmission connection between the Snowy 2.0 - Main Works project to the existing high voltage transmission network. This includes construction of a new substation in Bago State Forest (future Maragle substation), new access tracks and upgrade of existing access tracks and ancillary work to support construction. ▪ Project construction expected to commence late 2023 with expected completion by the end of 2025.	▪ HumeLink to connect to the future Maragle 500 kV substation being constructed as part of the Snowy 2.0 - Transmission Connection project.	▪ The EIS, prepared by Jacobs Group (Australia) Pty Ltd for Transgrid in 2021 indicated that key impacts included erosion and sedimentation from earthworks, spills and other contaminant discharges, and contamination risks associated with NOA and historical land uses. ▪ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ▪ Based on this, the cumulative risk from this project is considered to be low.
Snowy 2.0 - Main Works (Snowy Hydro Limited, 2019)	▪ The project includes an underground pumped hydro power station and ancillary infrastructure. ▪ Main works at Talbingo Reservoir site include excavated rock placement, portal construction and tunnelling, access roads and ancillary facilities for emplacement activities and tunnelling support. ▪ Construction began in October 2020 with expected completion by 2026.	▪ Talbingo Reservoir site is approximately 5 km east of the HumeLink project footprint.	▪ The EIS, prepared by EMM Consulting Pty Limited for Snowy Hydro Limited in 2019 indicated that there would be potential for localised areas of soil, mine waste, surface water and groundwater contamination. NOA and potentially acid forming rocks are likely to be encountered and require management. Local waterways may also be impacted from runoff and erosion. ▪ The report also indicated that the adoption of the mitigation and management measures outlined in the report would minimise these risks. ▪ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ▪ Based on this and the distance, the cumulative risk from this project is considered to be low.

Project	Details	Distance/ Interface	Cumulative impacts
Inland Rail – Albury to Illabo	▪ Upgrade 185 km of rail track from Albury to Illabo. ▪ The upgrade of rail track passes through Wagga Wagga. ▪ Key issues could include worker availability and accommodation capacity around Wagga Wagga during peak construction periods with a large influx of workers using short-term accommodation during the scheduled rail possessions in March and September 2024. Without mitigation, this demand would have an impact on the local economy when short-term accommodation demand is high. A worker accommodation strategy would be prepared to manage demand on local accommodation and detailed construction planning would look to scheduling opportunities to minimise the peak demand on the short-term accommodation market. ▪ Construction is proposed to commence in early 2024 and is expected to take about 16 months.	▪ Roughly 9 km north-west of existing Wagga 330 kV substation.	▪ The EIS, prepared by WSP Pty Ltd for the Australian Rail Track Corporation (ARTC) in August 2022 indicated that there would be potential for localised areas of soil excavations, ground disturbance and excavations for construction. ▪ The project would generally be limited to the existing rail corridor where land contamination risks would be localised and soils and excavations would increase erosion potential. ▪ The report indicated that the adoption of the mitigation and management measures outlined in the report would minimise these risks. ▪ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ▪ Based on this and the distance, the cumulative risk from this project is considered to be low.
Crookwell 3 Wind Farm	▪ 16 wind turbines up to 157 m in height, connected to the grid via the 330 kV transmission line. ▪ Key issues include biodiversity impacts, visual amenity and operational noise. Given timing, there could be potential for “construction fatigue” type impacts related to construction noise and construction traffic management. ▪ Detailed design and pre-construction activities are being carried out with main construction work expected to take about 18 months once commenced.	▪ Project site is under the project footprint.	▪ The EIS, prepared by Tract Consultants Pty Ltd for Crookwell Development Pty Ltd in July 2012 indicated that there would be potential for localised areas of soil excavations, ground disturbance and excavations for construction. An addendum EIS was prepared by Mecone Pty Ltd for Crookwell Development Pty Ltd in September 2016, however the Addendum EIS did not detail further assessment of soils or contamination. ▪ The technical report and EIS chapter (2012) was geotechnically focussed and provided high level summary information on potential impacts and mitigation measures. ▪ The report indicated that the adoption of the mitigation and management measures outlined in the report would minimise risks to soil and land. ▪ It is expected that appropriate control and monitoring measures would be implemented for the project, minimising soil and contamination concerns. ▪ Based on this, the cumulative risk from this project is considered to be low.

9 Management of impacts

9.1 Overview of approach

9.1.1 Construction phase

The construction phase of the project has the potential to impact upon the surrounding environment, and as such, a Construction Environmental Management Plan (CEMP) would be prepared prior to construction commencing. The CEMP would identify all reasonably foreseeable risks associated with earthworks/ground disturbance during the construction phase of the project. This would include mitigating the risk of generating soil and water contamination, as well as mitigating any human and ecological health risks.

