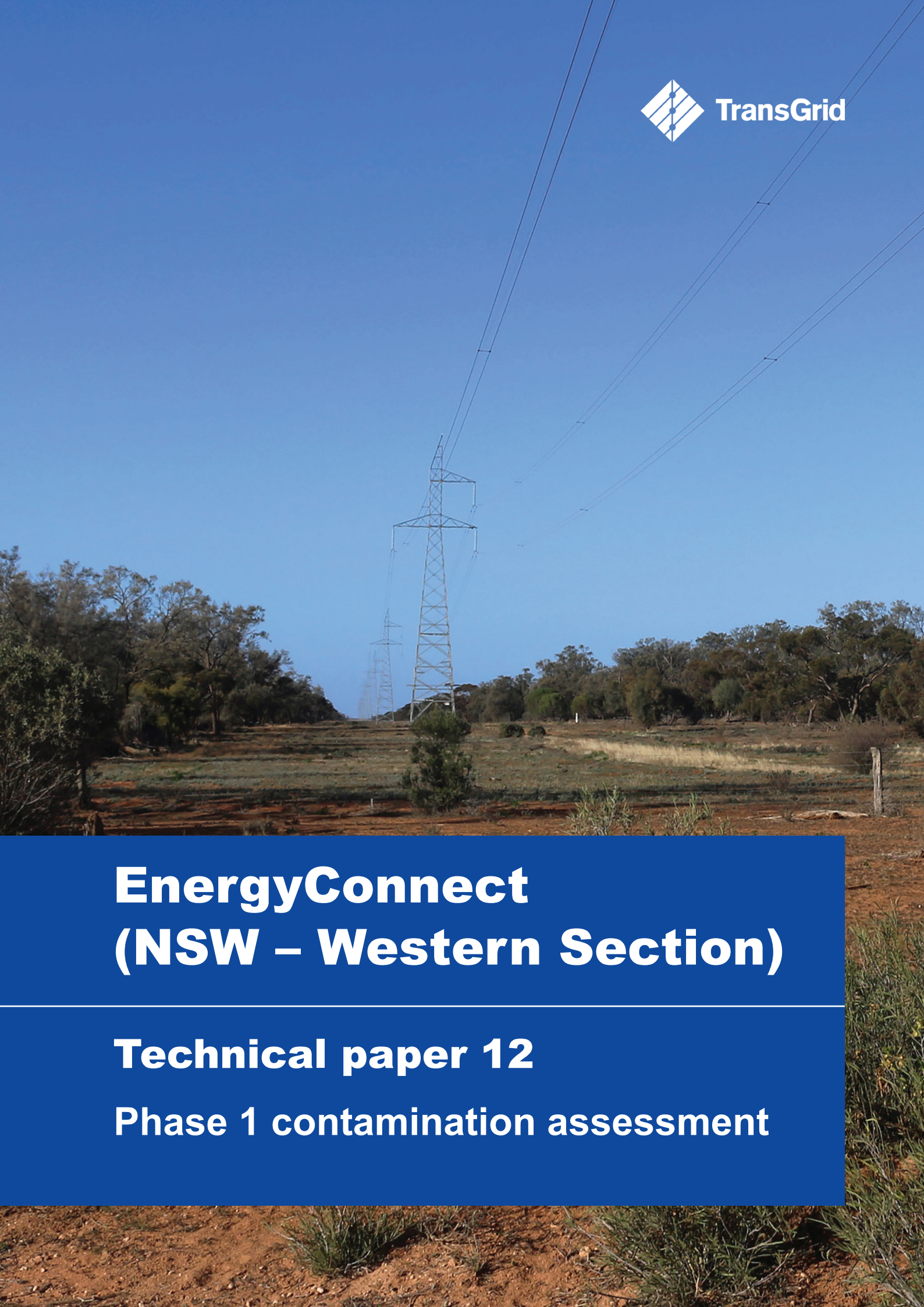

TransGrid

EnergyConnect (NSW – Western Section)

Technical paper 12

Phase 1 contamination assessment

Question today
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EnergyConnect (NSW – Western Section)
Technical paper 12 – Phase 1 contamination assessment

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REV	DATE	DETAILS
Final	21/10/2020	Final

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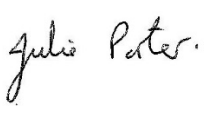
Reviewed by:	Julie Porter	21/10/2020	
Approved by:	Emma Taylor	21/10/2020	

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GLOSSARY

Aeolian	Sediments deposited by the action of wind, such as dunes.
Alluvial	Sediments deposited by flowing water.
Alluvium	A general term for unconsolidated deposits of inorganic materials (clay, silt, sand, gravel, boulders) deposited by flowing water.
Aquifer	Rock or sediment in a formation, group of formations or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.
Bore	Artificially constructed or improved groundwater cavity used for the purpose of accessing or recharging water from an aquifer. Interchangeable with borehole, piezometer.
Borehole	Includes a well, excavation, or other artificially constructed or improved groundwater cavity which can be used for the purpose of intercepting, collecting or storing water from an aquifer; observing or collecting data and information on water in an aquifer; or recharging an aquifer. Interchangeable with bore, well, piezometer.
Clay	Deposit of particles with a diameter of less than 0.002 mm, typically contains variable amounts of water within the mineral structure and exhibits high plasticity.
Conceptual model	A simplified and idealised representation of the physical contamination setting and the understanding of the contamination pathways of the system.
Confined aquifer	An aquifer bounded above and below by impervious (confining) layers. In a *confined aquifer*, the water is under sufficient pressure so that when wells are drilled into the aquifer, measured water levels rise above the top of the aquifer.
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second. Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (e.g. metres per second).
Draw-down	The change in groundwater level in a bore, or the change in water table elevation in an unconfined groundwater system, due to the extraction of groundwater.
Detailed design	The stage of design where proposal elements are designed in detail, suitable for construction.
Earthworks	All operations involved in loosening, excavating, placing, shaping and compacting soil or rock.
Fluvial	Synonymous with alluvial. Refer to alluvial for definition.
Formation	A general term used to describe a sequence of soil or rock layers.
Groundwater	Water found in the subsurface in the saturated zone below the water table or piezometric surface, i.e. the water table marks the upper surface of groundwater systems.
Groundwater flow	The movement of water through openings and pore spaces in rocks below the water table, i.e. in the saturated zone.

Groundwater resource	Groundwater available for beneficial use, including human usage, aquatic ecosystems and the greater environment.
Hydrogeology	The study of the interrelationships of geological materials and processes with water, especially groundwater.
Impact	An event that disrupts ecosystem, community, or population structure and alters the physical environment, directly or indirectly.
Monitoring bore	A bore used to monitor groundwater levels or quality.
Permeability	The ease with which a fluid can pass through a porous medium and is defined as the volume of fluid discharged from a unit area of an aquifer under unit hydraulic gradient in unit time (metres per day).
Proposal study area	The study area for this EIS, which comprises a one km wide corridor between the SA/NSW border near Chowilla and Buronga and a 200 m wide corridor between Buronga and the NSW/Victoria border at Monak, near Red Cliffs. The proposal would be located within the proposal study area, however the full area would not be subject to direct impacts.
Recharge	*Recharge* is defined as the process by which water is added from outside to the zone of saturation of an aquifer, either directly into a formation, or indirectly by way of another formation.
Run-off	All surface and subsurface flow from a catchment, but in practice refers to the flow in a river, i.e. excludes groundwater not discharged into a river.
Semi-confined aquifer	An aquifer that is partly confined by layers of lower permeability material through which recharge and discharge may occur also referred to as a leaky aquifer.
Sensitive receivers	Land uses landscape features and activities that are sensitive to changes in the environment such as water quality and quantity, noise, vibration, air and visual impacts. Sensitive receivers may include aquatic ecosystems, aquaculture areas, residential dwellings, schools and recreation areas.
Standing water level	The height to which groundwater rises in a bore after it is drilled and completed, and after a period of pumping when levels return to natural atmospheric or confined pressure levels.
Water table	The surface in an unconfined aquifer or confining bed at which the pore water pressure is atmospheric; it can be measured by installing shallow wells extending a few feet into the zone of saturation and then measuring the water level in those wells.

ABBREVIATIONS

ANZECC	Australian and New Zealand Environment and Conservation Council
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BOM	Bureau of Meteorology
COC	Chain of Custody
CEMP	Construction and Environment Management Plan
DQI	Data Quality Indicators
DQO	Data Quality Objectives
DO	Dissolved Oxygen
EC	Electrical Conductivity
EPL	Environment Protection Licence
EIS	Environmental impact statement
GIS	Graphical information systems
HSL	Health Screening Level
LDL	Laboratory Detection Limits
LOR	Limit of Reporting
µg	Micrograms
mg	Milligrams
MW	Monitoring Well
MLDRR	Murray and Lower Darling Regulated Rivers
MDBA	Murray Darling Basin Authority
MDBPR	Murray Darling Basin Porous Rock
NATA	National Association of Testing Authorities
NGIS	National groundwater information system
NSW EPA	New South Wales Environmental Protection Agency
ORP	Oxygen Reducing Potential
PFAS	Per- and Poly-fluorinated Alkyl Substances
PFHxS	Perfluorohexanoic Acid
PFOS	Perfluorooctane Sulfonate
PFOA	Perfluorooctanoic Acid
PSH	Phase Separated Hydrocarbons
PAH	Polycyclic Aromatic Hydrocarbons
QA/QC	Quality Assurance/Quality Control
RPD	Relative Percentage Difference

TOC	Top of Case (of monitoring well)
TRH	Total Recoverable Hydrocarbons
pH	Unit of measurement for acidity and alkalinity
vTRH	Volatile Total Recoverable Hydrocarbons (C_6 to C_{10})
WSP	WSP Australia

EXECUTIVE SUMMARY

ENERGYCONNECT (NSW – WESTERN SECTION)

TransGrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north-west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

The proposal, focusing on the western section of EnergyConnect in NSW (and the subject of this technical paper), would involve the construction and operation of new 330kV transmission lines between the SA/NSW border and Buronga, an upgrade and expansion of the existing Buronga substation from an operating voltage of 220kV to 330kV and an upgrade of the existing 220kV transmission line between Buronga substation and the border of NSW and Victoria.

OVERVIEW OF ENVIRONMENTAL ASSESSMENT RESULTS

CONSTRUCTION

The proposal study area has been largely used as agricultural land with no significant development modification observed, and it is unlikely to undergo significant modification during the construction of the proposal. Agricultural land uses dominate the proposal study area with over 90 per cent of the proposal study area being native undisturbed vegetation utilised for grazing which poses a very low risk of contamination. There is no evidence to suggest that gross contamination would be identified in soils and groundwater across the proposal study area.

Minimal potential contamination sources were identified both on-site and in the vicinity of the proposal study area, and where identified are limited to the Buronga and Ellerslie substations, existing transmission infrastructure, residential properties, cleared agricultural land, farm dams, and a potential quarry located east of the SA border. The majority of these area of concern have been assessed to pose a low risk during construction, with areas of cleared agricultural land and a potential quarry assigned a medium risk. The Ellerslie substation is not owned by TransGrid and no works will occur at this location.

Acid sulfate soils (ASS) or acid rocks are unlikely to be present across the majority of the proposal study area: however, low lying areas surrounding former lakes and river beds are mapped as having a high probability of acid sulfate soil occurrence and if encountered subsurface material may pose an acid generation risk if exposed to oxygen during redevelopment. This potential issue would need to be addressed within an appropriate management plan (developed with reference to the Acid Sulfate Soils Management Advisory Committee (ASSMAC) Assessment Guidelines (1998), with active on-going management through the construction phase as prescribed within the plan (as required).

No naturally occurring asbestos impacts expected in relation to the construction of the proposal. Geotechnical testing has indicated that while saline soils would likely be encountered within the proposal study area, this is not likely to present a significant contamination risk.

Potential groundwater contamination from identified areas of environment concern poses a low risk to the construction of the proposal. This is because the volumes of groundwater expected to interact with proposal during construction would be negligible or are not expected to require management.

The proposal has the potential to create contamination and other soil impacts on the surrounding environment if not managed appropriately. The construction environmental management plan (CEMP) would specify measures to minimise these potential impacts. Measures would relate to minimising the potential for spills and leaks from materials, plant and equipment, protocols for responding to incidents, erosion and sediment controls, and unexpected contamination finds procedure.

OPERATION

Operation of the proposal should not result in exposure to the surrounding environment and users (e.g. maintenance workers or farmers) to potentially contaminated soil or groundwater. Soil disturbance activities required under the general maintenance procedures would be limited to removal of regrowth if present along sections of the easement.

The operational impact related to the proposal would be potential hydrocarbon (fuels, diesel, oils) contamination of soil, surface water and groundwater arising from incidents involving vehicle accidents, leaks and spills in the transmission line easement or at the Buronga substation site. Spill volumes from such incidents would be expected to be minor; however, the potential for hydrocarbon fuel to migrate off-site cannot be discounted. Spill containment facilities would be used on maintenance work sites and at the upgraded Buronga substation and incident response procedures developed to manage the risk from these occurrences.

CONCLUSION

The risks associated with the proposal are considered to be low subject to the implementation of the mitigation measures, as detailed in this report, which would ameliorate or minimise any expected impacts to generally acceptable levels. Any residual risk will be managed through CEMP measures and management controls during site development. An unexpected contamination finds protocol has been identified for construction and post-construction management should contamination issues be identified during further investigation or uncovered during construction. Operational phase contamination risk management would be manageable with appropriate spill containment measures and incident response.

1 INTRODUCTION

1.1 OVERVIEW OF ENERGYCONNECT

TransGrid (electricity transmission operator in New South Wales (NSW)) and ElectraNet (electricity transmission operator in South Australia (SA)) are seeking regulatory and environmental planning approval for the construction and operation of a new High Voltage (HV) interconnector between NSW and SA, with an added connection to north-west Victoria. Collectively, the proposed interconnector is known as EnergyConnect.

EnergyConnect comprises several components or 'sections' (shown on Figure 1.1). The Western Section (referred to as 'the proposal') is the subject of this technical paper.

EnergyConnect aims to secure increased electricity transmission between SA, NSW and Victoria, while facilitating the longer-term transition of the energy sector across the National Electricity Market (NEM) to low emission energy sources.

EnergyConnect has been identified as a priority transmission project in the NSW Transmission Infrastructure Strategy (Department of Planning and Environment, 2018), linking the SA and NSW energy markets and would assist in transporting energy from the South-West Renewable Energy Zone to major demand centres.

