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TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit

CONSTRUCTION SOIL AND WATER MANAGEMENT PLAN

(CSWMP)

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Abbreviations and acronyms

Abbreviation/ Acronym	Expanded term
AMP	Asbestos Management Plan
ASSMP	Acid Sulfate Soils Management Plan
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DPIE	Department of Planning, Industry and Environment
ESCMP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Mitigation Strategy
GMS	Groundwater Management Strategy
OOHW Protocol	Out-of-hours work Protocol
PSF	Powering Sydney's Future
SSLGMP	Site Specific Landfill and Gas Management Plan
SWMP	Surface Water Management Plan
TCP	Traffic Controls Plans
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure

1 Introduction

1.1 Context

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill at Potts Hill and the Beaconsfield West substation Alexandria.

The NSW Department of Planning, Industry and Environment (DPIE) has assessed the State Significant Infrastructure (SSI-8583) and has granted Infrastructure Approval on 14 May 2020 in accordance with Section 5.19 of the Environmental Planning and Assessment Act 1979 (EP&A Act).

The purpose of this Construction Soil and Water Management Plan (CSWMP) is to address:

- the requirements of the Minister's Conditions of Approval (CoA) for SSI-8583
- the Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) as documented in the Amendments Report;
- applicable environmental legislation; and
- applicable contract requirements.

1.2 Scope and objectives of the CSWMP

This Construction Soil and Water Management Plan (CSWMP) describes how TransGrid and its contractors will manage potential environmental impacts on surface and groundwater during construction of the Project. This plan is applicable to all aspects of the project. Specifically, this Sub-plan addresses environmental aspects and impacts that relate to soil and water. This includes:

- Erosion and sediment control
- Surface Water Management
    - Surface water quality
    - Surface water quantity
    - Potential watercourse impacts
    - Potential flooding impacts.
- Groundwater Management
- Acid sulfate soil management
- Contamination land management
    - Site-specific landfill gas management
- Asbestos management
- Unexpected contamination and asbestos finds.

TransGrid and its contractors will manage soil and water quality impacts in accordance with best practice and legal requirements (including environmental mitigation measures, controls, monitoring and reporting) during the construction of the transmission line.

To achieve this objective, the following will be undertaken:

- Ensure appropriate measures are implemented to address the applicable Conditions of Approval (CoA, E12-E14) and Environmental Management Mitigation Measures (EMMM) (Section 2.3 & 2.4);

- Minimise the extent and duration of exposed surfaces (particularly those works that have the greatest potential to be contaminated, Acid Sulfate Soil or high erosion and runoff hazard);
- Develop, establish and maintain surface and ground water quality control measures prior to construction, including erosion and sedimentation controls in accordance with Managing Urban Stormwater: Soils and Construction (Landcom 2004);
- Investigate and, where possible, reuse excavated materials as fill and/or dispose off-site in accordance with EPA's Waste Classification Guidelines (EPA, 2014);
- Apply an Unexpected Protocol where contaminated lands, not previously identified, are detected and works in these areas managed to minimise risk and achieve a require level of removal and/or remediation.
- To the available extent, pre-classified materials to enable directly off-site disposal into haulage trucks for transportation to waste facility licensed to accept the material; Notwithstanding the above objective and as a support measure, develop procedures for the assessment, handling and stockpiling of potentially contaminated materials, in accordance with the EPA's Waste Classification Guidelines (EPA 2014);
- Manage off-site release of water runoff, in compliance with the requirements for Surface and ground water disposal as permitted (CoA E13 and E14);
- No proposed extraction of groundwater for construction use to ensure no impact on potable water supplies, groundwater dependant ecosystems, licenced abstractions or overlying soils; and
  Ensure training on best practice soil and water management is provided to all construction personnel through site inductions and targeted training programs where required.

This Sub-plan is applicable to all activities during construction of the Project, including all areas where physical works will occur or areas that may be otherwise impacted by the construction works, and under the control of the TransGrid and its contractors. All staff and sub-contractors are required to operate under the requirements of this Sub-plan and related environmental management plans, over the duration of the construction program.

1.3 Changes since the Project EIS

The following changes have been implemented since the Environmental Impact Statement (EIS) was completed.

- Trench width reduced to 1.6m wide, where possible.
- Additional locations have been included for underboring works, which has reduced waste compared to open trenching.

The EIS included a number of potential route options and other project alternatives. Further detailed design and assessment has been undertaken for the final route only, consistent with the Amendment Report and Conditions of Approval. The following changes documented in the EIS and Conditions of Approval are considered in this CSWMP.

- Construction and operation of the cable bridge (special crossing) required to cross the Cooks River is has been replaced with an underbore from the cul-de-sac at the end of Lindsay Street into Lees Park before the cable route continues on to Harmony Street, Ashbury.

- The proposed construction laydown area at Cooke Park in Belfield, within the Strathfield Local Government Area (LGA), as it is no longer required to support construction of the project.
- There are some changes to locations of open trenching and underboring, however the alignment has been maintained.

Further detailed design as described in the Amendment Report confirms that the crossing of the Cooks River will be undertaken via underboring therefore construction of the cable bridge at Cooks River no longer has potential flooding impacts.

Modelling has been completed for areas with potential to alter surface flows.

As outlined in Chapter 4 Project description of the EIS, the project description and associated assessment presented in the EIS was based on an initial concept design. As the project design developed the initial concept design was subject to refinement, subsequent to the EIS being exhibited TransGrid proposed a number of refinements to the project. These are described in the Amendment Report and summarised below.

1.4 Project environmental management system overview

The Project Environmental Management System (EMS) is described in Figure 1-1.

To achieve the intended environmental performance outcomes, TransGrid and its contractors has established, implemented, maintained and continually improved an EMS.

The EMS consists of environmental plans, including this Sub-plan, procedures, protocols and tools as set out below and illustrated in Figure 1-1.

1.5 Consultation for preparation of the CSWMP

Stakeholder consultation with relevant councils has been completed as documented in **Appendix 1**. All comments have been addressed.

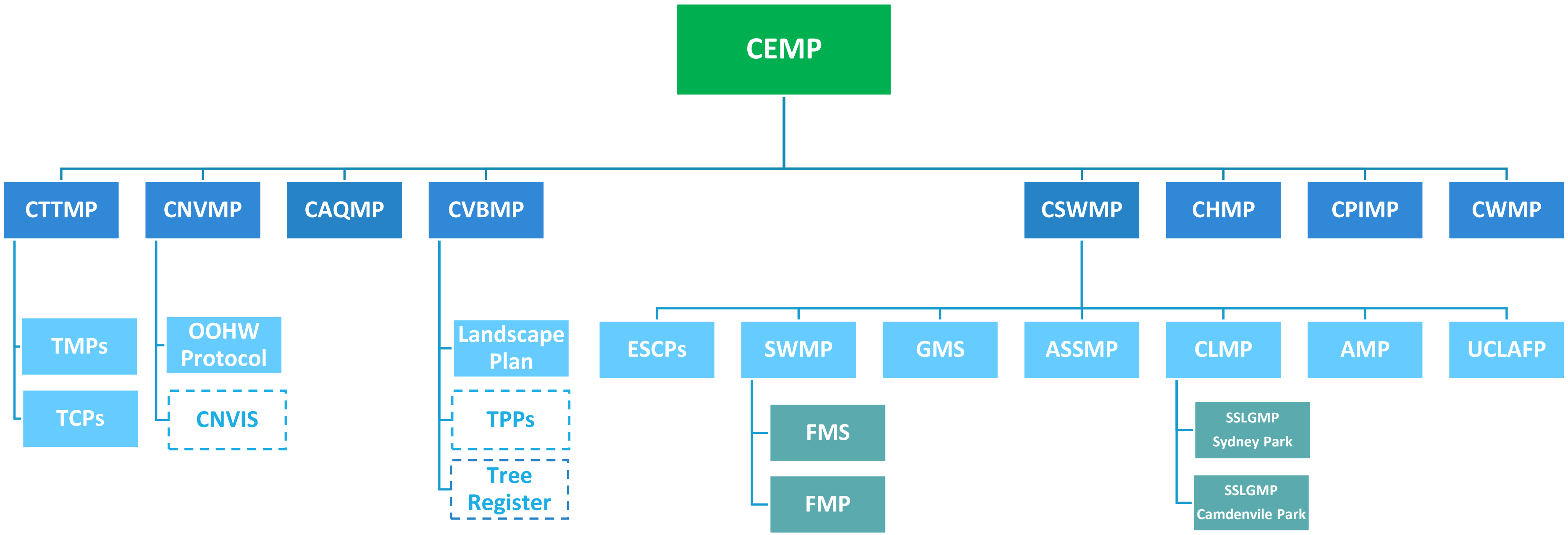


Figure 1-1 Project environmental management system

2 Environmental Requirements

2.1 Legislation

Legislation relevant to soil and water management includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Contaminated Land Management Act 1997* (CLM Act);
- *Water Act 1912*
- *Water Management Act 2000.*
- *Work Health and Safety Act 2011* (NSW)
- Work Health and Safety Regulation 2017 (NSW)

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to this sub-plan include:

Soil and water management

- Acid Sulfate Soil Manual (ASSMAC 1998)
- Australian Standard AS 1940B1993: The Storage and Handling of Flammable and Combustible Liquids
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
- Department of Environment and Conservation (DEC): Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu" November 1997
- Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the "Blue Book"). Volume 1 and Volume 2
  - Volume 2A Installation of Services (DECCW 2008)
  - Volume 2C Unsealed Roads (DECCW 2008)
  - Volume 2D Main Roads Construction (DECCW 2008)
- Floodplain Development Manual (NSW Government, 2005)
- TransGrid, 2016. *Environmental Handbook*
- NSW EPA, 2014. *NSW Waste Classification Guidelines*.

Groundwater management

- *Aquifer Interference Policy* (AIP) (NSW Office of Water, 2012)
- *Greater Metropolitan Region Groundwater Source Water Sharing Plan* (NSW Office of Water 2011)
- National Uniform Drillers Licensing Committee (NUDLC), 2011, *Minimum Requirements for Water Bores in Australia*
- Australian and New Zealand Governments, 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)[1]

[1] ANZG (2018) have superseded the ANZECC Water Quality Guidelines (2000) referred to in the CoA and EIS Amendment Report.

- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure*, amended 2013 (ASC NEPM)
- National Health and Medical Research Council (NHMRC) *Australian Drinking Water Guidelines (2011)*, updated August 2018
- Heads of EPAs Australia and New Zealand (HEPA), 2018. *PFAS National Environmental Management Plan* (PFAS NEMP)
- New South Wales Environment Protection Authority (NSW EPA), 2014. *Waste Classification Guidelines: Part 1 Classifying Waste*
- RMS, 2011, *Technical Guideline: Environmental Management of Construction Site Dewatering*, 2 April 2011
- TransGrid Guidelines and Procedures:
  - TransGrid Procedure – Contaminated Land Management
  - TransGrid Procedure – Health and Safety Incident Management
  - TransGrid procedure – Environmental Incident Management

Acid Sulfate Soils

- ASSMAC, 1998. *NSW Acid Sulfate Soils Manual* ('NSW ASS Manual')
- TransGrid Guidelines and Procedures:
  - TransGrid Environmental Guidance Note – Acid Sulphate Soils
- Heads of EPAs Australia and New Zealand (HEPA), 2020. PFAS National Environmental Management Plan 2.0 (PFAS NEMP).

Contaminated land management

- National Environment Protection Council (NEPC), 1999. National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment (ASC NEPM).
- New South Wales Environment Protection Authority (NSW EPA), 2014. Waste Classification Guidelines
- NSW EPA, 2015. Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.
- NSW EPA, 2017. Guidelines for the NSW Site Auditor Scheme. 3rd edition.
- NSW EPA, 2019. Assessment and management of hazardous ground gases: Contaminated Land Guidelines.
- NSW EPA, 2020. Guidelines for Consultants Reporting on Contaminated Sites.

Asbestos management

- NSW Government, 2014, *Managing asbestos in or on soil*, March 2014, Workcover NSW
- NSW Government, 2019. *Code of Practice: How to Manage and Control Asbestos in the Workplace*.
- Safe Work Australia, 2018. *Code of Practice*: *How to safely remove asbestos.*
- Australian Standard – AS 1319 – Safety signs in the occupational environment
- Australian Standard – AS 1216 – 2006 – Class labels for Dangerous Goods
- National Occupational Health and Safety Commission (NOHSC), 1995. *National Guidelines for Health Surveillance*
- NOHSC, 2005. *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre, 2nd Edition*

2.3 Minister's Condition of Approval

The CSWMP is developed in accordance with the Conditions of Approval (CoA) from the DPIE (2020) as described below.

2.4 Updated Environmental Mitigation and Management Measures

The CSWMP is developed in accordance with the Environmental Mitigation and Management Measures (EMMMs) included in the Amendments Report as described below.

Table 2-1 Relevant Conditions of Approval

CoA	Condition requirement	Document Reference	How addressed
E12	The Proponent must install and maintain suitable erosion and sediment control measures in **the project area during construction, in accordance with the relevant requirements in the guidance series *Managing Urban Stormwater: Soils and Construction (Landcom, 2004).***	Section 5 **SWMP** **CLMP**	Erosion and sediment control measures are documented throughout this plan.
E13	Unless otherwise authorised by an EPL, the Proponent must comply with section 120 of the POEO Act.	This document	
E14	The Proponent must ensure that any groundwater dewatering activities consider reasonable and feasible alternatives to discharge to stormwater. Where groundwater is discharged to stormwater, wastewater pollutant discharge concentrations, unless otherwise agreed by the EPA, must achieve criteria in the national *Water Quality Guidelines* at a 95% protection level for marine ecosystems and, for analytes not covered by the guidelines, the amended National Health and Medical Research Council (NHMRC) *Australian Drinking Water Guidelines (2015)*.	**GMS**	The approach to groundwater dewatering is described in detail in the GMS.
E15	Works on waterfront land must be carried out in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (2018).	Section 4.4.2	Works will be carried out in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (2018), however an "Controlled Activity Approval' is not required under the SSI.
E16	The Proponent must ensure that the SSI does not materially alter the flood storage capacity, flows or characteristics in the project area, unless otherwise agreed by the relevant council(s).	**FMS**	The FMS describes the work completed to assess flood impacts , and requires the existing surfaces to be returned to pre-existing.
E17	The Proponent must ensure that any construction activities in identified areas of acid sulfate soil risk are undertaken in accordance with the *Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998).*	**ASSMP**	The ASSMP has been developed consistent with the *Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee, 1998).*
E18	The Proponent must engage an EPA accredited site auditor to prepare a **Site Audit Statement(s)** in accordance with the Contaminated Land Management Act 1997, confirming that the proposed measures in the **Contaminated Land Management Plan** required under **Condition E20** are appropriate to manage contaminated soils, groundwater and/or landfill gas in: (a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters; and (b) any additional or unexpected areas of contamination identified during the development.	**CLMLP**	An EPA accredited auditor has confirmed the measures proposed in the **CLMP** meet the requirement of Condition E20.
E19	A copy of the **Site Audit Statement** must be submitted to the Planning Secretary and the relevant council(s) for information prior to the commencement of construction in the area to which the Statement applies.	**CLMP**	A copy of Site Audit Statement has been provided to the Planning Secretary as required by Condition E19.

E20	the **Soil and Water CEMP Sub-Plan** required under **Condition C3** must include a:	This Plan	This document.
	a) **Erosion and Sediment Control Plan**, for managing erosion and sedimentation risks during construction;	**ESCP** **SWMP**	Refer Appendix 2 – Example Erosion and Sediment Control Plans (ESCPs) and Appendix 3 – Surface Water Management Plan (SWMP).
	b) **Surface Water Management Plan**, for managing surface water quality and quantity, watercourse and flooding impacts of the SSI. This plan must include a:	**SWMP**	Refer Appendix 3 – Surface Water Management Plan (SWMP).
	i. **Flood Mitigation Strategy** for work within flood prone or flood affected land, demonstrating that the SSI will not exacerbate existing flooding characteristics, unless otherwise agreed by the relevant council(s); and	**FMS**	Refer Appendix 3 – Surface Water Management Plan (SWMP) Attachment II **Flood Management Strategy (FMS)** and Attachment III **Flood Management Plan (FMP)** No exacerbation of flooding characteristics is expected.
	ii. **Flood Management Plan** for managing flood risk during construction;	**FMP**	Refer Appendix 3 – Surface Water Management Plan (SWMP) Attachment III **Flood Management Plan (FMP)**.
	c) **Groundwater Management Strategy**, for investigating, assessing and managing any groundwater dewatering for the SSI;	**GMS**	Refer Appendix 4 – **Groundwater Management Strategy (GMS)**.
	d) **Acid Sulfate Soils Management Plan,** for investigating, assessing and managing potential and actual acid sulfate soils in the project area;	**ASSMP**	Refer Appendix 5 – **Acid Sulfate Soil Management Plan (ASSMP).**
	e) **Contaminated Land Management Plan**, for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area;	**CMLP**	Refer Appendix 6 – **Contaminated Land Management Plan (CLMP)**.
	f) **Asbestos Management Plan**, for investigating, assessing and managing the potential for asbestos and other hazardous materials in the project area; and	**AMP**	Refer Appendix 7 – **Asbestos Management Plan (AMP)**.
	g) **Unexpected Contaminated Land and Asbestos Finds Procedure** for managing any unexpected contaminated land or asbestos (or suspected contaminated land or asbestos) excavated or otherwise discovered during construction.	**UCLAFP**	Refer Appendix 8 – **Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP)**.

Table 2-2 Environmental Mitigation and Management Measures

Impact	EMMM ID	Measure	Document reference	How addressed
Water quality, soil erosion and sediment control (CSWMP)	WQ1	A CSWMP will be prepared as part of the overall CEMP to document the measures required to mitigate and manage potential impacts on soils, surface water and groundwater during construction. The CSWMP will include the following sub-plans and measures: • ESCPs (see WQ2); • where wheel washing is required, wheel wash wastewater will be collected (e.g. through temporary containment and directing to sediment basins or tanks) and disposed of appropriately; • water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act, 1997 and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems.* Contaminated water captured during construction would be disposed of at an appropriately licensed facility; and • where works are within the riparian zone (40 metres from the top of the watercourse bank) the *Controlled Activities on Waterfront Land Guidelines* (DPI, 2012) would be reviewed and relevant measure included into the CSWMP where appropriate. Procedures and protocols to manage potentially contaminated fill, soil, bedrock, acid sulfate soils and extracted groundwater will be detailed in the CEMP in accordance with conditions outlined in the Preliminary Site Investigation report (refer to Appendix K of the EIS) and the NSW Acid Sulfate Soils Manual (Stone et al, 1998).	This Plan	This document identifies measures required to mitigate and manage potential impacts on soils, surface water and groundwater during construction. Erosion Control Sediment Plans (ESCPs) will be prepared in accordance with the Bluebook (Landcom (2004) and Section 5.1. Wheel washing will be managed in accordance with ECM-SW20 and the procedure in Section 3 of the Surface Water Management Plan. Surface water runoff will be managed in accordance with the **Surface Water Management Plan**. Groundwater dewatering will be managed in accordance with **Groundwater Management Strategy** Dewatering Procedure. Works within 40 metres from the top of the watercourse bank) will be managed consistent with the *Controlled Activities on Waterfront Land Guidelines* (DPI, 2012). A *Controlled Activity Approval* is not required as the project is listed as 'major project' under the SSI Approval. Procedures and protocols to manage contaminated materials e.g. fill, soil, bedrock, acid sulfate soils and extracted groundwater are documented in: • **Appendix 4** – Groundwater Management Strategy (GMS) • **Appendix 5** – Acid Sulfate Soil Management Plan (ASSMP) • **Appendix 6** – Contaminated Land Management Plan (CLMP) • **Appendix 7** – Asbestos Management Plan (AMP) • **Appendix 8** – Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP). Environmental Control Measures associated with the above are included in **Section 5.**

Water quality, soil erosion and sedimentation (ESCP)	WQ2	ESCPs will be prepared as part of the CEMP for transmission cable route work sites, substations and construction laydown areas, in accordance with the Blue Book (Landcom, 2004). ESCPs will be implemented in advance of site disturbance and updated as required as the construction progresses and the work site locations change. Measures in the ESCPs will include: • construction traffic to be restricted to access tracks, where existing roads cannot be utilised (e.g. through Sydney Park). These access tracks will be clearly delineated and maintained until construction is complete; • where possible, clean water will be prevented from entering excavations by diverting runoff away from earthworks activities; • the extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion; • disturbed ground and exposed soils, such as inside trenches or at construction laydown areas, will be temporarily stabilised (e.g. with geotextile) prior to extended periods of site inactivity and permanently stabilised as soon as possible to minimise the potential for erosion; • stormwater flows will be managed to avoid flow over exposed soils which may result in erosion and impacts to water quality. Inside the excavation this may require the use of trench stops; and • rainfall forecasts will be monitored daily during construction and works rescheduled if necessary and as determined by the contractor, to reduce risk of erosion and sedimentation and to minimise the impact of heavy rainfall and flood events.	This Plan ECM-AQ18 ECM-SW02 ECM-SW03 ECM-SW04 ECM-SW05 ECM-SW06 ECM-SW07 ECM-SW08 ECM-SW09 ECM-SW10 ECM-SW14 ECM-SW15	ESCPs prepared in accordance with the Blue Book (Landcom, 2004) are documented in Section 5.1.
Water quality – spills and leaks	WQ3	The following measures will be documented in the CSWMP and implemented to mitigate and manage spills and leaks: • areas will be allocated for the storage of fuels, chemicals and other hazardous materials. These areas will be as far away as feasible and reasonable from watercourses, located where flooding during a 20 year Average Recurrence Interval (ARI) event is unlikely, and on an impervious bunded area; • the storage and handling of dangerous goods will be in	This Plan **CLMP** ECM-SW22 ECM-SW23 ECM-SW24 ECM-SW25 ECM-SW26	The approach to preventing and managing Water quality – spills and leaks is described extensively in this Plan and in the CLMP.

		accordance with relevant guidelines and standards such as the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005); • fuel and liquid storage at construction laydown areas will be secured and stored in accordance with the NSW EPA guidelines (Department of Environment and Climate Change NSW, 2007b); • appropriate spill containment and prevention measures will be applied to fuel and liquid storage, where feasible and reasonable; • accidental spills or leaks will be managed through the use of spill containment measures including spill kits. Any contaminated material will be disposed of to an appropriately licenced facility; • re-fuelling of construction plant and equipment will be undertaken using appropriate spill containment measures to mitigate pollution risks from accidental spills or leaks; • refuelling activities will be undertaken at least 100 metres from the nearest watercourse; • a spill response kit will be available on-site at all work sites at all times; • where bulk fuel or other liquid substances are to be brought to a work site, a container specifically designed for that purpose will be used; • underboring sites will have appropriate stormwater diversions, as well as downstream pollution and sediment control measures to both prevent stormwater entering the excavation as well as to assist with containing any loss of drilling fluid; and • flows of drilling fluid will be visually monitored in accordance with the CSWMP.	ECM-SW27 ECM-SW28 ECM-SW29 ECM-SW30	
Groundwater interception	GW1	A Groundwater Management Strategy will be prepared that will outline the requirement for drilling and installation of monitoring wells and baseline groundwater level and quality monitoring. This additional information will be collected prior to or during detailed design in locations where it is likely that the watertable may be intersected. This data will be used to confirm whether groundwater control measures or dewatering will be required. Where it is likely that groundwater will be intersected, estimates of groundwater inflows will be predicted to assess if a groundwater	**GMS** ECM-SW46 ECM-SW47 ECM-SW48 ECM-SW49 ECM-SW50 ECM-SW51	The approach to managing groundwater is described in the **GMS**.

		extraction license would be required (that is if 3 ML/year of groundwater discharge was to be exceeded). Outcomes from the GMS will inform the Construction Environmental Management Plan (CEMP). The CEMP, where necessary: • measures to stabilise the excavation, such as installation of temporary shoring in trenches (e.g. sheet piling); • localised temporary dewatering measures to maintain dry working conditions; • measures to maintain groundwater flow conditions to minimise disruption to down-gradient receptors; and measures to minimise groundwater drawdown to reduce any ground settlement impacts.	ECM-SW53 ECM-SW54	
Aquifer interference	GW2	Detailed hydrogeological information (e.g. bore data) will be used to inform the most suitable underboring construction method at select special crossings that will minimise the need for dewatering. Where an aquifer is to be completely penetrated at the underboring special crossings, appropriate controls (such as drainage blankets) will be installed beneath the infrastructure to ensure groundwater flow is maintained to minimise disruption to groundwater flow paths.	**GMS** ECM-SW46 ECM-SW47 ECM-SW48 ECM-SW49 ECM-SW50 ECM-SW51 ECM-SW52 ECM-SW54	The approach to managing potential aquifer interference issues is described in the **GMS**.
Intersection of contaminated groundwater	GW3	In areas where contaminated groundwater is identified, measures will be implemented to ensure that the backfill within the excavation does not create a more permeable pathway for migration of contamination.	**GMS** **CLMP** ECM-SW50	It is possible the project may intercept contaminated groundwater. An approach to managing this is documented in the GMS and CLMP.
Dewatering	GW4	A CSWMP will be prepared as part of the CEMP to document the measures required to mitigate and manage potential impacts on groundwater during construction. The CSWMP would include the following measures: • water collected during dewatering of excavations would be discharged or disposed of in accordance with the Protection of the Environment Operations Act 1997 and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems; and contaminated groundwater captured during construction will be disposed of at an appropriately licenced facility.	**GMS** ECM-SW46 ECM-SW47 ECM-SW48 ECM-SW49 ECM-SW55 ECM-SW56 ECM-SW57 ECM-SW58 ECM-SW59	An approach to dewatering is documented in the GMS.

			ECM-SW60	
Assessment of excavation areas	CT1	Soil investigations will be undertaken prior to construction along the project area to: • assess the presence of contamination and risks posed to project workers and the environment, so that appropriate controls can be implemented during construction; • chemically classify the soil *in-situ,* for potential re-use or off-site disposal to licensed landfill or re-use facility in accordance with the applicable land use criteria, Waste Classification Guidelines (NSW EPA, 2014a) or applicable Resource Recovery exemption and order; and • assess for the presence of acid sulfate soils and liming rates, so Acid Sulfate Soils Management Plans (ASSMPs) can be prepared and waste classified in accordance with Waste Classification Guidelines (NSW EPA, 2014a). A Sampling Analysis Quality Plan (SAQP) will be prepared for soil investigation in accordance with the NEPM (ASC NEPM, 2013). The SAQP will detail: • data quality objectives (DQOs) and data quality indicators (DQIs); • justification of the number, density and location of sampling locations based on the potential for contamination, excavation extent and quantities requiring off-site disposal; • analytical suite and schedule, including contaminants of concern identified; • assessment criteria for on-site reuse or off-site disposal (waste classification); • sampling and laboratory methodologies, field and laboratory quality assurance and control. Following the completion of the soil investigations a report will be prepared for each construction precinct providing conclusions on waste classification and recommendations for health and environmental controls; and • during construction. The reports will provide clear commentary on the classification of the waste in accordance with the Waste Classification Guidelines (NSW EPA, 2014a).	**CLMP** ECM-SW79 ECM-SW80 ECM-SW81 ECM-SW82 ECM-SW83 ECM-SW84 ECM-SW85	Soil investigation areas have been assessed and are included in the CLMP.

Assessment of imported Virgin Excavated Natural Material (VENM)	CT2	Prior to the backfilling of trenches during construction with VENM, the VENM source(s) will be identified and assessed against the definition of VENM in the Waste Classification Guidelines (NSW EPA, 2014a) and *Protection of the Environment Operations Act 1997* (POEO Act). The VENM source(s) will be assessed by an appropriately qualified contaminated land consultant, which will entail: • identifying whether the current and past activities at the source site that had potential to contaminate the land, whether actual acid sulfate soils (AASS) or potential acid sulfate soils (PASS) is present and that the site is not within an area mapped as containing naturally occurring asbestos; and • undertaking chemical assessment to ascertain that the material is not contaminated. The NSW EPA VENM certificate will be completed and signed by the consultant (or supplier) and provided to TransGrid prior to importation and use of the VENM. The VENM will also be inspected at the work site to check the imported VENM is from the same source assessed.	**CLMP** ECM-SW86 ECM-SW87 ECM-SW88	The importation of VENM has been assessed and is discussed in the CLMP.
Construction laydown areas	CT3	Limited baseline soil investigations and site inspections will be undertaken for each construction laydown area to manage identified risks during construction. The investigations will include limited sampling to identify and assess contamination in surface soil. A baseline report will be prepared for each construction laydown area. Where contamination is identified, a site-specific management plan will be implemented prior to construction to inform the management of asbestos or chemical contamination in soil while the construction laydown area is in use. Following demobilisation of the construction laydown area a post–construction report will be prepared for each construction laydown area. The post-construction report will compare to the baseline report and confirm whether or not conditions are the same and if remedial works are required to clean up contamination from the project works within the construction laydown areas.	**CLMP** ECM-SW89	Further soil investigations of construction laydown areas is considered in the CLMP.
Contaminated soil management during construction	CT4	Protocols for the management of contaminated soil during construction will be included in the CEMP for all construction works and will: • detail requirements for safety controls including the following where required: - air monitoring;	CLMP AQMP ECM-SW90 ECM-SW91 ECM-SW92	Protocols for the management of contaminated soil during construction are included in the CLMP and further addressed in the AQMP.

		- exclusion zones and decontamination; - excavation ventilation; - dust suppression and containment; - odour suppression and monitoring; - personnel protective equipment; - training and supervision; • detail requirements for environmental controls including the following: - sediment and erosion control; - management of surface water runoff around the excavation areas and prevention of surface water entering excavations; - stockpile management and separation; and - materials tracking and records. Sediment and erosion mitigation measures will be implemented in accordance with ESCPs.	ECM-SW93 ECM-SW94 ECM-SW95 ECM-SW96 ECM-SW97 ECM-SW98 ECM-SW99 ECM-SW100 ECM-SW101 ECM-SW102	
Spoil waste management and transport	CT5	Spoil which has been assessed as not suitable for reuse or cannot be reused will be classified in accordance with the Waste Classification Guidelines (NSW EPA, 2014a). The spoil will be transported to an appropriate waste disposal facility licensed to receive such waste. Approval will be obtained from the respective landfill facility prior to transport and will require an estimate of the likely volume of waste to be disposed. The following material handling requirements will be implemented for trucks transporting materials off-site: • a licensed transporter will be used to transport material to an appropriately licensed NSW EPA waste facility; • all truck loads will be filled to the correct level and not over filled; • trucks carrying waste materials will be covered prior to exiting the work site and will remain covered until authorised to unload at the destination (NSW EPA licensed waste facility); • trucks will be fitted with seals to ensure that the movement of potentially saturated materials is undertaken appropriately. The integrity of the seals will be inspected and tested prior to commencement of each day's haulage works; • in the event that materials are tracked or spilt outside of the construction zone, soil will be immediately	CLMP WMP ECM-SW103	Soil waste management will be conducted in accordance with the CLMP and WMP.

		cleaned up in a way that prevents contamination of land, the stormwater or waterways; and • all truckloads and landfill waste tickets/dockets will be tracked and a register completed to reconcile and check spoil has been lawfully disposed. Temporary spoil stockpiles may be stored at select construction laydown areas. As all spoil will be classified in- situ prior to excavation, the stockpiled material will already be classified in accordance with the NSW EPA guidelines. Stockpiles will be kept separate based on their classification. All stockpiles will be tracked in accordance with protocols within the CEMP for material tracking. Stockpiles will be managed with appropriate sediment and erosion controls as outlined in an ESCP.		
Asbestos management	CT6	An Asbestos Management Plan (AMP) will be developed for areas identified during pre-construction investigations as containing Asbestos Containing Materials (ACM), areas suspected of containing ACM and to address unexpected finds of ACM during construction. Specifically, protocols will be stipulated for separation, monitoring, validation and clearance of asbestos. The AMP and associated Standard Work Procedures will satisfy the requirements of: • Work Health and Safety Regulation 2011; • the Safe Work Australia Asbestos Codes of Practice and Guidance Notes: - Code of Practice: How to Manage and Control Asbestos in the Workplace; - Code of Practice: How to Safely Remove Asbestos; and - Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre, 2nd Edition [NOHSC: 3003 (2005)]. An Occupational Hygienist (Hygienist) will be on-site for the duration of the excavation works where ACM has been identified from pre-construction or where unexpected finds of ACM are encountered. The Hygienist will: • undertake air monitoring for asbestos during excavation; • provide on-site visual inspection, identification of asbestos impacted material and clearance of non-asbestos impacted surfaces; and • supervise works to ensure compliance with the AMP and NSW regulatory requirements for asbestos	AMP ECM-SW104	Asbestos will be managed in accordance with the AMP. An Occupational Hygienist has been identified as one of the roles and responsibilities in Section 6.1

		containing material management and disposal. In the event that friable asbestos is detected, a suitably licensed Asbestos Removal Contractor (licensed to undertake friable asbestos (Class A) removal) will be required to undertake and oversee all the asbestos removal and disposal works outlined in the AMP. All persons performing the works will be required to undertake a suitable risk assessment and develop a Safe Work Method Statement (SWMS) for all of their work activities prior to commencing work in ACM impacted areas. Identified ACM will be segregated, managed and disposed of as Special Waste and transported and disposed in accordance with Protection of the Environment Operations (Waste) Regulation (2014). Where more than 100 kg of asbestos waste or more than 10 square metres of asbestos sheeting is transported the NSW EPA online tool WasteLocate will be used. The handling and disposal of asbestos waste will be tracked and recorded.		
Acid sulfate soils	CT7	ASSMPs will be prepared in accordance with the ASSMAC (1998) guidelines based on the results of the pre- construction investigations for locations within Precinct 2, 3, 4 and 5. The ASSMPs will incorporate the following procedures: • soil will be treated with lime in accordance with the ASSMP where PASS is not able to be loaded and transported to a landfill licensed to receive untreated PASS within 24 hours of excavation or if AASS are identified and excavated; • exposure of PASS material within an excavated trench or excavation site will be minimised to reduce the potential for oxidation and acid leachate generation; • excavation will be done under dry conditions, where possible using a truck and shovel (tracked excavator) operation and the water table will be lowered within excavation areas, as part of excavation dewatering; • excavated fill will be monitored for colour and leachate quality; • no PASS material will be placed and left at the surface untreated; • soil will be placed into an appropriately bunded treatment area (pads) and treated with a neutralising agent (e.g. lime). Leachate water from the PASS material will be managed	ASSMP ECM-SW67 ECM-SW68 ECM-SW69 ECM-SW70 ECM-SW71 ECM-SW72 ECM-SW73 ECM-SW74 ECM-SW75 ECM-SW76 ECM-SW77 ECM-SW78 ECM-SW105	Acid Sulfate Soils will be managed in accordance with the ASSMP.

		and treated to ensure no acid is released to the environment; • leachate generated during the ASS treatment operations will be captured. Any water potentially affected by leachate collecting within the excavation will be treated with hydrated lime or equivalent prior to discharge. Water potentially affected by leachate accumulating within the work site will not be discharged until it meets acceptable water quality standards or collected and disposed at a licensed liquid waste treatment facility; and • PASS materials will be kept separate from non-PASS materials at all times to reduce the volume of material requiring treatment. Acid is transported by water; therefore, excavation works in PASS will be conducted during dry periods (where practical) to minimise the risk of overflow associated with sudden or heavy rain and to allow better control of treated waters for discharge.		
Unexpected finds	CT8	An unexpected finds procedure will be included in the CEMP. An unexpected find is potential contamination that was not previously identified during this PSI or pre-construction investigations. Project workers will be trained in identifying the following: • soil that appears to be contaminated based on visual and olfactory (odour) observations; • ACM (i.e. either bonded or friable asbestos); • groundwater that appears to be contaminated based on visual and olfactory (odour) observations (including potential hydrocarbon sheens on the water surface, free phase liquids such as petroleum fuel, discolouration etc.); • drums or underground storage tanks (USTs); and • fill containing wastes (e.g. slag, refuse, demolition materials). In the event of an unexpected find, excavation works will temporarily be suspended at the location of the unexpected find, the environment manager contacted and the area of concern appropriately isolated; • the area will be inspected by a contaminated land consultant and if required, appropriate sampling and analysis will be undertaken, the sampling works will be documented in a report; • the requirement for additional controls will be assessed by the consultant and implemented by the proponent; and	UCLAFP ECM-SW82	Refer Appendix 8 – Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP)

		• workplace health and safety and environmental protection requirements will be reviewed, depending on the type of unexpected finds encountered.		
Former landfill management	CT9	Site-specific management plans for former landfill sites will be required for excavation works in Sydney Park and Camdenville Park. A plan may also be required for Henson Park following the outcome of investigations (see CT1). The development of the plans will include consultation with the relevant councils. Approval will be sought from the NSW EPA in all areas where exhumation of landfill waste is required in accordance with Clause 110A of the *Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation).* Where there are existing environmental management plans, such as for Camdenville Park, site-specific mitigation measures outlined in these plans will be reviewed and implemented as required. The plan will be prepared by a contaminated land consultant and occupational hygienist. The plan will specify: • an excavation plan specifying areas classified as per in-situ waste classification and suitability for reuse; • trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (also refer to AQ12); • ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds; • action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented; • exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh fences with bracing, where required; • geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable; • final capping layer above the concrete cable conduit casing as per the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016), unless otherwise specified or agreed by with City of Sydney ~~Council~~ and Inner West	CLMP ECM-SW106	Landfill gas will be managed in accordance with the Site Specific Landfill Gas Management Plans for Sydney Park and Camdenville Park. If the project alignment intersects with Henson Park, a Specific Landfill Gas Management Plans may also be required. Further guidance and detail is provided in the **CLMP**.