Given there is identified areas of NOA, a site-specific asbestos management plan (AMP) (as a sub plan to the CEMP) is required under Part 8.4 of the *NSW Work Health and Safety Regulation 2017* where there is potential for NOA or other asbestos materials to be encountered (i.e. demolition of older farming buildings and structures). The AMP would include specific protocols for separation, handling, monitoring, validation and clearance of asbestos. Any asbestos removal or management works must be conducted by appropriately licenced personnel, in accordance with relevant Safe Work codes of practice and with appropriate notification to SafeWork NSW.A project specific Erosion and Sediment Control Plan (ESCP) and Soil and Water Management Plan (SWMP) would be prepared as part of the CEMP prior to construction commencing. The ESCP would provide mitigation measures to minimise the risk of erosion and prevent sediment migration, including management during wet weather events. The SWMP would provide mitigation measures to minimise impacts to soils and surface water due to sediment migration, saline soils and incidental spills. The CEMP and all sub-plans would be implemented during the construction phase of the project.

Waste management guidance during construction would be incorporated within the CEMP. Spoils generated may be reused onsite following an assessment of the suitability of the material. Excess soils or materials unsuitable for reuse will be removed off-site for disposal following a classification as per the *Waste Classification Guidelines* (NSW EPA, 2014). This would include testing the materials for any possible contaminants. Materials to be tested would include excess spoil to be removed off site, construction demolition and related waste, asbestos waste, as well as anything that is considered to be ‘special waste’ by the NSW EPA, in which case it would be removed under the appropriate NSW guidelines and the POEO Act. All waste related documentation such as waste classifications, transfer and disposal documentary evidence would be held for a minimum of seven years from the date the waste is generated.

9.1.2 Operational phase

During operation of the project, environmental management would be undertaken in accordance with Transgrid’s existing environmental policies and internal environmental management system EMS. This includes management of waste, soil erosion, spills and leaks and other associated operational aspects. All wastes generated from routine maintenance, inspections, site staff and operations would be contained, handled, and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014).

9.2 Summary of mitigation measures

Table 9-1 provides a summary of the mitigation measures that would be implemented for the project.

Table 9-1 Summary of mitigation measures

Impact	Mitigation measures	Timing	Relevant location
Salinity	Prior to ground disturbance within areas mapped as moderate to high risk saline soils, an inspection will be undertaken for the presence of saline soils. Areas of known or suspected salinity will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW DECC, 2008) and the *Salinity Training Manual* (DPI, 2014) to manage salinity impacts. Erosion controls will be implemented in accordance with The *Blue Book* (Landcom 2004b). Prior to construction materials will be selected to withstand acidic or high saline soil and groundwater environment (where applicable). During construction, existing areas of waterlogging and poor drainage will be avoided, where possible, regarding access tracks and permanent structures.	Detailed design and construction	All locations
Soil contamination	Disturbance to areas of environmental concern identified as having a moderate risk or greater will be avoided or minimised where practicable during construction. Where disturbance cannot be avoided, potential impacts will be minimised during finalisation of the design and construction methodology where practicable. Areas of environmental concern identified as having a moderate risk that will be disturbed will be further assessed prior to construction. The investigations will be undertaken in accordance with the assessment of site contamination NEPM 2013. Any remediation required for the project will be undertaken based on a site specific Remedial Action Plan. The Remedial Action Plan will define remedial goals and objectives, performance criteria for remedial effort and remediation methodology. A validation report will be prepared after remedial effort and be in accordance with the NSW EPA *Guidelines for Consultants Reporting on Contaminated Land* (NSW EPA, 2020b).	Detailed design and construction	All locations
Acid sulfate soils and rocks	Prior to ground disturbance in areas of potential acid sulfate soil or rock occurrence, testing will be carried out to determine the presence of actual and/or potential acid sulfate soils or rocks. If acid sulfate soils or rocks are encountered, they will be managed in accordance with the *Acid Sulfate Soil Manual* (ASSMAC, 1998) and Transgrid's Health, Safety and Environment Guideline.	Detailed design and construction	All locations
Soil contamination - chemical spills and runoffs	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. Environmental spill kits containing spill response materials suitable for the work being undertaken will be available with extras available to be carried in vehicles. A spill response procedure will be developed and implemented. All staff will be trained in emergency spill procedures.	Construction and operation	All locations