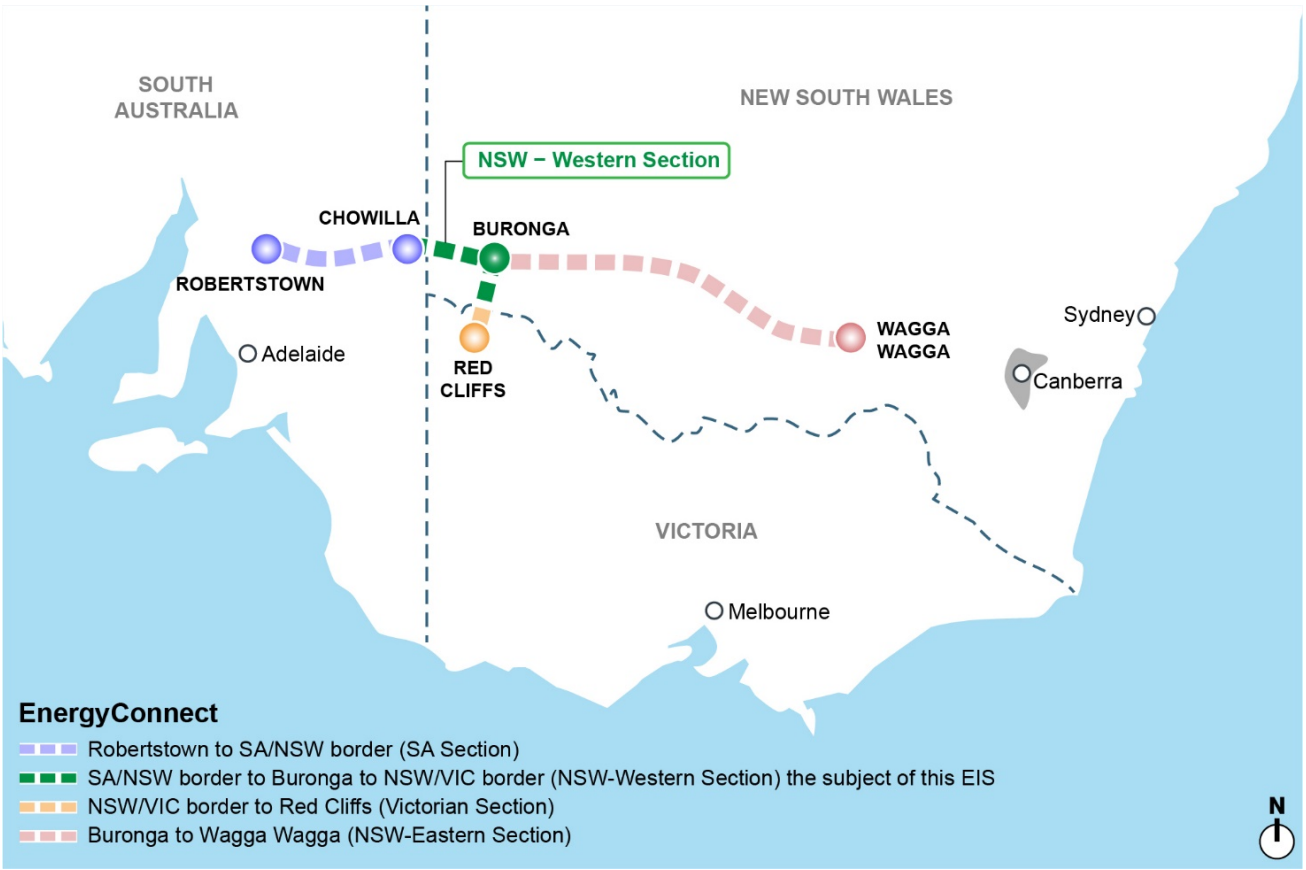

Figure 1.1 Overview of EnergyConnect

1.2 THE PROPOSAL

TransGrid is seeking approval under Division 5.2, Part 5 of the Environmental Planning and Assessment Act 1979 (the EP&A Act) to construct and operate the proposal. The proposal has been declared as Critical State significant infrastructure under Section 5.13 of the EP&A Act.

The proposal was also declared a controlled action on 26 June 2020 and requires a separate approval under the (Commonwealth) Environment Protection and Biodiversity Conservation Act 1999. The proposal is subject to the bilateral assessment process that has been established between the Australian and NSW governments.

The proposal is located in western NSW within the Wentworth Local Government Area (LGA), approximately 800 kilometres west of Sydney at its nearest extent. The proposal spans between the SA/NSW border near Chowilla and Buronga and the NSW/Victoria border at Monak, near Red Cliffs. It traverses around 160 kilometres in total.

1.2.1 KEY PROPOSAL FEATURES

The key components of the proposal include:

- a new 330 kilovolt (kV) double circuit transmission line and associated infrastructure, extending around 135 kilometres between the SA/NSW border near Chowilla and the existing Buronga substation
- an upgrade of the existing 24 kilometre long 220kV single circuit transmission line between the Buronga substation and the NSW/Victoria border at Monak (near Red Cliffs, Victoria) to a 220kV double circuit transmission line, and the decommissioning of the 220kV single circuit transmission line (known as Line 0X1)
- a significant upgrade and expansion of the existing Buronga substation to a combined operating voltage 220kV/330kV
- new and/or upgrade of access tracks as required
- a minor realignment of the existing 0X2 220kV transmission line, in proximity to the Darling River
- ancillary works required to facilitate the construction of the proposal (e.g. laydown and staging areas, concrete batching plants, brake/winch sites, site offices and accommodation camps).

An overview of the proposal is provided in Figure 1.2. The final alignment and easement of the transmission line would be confirmed during detailed design and would be located within the transmission line corridor as shown in Figure 1.2.

Subject to approval, construction of the proposal would commence in mid-2021. The construction of the transmission lines would take approximately 18 months The Buronga substation upgrade and expansion would be delivered in two components and would be initially operational by the end of 2022, with site decommissioning and rehabilitation to be completed by mid-2024. The final construction program would be confirmed during detailed design.

The proposal is further described in Chapter 5 and Chapter 6 of the Environmental Impact Statement (EIS).

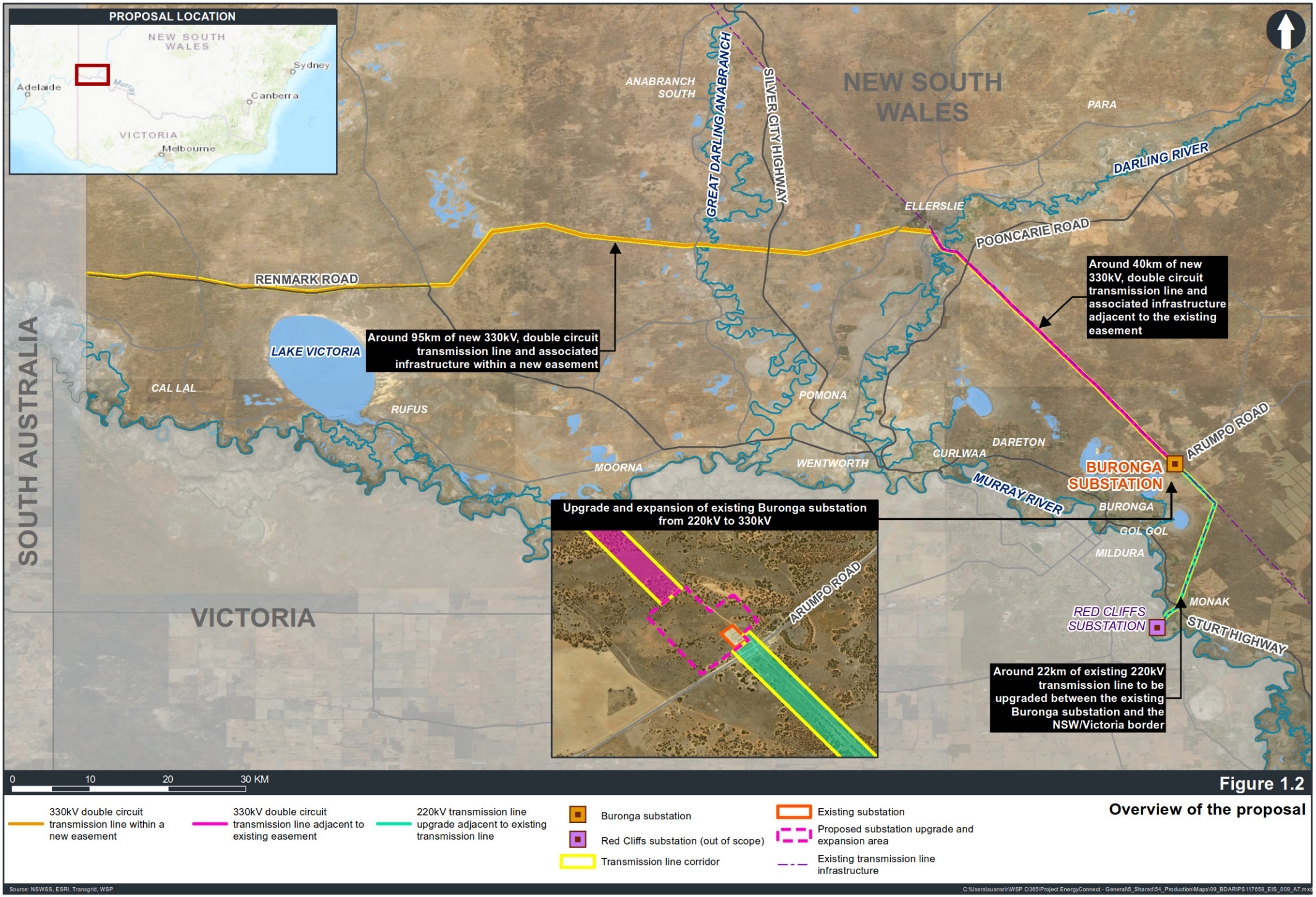

Figure 1.2

Overview of the proposal

1.2.2 PROPOSAL NEED

The proposal is required to complete the missing transmission link between SA and NSW transmission networks. The upgrade to the existing transmission line between Buronga and Red Cliffs would also enhance the capacity of the network to provide electricity between NSW and Victoria.

This connection would relieve system constraints and allow for NSW, SA and Victorian consumers to benefit from significant amounts of low-cost, large-scale solar generation in south-west NSW. The proposal is an essential component of EnergyConnect.

1.3 PURPOSE OF THIS TECHNICAL REPORT

This technical paper is one of a number of technical papers that form part of the EIS for the proposal. The NSW Department of Planning, Industry and Environment (DPIE) has provided the Secretary's Environmental Assessment Requirements (SEARs) for the EIS.

The purpose of this technical paper is to identify and assess the potential impacts of the proposal in relation to contaminated land management. It responds directly to the SEARs (refer to Section 1.3.1).

This technical paper:

- identifies areas of environmental concern (AEC) which have the potential to impact on the proposal with respect to contamination
- identifies areas of acid sulfate soils (ASS), saline soil or naturally occurring asbestos which may be disturbed during the project
- outlines mitigation and management measures for potential impacts
- assesses the impacts of constructing and operating the proposal on human health and environmental receivers
- documents how further assessment (if required) should be carried out in accordance with current guidelines.

This assessment comprises a preliminary (also referred to as Phase 1) investigation which assesses the potential for contamination to exist based on a desktop study.

1.3.1 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The SEARs specific to this assessment and where these aspects are addressed in this technical report are outlined in Table 1.1.

Table 1.1 Summary of key components of the proposal

REFERENCE	SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS	WHERE ADDRESSED
Key issue – Land	An assessment of the risk of soil contamination and disturbance of land associated with naturally occurring asbestos in the vicinity of the site.	Section 5 and Section 6

1.4 STRUCTURE OF THIS REPORT

The structure and content of this report is as follows:

- *Chapter 1 – Introduction:* Outlines the background and need for the proposal, and the purpose of this report.
- *Chapter 2 – Legislative and policy context:* Provides an outline of the key legislative requirements and policy guidelines relating to the proposal.
- *Chapter 3 – Methodology:* Provides an outline of the methodology used for the preparation of this report.
- *Chapter 4 – Existing environment:* Describes the existing environment with reference to the potential for contaminated land and groundwater.
- *Chapter 5 – Assessment of construction impacts:* Describes the potential construction impacts associated with the proposal.
- *Chapter 6 – Assessment of operational impacts:* Describes the potential operational impacts associated with the proposal.
- *Chapter 7 – Cumulative impacts:* Outlines the potential cumulative impacts with respect to other known developments within the vicinity of the proposal.
- *Chapter 8 – Mitigation measures:* Outlines the proposed mitigation measures for the proposal.
- *Chapter 9 – Conclusion:* Provides a conclusion of the potential impacts of the proposal with reference to the potential for contaminated land and groundwater.
- *Chapter 10 – References*: Identifies the key reports and documents used to generate this report.

Appendices to this report include:

- **Appendix A** – Unexpected Finds Protocol.

1.5 REPORT TERMINOLOGY

The following terms are discussed throughout this report and are defined as:

- **Proposal study area** – the proposal, including transmission line corridor, Buronga substation upgrade and expansion, access tracks, and the main construction compounds and accommodation camps at Buronga and Anabranch South would be contained within the proposal study area. The proposal study area comprises of a one kilometre wide corridor between the SA/NSW border near Chowilla and Buronga and a 200 metre wide corridor between Buronga and the NSW/Victoria border at Monak, near Red Cliffs, and is used in the environmental assessment to provide a broader understanding of the constraints and conditions of the locality.
- **Transmission line corridor** – the corridor in which the final easement and transmission line is expected to be contained within. It would consist of a 200 metre corridor along the transmission line component of the proposal. Transmission line construction activities would be contained within this area, but some access tracks may extend beyond this corridor.

1.6 LIMITATIONS

The assessment is based on a model developed by specialist contaminated land consultants from WSP and data from the accompanying WSP Create, an online system. No physical site inspection or survey has been carried out. Therefore, the assessment is based on datasets which were available at the date of the assessment and findings from available investigations. These datasets are continually updated as more information becomes available, and additional data obtained in the future may change the outcome of the assessment. As such, no expressed warranty is given by WSP in relation to the accuracy or completeness of the data reported, the actual state or condition of the property, or the suitability of the site for any current or proposed use.

The datasets in the WSP Create portal were selected to provide an indication of the presence of contamination on and surrounding the site. However, they may not identify all historical uses and activities which may have caused the site and/or its surrounds to become contaminated. In particular, many sites are impacted by the presence of asbestos in fill material from unknown sources usually associated with poor demolition practices, for which a dataset is not available.

The assessment provides an indication of the likelihood of contamination to be present at, or impact, the site. It does not constitute advice as to the value of the site, or the suitability of the site for purposes other than the proposal. It also does not consider any environmental investigations or remediation works which may have been undertaken across the proposal study area as this information was not available to WSP during the phase 1 investigation.

2 LEGISLATIVE AND POLICY CONTEXT

The following section provides an overview of the legislative and policy context relevant to the proposal.

2.1 PROTECTION OF THE ENVIRONMENT OPERATIONS ACT 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the legislative framework for the protection and enhancement of the environment in NSW. Its primary objectives are to reduce risks to harmless levels through pollution prevention, cleaner production, application of waste management hierarchy, continual environmental improvement and environmental monitoring.

2.2 CONTAMINATED LAND MANAGEMENT ACT 1997

The *Contaminated Land Management Act 1997* (CLM Act) is part of the management framework for contaminated land in NSW. The act enables the NSW Environment Protection Authority (the EPA) to respond to and manage site contamination when it considers that contamination is significant enough to require regulation. Site contamination requires regulation under the CLM Act when a site is declared "significantly contaminated land" (defined as land described in a notice having effect under section 11 of the CLM Act) or when land is subject to a management order or an approved voluntary management proposal. Lands within the proposal study area have not been declared "significantly contaminated" and are not subject to a management order.

Section 105 of the CLM Act allows the EPA to make or approve guidelines for the purposes connected with the objectives of the CLM Act.

Contaminated sites not regulated by the EPA can be managed through the planning process by the relevant planning consent authority.

2.3 STATE ENVIRONMENTAL PLANNING POLICY 55 – REMEDIATION OF LAND

State Environmental Planning Policy 55 – Remediation of Land (SEPP 55) pertains to, and aims to, promote the remediation of contaminated land. Through the development application process, planning authorities (local councils, in particular) are required to assess the contamination status of land prior to granting development consent. SEPP 55 lists remediation work that may be undertaken without the consent of the consent authority.

In accordance with clause 7(1) of SEPP 55, a consent authority must not consent to carrying out development on land unless it has considered whether the land is contaminated. Sections of the proposed work would occur within or adjacent to an existing transmission corridor and existing substation facility. Based on the potential for contamination from the exiting land uses the development approval needs to be able to consider if the existing information is sufficient to make planning decisions. This report has been undertaken to determine the potential for contamination and provide a recommendation on next steps in relation to contamination (if any).

2.4 NATIONAL ENVIRONMENT PROTECTION (ASSESSMENT OF SITE CONTAMINATION) MEASURE 1999 AS AMENDED IN 2013

The National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013 (NEPM 2013) is made under the *National Environment Protection Council Act 1994* and is given effect by individual legislation and guidelines in each state and territory. The NEPM 2013 is approved by the EPA under section 105 of the CLM Act. The purpose of the measure is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community, which includes regulators, site assessors, environmental auditors, landowners, developers and industry.

The desired environmental outcome for this measure is to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

Authorities (at local and state government level) that consent to development or changes in land use consider the land's suitability for its intended use. To determine if a site is suitable, a site's history of use and whether it is indicative of potential contamination should be considered.

Under the NEPM 2013, site contamination assessment is generally carried out in stages involving progressively more detailed levels of data collection and analysis, such as preliminary (Phase 1) site investigations, detailed site investigations and site-specific risk assessment. This technical report is a preliminary (Phase 1) investigation, which assesses the potential for contamination to exist based on a desktop study and review of previous reports/assessments undertaken within the proposal study area.

In general, as per the guidance in the NEPM 2013, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In assessing the contamination, the site assessor (if required) and others should consider the preferred hierarchy of options for site clean-up and/or management which is outlined in Table 2.1.