		Council: - compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic conductivity of less than 1 x 10–9 metres/s (where subsurface waste either side of the trench is less than; - a revegetating layer from the top of the capping layer to the surface comprising clean soils with 200 mm of topsoil (in landscaped areas); and • the construction of joint bays, link boxes and sensor pits within former landfill areas will be designed to prevent the accumulation of landfill gases. Inner West Council and City of Sydney ~~Council~~ will be consulted on the design, monitoring and location of the pits within Sydney Park, Camdenville Park, and Henson Park (if required).		
Sydney Park	CT10	TransGrid will undertake additional investigations at Sydney Park on leachate and methane risks prior to or during construction and will report these findings to the City of Sydney.	**CLMP** **GMS**	Findings will be reported City of Sydney Council.
Drilling slurry	CT11	TransGrid will investigate and adopt good practice measures for the management of drilling slurry during horizontal directional drilling, where used, taking into consideration the volume of slurry that will be generated.	**This Plan** **CLMP**	Measures documented can be found throughout this plan and in the CLMP.

3 Existing Environment

3.1 Project Area

The project area comprises the overall potential area of direct disturbance by the project, which may be temporary (for construction) or permanent (for operational infrastructure). A detailed description of the project area is provided in the EIS.

The Project Area comprises portions of the following catchments as shown in Figure 3-1:

- Cooks River catchment;
- Parramatta River (Iron Cove) catchment; and
- Georges River catchment.

These broader catchments have been considered in the EIS and the Amendment report and potential impacts have been considered at a more localised level surrounding the project area including potential impacts on intersected water features along the cable route. Flooding and surface-water impacts during operation were assessed to be not significant as works would be returned to pre-existing conditions.

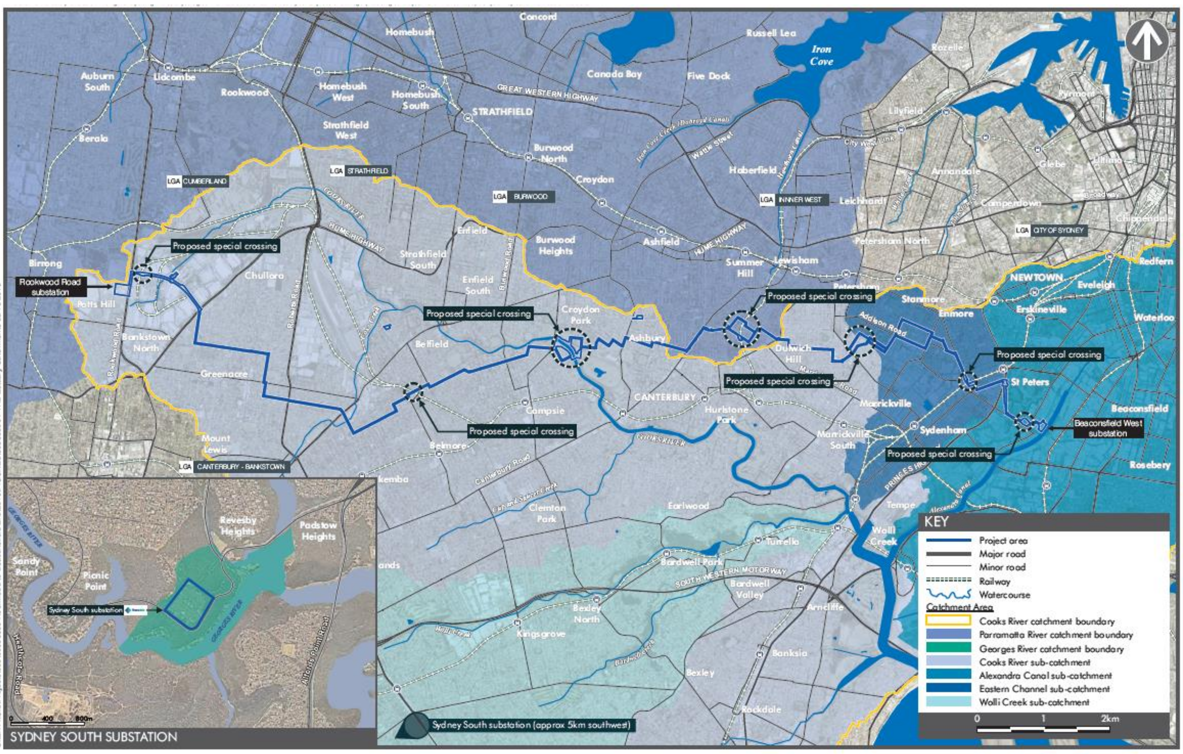


Figure 3-1 Estuary Catchments

Adopted from AECOM (2019)

3.2 Topography

Most of the land traversed by the transmission cable route drains into catchments and waterways via local piped urban stormwater networks. Localised flooding is known to occur in some areas as a result of overflow of these networks. The transmission cable route is predominantly in elevated topographical areas.

Topography and drainage across the study area is summarised in Table 3-1.

Table 3-1 Drainage and topography summary

Precinct	Elevation range	Drainage
1	36-53 metres Australian Height Datum (AHD)	Area drains into a tributary of the Cooks River which drains to the northwest into the Cooks River.
2	Generally 9-50 metres AHD with low point around Cooks River (6 metres AHD)	Western portion drains into a tributary of the Cooks River which drains to the northwest into the Cooks River. Centre portion drains into Coxs Creek which drains to the northwest into the Cooks River. Eastern portion drains into the Cooks River.
3	Generally 9-46 metres AHD with low point around Cooks River (3 metres AHD) and relative low point around Hawthorn Canal (20 metres AHD).	The eastern and western portions drain into the Cooks River to the south. The centre portion drains to Hawthorn Canal in the north.
4	4-16 metres AHD, lowest in the east	Drains into the Cooks River to the south.
5	6-18 metres AHD, lowest in the eastern most and western most extent of the construction precinct, high point at King Street.	Drains into the Cooks River and Alexandra Canal. A flood detention basin is present in Camdenville Park and man-made wetlands are present within Sydney Park, and local stormwater is harvested from the urban drainage network near Sydney Park Road.

3.3 Geology and Soils

The geology within the study area is dominated by the Triassic aged Wianamatta Group that is overlain in part by Quaternary aged Alluvium and Marine deposits outcropping adjacent to major waterways. The Wianamatta Group includes Bringelly Shale (Rwb) and Ashfield Shale (Rwa) (Precincts 1-5). The Bringelly Shale is expected to underlie the Rookwood Road substation (Precinct 1). The residual soils derived from Bringelly Shale generally being between 3 metres and 6 metres thick and comprise medium to high plasticity clays. The Ashfield Shale comprises black to dark grey shale and laminite. The shale is underlain by the Hawkesbury Sandstone, a medium to coarse grained quartzose sandstone. The sandstone outcrops at the edge of the study area at Marrickville.

Quaternary Alluvium (Qha) is mapped within the floodplains of the Cooks River (Precinct 3) and comprise silty to peaty quartz sand, silt and clay. Quaternary Swamp Deposits (Qhs) composed of peat, sandy peat and mud are mapped within the floodplains of the Alexandra Canal (Precinct 5), including around 0.5 kilometres of the project area between the southern end of Sydney Park to Alexandra Canal. There is also a small area of Quaternary marine deposits (Qhd) mapped within Sydney Park, comprised of medium to fine-grained marine sand with podsols. The majority of the Qhd unit in Sydney Park was formerly excavated during the former brick works and filled with municipal, demolition waste and imported soil. The Beaconsfield West substation, along with about 500 metres of the transmission cable route, is expected to be underlain by the Qhs unit. The Sydney South substation, located north of the Georges River, is expected to be underlain by weathered Hawkesbury Sandstone.

Igneous intrusions of Jurassic age including dykes are mapped within the study area. The cross cutting dykes are composed of basalt, dolerite and volcanic breccia. The project area passes through these dykes in Dulwich Hill at Arlington Street, Constitution Road, Terry Road, Hill Street, Denison Road and Pigott Street.

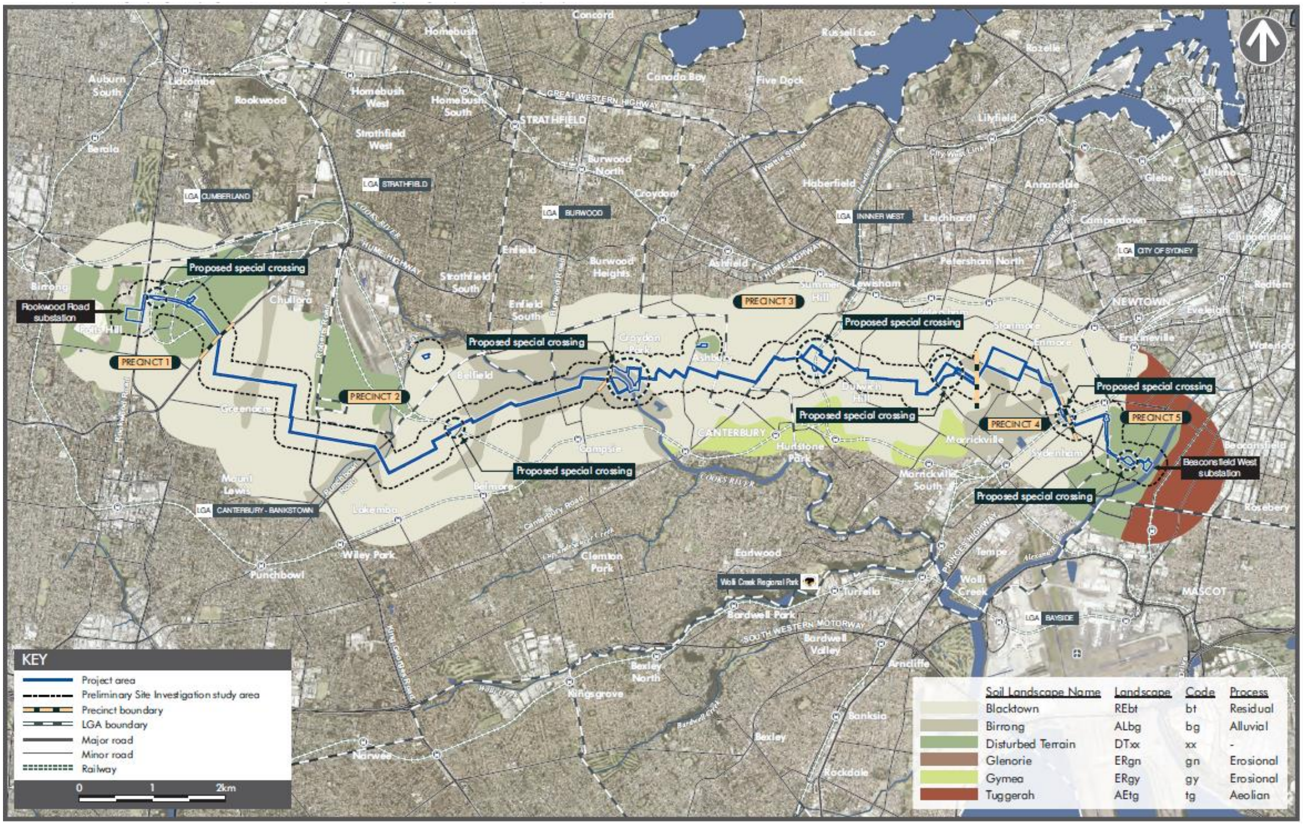


Figure 3-2 Soil Landscapes

Note: Adapted from (AECOM, 2019)

The soil landscaped encountered along the transmission line was identified in the Project EIS (AECOM, 2019) as shown in Figure 3-2, being the:

- Blacktown Soil Landscape;
- Birrong Soil Landscape; and
- Disturbed terrain.

Much of the soil landscapes is covered by urban development and/or highly disturbed (for example, previous brick pits and landfill sites) and it is these features that likely to be the key determinant as to erosion potential than the inherent soil characteristics. However, the Birrong Soil landscape, which predominates in Precinct 2 and to a lesser extent in Precinct 3, is a fluvial landscape characterised by high soil erosion potential which will need additional consideration in the development of the site specific Erosion and Sediment Control Plans.

3.4 Surface Water Quality

A description of existing surface water quality is included in **Appendix 3 – Surface Water Management Plan (SWMP)**.

It is noted that the project will be located in close proximity water quality management assets including:

- Corner of Juliett Street and Scouller Street, Marrickville rain garden;
- Camdenville Park detention basin; and
- Sydney Park wetland.

3.5 Flooding

A description of existing flooding is included in **Appendix 3 – Surface Water Management Plan (SWMP) Attachment II Flood Management Strategy (FMS)**.

The FMS is a technical report that provides:

- a summary of the flood assessments undertaken for the permanent works;
- an assessment of flooding during construction and operation of the Project;
- identification of specific flood risks; and
- a discussion on proposed mitigation measures to meet Condition of Approval for SSI-8583.

Specifically, the Flood Mitigation Strategy (FMS) has been prepared in accordance with the *Floodplain Development Manual* (DIPNR, 2005) for work within flood prone or flood affected land within the project area, to demonstrate that the existing flooding characteristics will not be exacerbated.

3.6 Groundwater

A description of existing surface water quality is included in **Appendix 4 – Groundwater Management Strategy (GMS)**.

3.7 Acid Sulfate Soils

Acid sulfate soils (ASS) is the common name given to a range of soil types containing iron sulfides. ASS may be present as actual ASS (AASS) or potential ASS (PASS). When exposed to air, the iron sulfides (commonly pyrite) within ASS can oxidise, producing sulfuric acid. These soils may become exposed to air by either excavation or dewatering and may cause the generation of acidic runoff and/or the increased acidity of groundwater, which can impact on water quality and aquatic ecosystems.

The ASS risk class within the study area is largely Class 5 indicating no risk of intercepting acid sulfate soils for activities not resulting in the lowering of the water table by more than 1 metre, with the exception of the areas listed in Table 3-2.

Table 3-2 Acid sulfate soil risk and class

Precinct	Section of project area	Probability	Acid sulfate soil risk classification
2 and 3	Along Omaha Street east of Baltimore Street and Seventh Avenue, Campsie to Hay/Harmony Street intersection in Canterbury (2.2 kilometre length)	Low	Class 4
3	Cooks River (35 metre length)	High	Class 1
3	Centennial Street, Sydenham Road and Neville Street, Marrickville (130 metre length)	Low	Class 4
4	Edgeware Road between Darley Street in Marrickville and May Street in St Peters (360 metre length)	Low	Class 2
5	Princes Highway to Alexandra Canal (1.3 km length) including the Beaconsfield West substation	Low	Class 3

A detailed description of existing acid sulfate soils along expected to be present along the alignment is located in **Appendix 5 – Acid Sulfate Soil Management Plan (ASSMP)**.

3.8 Contamination

A detailed description of existing contamination expected to be present along the alignment is located in **Appendix 6 – Contaminated Land Management Plan (CLMP)**.

3.9 Asbestos

Asbestos may be present in some areas of the project alignment. Further information can be found in **Appendix 7 – Asbestos Management Plan (AMP)**.

4 Environmental Aspects and Impacts

4.1 Construction activities

Key aspects of the Project that could result in adverse impacts to soils and water include:

- Site access
- Vegetation clearing and topsoil stripping
- Utility relocation and alignment works (all utility providers)
- Slope or embankment stabilisation
- Bridge construction and piling (in-stream works)
- Excavation
- Ancillary facility operation including fuel and chemical storage, refuelling and chemical handling
- Concrete paving activities and concrete cutting
- Asphalt paving and bitumen spaying
- Dewatering of excavations and sediment basins
- Underboring
- Piling.

4.2 Impacts

The potential for impacts on soil and water will depend on many factors. Primarily impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction might include:

- Erosion and sediment mobilisation from disturbed areas or stockpiles resulting in increased turbidity in receiving waters and/or deposition of sediment in stormwater pits and drainage.
- Discharge of turbid water from excavations and sediment basins impacting receiving waters.
- Interception of groundwater aquifers, resulting in cross-contamination.
- Amenity impacts to sensitive receivers when dust is deposited on surfaces resulting in community complaints.
- Mobilisation of contaminants or leachate.
- Disturbance acid sulfate soils (ASS) resulting in generation of acidic leachate entering receiving waters.
- Mud tracking on public roads resulting in road safety issues and community complaints
- Drilling fluid escape.
- Chemical spills resulting in pollution of surface waters or contamination of groundwater.
- Hydrocarbon runoff from asphalt paving or bitumen seals.
- Concrete works and washout resulting in discharge of cementitious water contaminating land, groundwater or surface waters.
- Alteration of groundwater flow or landfill gas management measures.

Some impacts on soil and water attributable to the Project are anticipated in the EIS (AECOM, 2019). Relevant aspects and the potential for related impacts have been considered in a risk assessment and Appendix A2 of the **CEMP**. Section 5 provides a suite of mitigation measures that will be implemented to avoid or minimise those impacts.

4.3 Impact on Flooding

The permanent project works, and operation of the project will have negligible impact on flooding.

Construction the project would involve a variety of activities with potential to impact on quality and flow of surface water during floods, which are to be managed in accordance with the Environmental Control Measures (ECMs).

4.4 Impact on water quality

Once the trenches and underboring launch and receive pits are backfilled and the surface restored, there are unlikely to be ongoing water quality impacts associated with the project. Maintenance activities may occur from time to time, which has the potential for spills or leaks of fuels and/or oils to occur and impact on the water quality of groundwater and nearby waterways.

4.4.1 Impacts to existing stormwater network

Where the transmission cable route crosses existing stormwater assets, these assets may require relocation, or protection during construction. There would also be a need to divert stormwater as part of construction management activities to help manage flow. Where diversion would result in additional stormwater flow being diverted into the existing stormwater network, appropriate sediment management would be required and consultation with relevant authorities, including OEH, Sydney Water and local governments undertaken.

Impacts to the urban stormwater network are not anticipated if the alignment of the transmission cable circuit passes below the stormwater pipes, which would be supported during construction. However, there is a risk that stormwater could enter the trench if the stormwater pipes are temporarily cut and replaced during asset relocation. If pipes are required to be cut and replaced, rainfall forecasts would be monitored and works rescheduled if required, to avoid disrupting the flow of stormwater so as to minimise the risk of uncontrolled stormwater discharge. Temporary stormwater pipe bandages may be used.

At Camdenville Park, where there is an existing flood detention basin, the construction of the transmission cable circuit would be designed to not compromise the integrity of the embankment wall. That is, the integrity of the flood detention basin would need to be considered during detailed design to prevent potential damage.

Stormwater is harvested from the Ashmore trunk drain to support the Sydney Park wetlands in the north-eastern corner of Sydney Park. This system captures a portion of the stormwater runoff from Sydney Park Village and the Ashmore Street precinct. The proposed transmission cable route is outside the catchment draining to the harvesting point, and as such impacts to stormwater quantity or quality available to the harvesting system are not predicted.

4.4.2 Impacts to waterfront land

The existing riparian corridors within the project area have undergone significant urbanisation therefore the potential for additional impacts to the riparian corridors are limited.

Works within 40m of a watercourse may occur at Lindsay Street, Bellfield, where the project alignment crosses the Cooks River. No impacts to this land are anticipated as the works will be wholly within the existing road reserves.

Works on waterfront land must be carried out in accordance with the Guidelines for Controlled Activities on Waterfront Land (2018).

5 Environmental control measures

5.1 Site Specific Erosion and Sediment Control Plans (ESCPs)

To ensure the Environmental Controls Measures are set in place, site specific Erosion and Sediment Control Plan will be developed so that controls are established prior to construction, maintained whilst construction pass along the route and then removed post construction.

The Plans will be developed by a suitable professional and be in accord with *Managing Urban Stormwater: Soils and Construction* (Landcom 2004).

The number and lateral extent of the plans will be determined as to the potential risk of erosion and sedimentation associate with the extent of disturbance and the nature of the construction. It will consider the nature of the terrain, soil landscape units and the extent of construction (for example trenching verses joiner pits) as further detailed below.

Erosion and Sediment Control Plans will, as appropriate, include the following:

- be based on the relevant soil landscape unit and reflect the site's terrain position;
- seek to carry/divert ('clean') rainwater from interfacing with the construction site with soils and divert stormwater away from the construction area site;
- minimise sediment transfer through sediment control devices, including gravel filter socks, geofabric drainage socks, sediment fencing, hay bales, stakes/star pickets and plastic/geofabric (or other material) to reduce the rate of flow and volume and sediments in runoff;
- incorporate corridor or site fencing, concrete kerbs and hay bales acts as a sediment barrier and helps to reduce sediment movement on and off-site;
- require gravel filter socks and geofabric drainage socks will be set up locally around drains and gutters to prevent sediment ingress into the storm water system;
- involve regularly inspection of controls for integrity and any maintenance required, as necessary;
- emplacement of sandbags or silt socks around stormwater drains which may be affected;
- include where necessary exclusion zones around active remediation works (e.g. excavation of contaminated materials), stormwater and other water sources shall be contained within exclusion zones (Note : If stormwater drains are located within an active exclusion zone, these may require temporarily closure to prevent run-off into the stormwater system; and
- be updated in accord with the changes in construction activity.

5.2 Specific ECMs for all aspect of soil & water management

Table 5-1 summarises specific Environmental Control Measures (ECMs) to meet the objectives of this CSWMP and its supporting plans to address impacts on soil and water.

Table 5-1 Environmental Control Measures

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW01	Training will include: • Relevant legislation • Roles and responsibilities for soil and water management • Surface water quality management and protection measures • Flood management plan and Flood awareness (when wet weather is forecast) • Site water reuse and dewatering procedure. • Erosion and Sediment Control Plans • The location of ASS or PASS • Existence and requirements of this CLMP. • Environmental and occupational health and safety risks associated with contaminated materials. • The location of known or suspected contaminated soil and management protocols. • The location of known or suspected asbestos and management protocols. • The location of known or suspected potential or actual ASS and management protocols. • Landfill gas trigger levels, actions and management protocols. • Unexpected finds protocol. • Complaints response and reporting.	Project Manager Environment and Sustainability Manager	Prior to construction Construction	
ECM-SW01	Ongoing develop Site specific ESCPs in accordance the **SWMP**.	Civil Project Manager	Prior to construction in the area. Construction	
ECM-SW02	Implement all controls identified on the ESCPs.	Site Manager	Construction	
ECM-SW03	Prior to ground disturbance activities, implement controls to reduce sediment discharge into waterways, in accordance with the Blue Book (Landcom, 2004).	Site Manager	Construction	WQ1, WQ2, BD6 CoA E12
ECM-SW04	Minimise ground disturbance and exposed soil as far as practicable.	Site Manager	Construction	WQ2
ECM-SW05	Temporarily divert stormwater flow paths around the works, where possible.	Site Manager	Construction	WQ2

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW06	Notify the Environmental and Sustainability Manager if water is unable to be diverted around excavations.	Site Manager	Construction	
ECM-SW07	Where it not possible to divert stormwater around the works, undertake all reasonable measures to prevent water ingress into excavations, to avoid the need to pump out following a rainfall event.	Site Manager	Construction	
ECM-SW08	Avoid large volumes of stormwater accumulating in excavations.	Site Manager	Construction	
ECM-SW09	Manage Stormwater flows to avoid flow over exposed soils which may result in erosion and impacts to water quality. Inside the excavation this may require the use of trench stops.	Site Manager	Construction	WQ2
ECM-SW10	Monitor rainfall forecasts will daily during construction and reschedule works if necessary, to reduce risk of erosion and sedimentation and to minimise the impact of heavy rainfall and flood events.	Site Manager Environment and Sustainability Manager	Construction	WQ2 CoA E12
ECM-SW11	Manage surface water runoff in accordance with **SWMP**. *Note: surface water would be discharged or disposed of in accordance with the Protection of the Environment Operations Act, 1997 and Blue Book (Landcom, 2004). In areas where contamination is present the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems.*	Site Manager	Construction	E13, E14 WQ1
ECM-SW12	Manage groundwater dewatering in accordance with **GMS**.	Site Manager	Construction	E14
ECM-SW13	Where works are within the riparian zone (40 metres from the top of the watercourse bank) control measures are to be consistent with the *Controlled Activities on Waterfront Land Guidelines* (DPI, 2012),	Site Manager	Construction	WQ1
ECM-SW14	Restrict construction traffic to access tracks, where existing roads cannot be utilised (e.g. through Sydney Park).	Site Manager	Construction	
ECM-SW15	Ensure access tracks are clearly delineated until construction is complete.	Site Manager	Construction	
ECM-SW16	Backfill excavations as soon as each section of conduits has been installed, or as soon as practicable.	Site Manager	Construction	
ECM-SW17	Cover trenches temporarily when worksites are not in use.	Site Manager	Construction	
ECM-SW18	Monitor excavations during periods of heavy rain, so that if so that if pumping is required this can take place to prevent spill-over in an uncontrolled manner.	Site Manager	Construction	

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW19	Detailed hydrogeological information (e.g. bore data) will be used to inform the most suitable underboring construction method at select special crossings that will minimise the need for dewatering. Where an aquifer is to be completely penetrated at the underboring special crossings, appropriate controls (such as drainage blankets) will be installed beneath the infrastructure to ensure groundwater flow is maintained to minimise disruption to groundwater flow paths.	Site Manager Environment and Sustainability Manager	Construction	WQ1 GW2
ECM-SW20	Wheel wash water is to either be: 1. managed by containing and treating in a sediment basin used to manage surface water (excavation required as part of the works or surface basin); or 2. disposal in accordance with the **SWMP** discharge procedure.	Site Manager	Construction	
ECM-SW21	Manage storage and handling of dangerous goods in accordance with relevant guidelines and standards such as the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005).	Site Manager	Construction	WQ3
ECM-SW22	Ensure fuel and liquid storage at construction laydown areas is secure and stored in accordance with the NSW EPA guidelines (Department of Environment and Climate Change NSW, 2007b;	Site Manager	Construction	WQ3
ECM-SW23	Apply spill containment and prevention measures to fuel and liquid storage, where feasible and reasonable,	Site Manager	Construction	WQ3
ECM-SW24	A spill response kit will always be available at each worksite.	Site Manager	Construction	
ECM-SW25	Accidental spills or leaks will be managed through the use of spill containment measures including spill kits. Any contaminated material caused by spills will be disposed of to an appropriately licenced facility.	Site Manager	Construction	
ECM-SW26	Re-fuelling of construction plant and equipment will be undertaken using appropriate spill containment measures to mitigate pollution risks from accidental spills or leaks.	Site Manager	Construction	
ECM-SW27	Refuelling activities will be undertaken at least 100 metres from the nearest watercourse.	Site Manager	Construction	
ECM-SW28	When bringing in bulk fuel or other liquid substances, a container specifically designed for that purpose will be used.	Site Manager	Construction	

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW29	At underbore sites. Install appropriate stormwater diversions, as well as downstream pollution and sediment control measures to both prevent stormwater entering the excavation as well as to assist with containing any loss of drilling fluid.	Site Manager	Construction	
ECM-SW30	At underbore sites, visually monitor flows of drilling fluid.	Site Manager	Construction	
ECM-SW31	At underbore sites, diversions around launch and receive pits are to consider known localised flooding conditions with the aim of avoiding scour where possible.	Site Manager	Construction	
ECM-SW32	Install sediment and erosion controls should be installed prior to works commencing.	Site Manager	Construction	
ECM-SW33	Stabilise and restore watercourse crossings to as near as practical to their original profile, as fast as possible.	Site Manager	Construction	
ECM-SW107	Avoid compromising function of local rain gardens (including at corner of Juliett Street and Scouller Street Marrickville), detention basins and wetlands for water quality treatment. Where not possible to avoid, restore function as part of the works.	Site Manager	Construction	
ECM-SW108	If disposal of wastewater to sewer is identified as a potential option, obtain approval from Sydney Water prior to disposal to sewer.	Sustainability and Environmental Manager	Construction	
Flooding				
ECM-SW34	Stage worksites to limit the extent and duration of temporary works in a floodplain.	Site Manager Civil Project Manager	Construction	FF3
ECM-SW35	Schedule works within ephemeral watercourses and urban drains and urban drains when there is no rain forecast for several days.	Site Manager Civil Project Manager	Construction	
ECM-SW36	Avoid working inside ephemeral watercourses and other urban drainage network assets during or immediately following runoff generating rainfall events when stormwater flows in these watercourses are expected. Where the transmission cable must pass below stormwater pipes and pipes are required to be cut and replaced, rainfall forecasts should be monitored and works rescheduled if required.	Site Manager	Construction	FF3 Best practice
ECM-SW37	Remove equipment and materials from the floodplain areas at the completion of each work activity or in the event a weather warning is issued for impending flood producing rain.	Site Manager All Staff	Construction	FF3

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW38	Locate stockpiles outside areas of frequent inundation, surface runoff flow paths and above the 10% AEP flood level, where feasible and reasonable.	Site Manager	Construction	Best practice
ECM-SW39	Allocate storage for fuels, chemicals and other hazardous materials that is: • as far away from watercourses as possible; • located in an area immune to flooding during a 20 year Average Recurrence Interval (ARI) event; and • on an impervious bunded area. Measures are to be feasible and reasonable.	Site Manager	Construction	WQ3
ECM-SW40	At the Beaconsfield West substation site, regional weather conditions and river flow levels should be monitored during construction to pre-empt changes in weather patterns and flow regimes to minimise impacts that would be associated with wet weather. Allow sufficient time to vacate and prepare the site prior to the commencement of heavy rainfall and flood events.	Site Manager	Construction	
ECM-SW41	Ensure adequate supplies of flood response equipment, including sand bags, geofabric and pegs, are sufficient to divert work around all open worksites.	Site Manager	Construction	
ECM-SW42	Register with the BoM Flood Warning Service Program (www.bom.gov.au/australia/warnings) to receive flood warnings. *ECM applicable to Site Managers, Civil Project Managers and the Safety Manager.*	Site Manager Civil Project Manager Environment and Sustainability Manager	Construction	
ECM-SW43	Upon receipt of a "flood watch" warning, prepare the site in accordance with Section 5 of the **Flood Management Plan**.	Site Manager	Construction	
ECM-SW44	During a flood event complete the actions identified in Section 5 of the **Flood Management Plan**.	Site Manager	Construction	
ECM-SW45	Following a flood event, observe the proposed responses identified in Section 5 of the **Flood Management Plan**.	Site Manager Environment and Sustainability Manager	Construction	
Groundwater management				
1. Project areas that are predicted to require dewatering				