Impact	Mitigation measures	Timing	Relevant location
Naturally occurring asbestos	An asbestos management plan will be prepared in accordance with the NSW Government Code of Practice *How to manage and control asbestos in the workplace* (SafeWork, 2020). The asbestos management plan will include the following: ■ management or isolation of areas mapped as medium to high risk of NOA, where direct disturbance of NOA is confirmed to be required for project construction works ■ placement of suitable signage around the work areas ■ list of appropriate personal protective equipment, including Respiratory Protective Equipment ■ implementation of dust suppression controls including wetting surfaces, covering disturbed surfaces and the use of sealed air-conditioned vehicles to minimise potential asbestos impacts to workers ■ decontamination of the workers' coveralls, personal protective equipment, equipment and work site ■ procedures for the disposal of NOA material or waste, if required ■ setting up air monitoring using pumps and sample filter grid cowls for asbestos fibres and dusts if it is suspected that exposure to NOA dust during work might exceed safe levels of airborne asbestos. The air monitoring pumps, and reporting must be undertaken by a licensed asbestos assessor.	Detailed design and construction	All locations
Soil contamination	The contractor will undertake compliance monitoring and recording of waste volumes, waste types, stockpiles register where excavations and stripping of surface soil contamination occurs for the project. The contractor will keep all records during construction for waste disposal and for the importation of materials such as engineering fill and excavated natural materials (ENM) or virgin excavated natural materials (VENM) soils. Engineering fill materials for use on site will be validated to ensure they meet the classification of VENM or ENM prior to being transported to site.	Construction	All locations
Unexpected contamination	The discovery of any unexpected contamination during construction will be managed in accordance with an Unexpected Contaminants Finds Protocol which will be prepared prior to construction.	Construction	All locations

10 Conclusion

This report assesses the impacts of potential contamination and soil disturbance during construction and operation of the project. The assessment has included a desktop review of available information and public databases, field survey, consolidation and interpretation of the data to identify potential areas of environmental concern (AECs) within the contamination study area and recommendations for mitigation measures relating to soil and contamination.

Based on the information reviewed and assessed, the contamination study area is not affected by broad-scale contamination, and the risk of soil and groundwater contamination is generally low. Most of the contamination study area comprises farmlands, forestry or native vegetation with minimal areas of potential soil contamination identified. Potential groundwater contamination is also considered low, given the absence of groundwater contamination sources and minimal interaction of the project with groundwater.

Potential contamination sources and AECs include existing substations, farm lands and built up areas, existing transmission infrastructure, residential properties, cleared agricultural land, farm dams, waste management centres, areas of localised disturbed land, uncontrolled fill, stockpiling and dumping and quarries. The majority of AECs have been assessed to pose a low risk during construction and operation, with land uses including existing substations, waste centres/depots and areas of uncontrolled fill assigned a moderate risk rating.

Regarding dryland salinity, very low to very high-risk areas of saline soils are present across the contamination study area. Moderate to very high-risk areas are located along the banks of O'Briens Creek and Brungle Creek, to the south of the Crookwell town centre and around the town centre of Yass. Dryland salinity impacts are considered to be very localised and limited in nature due to the level of ground disturbance and lack of changes to long term hydrological regimes and existing landscapes. The disturbance of these soils in localised areas is not expected to result in a high environmental risk to the project.

The probability of encountering acid sulfate soils (ASS) within the contamination study area is low. The probability of encountering acid sulfate rock within localised veins and dykes of certain geological formations is low throughout the contamination study area, with limited potential for disturbance from deeper excavations and piling.

The overall risk of exposure to naturally occurring asbestos (NOA) is considered low, with the majority of the contamination study area containing low to no probability of NOA. However, there are several areas of medium and high NOA probability. Medium potential regions of NOA are present to the south of Red Hill and between Sharps Creek and Wondalga and high potential regions of NOA are present around Red Hill and Gadara. During construction, an asbestos management plan (AMP) would be prepared as part of the CEMP to manage the risks of NOA disturbance from project construction.

The project impact on soil and contamination would be avoided or minimised through the implementation of mitigation measures provided in this report. Additional contaminated land investigations following detailed design would be undertaken to target proposed ground disturbance within AECs with moderate or high risk identified in this report.

Any further contamination specific detailed site investigations (DSI) would target areas identified within this investigation as moderate risk AECs and be dependent on the likelihood of ground disturbance occurring at that AEC. The DSI must be tailored to the proposed area of ground disturbance and be undertaken in accordance with the assessment of site contamination NEPM 2013 and guidelines endorsed by the NSW EPA. It is not considered necessary to undertake DSI work within identified low risk AECs nor broad scale sampling programs within low risk land uses of the contamination study area such as forestry, national parks and agricultural lands with no or minimal structures or uncontrolled filling.

Should unexpected contamination be identified during construction, appropriate management and remediation options would need to be identified through a project specific UCFP, within the CEMP (refer to Attachment A for an example UCFP). The mitigation measures relevant to construction detailed in this report would be included in the project CEMP. With the implementation of these measures, the project's impact on soil and contamination is expected to be low.