Table 2.1 Hierarchy of clean-up options (NEPM 2013)

PREFERENCE	OPTION
1	On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level.
2	Off-site treatment of excavated soil, so that the contamination is destroyed, or the associated risk is reduced to an acceptable level, after which soil is returned to the site.
If the above is not practicable:	
3	Consolidation and isolation of the soil on-site by containment with a properly designed barrier.
4	Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.
Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy is required.	

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option.

2.5 NATIONAL WATER QUALITY MANAGEMENT STRATEGY

The *National Water Quality Management Strategy* (NWQMS) (Australian Government, 2018) aims to protect the nation's water resources by improving water quality while supporting the businesses, industry, environment and communities that depend on water for their continued development. The main policy objective of the NWQMS is to achieve sustainable use of water resources, by protecting and enhancing their quality, while maintaining economic and social development.

The NWQMS includes water quality guidelines that define desirable ranges and maximum levels for specific parameters that can be allowed (based on scientific evidence and judgement) for specific uses of waters for protection of specific values. They are generally set at a low level of contamination to offer long-term protection of environmental values. The NWQMS water quality guidelines include the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) and the *Australian Drinking Water Guidelines* (NHMRC, 2011).

2.6 AUSTRALIAN AND NEW ZEALAND GUIDELINES FOR FRESH AND MARINE WATER QUALITY

The *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) have been prepared as part of the NWQMS. The guidelines provide a process for developing water quality objectives required to sustain current or likely future environmental values for natural and semi-natural water resources. The process involves the following:

- identifying the environmental values that are to be protected in a particular water body
- identifying management goals and selecting the relevant water quality guidelines for measuring performance
- developing statistical performance criteria to evaluate the results of the monitoring programs (e.g. statistical decision criteria for determining whether the water quality objectives have been exceeded or not)
- developing tactical monitoring programs focusing on the water quality objectives
- initiating appropriate management responses to attain (or maintain if already achieved) the water quality objectives.

Environmental values (sometimes referred to as beneficial uses) are particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and which require protection from the effects of pollution, waste discharges and deposits. The following environmental values are recognised in the water quality guidelines:

- aquatic ecosystems
- primary industries (irrigation and general water uses, stock drinking water, aquaculture and human consumption of aquatic foods)
- recreation and aesthetics
- drinking water
- industrial water
- cultural and spiritual values.

Default guideline values (DGVs) are presented in the guidelines as a starting point for assessment. DGVs are numerical concentration limits recommended to support and maintain a designated water use.

The *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* are a revision from the Australian and New Zealand Environment Conservation Council (ANZECC) guidelines, published in 2000. The current guideline provides DGVs for varying toxicants, which are the same as the ANZECC guidelines.

The *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* establish a guide for setting water quality objectives for surface water resources required to sustain environmental values and the guideline values represent target concentrations within the surface water resource (or surface water body).

2.7 ACID SULFATE SOIL MANUAL

Acid sulfate soils (ASS) are naturally occurring soils, sediments or organic substrates (e.g. peat) that are formed under waterlogged conditions. These soils contain iron sulphide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However, if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulphides react with oxygen to form sulfuric acid.

The management of ASS is coordinated by the NSW Acid Sulfate Soil Management Advisory Committee (NSW ASSMAC). This Committee is made up of representatives from various government organisations and other affected parties. The Committee published the *Acid Sulfate Soil Manual* (ASSMAC, 1998) to provide best practice guidance in the assessment and management of projects in areas potentially affected by ASS in NSW.

The manual set out a process (refer to Figure 2.1) to decide whether ASS is present on-site and how to mitigate potential impacts.

When works involving the disturbance of soil or a change in groundwater levels are proposed in coastal areas, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils. The purpose of the preliminary assessment is:

- to establish the characteristics of the proposed works
- to establish whether ASS is present on the site and if they are at such concentrations to warrant the preparation of an acid sulfate soil management plan (ASSMP)
- to provide information to assist in designing a soil and water assessment program.

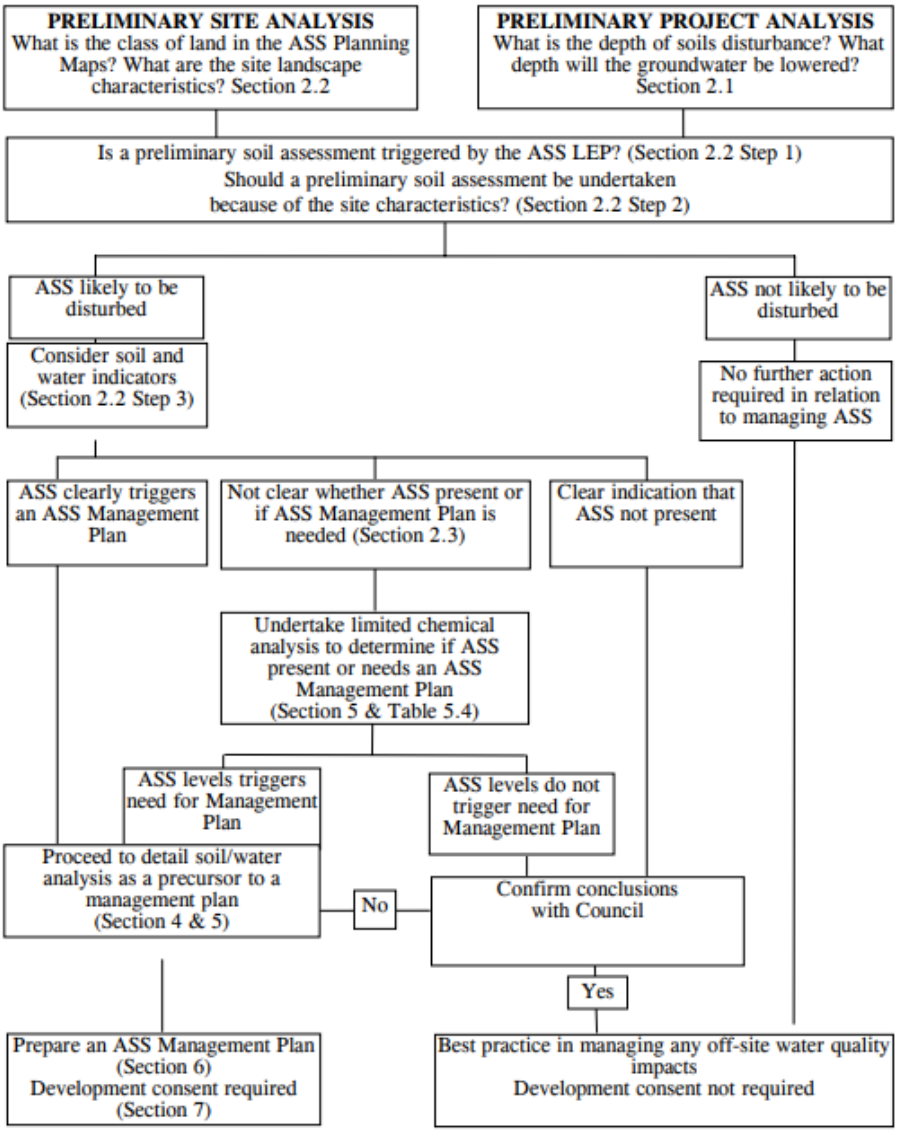

Figure 2.1 Preliminary Assessment Phase from the Acid Sulfate Soil Manual *(New South Wales – Acid Sulfate Soil Management Advisory Committee, 1998)*

2.8 MANAGING ASBESTOS IN OR ON SOIL

The *Managing Asbestos in or on Soil* guide (SafeWork NSW, 2014) provides general guidance on the Assessment of Asbestos in soil. Managing Asbestos in soil has implications for the current and future occupants of the land/or any worker employed on the site. The principles underlying the guidance in this document are those endorsed by the NSW Heads of Asbestos Coordination Authorities (HACA) and contained in the NSW Asbestos Blueprint (SafeWork NSW 2017). Work health and safety, land use planning and environmental legislation, and the amended NEPM 2013 are referenced where they apply.

The NEPM 2013 emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials, the potential for damage, and the resulting release of asbestos fibres. Bonded Asbestos in sound condition represents a low risk to human health. However, both friable and fibrous asbestos materials have a significantly higher potential to generate, or be associated with, free asbestos fibres, and may represent a significant human health risk if disturbed and fibres are made airborne.

The objective of the approach outlined in *Managing Asbestos in or on Soil* guide is to ensure that proportionate and practicable controls are applied per regulatory requirements and a manner commensurate with actual risk.

2.9 OTHER GUIDELINES

A number of other guidelines, which are relevant to the management of contamination, were considered in the preparation of this technical report and presented in Table 2.2.

Table 2.2 Other guidelines

GUIDELINE	CONSIDERATION IN THIS REPORT
Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia (WA Department of Health, 2009)	The guidelines provide a framework and best practice for the assessment, remediation and management of asbestos-contaminated sites. The guidelines would need to be considered **if** the preparation of the asbestos management plan for the proposal is identified as being required as a result of an unexpected find during construction works.
Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015)	The guidelines detail circumstances in which contamination at a site triggers the requirement to notify the NSW EPA. The guidelines are made under Section 105 of the CLM Act. The duty to report lies with landowners and those responsible for the contamination. The triggers would need to be considered if contamination is encountered within the proposal study area.
Guidelines for the NSW Site Auditor Scheme (3rd edition) (EPA, 2017)	The guidelines describe the obligations of accredited site auditors undertaking site audits in NSW. The guidelines are made under Section 105 of the CLM Act. These guidelines would need to be considered if reports are required to be prepared that may be reviewed by site-auditor (e.g. investigation report or remediation action plan). This would only occur as a result of certain unexpected find incidents and the need be determined at that time.
Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004)	The guidelines provide best practice guidance on erosion controls that need to be implemented during construction. The guidelines would need to be considered during the preparation of the Construction Environmental Management Plan (CEMP) and associated Soil and Water Management Plan (SWMP) for the proposal.

3 METHODOLOGY

3.1 APPROACH

The assessment methodology generally followed the framework for the assessment of site contamination outlined in the National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended) (the NEPM). The NEPM 2013 states that 'the preliminary investigation and initial assessment of site contamination should consider the possibility of all forms of potential contamination based on past use. The preliminary investigation should be sufficient to identify whether contamination exists on the site. Depending on the proposed use and the results of initial site history investigations, the assessment of a site may involve both preliminary and detailed investigations. Many site investigations proceed in multiple stages due to the complexity of the site and the discovery of unexpected contamination. For the purpose of this technical working paper, the staged process presented in NEPM 2013 is summarised in Figure 3.1.

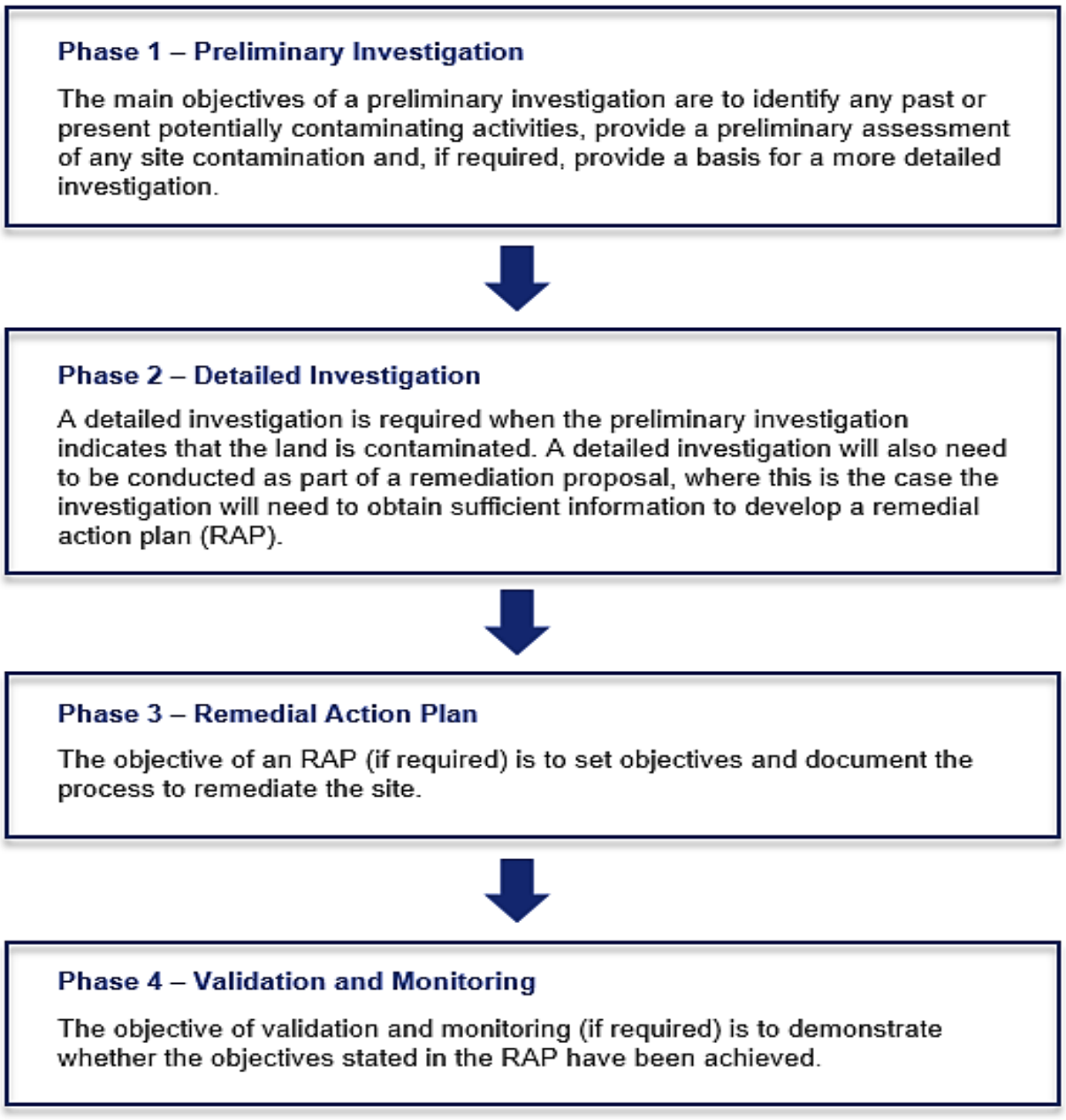

Figure 3.1 Staged site investigation process

This report comprises a preliminary (also referred to as Phase 1) site investigation which assesses the potential for contamination to exist based on a desktop study and review of previous detailed site investigation (also referred to as Phase 2) reports/assessments. The contamination assessment comprised the following:

- a review of previous investigation reports undertaken within the proposal site (listed in Section 11)
- identify potential areas of ASS, soil salinity and naturally occurring asbestos which may be disturbed by the proposal
- a review of available information to identify potentially current or historical contaminating land uses and subsequent identification of potential areas of environmental concern (AECs)
- identify and assess pollution linkages associated with the construction and operation of the proposal to inform the impact assessment of the proposal
- a construction phase impact assessment which identifies potential contamination impacts based on the current understanding of the likely construction methodology. A qualitative risk ranking is used to identify the potential severity of the impact. Mitigation measures are proposed to minimise, mitigate and manage potential impacts, as relevant
- an operational phase impact assessment which identifies whether any long-term operational or maintenance activities have the potential to impact on land suitability.

In preparing this technical working paper, the following sources of information were reviewed:

- databases to identify areas of known and potential contamination, including:
  - Department of Defence database for unexploded ordnance
  - Department of Primary Industries register of cattle dip sites
  - NSW EPA PFAS investigation database
  - NSW EPA register of contaminated sites and list of notified sites, under sections 58 and 60 of the CLM Act, for sites located within two kilometres of the proposal study area
  - NSW EPA's environment protection licence records under section 308 of the POEO Act
  - NSW Government database of former gasworks sites
- publicly available data and web-based information searches, background information relevant to the study area, survey data, and topography including:
  - Historical aerial photographs from the NSW Government Land and Property Information website
  - Australian Soil Resource Information System (maintained by the Commonwealth Scientific and Industrial Research Organisation (CSIRO))
  - Geology of the proposal study area
  - NSW Soil and Land Information System
  - NSW Government acid sulfate soils risk mapping
  - NSW Government's Heads of Asbestos Coordination Authorities naturally occurring asbestos risk mapping
  - maps published by the Geological Survey of NSW, former Department of Conservation and Land Management, and Australian Soils Resource Information System.