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW46	Identify project areas that will intersect groundwater and groundwater contamination during construction and/or operation via desktop review by a suitably qualified hydrogeologist of: ○ the preferred alignment and preliminary detailed design; ○ EIS information; and ○ information from supplementary contamination or ASS pre-construction investigations identified under sub-plans of the CSWMP.	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW1, GW2
ECM-SW47	Identify areas of concern, each being a project area where the aquifer is to be completely penetrated or has an elevated risk of impact on groundwater from dewatering identified in the GMS Section 4.1 or existing contamination identified in Table 5-1 of the CLMP or Table 3-2 of the PASS. The key areas expected to require assessment include select underbore special crossings at Cooks River and near Sydney Park.	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW1, GW2
ECM-SW48	Investigate groundwater in the areas of concern prior to the construction to assess the nature (including groundwater levels, flow direction, water quality and aquifer hydraulic conductivity) of groundwater and estimate potential dewatering requirements (rate, cumulative volume and water quality). The investigation design shall be developed and implemented by a suitably qualified and experienced hydrogeologist and shall consider: ○ Use of existing monitoring wells (e.g. near Sydney Park), and/or installation of supplementary monitoring wells or piezometers by drilling using construction methods consistent with guidance in NUDLC (2011) *Minimum Requirements for Water Bores in Australia*. ○ Groundwater sampling design and methods in NSW EPA made or approved guidelines under the *Contaminated Land Management Act 1997*, including ASC NEPM. ○ Estimate potential dewatering rates and drawdown using analytical calculation or computational methods. ○ Identify possible water quality objectives and criteria for extracted water, including consideration of feasible options of on-site re-use, discharge to sewer or stormwater, or off-site disposal of contaminated water to a suitable licensed facility consistent with this GMS.	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW1, GW2

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW49	Undertake baseline groundwater monitoring to provide an initial assessment of groundwater levels and water quality prior to the commencement of excavation in the select areas of concern.	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW1, GW2
2. Project design to minimise potential environmental impacts during operation				
ECM-SW50	Develop detailed design to mitigate to the extent practicable impacts from groundwater interference caused by project structures that fully penetrate an aquifer. This may include, but not be limited to: ○ Design depth and geometry of structures below the water table to reduce interference with groundwater flow. ○ Gravel drainage blankets beneath parts of the transmission cable route where bedrock is shallow and groundwater mounding could be caused by the blocking of groundwater flow paths.	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW1, GW2, GW3
ECM-SW51	Develop detailed design to mitigate to the extent practicable possible adverse preferential migration of contaminated groundwater, if present, caused by the backfill within the excavation. This may include, but not be limited to: ○ Sealing of annulus of structures or bores. ○ Reducing permeability of backfill to mitigate preferential flow (e.g. grout 'collar's placed periodically with trench backfill).	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW2
3. Project design to minimise potential environmental impacts during construction				
ECM-SW52	Develop the preferred underbore method (e.g. horizontal direction drilling [HDD] requires less excavation and dewatering for entry/exit pits than the thrust bore method) at selected special crossings based on investigations (above).	Civil Project Manager Environment and Sustainability Manager	Design / Prior to construction	GW2
4. Develop excavation and dewatering methods to minimise potential environmental impacts				
ECM-SW53	Assess and develop methods to reduce groundwater extraction and drawdown required for temporary dewatering to minimise disruption to downgradient receptors and reduce possible associated ground settlement including, but not be limited to: ○ Excavation retention systems (e.g. sheet piling) required for excavation safety purposes. ○ Excavation method and staging to minimise depth and duration.	Civil Project Manager Environment and Sustainability Manager	Construction Planning	GW1

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
	○ Measures to control surface runoff inflows in the SWMP. ○ Dewatering methods (e.g. sump and pump, spearpoints, careful control of drawdown).			
5. Groundwater management controls to minimise potential environmental impacts				
ECM-SW54	Refine estimates of potential dewatering rates and drawdown for the preferred project design and construction methods. Use these estimates to: ○ Assess possible adverse ground settlement impacts attributable to the project. ○ Determine whether approval from WaterNSW for construction dewatering is required – i,e, EMMM GW1 states that a groundwater extraction license would be required if 3 ML/year of groundwater discharge will be exceeded. This shall be applied per site within the project area.	Civil Project Manager Environment and Sustainability Manager	Construction Planning	GW1
ECM-SW55	Assess and develop appropriate methods to manage water collected during dewatering of excavations. The goal is to minimise potential impacts on the environment and will include consideration of reasonable and feasible alternatives to discharge to stormwater.	Civil Project Manager Environment and Sustainability Manager	Construction Planning	CoA E14, WQ1, GW4
ECM-SW56	The water will be discharged or disposed of in accordance with the POEO Act and relevant NSW waste regulations, and include one or a combination of: ○ On-site re-use (e.g. re-injection, use in dust suppression) of suitable water. ○ Discharge to stormwater - discharged water shall meet water quality criteria in ANZG (2018) for 95% protection level for marine ecosystems and, for analytes not covered by the guidelines, NHMRC (2011) as updated at the time of construction. ○ Discharge to sewer – Sydney Water acceptance standards. ○ Off-site disposal of contaminated water to a suitable licensed facility – disposed water shall be classified, transported and disposed in accordance with *Waste Classification Guidelines* (NSW EPA, 2014) and NSW waste regulations.	Civil Project Manager Environment and Sustainability Manager	Construction Planning	CoA E14 WQ1, GW4
ECM-SW57	Develop treatment requirements and design to meet the appropriate discharge water quality objectives.	Environment and Sustainability Manager	Construction Planning	CoA E14

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
				WQ1, GW4
ECM-SW58	Determine the licence / permit requirements for discharge.	Environment and Sustainability Manager	Construction Planning	CoA E14 WQ1, GW4
ECM-SW59	Develop a monitoring program to be implemented during construction dewatering. The aim of the program will be to monitor drawdown and possible adverse changes in groundwater conditions surrounding the project area, and comply with discharge water quality objectives. The program is envisaged to include gauging available monitoring wells, recording rate and volume of groundwater collected, and discharge water quality.	Environment and Sustainability Manager	Construction Planning	CoA E14 WQ1, GW4
6. Dewatering Management Plan (DMP)				
ECM-SW60	Document the preferred dewatering approach and management controls developed in the above measures in a DMP that is consistent with requirements of *Dewatering Work Method Statements* in RMS (2011) and in WaterNSW *Dewatering Checklist for a Water Works Approval.*	Environment and Sustainability Manager	Construction	CoA E14 WQ1, GW4
7. CSWMP				
ECM-SW61	Develop sub-plans under CSWMP that document management procedures and controls to mitigate possible impacts to groundwater from surface water runoff, erosion and sediments controls, and use of hazardous materials as part of construction.	Environment and Sustainability Manager	Construction	WQ1
8. Implementation of Management Plans				
ECM-SW62	Implement the CSWMP.	Site Manager	Construction	CoA E14
ECM-SW63	Implement the DMP(s).	Site Manager	Construction	CoA E14
9. Monitoring				
ECM-SW64	Undertake monitoring of groundwater levels and quality, and water discharge.	Environment and Sustainability Manager Site Manager	Construction	
10. Documentation				
ECM-SW65	Document groundwater monitoring and dewatering records for retention in general accordance with WaterNSW requirements in the *Dewatering Checklist for a Water Works Approval*.	Site Manager	Construction	

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
11. Compliance Management				
ECM-SW66	Perform compliance management in accordance with **Section 5.3** of the GMS.	Site Manager	Construction	
Acid Sulfate Soils management				
ECM-SW67	Follow the ASSMP.	Site Manager	Construction	CT7
ECM-SW68	Treat soil with lime in accordance with the ASSMP where PASS is not able to be loaded and transported to a landfill licensed to receive untreated PASS within 24 hours of excavation or if AASS are identified and excavated.	Site Manager	Construction	CT7
ECM-SW69	Minimise exposure of PASS material within an excavated trench or excavation site will be minimised to reduce the potential for oxidation and acid leachate generation.	Site Manager	Construction	CT7
ECM-SW70	Excavation to be done under dry conditions, where possible using a truck and shovel (tracked excavator) operation and the water table will be lowered within excavation areas, as part of excavation dewatering.	Site Manager	Construction	CT7
ECM-SW71	Monitor excavated fill for colour and leachate quality.	Site Manager	Construction	CT7
ECM-SW72	Do not place and leave untreated PASS material at the surface.	Site Manager	Construction	CT7
ECM-SW73	Place soil into an appropriately bunded treatment area (pads) and treat with a neutralising agent (e.g. lime).	Site Manager	Construction	CT7
ECM-SW74	Manage leachate water from the PASS material and treat to ensure no acid is released to the environment.	Site Manager	Construction	CT7
ECM-SW75	Capture any leachate generated during the ASS treatment operations.	Site Manager	Construction	CT7
ECM-SW76	If water potentially affected by leachate is collected within the excavation, treat with hydrated lime or equivalent prior to discharge.	Site Manager	Construction	CT7
ECM-SW77	Do not discharge Water potentially affected by leachate accumulating within the work site until it meets acceptable water quality standards or is collected and disposed at a licensed liquid waste treatment facility.	Site Manager	Construction	CT7
ECM-SW78	Manage PASS materials separate from non-PASS materials at all times to reduce the volume of material requiring treatment.	Site Manager	Construction	CT7

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
	Acid is transported by water; therefore, excavation works in PASS will be conducted during dry periods (where practical) to minimise the risk of overflow associated with sudden or heavy rain and to allow better control of treated waters for discharge.			
Contaminated Land Management				
ECM-SW79	Assess excavation areas in accordance with the **CLMP** Section 5.1.		Construction	CT1
ECM-SW80	Waste classifications referred to in the **CLMP** Section 5.1.1 may be used, except for areas that were identified as medium to high risk of contamination in the EIS.	Site Manager	Construction	CT1
ECM-SW81	Conduct further sampling to classify waste in areas identified as a medium to high risk of contamination in the EIS.	Site Manager	Construction	CT1
ECM-SW82	If unexpected finds are encountered follow the procedures outlined in the UCLAFP.	Site Manager	Construction	CT1, CT8
ECM-SW83	For parts of the transmission cable route where preliminary waste classification has not been undertaken or needs to be confirmed (refer to CLMP Table 5-1 and Section 5.1.2), waste classification will be undertaken in accordance with the NSW EPA (2014) *Waste Classification Guidelines: Part 1 Classifying Waste* and/or the *Excavated Natural Material Order* 2014.	Site Manager	Construction	CT1
ECM-SW84	Material classifications are to be documented in accordance with NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites*.	Site Manager	Construction	CT1
ECM-SW85	Prepare a SAQP to detail the additional investigations to address data gaps identified in the **CLMP** Table 5-1. *Refer CLMP Section 5.1.4 for guidance on preparation.*	Site Manager	Construction	CT1
ECM-SW86	Assess imported Virgin Excavated Natural Material in accordance with the **CLMP** Section 5.2.	Site Manager	Construction	CT2
ECM-SW87	Assess imported soil, mulch or aggregate material other than VENM in accordance with the **CLMP** Section 5.2.	Site Manager	Construction	CT2
ECM-SW88	Record the location of imported material and its classification in the material tracking register.	Site Manager	Construction	CT2
ECM-SW89	Camdenville Park	Site Manager	Construction	CT3

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
	Conduct limited baseline soil investigations at Camdenville Park laydown area prior to construction, then again at the completion of the project in accordance with the **CLMP** Section 5.3.			
ECM-SW90	Conduct air quality monitoring in accordance with the **AQMP** and asbestos air monitoring requirements in **AMP**.	Site Manager	Construction	CT4
ECM-SW91	Conduct air quality monitoring in accordance with Sydney Park and Camdenville Park **SSLGMP**s.	Site Manager	Construction	CT4
ECM-SW92	Exclusion zones and decontamination • Establish a safe work zone (exclusion zone) around the work areas that clearly defines the work zone and restricts public access and intruders after hours (i.e. fencing). • Provide adequate signage at the boundary of the safe work zone to deter entry, provide contact details for any enquiries and identify areas where asbestos may be present (refer to AMP). • Provide first aid, washing, toilet, eating, drinking and smoking facilities away from work areas. • Workers will change clothes daily and wash clothes separately from other clothes. • If the excavator bucket or other plant becomes contaminated during trenching works (e.g. soils known or suspected to be contaminated stick to the excavator bucket), then the plant will be decontaminated before the trenching continues into uncontaminated soils or plant is transported off-site.	Site Manager	Construction	CT4
ECM-SW93	Excavation ventilation to be provided in accordance with the **SSLGMP**s and **CLMP** Section 5.9.	Site Manager	Construction	CT4
ECM-SW94	Do not enter trenches immediately following excavation. Monitoring inside the trench with a landfill gas meter and PID prior to entry. Trigger points for non-entry are provided in the CLMP Section 5.9.1.	All Staff	Construction	CT4
ECM-SW95	Dust suppression and containment of contaminated areas • Follow guidance in AMP. • Follow guidance in AQMP. • The length of trench open at any particular location at any time is to be minimised to limit the opportunity for loose,	Site Manager	Construction	CT4

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
	exposed soils being present at the surface for extended periods of time that may result in generation of dust and. Trenches will be progressively rehabilitated throughout the day. • If required, the open trench will be watered down to minimise the generation of dust. In addition, regularly water all exposed unpaved surfaces at construction laydown areas (excluding stockpiles) or special crossing work sites when conditions are dry and windy, through the use of water sprays, sprinkler systems, a water cart or other suitable methods. Frequency would be determined by how quickly the surface dries out again, with higher frequency watering required on hot, dry, windy days. • Disturbed ground and exposed soils, such as inside trenches or at construction laydown areas, will be temporarily stabilised (e.g. with geotextile) prior to extended periods of site inactivity and permanently stabilised as soon as possible to minimise the potential for erosion. • Minimise drop heights from excavators when placing spoil into trucks or onto stockpiles to reduce the potential for dust generation.			
ECM-SW96	Odour suppression and monitoring • Follow guidance in AQMP. • If odours from impacted soils are encountered during excavation works, monitoring of ambient air with a volatile organic compound gas detector (e.g. photoionisation detector [PID]) will be conducted in accordance with the SWMS/JSA. • In excavations adjacent to (Arlington Oval, Marrickville Park, Henson Park) or within former landfills (Camdenville Park and Sydney Park), then additional monitoring with a landfill gas meter will be undertaken (Refer to **CLMP** Section 5.9.1 and SSLGMPs). • Excessive odour emissions may be mitigated by odour suppression controls, such as covering odorous materials or perimeter misting systems.	Site Manager	Construction	CT4
ECM-SW97	Personal protection equipment (PPE) • Use PPE to minimise direct contact with soils, inhalation of dust or LFG generated during the handling of	Site Manager	Construction	CT4

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
	contaminated soil or excavation in landfill material. Appropriate PPE will be detailed in the SWMS/JSAs and include, at a minimum, PPE (and procedures for proper use of PPE) to minimise direct contact with contaminated media including gloves, long-sleeved tops, long trousers and safety glasses. Additional PPE may be required where asbestos is present (refer to the AMP). • Refer to AMP and SSLFGMP for specific PPE requirements.			
ECM-SW98	Stockpile management and separation • Place excavated contaminated materials on temporary, impermeable barriers (e.g. builders plastic) or pavement to protect underlying surface soils from potential cross-contamination. • Store excavated materials in stockpiles in accordance with guidelines in the TransGrid Environmental Handbook. • Soils that appear different (e.g. inclusion of anthropogenic material, different colour, different texture, different odour) should be stockpiled separately. • Suspected or identified ASS material stockpiles will be segregated and managed in accordance with the ASSMP. • Non-active (i.e. not in use for more than 24 hours) stockpiles will be covered with a tarpaulin or alternative geotextile to prevent generation of dust and limit runoff from soil stockpiles during rainfall events. • Fully cover and protect exposed stockpiles with plastic sheeting when the work area is not occupied to prevent generation of dust, reduce odours and provide protection during rainfall. • Provide a suitable barrier around stockpiles to minimise sediment runoff during rainfall. This will be in accordance with the ESCP.	Site Manager	Construction	CT4
ECM-SW99	Spoil and excavation management • Excavated material from trenches assessed to be suitable for use (refer to CMLP Section 5.1) will be reinstated into its originating position if required for excavation backfill. Trenches will be backfilled immediately following laying of conduits. • If excess spoil requires off-site disposal, or excavated spoil comprises ASS or is not suitable for re-use, then waste	Site Manager	Construction	CT4

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
	classification of the spoil must be undertaken in accordance with the **CLMP** Section 5.1.1 In the event that materials are to be disposed off-site, a waste and materials tracking log will be maintained (refer to **CLMP** Section 5.5). • If the volume of suitable site-won excavated soil is insufficient, then appropriately classified imported materials (refer to **CLMP** Section 5.2). • In areas of identified contamination, excavation works will continue to "chase out" contaminated materials, to the extent practicable, within the planned trench extent. • Contaminated soils or asbestos (if any) remaining at boundaries of excavations required for the project area will not be removed, but will be characterised by asbestos clearance and validation, with the nature and location of remaining contamination recorded. • As outlined in the AMP, a marker layer will be placed along the length of any walls or floor of the trench where residual asbestos or other contamination remains. This aims to provide a visual aid to future construction or maintenance workers that residual asbestos / contamination is present along the trench walls or floor and that appropriate health and safety protocol should be followed. • The surface of trenches will be pavement, imported VENM or, if site-won suitable soils, free of any anthropogenic material.			
ECM-SW100	Situation responsiveness • is to be followed (refer to the UCLAFP). • Site works will be delayed during windy conditions (i.e. when airborne dust is visible and persistent at the works area boundary) to reduce the potential for unacceptable quantities of disturbed soils to become airborne. The forecast weather conditions will be included in daily tool box talks and construction planning. Refer to the AQMP. • Site works will be delayed during heavy rainfall to reduce the potential for exposed soils to be washed away from the work area causing erosion and sedimentation. Rainfall forecasts will be monitored daily during construction and works rescheduled if necessary and as determined by the contractor.	Site Manager	Construction	CT4 CT8

ID	Indicative Mitigation and Management Measures	Responsibility	When to implement	Reference
ECM-SW101	Water management • No uncontrolled discharge of any solid or liquid substances is to enter into gutters, stormwater inlets/ drains, drainage lines or watercourses. Refer to sediment and surface water procedures and controls in the ESCP and SWMP, respectively. • Water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) will be collected and discharged or disposed of in accordance with the procedures and water quality objectives outlined in the GMS. • Contaminated water captured during construction will be treated or disposed of at an appropriately licensed facility in accordance with the procedures and water quality objectives outlined in the GMS. • Dewatering of excavations in small portions of the project may be required to enable construction, particularly at select underbore special crossings. Procedures and controls to assess dewatering requirements and mitigate possible impacts are outlined in the GMS.	Site Manager	Construction	CT4
ECM-SW102	Incident response procedures are to follow the procedure documented in the **CEMP** Section 7.	Site Manager	Construction	CT4
ECM-SW103	Waste spoil is to be managed in accordance with the **CWMP** and **CLMP** Section 5.5.	Site Manager	Construction	CT5
ECM-SW104	Asbestos containing materials are to be managed in accordance with the **AMP**.	Site Manager	Construction	CT6
ECM-SW105	Acid Sulfate Soils are to be managed in accordance with the **AMP**.	Site Manager	Construction	CT7
ECM-SW106	Former landfills are to be managed in accordance with the **CLMP** Section 5.9 and any relevant **SSLGMP**s.	Site Manager	Construction	CT9

5.3 TransGrid Guidance notes

A copy of relevant TransGrid standard environmental guidance notes are included in **Attachment 9**. These guidance notes are intended to provide general environmental guidance. Where specific compliance is required with a particular guidance note, it is noted in the CSWMP.

6 Compliance Management

6.1 Roles and responsibilities

The Project organisational structure and overall roles and responsibilities are outlined in the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 5.3 of this Sub-plan.

Key roles with relevant to the management of soil and water are identified in Table 6-1.

Table 6-1 Roles and responsibility

Role	Authority and responsibility
Environment and Sustainability Manager	Oversee implementation and compliance with this Sub-plan Complete inspections and monitoring Complete reporting Identify additional ECMs relevant to work activities involved with construction activities Facilitate an induction and training program for all key personnel Carry out environmental audits during construction work to verify compliance with this CEMP, and report findings to the Project Manager Respond to environmental incidents and non-conformances Prepare and update Erosion and Sediment Control Plans Confirmation that AMP is being implemented through regular inspections.
Suitably qualified and experienced hydrogeologist	Assess nature and extent of dewatering required Assess design requirements to mitigate impacts on groundwater flow Prepare DMP (if required)
Contaminated Land Consultant	Assess dewatering discharge water quality objectives and treatment requirements Assess design requirements to mitigate impacts on groundwater contamination Field pH testing of potential ASS for re-use at request of contractor Person who conducts assessments of contaminated land, including asbestos as required by the contractor
Suitably qualified and experienced driller	Appropriate construction of monitoring wells and underbores in accordance with *Minimum Requirements for Water Bores in Australia* (NUDLC, 2011).
Suitably qualified and experienced engineer	Design groundwater flow mitigation systems (e.g. drainage blankets), if required

Civil Project Manager	Review and provide resources to implement the controls identified in the ECM
Site Manager	Install and maintain environmental control in accordance with ESCPs, ECMs and This Plan Attend inspections with the Environmental Coordinator, TfNSW / ER, Soil Conservationist or other stakeholders Implement corrective actions raised during environmental inspections in agreed timeframes Obtain and comply with Water Discharge Permits prior to any discharge of water from site Notify the Environmental Coordinator of any observations of Visual difference in water quality (turbidity) from upstream to down of works or site discharge or other pollution event evident in waterway including discolouration, fish kill or strong odour
Asbestos Occupational Hygienist	Person who conducts asbestos clearances and air monitoring Must be a Competent Person or Licensed Asbestos Assessor as defined in SafeWork NSW Codes of Practice
Asbestos Removal Contractor	Suitably licensed person who removes asbestos
All personnel	Notify Site Supervisor of any observations of Visual difference in water quality (turbidity) from upstream to down of works or site discharge or other pollution event evident in waterway including discolouration, fish kill or strong odour Carry out work in accordance with the requirements of this CEMP in conjunction with the latest drawings issued for construction Exercise due care, skill and foresight when carrying out tasks Immediately report all environmental incidents to TransGrid's representative Comply with all permits, approvals and subsequent plans associated with these works Be able to locate a copy of this EMP on site if requested Implement corrective actions which have been approved by the appointed site supervisor

6.2 Training & Induction

All project personnel will only be permitted to perform project works if they have had the following training and signed a register of acknowledgement for each step. Each person has:

- completed a full site-specific induction, including an environmental component;
- agreed to work under the constraints of the CEMP;
- have read and understood all relevant site-specific Safe Work Method Statement (SWMS) documents for the project site work; and
- relevant construction personnel have attended the daily pre-start toolbox talk where aspects of environmental protection and worker's safety are discussed.

The induction training will address elements related to soil and water management including:

- Relevant legislation
- Roles and responsibilities for soil and water management

- Surface water quality management and protection measures
- Flood management plan
- Site water reuse and dewatering procedure.
- Erosion and Sediment Control Plans
- The location of ASS or PASS
- Existence and requirements of this CLMP
- Environmental and occupational health and safety risks associated with contaminated materials
- The location of known or suspected contaminated soil and management protocols
- The location of known or suspected asbestos and management protocols
- The location of known or suspected potential or actual ASS and management protocols
- Landfill gas trigger levels, actions and management protocols
- Unexpected finds protocol
- Complaints response and reporting

Targeted training in the form of toolbox talks or specific training will also be provided to relevant construction personnel with a key role in soil and water management.

- Erosion and sediment control planning and installation methodology
- Temporary stockpile location criteria
- Waste separation
- Sediment basin construction
- Sediment basin maintenance
- Working near or in waterways
- Preparedness for high rainfall events
- Chemical storage and spill response
- Concrete washout requirements
- Emergency response measures in high rainfall events

Further details regarding staff induction and training are outlined in Section 3.4 of the CEMP.

6.3 Monitoring and inspections

Monitoring and Inspections requirements relevant to the management of soil and water including avoidance, minimisation and management of erosion is identified in Table 6-2.

6.4 Audits

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental control measures, compliance with this Sub-plan, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in the CEMP.

6.5 Approvals, Licenses and permits

Approval from WaterNSW may be required for construction dewatering if the extracted volume is expected to exceed, or exceeds, 3 ML in a year commencing on 1 July in any year.

Table 6-2 Inspection and Monitoring Requirements

Item	Scope	Timing	Frequency	Responsibility	Records / Reporting
Weather forecasts	Monitoring of Bureau of Meteorology Canterbury Detailed Forecast and MetEye or other relevant forecasts when adverse weather is predicted. Issue notifications to Project Manager, Civil Project Manager and Site Manager if • adverse weather is forecast; or • rainfall depth exceeding the 5-day 80th %tile (24.4mm) is forecast. [a]	Construction	Weekly forecast Daily updates when adverse weather is predicted	Environment and Sustainability Manager	Email alerts Pre-starts
Weather observations	Weather observations from Bureau of Meteorology IDN60901 for Canterbury or other relevant gauge.	Construction	Monthly	Environment and Sustainability Manager	Monthly Environmental Monitoring Report
Visual water quality (Turbidity) surveillance	Surveillance of discharges or downgradient watercourses for visual alteration of receiving water quality.	Construction	Continual	Site Manager	Daily dairy Notification of issues / incidents / non-compliance to Environment and Sustainability Manager
Erosion and sediment control measures pre- and post-rainfall Inspection	Pre- and Post-rainfall event forecast to exceed 24.4mm [a] to ensure erosion and sediment controls functionality is maintained.	Construction	Within 5 days of the cessation of the rainfall event.	Site Manager	Environmental Inspection Checklist
Visual inspections	Daily site checks of maintenance of soil water management measures.	Construction	Daily	Site Manager	Environmental Inspection Checklist
Trench, joint bay and cat pit, underbore pit overtopping inspections	Inspection of trench, joint bay, cat pit and underbore pit overtopping inspection during rainfall events that exceed 24.4mm [a] that may result in the overtopping of untreated water .	Construction	as soon as reasonably possible during or following a rainfall event	Site Manager Environment and Sustainability Manager	Environmental Inspection Checklist
Review of ESCPs	Review and revision by the Environment and Sustainability Manager and Site Managers to ensure • coverage of all active work areas; • the ESCPs are relevant to the areas of disturbance; and • the suitability of planned controls.	Construction	Quarterly	Site Manager	Updated or reviewed ESCPs

Notes:

[a] Adopted from Landcom (2004) Table 6.3a 75th, 80th, 85th, 90th and 95th-percentile 2 and 5-day rainfall depths for 59 sites in New South Wales for Bankstown.

7 Review and Improvement

7.1 Continuous improvement

Continuous improvement of this Sub-plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for identifying opportunities for improvement.

Monthly reviews undertaken by the Environment and Sustainability Manager and quarterly management reviews provide specific opportunities to identify improvements in the environmental management system and/or this plan.

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance;
- Determine the cause or causes of non-conformances and deficiencies;
- Develop and implement a plan of corrective and preventative action to address any non- conformances and deficiencies;
- Verify the effectiveness of the corrective and preventative actions; and
- Document any changes in procedures resulting from process improvement.

Make comparisons with objectives and targets.

7.2 CSWMP update and amendment

This plan will be updated as required. Updates or revision this Sub-plan may be triggered by:

- the processes described in the EMS;
- result of any investigations into any exceedances or non-conformances that determine changes to this plan are required to prevent reoccurrences;
- to take into account changes to the environment or generally accepted environmental management practices, new risks to the environment or changes in law;
- where requested or required by the NSW Department of Planning and Environment or any other Authority; or
- in response to internal or external audits.

The updated plan must be endorsed by the Environment and Sustainability Manager and approved internally by the Project Manager. Minor changes may be approved by the Environment and Sustainability Manager. Minor changes would typically include those that:

- are editorial in nature (e.g. staff and agency/authority name changes);
- do not increase the magnitude of impacts on the environment when considered individually or cumulatively; and
- do not compromise the ability of the project to meet approval or legislative requirements.

Where the Environmental Representative deems it necessary, the plan will be provided to relevant stakeholders for review and comment if required and forwarded to the Secretary of DPIE.

Where approval of the Secretary of DP&E is not required, a copy of the updated plan will be provided to the Secretary for information.

8 References

AECOM (2019), Powering Sydney's Future - Potts Hill to Alexandria transmission cable project, Environmental Impact Statement, Volume 1 – Main Volume, 11 October 2019.

AECOM (2020), Powering Sydney's Future - Potts Hill to Alexandria transmission cable project, Amendment Report February 2020.

NSW EPA (2014) Waste Classification guideline

Landcom (2004), Managing Urban Stormwater: Soils and Construction (Blue Book).

ASSMAC, 1998, *NSW Acid Sulfate Soils Manual*.

National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure,* as amended 15 May 2013.

NSW EPA, 2014. *Waste Classification Guidelines – Part 1: Classifying Waste.*

Soil Conservation Service of New South Wales, *Botany Bay Acid Sulphate Soil Risk Map* (1:25,000 scale)

Australian Standard AS 1940B1993: The Storage and Handling of Flammable and Combustible Liquids

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)

Appendix 1 – Consultation Evidence

#	Document No	Plan Title	Date	Organisation	Name	Document name Page / section / reference	Revision	Comment	TransGrid/Taihan How addressed	Status
44	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	19-Jun-20	City of Canterbury Bankstown	Jeff Senior	Construction Soil and Water Management Plan	0	No comment		Closed
45	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	19-Jun-20	Inner West Council	Lana Frost	Construction Soil and Water Management Plan, Page 33, Section 4.4.1, Impacts to existing stormwater network	0	Please add a note that WSUD infrastructure, such as rain gardens may be present in connection to the stormwater network, the construction of the transmission cable circuit would be designed to not compromise the integrity of the rain garden.	Note added, though not anticipated to impact being, generally trenching in mid road	Closed
46	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	19-Jun-20	Sydney Water	Peter Jansen	33 / Section 4 / Section 4.4.1	0	adjustment works relating to Stormwater needs approval and design works where the assets are Sydney Water assets.	TransGrid and its subcontractor do not envisage any modification or relocation of SWC assets.	Closed
47	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	19-Jun-20	Sydney Water	Peter Jansen	General	0	no direction connection to Our stormwater has been approved. No approval has been given for any ground water discharges - this will be required to be lodged and assessed.	Where discharge to SWC assets is required a trade waste licence will be applied for	Closed
48	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	17-Jun-20	City of Sydney	Rowan Clark (Parks Environmental Engineer)	Unexpected Contaminated Land and Asbestos Finds Procedure (TEA-PSF-MP-004.580 PSF UCLAFP)	0	Document sufficiently addresses any concerns raised. No Comments recorded.		Closed
49	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	25-Jun-20	City of Sydney	Rowan Clark (Parks Environmental Engineer)	Contaminated Land Management Plan (TEA-PSF-MP-004.560 PSF CLMP)	0	Document sufficiently addresses any concerns raised. No Comments recorded.		Closed
50	TEA-PSF-MP-004.500	Construction Soil and Water Management Plan	25-Jun-20	City of Sydney	Rowan Clark (Parks Environmental Engineer)	Appendix 1 to CLMP - Landfill Gas Management Plan (SPLGMP)	0	Document sufficiently addresses any concerns raised. No Comments recorded.		Closed
51	TEA-PSF-MP-004.570	Construction Asbestos Management Plan	19-Jun-20	City of Sydney	Rowan Clarke	Construction Asbestos Management Plan	1	No comment		Closed
52	TEA-PSF-MP-004.570	Construction Asbestos Management Plan	26-Jun-20	City of Canterbury Bankstown	Jeff Senior	Construction Asbestos Management Plan	1	No comment		Closed

Appendix 2 – Example Erosion and Sediment Control Plans (ESCPs)

This Environmental Controls Drawing (ECD) is to be read in conjunction with the Environmental Work Method Statement (EWMS)

Prior to commencement of works supervisor should ensure pre-start communication with work crews regarding the control measures, exclusion zones and sensitivities of the area is conducted.

All works are to be confined within the works boundary.

Erosion and sediment controls are to be implemented as indicated. On ground modifications to ERSED controls must be consistent with Blue Book best practise.

Erosion and sediment controls MUST be inspected following a rain event and at least weekly as part of a workplace inspection.

Limited (50L) fuel or chemicals may stored in bunded containers within the work boundary and at least 50m from the River. Where 50m isn't practicable inform the Environment and Sustainability Manager.