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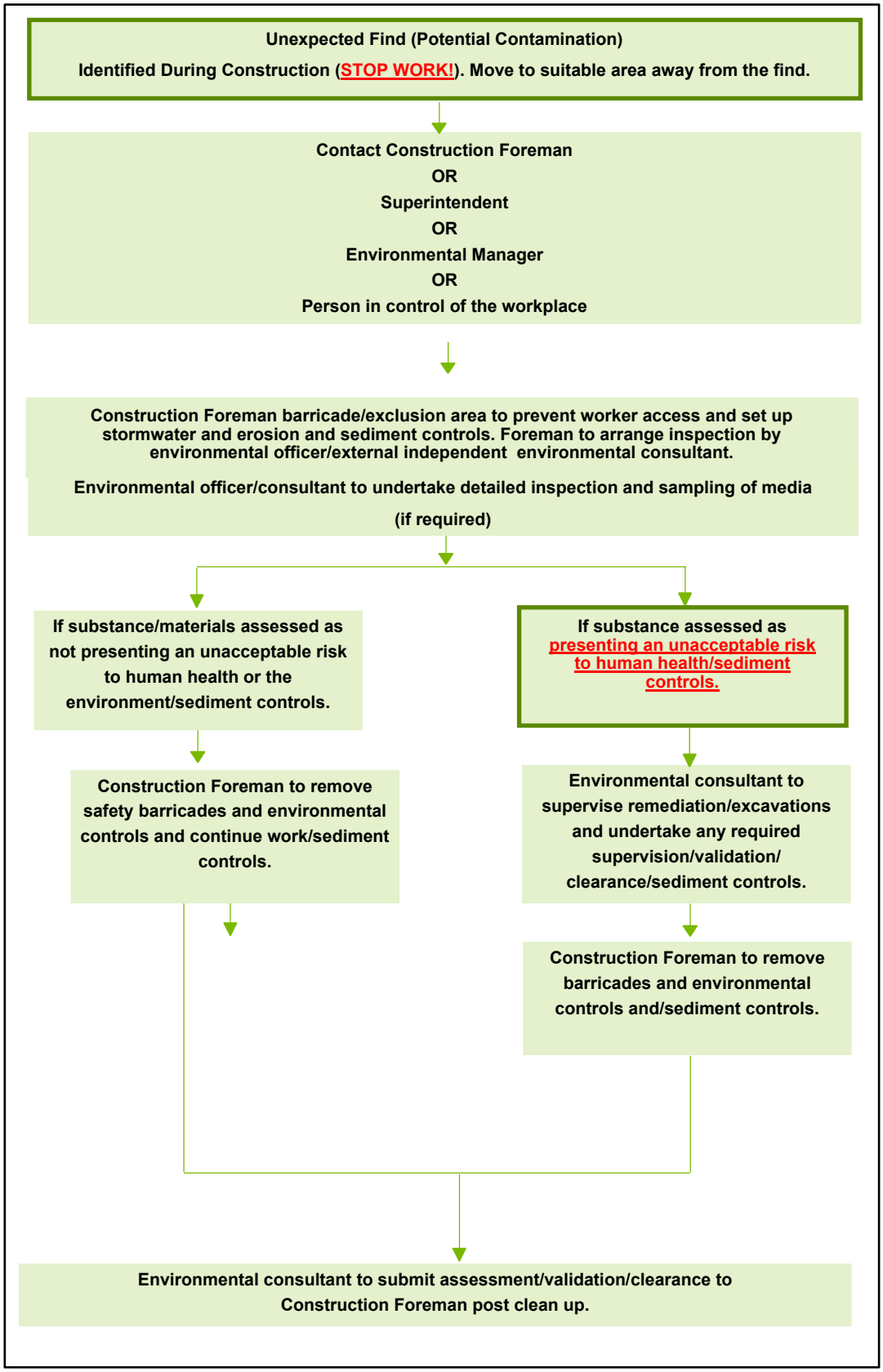
Attachment A
Unexpected Contamination Finds Protocol (UCFP) flow chart


Unexpected Find (Potential Contamination)
Identified During Construction (STOP WORK!). Move to suitable area away from the find.
Contact Construction Foreman
OR
Superintendent
OR
Environmental Manager
OR
Person in control of the workplace
Construction Foreman barricade/exclusion area to prevent worker access and set up stormwater and erosion and sediment controls. Foreman to arrange inspection by environmental officer/external independent environmental consultant.
Environmental officer/consultant to undertake detailed inspection and sampling of media (if required)
If substance/materials assessed as not presenting an unacceptable risk to human health or the environment/sediment controls.
If substance assessed as presenting an unacceptable risk to human health/sediment controls.
Construction Foreman to remove safety barricades and environmental controls and continue work/sediment controls.
Environmental consultant to supervise remediation/excavations and undertake any required supervision/validation/ clearance/sediment controls.
Construction Foreman to remove barricades and environmental controls and/sediment controls.
Environmental consultant to submit assessment/validation/clearance to Construction Foreman post clean up.

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