3.2 RISKS IDENTIFIED

Potential environmental risks were identified associated with construction and operation, and rating the potential risks according to likelihood, consequence and overall level of risk, in general accordance with:

- AS/NZS ISO 31000:2009 Risk management – Principles and guidelines.

Potential impacts associated with contamination and soils identified by the environmental risk assessment included:

- interaction with potentially contaminated soils and groundwater as a result of sub-surface disturbance during construction and operation, including disturbance and potential migration/mobilisation of contaminants
- release of potentially contaminated groundwater where construction activities such as piling intercept groundwater and de-watering are required
- de-watering, management and disposal or discharge of contaminated groundwater and managing the disposal of contaminated soils encountered during construction in areas where existing contamination is present
- contamination of soils and groundwater due to spills or leaks of fuels, oils or other hazardous substances during construction and operation
- direct contact and inhalation of contaminated soil and groundwater by site workers where construction and operational activities result in the exposure of existing contamination.

3.3 QUALITATIVE RISK RANKING

The assessment includes a preliminary contamination risk evaluation (considering the potential for risks without the implementation of appropriate controls or remediation) to understand the potential risk of the identified areas of contamination concern. The risk ranking has been based on the likelihood of encountering contamination on the assessment of current regulated activities, and historical land uses/activities at the subject site as described in Table 3.1.

Table 3.1 Qualitative risk rankings

RISK RANKING	LIKELIHOOD THAT THE SITE MAY BE AFFECTED BY CONTAMINATION	BASIS FOR RISK RANKING
High	Likely contamination source identified	The available information indicates that the subject site: — is currently identified as being contaminated on a public register of contaminated sites maintained by a regulator or has been the subject of an activity which is frequently associated with contamination.
Medium	Possible contamination source identified	The available information indicates that the subject site: — is or has been the subject of an activity which in some circumstances is known to be associated with contamination — has been historically filled with imported material, the origin of which is unknown; and/or — has groundwater records indicating the potential for contamination. The available information indicates that land within 1 km of the disturbance area: — is currently identified as being contaminated on a public register of contaminated sites maintained by a regulator — is or has been the subject of an activity which is in some circumstances known to be associated with contamination — has groundwater records indicating the potential for contamination.

RISK RANKING	LIKELIHOOD THAT THE SITE MAY BE AFFECTED BY CONTAMINATION	BASIS FOR RISK RANKING
Low	No contamination sources identified	The available information does not indicate that the subject site, or land within 1 km of the subject site: — is currently identified as being contaminated on a public register of contaminated sites maintained by a regulator — is or has been the subject of an activity which is frequently associated with contamination — has been historically filled with imported material, the origin of which is unknown — has groundwater records indicating the potential for contamination.

4 EXISTING ENVIRONMENT

4.1 TOPOGRAPHY

The topography of the proposal study area is largely flat but generally slopes towards the existing large watercourses of the Darling River and the Darling Anabranch and then to the south to the Murray River. There is a very shallow grade with the average grade being four to six centimetres per kilometre in the Darling River catchment. Additionally, there are large flat areas around the Darling River and Lake Victoria areas. The elevation across the proposal study area is about 35 to 80 metres above sea level.

4.2 SOILS AND GEOLOGY

4.2.1 GEOLOGY

Published geological mapping data from NSW Seamless Geology Project (2019) indicates that Quaternary aged transported soils cover most of the proposed study area. These soils have been deposited in alluvial flood plains, dune sands and swamp or lake deposits. The geological unit, origin and their corresponding dominant soil type are listed in Table 4.1.

Table 4.1 Dominant regional geology within the proposal investigation area

NSW SEAMLESS GEOLOGY CODE	GEOLOGICAL UNIT	DOMINANT SOIL TYPE
Q_acm	Alluvial channel	SAND or SILT
Q_af	Alluvial floodplain	SAND, SILT or CLAY
Q_ath	Alluvial terrace	SAND SILT or CLAY
Q_av	Alluvial Valley	GRAVEL, SAND, SILT or CLAY
Q_ddl	Aeolian sand plain	SAND
Q_dds	Bordering dunes	SAND
QH_w_x	Woorinen Formation	SAND
QH_w	Woorinen Formation	SAND, SILT or CLAY
QH_s	Molineaux Sand (formerly Lowlan Formation)	SAND
Q_l	Claypan and lacustrine deposits	CLAY or SILT
CZwua	Blanchetown Clay	CLAY

Approximately 70 per cent (about 108 kilometres) of the proposal study area is covered in aeolian sediments of the Woorinen Formation. This dominant geological unit transitions into alluvial sediments near creeks, river tributaries and in areas surrounding the Darling and Darling-Anabranch Rivers, where alluvial soils extend up to seven kilometres and two and a half kilometres from the current river channel, respectively. Scattered between the Woorinen Formation and alluvial deposits associated with the Darling and Darling Anabranch River systems exists a mixture of alluvial, fluvial and aeolian deposits.

4.2.2 SOIL TYPES

The soils along the proposal study area are expected to be generally calcarosols according to Australian Soil Classification (CSIRO, 2016) comprised of red dune fields, with some vertisols found along the main watercourses sand and alluvial plains in proximity to the Murrumbidgee, Darlings, and Darling – Anabranch Rivers. Published soil mapping along the alignment indicates that the regional geology and soils are expected to be predominantly transported Quaternary-aged sediments deposited in alluvial flood plains, and dune. The predominant soil types are typically sand and clay or a mixture of the two.

Investigation results from (Douglas Partners, 2020) indicate that the Woorinen Formation typically comprises large proportions of very stiff to hard (calcareous) clays and dense to very dense sands with occasional bands of medium dense sands.

4.2.3 SOIL SALINITY

Dryland salinity is the accumulation of salts in the soil surface and groundwater in non-irrigated areas. Salinity is commonly caused by the mobilisation of salts in the soil profile by surface water or groundwater. The broad processes for groundwater mobilisation include groundwater recharge (or deep drainage), groundwater movement or groundwater discharge.

Dryland salinity may also be caused by the exposure of naturally saline soils such as hypersaline clays. It can be associated with sodic soils (soils with an exchangeable sodium percentage (ESP) of more than six per cent.

Most of the proposal study area is mapped as having low salinity potential. Areas shown on Figure 4.1 as having high salinity potential are not within the vicinity of the proposal study area.

Soil conductivity testing undertaken by Douglas Partners 2020a indicates variable salinity across the proposal study area with some soil results indicating moderately saline and very saline soil conditions. An assessment of soil aggressivity undertaken by (Douglas Partners, 2020a) with reference to AS2159-2009 indicated that the soils are highly alkaline, with high levels of sodicity.

4.2.4 ACID SULFATE SOILS

Acid sulfate soils (ASS) and potential acid sulfate soils (PASS) are naturally occurring soils containing iron sulphides. On exposure to air, iron sulphides oxidise and create sulfuric acid. This increase in acidity can result in the mobilisation of aluminium, iron and manganese from the soils. Acid sulfate soil risk mapping is shown in Figure 4.2, which shows acid sulfate risk classifications for land within and in the vicinity of the proposal study area. The risk classifications are based on the NSW Government acid sulfate soil risk mapping. The published digital GIS and The CSIRO Australian Soil Resource Information System indicates that there is an extremely low probability of acid sulfate soils within most of the proposal study area, except for low lying areas surrounding former lakes and river beds, which are mapped as having a high probability of acid sulfate soil occurrence.

Figure 4.1

Soil salinity risk mapping

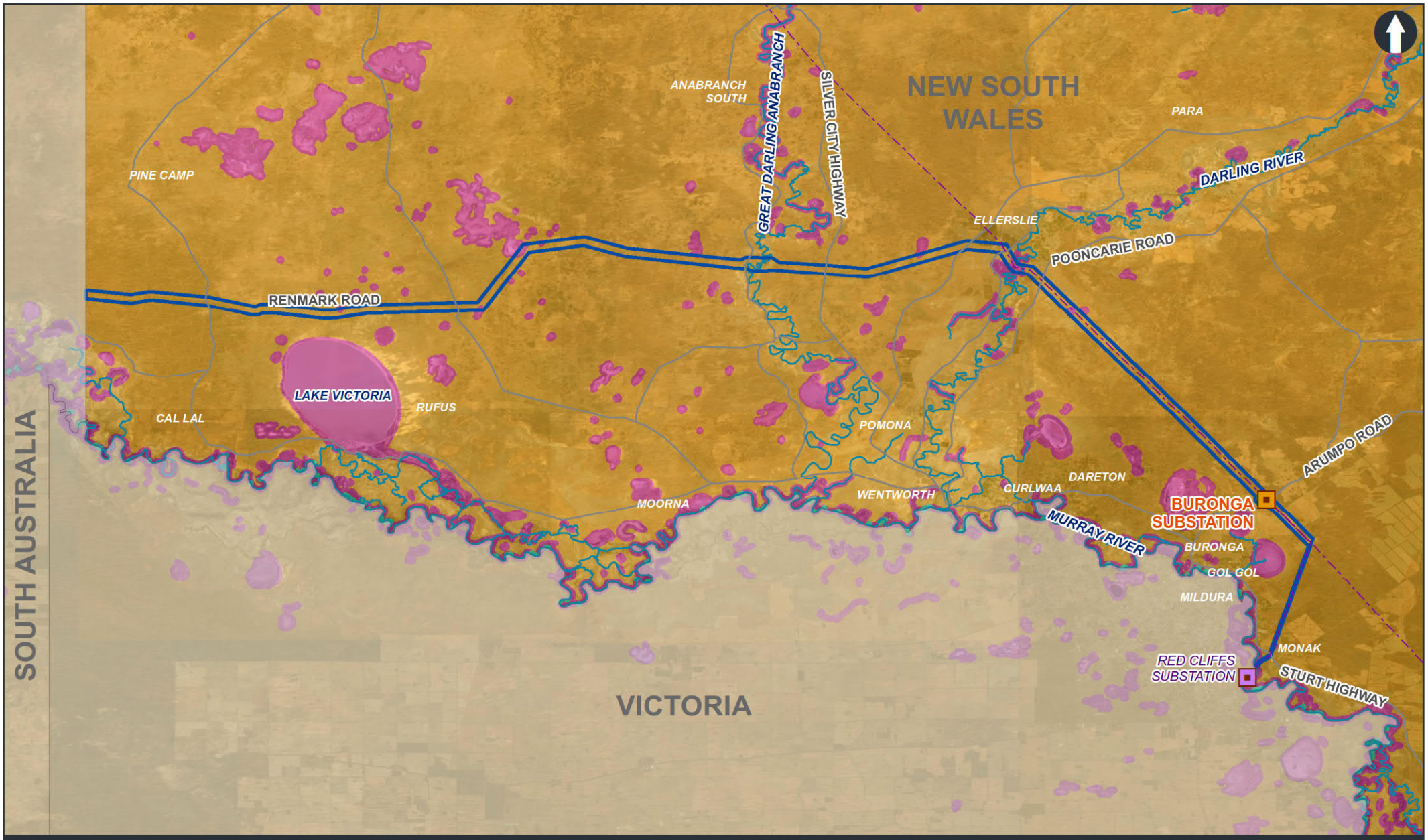

Figure 4.2

Acid Sulfate Soil risk mapping

- Buronga substation
- Red Cliffs substation (out of scope)
- Proposal study area
- Existing transmission line infrastructure

Acid sulfate soils (CSIRO)

- High probability of occurrence - >70% chance of occurrence
- Low probability of occurrence - 6-70% chance of occurrence
- Extremely low probability of occurrence - 1-5% chance of occurrence with occurrences in small localised areas

Source: NSWSS, ESRI, Transgrid, WSP

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4.2.5 NATURALLY OCCURRING ASBESTOS

The term “naturally occurring asbestos” refers to the mineral as a natural component of soils or rocks as opposed to asbestos in commercial products, mining or processing operations. Naturally, occurring Asbestos can be released from rocks or soils by routine human activities, such as construction, or natural weathering processes. If naturally occurring asbestos is not disturbed, and fibres are not released into the air, then it is not a health risk. Asbestos is a commercial and industrial term describing a group of specific silicate minerals that forms bundles of long, very thin mineral fibres. The form and structure of these fibres are called asbestiform. In addition to asbestos, there are additional minerals that are asbestiform, including winchite and richterite that are not technically considered asbestos. Asbestos is most commonly found in three rock types: serpentinites, altered ultramafic rocks, and some mafic rocks. The NSW government’s Heads of Asbestos Coordination Authorities (HACA) has published digital GIS data on naturally occurring Asbestos. Depending on the probability of naturally occurring Asbestos being present, NSW has been mapped into low, medium, or high potential regions. The published digital GIS data does not show any occurrences of expected naturally occurring asbestos minerals or serpentine and amphibole occurrence within the proposal study area. NSW naturally occurring Asbestos mapping is shown in Figure 4.3.

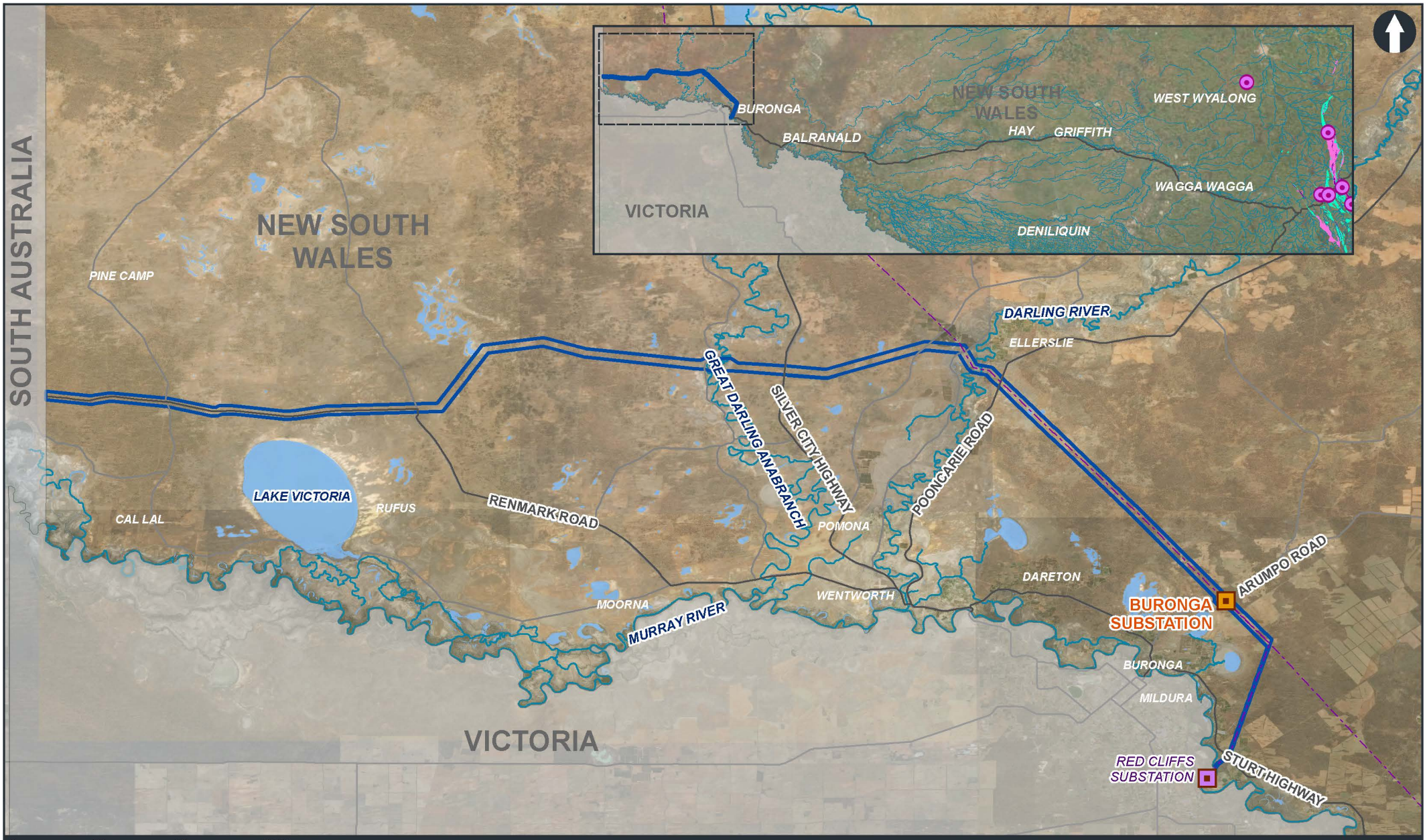

Figure 4.3

Naturally occurring asbestos mapping

4.3 HYDROGEOLOGY

Whilst there are two groundwater water sharing plans that govern the water resources within the proposal study area, the hydrogeology is considerably more complex. This is because the water sharing plans have been designed for simplicity; to make the legislative process more transparent and more comfortable to read, while maintaining legislative accuracy (DPIE, 2019).