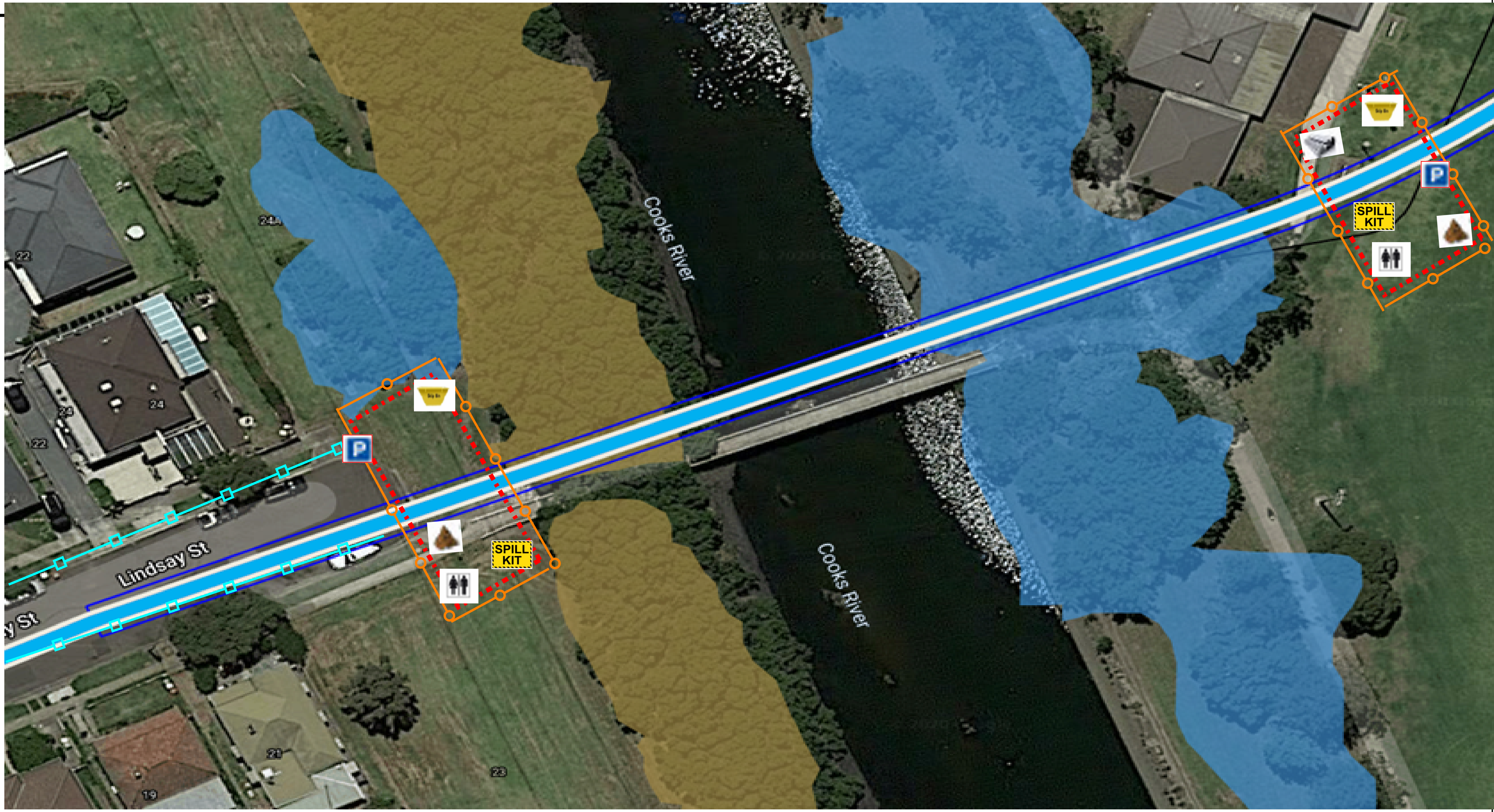
Clean up any mud tracking on roads at the end of work day.

Note: All environmental controls on this drawing are indicative only and not to scale. On ground validation of indicated areas must be conducted.

N

Legend

- Portaloo
- Waste Bin/Skip
- Sediment fencing
- Kerb & Inlet Controls as required
- Works Boundary
- Undisturbed riparian zone
- Disturbed riparian zone
- SPILL KIT — Spill kit locations
- Indicative HDD tunnel.
- Material Stockpile
- Soil stockpile
- P — ParkingArea



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APPROVED: -	DATE: -	PROJECT No: - / DRAWING No: -	REV No: -

TITLE: ECD 001 - HDD Lindsay St

Appendix 3 – Surface Water Management Plan (SWMP)

Surface Water Management Plan

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1 Environmental Requirements

1.1 Legislation

Refer **Construction Soil and Water Management Plan (CSWMP)** and **Construction Environmental Management Plan (CEMP)** Appendix A1 Legal Requirements Register.

1.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to this sub-plan include:

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
- Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the "Blue Book"). Volume 1 and Volume 2
- Volume 2A Installation of Services (DECCW 2008)
- Volume 2C Unsealed Roads (DECCW 2008)
- Volume 2D Main Roads Construction (DECCW 2008)
- Floodplain Development Manual (NSW Government, 2005)

1.3 Minister's Condition of Approval

The Surface Water Management Plan (SWMP) was developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 the **Soil and Water CEMP Sub-Plan** required under **Condition C3** must include a:

(b) **Surface Water Management Plan**, for managing surface water quality and quantity, watercourse and flooding impacts of the SSI. This plan must include a:

(i) **Flood Mitigation Strategy** for work within flood prone or flood affected land, demonstrating that the SSI will not exacerbate existing flooding characteristics, unless otherwise agreed by the relevant council(s).

(i) **Flood Management Plan**, for managing flood risk during construction.

CoA No	Condition requirement	Reference	How addressed
E20	the **Soil and Water CEMP Sub-Plan** required under **Condition C3** must include a:		
	b) **Surface Water Management Plan**, for managing surface water quality and quantity, watercourse and flooding impacts of the SSI. This plan must include a:	Section 3 Surface Water Quality Management	
	i. **Flood Mitigation Strategy** for work within flood prone or flood affected land, demonstrating that the SSI will not exacerbate existing flooding characteristics, unless otherwise agreed by the relevant council(s); and	Attachment II – Flood Mitigation Strategy	The flood mitigation strategy identifies existing flooding characteristics along the project alignment.
	ii. **Flood Management Plan** for managing flood risk during construction;	Attachment III – Flood Management Plan	The flood management plan identifies requirements relating to management of flooding risks during construction.

1.4 Environmental Mitigation and Management Measures

EMMMs were developed (AECOM, 2020) following submissions from the EIS and a number of design refinements for the project. A summary of the updated EMMMS for the project including changes associated with the design refinements considered are provided in the Amendment Report (AECOM, 2020).

Table 1-1 Environmnetal Mitigation and Management Measures (EMMMs) applicable to this document

Impact	ID	Measure
Water quality – spills and leaks	WQ3	The following measures will be documented in the CSWMP and implemented to mitigate and manage spills and leaks: • areas will be allocated for the storage of fuels, chemicals and other hazardous materials. These areas will be as far away as feasible and reasonable from watercourses, located where flooding during a 20 year Average Recurrence Interval (ARI) event is unlikely, and on an impervious bunded area; • the storage and handling of dangerous goods will be in accordance with relevant guidelines and standards such as the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005); • fuel and liquid storage at construction laydown areas will be secured and stored in accordance with the NSW EPA guidelines (Department of Environment and Climate Change NSW, 2007b); • appropriate spill containment and prevention measures will be applied to fuel and liquid storage, where feasible and reasonable; • accidental spills or leaks will be managed through the use of spill containment measures including spill kits. Any contaminated material will be disposed of to an appropriately licenced facility; • re-fuelling of construction plant and equipment will be undertaken using appropriate spill containment measures to mitigate pollution risks from accidental spills or leaks; • refuelling activities will be undertaken at least 100 metres from the nearest watercourse; • a spill response kit will be available on-site at all work sites at all times; • where bulk fuel or other liquid substances are to be brought to a work site, a container specifically designed for that purpose will be used; • underboring sites will have appropriate stormwater diversions, as well as downstream pollution and sediment control measures to both prevent stormwater entering the excavation as well as to assist with containing any loss of drilling fluid; and • flows of drilling fluid will be visually monitored in accordance with the CSWMP.

2 Existing Environment

2.1 Surface Water Quality

Water quality of the catchments and waterways within the study area are generally highly influenced by their urban context. The following features influence the water quality of the receiving waters in the study area:

- the urbanisation of the catchments and subsequent reduction in pervious areas reduces the likelihood of the settling or depositing out of pollutants and sediments being transported in stormwater runoff to settle or deposit out before entry into the estuary or contributing waterways;
- the artificial channelisation and hard (typically concrete) lining of waterways reduces the potential for erosion in the channels, minimising the sediment load transfer from upstream catchments to the discharge location;
- exhibits elevated levels of heavy metals, pH, turbidity and nutrients which is representative of waterways within a highly urbanised catchment; and
- pollution control devices including Gross Pollutant Traps (GPTs) and litter booms have been installed at a number of locations on waterways downstream of the project to assist with managing the water quality in the receiving waters. These devices are typically maintained by Council.

Surface water quality within Cooks River, Parramatta River and Georges River catchments are discussed in Table 2-1.

Table 2-1 Surface Water Quality Summary

Catchment	Description of water quality
Cooks River	Water quality in the Cooks River catchment has been affected historically by stormwater pollution, industrial and domestic wastewater discharge, rubbish dumping and modifications of the waterway. Present levels of pollutants, including nutrients, sediments, toxicants and faecal coliforms make the Cooks River unsafe for swimming, unsuitable for many aquatic species and a health risk for commercial fishing.
Parramatta River	Pollution to the waters and sediments in Sydney Harbour (including Iron Cove) result from stormwater, sewage overflows and leachate from contaminated reclaimed land (Montoya 2015). Stormwater discharged via large canals with extensive catchments is a major point source of contaminants to Parramatta River estuary and Sydney Harbour (Birch and Taylor, 1999). Stormwater discharged from highly urbanised catchments on the southern shore of the Parramatta River estuary and Sydney Harbour has been identified as the primary source of contaminants responsible for ecological degradation and reduction in recreational value of these waters (Beck and Birch, 2010).
Georges River catchment	Estuary health monitoring gives a rating of B- (Fair). Estuary conditions are affected by the urbanisation of the tributaries. Stormwater inflows flush pollutants into the estuary, while the upper estuary where the Sydney South substation is located receives minimal tidal flushing.

2.2 Surface Water Quantity

Refer **Attachment II – Flood Mitigation Strategy**.

3 Surface Water Quality Management

3.1 Managing surface water entering open excavations

Stormwater may enter open excavations, including trenches, pits and joint bays. In some circumstances it may not be possible to divert all upstream catchment flows during construction. For example, where the trench intersects low points in road crossings. At these locations, the open excavation would act as a sediment basin. These open excavations would be managed in accordance with Landcom (2004) to manage the 5-day 80th percentile storm depth of 24.4mm.

3.2 Surface water reuse and discharge

Water discharge from the project may be required either to ensure that sufficient storage capacity is available in open excavations or where water has been detained after wet weather within open excavations.

Where practicable, water contained in excavations will be reused onsite (e.g. dust suppression, watering retained vegetation, cooling).

Where necessary, treatment of any water to be discharged will be undertaken in accordance with the Dewatering and Discharge Procedure provided in this Section and the Ground Water Management Strategy (as applicable) and will be carried out prior to discharge offsite. Testing and treatment can occur within open excavations or in a sealed container(s).

Prior to any discharge offsite or reuse onsite the Environment and Sustainability Manager is to sign off that the water is suitable for the proposed reuse or discharge. Water quality monitoring will be undertaken in accordance with this Section and the Ground Water Management Strategy (as applicable), which includes the relevant discharge criteria contained in the project Conditions of Approval E14.

Based on the sediment basin design criteria in Section 3.1, when rainfall received within a 5-day period exceeds 24.4 mm, it is expected that open excavations may discharge naturally without an opportunity to flocculate and test basins.

Any discharges of water originating from the surface would follow the TransGrid *Environmental Guidance Note: Minor Civil Works-Dewatering* (refer **CSWMP** Appendix 9) and Landcom (2004)[1]. It is noted that the TransGrid guidance note provides relevant criteria that proposed discharge water must meet before it enters any creeks or stormwater.

3.3 Groundwater management

Testing and, where necessary, treatment of any groundwater dewatering will be undertaken in accordance with the **Dewatering and Discharge Procedure** provided in the **Groundwater Management Strategy** and will be carried out prior to discharge offsite. Testing and treatment can occur within open excavations or in a sealed container(s).

3.4 Water quality monitoring

Water quality monitoring would be implemented during construction to monitor compliance as described below.

[1] Refer Volume 1 and Volume 2A Installation of Services

3.4.1 Sampling

Water quality monitoring may be conducted for three reasons.

- **Open excavation overtopping event –** during rainfall events that exceed a construction basin design rainfall event and result in discharge of untreated water from the basin.
- **Incident investigation** – in response to discharges, incidents or complaint observed to result in visual impact to water quality.
- **Construction site dewatering and discharge monitoring** – sampling of water prior to discharge to confirm compliance of water quality with the standard project water quality criteria Relevant surface water discharge criteria is discussed in Section 3.2.

3.4.2 Monitoring frequency

The frequency of monitoring would be conducted as follows.

- **Open excavation overtopping event** – during each basin overtopping events.
- **Incident investigation –** In response to any discharge, in-stream works, incident or complaint observed to result in impact to water quality.
- **Construction Site Dewatering and Discharge monitoring –** prior to any discharge or construction water from site.

3.4.3 Water quality parameters

Surface water

Two sets of water quality parameters have been defined:

- Field parameters to be assessed with a field water quality probe
  - Turbidity (NTU)
  - pH
  - Conductivity
  - DO %
  - Oil and grease (visual assessment)
  - Temperature.
- Laboratory Samples
  - TSS
  - Salinity (EC)
  - pH
  - Sulfate
  - Chloride
  - Metals
  - Phosphorus
  - Nitrogen
  - Hydrocarbons (TPH, TRH).

The following additional information will be collected with all sampling events:

- Preceding rainfall
- River / creek water level
- Tidal sequence in tidal reaches
- Visual observations for litter, debris, oil, grease and large pollutants

- Summary of relevant construction activities and discharges
- Observations of other non-construction contributors to variations in water quality (e.g. stormwater)
- Photos

Groundwater

Any proposed water associated with groundwater dewatering would be subject to assessment under *ANZECC (2000)* and the *National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines (2015)* in accordance with Condition E14. Refer **Groundwater Management Strategy** for more information.

4 Surface Water Quantity Management

Refer **Attachment III – Flood Management Plan**.

Attachment I – Not used

Attachment II – Flood Mitigation Strategy

Flood Mitigation Strategy

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3.1.5 EC East Sub-catchment Management Plan: Volume 2 - Flood Study (Golder Associates, 2010) 7

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1 Overview

This Flood Mitigation Strategy (FMS) is a technical report that provides:

- a summary of the flood assessments undertaken for the permanent works;
- an assessment of flooding during construction and operation of the Project;
- identification of specific flood risks; and
- a discussion on proposed mitigation measures to meet Condition of Approval for SSI-8583.

Specifically, this Flood Mitigation Strategy (FMS) has been prepared in accordance with the *Floodplain Development Manual* (DIPNR, 2005) for work within flood prone or flood affected land within the project area, to demonstrate that the existing flooding characteristics will not be exacerbated.

Generally, the proposed works are located clear of the 100 year ARI flood, except where the alignment crosses major stormwater features along Muir Road, Wangee Road, Rawson Road, Cooks River, Omaha Street, Centennial Street at Bedwin Road Bridge and at Beaconsfield West substation. To ensure flood levels are not exacerbated during construction at these locations, reasonable and feasible measures will be implemented to avoid the identified stormwater features and flood area (e.g. by underbore or through normal construction practices to maintain the integrity and operation of the particular stormwater feature) during a rainfall event.

2 Environmental Requirements

The following section describes the relevant environmental planning and statutory approval requirements for the project relating to surface water, flooding and the FMS.

2.1 Minister's Condition of Approval

The FMS is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 the **Soil and Water CEMP Sub-Plan** required under **Condition C3** must include a:

(b) **Surface Water Management Plan**, for managing surface water quality and quantity, watercourse and flooding impacts of the SSI. This plan must include a:

(i) **Flood Mitigation Strategy** for work within flood prone or flood affected land, demonstrating that the SSI will not exacerbate existing flooding characteristics, unless otherwise agreed by the relevant council(s); and.

(ii) **Flood Management Plan**, for managing flood risk during construction.

2.2 Environmental Mitigation and Management Measures (EMMMs)

EMMMs were developed (AECOM, 2020) following submissions to the EIS and a number of design refinements for the project. A summary of the updated EMMMS for the project including changes associated with the design refinements considered are provided in the Amendment Report (AECOM, 2020).

This FMS has been developed in accordance with the EMMMs described in Table 2-1. Note EMMM FF2 is addressed in the Floodplain Management Plan.

Table 2-1 Environmental Mitigation and Management Measures (EMMMs) applicable to this document

Impact	ID	Measure
Flooding and water flows during construction	FF1	A Flood Mitigation Strategy (FMS) will be prepared in accordance with the Floodplain Development Manual (DIPNR, 2005) for work within flood prone or flood affected land within the project area to demonstrate that the existing flooding characteristics will not be exacerbated. The FMS will be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, DPI-Water, DPIE, Sydney Water and relevant councils. The FMS will be prepared during detailed design and prior to construction. The FMS will identify design and mitigation measures that will: • be considered by the contractor in the development of site-specific flood management plans, including the need to protect plant, staff, materials and earthworks activities from flooding (also refer to FF2); • avoid or reduce impacts at adjacent properties; and • not significantly alter surface water flows during construction and operation. The FMS will limit flooding characteristics to the following levels, or else provide alternative flood mitigation solutions consistent with the intent of these limits: • a maximum increase in inundation time of one hour in a 100 year ARI rainfall event; • a maximum increase of 10 millimetres in inundation at properties where floor levels are currently exceeded in a 100 year ARI rainfall event; • a maximum increase of 50 millimetres in inundation at properties where floor levels would not be exceeded in a 100 year ARI rainfall event; and • no inundation of floor levels which are currently not inundated in a 100 year ARI rainfall event.
Camdenville Park flood detention basin	FF3	Design of the transmission cable route through Camdenville Park will consider the integrity and functionality of the existing flood detention basin.

2.2.1 Local Environmental Plans

The project is located in the Canterbury-Bankstown, Inner West and City of Sydney LGAs. The Local Environment Plans (LEPs) for each of the councils specify Flood Planning Levels (FPLs). Their approach is consistent with the NSW Government's Floodplain Development Manual (DIPNR, 2005). To support land use planning and development assessment, certain councils and Sydney Water have undertaken various flood studies and floodplain risk management studies in selected areas.

2.3 Guidelines and Standards

2.3.1 Floodplain Development Manual

The *Floodplain Development Manual* (DIPNR, 2005) incorporates the NSW Government's Flood Prone Land Policy, the primary objectives of which are to reduce the impact of flooding and flood liability on owners and occupiers of flood prone property. Additionally, it is also intended to reduce public and private losses resulting from floods, while also recognising the benefits of use, occupation and development of flood prone land. The project area crosses the Coxs Creek and Cooks River floodplains, and the project has the potential to affect flooding conditions due to the location, nature and extent of proposed works.

The Floodplain Development Manual forms the NSW Government's primary technical guidance for the development of sustainable strategies to support human occupation and use of the floodplain. It also promotes strategic consideration of key issues including safety to people, management of potential damage to property and infrastructure, and management of cumulative development impacts.

This FMS has been developed in accordance with the *Floodplain Development Manual* (DIPNR, 2005).

2.3.2 Australian Rainfall and Runoff

Australian Rainfall and Runoff (ARR) is a national guideline document, data and software suite that can be used for the estimation of design flood characteristics in Australia. ARR is pivotal to the safety and sustainability of Australian infrastructure, communities and the environment. It is an important component in the provision of reliable and robust estimates of flood risk. Consistent use of ARR ensures that development does not occur in high risk areas and that infrastructure is appropriately designed.

2.3.3 Managing Urban Stormwater – Soils and Construction

The Managing Urban Stormwater (commonly known as The Blue Book) – Soils and Construction series of handbooks are an element of the NSW Government's urban stormwater program specifically applicable to the construction phase of developments. These are aimed at providing guidance for managing soils in a manner that protects the health, ecology and amenity of urban streams, rivers estuaries and beaches through better management of stormwater quality.

The Blue Book handbooks were produced to provide guidelines, principles, and recommended minimum design standards for good management practice in erosion and sediment control during the construction of roads. Of particular relevance to the project are Volume 1, 4th Edition (Landcom, 2004) and Volume 2A, Installation of services (DECC, 2008). These guidelines will be used for the development of construction management measures (refer to Section 5.0).

3 Existing Environment

3.1 Available information and previous studies

3.1.1 Alexandra Canal Flood Study (Cardno, 2014)

The Alexandra Canal Catchment covers the suburbs of Alexandria, Rosebery, Erskineville, Beaconsfield, Zetland, Waterloo, Redfern, Newtown, Eveleigh, Surry Hills and Moore Park.

The Alexandra Canal Catchment Flood Study was prepared for the City of Sydney by Cardno and defines the flood behaviour of existing conditions in the catchment (Cardno, 2014). According to Cardno (2014) the majority of the catchment is fully developed and consists predominantly of medium to high-density housing, commercial and industrial development with some large open spaces. Its 'Study Area' represents the portion of the catchment which lies within the City of Sydney LGA and coincides with Precinct 5 of the Transmission Cable Project Area.

Objectives of the Study were to define the flood behaviour of the catchment and produce information on the flood levels, velocities and flow for Average Recurrence Interval (ARI) events – including 1 year, 2 year, 5 year, 10 year, 20 year, and 100 year together with the Probable Maximum Flood (PMF) event (Cardno, 2014).

The majority of flooding within the Alexandra Canal catchment is characterised by overland flow (Cardno, 2014). According to Cardno (2014) analysis of the model indicates that it is more sensitive to pit and culvert blockages than to climate change in regard to impacts of sea level rise and rainfall intensity increases.

In terms of rainfall events and their impact on surface water flows in the project area of Precinct 5, the study indicates that rainfall on Sydney Park is conveyed to the ponds within the Park and excess runoff may flow towards Euston Road in large ARI events (Cardno, 2014). Sub-catchment drainage is usually towards Burrows Road which has several lowpoints along its length that are drained by pit and pipe systems (Cardno, 2014). In large ARI events, inundation to properties may result from overland flows from upstream areas and or elevated levels in Alexandra Canal itself (Cardno, 2014).

3.1.2 Alexandra Canal Floodplain Risk Management Study and Plan

The Alexandra Canal Floodplain Risk Management Study and Plan was prepared for the City of Sydney by Cardno (2014) and relates directly to the Alexandra Canal Flood Study (Cardno, 2014a).

The study was undertaken to define the existing flooding behaviour and associated hazards within the Alexandra Canal floodplain, and to investigate possible management options to reduce flood damage and risk as well as to provide recommendations (Cardno, 2014b).

The study indicates that the majority of flooding within the catchment is characterised by overland flow and that it is susceptible to short duration 'flash' flooding (Cardno, 2014b).

3.1.3 Hawthorne Canal Flood Study (WMAwater, 2014)

The Hawthorne Canal Flood Study was prepared for Ashfield Council and Marrickville Council (now known as the Inner West) to identify local overland flow as well as mainstream flow and define existing flood liability (WMAwater, 2014). The Hawthorne Canal is located approximately eight kilometres west south-west of Sydney's CBD and its catchment area includes the suburbs of Ashfield, Dulwich Hill, Haberfield, Leichhardt, Lewisham, Petersham and Summer Hill (WMAwater , 2014). A small portion of the project area in Precinct 3 Dulwich Hill drains to the Hawthorn Canal.

The catchment is drained by a series of pits (inlets), pipes and overland flow-paths into Iron Cove on the Parramatta River (WMAwater , 2014). The design flood modelling indicates that significant flood depths may occur in a number of locations including Ashfield/Dulwich Hill (WMAwater, 2014). The study provides a detailed examination of existing flood behaviour at these "hot spots".

Within the Ashfield/Dulwich Hill area the study results describe the overland flow-path from Queen Street to Yeo Park as being orientated perpendicular to the roadway alignment (WMAWater, 2014). From Old Canterbury Road to Dixson Avenue, the overland flow-path is parallel to the roadway alignment of Cobra Street and Elizabeth Avenue. This flow-path occurs along the boundary of properties located on the two roadways. Between Dixson Avenue and Arlington Recreation Reserve, the overland flow-path is again orientated perpendicular to the roadway (WMAWater, 2014). .

The sea level rise scenarios had very little impact on flood levels within the catchment except along Hawthorne Parade and within the open channel adjacent to Hawthorne Parade. The sea level rise impacts along this section were found to decrease with increasing distance from the Iron Cove confluence

3.1.4 Dobroyd Canal and Hawthorne Canal Floodplain Risk Management Study and Plan (WMAWater, 2019)

The Dobroyd Canal and Hawthorne Canal Floodplain Risk Management Study and Plan was prepared for Inner West Council and follows on from the Hawthorn Canal Flood Study. The study objective was to develop floodplain risk management plans for the Dobroyd Canal and Hawthorne Canal study areas which address the existing, future and continuing flood risk (WMAWater, 2019).

The study area represents the portion of the catchment which lies within the City of Sydney LGA and coincides with Precinct 5 of the Transmission Cable Project Area. The Dobroyd Canal and Hawthorne Canal catchments discharge into Iron Cove on the Parramatta River. The open channel sections are concrete-lined, tidal and extend up to Norton Street along the Dobroyd Canal and up to Pigott Street along the Hawthorne Canal (WMA Water, 2019).

A full assessment of the existing flood risk in the catchment was undertaken including flood hazard across the study area, overfloor flooding of residential, commercial and industrial properties, identification of known flooding issues and hotspots, and emergency response during a flood event (WMA Water, 2019).

3.1.5 EC East Sub-catchment Management Plan: Volume 2 - Flood Study (Golder Associates, 2010)

Information on this study was not available.

3.1.6 Marrickville Valley Flood Study (WMAwater, 2013)

The Marrickville Valley Flood Study constitutes the first stage of the risk management process for the areas including and adjacent to Marrickville (including parts of or all of the suburbs of Petersham, Stanmore, Enmore, Newtown, St Peters, Tempe, Marrickville and Dulwich Hill) and has been prepared for Marrickville Council by WMAwater (WMAwater, 2013). The study area coincides with Precinct 5 of the Transmission Cable Project Area.

The study objectives were to define design flood behaviour particularly for the 1% Annual Exceedance Probability(AEP) event and produce a modelling system that will be suitable for analysing floodplain management measures in subsequent stages of the Floodplain Risk Management Program (WMAwater, 2013).

The study catchment area ultimately drains via four outfalls into the Cooks River to the south, namely the Eastern, Central and Western Channels as well as the Malakoff Street Tunnel (referred to as the Western Channel Amplification by Sydney Water). It is heavily developed and consists primarily of high density residential and light industrial developments (WMAwater, 2013).

The Marrickville Industrial Area is adversely affected during all design flood events. A critical factor for this is its relative low level and flat topography (WMAwater, 2013). In the 1% AEP event more than 50% of the streets are categorised as High Hazard areas (WMAwater, 2013).

Other locations such as Sydenham Road, Marrickville and Sydenham Railway Stations and Carrington Road are also categorised as High Hazard areas in the 1% AEP event (WMAwater, 2013).

3.1.7 Cooks River and Coxs Creek Flood Study (WMAwater, 2010)

The Cooks River and Coxs Creek Flood Study constitutes the first stage of the management process for the areas adjacent to the Cooks River and Coxs Creek (the suburbs of Strathfield South, Enfield, Enfield South, Rookwood, Chullora, Potts Hill, Bankstown North, Greenacre, Punchbowl, Mt Lewis, Wiley Park, Roselands and Belmore) and has been prepared for Strathfield Municipal Council by WMAwater (WMAwater, 2010). The project area is located within the larger Cooks River catchment and intersects with a number of sub-catchments and tributaries into the Cook River such as the Cox Creek sub-catchment in Precinct 2. The project area intersects the Cooks River in Precinct 3.

Objectives of the study were to define flood behaviour in terms of flood levels, depths, velocities, flows and extents within the Cooks River and Coxs Creek catchment study area, prepare flood hazard and flood extent mapping, prepare suitable models of the catchment and floodplain for use in a subsequent Floodplain Risk Management Study and to assess the adequacy and capacity of Council's existing pipe network and to quantify overland flows, to consider the potential effects of a climate change induced increase in design rainfall intensities (WMAwater, 2010).

3.1.8 Cooks River Flood Study (PB MWH Joint Venture 2009).

The Cooks River Flood Study was prepared by PB MWH (joint venture) for Sydney Water. Sydney Water is responsible for the management of significant stormwater assets, including a substantial portion of the Cooks River and Alexandra Canal (PB MWH Joint Venture, 2009).

The Cooks River Catchment is located in south-west Sydney with flows discharging to Botany Bay at Tempe, near Sydney Airport. The catchment is approximately 102 km2 in area and covers portions of 13 local government areas (PB MWH Joint Venture 2009). The Cooks River has two major tributaries, Alexandra Canal and Wolli Creek. The banks of the lower and middle reaches of both the Cooks River and the Alexandra Canal largely consist of concrete, masonry or steel sheet pile walls. Some of the upper reaches have been entirely replaced with concrete trapezoidal channel sections (PB MWH Joint Venture 2009).

Objectives of the study were to develop a hydrologic model for the Cooks River catchment, a hydraulic model for the Cooks River and its significant tributaries (Alexandra Canal and Wolli Creek) and develop an understanding of existing flood behaviour within the catchment during the 2 year, 20 year and 100 year average recurrence interval (ARI) and probable maximum flood (PMF) design events (PB MWH Joint Venture, 2009).

3.2 Flooding

The transmission cable route is generally only subject to local overland (surface runoff) flows.

3.3 Existing flood regime

The transmission cable route (including Rookwood Road and Beaconsfield West substations) is located within the Cooks River catchment (which includes Coxs Creek) and the Sydney Harbour and Parramatta River catchment (SHPR catchment) , including the Alexandra Canal, Eastern Channel and Hawthorne Canal sub-catchments. The Sydney South substation is located within the Georges River catchment.

The Cooks River catchment covers an area of 100 square kilometres in southern Sydney and discharges to Botany Bay at Mascot. The SHPR catchment covers an area of around 484 square kilometres including its main tributary the Parramatta River.

Waterways within each catchment consist of a mix of concrete lined and modified watercourses that convey stormwater to the Cooks River or in the case of Hawthorne Canal to Rozelle Bay, which is part of the Parramatta River estuary.

The transmission cable route would cross the Cooks River, which is the main hydrological feature within the project area. Coxs Creek, a primary tributary of the Cooks River, would also be crossed by the transmission cable route in the western portion of the project area. At the point of crossing Coxs Creek, the waterway is a concrete channel.

The Beaconsfield West substation, to the eastern end of the project, is located adjacent to the Alexandra Canal, a highly modified waterway (formerly Shea's Creek) which also flows into the Cooks River.

The Sydney South substation is located approximately 150 metres north of the Georges River estuary, which flows into Botany Bay. The Georges River estuary at the Sydney South substation is a tide dominated drowned valley estuary (OEH, 2018). Although much of the catchment is urbanised, the estuary has retained many of its natural characteristics.

Alexandra Canal is one of the main waterways downstream of the project area within the Cooks River catchment. Alexandra Canal is one of only two navigable canals built in NSW and is characterised by its controlled route, defined edges and sandstone embankment walls. The canal is considered to be of high historic, aesthetic and technical/research significance (Sydney Water, 2014).

Typically, the transmission cable route is only subject to local overland (surface runoff) flows. The transmission cable route is subject to mainstream flooding at the following locations.

These locations are:

- Cooks River at Muir Road (Precinct 1);
- un-named tributary of the Cooks River at Rawson Road (Precinct 2);
- Coxs Creek at Wangee Road (Precinct 2);
- un-named tributary of the Cooks River at Omaha Street (Precinct 2); and
- Cooks River at Lindsay Street (Precinct 3).

The Cooks River Flood Study (PB MWH Joint Venture, 2009) shows areas of key inundation during the 100 year ARI flood. The Cooks River at Lindsay Street in Campsie (Precinct 3) has been identified as the location, across the project area, with the greatest potential for flood impacts.

Table 3-1 identifies elements of the SSI located near water features.

Table 3-1 SSI elements near water features

SSI element	Water feature
Construction laydown area adjacent to Camdenville Park	Adjacent to the Camdenville Park flood detention basin
Rookwood Road substation	Approx. 150 m from the Cooks River
Beaconsfield West substation	Adjacent to the Alexandra Canal
Sydney South substation	Approx. 200m from the Georges River

The Sydney South substation is sufficiently far from the Georges River estuary, and is elevated above the anticipated water surface, such that mainstream flooding is not likely to affects the substation. The flow breaks out of the formal channel in the 100 year ARI event and inundates part of the overbank area up to 2 metres in depth.

Localised flooding is known to occur in some areas as a result of overflow to local piped urban stormwater networks.

3.4 Flood levels along the alignment

The transmission cable route passes through flood-prone areas. This section provides an overview of the existing flood conditions within each precinct (refer to Table 3-2).

Discussion of potential impacts is provided in Sections 4.1 and 4.2.

Table 3-2 Existing Flood Behaviour

Precinct	Catchment	Existing Flood Behaviour
Precinct 1	**Cooks River (Rookwood Road)** The Cooks River in this precinct flows past the Yanu Badu Wetland approx. 200 m downstream of Muir Rd, which is a naturalised watercourse (artificial wetland) built for flood events.	The Rookwood Rd catchment discharges into the upper Cooks River. This area experiences stormwater flooding usually in short duration storm events of 2hrs or less (BMT WBM, 2010). Some areas along Muir Rd between Rookwood Rd and the Cooks River are affected by some minimal localised flooding in the 20 year ARI event. Peak flood levels are 0.00 m to 0.25 m (AHD) (BMT WBM, 2010).
Precinct 2	**Cooks River (Coxs Ck. Sub-catchment)** Coxs Ck has been channelised with a concrete lined channel in this precinct.	Precinct 2 project area crosses the Coxs Creek at Wangee Rd. This area may experience minimal flooding due to the creek overtopping the main channel or due to overland flow in natural low-points.
Precinct 3	**Cooks River (Eastern Channel sub-catchment), Parramatta River** The majority of this precinct is in the Cooks River catchment and drains either via drainage channels, or by being discharged to the Sydenham flood detention basin, and then pumped back to the Cooks River. A small portion of this precinct in Dulwich Hill drains to the Hawthorne Canal.	Cooks River: The Cooks River is the main waterbody that will be crossed in the project area. This area may experience flooding due to the river overtopping the main channel, or due to overland flow in natural low points as a result of excess flow to the pit and pipe networks. The MWH PB (2009) flood study provides design flood levels for Brighton Avenue, which is located ~1km upstream from the proposed special crossing at Lindsay St. Design flood levels are for 2 yr ARI 2.73m (AHD), 20 year ARI 4.05 m (AHD) and 100 year ARI 4.87 (AHD) (MWH PB, 2009). The main channel of Cooks River may overtop leading to flow being conveyed along roads and overland flowpaths to natural low points (WMAWater, 2010). This may also occur due to flow in excess of the capacity of the pit and pipe networks Hawthorne Canal: The Light Rail Track (L1 Line) bisects the Hawthorne Canal catchment in a north-south orientation; at times in the form of an embankment and at others as cuttings. To the south of Hill Street, the Light Rail Track (L1 Line) is lower in elevation than the surrounding ground and forms the primary overland flow-path through this area. Connecting these locations, the light rail alternates several times between functioning as a flow-path and forming an embankment (WMAwater, 2019). The peak flood levels along the Light Rail Track under the Constitution Road Bridge are: 0.5 EY 20.64 m, 0.2 EY 20 m, 10% AEP 21.02 m 5% AEP 21.15, 2% AEP 21.28 and 1 % AEP 21.39 m (WMAwater, 2019). In the Hawthorne Canal catchment, the H6 classification is concentrated in the open channel sections across a range of events. In the 0.2 EY event, the Light Rail Track under Davis Street is classified as H5; and areas of H4 classification are located along the Light Rail Track (between Hill Street and Denison Road) (WMAwater, 2019).