Evans and Kellet (1989) identified several regional hydrogeological systems within the Murray-Darling Basin, which have been incorporated into the NGIS data (BOM, 2020b). The NGIS data have summarised the regional hydrogeological systems into four aquifer types, as outlined in Table 4.2. Hydrogeological unit relationships are depicted in Figure 4.4, adapted from Viezzoli, Auken and Munday (2009) and Figure 4.5 from Evans and Kellet (1989), cited by Middlemis et al. (2005).

Table 4.2 Anticipated hydrogeological units and their properties within the proposal study area, adapted from BOM (2020b)

AQUIFER TYPE	HYDROGEOLOGICAL UNIT	HYDROGEOLOGICAL PROPERTY	CORRESPONDING MAPPED GEOLOGY[4]
Upper[1]	Quaternary unconfined[2]	Perched, unconsolidated aquifer	Q_acm; Q_ath; Q_av; Q_ddl; Q_dds; QH_w_x; QH_w;
Upper[1]	Shepparton; Yamba Formations	Aquitard[3]	N/M; Q_l
Upper	Blanchetown Clay	Aquitard	CZwua
Upper	Loxton-Parilla Sand	Semi-confined aquifer	N/I
Middle – upper	Bookpurnong Formation	Aquitard	N/I
Middle – upper	Winnambool Formation	Aquitard	N/I
Middle – upper	Murray Group Limestones	Confined aquifer	N/I
Middle – lower	Ettrick Formation	Aquitard	N/I
Lower	Renmark Group	Confined aquifer	N/I

(1) Hydrogeological unit not identified by BOM (2020b), adapted for this study.

(2) Includes relevant recent sedimentary deposits of the Woorinen and Coonambidgal Formations.

(3) Based on the dominant soil type identified during fieldworks undertaken by Douglas Partners (2020)

(4) N/I = not identified during fieldworks undertaken by Douglas Partners (2020); N/M = not mapped on Seamless Geology Project (Colquhoun, Hughes & Deyssing et al., 2019), but intersected during fieldworks undertaken by Douglas Partners (2020).

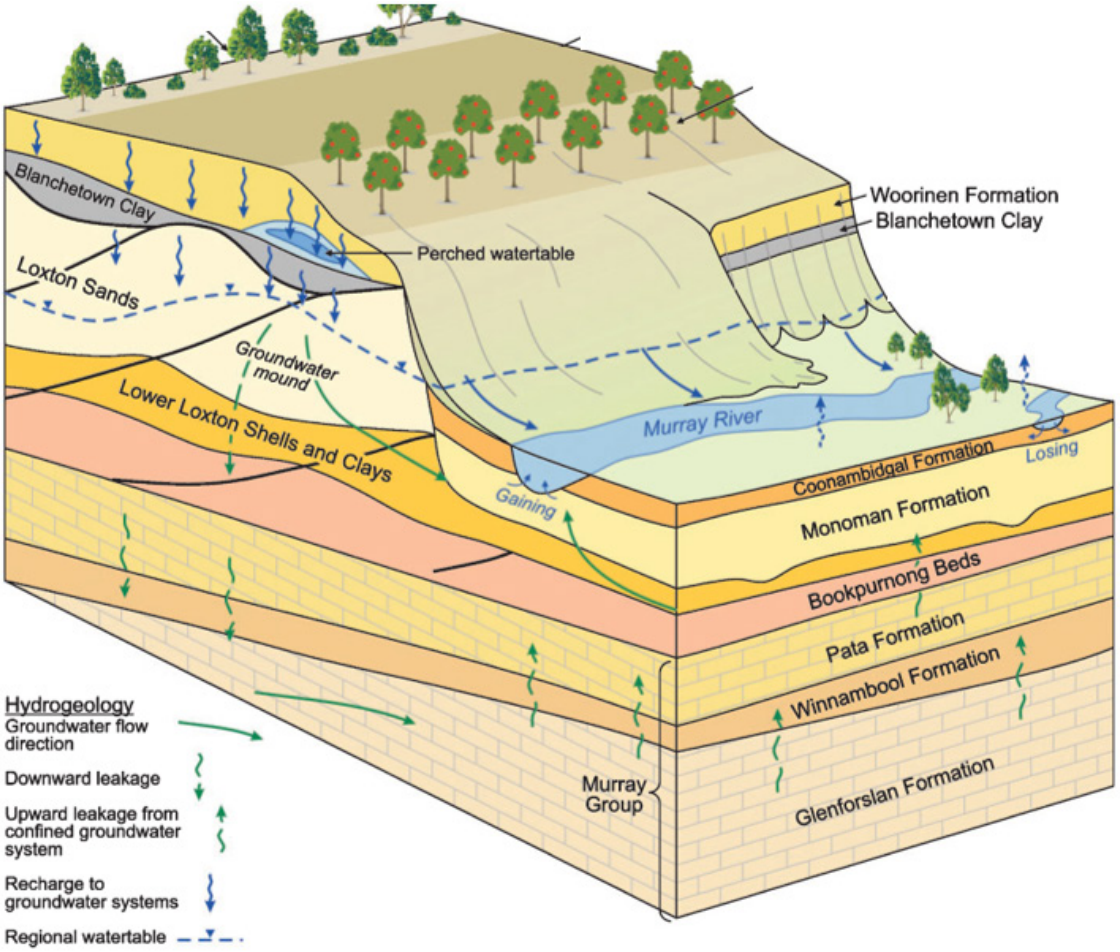

Figure 4.4 Simplified hydrogeological conceptual model adapted from Viezzoli, Auken and Munday (2009)

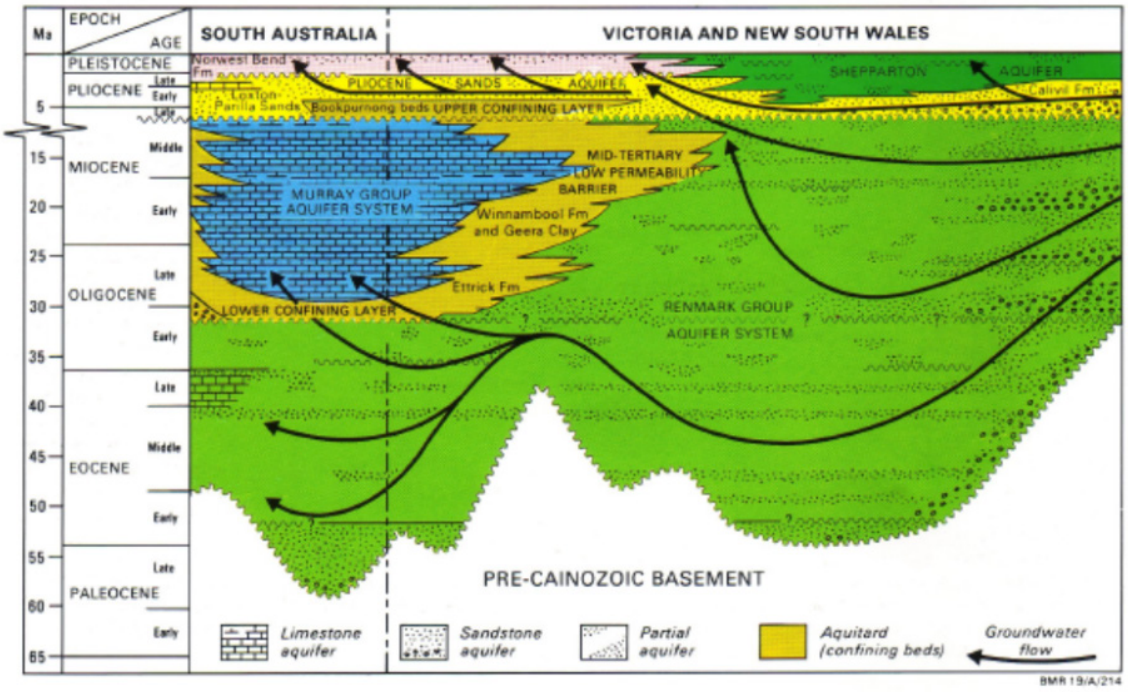

Figure 4.5 Simplified hydrostratigraphic section of the Murray Basin (Evans & Kellet 1989, cited by Middlemis et al., 2005)

4.3.1 SENSITIVE GROUNDWATER RECEIVERS

Three registered bores (GW088272, GW500139 and GW600168) within the groundwater study area were identified as sensitive receivers. Two of the bores were registered for household water supply (GW088272 and GW500139, located approximately 150 metres and 900 metres from the proposal study area, respectively) and one for irrigation (GW600168, located approximately two kilometres from the proposal study area). A further two registered bores (GW088454 and GW600452) exist within the proposal study area, although they are used for monitoring only. No high priority groundwater dependant ecosystems were identified within the recently superseded water sharing plans for the NSW Murray Darling Basin Porous Rock Groundwater Sources 2011 and Lower Murray Darling Unregulated and Alluvial Water Sources 2011. Potential groundwater mounding located near fresh surface water features connected to groundwater systems, such as the Darling River and Lake Victoria, may cause saline groundwater intrusion into freshwater lenses within the alluvial sediments that over time may eventuate into the connected surface water feature.

4.4 GENERAL SITE LAND USE

Most of the proposal study area and surrounding areas are used for grazing native vegetation and is classified as such in mapping completed by the former NSW Office of Environment and Heritage, *NSW Land Use* 2013 (OEH, 2013a). Grazing of goats, cattle and sheep (for wool and meat) is common.

Much smaller proportions are classified as cropping or grazing modified pastures by OEH (2013a). There are some relatively small areas with a recent history of dryland cropping and improved pastures at the south-eastern end of the proposal study area around Buronga; however, some other areas in the central part of the proposal study area do not appear to have been cropped or been improved pastures in recent years.

There are some irrigated grapevines on and adjacent to the proposal study area near the Darling River and near the Murray River. A map of land use across the proposal study area has been included as Figure 4.6. Relevant areas are summarised in Table 4.3.

Table 4.3 Summary of land use in the proposal study area (Source: OEH (2013a)

LAND USE	AREA (HA)[1]	PROPORTION (%)[1]
2.1.0 Grazing native vegetation	13,000	89%
3.2.0 Grazing modified pastures	498	3%
3.3.0 Cropping	648	4%
4.4.0 & 4.6.0 Irrigated land	132	1%
5.4.0 Residential and farm infrastructure	39	0%
5.7.0 Transport and communication	84	1%
6.1.0 Lake	17	0%
6.3.0 River	85	1%
6.5.0 Marsh/wetland	35	0%
Other	12	0%
Total	**14,550**	**100%**

(1) Hectares and percentages have been rounded

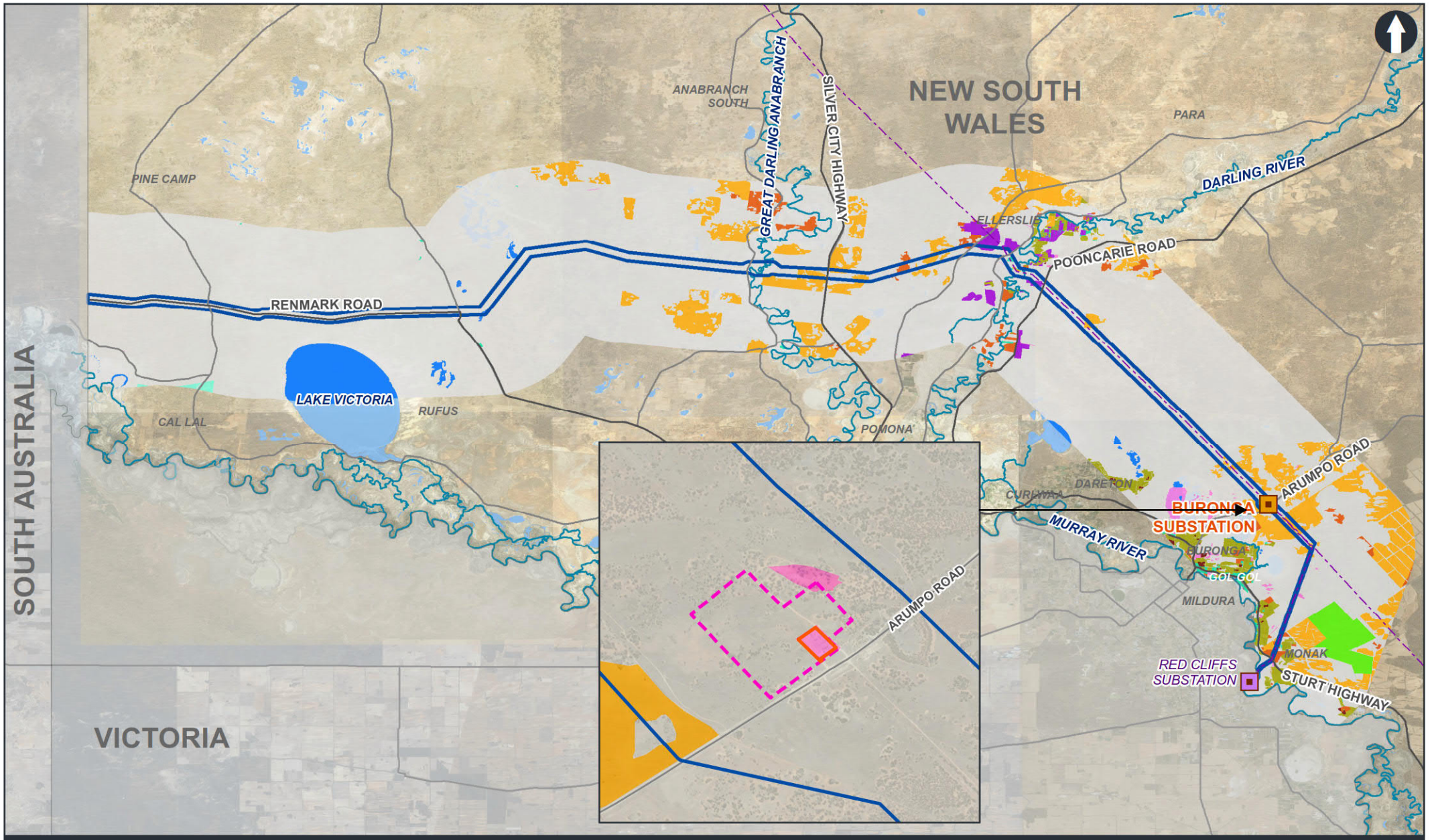

Figure 4.6

Land use within and surrounding the proposal study area (based on NSW Land Use Categories 2013)

4.5 ZONING

The proposal study area is zoned RU1 Primary Production under the Wentworth Local Environmental Plan 2011 (Wentworth LEP, 2011), apart from two small areas, being an area totalling approximately 40 hectares near the Darling River, and another area of 0.2 hectares near the Murray River. Both are zoned as E2 Environmental Conservation. The objectives of the RU1 zone are as follows:

- to encourage sustainable primary industry production by maintaining and enhancing the natural resource base
- to encourage diversity in primary industry enterprises and systems appropriate for the area
- to minimise the fragmentation and alienation of resource lands
- to minimise conflict between land uses within this zone and land uses within adjoining zones
- to ensure the protection of both mixed dryland and irrigation agricultural land uses that together form the distinctive rural character of Wentworth
- to ensure land is available for intensive plant agricultural activities
- to encourage diversity and promote employment opportunities related to primary industry enterprises, including those that require smaller holdings or are more intensive in nature.

4.6 DATABASE SEARCH OF POTENTIAL CURRENT AND FORMER CONTAMINANT SOURCES

A review of a database search of potential current and former contaminant sources in the vicinity of the site is presented in Table 4.4 below.

Table 4.4 Search of potential current and former contaminant sources

ITEM	DETAILS
List of NSW contaminated sites notified to EPA	A search of the NSW EPA contaminated land database, was conducted in July 2020 and it was revealed that there has been no record of written notices issued in the proposal study area, under the Contaminated Land Management Act 1997 (CLM Act). Additionally, lands within the proposal study area have not been notified to the EPA under the section 60 duty to report contaminated sites section of the CLM Act. Source: List of NSW contaminated sites notified to EPA, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/contaminated-land/notification-policy/contaminated-sites-list – Accessed July 2020.
Current NSW EPA licensed activities	There are no sites within the proposal study area that performs a licensed activity under the Protection of the Environment Operations (POEO) Act 1997. Source: POEO Public Register: Search for Licenses, New South Wales Environment Protection Authority https://apps.epa.nsw.gov.au/prpoeoapp/Detail.aspx – Accessed July 2020.
Clean Up Notices	There are no nearby sites that have a record of notice issued by the EPA under Section 55 of the Protection of the Environment Operations (POEO) Act 1997. Source: Contaminated Land: Records of Notice, New South Wales Environment Protection Authority http://app.epa.nsw.gov.au/prclmapp/searchregister.aspx – Accessed July 2020.

ITEM	DETAILS
Former licensed activities, now revoked or surrendered	There are no former licensed activities under the POEO Act, now revoked or surrendered in or nearby to the proposal study area. Source: Former Licensed Activities, New South Wales Environment Protection Agency https://apps.epa.nsw.gov.au/prpoeoapp/Detail.aspx – Accessed July 2020.
Delicensed activities still regulated by the NSW EPA	There are no nearby delicensed activities regulated by the EPA near the proposal study area site. Source: POEO Public Register: Delicensed Premises Search, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/licensing-and-regulation/public-registers/about-prpoeo/unlicensed-premises-epa-reg – Accessed July 2020.
Former gasworks	There are no nearby former gas works noted within the proposal study area. Source: Contaminated Land: Location of former gasworks sites, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/contaminated-land/other-contamination-issues/former-gasworks-sites/remediating-former-gasworks-sites – Accessed July 2020.
National waste management site data base	There no site on the National Waste Management Site Database within the proposal study area. Source: Waste Management Facilities, Australian Government Geoscience Australia https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search?node=srv#/metadata/a66ac3ca-5830-594b-e044-00144fdd4fa6 – Accessed July 2020.
NSW EPA PFAS investigation program	There are no nearby sites listed on the EPA PFAS investigation program within the proposal study area. Source: PFAS investigation program, New South Wales Environment Protection Authority https://www.epa.nsw.gov.au/your-environment/contaminated-land/pfas-investigation-program – Accessed July 2020.
UXO database review	The proposal study area crosses the Til Til (NSW) UXO area east of Pooncarie Road in which there is a slight occurrence of UXO reported. There are no other mapped UXO areas within the study area. Source: Department of Defence Unexploded Ordnance database, http://52.65.9.125/ – Accessed July 2020.
Cattle dips	No cattle dips were identified within the proposal study area. Source: Department of Primary Industries Cattle Dip Site Locator, https://www.dpi.nsw.gov.au/animals-and-livestock/beef-cattle/health-and-disease/parasitic-and-protozoal-diseases/ticks/cattle-dip-site-locator – Accessed July 2020.

4.7 HISTORICAL AERIAL PHOTOGRAPHY REVIEW

Available historical aerial photographs from (Douglas Partners, 2020e) were reviewed for the proposal study area. Land uses in the proposal study area don't appear to have significantly changed since the 1960s with minor exceptions, surrounding Buronga, and towards Red Cliffs. A review of aerial photography of the proposal study area did not identify any areas of potential historical filling or stockpiling as would be indicated by large embankments or scaring. There do not appear to be any areas within the majority of the disturbance area, which included any major earthworks, except for the agricultural land immediately north of Red Cliffs (which is located on the southern side of the Murray River in Victoria and outside the proposal study area).

4.8 PREVIOUS INVESTIGATIONS

This section provides a summary of previous environmental investigations undertaken within the site. The following reports have been reviewed for the proposal study area and are discussed further in the sections which follow:

- Report on Geotechnical Investigation, Project EnergyConnect, South Australia Border to Balranald, (Douglas Partners, 2020a).
- Acid Sulfate Soils and Naturally Occurring Asbestos Desktop Study, Project EnergyConnect, South Australian Border to Wagga Wagga, South Australia, (Douglas Partners, 2020b).
- Electrical Resistivity Testing for Earthing, Project EnergyConnect – Geotechnical Field Investigation, South Australian Border to Balranald NSW (Douglas Partners, 2020c).
- Report on Geotechnical Investigation, PEC – Proposed Buronga Substation Expansion, Arumpo Road, Buronga, (Douglas Partners, 2020d).
- Report on Preliminary Site Investigation for Contamination, Project EnergyConnect Proposed Buronga Substation, Expansion, Arumpo Road, Buronga, (Douglas Partners, 2020e).
- In Situ Virgin Excavated Natural Material Classification, Arumpo Road, Buronga, (Douglas Partners, 2020f).
- Report on High-Level Preliminary Site (Contamination) Investigation, Project EnergyConnect South Australia Border to Balranald, (Douglas Partners, 2020g).

4.8.1 DOUGLAS PARTNERS (2020A), REPORT ON GEOTECHNICAL INVESTIGATION, SOUTH AUSTRALIA BORDER TO BALRANALD

The Douglas Partners geotechnical investigation included 99 individual cone penetration tests (CPTs) and 25 individual boreholes at a total of 121 new transmission line tower locations along the proposed alignment. Laboratory testing was undertaken on select samples collected from the boreholes primarily for soil aggressivity and other geotechnical parameters. The information and laboratory analysis on soils for soil aggressivity can be used to make early conclusions as to the potential for soil salinity.

The fieldwork results indicate that the subsurface conditions vary along the proposed study area, particularly between the various geological formations through which the alignment is shown to pass. The results of the field investigation indicate that there is a general absence of a distinct “topsoil” layer along the alignment, the upper 300 mm of soil typically contained some roots or rootlets from the surface vegetation throughout the landscapes. Emerson Crumb tests were completed on a few select samples, with the results indicating that the surface soils have a moderate to high potential for dispersion. An assessment of soil aggressivity undertaken by (Douglas Partners, 2020a) with reference to AS2159-2009 indicated that the soils are highly alkaline, with high levels of sodicity.

Groundwater was observed during the investigation at 19 of the proposed transmission tower locations, encountered at depths between 2.8 and 12.5 metres below ground level. In many of the boreholes where groundwater was encountered, the water appeared to enter the borehole from confined aquifers possibly under pressure within ‘buried’ sand layers. Significant quantities of fill were not identified in any of the boreholes, or during the investigative works.

4.8.2 DOUGLAS PARTNERS (2020B), ACID SULFATE SOILS AND NATURALLY OCCURRING ASBESTOS DESKTOP STUDY, SOUTH AUSTRALIAN BORDER TO WAGGA WAGGA

The Douglas Partners investigation included the desktop review of available mapping and preparation of two map sets to assess the likelihood of encountering ASS or naturally occurring asbestos (NOA) along the proposed study area. The information presented in the report was sourced from the above referenced CSIRO mapping and indicated an extremely low to very low probability of occurrence for acid sulfate soils along the alignment. The mappings suggest that there are small areas of high probability of ASS; these mapped areas are at a lower elevation to the surrounding landscape, in places with a higher recurrence of water standing.

The NOA mapping presented in the Douglas Partners (2020b) report uses data from the New South Wales Naturally Occurring Asbestos Potential Map, which identifies areas of low, medium and high potential for NOA. These maps indicate that the entire alignment is not within an area mapped as likely to contain naturally occurring asbestos. Furthermore, the alignment is generally underlain by a deep soil profile. NOA is not likely to be encountered, as it is generally only found in ultramafic ('dark-coloured' igneous and meta-igneous) rocks such as those of the serpentine and amphibole group

4.8.3 DOUGLAS PARTNERS (2020C), ELECTRICAL RESISTIVITY TESTING FOR EARTHING, SOUTH AUSTRALIAN BORDER TO BALRANALD NSW

The Douglas Partners investigation primarily focused on soil geophysics and presented little to no contamination data. As part of the report, a series of 32 photographs of the site were included. Information pertaining to the potential for contamination and the site itself could be gained. The photographs confirmed assumptions made about the soil type from soil mapping, and the low potential for filling or gross contamination in the locations photographed.

4.8.4 DOUGLAS PARTNERS (2020D), GEOTECHNICAL INVESTIGATION, PEC – PROPOSED BURONGA SUBSTATION EXPANSION, ARUMPO ROAD, BURONGA

The Douglas Partners investigation included the drilling of 30 boreholes and the excavation of 14 test pits followed by laboratory testing on selected samples and engineering analysis. The borehole and test pit logs indicated relatively variable subsurface conditions underlying the site; the general subsurface profile primarily consisted of natural Clayey Sands and Sands. The geotechnical logs did not indicate any areas of filling. No free groundwater was observed during the drilling/excavation of the boreholes/test pits. Information indicated that much of the soil profile was mildly aggressive to steel. As such, it is assumed that soils affected by dryland salinity may be found in the vicinity of the Buronga Substation.

4.8.5 DOUGLAS PARTNERS (2020E), PRELIMINARY SITE INVESTIGATION FOR CONTAMINATION, PROJECT ENERGYCONNECT – PROPOSED BURONGA SUBSTATION EXPANSION, ARUMPO ROAD, BURONGA

The Douglas Partners investigation included the review of historical information, a site walkover inspection and a limited subsurface investigation with sampling and laboratory testing for the presence of a suite of potential contaminants. Samples were analysed for total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN), poly-cyclic aromatic hydrocarbons (PAHs), organo-chloride pesticides (OCP) and organo-phosphorous pesticides (OPP), polychlorinated biphenyls (PCBs), and phenols. The PSI indicated that prior to the development of the current substation between 1979 and 1990, the site was undeveloped and appeared to be open scrubland. After the construction of the substation, the site appears to have been largely unchanged. No buildings or structures, with the exception of the power line and existing substation, were noted. No chemical or fuel storage areas were noted, and no areas of stained or odorous soil were noted at the site. As the substation was constructed between 1979 and 1990, it was considered unlikely to contain polychlorinated biphenyls.

The results of the investigation indicated that the site is suitable for the proposed electricity substation expansion, from a contamination perspective and it is considered that the potential for contamination to be present at the site is low.

4.8.6 DOUGLAS PARTNERS (2020F), IN SITU VIRGIN EXCAVATED NATURAL MATERIAL (VENM) CLASSIFICATION ARUMPO ROAD, BURONGA

The site at Part Lot 2, DP1195524, Arumpo Road, Buronga is proposed to be developed as an extension to the existing Buronga Substation. This waste classification investigation collected 25 samples from a combination of test pits and boreholes that were analysed for TRH, BTEXN, PAHs, OCP/OPP, PCBs, phenols, and asbestos. The report concluded based on results from laboratory analysis that material appeared to be virgin material and was classified as VENM with reference to the VENM definition in the POEO Act and the EPA Waste Classification Guidelines (2017).

4.8.7 DOUGLAS PARTNERS (2020G), HIGH LEVEL PRELIMINARY SITE (CONTAMINATION) INVESTIGATION PROJECT ENERGYCONNECT SOUTH AUSTRALIA BORDER TO BALRANALD

Douglas Partners undertook a high-level preliminary site investigation for the portion of the EnergyConnect spanning from the SA Border to Balranald, which covered the proposal study area and parts of the eastern section of the NSW components of EnergyConnect (i.e. beyond the scope of this proposal). The investigation included a site walkover of the proposed study area, analysis of samples collected as part of the Douglas Partners (2020a) geotechnical investigation. It reported that the surrounding land use is generally cleared agricultural land and areas of more dense vegetation, rivers, lakes and water reservoirs. Douglas Partners concluded that there were no notices of contaminated land or licenses along the proposed study area and there appears to be little historical activity which could potentially contaminate the site. Historical activity is likely limited to land clearing, agricultural practices and the development of associated residential dwellings, task-specific structures, roads and the transmission line. The site walkover indicated that there was a section of existing transmission towers which potentially contain asbestos coatings with labelled warnings of asbestos (yellow labels) confirming this; these towers were observed between CPT-4-86 and BH-4-81 and just south-east of Buronga substation (possible Lush or Linklater property). There were no apparent visual or olfactory impacts (e.g. staining or odours) to suggest the presence of contamination within the fill soils or groundwater observed in the investigation. Analysis of the soil samples reported concentrations of contaminants were below the adopted site assessment criteria within this proposal scope.

4.9 AREAS OF CONTAMINATION CONCERN

Table 4.5 provides an overview of the areas of contamination concern, and the associated contaminants of concern at these sites, located within the proposal study area. The identification of areas of contamination concern is based on existing land uses and the potential for contamination to occur. Figure 4.7 shows the locations of these areas of interest.

Table 4.5 Identified areas of contamination concern within the proposal study area

AREAS OF CONTAMINATION CONCERN AND RATIONALE FOR CONCERN		CONFIRMED LOCATION (BASED ON AERIAL IMAGERY)	SENSITIVE RECEIVER	POTENTIAL CONTAMINANTS OF CONCERN
Buronga substation	Spills from maintenance activities on-site and leaks	34.103°S, 142.259°E	— Recreational users of Lake Gol Gol — Flora/fauna of Lake Gol Gol — Terrestrial flora/fauna	— Poly chlorinated biphenyls (PCBs) — Benzene, toluene, ethylbenzene, xylene and naphthalene (collectively referred to as BTEXN) — Total recoverable hydrocarbons (TRH)
Ellerslie Substation near Wentworth (off Pooncarie Road)	Spills from maintenance activities on-site and leaks	33.869°S, 142.021°E	— Off-site agricultural users on adjacent farming land — Terrestrial flora/fauna	— PCBs — BTEXN — TRH
Existing transmission line infrastructure	Spills from maintenance activities on site, Asbestos paints on tower infrastructure	Portions of the proposal study area	— Terrestrial flora/fauna — Surface water features	— BTEXN — TRH — Asbestos
Built-up areas and residences	Historical uncontrolled earthworks and building structures previously demolished/ degraded	33.854°S, 141.991°E	— Current residential site users — Terrestrial flora/fauna — Surface waters of the Darling River	— Heavy metals — BTEX — Asbestos — PAH — Pesticides — TRH
Cleared improved agricultural land (including cropping and irrigated land)	Historical use of pesticides, and foliants, large scale land use and the use of heavy machinery.	— near 34.259°S, 142.283°E — near 33.866°S, 142.016°E — near 33.832°S,141.956°E	— Current agricultural site users — Terrestrial flora/fauna	— Heavy metals — Organochlorine pesticides (OCP) — Organophosphorus pesticides (OPP)

AREAS OF CONTAMINATION CONCERN AND RATIONALE FOR CONCERN		CONFIRMED LOCATION (BASED ON AERIAL IMAGERY)	SENSITIVE RECEIVER	POTENTIAL CONTAMINANTS OF CONCERN
Farm dams	Areas of potential contaminant sediment build-up	— 34.259°S, 142.283°E — 33.853°S, 141.866°E — 33.831°S, 141.510°E — 33.883°S, 141.036°E		— Heavy metals — OCP — OPP — Nutrients
Potential quarry	Areas of potential fill	— 33.883°S, 141.440°E	— Adjacent residents — Terrestrial flora/fauna — Surface water	— Heavy metals — BTEX — PAH — TRH