		In the 5% AEP event, additional H5 classifications are located along the Light Rail Track (between Hill Street and Denison Road). The H5 classification is unsafe for vehicles and people. In the 1% AEP event no further areas in the project area were identified.
Precinct 4	**Cooks River (Eastern Channel sub-catchment)** The precinct drains to the Cooks River, either via the Eastern Channel, or by being discharged to the Sydenham Flood Detention Basin, and then pumped back to the Eastern Channel.	Precinct 4 is not impacted by mainstream flooding. Overland flow flooding is predicted to occur due to localised low points and insufficient capacity of the existing drainage network at the following locations according to (Golder, 2010): The corner of Edgeware Rd and Alice Street experiences a confluence of surface overland flow. Modelled flood depth ranges from 30 cm in the 2 yr event to 60 cm in the 100 yr event. Modelled flood velocity at this intersection ranges from less than 0.50 m/s in the 2 year event to only 1.2m/s in the 100 year event. Modelled flood hazard category is low for the 2, 5 and 10 year event (Golder, 2010). The corner of Railway Parade and Edgeware Rd where Railway Parade passes underneath Bedwin Rd is reported as an area experiencing regular issues (Golder, 2010). Drainage from the Railway also arrives at this low point as overland flow. Modelled flood depth beneath Bedwin Road bridge ranges from 60 cm in 2 year event up to 85 cm in the 100 year event. Modelled flood velocity is 0.5 m/s or less, implying that stormwater is ponding here. Flood hazard category is low for 2, 5 and 10yr event (Golder, 2010).
Precinct 5	**Cooks River (Alexandra Canal sub-catchment)** West of the Princes Highway, St Peters drains to the Cooks River via the Eastern Channel. There is a detention basin in Camdenville Park which is pumped out into the Eastern Channel. East of the Princes Highway (Alexandria) Precinct 5 drains to the Alexandra Canal. Currently stormwater is harvested from the stormwater culvert in the north-eastern corner of Sydney Park.	The project area east of the Princes Hwy: Areas here experience minimal mainstream and overland flooding for the 1yr, 5yr, 20 yr, 100yr and PMF. Overland flooding in low lying areas such as parts of Barwon Rd and Burrows Rd occurs generally where catchment rainfall cannot enter the stormwater drainage system and flows 'overland'. Critical durations for peak flood levels in the area vary depending on the location and flood characteristics for specific locations. shorter duration events result in higher peak water levels at the upstream and higher elevation areas whilst longer duration events are critical in main flow-paths and ponding areas. The event critical duration range for the 1-100yr ARI is 60-180 mins (Cardno, 2014).

4 Environmental Aspects and Impacts

The permanent project works, and operation of the project will have negligible impact on flooding.

Construction the project would involve a variety of activities with potential to impact on quality and flow of surface water during floods.

4.1 Potential impacts of the permanent works (operation)

4.1.1 Overview

The risk of flooding as a result of the project has been assessed in the EIS, including consideration of potential impacts that the project might have on surrounding properties during the construction as well as operational phases. The risk of exacerbating flooding impacts across the study area is considered negligible for the majority of the transmission cable route, given that infrastructure would be located below ground and the surface returned to its natural level at the end of construction.

The FMS has further assessed the permanent works and the operation of the project. The permanent works will have negligible flood impacts, given the majority of infrastructure would be located underground and separate from the surface water environment. The substation upgrade works will not have additional impacts to those already occurring in the existing substations, as the infrastructure footprint and operation of the substations would generally remain unchanged.

When developing the FMS, it was identified that new above ground infrastructure or alteration of existing stormwater infrastructure has the potential to impact flood levels and change the existing flow paths and flood storage at key locations. Specifically, this includes:

- Cable bridges at Bedwin Road and Muir Road;
- Changes to the surface following installation of the conduits; and
- Changes to stormwater infrastructure.

Flooding impacts at substations were not considered in this assessment as the project would not change the flood flow paths in the existing substations. Of the three substations, Beaconsfield West substation is documented to be within the 100 ARI flood extent.

4.1.2 Potential for changes to surface water flows

This FMS has considered the potential for changes flood flows as a result of new infrastructure and reductions in the floodplain area, which could have an impact on flooding behaviour or on nearby existing developments.

For the majority of the transmission cable route, the surface would be restored to be similar to the existing condition, and as a result alteration to overland flows are anticipated.

Minor alterations to overland flow routes may occur around bridge piers where cable bridges are required. However, with the appropriate design of cable bridges, these alterations are expected to be negligible as flowpaths would be maintained and the loss of storage is minor.

Cooks River special crossing

The underbore launch and receival pits are located above the extent of the 100 year ARI at the Cooks River special crossing.

Bedwin Road cable bridge

Bedwin Road Cable Bridge is a new cable bridge (permanent works) located on Bedwin Bridge Road, St Peters (Precinct 5). The cable bridge will cross the Illawarra rail line immediately adjacent to the existing Bedwin Road overbridge on the eastern side of the existing road bridge. A new blade pier will be constructed between Edgeware Road underneath the cable bridge and the Illawarra rail line.

Sydney Metro, WestConnex and City of Sydney Council have recently carried out works within the local area associated with the adjustment of utilities, road network improvements and other infrastructure.

Overland low-level flooding of the rail corridor where the Bedwin Road Pedestrian Bridge is located occurs of the Illawarra railway line in events greater than or equal to the 10% AEP flood event. During the PMF, the majority of the existing rail line between the Bedwin Road overbridge would be flooded to depths varying between 0.5 and 1.5 metres.

To understand possible flood impacts associated with the new cable bridge a flood assessment was completed using the same flood model as developed for Sydney Metro. This comprised a TUFLOW 2D model. The model was run for the 1% AEP + 10% rainfall event. Model scenarios included:

1. pre-Sydney Metro;
2. pre- Sydney Metro conditions with the permanent works; and
3. Post-Sydney Metro conditions with the proposed cable infrastructure footprint.

A comparison between scenarios 1 & 2 indicates that there are no increases in flood levels expected for the permanent works.

A comparison between scenarios 1 & 3 indicates a reduction (~90mm) in flood levels on Edgeware Road. The reduction in flood level is due to the proposed Metro works.

Sydney Metro has considered the flood risk during construction of the cable bridge and confirm that construction of the cable bridge would result in no increase in flood risk. A copy of the results is included in **Appendix A** (Figure A3).

Camdenville Park detention basin

The cable route and future Joint Bay 22/23 are likely to be located adjacent to the existing Camdenville Park detention basin.

No works are proposed within the boundary fenceline of the existing detention basin. The cable route will cross existing stormwater pipes connecting to the detention basin. There is no increased risk of scour associated with the operation of the detention basin.

The existing functionality of the detention basin will not be altered.

The integrity of the detention basin wall adjacent to the project construction area will be maintained.

The proposed works are located within the PMF extent, however on the basis that surface levels will match existing, impacts would be negligible.

4.2 Potential impacts during construction

4.2.1 Overview

Construction of the project has the potential to further degrade the receiving water quality in the Cooks River, Georges River and Parramatta River estuary unless suitable management and mitigation measures are implemented. Construction of the project would involve a variety of activities with potential to impact on quality and flow of surface water. These are discussed in the following sections. Measures identified to avoid, minimise and manage potential impacts are presented in Section 17.0 of the EIS, special considerations related specifically to flood mitigation are included in this section and as ECMs in the CSWMP.

4.2.2 Changes to surface water flows

Construction flooding and drainage impacts could potentially arise as a result of:

- Work sites may increase runoff volumes and peak flows (e.g. maximum flow rates) following rainfall events due to an increase in impermeable surfaces.
- Drainage infrastructure may become blocked (e.g. by soil, vegetation, waste) or temporarily diverted due to construction activities. Disruption to local drainage lines may result in localised flooding upstream of the project areas.
- Removal of existing pavement could divert flow away from designed drainage structures and into new receiving areas. Diverting drainage lines may also create localised areas of flooding and scour.

4.2.3 Open excavations

Construction of the transmission cable circuit would require excavating a trench in which to lay the conduits. Trenching and conduit installation would only require the opening of short sections of trench at a time (typically up to around 20 metres at any one location per day), with backfilling occurring as soon as each section of the conduits has been installed, leaving typically no more than 20 metres open at one time. During this period, there is a possibility that overland flow would enter the trench, either as sheet flow from surrounding areas or as channelised flow in the kerb and gutter system.

Trenches would be temporarily covered when works are not occurring; however, there is a potential that temporary covers are not sealed, and flow may enter the trench. There may also be disruption of existing drainage networks during decommissioning, upgrade or replacement of drainage pits and pipes during trenching activities.

Water may be diverted from the existing flow path into the excavated trenches, requiring it to be pumped out of the trench to a tank/basin. If large volumes of water accumulate during heavy rain, the water may spill from the trench in an uncontrolled manner.

4.2.4 Cable bridge (special crossing)

Where cable bridges are required, the construction of the bridges and piers may have some localised impact on overland stormwater flows. This has been considered further for Bedwin Road Bridge (see above).

4.2.5 Underbore (special crossing)

The impact of permanent works associated with underbores is negligible and had not been considered further.

4.2.6 Substations

As substation upgrades and construction laydown area works at the Beaconsfield West substation would be contained within the existing perimeter walls of the site, it is unlikely that surface water flows would be impacted in this location.

5 Management of impacts

The implementation of the suite of EMMMs related to flooding as documented in the CSWMP and will ensure that the severity of impacts will be reduced.

The **Flood Management Plan** provides further detail on how flood risks will be managed during construction.

Appendix A – Flood Maps

Figure	Description
A1	100 year ARI Flood Extents and Depths - Cooks River Flood Study
A2	100 year ARI Flood Extents and Depths at the Proposed Underbore of Cooks River
A3	Bedwin Road Bridge Cable Bridge 1% AEP + 10% AEP impact

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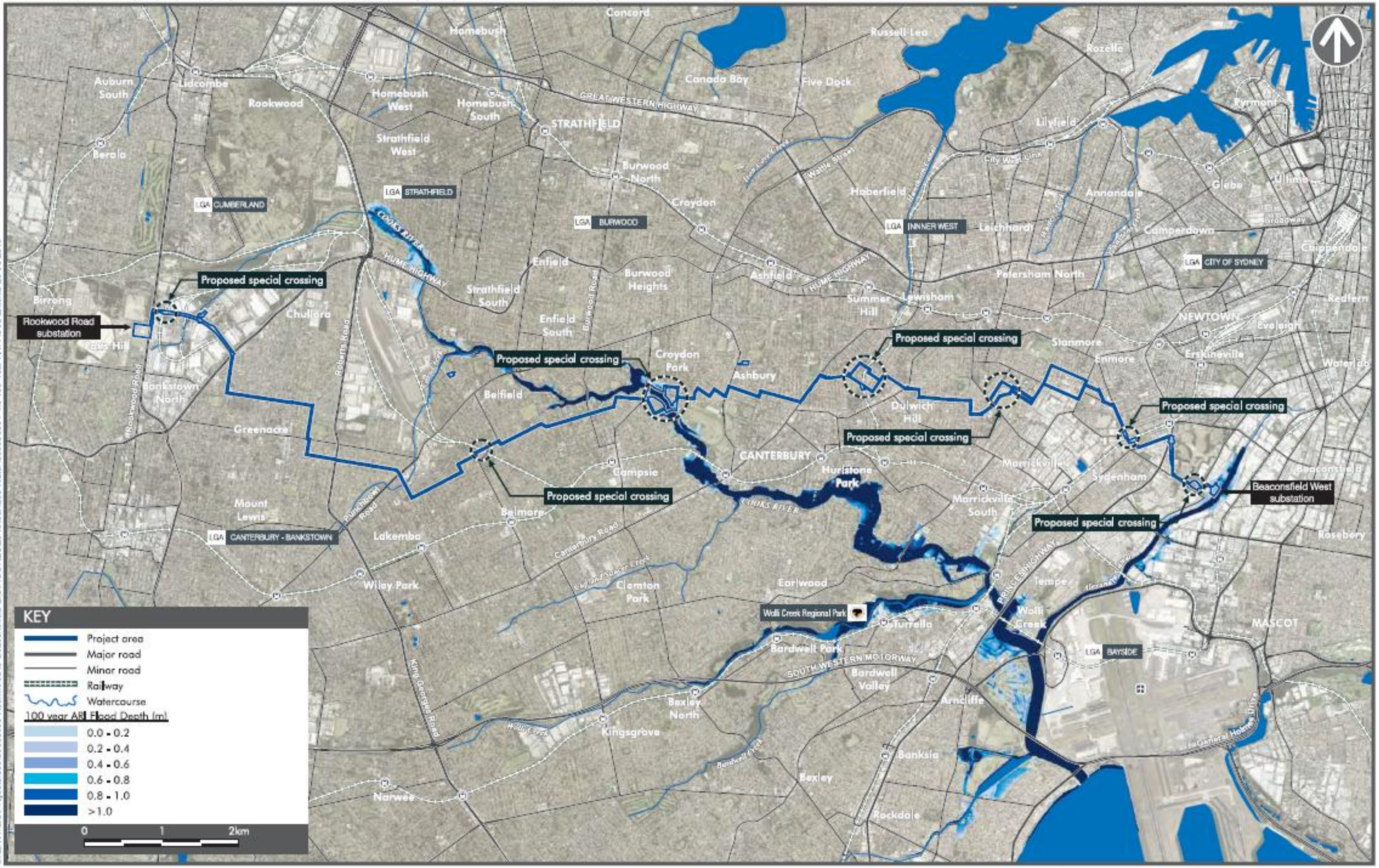

Figure A1 100 year ARI Flood Extents and Depths - Cooks River Flood Study

Source: AECOM (2019)

Figure A2 100 year ARI Flood Extents and Depths at the Proposed Underbore of Cooks River

Source: AECOM (2019)

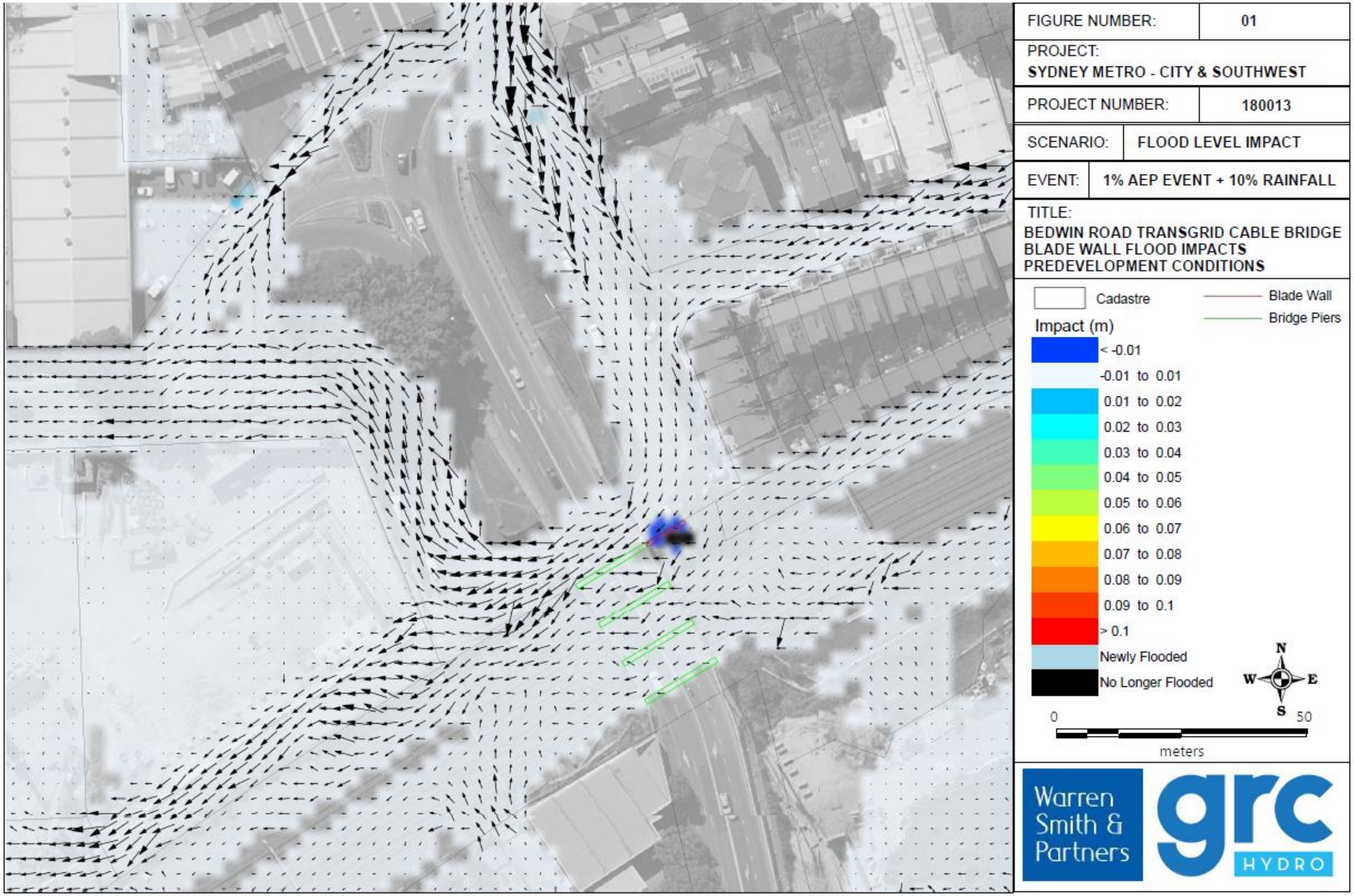

Figure A3 Bedwin Road Bridge Cable Bridge 1% AEP + 10% AEP impact

Attachment III – Flood Management Plan

Flood Management Plan

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1 Overview

This Flood Management Plan (FMP) describes how Taihan will manage potential environmental impacts on flooding during construction of the Project. This includes:

- Approach to managing the project to limit the extent and duration of temporary works in a floodplain; and
- flood emergency response procedures.

Generally, the proposed works are located clear of the 100 year ARI flood, except where the alignment crosses major stormwater features along Muir Road, Wangee Road, Rawson Road, Cooks River, Omaha Street, Centennial Street at Bedwin Road Bridge and at Beaconsfield West substation. To ensure flood levels are not exacerbated during construction at these locations, reasonable and feasible measures will be implemented to avoid the identified stormwater features and flood area (e.g. by underbore or through normal construction practices to maintain the integrity and operation of the particular stormwater feature) during a rainfall event.

2 Environmental Requirements

2.1 Legislation

Legislation relevant to flooding and hydrology management includes:

- *Environmental Planning and Assessment Act 1979 (EP&A Act)*
- *Protection of the Environment Operations Act 1997 (POEO Act)*
- *State Emergency and Rescue Management Act 1989 (SERM Act)*
- *State Emergency Service Act 1989*
- *Water Management Act 2000 (WM Act)*
- *Water Act 1912 (Water Act)*

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

2.2 Guidelines and Standards

The main guidelines, specification and policy documents relevant to this Sub-plan include:

- *Floodplain Development Manual (OEH)*
- *Floodplain Risk Management Guideline (OEH)*
- *New South Wales State Emergency Management Plan (EMPLAN, December 2012)*
- *New South Wales State Flood Plan (a sub-plan of EMPLAN) (March 2015)*
- *New South Wales State Emergency Management Plan – Evacuation Management Guidelines (March 2014)*
- *New South Wales Flood Prone Land Policy (May 2005)*

2.3 Minister's Condition of Approval

The FMP is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 the **Soil and Water CEMP Sub-Plan** required under **Condition C3** must include a:

(b) **Surface Water Management Plan**, for managing surface water quality and quantity, watercourse and flooding impacts of the SSI. This plan must include a:

(i) **Flood Mitigation Strategy** for work within flood prone or flood affected land, demonstrating that the SSI will not exacerbate existing flooding characteristics, unless otherwise agreed by the relevant council(s).

(i) **Flood Management Plan**, for managing flood risk during construction.

2.4 Environmental Mitigation and Management Measures (EMMM)

EMMMs were developed (AECOM, 2020) following submissions to the EIS and a number of design refinements for the project. A summary of the updated EMMMS for the project including changes associated with the design refinements considered are provided in the Amendment Report (AECOM, 2020).

This FMP has been developed in accordance with the EMMMs described in **Table 1**:

EMMMs FF1 and FF3 are addressed in the FMS.

Table 2-1 Environmental Mitigation and Management Measures (EMMM)

Impact	New ID	Measure
Flooding and water flows during construction	FF2	Flood Management Plans (FMPs) will be developed as part of the CSWMP for works within flood prone or flood affected land within the project area. Measures to be detailed in the FMPs to manage potential flood and water flow impacts would include: • The construction of the project will be staged to limit the extent and duration of temporary works in a floodplain; • Work inside ephemeral watercourses including, but not limited to the Coxs Creek and other drainage network assets, will not be undertaken during or immediately following runoff generating rainfall events when stormwater flows in these watercourses are expected; and • Flood emergency response procedures will be documented within the FMPs to make sure construction equipment and materials are removed from floodplain areas at the completion of each work activity or in the event of a weather warning being issued for impending flood producing rain.

3 Existing Environment

A description of the existing flood regime for the Project is included within the **Flood Mitigation Strategy**, which is part of the **Construction Soil and Water Management Plan (CSWMP)**.

3.1 Flood extents

Peak flood depth and extents of inundation maps along the Cooks River in relation to the project area are provided in Appendix A of the **Flood Mitigation Strategy**.

4 Environmental aspects and impacts

4.1 Construction activities

Construction works and laydown areas have the potential to impact local overland flows and existing minor drainage paths. Runoff entering the construction area or rainfall falling directly into the construction area therefore has the potential to cause localised flooding issues and adverse downstream impacts if not appropriately managed through mitigation measures.

Key aspects of the Works that could result in adverse impacts to flooding and changes to overland flows include:

- Site preparation and construction laydown area placement
- Trenching and excavation/earthworks
- Conduit installation and backfilling
- Cable bridge and underboring works/construction
- Culverts and drainage works
- Relocation of minor utilities/services
- Cable pulling and jointing
- Permanent road restoration
- Cable markers
- Substation upgrades

4.2 Potential impacts of flooding on the Project

Flooding during construction activities has the potential to result in delays to construction and damage to plant and materials caused by inundation from floodwaters. It may also pose a safety risk to construction personnel and the public. Consideration of flood risk and potential flood impact has been carried out for the following key aspects as detailed in the sections that follow:

- Construction laydown areas;
- Trenching, excavation and conduit installation;
- Excavation for joint bays;
- Special crossings e.g. underbores and cable bridges; and
- Substation upgrades

4.2.1 Construction laydown areas

Construction laydown areas are generally located outside of areas impacted by mainstream flooding. As detailed in Table 4-1, the potential impacts of flooding on these sites is limited.

Table 4-1 Potential Impacts of flooding on construction laydown areas

Construction laydown area	Key Activities	Potential impacts of flooding
Camdenville Park	Store materials, equipment, excavated spoil and provide space for other ancillary facilities such as site offices.	The installation of temporary structures may result in minor redirection of overland flows and increased impermeable areas. The EIS determined that the proposed changes are unlikely to result in flood impacts outside the site boundary.

Trenching, excavation and conduit installation

Trenching, excavation and conduit installation are proposed outside of areas impacted by mainstream flooding with the exception of where the transmission cable route intersects with key stormwater features as shown in Table 4-1.

The following methods will be used at locations where the Project alignment intersects with key stormwater infrastructure.

1. Where feasible, underboring will be used as the primary means to minimise surface impacts.
2. Where the level of cover above existing stormwater infrastructure would be insufficient to construct the new transmission cable circuit above the culverts, the construction process would likely involve trenching through the existing culverts, laying the transmission cable conduits and then reconstructing the culverts to match the pre-existing conditions.

Table 4-2 Approach to conduit installation where the Project alignment intersects with key stormwater features

Location / type	Tributary	Method
Muir Road, Chullora Concrete box culvert	Stormwater drain	Trenching over/under the channel with no direct impact on the structure.
Wangee Road Concrete lined channel	Coxs Creek	Underbore
Rawson Road Concrete lined channel	un-named tributary of the Cooks River	Underbore
Cooks River Natural channel	Cooks River	Underbore
Omaha Street Concrete lined channel	un-named tributary of the Cooks River	Underbore
Centennial Street Concrete lined channel	Stormwater drain	Trenching over/under the channel with no direct impact on the structure.

As detailed in Table 4-3, the potential impacts of flooding during trenching, excavation and conduit installation is limited. Controls to manage the identified potential impacts are included in **CSWMP**.

Table 4-3 Potential Impacts of flooding on during trenching, excavation and conduit installation

Proposed work/special location	Key Activities	Potential impacts of flooding
Trenching/ excavation and conduit installation	• Clearing of surface vegetation along excavation area if required. • Saw cutting of the road. • Removal of material down to the base of the trench using an excavator. • Placement of spoil directly onto trucks to be transported to a licensed facility. The trench would typically be around 1.6 metres wide and 2.0 metres deep. • Openings of short section of trench at a time (approx. 20 m per day). • Backfilling to occur directly after conduits are installed.	• There is a possibility that overland flow would enter the trench either as sheet flow from surrounding areas or as channelised flow in the kerb and gutter system. • Trenches would be temporarily covered when works are not occurring. • There is potential for temporary covers to not be sealed and flow may enter the trench. • Water may be required to be pumped out of the trench to a tank/basin. If large volumes of water accumulate during heavy rain, it may spill from the trench in an uncontrolled manner. • There may also be disruption to the local drainage networks during decommissioning, upgrade or replacement of drainage pits and pipes during trenching activities. • Drainage works, such as the installation of drainage diversions during construction have the potential to concentrate flows, which may exacerbate erosion and result in scour or the mobilisation of pollutants. • If stormwater pipes are cut and replaced during asset relocation there is a chance that stormwater could enter the trench.
Camdenville Park	• Placement of spoil directly onto trucks to be transported to a licensed facility. The trench would typically be around 1.6 metres wide and 2.0 metres deep. • Openings of short section of trench at a time (approx. 20 m per day). • Backfilling to occur directly after conduits are installed	• As above. • In addition, the construction of the transmission cable circuit in this location could compromise the integrity of the embankment wall of the flood detention basin.

4.2.2 Excavation and establishment of joint bays

Trenching, excavation and conduit installation are proposed mainly outside of areas impacted by mainstream flooding. A number of proposed joint bays are located nearby to areas that may be flood affected, these include:

- Proposed Joint bays in Dulwich Hill are nearby to areas that may be flood affected;
- 11 Barwon Park Road, St Peters is located near to areas that may be flood affected; and .
- Camdenville Park, St Peters is located near to the Flood Detention Basin.

As detailed in Table 4-4, the potential impacts of flooding during excavation and establishment of joint bays is limited. Controls to manage the identified potential impacts are included in **CSWMP**.

Table 4-4 Potential Impacts during excavation and establishment of joint bays

Proposed work/special location	Key Activities	Potential impacts of flooding
Trenching/Excavation and establishment of joint bays	• Joint bays are concrete lined pits, generally located every 600-800 metres along the transmission cable route, where sections of the transmission cable are connected. Joint bays are typically around 10 metres long, 3 metres wide and 2 metres deep. • Excavation of joint bays via open trenching; • Installation of erosion and stormwater flow controls and barriers; • Erecting fencing or hard barriers as required; • Provision for vehicle access, worker amenities and equipment storage; • Temporary covering with steel plates to provide access to adjacent properties where required; and • Excavation of nearby pits to facilitate the installation of link and sensor boxes. • Each individual joint bay typically would take up to three weeks to establish (in addition to trenching works). Each joint bay contains one cable circuit.	• There is a possibility that overland flow would enter the trench either as sheet flow from surrounding areas or as channelised flow in the kerb and gutter system. • Trenches would be temporarily covered when works are not occurring. • There is potential for temporary covers to not be sealed and flow may enter the joint bay. • Water may be required to be pumped out of the trench to a tank/basin. If large volumes of water accumulate during heavy rain, it may spill from the joint bay in an uncontrolled manner. • There may also be disruption to the local drainage networks during decommissioning, upgrade or replacement of drainage pits and pipes during trenching activities. • Drainage works, such as the installation of drainage diversions during construction have the potential to concentrate flows, which may exacerbate erosion and result in scour or the mobilisation of pollutants.
Camdenville Park, St Peters	• As above.	As above. • In addition, the construction of the joint bay in this location could compromise the integrity of the embankment wall of the flood detention basin.

4.2.3 Special crossings (underbores and cable bridges)

The construction activities involving underboring or construction of cable bridges have the greatest risk where they occur near waterways, on steep slopes or on land subject to surface flows or flooding.

The potential impacts of flooding during construction activities such as underboring or cable bridges for special crossings are described in Table 4-5.

It is noted that the bridge piers for Bedwin Road Bridge was assessed for its impact on overland flow flooding in the **Flood Mitigation Strategy**. This will however have a negligible potential impact during construction. Controls to manage the identified potential impacts are included in **CSWMP**.

Table 4-5 Potential Impacts during construction at special crossings e.g. underbores and cable bridges

Proposed work/special location	Key Activities	Potential impacts of flooding
Underbores	• Underboring around 4 to 10 metres below the ground surface by either thrust boring or horizontal directional drilling (HDD). • Thrust boring would require a launch pit (at least 4 metres deep) and associated work site of up to around 800 square metres and a receival pit and work site of about 100 square metres; these would be in operation for about 10 weeks at each location. • Backfilling of pits would occur as soon as conduits are installed. • HDD would require a work site at the drill launch area of up to around 800 square metres and a receival pit for the drill exit of around 1.5 metres deep. • Work sites would be restricted to the road reserve and public open space areas where feasible and reasonable to limit the need for vegetation removal.	• Underbore launch and receival pits could potentially fill with stormwater from overland surface water – however the pits shall have diversions in place to prevent water flow from entering. • Construction activities adjacent to or within waterways could introduce foreign contaminants such as oil or greases and disturb contaminated sediments. • Pollutants from work sites may be carried downstream by stormwater, potentially impacting on the water quality in nearby rivers and creeks.
Cable bridges	• Cable bridge includes concrete trough structures into which the cables would be pulled and covered for protection. • Establishment of the work site and access including vegetation clearing (where required). • Boring and earthworks for the bridge piers. • Installation of the pre-cast cable bridge and steel cage (where required) by crane. • Integration with the conduits in the road reserve. • reinstatement of the work site.	• Negligible.

4.2.4 Substations

Upgrade work at substations are proposed mainly outside of areas impacted by mainstream flooding. With the exception of Beaconsfield west substation which is located adjacent to Alexandra Canal.

Beaconsfield west substation may be used for stockpiling and storing materials and is exposed to flooding from both overland flows along Burrows Road, and flooding of the Alexandra Canal. There is potential for material that is stockpiled below the Probable Maximum Flood (PMF) level to be inundated and released into the environment by flood velocity. Any contaminated material, if present within the stockpile, could therefore be released into the environment.

As substation upgrades and construction laydown areas works at the Beaconsfield West substation would be contained within the existing boundary of the site and would be managed by existing site stormwater infrastructure, it is unlikely that surface water flows would be impacted in this location.

As detailed in Table 4-6, the potential impacts of flooding during substation upgrades is limited. Controls to manage the identified potential impacts are included in **CSWMP**.

Table 4-6 Potential Impacts during substation upgrades

Proposed work/special location	Key Activities	Potential impacts of flooding
Beaconsfield west	• Installation of a new cable sealing ends. • Modifications to the 330 kV switchgear. • Installation and modification of secondary systems (control and protection equipment), as required • Cabling and cable connections within the substation site. • Stockpiling of excavated material and materials.	• Construction activities adjacent to or within waterways could introduce foreign contaminants such as oil or greases and disturb contaminated sediments. • Pollutants from work sites may be carried downstream by stormwater, potentially impacting on the water quality in nearby rivers and creeks.

4.3 Potential impacts of construction on the flood regime

The majority of the project area where construction activities will take place are outside of areas of mainstream flooding, with the exception of those described in Table 4-2 and works at the Beaconsfield west substation which is located adjacent to Alexandra Canal.

For the majority of the transmission cable route the surface would be restored to be similar to the existing condition, and as a result no major alterations to overland flow are anticipated. During construction there may be some minor increases in impervious surfaces and diversions of stormwater flow.

Potential impacts of the construction activities on the flood regime include:

- Interruption of overland flow paths by installation of temporary construction ancillary facilities, raised hardstand areas or construction hoarding. For example, through the erection of site hoardings or barriers to cordon off construction areas within existing road carriageways.
- Disruption of existing drainage lines during decommissioning, upgrade or replacement of drainage pits and pipes, resulting in localised flooding upstream
- Potential water quality impacts downstream due to the mobilisation of sediments, pollution, hazardous materials and/or construction materials from the construction site.

4.4 Management of the severity of impacts

A suite of implementation of mitigation and management measures, are identified below (and included in the suite of EMMMs related to flooding as documented in the CSWMP) and in Section 5 Emergency response and evacuation. These measures, will ensure that the severity of the potential impacts identified in Section 4.3 will be relatively minor and not exacerbate flooding.