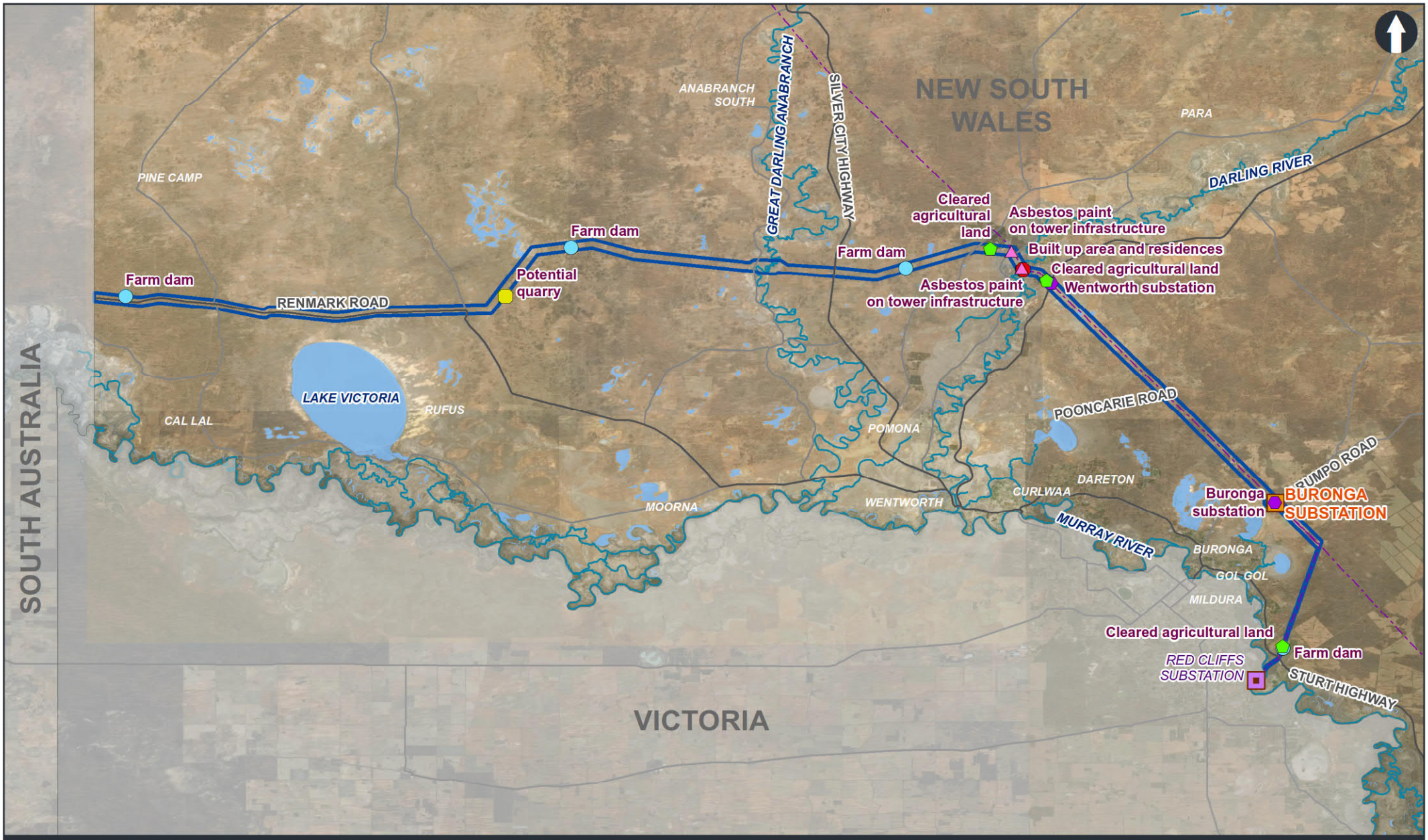

Figure 4.7

Areas of contamination concern

Source: NSWSS, ESRI, Transgrid, WSP

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5 ASSESSMENT OF CONSTRUCTION IMPACTS

5.1 POTENTIAL TO ENCOUNTER CONTAMINATION

Information reviewed during the desktop assessment has identified that greater than 90% of the proposal study area is undisturbed native vegetation with minimal areas of contamination concern identified.

A number of potentially contaminating activities that have been identified within the proposal study area are presented in Table 4.3 with the associated area of contamination concern illustrated in Figure 4.7. A previous investigation report has been reviewed for the Buronga substation (Douglas Partners 2020e) which included limited soil testing. Douglas Partners concluded that the Buronga substation site is suitable for the proposed electricity substation expansion.

If inadequately managed, disturbance of contaminated areas has the potential to:

- mobilise contaminants, affecting nearby 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, with the potential to impact on receiving environments, such as Lake Victoria, the Darling River, the Great Darling Anabranch and the Murray River, and the surrounding community
- increase the risk of exposure to contaminants (direct contact and/or inhalation) by site workers, visitors and the local community.

Soil contamination could also be encountered during construction work at locations not previously identified as areas of potential concern. An unexpected contamination finds procedure would need to be developed as part of the construction environmental management plan (CEMP).

The risk of disturbing or encountering contaminated material during construction varies depending on the extent and type of contamination and the work undertaken. Based on available information, and experience, a risk rating has been assigned to each land use and activity based on the potential for that use or activity to cause contamination; this information is presented in Table 5.1.

Table 5.1 Preliminary risk ranking

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
Farm dams	Excavation activities	As dams are replenished by rainfall, there is a potential for run-off carrying soil fertilisers, animal dung, pesticides and other pollutants to impact on water quality and sediment quality within the dam. If not managed appropriately, disturbance of sediments within the farm dam could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — surface water run-off and discharge into receiving environment.	Medium potential for contaminant build-up within the dam sediments; however, it is unlikely that the dam sediments would need to be disturbed during construction.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low
	Pile construction and de-watering	As dams are replenished by rainfall, there is a potential for run-off carrying soil fertilisers, animal dung, pesticides and other pollutants to impact on water quality and sediment quality within the dam. If not managed appropriately, construction de-watering activities have the potential to draw-down surface water from within the farm dam, which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — incidental discharge into receiving environment.	Unlikely that dam water would be disturbed during construction.	Potential exposure pathway (unknown if dam water is in continuity with groundwater)	Low

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
Cleared improved agricultural land (including cropping and irrigated land)	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Common contaminants of concern associated with agricultural activity include pesticides, herbicides, nutrients and heavy metals. If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment.	Medium potential for agricultural contaminants to be present.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Medium
	Pile construction and de-watering	Common contaminants of concern associated with agricultural activity include pesticides, herbicides, nutrients and heavy metals. If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — incidental discharge into receiving environment.	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
Ellerslie Substation near Wentworth (off Pooncarie Road)	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Common contaminants of concern associated with electrical substations include PCBs and hydrocarbons. If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment.	Medium potential for contaminants to be present.	Exposure pathway incomplete (The substation is not proposed to be disturbed during construction).	Low
	Pile construction and de-watering	Common contaminants of concern associated with electrical substations include PCBs and hydrocarbons. If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — incidental discharge into receiving environment.	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
Buronga substation	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Common contaminants of concern associated with electrical substations include PCBs and hydrocarbons. Douglas Partners (2020e) report did not identify any contaminant concentrations above the adopted assessment criteria within soil samples analysed. If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment.	Low potential for contaminants to be present.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low
	Pile construction and de-watering	Common contaminants of concern associated with electrical substations include PCBs and hydrocarbons. If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — incidental discharge into receiving environment.	Groundwater depth anticipated to be >5mbgl. Low likelihood for groundwater contamination	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
Existing transmission line infrastructure	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Common contaminants of concern associated with maintenance activity surrounding powerlines include pesticides, herbicides, and hydrocarbons. If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers — surface water run-off and discharge into receiving environment.	Low potential for contaminants to be present.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low
	Pile construction and de-watering	Common contaminants of concern associated with maintenance activity surrounding powerlines include pesticides, herbicides, and hydrocarbons. If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — incidental discharge into receiving environment.	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
Built-up areas and residences	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Potential contaminants of concern associated with residential areas and areas surrounding dwellings/homesteads include hydrocarbons, heavy metals, pesticides and asbestos impacted fill material. No significant filling is evident from aerial photographs. If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — direct contact, ingestion and inhalation by residential users — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers/residential users of the site — surface water run-off and discharge into receiving environment.	Low potential for widespread contaminants to be present.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
	Pile construction and de-watering	Common contaminants of concern associated with residential areas and areas surrounding dwellings/homesteads include hydrocarbons, heavy metals and asbestos impacted fill material. If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers and residential users — incidental discharge into receiving environment.	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low
Potential Quarry	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Potential contaminants of concern associated with quarry activities include hydrocarbons and heavy metals. If not managed appropriately, disturbance of contaminated soil could result in the following exposure scenarios which have the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers — direct contact, ingestion and inhalation by residential users — off-site transport of contaminants via vehicle/plant movements — risk of dust exposure to construction workers/residential users of the site — surface water run-off and discharge into receiving environment.	Low potential for widespread contaminants to be present.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Medium

AREA OF INTEREST	CONSTRUCTION ACTIVITY	CONSTRUCTION IMPACT	LIKELIHOOD	CONSEQUENCE	PRELIMINARY RISK EVALUATION
	Pile construction and de-watering	Potential contaminants of concern associated with quarry activities include hydrocarbons, heavy metals, pesticides which may leach into the groundwater table. If not managed appropriately, construction de-watering activities have the potential to encounter contaminated groundwater which has the potential to impact on human health and/or the environment: — direct contact, ingestion and inhalation by construction workers and residential users — incidental discharge into receiving environment.	Groundwater depth anticipated to be >5 mbgl. Low likelihood for groundwater contamination.	Exposure pathway complete during construction (without the implementation of appropriate controls).	Low/Medium

5.2 POTENTIAL IMPACTS TO THE PROPOSAL FROM CONTAMINATION

5.2.1 NATURALLY OCCURRING ASBESTOS

Based on the information reviewed in Section 4.2.5, there is no known or expected naturally occurring asbestos minerals or serpentine and amphibole occurrence within the proposal study area. Therefore, no naturally occurring asbestos impacts are expected in relation to the construction of the proposal.

5.2.2 SOIL CONTAMINATION

Construction activities, including excavation activities, vegetation clearing, vehicle movement and utility works, would disturb the soil. This could result in the exposure of sensitive receivers to contaminated soils, which could lead to ecological or human health impacts, if not properly managed. To assess the potential for contamination impacts during construction of the proposal, a contamination assessment has been performed in accordance with guidelines made or approved under the CLM Act. The outcomes of the qualitative risk ranking completed are presented in Table 5.1. The majority of the areas of environmental concern were evaluated to pose a low risk during construction, with areas of cleared agricultural land and a potential quarry assigned a medium risk. It is noted that the risk rankings in Table 5.1 are prior to the implementation of the recommended management measures identified in Section 8.

The potential risk associated with unexpected contamination finds (including potential uncontrolled filling) have not been assessed as this would be managed in accordance with an unexpected contaminated finds protocol (refer to Appendix A).

Following the implementation of recommended management measures, it is anticipated that the identified medium risk rankings would ultimately present a low risk of exposure and would be effectively managed through controls in place in the CEMP and unexpected finds protocol.

5.2.3 GROUNDWATER CONTAMINATION

Based on the findings of the contamination and groundwater investigations, groundwater from identified areas of environmental concern poses a low risk to the environment with regard to the construction of the proposal. This is because the volumes of groundwater expected to interact with proposal infrastructure features during project construction would be negligible or are not expected to require management.

If during construction, volumes of groundwater are encountered which may require management and potential disposal associated with de-watering activities, further investigations would need to be carried out to confirm the contaminant levels within the groundwater, potential volumes that may need to be managed and measures for appropriate management.

Releases of groundwater off-site into the surrounding environments would be managed through the CEMP to protect the surrounding surface and groundwater environments.

5.3 IMPACTS TO THE SOIL ENVIRONMENT FROM CONSTRUCTION ACTIVITIES

Storage and laydown areas would be used to store construction materials, plant and equipment and recovered waste and recycling materials. Hazardous and dangerous goods storage would include petroleum, diesel, liquefied natural gas (LPG), herbicide, pesticide and mineral oils that would be secured in purpose-built bunded and secure areas. The potential impact resulting from construction storage and waste management is exposure of the surrounding soil and water environments to contamination from spills and leaks from plant and equipment during standard operations or incidents.

With appropriate and relatively standard construction controls in place as part of the CEMP, the risks from these activities would be minimised.

5.3.1 ACID SULFATE SOILS AND ACID ROCK

Based on the information reviewed in Section 4.2.4, there is a low probability of encountering acid sulfate soils within most of the proposal study area with the exception of low lying areas surrounding former lakes and river beds, which are mapped as having a high probability of acid sulfate soil occurrence. Areas of potential acid sulfate soils or actual acid sulfate soils should be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998). Should avoidance of low lying and waterlogged areas be unavoidable a preliminary assessment as per Figure 2.1 should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils.

5.3.2 SALINITY

Development of bushland for alternative land use can change the movement of surface, and groundwater, resulting in a change in the way salts and other minerals interact. When the water table rises close to the surface, it carries dissolved salts that are typically locked in the soil and rock profile to the surface.

The current hydrogeological model is not anticipated to alter significantly during the proposal, given the limited scale of the proposed construction activity. As such, no significant impact on soil salinity is anticipated from the proposal. The localised impact would be managed by preventing re-use of excavated saline soils in low salinity areas.

Salinity has the potential to damage foundations of infrastructure, make soils unsuitable for re-use as fill, preclude vegetation growth and may affect landscaping. Saline soil and water have the potential to damage concrete and metal structures, including piers and transmission line structure foundations. Given the presence of moderate to high risk of saline soils throughout the proposal study area, there is the potential to impact on structures associated with the proposal. Construction materials that can provide a resistance to saline conditions should be selected (where practicable) in areas of high-risk salinity soils.

Construction within areas of moderate to high-risk saline soils would be managed under a CEMP and should be carried out in accordance with the NSW Department of Primary Industries (2014) Salinity Training Handbook.

5.3.3 SOIL EROSION AND SEDIMENT TRANSPORTATION

The highest potential for soil erosion would be associated with the disturbance of soils on existing slopes during construction. Given the terrain of the construction, the footprint is predominantly flat; however, it includes rolling hills to alluvial floodplains. As soil disturbance could occur across the length of the permanent works footprint, soil erosion and the associated sediment transportation is a hazard that could occur as a result of the construction of the proposal. The Douglas Partners 2000a geotechnical report indicates that surface soils have a moderate to high potential for dispersion. Off-site transportation of sediments and soils could transport contaminated soils (if present) to sensitive receivers which may cause the contamination of surface water bodies.

6 ASSESSMENT OF OPERATIONAL IMPACTS

6.1 IMPACTS FROM EXISTING POTENTIAL SOURCES OF CONTAMINATION TO THE ENVIRONMENT AND EXPOSURE TO USERS

The operation of the proposal should not result in exposure to the surrounding environment and users (e.g. maintenance workers or farmers) to potentially contaminated soil or groundwater. Soil disturbance activities would not be part of the general maintenance activities as the infrastructure components would all be above ground.

During the operation of the proposal, groundwater levels could be impacted through changing the natural pervious land surface into impermeable layers such as concrete pavement, that can reduce infiltration of rainfall and surface water recharge to the underlying aquifer. The proposed impervious areas are small relative to the local catchment area and the net impact on regional recharge and groundwater levels is low.

No groundwater take is required during the operation of the proposal.

6.2 IMPACTS TO THE ENVIRONMENT FROM PROPOSAL ACTIVITIES

The operational impact related to the proposal would be potential hydrocarbon (fuels, diesel, oils) contamination of soil, surface water and groundwater arising from incidents involving vehicle accidents, leaks and spills in the transmission line easement or at the Buronga substation site. Spill volumes from such incidents would be 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 the Buronga substation. Furthermore, it is expected that the operator will implement and develop incident response procedures to manage the risk from these occurrences.

7 CUMULATIVE IMPACT

Cumulative impact assessment means the consideration of other nearby development projects along with the proposal. Projects with the potential for cumulative impacts with the proposal were identified through a review of publicly available information and environmental impact assessments from the following databases:

- NSW Major Projects website (NSW Government, searched June 2020)
- Wentworth Shire Council website (Wentworth Shire Council, searched June 2020)
- Australian Government – Department of Environment and Energy, EPBC Public notices list (Australian Government, searched June 2020).

Three proposed developments have been identified, and these include:

- Copi Mineral Sands Mine
- Buronga Solar Farm; and
- Buronga – Gol Gol residential expansion.

7.1 COPI MINERAL SANDS MINE

The Copi Mineral Sands development, located around 25 kilometres north of the proposed alignment, involves an open cut mineral sands mine and associated infrastructure to extract and process up to 1.5 million tonnes per annum (Mtpa) for up to six years, transporting the heavy mineral concentrate via road for off-site processing; and progressively rehabilitating the site.

This development is in the early stages of planning but the impacts of the project will largely be isolated from the proposal. The proposal contamination impacts during construction and operational phases are expected to be relatively localised to the proposal disturbance areas and therefore cumulative impacts are not expected.

7.2 BURONGA SOLAR FARM

The Buronga Solar Farm development included a 400 MW solar farm with energy storage and associated infrastructure located adjacent to the proposal Buronga substation.

The proposal contamination impacts during construction and operational phases are expected to be relatively localised to the proposal disturbance areas, and therefore cumulative impacts are not expected. No operational cumulative impacts would be expected.

7.3 BURONGA – GOL GOL RESIDENTIAL EXPANSION

Wentworth Shire Council are planning new subdivisions to provide approximately 500 new large residential housing allotments in the Buronga – Gol Gol growth area, approximately 10 kilometres to the west of the proposal study area.

The proposal contamination impacts during construction and operational phases are expected to be relatively localised to the proposal disturbance areas, and therefore cumulative impacts are not expected. No operational cumulative impacts would be expected.

No operational cumulative impacts would be expected.

7.4 SUMMARY

With appropriate measures in place for all developments during construction, no substantial cumulative impacts would be expected. No cumulative operational impacts would be expected.

8 MITIGATION MEASURES

The proposal is anticipated to have a limited impact to contamination, which will be further reduced with the implementation of mitigation measures outlined within the CEMP and the soil and water management sub-plan.

The mitigation measures would be implemented and monitored for their effectiveness during construction. Typical provisions within the CEMP would include:

- erosion and sediment controls – these would be developed in consideration of guidance in relevant volumes of the Managing Urban Stormwater: Soils and Construction Volume 1 Landcom, 2004 (Blue Book), section 3.2.13
- stockpile management procedures for segregating soil and preventing cross-contamination of clean soil with contaminated soil
- management of surface water – including at excavation sites with the aim of diverting water around the sites
- materials (i.e. spoil) tracking and records.

Table 8.1 provides the mitigation measures which would be implemented for the proposal.

Table 8.1 Mitigation measures

ID	IDENTIFIED MITIGATION MEASURE	TIMING	APPLICABLE LOCATION(S)
CL-1	Locations of transmission line structure foundations, and ancillary construction sites will be positioned to avoid disturbance to any known farm dams where practical.	Detailed design and pre-construction	Transmission line
CL-2	Existing areas of waterlogging and poor drainage will be avoided, where possible, with regard to access tracks and permanent structures.	Detailed design	Locations mapped as moderate to high-risk salinity.
CL-3	Disturbance to areas of medium risk of contamination will be avoided or minimised where practicable during construction. This includes the position of transmission tower foundations and ancillary construction sites. Areas of medium risk of contamination that would be disturbed by construction activities will be further investigated including completion of a site inspection. Where considered to be required, a Phase 2 investigation will be completed in accordance with NEPM 2013. Mitigation measures identified through further investigation would be implemented for the proposal.	Detailed design and pre-construction	Locations mapped as medium risk for contamination
CL-4	Construction materials will be selected to withstand high saline soil and groundwater environment (where applicable).	Detailed design and pre-construction	Locations mapped as moderate to high-risk salinity
CL-5	Existing areas of waterlogging and poor drainage will be avoided, where possible, with regard to access tracks and permanent structures.	Detailed design	Locations mapped as moderate to high-risk salinity

ID	IDENTIFIED MITIGATION MEASURE	TIMING	APPLICABLE LOCATION(S)
CL-6	Prior to ground disturbance in areas of potential acid sulfate soil occurrence (e.g. in low lying areas surrounding former or current lakes and river beds), testing would be carried out to determine the presence of actual and/or potential acid sulfate soils. If acid sulfate soils are encountered, they will be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC, 1998) and TransGrid's HSE Guideline.	Pre-construction and construction	Locations mapped as containing potential acid sulfate soils
CL-7	Prior to ground disturbance, a visual inspection would 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 would be managed in accordance with Book 4 Dryland Salinity: Productive use of Saline Land and Water (NSW DECC 2008) to prevent impacts from salinity. Erosion controls will be implemented in accordance with Blue Book (Landcom, 2004).	Pre-construction and construction	All locations
CL-8	The discovery of previously unidentified contaminated material will be managed in accordance with a contamination unexpected finds protocol.	Construction	All locations
CL-9	Construction materials, spoil and waste will be suitably stored to minimise the potential for soil, groundwater or water quality impacts.	Construction	All locations
CL-10	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. The capacity of any bunded area shall be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s shall be shown on site plans.	Construction	All locations
CL-11	Emergency spill procedures will be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities in accordance with the TransGrid's HSE Guideline. Environmental spill kits will be provided at strategic, accessible locations, and staff will be trained in spill response procedures.	Operation	All
CL-12	All chemicals or other hazardous substances at the Buronga substation will be stored in bunded and weatherproof facilities away from drainage lines, and in accordance with supplier's instructions and relevant legislation, Australian Standards and applicable guidelines. The capacity of the bunded area will be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on site plans.	Operation	Buronga substation

9 CONCLUSION

This report assesses the impacts of potential contamination during construction and operation of the proposal. The assessment has included a desktop review of available information and databases, and consolidation of the data to identify potential areas of interest and concern. This assessment is adequate to assess typical environmental impacts and provide recommendations for mitigation measures. Recommendations would be subject to refinement as the proposal progresses through the detailed design stage and validation is undertaken during construction.

Based on the results reported herein, the information suggests that the disturbance area did not appear to be affected by broad-scale contamination, and the risk of soil contamination is generally low. Greater than 90% of the disturbance area is undisturbed native vegetation with minimal areas of contamination concern identified. Furthermore, given the expected depth to groundwater, and the absence of an identified groundwater contamination source and potential contaminants in soil, the potential for significant groundwater contamination beneath the site is also considered to be low.

Minimal potential contamination sources were identified both on-site and in the vicinity of the proposal study area, and where identified are limited to the Buronga and Ellerslie substation, existing transmission infrastructure, residential properties, cleared agricultural land, farm dams, and a potential quarry located east of the SA border. The majority of these areas of contamination concern have been assessed to pose a low risk during construction, with areas of cleared agricultural land and a potential quarry assigned a medium risk. The Ellerslie substation is not owned by TransGrid and no works will occur at this location. While dryland salinity has been identified as posing a potential issue to the construction and management of the proposal; these are not expected to result in a high risk to the proposal. The probability of encountering acid sulfate soils within most of the proposal study area is low with the exception of low lying areas surrounding former lakes and river beds, which are mapped as having a high probability of acid sulfate soil occurrence. Potential naturally occurring asbestos hazards were not identified based on available risk mapping, and geotechnical data.

Mitigation measures, as detailed in this report, would ameliorate or minimise any expected impacts to generally acceptable levels. Additional investigation is recommended following detail design to target proposed disturbance within areas of cleared agricultural land or the potential quarry (if applicable). Mitigation measures are detailed in Section 8. The remaining residual risks are considered low and would be managed by a CEMP. Should unexpected contamination be identified during the site works appropriate management, and remediation options would need to be identified through the unexpected contamination finds protocol (Appendix A).

10 LIMITATIONS

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APPENDIX A

UNEXPECTED FINDS PROTOCOL

A1 UNEXPECTED FINDS PROTOCOL

The following document details protocols regarding what must be done if potentially contaminated or hazardous materials are unexpectedly encountered during construction activities

A1.1 WHAT IS AN UNEXPECTED FIND AND WHERE COULD IT BE?

An unexpected find is likely to comprise of any buried material which is not a typical soil material (i.e. fill, soil, rock) or waters which are suspected of being contaminated or Potential Asbestos Containing Materials are encountered during development works. There could be many kinds of unexpected materials that could be encountered during excavation works including (but not limited to):

- buried wastes
- buried containers/drums
- discoloured and odorous soils and groundwater/seepage
- underground tanks
- munitions/unexploded ordnance (UXO)
- asbestos (the management of unexpected asbestos finds is presented as a separate protocol).

These unexpected finds are likely to be associated with poor waste disposal or construction activities.

A1.2 WHERE IS THERE A RISK OF ENCOUNTERING AN UNEXPECTED FIND?

The higher risk activities for encountering unexpected finds during construction activities are considered to be excavation works.

Higher risk areas for encountering unexpected finds during construction activities are considered to be:

- areas within and immediately adjacent to current or historical refuelling facilities, mechanical and industrial operations and historical airport operations.

A1.3 WHAT TO DO IF AN UNEXPECTED FIND IS ENCOUNTERED?

Cease any further excavation or ground disturbance, in the area of the find(s).

The discoverer of the find(s) will notify machinery operators in the immediate vicinity of the find(s) so that work can be temporarily halted.

The site supervisor and the Principal will be informed of the find(s).

Do not remove or unnecessarily disturb the area of the find(s).

Ensure that the area of the find(s) is adequately marked as a no-go area for machinery or further disturbance and that the potential for accidental impact is avoided.

Note the location and nature of the finds, and report the find to:

- TransGrid Person – XXX
- Environmental Consultant – XXX.

Where feasible, ensure that any excavation remains open so that the finds can be recorded and verified. Excavation may be backfilled if this is necessary to comply with work safety requirements. An excavation that remains open should only be left unattended if it is safe and adequate protective fencing is installed around it.

Following consultation with the *environmental consultant*, and, where advised, any other relevant stakeholder groups, the significance of the finds should be assessed, and an appropriate management strategy followed. Depending on project resources and the nature of the find(s), this process may require input from external consultants.

Development works in the area of the find(s) may re-commence, if and when outlined by the management strategy, developed in consultation with, and approved by the relevant environmental advisor.

For munitions and UXO, a project representative will need to contact the local police to organise attendance and disposal of munitions/UXO by Defence personnel.

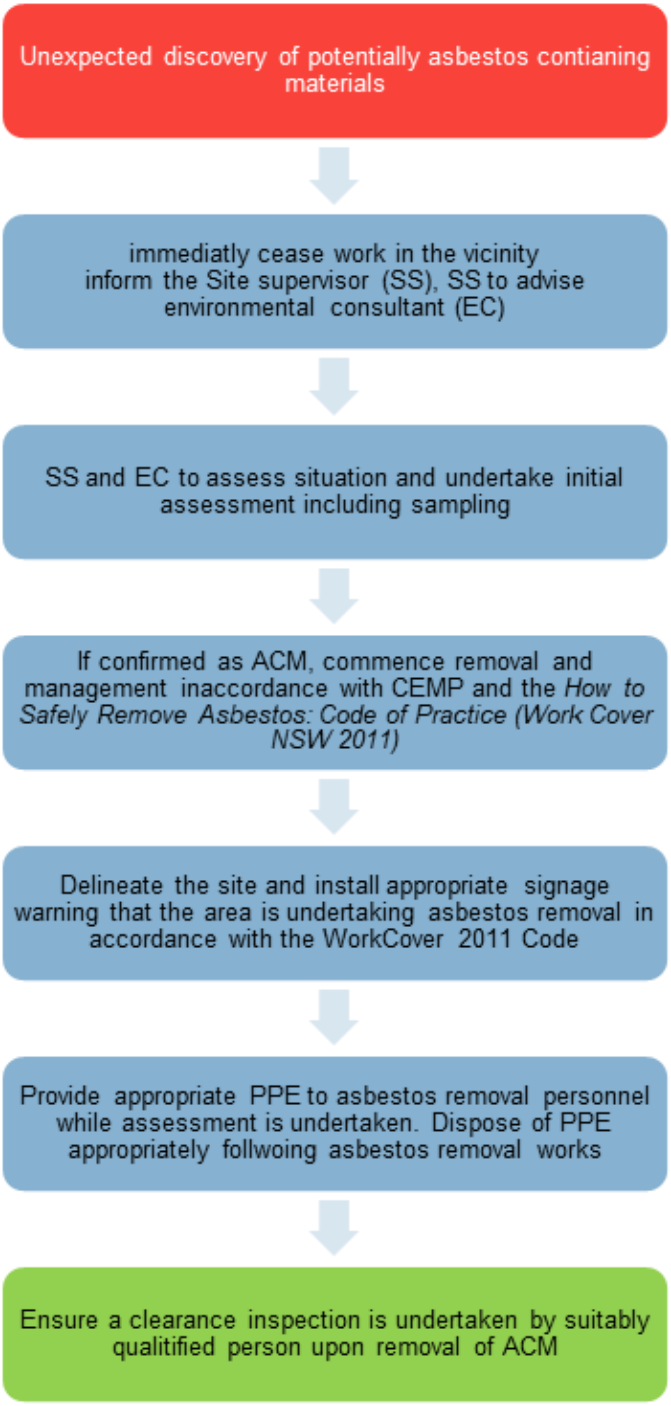
A flow chart demonstrating the requirements for managing unexpected finds is provided below .

A1.4 LEGISLATIVE, STANDARDS AND CODES OF PRACTISE

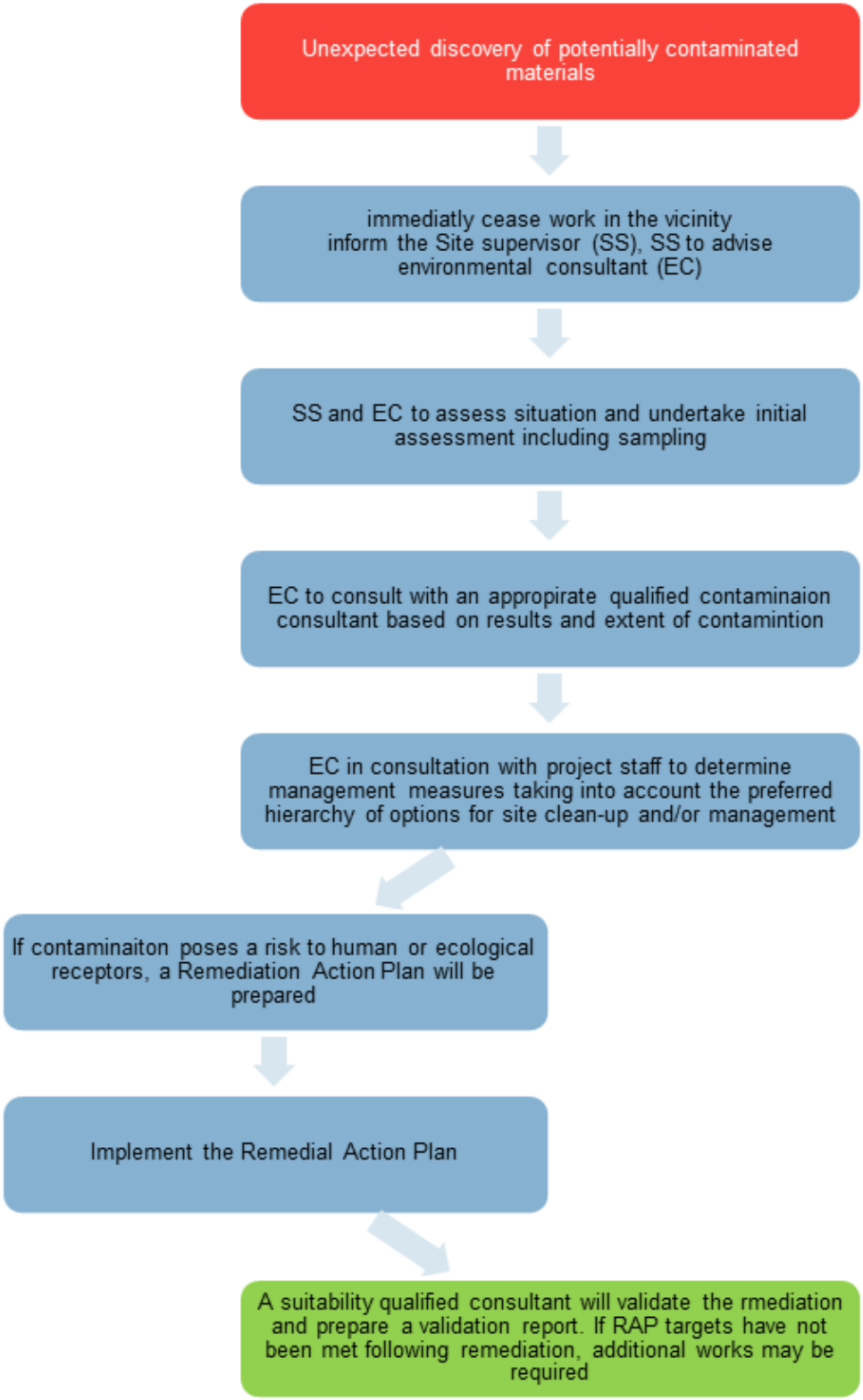
These protocols have been developed to ensure adherence to relevant legislative, standards and codes of practices.

- Occupational Health and Safety Act 2000 and associated regulations
- Contaminated Land Management Act 1997.

A1.5 POTENTIAL ASBESTOS CONTAINING MATERIALS



A1.6 POTENTIAL CONTAMINATION



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