Measures to ensure flood levels and risks are not exacerbated during construction include the following.

- Temporarily divert stormwater flow paths around the works, where possible.
- Notify the Environmental and Sustainability Manager if water is unable to be diverted around excavations.
- Where it not possible to divert stormwater around the works, undertake all reasonable measures to prevent water ingress into excavations, to avoid the need to pump out following a rainfall event.

- Avoid large volumes of stormwater accumulating in excavations.
- Stage worksites to limit the extent and duration of temporary works in a floodplain.
- Schedule works within ephemeral watercourses and urban drains and urban drains when there is no rain forecast for several days.
- Avoid working inside ephemeral watercourses and other urban drainage network assets during or immediately following runoff generating rainfall events when stormwater flows in these watercourses are expected.
- Where the transmission cable must pass below stormwater pipes and pipes are required to be cut and replaced, rainfall forecasts should be monitored and works rescheduled, if required.
- Remove equipment and materials from the floodplain areas at the completion of each work activity or in the event a weather warning is issued for impending flood producing rain.
- Locate stockpiles outside areas of frequent inundation, surface runoff flow paths and above the 10% AEP flood level, where feasible and reasonable.
- Allocate storage for fuels, chemicals and other hazardous materials that is:
    - as far away from watercourses as possible;
    - located in an area immune to flooding during a 20 year Average Recurrence Interval (ARI) event; and
    - on an impervious bunded area.

  (Measures are to feasible and reasonable).
- At the Beaconsfield West substation site, regional weather conditions and river flow levels should be monitored during construction to pre-empt changes in weather patterns and flow regimes to minimise impacts that would be associated with wet weather. Allow sufficient time to vacate and prepare the site prior to the commencement of heavy rainfall and flood events.
- Ensure adequate supplies of flood response equipment, including sand bags, geofabric and pegs, are sufficient to divert work around all open worksites.
- Register with the BoM Flood Warning Service Program (www.bom.gov.au/australia/warnings) to receive flood warnings.
- ECM applicable to Site Managers, Civil Project Managers and the Safety Manager.
- Upon receipt of a "flood watch" warning, prepare the site in accordance with Section 5 of the Flood Management Plan.
- During a flood event complete the actions identified in Section 5 of the Flood Management Plan.
- Following a flood event, observe the proposed responses identified in Section 5 of the Flood Management Plan.

5 Emergency response and evacuation

This section provides key information and instructions to manage flood risk during the construction phase of the project in areas that have been identified as experiencing flooding at the 10 year ARI event.

During a major flood event (defined as flooding greater than the 10 year ARI), all on-site vehicles will be directed to move outside of the known flood impacted areas, which should be located in areas above the 100 year ARI.

It is expected that warnings would be issued by the BOM in advance of rainfall causing major flooding e.g. for the Cooks River. Worksites would be evacuate based on BOM warnings.

Staff should be made aware that they should not enter the worksites if:

- a major flood warning has been issued for the Cooks River
- rainfall in excess of 10 year ARI is measured or predicted
- staff have been advised not to enter worksites.

Considerations for flooding shall be written into site risk assessments, when working near watercourses, ephemeral drains and stormwater network assets.

5.1 Measures to be implemented prior to a flooding event

In areas that are identified as experiencing mainstream flooding as well as other low-lying flood prone areas, the following mitigation measures should apply prior to a flooding event.

5.1.1 Monitor flood warning services

Site Managers, Civil Project Managers and the Safety Manager will register with the BoM Flood Warning Service Program (www.bom.gov.au/australia/warnings) to receive flood warnings. A "Flood Watch" is typically issued several days before the event is anticipated.

5.1.2 Preparation of the site

Site Managers will ensure adequate supplies of flood response equipment, including sand bags, geofabric and pegs, are sufficient to divert work around all open worksites. Quantities of equipment will vary depending on the construction stage and shall be reviewed regularly by the Site contractor.

Following the receipt of a "Flood Watch" the following actions will be considered, as a minimum:

- Inform all site staff well in advance of a predicted flood event and confirm flood emergency procedures.
- Ensure materials are not stockpiled in areas of concentrated overland flow.
- All dangerous and hazardous goods will be stored at the main compound, outside the extent of a 10% AEP flood level, in a dangerous goods (shipping) container which is purpose built, bunded and compliant with the Australian Standard for the storage and handling of flammable and combustible liquids (AS 1940:2004). In the event that a flood greater than the 10% AEP flood level is predicted, the dangerous goods (shipping) container is to be removed/ relocated from site (where feasible) to a safe and secure location outside the extent of the predicted flood event.

- All plant and equipment, including earthworks plant and cranes, is to be moved and parked in areas outside the 10% AEP flood level flood extent or higher depending on information from the Flood Warning Service.

It should be noted that a "Flood Watch" can be issued without an actual flood occurring. Therefore, consideration of the actions listed above will be determined by the Environment and Sustainability Manager, or Civil Project Manager on a case-by-case basis depending on the most current information available and advice received from SES.

5.2 Measures to be implemented during a flooding event

Upon the issuing of a "Flood Warning" the following actions are advised if they were unable to be carried out/ completed prior to a predicted flood event:

- Secure all items in ancillary facilities that may become hazardous and cause damage if moved by flood water.
- Relocate chemicals to the highest level that could contaminate flood water, react with water to give off heat or form explosive or toxic gases.
- Tie down timber, drums and other loose, buoyant items to prevent them from being carried away by flood water or battered against other items or structures.

If a flood warning is issued for the Cooks River, sufficient warning time is available to evacuate the Site, however, this does not prevent staff from being placed at risk for any potential flooding at the Site. Staff should not enter the Site and must be made aware that they are not to enter the worksite and should return to higher ground.

5.3 Flood recovery

Generally during recovery, the following should be responses should be observed:

1. **Road and surface structural damage**. Water damage to the subsurface layer could lead to instability. Drive slowly and carefully. Advise the Site project manager of any potentially hazardous areas and do not enter these.
2. **Power**. Site power should remain off until a qualified electrician checks any inundated or water effected power boxes and electrical equipment.
3. **Impacted or damaged equipment**. Equipment should be moved to safe positions.
4. **Erosion and sedimentation**. River banks, stockpiles, trenches, excavations, walls, bunds, berms and any other structures or construction areas (whether temporary or permanent) should be checked to ensure contents are stable and are functioning as per the sediment and erosion control plan.
5. **Water and wastewater systems**. These should be checked for damage and serviced immediately, if required. Portable toilets should be serviced.
6. **Flood report**. If a flood greater than the year ARI occurs, a flood report would be prepared by a suitably qualified person(s). Contents of the report should include:
   a. identification of the properties surrounding the Site and infrastructure (located on-Site) affected by flooding during the reportable event;
   b. a comparison of the actual extent, level and duration of the flooding event against the impacts predicted in the flood study;
   c. where the actual extent and level of flooding exceeds the predicted level with the consequent effect of adversely impacting on property, structures and infrastructure, identification of the measures to be implemented to reduce

future impacts of flooding including the timing and responsibilities for implementation; and

d. identification of additional mitigation measures to respond to future flood events.

6 Environmental control measures

A range of Environmental Control Measures (ECMs) have been identified and are included in Section 5 of the **Soil and Water Management Plan**. ECMs will be implemented to avoid, minimise or manage impacts to hydrology and to minimise impacts to construction in the event of a flood.

Appendix 4 – Groundwater Management Strategy (GMS)

TEA-PSF-MP-004.540

TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit

GROUNDWATER MANAGEMENT STRATEGY
(GMS)

taihan

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Abbreviations and Acronyms

Abbreviation/ Acronym	Expanded term
AASS	Actual Acid Sulfate Soils
AIP	Aquifer Interference Policy
AMP	Asbestos Management Plan
ANZECC	Australian and New Zealand Environment and Conservation Council
ANZG	Australian and New Zealand Governments
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
CAQMP	Construction Air Quality Management Plan
CoA	Conditions of Approval (for SSI-8583)
CEMP	Construction Environmental Management Plan
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DMP	Dewatering Management Plan
DPI	Department of Primary Industries
DPIE	Department of Planning Infrastructure and Environment
EIS	Environmental Impact Statement
EMS	(Project) Environmental Management System
EMMM	Environmental Management and Mitigation Measure
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Authority
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Management Strategy
GDE	Groundwater Dependent Ecosystem
GMS	Groundwater Management Strategy
HDD	Horizontal Directional Drilling
HEPA	Heads of EPAs Australia and New Zealand
NHMRC	National Health and Medical Research Council
NSW	New South Wales
NUDLC	National Uniform Drillers Licensing Committee
OOHW Protocol	Out-of-hours work Protocol
PASS	Potential Acid Sulfate Soils
PFAS	Per- and Polyfluoroalkyl Substances
POEO Act	*Protection of the Environment Operations Act 1997*
PSF	Powering Sydney's Future
SSI	State Significant Infrastructure
SSLGMP	Site Specific Landfill Gas Management Plan
SWMP	Surface Water Management Plan
TCP	Traffic Controls Plans
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

The New South Wales (NSW) Department of Planning Infrastructure and Environment (DPIE) has assessed the project State Significant Infrastructure (SSI-8583) and granted Infrastructure Approval on 14 May 2020 in accordance with Section 5.19 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) subject to Conditions of Approval (CoA). The CoA for SSI-8583 require preparation of a Groundwater Management Strategy (GMS).

1.1 Context

This GMS forms part of the Construction Soils and Water Management Plan (CSWMP) for the project, which in turn forms part of the Construction Environmental Management Plan (CEMP). An overview of the project is presented in the CEMP.

The purpose of the GMS is to address:

- the requirements of the CoA for SSI-8583, principally being for investigating, assessing and managing any groundwater dewatering for the SSI;
- the relevant Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) (AECOM, Oct 2019) as documented in the EIS Amendments Report (AECOM, Feb 2020); and
- applicable environmental regulations, policies and guidance.

1.2 Scope and objectives of the GMS

This GMS describes the procedures and protocols that TransGrid and its contractors will implement for investigating, assessing and managing groundwater dewatering for the SSI.

Specifically, this GMS addresses the approach to mitigate environmental impacts that relate to groundwater during construction and operation of the project.

The GMS is applicable to all activities during design and construction of the project and is applicable to all areas where physical works will occur or areas that may be otherwise impacted by the construction works, and are under the control of TransGrid and its contractors. All staff and sub-contractors are required to operate fully under the requirements of the GMS and related environmental management plans, over the full duration of the design and construction program.

1.3 Project environmental management system overview

The project Environmental Management System (EMS) is described in **Figure 1-1**.

To achieve the intended environmental performance outcomes, the Project has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, including the GMS, procedures, protocols and tools as set out below and illustrated in **Figure 1-1**.

1.4 Consultation for preparation of the GMS

Stakeholder consultation with relevant councils has been completed as documented in the Construction Soil and Water Management Plan (CSWMP). All comments have been addressed.

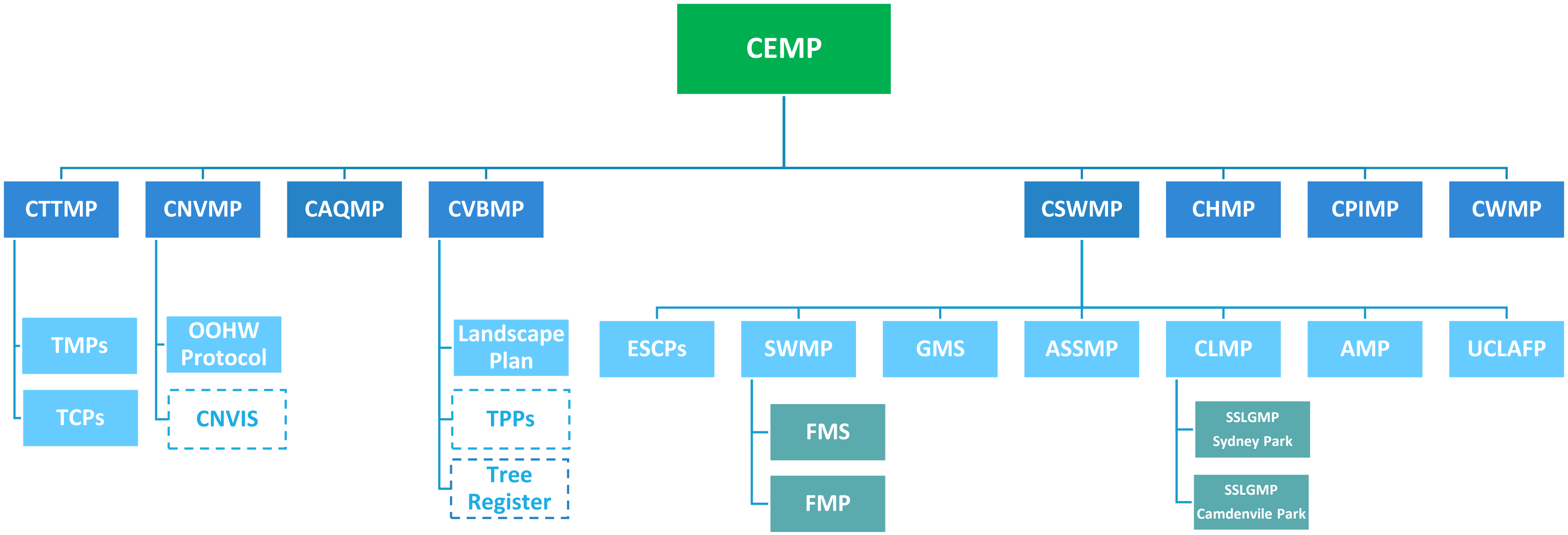


Figure 1-1 Project environmental management system

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register. The key legislation relevant to the GMS are:

- *Water Act 1912*
- *Water Management Act 2000*
- *Protection of the Environment Operations Act 1997* (POEO Act)

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the GMS include:

- *Aquifer Interference Policy* (AIP) (NSW Office of Water, 2012)
- *Greater Metropolitan Region Groundwater Source Water Sharing Plan* (NSW Office of Water 2011)
- National Uniform Drillers Licensing Committee (NUDLC), 2011, *Minimum Requirements for Water Bores in Australia*
- Australian and New Zealand Governments, 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)[1]
- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure*, amended 2013 (ASC NEPM)
- National Health and Medical Research Council (NHMRC) *Australian Drinking Water Guidelines (2011)*, updated August 2018
- Heads of EPAs Australia and New Zealand (HEPA), 2018. *PFAS National Environmental Management Plan* (PFAS NEMP)
- New South Wales Environment Protection Authority (NSW EPA), 2014. *Waste Classification Guidelines: Part 1 Classifying Waste*
- RMS, 2011, *Technical Guideline: Environmental Management of Construction Site Dewatering*, 2 April 2011
- TransGrid, 2016. *Environmental Handbook*
- Guidelines under *Controlled Activities on Waterfront Land Guidelines (DPI, 2012)* (refer to CSWMP)
- Guidelines under *NSW Acid Sulfate Soils Manual (ASSMAC, 1998).*
- TransGrid Guidelines and Procedures:
  - TransGrid Procedure – Contaminated Land Management
  - TransGrid Procedure – Health and Safety Incident Management
  - TransGrid procedure – Environmental Incident Management

2.3 Minister's Condition of Approval

The GMS is developed in accordance with the CoA for SSI-8583 as described below.

E14 The Proponent must ensure that any groundwater dewatering activities consider reasonable and feasible alternatives to discharge to stormwater. Where groundwater is discharged to stormwater, wastewater pollutant discharge concentrations, unless otherwise agreed by the EPA, must achieve criteria in the national Water Quality Guidelines at a 95% protection level for marine ecosystems and, for analytes not covered by the guidelines, the amended National Health and Medical Research Council (NHMRC) Australian Drinking Water Guidelines (2015).

[1] ANZG (2018) have superseded the ANZECC Water Quality Guidelines (2000) referred to in the CoA and EIS Amendment Report.

E20(c) Groundwater Management Strategy, for investigating, assessing and managing any groundwater dewatering for the SSI.

2.4 Environmental Mitigation and Management Measures

The GMS is developed to include the relevant EMMMs detailed in the EIS Amendment Report listed in **Table 2-1** below.

Table 2-1 Relevant EMMMs to the GMS

Impact	ID	Measure
Water quality, soil erosion and sediment control (CSWMP)	WQ1	A CSWMP will be prepared as part of the overall CEMP to document the measures required to mitigate and manage potential impacts on soils, surface water and groundwater during construction. The CSWMP will include the following sub-plans and measures: • ESCPs (see WQ2); • where wheel washing is required, wheel wash wastewater will be collected (e.g. through temporary containment and directing to sediment basins or tanks) and disposed of appropriately; • water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act 1997 and the ANZECC Water Quality Guidelines (2000) for 95% protection level for marine ecosystems.* Contaminated water captured during construction would be disposed of at an appropriately licensed facility; and • where works are within the riparian zone (40 metres from the top of the watercourse bank) the *Controlled Activities on Waterfront Land Guidelines* (DPI, 2012) would be reviewed and relevant measure included into the CSWMP where appropriate. Procedures and protocols to manage potentially contaminated fill, soil, bedrock, acid sulfate soils and extracted groundwater will be detailed in the CEMP in accordance with conditions outlined in the Preliminary Site Investigation report (refer to Appendix K of the EIS) and the *NSW Acid Sulfate Soils Manual* (Stone et al, 1998).
Groundwater interception	GW1	A Groundwater Management Strategy will be prepared that will outline the requirement for drilling and installation of monitoring wells and baseline groundwater level and quality monitoring. This additional information will be collected prior to or during detailed design in locations where it is likely that the watertable may be intersected. This data will be used to confirm whether groundwater control measures or dewatering will be required. Where it is likely that groundwater will be intersected, estimates of groundwater inflows will be predicted to assess if a groundwater extraction license would be required (that is if 3 ML/year of groundwater discharge was to be exceeded). Outcomes from the GMS will inform the Construction Environmental Management Plan (CEMP). The CEMP, where necessary: • measures to stabilise the excavation, such as installation of temporary shoring in trenches (e.g. sheet piling); • localised temporary dewatering measures to maintain dry working conditions; • measures to maintain groundwater flow conditions to minimise disruption to down-gradient receptors; and • measures to minimise groundwater drawdown to reduce any ground settlement impacts.
Aquifer interference	GW2	Detailed hydrogeological information (e.g. bore data) will be used to inform the most suitable underboring construction method at select special crossings that will minimise the need for dewatering. Where an aquifer is to be completely penetrated at the underboring special crossings, appropriate controls (such as drainage blankets) will be installed beneath the infrastructure to ensure groundwater flow is

Impact	ID	Measure
		maintained to minimise disruption to groundwater flow paths.
Intersection of contaminated groundwater	GW3	In areas where contaminated groundwater is identified, measures will be implemented to ensure that the backfill within the excavation does not create a more permeable pathway for migration of contamination.
Dewatering	GW4	A CSWMP will be prepared as part of the CEMP to document the measures required to mitigate and manage potential impacts on groundwater during construction. The CSWMP would include the following measures: • water collected during dewatering of excavations would be discharged or disposed of in accordance with the *Protection of the Environment Operations Act 1997* and the *ANZECC Water Quality Guidelines (2000)* for 95% protection level for marine ecosystems; and • contaminated groundwater captured during construction will be disposed of at an appropriately licenced facility.

3 Existing Environment

A summary of the existing environment described in the EIS relevant to the GMS is provided in the following sections. Further details are provided in the CWSMP or other sub-plans.

3.1 Hydrogeological Setting

Groundwater across the project area is present in:

- fill, imported and local, used for the construction of infrastructure and waste infilling such as at former quarries and brick pits at Sydney Park and Camdenville Park;
- alluvium around the edges of major waterways including the Cooks River and Alexandra Canal; and
- bedrock aquifer of the Ashfield Shale and Hawkesbury Sandstone.

Groundwater within the project area is recharged by infiltration of rainfall and runoff. Perched groundwater may be encountered within fill and natural clayey soils. In lower lying areas, tidal influences are typically experienced within close proximity to the foreshore. Groundwater levels fluctuate in response to diurnal variation, tidal influences, variable rainfall, dewatering, seasonal variation and longer term in response to natural climatic variation.

The project area is located in an urbanised part of Sydney where rainfall recharge has been reduced by hard stand and roof runoff being captured and directed to stormwater. The majority of groundwater recharge occurs in parks, gardens and bushland. Alluvium flanking the Cooks River and Alexandra Canal is recharged daily by tidal fluctuations.

Groundwater flow typically follows the surface topography but is also influenced by a number of factors such as geological boundaries, palaeochannels, building foundations and groundwater extraction.

3.1.1 Groundwater levels

Groundwater levels are variable across the project area and are expected to be typically greater than 1 or 2 metres below ground level. Elevated groundwater levels may be present where the water table is perched, which is generally encountered within areas of fill and natural clayey soils.

Under natural conditions, groundwater levels would be expected to naturally fluctuate over an amplitude of approximately 1 metre.

In areas where the water table is less than 2 metres below ground level, the trench excavation depth may intercept groundwater and require temporary dewatering during construction.

3.1.2 Groundwater quality

Contamination was assessed as part of the EIS. Identified areas of concern from a contamination viewpoint in each precinct of the cable transmission route and at the construction laydown areas, and a preliminary conceptual model identifying relative risks of existing groundwater contamination, was presented in Table 16-7 of the EIS.

Groundwater quality across the project area is variable and dependent upon the occurrence and quality of fill, lithology of the aquifer, tidal influences, and current and previous land uses. Contaminated groundwater may have originated from previous activities undertaken on land overlying the project area or hydraulically up-gradient of the project area.

The unconfined alluvial aquifers and Botany Sands aquifer are susceptible to contamination from former and current land use practices such as leakage from industrial sites, leaky sewage systems or the application of fertilisers. Former quarries and brick pits near the cable alignment are also potential sources of groundwater contamination.

Groundwater quality can also be affected by the presence of acid sulfate soils (ASS).

While the EIS identified potential sources of groundwater contamination in all project precincts, groundwater contamination is principally relevant to design and construction of the project only in areas where the cable trench, pits or underbores intersect groundwater. Key areas of concern include:

- Where project excavations intersect the water table in areas near former brick pits / quarries that have been filled with waste and fill materials (identified in CLMP) - e.g. possibly near Sydney Park. However, the EIS assessed that dewatering requirements would be limited at Sydney Park as the deeper excavations for the thrust bore launch and receive pits would occur in the shale bedrock, which has a low hydraulic conductivity.
- At the launch and receive pits for selected underbore special crossings, particularly, such as near Cooks River.

3.1.3 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater, such as wetlands and vegetation on coastal sand dunes. Most wetland communities and many river systems have some degree of dependence on groundwater.

The EIS (Section 18.2.3) included review of GDEs near the study area. The review did not identify high priority GDEs within the study area that are likely to be dependent on groundwater. The closest GDEs were identified as the Botany Wetlands or Lachlan Swamps located in Centennial Park approximately 4 kilometres northeast of the eastern most extent of the project area and east of Alexandra Canal - it is considered unlikely that the GDEs would be impacted by any dewatering due to the project. The project is not expected to change availability of water for plants due to the low permeability of the clayey soils, frequent rainfall events and nearby GDEs are located at points of recharge.

3.1.4 Groundwater Users

Existing groundwater use within the study area is limited as the area is serviced by a reticulated water supply provided by Sydney Water. Groundwater usage to the east of the railway corridor at St Peters within the Botany Sands aquifer (refer to the figure in **Appendix 1)** is potentially higher because groundwater is typically relatively shallow and extraction bores high yielding. However, groundwater use in this area is restricted in accordance with *Temporary Water Restriction (Botany Sands Groundwater Source) Order 2018* under the *Water Management Act 2000*.

A review during preparation of the EIS of bores registered within the study area identified 16 registered bores – these are shown on the plan in **Appendix 1**. It is possible there are other private bores present within the 500 metre radius that have not been registered. The EIS stated review of these boreholes indicates that 14 are registered as monitoring bores, one is for domestic use, one is for recreation and culture. The dominant purpose of the wells for groundwater monitoring is consistent with low groundwater use in the project area. The wells are typically shallow, being less than 10 metres deep. Exceptions are domestic bore GW105215 located in Bellombi Street, Canterbury, that is drilled to a depth of 15 metres and monitoring wells GW109821 (35 metres) and GW109825 (22 metres) located at Alexandria Landfill, south of Sydney Park.

3.2 Topography and Hydrology

The transmission cable route is predominantly in elevated topographical areas, with low points principally where the route crosses creeks and rivers.

Most of the land traversed by the transmission cable route drains into catchments and waterways via local piped urban stormwater networks. A flood detention basin is present in Camdenville Park and man-made wetlands are present within Sydney Park, and local stormwater is harvested from the urban drainage network near Sydney Park Road.

The transmission cable route would cross:

- Cooks River, which is the main hydrological feature within the project area. Cooks River flows into Botany Bay.
- Coxs Creek, a primary tributary of the Cooks River, in the western portion of the project area. At the point of crossing Coxs Creek, the waterway is a concrete channel.

The Beaconsfield West substation, to the eastern end of the study area, is located adjacent to the Alexandra Canal, a highly modified waterway (formerly Shea's Creek) which also flows into the Cooks River.

The Sydney South substation is located approximately 150 metres north of the Georges River estuary, which flows into Botany Bay.

3.3 Geology and Soils

The geology within the study area is dominated by the Triassic aged Wianamatta Group that is overlain in part by Quaternary aged Alluvium and Marine deposits outcropping adjacent to major waterways. The Wianamatta Group includes Bringelly Shale (Rwb) and Ashfield Shale (Rwa). The shale is underlain by the Hawkesbury Sandstone, a medium to coarse grained quartzose sandstone. Igneous intrusions of Jurassic age including dykes are mapped within the region.

Quaternary sediments are mapped within the floodplains of Cooks River, Alexandra Canal, and between the southern end of Sydney Park to Alexandra Canal.

The project area is located within an urban environment, and landscape alteration is common ranging from minor landscaping to extensive cut and fill activities associated with the construction of major buildings and infrastructure. The fill typically consists of locally excavated and imported materials. More substantial filling has occurred along low-lying areas such as the Cooks River and Alexandra Canal where some areas have been reclaimed from locally dredged river sediments.

Sydney Park and the nearby former Alexandria Landfill comprised a series of former quarries that were subsequently infilled with waste material, including putrescible waste. Camdenville Park, located west of Sydney Park in Marrickville, is a former brickpit that has been infilled with municipal waste and converted to a playing field.

3.4 Acid Sulfate Soils

Acid sulfate soils (ASS) is the common name given to a range of soil types containing iron sulfides. ASS may be present as actual ASS (AASS) or potential ASS (PASS). When exposed to air, the iron sulfides (commonly pyrite) within ASS can oxidise, producing sulfuric acid. These soils may become exposed to air by dewatering and cause increased acidity of groundwater, which can impact on surrounding water quality and aquatic ecosystems.

The ASS risk class within the study area is largely Class 5 (indicating no risk of intercepting ASS for activities not resulting in the lowering of the water table by more than 1 metre), with the exception of areas near Cooks River, and at the eastern end of the route in part of Marrickville and from Princes Highway to Alexandra Canal – refer to the ASSMP for more details.

4 Environmental Aspects and Impacts on Groundwater

Some impacts on groundwater attributable to the project were assessed in the EIS. Relevant aspects and the potential for related impacts have been considered in a risk assessment and Appendix A2 of the CEMP. A summary of key potential impacts to groundwater are described in the sections below. **Section 5** provides the strategy to assess and mitigate these impacts.

4.1 Construction activities and possible impacts

Key activities during project construction that could impact groundwater or groundwater receptors include, but are not limited, to the following project activities:

- Use of fuels, oils, chemicals or construction materials.
- Temporary dewatering of excavations for cable trenches and joint bays, underboring launch/receive pits and sediment basins.
- Underboring.

Groundwater impacts have the potential to occur where the excavation intersects the water table and dewatering is necessary in areas such as joint bay and trench excavations in excess of two metres, and at select underbore locations, especially at the Cooks River. Given that the cable transmission structures will be shallow (less than 2 metres below ground level) for most of the alignment, the areas of possible groundwater impact are limited. Creation of impermeable surfaces, such as at construction laydown areas, can also affect groundwater recharge.

Key potential groundwater impacts attributable to the project during construction assessed in the EIS are listed in **Table 4-1** below.

4.2 Operation activities and possible impacts

Key activities during project operation that could impact groundwater or groundwater receptors include, but are not limited to, the following project activities:

- Project structures that interfere with recharge or fully intersect an aquifer causing compartmentalisation of groundwater flow.
- Project structures that intersect an aquifer and cause an adverse change in existing groundwater contamination conditions.

Operation of the project is anticipated to have limited impacts on groundwater, given the majority of infrastructure would be located above the expected groundwater elevation. Although project infrastructure would be in contact with groundwater at a number of special crossings, there would be no dewatering or significant alteration of the groundwater flow regime. Key potential groundwater impacts attributable to the project operation (and require consideration in project planning) assessed in the EIS are listed in **Table 4-2** below.

Table 4-1: Potential Groundwater Impacts Identified in the EIS – Project Construction

<table>
<tr><th>Aspect</th><th>Possible Impact</th><th>Risk</th><th>Management Approach</th></tr>
<tr><td>Impacts on groundwater quality</td><td>• Spills of fuels, oils, chemicals or construction materials or drilling muds may infiltrate to groundwater through underboring activities or open excavations.
• Construction activities could introduce foreign contaminants such as oil or greases, and disturb contaminated sediments, potentially having an adverse impact on groundwater quality.
• Concrete works and washout resulting in discharge of cementitious water contaminating groundwater.
• Contaminated or ASS sediments that may be mobilised by construction activities.
• Accidental spills or leaks (such as frac-outs, leaks along vertical fractures) during underboring.</td><td rowspan="2">Temporary dewatering may be required where groundwater is intersected to allow construction. Since the majority of the transmission cable route is predominately located in topographically elevated areas and is to be excavated from shale (typically low hydraulic conductivity), it is anticipated that groundwater would not be intersected along the majority of the transmission cable route.

Areas with the highest potential to intersect groundwater are immediately adjacent to the Cooks River and special crossing locations that require underboring.

Predicted groundwater level drawdown is not expected to be substantial. This is due to the water table in the project area being typically deeper than 1 or 2 metres below ground level and the base of the excavation (for the transmission cable conduits and joint bays) being approximately 2 metres deep.

There is the potential for greater drawdown local to deeper excavations required for underboring (excavation depths of four metres for launch and receive pits and up to 10 metres for the underbore itself).

Since the predicted impacts on groundwater levels are considered minimal (i.e. generally less than 1 metre) and temporary, potential impacts on nearby registered bores, GDEs or wetlands are considered acceptable in accordance with the AIP (NSW Office of Water, 2012).

Potential impacts related to an increase of impervious surfaces are considered minor and temporary.</td><td>• Management of fuels, oils, chemicals, construction materials and concrete works discharge in CWMP
• Contamination management procedures and controls in CLMP
• ASS management procedures and controls in ASSMP
• Surface water management procedures and controls in SWMP.
• Underboring procedures and controls in this GMS</td></tr>
<tr><td>Temporary dewatering</td><td>• Loss of water from existing registered extraction bores (if any).
• Damage to nearby infrastructure caused by ground settlement.
• Degradation of water quality in receiving waterways due to inappropriate discharge.</td><td>• Strategy in this GMS</td></tr>
<tr><td>Acid Sulfate Soils</td><td>• Localised lowering of the water table at underboring launch/received pit locations at the Cooks River and Sydney Park due to temporary</td><td>Given the localised and temporary dewatering that would be required, only a small area of surrounding</td><td>• ASS management procedures and controls in ASSMP</td></tr>
</table>

Aspect	Possible Impact	Risk	Management Approach
	dewatering potentially causing degradation of local water quality due to oxidation of PASS.	soil could be expected to be exposed to oxidising conditions that would require management.	• Strategy in this GMS
Impacts on groundwater contamination	• Intersecting existing contaminated groundwater during excavation or creating a more permeable pathway for contamination to reach groundwater.	Given the localised and temporary dewatering that would be required, only a small area of existing contamination, if present, could be expected to be intersected.	• Strategy in this GMS

Table 4-2: Potential Groundwater Impacts Identified in the EIS – Project Operation

<table>
<tr><th>Aspect</th><th>Possible Impact</th><th>Risk</th><th>Management</th></tr>
<tr><td>Aquifer interference</td><td>• Below ground infrastructure (such as deeper pit structures or transmission cable circuit that fully penetrates an aquifer) has the ability to create physical barriers resulting in temporary (e.g. after rainfall events) or permanent interruptions (e.g. compartmentalisation of an aquifer) to groundwater flow.</td><td rowspan="2">Project infrastructure may be in contact with groundwater at a number of special crossings, however, there would be no dewatering or significant alteration of the groundwater flow regime because: the majority of the transmission cable route is in the low hydraulic conductivity shales; the small footprint of special crossings relative to catchments; and, the special crossings in the Botany Sands aquifer also have a small footprint and effects on head conditions are expected to rapidly dissipate across the aquifer because of the higher hydraulic conductivity.

Potential impacts related to changes in groundwater recharge caused by impervious surfaces are considered insignificant due to the very small area of project structures relative to aquifer extents.

Long term groundwater levels are unlikely to be impacted by the project other than the potential for some localised groundwater mounding. There would be no dewatering or significant alteration of the groundwater flow regime. Therefore, operational impacts would be minimal.</td><td>• Strategy in this GMS</td></tr>
<tr><td>Impacts on groundwater contamination</td><td>• Intersecting existing contaminated groundwater and creation of a preferential flow pathway for contamination.</td><td>• Strategy in this GMS</td></tr>
</table>

5 Groundwater Management Strategy

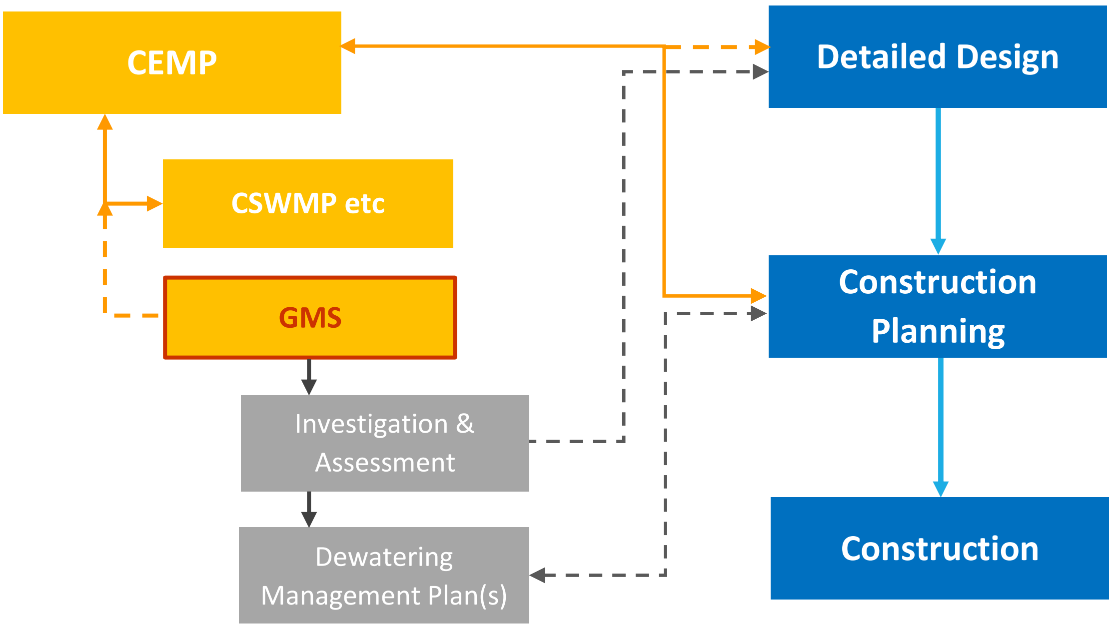
The strategy to manage investigating, assessing and managing potential groundwater impacts, including those from dewatering, during construction and operation of the project is described in the following sections. The strategy measures address, or will address through appropriate implementation of this GMS and other sub-plans under the CEMP referenced below, CoA E14 and E20(c), and EMMMs in **Section 2**.

An outline of the groundwater management strategy and the interrelation between the key elements is illustrated in the diagram below and includes:

1. **Pre-construction activities** to inform the detailed design of the project and the construction management plans.
2. **Construction planning activities**, including preparation of the CSWMP (under the CEMP), development of dewatering management plans (DMP) (where required) and specific construction measures to reduce groundwater dewatering requirements and mitigate possible impacts (e.g. excavation retention systems, staging, underbore method, water treatment method and discharge licences / permits).
3. **Implementation** of the design and management plans during **construction**.

The groundwater management measures for each of these stages is described in **Sections 5.1.1 to 5.1.3** below.

Once the detailed design has been developed sufficiently and the proposed construction staging and layouts for the transmission cable route work sites, construction laydown areas and substations are known, measures outlined in the CSWMP and its sub-plans may be refined and presented in the DMPs.



5.1.1 Pre-Construction and Design Measures

The principal goals of pre-construction measures (refer **Table 5-1** below) are to:

- Identify the locations and nature of project excavations where groundwater may be intersected and assess:

    - dewatering requirements; and
    - nature of possible groundwater contamination.
- Incorporate design features that mitigate possible impacts to groundwater during operation.

The key activities will include iterative design review and targeted groundwater investigations at select locations within the project area. Information from these activities will be used in detailed design of the project, construction planning and development of construction methods.

5.1.2 Construction Planning Measures

Information from pre-construction measures and detailed design will be used to develop specific construction methods, refine the CSWMP, prepare DMP(s) and obtain associated licences / permits (if required) (refer **Table 5-2** below).

5.1.3 Construction Measures

Groundwater management measures will include implementation of the detailed design, construction methods and management plans developed in preceding stages (refer **Table 5-3** below).

Table 5-1 Groundwater Environmental Control Measures – Pre-Construction and Design

Measure	Description	Reference
1. Identify and assess project areas that are predicted to require dewatering	• Identify project areas that will intersect groundwater and groundwater contamination during construction and/or operation via desktop review by a suitably qualified hydrogeologist of: o the preferred alignment and preliminary detailed design; o EIS information; and o information from supplementary contamination or ASS pre-construction investigations identified under sub-plans of the CSWMP. • Identify areas of concern, each being a project area where the aquifer is to be completely penetrated or has an elevated risk of impact on groundwater from dewatering identified in **Section 4.1** or existing contamination identified in Table 5-1 of the CLMP or Table 3-2 of the PASS. The key areas expected to require assessment include select underbore special crossings at Cooks River and near Sydney Park. • Investigate groundwater in the areas of concern prior to the construction to assess the nature (including groundwater levels, flow direction, water quality and aquifer hydraulic conductivity) of groundwater and estimate potential dewatering requirements (rate, cumulative volume and water quality). The investigation design shall be developed and implemented by a suitably qualified and experienced hydrogeologist and shall consider: o Use of existing monitoring wells (e.g. near Sydney Park), and/or installation of supplementary monitoring wells or piezometers by drilling using construction methods consistent with guidance in NUDLC (2011) *Minimum Requirements for Water Bores in Australia*. o Groundwater sampling design and methods in NSW EPA made or approved guidelines under the *Contaminated Land Management Act 1997*, including ASC NEPM. o Estimate potential dewatering rates and drawdown using analytical calculation or computational methods. o Identify possible water quality objectives and criteria for extracted water, including consideration of feasible options of on-site re-use, discharge to sewer or stormwater, or off-site disposal of contaminated water to a suitable licensed facility consistent with this GMS. • Undertake baseline groundwater monitoring to provide an initial assessment of groundwater levels and water quality prior to the commencement of excavation in the select areas of concern.	GW1, GW2
2. Project design to minimise potential environmental impacts during operation	• Develop detailed design to mitigate to the extent practicable impacts from groundwater interference caused by project structures that fully penetrate an aquifer. This may include, but not be limited to: o Design depth and geometry of structures below the water table to reduce interference with groundwater flow. o Gravel drainage blankets beneath parts of the transmission cable route where bedrock is shallow and groundwater mounding could be caused by the blocking of groundwater flow paths.	GW1, GW2, GW3

Measure	Description	Reference
	• Develop detailed design to mitigate to the extent practicable possible adverse preferential migration of contaminated groundwater, if present, caused by the backfill within the excavation. This may include, but not be limited to: ○ Sealing of annulus of structures or bores. ○ Reducing permeability of backfill to mitigate preferential flow (e.g. grout 'collar's placed periodically with trench backfill).	
3. Project design to minimise potential environmental impacts during construction	• Develop the preferred underbore method (e.g. horizontal direction drilling [HDD] requires less excavation and dewatering for entry/exit pits than the thrust bore method) at selected special crossings based on investigations (above).	GW2

Table 5-2 Groundwater Environmental Management Measures – Construction Planning

Measure	Description	Reference
4. Develop excavation and dewatering methods to minimise potential environmental impacts	• Assess and develop methods to reduce groundwater extraction and drawdown required for temporary dewatering to minimise disruption to downgradient receptors and reduce possible associated ground settlement including, but not be limited to: ○ Excavation retention systems (e.g. sheet piling) required for excavation safety purposes. ○ Excavation method and staging to minimise depth and duration. ○ Measures to control surface runoff inflows in the SWMP. ○ Dewatering methods (e.g. sump and pump, spearpoints, careful control of drawdown).	GW1
5. Develop extracted groundwater management controls to minimise potential environmental impacts	• Refine estimates of potential dewatering rates and drawdown for the preferred project design and construction methods. Use these estimates to: ○ Assess possible adverse ground settlement impacts attributable to the project. ○ Determine whether approval from WaterNSW for construction dewatering is required – i,e, EMMM GW1 states that a groundwater extraction license would be required if 3 ML/year of groundwater discharge will be exceeded. This shall be applied per site within the project area. • Assess and develop appropriate methods to manage water collected during dewatering of excavations. The goal is to minimise potential impacts on the environment and will include consideration of reasonable and feasible alternatives to discharge to stormwater. • The water will be discharged or disposed of in accordance with the POEO Act and relevant NSW waste regulations following the decision flow process shown in **Figure A** of **Appendix 2**, and include one or a combination of: ○ On-site re-use (e.g. re-injection, use in dust suppression) of suitable water (i.e. that meets criteria in the SWMP).	CoA E14 WQ1, GW4

Measure	Description	Reference
	○ Discharge to stormwater - discharged water shall meet water quality criteria in ANZG (2018) for 95% protection level for marine ecosystems and, for analytes not covered by the guidelines, NHMRC (2011) as updated at the time of construction. ○ Discharge to sewer – discharged water shall meet Sydney Water acceptance standards. ○ Off-site disposal of contaminated water (i.e. not suitable for re-use or discharge to sewer or stormwater) to a suitable licensed facility – disposed water shall be classified, transported and disposed in accordance with *Waste Classification Guidelines* (NSW EPA, 2014) and NSW waste regulations. • Develop treatment requirements and design to meet the appropriate discharge water quality objectives. • Determine the licence / permit requirements for discharge. • Develop a monitoring program to be implemented during construction dewatering. The aim of the program will be to monitor drawdown and possible adverse changes in groundwater conditions surrounding the project area, and comply with discharge water quality objectives. The program is envisaged to include gauging available monitoring wells, recording rate and volume of groundwater collected, and discharge water quality.	
6. Prepare a Dewatering Management Plan	• Document the preferred dewatering approach and management controls developed in the above measures in a DMP that is consistent with requirements of *Dewatering Work Method Statements* in RMS (2011) and in WaterNSW *Dewatering Checklist for a Water Works Approval.* A generic dewatering and discharge procedure specific to groundwater ingress into trenches is presented in **Appendix 2**. This should be revised for each location where dewatering is predicted to be required and updated with site-specific information obtained during the investigations outlined in Measure 1 in **Table 5-1** above.	
7. CSWMP	• Develop sub-plans under CSWMP that document management procedures and controls to mitigate possible impacts to groundwater from surface water runoff, erosion and sediments controls, and use of hazardous materials as part of construction.	WQ1

Table 5-3 Groundwater Environmental Management Measures – Project Construction

Measure	Description	Reference
8. Implement Management Plans	• Implement the CSWMP • Implement the DMP(s)	CoA E14
9. Monitoring	• Undertake monitoring of groundwater levels and quality, and water discharge.	
10. Documentation	• Document groundwater monitoring and dewatering records for retention in general accordance with WaterNSW requirements in the *Dewatering Checklist for a Water Works Approval*.	-
11. Compliance Management	• Compliance management in accordance with **Section 6** of this GMS.	-

6 Compliance Management

6.1 Roles and Responsibilities

In addition to those detailed in the CSWMP, CLMP and ASSMP, the roles and responsibilities presented in **Table 6-1** are relevant to the GMS.

Table 6-1: GMS Roles and Responsibilities

Role	Responsibility
Suitably qualified and experienced hydrogeologist	Assess nature and extent of dewatering required Assess design requirements to mitigate impacts on groundwater flow Prepare DMP (if required)
Contaminated Land Consultant	Assess dewatering discharge water quality objectives and treatment requirements Assess design requirements to mitigate impacts on groundwater contamination
Suitably qualified and experienced driller	Appropriate construction of monitoring wells and underbores in accordance with *Minimum Requirements for Water Bores in Australia* (NUDLC, 2011).
Suitably qualified and experienced engineer	Design groundwater flow mitigation systems (e.g. drainage blankets), if required.

6.2 Training & Induction

Refer to training and inductions requirements details in CSWMP and CLMP.

6.3 Complaints Management

Refer to training and inductions requirements details in CSWMP and CLMP.

6.4 Incident Response

Refer to training and inductions requirements details in CSWMP and CLMP.

6.5 Audits

Refer to training and inductions requirements details in CSWMP and CLMP.

6.6 Non-Conformances

Refer to training and inductions requirements details in CSWMP and CLMP.

6.7 Licenses, Permits and Qualifications

Refer to training and inductions requirements details in CSWMP and CLMP.

Approval from WaterNSW may be required for construction dewatering if the extracted volume is expected to exceed, or exceeds, 3 ML in a year commencing on 1 July in any year.

6.8 Review and Improvement

This plan may be updated or revised if required. The procedure for review and approval of any updates or revisions will be in accordance with the procedure described in the CSWMP.

7 References

ANZG, 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Governments.

AECOM Australia Pty Ltd, 2019. *Powering Sydney's Future Potts Hill to Alexandria transmission cable project*. Environmental Impact Statement, October 2019.

AECOM Australia Pty Ltd, 2020. *Powering Sydney's Future Potts Hill to Alexandria transmission cable project*. Amendment Report, February 2020.

National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure,* as amended 15 May 2013. (ASC NEPM)

NHMRC, 2011, *Australian Drinking Water Guidelines*, updated August 2018. National Health and Medical Research Council.

NSW EPA, 2014. *Waste Classification Guidelines – Part 1: Classifying Waste.* November 2014. New South Wales Environment Protection Authority.

NSW Office of Water, 2012, *Aquifer Interference Policy.*

NUDLC, 2011, *Minimum Requirements for Water Bores in Australia*, National Uniform Drillers Licensing Committee. National Uniform Drillers Licensing Committee.

RMS, 2011, *Technical Guideline: Environmental Management of Construction Site Dewatering*, 2 April 2011. Roads and Maritime Services.

WaterNSW, *Dewatering Checklist for a Water Management Works Approval.* Forms part of the Application for a water supply works approval for construction dewatering.

Appendix 1 – Selected Figures from EIS

Disclaimer: AECOM makes no representations or warranties of any kind, either expressed or implied, about the accuracy, reliability, completeness or suitability, including (without limitation) any warranty of merchantability or fitness for purpose in relation to the data provided on this figure. By using this data you agree that AECOM is under no liability for any loss or damage (including consequential or indirect loss) that you may suffer from use of the data.

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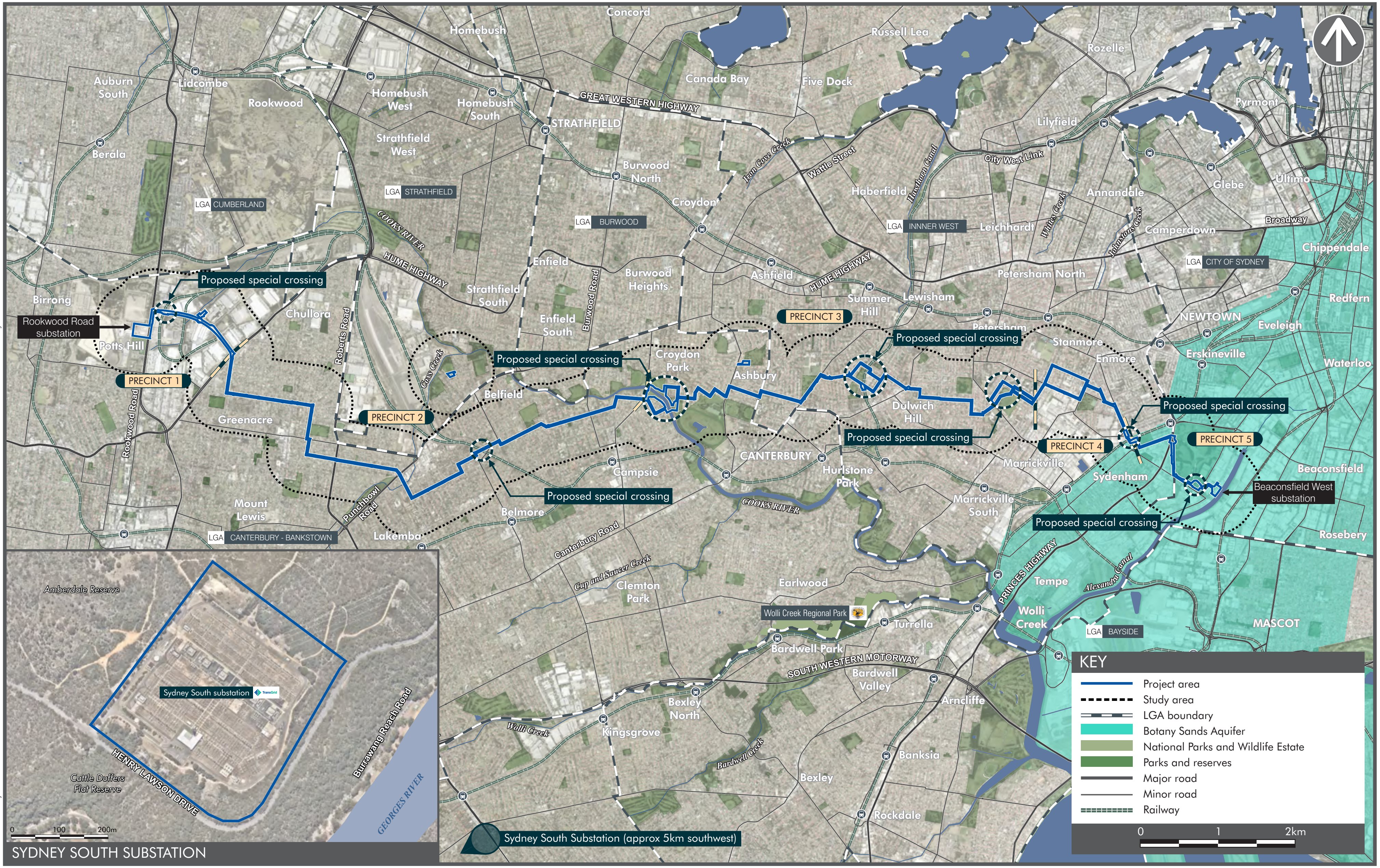

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GROUNDWATER STUDY AREA

Powering Sydney's Future
Potts Hill to Alexandria Transmission Cable Project

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations
Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

FIGURE 3-1

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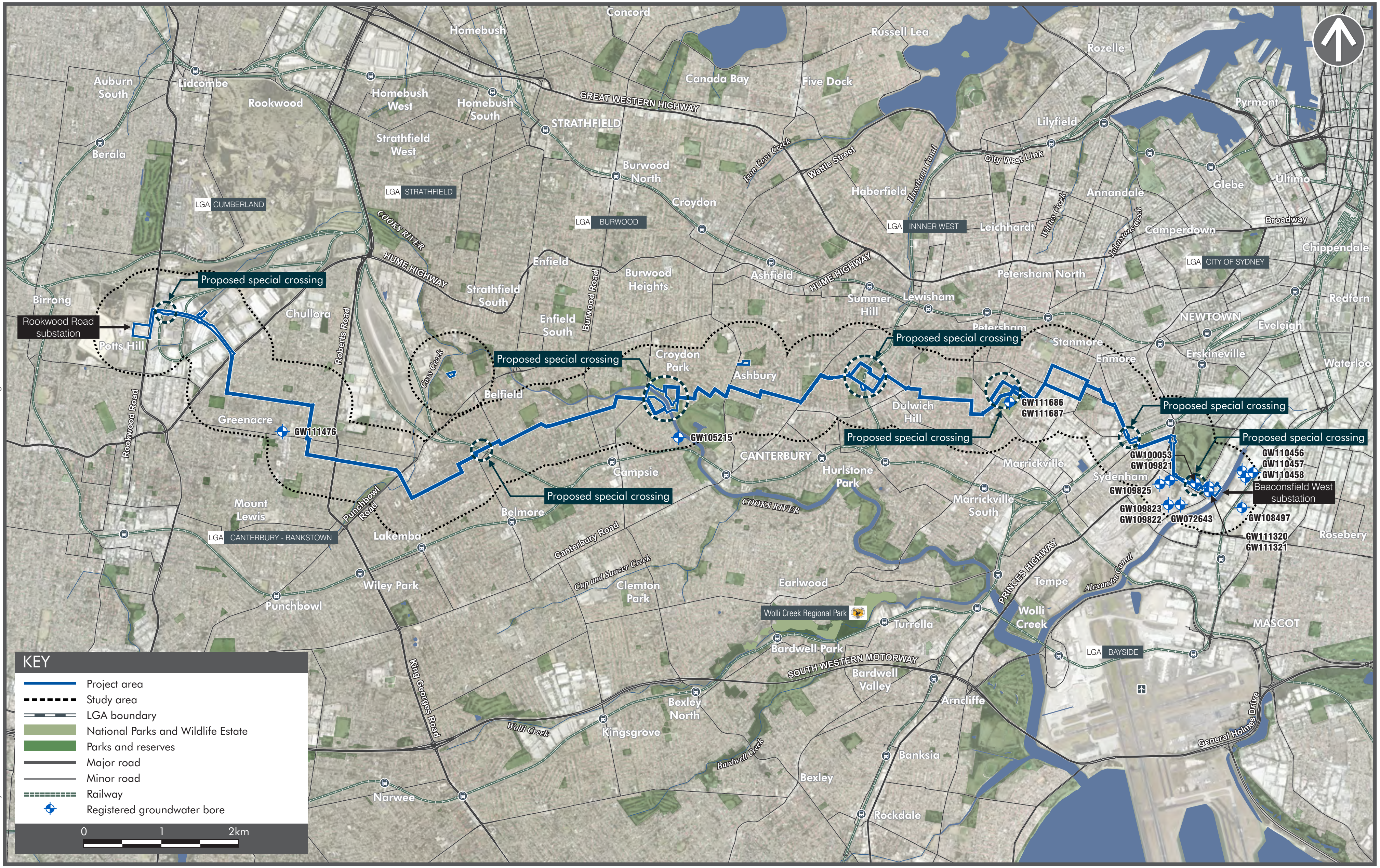

G:\ENV\GIS\Projects\60516\60558835 Rookwood to Beaconsfield EIS\FIGURES\2019\Groundwater\60558835 F4.1 Registered Groundwater Bores 26 08 2019

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REGISTERED GROUNDWATER BORES

Powering Sydney's Future

Potts Hill to Alexandria Transmission Cable Project

FIGURE 4-1

Note: The project area is confined to the roadway reserve with the exception of parks and existing substations

Source: Department of Finance, Services and Innovation - Spatial Services (2018), Nearmap (2018)

Appendix 2 – Generic Dewatering and Discharge Procedure

Purpose

The purpose of this procedure is to provide generic guidance to site personnel for re-use, discharging or disposing of excess groundwater encountered within trench excavations on-site. A dewatering management plan (DMP) will be prepared for each location where dewatering is anticipated to be necessary to lower the water table to allow excavation. Management and discharging of surface water inflow will be undertaken in accordance with the procedure outlined in the SWMP.

Dewatering and Discharge Requirements and Licensing

Dewatering activities may be required in locations identified in the GMS, dependent upon the results of the assessment detailed in Measure 1 of Table 5-1 in the GMS. There could also be minor groundwater ingress into trench and joint bay excavations in localised areas where shallow perched water is present.

A license for dewatering may be required under the *NSW Water Management Act 2000* – refer to Measure 5 in Table 5-2 of the GMS. This required will be based on the pre-construction assessment of the predicted dewatering volumes detailed in Measure 1 of Table 5-1 in the GMS. If required, an application for groundwater dewatering will be submitted to WaterNSW prior to construction.

It is an offence under section 120 of the *POEO Act 1997* to pollute waters. Approval or licensing of disposal of dewatered groundwater will be required but depend on the method used – refer to discussion of options below. Alternatively, disposal of dewatered groundwater may require a license under the *POEO Act 1997* for discharge of water from a point source. The licensing requirement should be assessed following the assessment detailed in Measure 1 of Table 5-1 in the GMS.

Analytical Testing of Water

In areas predicted to require dewatering, baseline groundwater level and quality monitoring will be undertaken as part of the assessment detailed in Measure 1 of Table 5-1 in the GMS. These water quality data will be used to assist in pre-determination of discharge and disposal options. Groundwater quality should be assessed for:

- Generic re-use potential will be undertaken in accordance with the SWMP (e.g. pH, turbidity, total suspended solids, oils and grease).
- Contaminants of potential concern or acid sulfate soils indictors. Potential or identified contamination along the transmission cable route is noted in Table 5-1 of the CLMP and Table 3-2 of the ASSMP.

Management Options for Dewatered Groundwater

Dewatered groundwater will be re-used, discharged or disposed of in accordance with the *POEO Act 1997* and relevant NSW waste regulations. The decision to either re-use, discharge or dispose of groundwater will be made in accordance with the decision process outlined in **Figure A** below. Discharge of dewatered groundwater is not permitted until the environment manager or nominated representative has signed a discharge form.

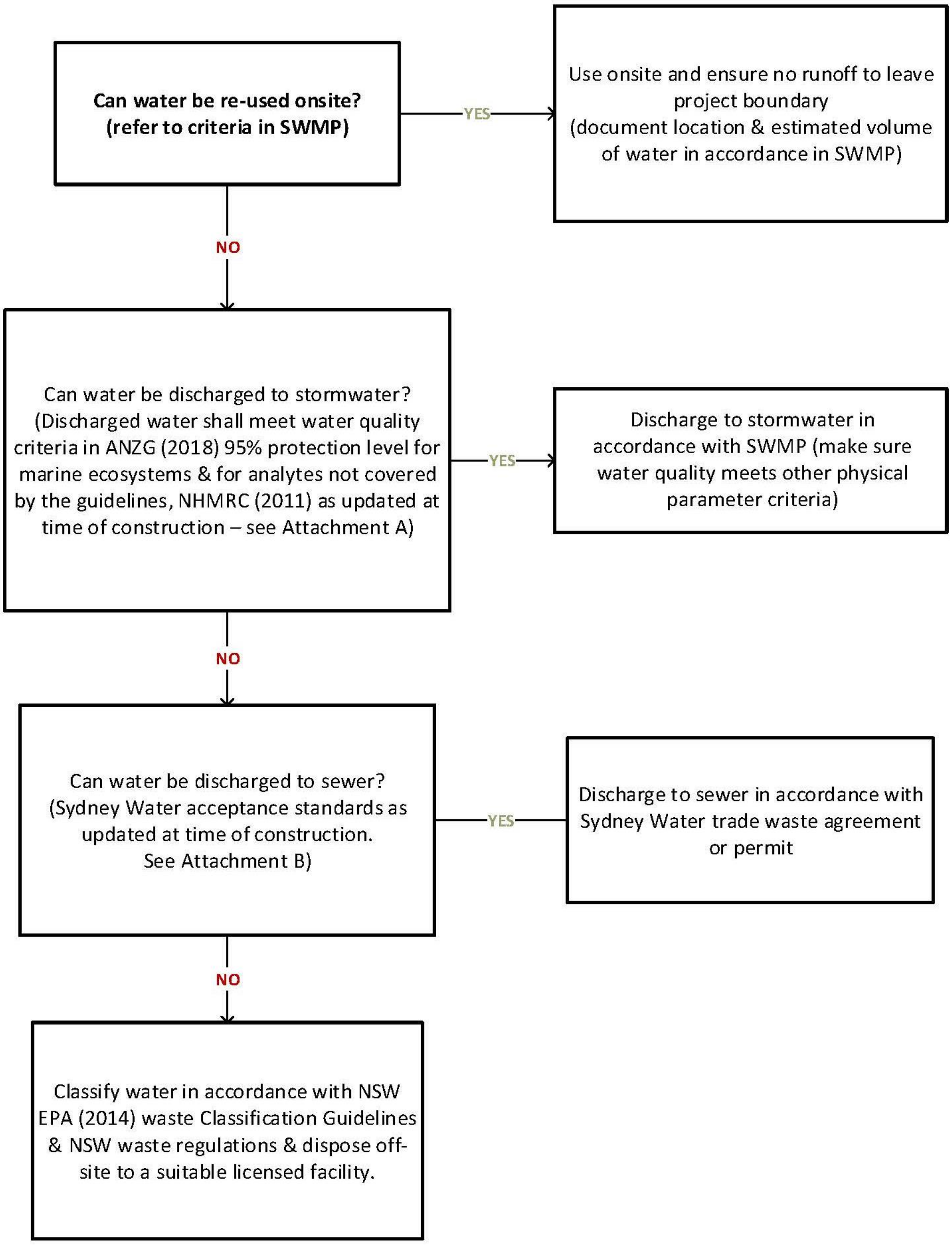

Figure A: Decision Tree for Re-use, discharge or disposal of dewatered groundwater

Groundwater which complies with the project's water quality criteria, and which will not pollute the receiving environment, may be re-used or discharged to stormwater / sewer only once a Dewatering and Discharge Permit has been issued by a person recognised by the Environment and Sustainability Manager. The Dewatering and Discharge Permit is presented in the SWMP.

Reuse on site

On-site re-use of groundwater ingress into excavations should be considered as a priority for all dewatering activities. Dewatered groundwater from areas with low potential for contamination (based on Table 16-7 in the EIS) may be re-used on site. Example re-use options include use for dust suppression, to assist with compaction, re-injection or for watering landscape areas. A visual inspection for oil or grease and pH testing must be undertaken as a minimum (refer to SWMP for criteria and testing methods).

Re-used water must never be discharged in a manner that exceeds the capacity of sediment controls and/or generates runoff with the potential to discharge from construction site, which will be considered an unauthorised discharge from site.

Groundwater from these areas which does not meet the project's re-use water quality criteria may be treated prior to assessment of discharge / disposal options in accordance with the SWMP.

Discharging water to stormwater or sewer

Discharge to stormwater or sewer must be in accordance with the SWMP and any applicable discharge permits, licences or trade waste agreements.

Discharged groundwater to stormwater shall meet water quality criteria in ANZG (2018) for 95% protection level for marine ecosystems and, for analytes not covered by the guidelines, NHMRC (2011) as updated at the time of construction (refer to **Attachment A** for current criteria for some possible contaminants of potential concern at the time of writing).

Discharged groundwater to sewer shall meet Sydney Water trade waste acceptance standards, updated at the time of construction (refer to **Attachment B** for current standards at the time of writing).

If the discharge criteria in discharge permits, licences or trade waste agreements are different to the above, then the criteria in the permits, licences or agreements take precedence.

The discharge must be monitored throughout to ensure that the water being syphoned or pumped:

- complies with the discharge criteria;
- does not come into contact with any soil or exposed surfaces before discharging; and
- does not mix with any sediment laden/untested water at either the inlet or outlet.

Disposal off-site

Water disposed off-site will be classified in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014) and NSW waste regulations. A licensed transporter will be used to transport material to an appropriately licensed NSW EPA waste facility and disposed water will be tracked using the project's waste tracking system.

Attachment A – Disposal Criteria to Stormwater

Chemical	ANZG (2018) 95% species protection (marine water) for toxicants – µg/L	NHMRC (2011) Australian Drinking Water Guidelines – µg/L
Metals		
Arsenic	2.3	-
Cadmium	5.5	-
Chromium (VI)	4.4	-
Copper	1.3	-
Lead	4.4	-
Mercury	0.4	-
Nickel	70	-
Zinc	15	-
Inorganics		
Ammonia	910	-
Nitrate	2400	-
Petroleum Hydrocarbons		
Benzene	700	-
Ethylbenzene	-	300
Toluene	-	800
Xylene	-	600
Total petroleum hydrocarbons	-	-
Oils and grease as per SWMP	-	-
Physicochemical Parameters		
pH	6.5 - 8.5	-
Total Suspended Solids as per SWMP	-	-
Others as per SWMP	-	-

Note: The analytes presented above are some possible common constituents of potential concern – the analytes and associated criteria should be reviewed and revised based on possible contamination issues identified as part of pre-construction baseline groundwater monitoring or ASS investigations defined in the GMS.

Attachment B – Disposal Criteria to Sewer

Industrial customers

Acceptance standards and charging rates for 2019-20

Sydney Water accepts trade wastewater to the wastewater system, if it meets certain acceptance standards.

What are acceptance standards?

Acceptance standards are generally limits to the concentration of substances in composite samples of trade wastewater discharge. For substances that pose a particular health and safety risk, acceptance standards also apply to the concentration of substances in a discrete sample of trade wastewater discharge.

Table 1 lists the acceptance standards for domestic substances, and Table 2 lists those for non-domestic substances. Table 1 also shows the value of the domestic equivalent concentrations in industrial discharges, which we deduct when calculating charges.

IPART has determined that Sydney Water will adjust all trade waste fees and charges from 1 July every year (IPART Determination No 5, 2016). These tables show the prices from 1 July 2019.

Who should do the testing?

Customers must ensure laboratories, registered by the National Association of Testing Authorities (NATA), test the substances specified in their trade waste agreements or permits, for the class of test(s) or specific test(s). You can download the approved analytical methods at sydneywater.com.au.

What are they based on?

Acceptance standards are based on:

- safe levels of substances that may otherwise be a health risk to workers in and around the wastewater system
- safe levels of substances to protect public health
- pollution reduction targets and discharge licence conditions set by the Environmental Protection Authority NSW (EPA NSW)
- the need to protect our assets and treatment processes
- the capability of the wastewater system to transport ‘domestic substances’, that is, suspended solids, grease and BOD
- concentrations obtainable by using proven pre-treatment technology (the standards do allow for you to trial new technology)
- quality specifications for biosolids and re-use water
- re-use considerations, including the need to provide wastewater that doesn’t interfere with re-use treatment processes, or limit re-use opportunities
- national acceptance criteria published as *National wastewater source management guidelines,* July 2008, WSAA.

Table 1: Acceptance standards, domestic equivalents and charging rates for domestic substances

Substance	Acceptance standard (mg/L)	Domestic equivalent (mg/L)	Note	Charging rate ($/kg)
BOD5 – primary treatment		230	1	0.318 + (0.137 x [BOD mg/L]/600)
BOD5 – secondary/tertiary treatment		230	1	2.066 + (0.137 x [BOD mg/L]/600)
Soluble BOD	100	Not applicable	14	0.318 + (0.137 x [BOD mg/L]/600)
Suspended solids – primary treatment	600	200		0.577
Suspended solids – secondary/tertiary treatment	600	200		1.672
Grease – primary treatment	110	50	2	0.521
Grease – secondary/tertiary treatment	200	50	2	1.597
Nitrogen as TKN – secondary/ tertiary treatment	250	50		1.894
Phosphorus – secondary/ tertiary treatment	50	10		6.792
Ammonia*	**100**	**35**	**4**	**-**
Sulphate	2,000	50		-
Total dissolved solids (ocean systems, no discharge limitation)	10,000	450	11	-
Total dissolved solids (inland and ocean systems with limitation)	500	450	11	-
Total dissolved solids (inland and ocean systems with advanced treatment to remove TDS)	10,000	450	11	-

* For substances that pose a particular health and safety risk, apply acceptance standards to the concentration of substances in a discrete sample of trade wastewater discharge as well as in composite samples.

Trade waste requirements

- Sydney Water will determine standards for colour and interference with ultra violet disinfection on a system-specific basis.
- There must be no fibrous material in the trade wastewater that we believe could obstruct or block the wastewater system.
- Sydney Water will not accept any wastewater that potentially contains asbestos.
- Non-faecal gross solids must have:
  - a maximum linear dimension of under 20 mm
  - a maximum cross section of 6 mm
  - a quiescent settling velocity of under 3 m/hr.
- Sydney Water will negotiate radioactive material activity rates for wastewater discharge on a site-specific basis.
- The Head of Service Planning and Asset Strategy will determine the acceptance standards for substances other than those listed in this fact sheet.
- Sydney Water does not accept substances (or mixtures of substances) that cannot mix with water.
- Exceeding acceptance standards can adversely impact the beneficial re-use of biosolids and recycled water quality.
- Exceeding acceptance standards can also represent a significant risk to staff safety and the environment.

Table 2 Acceptance standards for non-domestic substances

Substance	Acceptance standard (mg/L)	Note
Acetaldehyde*	**5**	**4**
Acetone*	**400**	**4**
Aluminium	100	
Arsenic	1	
Barium	5	
Boron	100	
Bromine*	**5**	**4**
Cadmium	1	
Chlorinated phenolics	0.05	5

Substance	Acceptance standard (mg/L)	Note
Chlorine*	**10**	**4**
Chromium	3	6
Cobalt	5	
Copper	5	
Cyanide*	**1**	**4, 7**
Fluoride	20	3
Formaldehyde*	**30**	**4**
General pesticides (excludes OC and OP)	0.1	8
Herbicides and defoliants	0.1	
Iron	50	
Lead	2	
Lithium (specified systems only)	10	9
Manganese	10	
Mercaptans	1	
Mercury	0.03	
Methyl Ethyl Ketone*	**100**	**4**
Molybdenum	100	
Nickel	3	
Organoarsenic compounds	0.1	
pH*	**7-10 units**	**1**
Petroleum hydrocarbons (flammable)*	**10**	**4, 10, 13**
• Benzene*	**0.1**	**4**
• Toluene*	**0.5**	**4**
• Ethylbenzene*	**1**	**4**

Substance	Acceptance standard (mg/L)	Note
• Xylene*	**1**	**4**
Phenolic compounds (non-chlorinated)	1	
Polynuclear aromatic hydrocarbons	5	
Propionaldehyde*	**5**	**4**
Selenium	5	
Silver	5	
Sulphide*	**5**	**4**
Sulphite	50	
Temperature*	**38° C**	**1**
Thiosulphate	300	
Tin	10	
Uranium	10	
Volatile halocarbons*	**1**	**4, 12**
• Chloroform*	**0.1**	**4**
• Perchloroethylene*	**0.3**	**4**
• Trichloroethylene*	**0.1**	**4**
Zinc	5	

* For substances that pose a particular health and safety risk, apply acceptance standards to the concentration of substances in a discrete sample of trade wastewater discharge as well as in composite samples

See notes on the next page.

Want to know more?

- Visit sydneywater.com.au.
- Email businesscustomers@sydneywater.com.au.
- Call 13 20 92 to speak to a business customer representative.

Notes to acceptance standards

1. Sydney Water will introduce acceptance standards for a substance on a sub-system specific basis as determined by:
   - how much the receiving system can transport and treat
   - how corroded the sub-system is
   - how wastewater treatment products will be used.
2. You must not discharge oil, fat or grease into the wastewater system.
3. Fluoride limits don't apply where the customer's wastewater system is connected to a wastewater treatment plant (WWTP) that discharges to the ocean.
4. Acceptance standards also apply to concentrations of ammonia, benzene, bromine, chlorine, cyanide, formaldehyde, petroleum hydrocarbons, sulphide and volatile halocarbons in discrete samples.
5. We will determine acceptance standards for individual chlorinated phenolic compounds on a catchment basis, following pollution reduction targets set by the EPA NSW. The concentration limit is a guide only. We may set lower limits for individual chlorinated phenolic compounds.
6. We don't allow discharge from cooling towers and evaporative condensers using products containing hexavalent chromium (chromate) or organometallic algicides.

   We don't allow discharge of hexavalent chromium from contaminated sites.
7. Cyanide is defined as labile cyanide amenable to alkaline chlorination. This includes free cyanide and those complex cyanides that are almost entirely, or in a large degree, dissociable, and so potentially toxic in low concentrations.
8. We won't consent to any discharge of organochlorine pesticides (including chlordane, dieldrin and heptachlor), or organophosphorus pesticides (including chlorpyrifos, diazinon and malathion) into the wastewater system.
9. The limit for lithium applies only to the Rouse Hill wastewater catchment.
10. Where flammable and/or explosive substances may be present, the customer must demonstrate to us that there is no possibility of explosions or fires in the wastewater system. We will discuss limits and charges with individual customers, before negotiating a trade waste agreement. The flammability of the discharge must never exceed five per cent of the Lower Explosive Limit (LEL) of hexane at 25 °C. In some cases, we may require a customer to install an LEL meter.
11. We will determine acceptance standards for total dissolved solids on a catchment-specific basis. A limit of 500 mg/L may apply to customers discharging to an inland WWTP or to one that is part of a designated re-use system. Acceptance standards will only apply to those customers discharging over 100 kg/day of total dissolved solids (TDS) or greater than one per cent of the total catchment TDS load (whichever is lower).
12. Analysis of volatile halocarbons must, at a minimum, include methylene chloride, chloroform, trichloroethylene and perchloroethylene.
13. This substance is made up of several substances including benzene, toluene, ethylbenzene, (m+p)-xylene and o-xylene.
14. As at 1 July 2013, the limit for soluble BOD applies only to the Smithfield catchment and SPS 67 catchments, due to corrosion.

Appendix 5 – Acid Sulfate Soil Management Plan (ASSMP)

TEA-PSF-MP-004.550

TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit

ACID SULFATE SOIL MANAGEMENT PLAN
(ASSMP)

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Abbreviations and Acronyms

Abbreviation/ Acronym	Expanded term
AASS	Actual Acid Sulfate Soils
AEI	Areas of Environmental Interest
AHD	Australian Height Datum
AMP	Asbestos Management Plan
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CoA	Conditions of Approval
CNVMP	Construction Noise and Vibration Management Plan
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DPIE	Department of Planning Infrastructure and Environment
EIS	Environmental Impact Statement
EMMM	Environmental Management and Mitigation Measures
EMS	Environmental Management System
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Management Strategy
GMS	Groundwater Management Strategy
NATA	National Association of Testing Authorities
NSW	New South Wales
NSW ASS Manual	ASSMAC, 1998. *NSW Acid Sulfate Soils Manual*
OOHW Protocol	Out-of-hours work Protocol
PASS	Potential Acid Sulfate Soils
pHf	Field pH
pHfox	pH following oxidation with peroxide
PSF	Powering Sydney's Future
PSI	Preliminary Site Investigation
SPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulfur
SSLGMP	Site Specific Landfill Gas Management Plan
SWMP	Surface Water Management Plan
TCP	Traffic Controls Plans
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction and installation of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

As part of the Conditions of Approval (CoA) associated with the project from the New South Wales (NSW) Department of Planning, Infrastructure and Environment (DPIE), an Acid Sulfate Soil Management Plan (ASSMP) is required to be developed to document requirements to mitigate and manage the environmental and health risks related to the disturbance of acid sulfate soils during construction.

Acid Sulfate Soils (ASS) are naturally occurring soils and sediments containing iron sulfides. When disturbed and exposed to the air these sulfides oxidise, resulting in the production of sulfuric acid, aluminium, and other heavy metals. ASS can exist as actual ASS (AASS) and potential ASS (PASS). Actual and potential ASS are often found in the same soil profile, with actual ASS typically overlying PASS horizons. Oxidised ASS can have significant impacts on the natural environment as well as built structures and human health.

1.1 Context

This ASSMP has been prepared to document the procedures to be undertaken to manage ASS when encountered during construction works, and forms part of the Construction Soil and Water Management Plan (CSWMP), which in turn forms part of the Construction Environment Management Plan (CEMP). Implementation of the ASSMP will ensure that ASS encountered during construction of the project is managed in such a way as to avoid harm to the environment.

This ASSMP has been developed in accordance with:

- the requirements of the Minister's CoA for E20 (d), being for investigating, assessing and managing potential and actual acid sulfate soils in the project area.
- the Revised Environmental Management and Mitigation Measures (REMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) as documented in the Amendments Report.
- relevant legislation.
- NSW Environmental Protection Authority (EPA) made or approved guidelines (including the waste guidelines).
- industry codes of practice.

1.2 Objectives and Scope of the ASSMP

The ASSMP describe the procedures and protocols TransGrid will implement for investigating, assessing, and managing potential or actual ASS in the project area.

Specifically, this ASSMP describes the requirements for the effective management of ASS and provides control measures for mitigating risk to the environment.

This ASSMP applies for any work carried out by workers and/or contractors where ASS may be present within the project area. Work undertaken in the project area involving ASS shall be conducted in accordance with the relevant legislation and in conjunction with the requirements of this ASSMP. All staff and sub-contractors are required to operate fully under the requirements of this ASSMP and related environmental management plans, over the full duration of the construction program.

1.3 Project Environmental Management System Overview

The Project Environmental Management System (EMS) is described in **Figure 1-1: Project Environmental Management System**.

To achieve the intended environmental performance outcomes, TransGrid has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, including the ASSMP, procedures, protocols and tools as set out below and illustrated in **Figure 1-1: Project Environmental Management System**.

1.4 Consultation for Preparation of ASSMP

Stakeholder consultation with relevant councils has been completed as documented in the Construction Soil and Water Management Plan (CSWMP). All comments have been addressed.

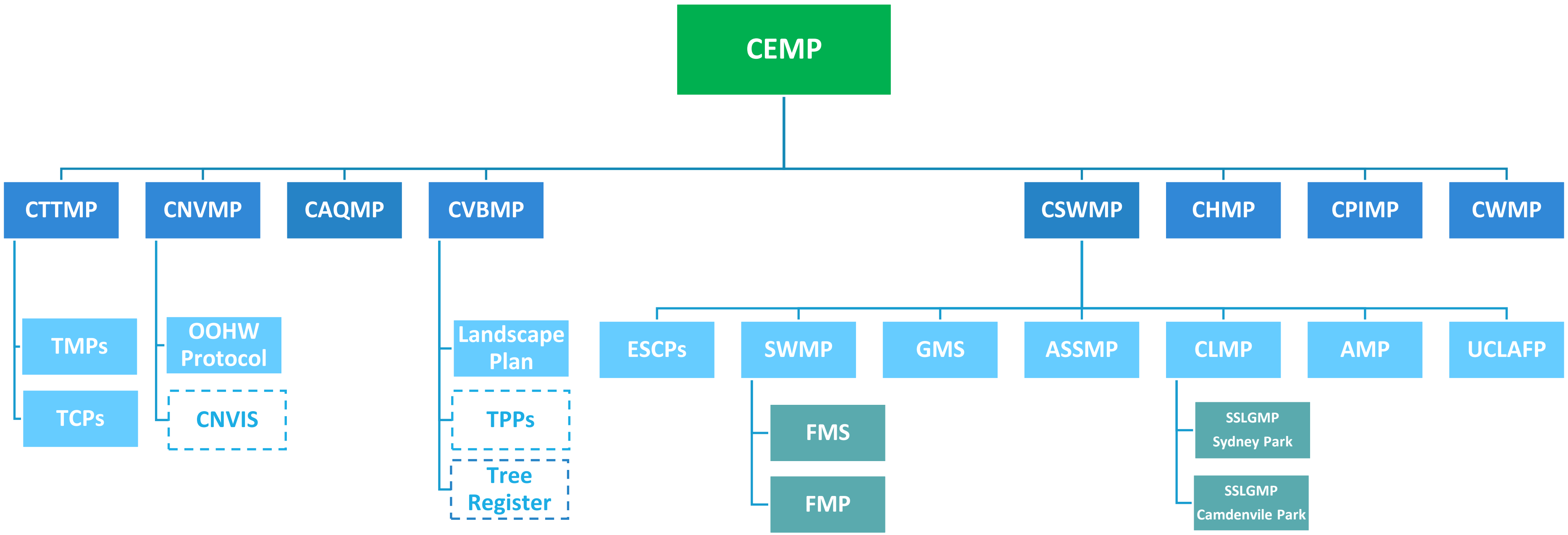


Figure 1-1: Project Environmental Management System

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the ASSMP include:

- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment* (ASC NEPM).
- ASSMAC, 1998. *NSW Acid Sulfate Soils Manual* ('NSW ASS Manual')
- NSW EPA, 2014. *NSW Waste Classification Guidelines*.
- TransGrid, 2016. *Environmental Handbook*
- TransGrid Guidelines and Procedures
    - TransGrid Procedure – Contaminated Land Management
    - TransGrid Procedure – Health and Safety Incident Management
    - TransGrid procedure – Environmental Incident Management
    - TransGrid Environmental Guidance Note – Acid Sulphate Soils

2.3 Minister's Condition of Approval

The ASSMP is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 (d) Acid Sulfate Soils Management Plan, for investigating, assessing and managing potential and actual acid sulfate soils in the project area.

2.4 Environmental Mitigation and Management Measures

The ASSMP has been developed to include the environmental mitigation and management measures detailed in the EIS Amendment Report and presented in **Table 2-1** below.

Table 2-1: Environmental Mitigation and Management Measures

Impact	ID	Measure
Acid sulfate soil management	CT7	ASSMPs will be prepared in accordance with the NSW ASS Manual guidelines based on the results of the pre-construction investigations for locations within Precinct 2, 3, 4 and 5. The ASSMPs will incorporate the following procedures: • soil will be treated with lime in accordance with the ASSMP where PASS is not able to be loaded and transported to a landfill licensed to receive untreated PASS within 24 hours of excavation or if AASS are identified and excavated; • exposure of PASS material within an excavated trench or excavation site will be minimised to reduce the potential for oxidation and acid leachate generation; • excavation will be done under dry conditions, where possible using a truck and shovel (tracked excavator) operation and the water table will be lowered within excavation areas, as part of excavation dewatering; • excavated fill will be monitored for colour and leachate quality; • no PASS material will be placed and left at the surface untreated; • soil will be placed into an appropriately bunded treatment area (pads) and treated with a neutralising agent (e.g. lime). Leachate water from the PASS material will be managed and treated to ensure no acid is released to the environment; • leachate generated during the ASS treatment operations will be captured. Any water potentially affected by leachate collecting within the excavation

Impact	ID	Measure
		will be treated with hydrated lime or equivalent prior to discharge. Water potentially affected by leachate accumulating within the work site will not be discharged until it meets acceptable water quality standards or collected and disposed at a licensed liquid waste treatment facility; and • PASS materials will be kept separate from non-PASS materials at all times to reduce the volume of material requiring treatment. Acid is transported by water; therefore, excavation works in PASS will be conducted during dry periods (where practical) to minimise the risk of overflow associated with sudden or heavy rain and to allow better control of treated waters for discharge.

3 Status of Acid Sulfate Soil

3.1 Areas of Environmental Interest (AEI)

A preliminary site investigation (PSI), which identified areas of concern from a contamination viewpoint in each precinct of the cable transmission route and at the proposed construction laydown areas, was included as Appendix K in the EIS (AECOM, 2019). Details of the areas of environmental interest (AEI) that were identified during the EIS are presented in Table 16-4 of the EIS (within the defined precincts of the transmission cable alignment and at Sydney South substation) and in Table 16-5 (for the construction laydown areas). The AEIs are described as areas that could potentially be contaminated as a result of historic and/or current activities. The locations of the AEIs are presented on Figure 16-3, Figure 16-4, Figure 16-5 and Figure 16-6 of the EIS.

Any potential or actual ASS underlying the project and ancillary facilities areas has the potential to be exposed or disturbed by construction activities. Activities with the highest level of risk include excavation, earthworks and stockpiling. The majority of the potential AEIs relating to ASS during the EIS were assessed to be located near surface water features, being Cooks River and Alexandra Canal. Other areas along the transmission cable alignment were deemed to be low risk.

The NSW ASS Manual defines five classes of ASS, which categorises the probability of ASS being present in a particular area and the type of work likely to present an environmental risk if undertaken in a particular class of land. **Table 3-1** below, a copy of Table 2.1 from NSW ASS Manual, presents the classification scheme for ASS.

Table 3-1: Classification Scheme for ASS

Class	Type of Work
1	Any works
2	Works below natural ground surface Works by which the watertable is likely to be lowered
3	Works beyond 1 metre below ground natural ground surface Works by which the watertable is likely to be lowered beyond 1 metre below natural ground surface
4	Works beyond 2 metre below ground natural ground surface Works by which the watertable is likely to be lowered beyond 2 metre below natural ground surface
5	Works within 500 metres of adjacent Class 1, 2, 3 or 4 land which are likely to lower the watertable below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land.

A review of the transmission cable alignment against the ASS classification mapping in the EIS has identified several areas with an increased risk of potential or actual ASS. Details of areas along the transmission cable alignment with an increased risk of potential or actual ASS are detailed in **Table 3-2**.

3.2 Waste Classification

Individual waste classification reports will need to be prepared for the transmission cable route. Several sections of the transmission cable route pass through areas with higher probabilities of encountering ASS.

Any other material that is encountered during construction that exhibits indications of potential or actual ASS can be further classified in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014) and disposed off-site at a suitably licensed facility.

3.3 Areas with Potential or Actual ASS

A summary of listed areas, within or near the project area, where potential or actual ASS is suspected to be encountered during construction, based on information provided in the EIS, is provided below in **Table 3-2**.

Excavation activities in these locations should be undertaken assuming that ASS will be encountered in sub-surface soils. Waste classification sampling will include analysis for ASS for areas where ASS is suspected.

Table 3-2: Summary of Potential or Actual ASS Impacted Areas

Site	Location	Type	Status	Reference
Precinct 2, 3	Along Omaha St, east of Baltimore St, Seventh Ave, Campsie to Hay St/Harmony St intersection in Canterbury (2.2 km length)	PASS	Class 4 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 3	Cooks River crossing (35 metre length)	AASS or PASS	Class 1 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 3	Centennial St, Sydenham Rd and Neville St, Marrickville (130m length)	PASS	Class 4 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 4	Transmission cable route along Edgeware Rd between Darley St, Marrickville and May St, St Peters (360m length)	PASS or AASS	Class 2 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 5	Transmission cable route between Princes Hwy to Alexandra Canal and Beaconsfield West substation (1.3km length)	PASS	Class 3 – Suspected	EIS (Table 4-2 of PSI, Appendix K)

4 Acid Sulfate Soil Control Measures

Potential or actual ASS encountered during project construction work will be identified, managed, removed and disposed off-site in accordance with the controls presented in the ASSMP and the following guidelines:

- Waste Classification Guidelines (NSW EPA, 2014)
- NSW ASS Manual
- ASC NEPM
- TransGrid, Environmental Guidance Note: Acid Sulphate Soils (**Appendix 1**)

4.1 Types and Indicators of Acid Sulfate Soil

Actual Acid Sulfate Soils – are sulfidic soils that have been disturbed and exposed to the air resulting in oxidation. The soil pH is acidic (e.g. field pH < 4). Oxidation of sulfidic soils results in the generation of sulfuric acid and potential mobilisation of entrained heavy metals in leachate. AASS must be neutralised, by pre-treatment, prior to off-site disposal.

Common indicators of actual ASS include:

- Sulfurous odours from disturbed soils
- Presence of shell in soils
- Presence of jarosite (a yellow mineral staining) or iron oxide (a rusty red staining)
- Corrosion of concrete or steel structures

Water in adjacent streams, drains or groundwater may be acidic (pH < 5.5) unusually clear or milky blue-green, and associated with iron stains.

Potential Acid Sulfate Soils – are soils that contain iron sulfides but have not been exposed to air and remain unoxidised, whilst undisturbed these soils maintain a neutral or alkaline pH. If potential ASS are disturbed, there is an increased risk of oxidation resulting in sulfuric acid generation.

Common indicators of potential ASS include:

- Sulfurous odours from disturbed soils
- Shell fragments in the soil
- Muds and sediments often blue grey or dark greenish grey in colour
- Presence of swamp vegetation
- Waterlogged land often below 5 m Australian height datum (AHD).

4.2 Acid Sulfate Soil Management

4.2.1 Prior to Construction

Prior to construction all personnel must be informed of the presence of potential or actual ASS and the additional management steps and stages required to minimise environmental and human health risks.

In areas with potential or actual ASS (refer to **Table 3-2**), the following activities should be completed prior to excavation commencing:

- Complete targeted sampling and SPOCAS[1] analysis of sample material to determine whether it is potential ASS or actual ASS (as defined by criteria in NSW ASS Manual).

[1] Suspension Peroxide Oxidation Combined Acidity and Sulfur

- Comparison of SPOCAS analytical results against action criteria in Table 4.4 of NSW ASS Manual and estimation of liming rates, if required.
- Setup of a designated stockpile and treatment area for ASS either at the excavation area or laydown yards.

Dewatering may be required to lower the water table by greater than 1 metre in areas of elevated ASS risk (e.g. for entry pits to underbores). These areas should be identified and subject to assessment as described above. Excessive drawdown of the water table exposing PASS for extended periods or extent in these areas could result in impacts to groundwater – though the EIS assessed the risk to the environment as low, the strategy to manage ASS risks associated with dewatering is described in the GMS.

4.2.2 Excavation and Segregation

Disturbance of potential or actual ASS during construction activities should be managed to minimise the sulfide oxidation and acid generation and potential for subsequent leaching. Mitigation strategies to be utilised include:

- Stage works to reduce the time when potential or actual ASS is exposed to air.
- Maintain to the extent practicable any disturbed potential or actual ASS in anaerobic conditions before treatment or off-site disposal.
- Excavation will be conducted under dry conditions where possible, with soil erosion and stormwater runoff controls documented in the ESCP and SWMP implemented.
- Segregation by stockpiling of suspected ASS material separately from non-ASS material and away from drainage lines,
- Placement of excavated ASS materials in sealed bins or bunded areas to enable capture of any generated leachate.
- Covering of stockpiles to avoid rainfall infiltration.
- Immediate neutralising treatment or off-site disposal.

For material to be disposed off-site, actual ASS should be treated on-site prior to disposal with potential PASS placed directly into a plastic-lined and covered haulage truck for transport directly to the licensed disposal facility.

TransGrid will maintain records of all potential or actual ASS material disposed off-site, the location of the facility at which it was disposed, and any receipt/certificate issued by the disposal facility. Records should be kept detailing the location, details of treatment and photographs should be taken of the material and kept on record for validation purposes.

4.2.3 Soil and Leachate Treatment

Where ASS, or potential ASS that cannot be immediately disposed off-site to a licensed disposal facility, is encountered, neutralising treatment must be completed in accordance with the guidance in NSW ASS Manual.

All treatment must occur within a bunded ASS treatment area, in which each load of material must be treated then removed to avoid mixing of treated and untreated material.

Agricultural lime with a pH of approximately 8.2 is the most common and safest neutralising agent. The treatment of potential or actual ASS should be completed in accordance with the guidance included in NSW ASS Manual and summarised below.

Immediate Reuse

Reusing excavated potential ASS material as backfill is an alternative disposal option depending on the characteristics of the material. This can be assessed by a suitably qualified and experienced person conducting a field pH (pHf) test of the excavated material.

The potential ASS must be low strength (pHf>5), lime should be applied prior to backfilling as a precautionary measure, and the material should be placed back into the trench at the same depth it was removed. The potential ASS should be backfilled within 1 day to minimise the potential for oxidation and acid generation.

Treatment Area

A designated ASS treatment area needs to be set up, either at the excavation area or elsewhere within the project area (e.g. laydown yard) prior to commencing excavation activities. The treatment area needs to contain the following features and controls:

- Bunded to prevent runoff of leachate.
- Positioned away from drainage lines.
- Signposted clearly to only allow potential or actual ASS.

The ESCP contains more detail on general soil erosion and sediment controls.

Treatment of ASS with Lime

The lime should be mixed with the potential or actual ASS at the ratio defined by the results of SPOCAS analysis and with reference to Table 4.5 of the NSW ASS Manual (**Appendix 2**).

The lime should be mixed (manually or mechanically) into the potential or actual ASS in 300 mm layers. Any generated leachate must be collected for subsequent treatment and/or off-site disposal.

Treatment of Acid Leachate

The treatment of acid leachate from excavated potential or actual ASS, or leachate from dewatering activities (refer to GWS), must be appropriately treated prior to off-site disposal or discharge. Where discharge to a watercourse is proposed, the quality of treated leachate must meet the appropriate criteria of the receiving water body.

Treatment may include use of a neutralising agent (e.g. lime). Calculation of the quantity of lime should be completed with reference to Section 7.1 of the NSW ASS Manual.

The effectiveness of using lime to treat acid leachate is driven by the limited solubility of the lime in water. It is preferable that microfine lime is utilised, added as a slurry and the acid leachate water is agitated.

Alternatively leachate may be disposed to a facility lawfully able to receive the waste.

4.2.4 Removal and Disposal

In accordance with the *Waste Classification Guidelines* (NSW EPA, 2014), waste actual ASS must be treated in accordance with the NSW ASS Manual prior to disposal an appropriate waste disposal facility.

Waste treated actual ASS and PASS must be chemically assessed and classified by Contaminated Land Professional in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014) prior to off-site disposal.

For potential ASS excavated and loaded for immediate off-site disposal (for receipt at landfill within 16 hours of being excavated), the following management measures must be implemented:

- Potential ASS to be kept wet at all times.
- Transport vehicle must have a plastic lined sealed tray and cover
- Transport must proceed directly from the project area to the designated disposal facility.

The receiving disposal facility must be lawfully able to receive the waste ASS material.

4.2.5 Monitoring

Following the completion of works and the reinstatement of the ground surface, the site should be visually monitored to verify that the ASS has not oxidised and impacted the local environment. Key indicators of environmental impacts might include vegetative stress, staining of surface soils (yellow or rusty red) in unsealed areas, sulfurous odours or changes to colour of local waterways or drainage channels.

4.3 Unexpected Finds

In project areas not identified to contain potential or actual ASS (i.e. excluding those areas in **Table 3-2**), an unexpected finds protocol will be implemented that includes indicators of ASS. This is documented in the UCLAFP.

4.4 Assessment Criteria and Waste Classification

The assessment of whether soil is potential or actual ASS can be completed by comparing pHf (field pH) and pHfox (pH following oxidation with peroxide) readings to the criteria presented below:

- Actual ASS
  - pHf ≤ 4 = actual ASS
  - pHf > 4 and ≤ 5 = limited oxidation, but not confirmation of actual ASS
  - pHf > 5 ≠ actual ASS
- Potential ASS
  - pHfox < 3 = potential ASS.
  - pHfox ≥ 3 and ≤ 4 ~ minor potential ASS.
  - pHfox > 4 and ≤ 5 ~ neither presence / absence of potential ASS.
  - pHfox >5 and (pHf – pHfox) <1 ≠ potential ASS.
  - pHfox >5 and (pHf – pHfox) >1 ~ possible potential ASS.

Further assessment of soil to determine degree of oxidation and treatment options should be undertaken by SPOCAS analysis of soil samples following laboratory method guidance in NSW ASS Manual, with results compared to criteria in Table 4.4 of NSW ASS Manual and presented in **Figure 4-1** below. The analytical laboratory shall be National Association of Testing Authorities (NATA) accredited for the analyses.

Figure 4-1: Action Criteria for ASS from Table 4.4 in NSW ASS Manual

Table 4.4. Action criteria based on ASS soil analysis for three broad texture categories

Type of Material		*Action Criteria 1-1000 tonnes disturbed*		*Action Criteria if more than 1000 tonnes disturbed*	
Texture range. McDonald et al. (1990)	*Approx. clay content (% < 0.002 mm)*	*Sulfur trail % S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}*	*Acid trail mol H^+/tonne (oven-dry basis) eg, TPA or TSA*	*Sulfur trail % S oxidisable (oven-dry basis) eg S_{TOS} or S_{POS}*	*Acid trail mol H^+/tonne (oven-dry basis) eg, TPA or TSA*
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5 - 40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≥40	0.1	62	0.03	18

5 Compliance Management

5.1 Roles and Responsibilities

In addition to those detailed in the CSWMP and CLMP, the roles and responsibilities presented in **Table 5-1** are relevant to the ASSMP.

Table 5-1: ASSMP Roles and Responsibilities

Role	Authority and Responsibility
Contaminated Land Professional	Field pH testing of potential ASS for re-use at request of contractor.

5.2 Training & Induction

Refer to training and inductions requirements details in CLMP.

5.3 Complaints Management

Refer to training and inductions requirements details in CLMP.

5.4 Incident Response

Refer to training and inductions requirements details in CLMP.

5.5 Audits

Refer to training and inductions requirements details in CLMP.

5.6 Non-Conformances

Refer to training and inductions requirements details in CLMP.

5.7 Licenses, Permits and Qualifications

Refer to training and inductions requirements details in CLMP. No specific licenses or qualifications are required to manage ASS.

5.8 Review and Improvement

This plan may be updated or revised if required. The procedure for review and approval of any updates or revisions will be in accordance with the procedure described in the CSWMP.

6 References

AECOM Australia Pty Ltd, 2019. *Powering Sydney's Future Potts Hill to Alexandria transmission cable project*. Environmental Impact Statement, October 2019.

AECOM Australia Pty Ltd, 2019. *Powering Sydney's Future Potts Hill to Alexandria transmission cable project*. Amendment Report, February 2020.

ASSMAC, 1998, *NSW Acid Sulfate Soils Manual*.

National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure,* as amended 15 May 2013.

NSW EPA, 2014. *Waste Classification Guidelines – Part 1: Classifying Waste.*

Soil Conservation Service of New South Wales, *Botany Bay Acid Sulphate Soil Risk Map* (1:25,000 scale)

TransGrid, 2016. *Environmental Handbook*.

TransGrid Guidelines and Procedures:

- TransGrid Procedure – Contaminated Land Management
- TransGrid Procedure – Health and Safety Incident Management
- TransGrid procedure – Environmental Incident Management
- TransGrid Environmental Guidance Note – Acid Sulphate Soils

Appendix 1 – TransGrid: Environmental Guidance Note – Acid Sulphate Soil

Environmental Guidance Note
Acid Sulphate Soils

TransGrid

Authorised by:	Krista Fogarty	Issue date:	22/03/19	HP TRIM No.	D2019/01107

Acid Sulphate Soil is the common name given to a range of soil types containing iron sulphides &/or their oxidation products. Chemical reactions associated with changing sea levels in the geological past produced iron sulphides in waterlogged sediments. When exposed to air, these sulphides & oxides to produce sulphuric acid, hence the name acid sulphate soils.

Acid sulphate soils are generally found in:

> Coastal lowlands, embayments & estuarine floodplains;

> Areas where the level of land is below 5m Australian Height Datum (AHD);

The sulphuric acid produced by oxidation of iron sulphides affects soil & water & can severely damage the environment. As sulphuric acid moves through the soil, it mobilises iron, aluminium, manganese & other heavy metals from mineral sources. Acidic & metal-rich waters can be highly detrimental to flora & fauna.

INDICATORS OF ACID SULPHATE SOIL PRESCENCE / RISK

- PASS/ ASS shown on mapping,
- Mangroves or swamp vegetation or marine/estuarine sediments,
- Rotten egg smell after rain (following a dry spell) or when soils are disturbed,
- Soft blue/grey or dark greenish grey soils (can be sands & gravels),
- Milky blue/green water,
- Shell fragments in the soil,
- Waterlogged, scalded or back-swamp areas,
- Land below 10m Australian height datum (AHD) elevation,
- Any jarosite (a pale yellow mineral deposit) or iron oxide (rusty) mottling of the soil,
- Extensive iron stains on surfaces or iron stained water & ochre deposits,
- Corrosion of concrete &/or steel structures, &
- Surface or ground water with either a pH below 5.5 or that is *unusually* clear.

IF ASS ARE SUSPECTED OR SHOWN ON MAPPING FOLLOW THE CONTROLS BELOW

Assess the soil & water risks present or potential risks on the work site (refer to TSS Mapping & Local government mapping)

Minimise the areas disturbed & keep excavation as shallow as possible

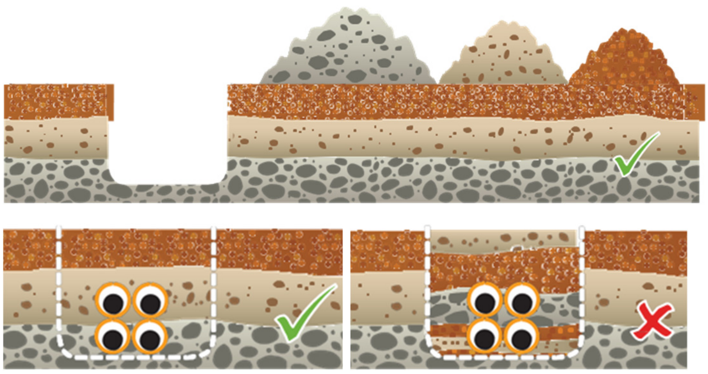
Keep spoil layers segregated & backfill in the same order

Re-bury soil at the same depth from which it was excavated

Separate ASS from other spoil

Minimise time that soils are exposed to air by staging works & storing soils in a lined & covered skip bin or wrapped in plastic.

If excavation/disturbance is >1 tonne of soil OR excavation connected directly with a creek, drain wetland or waterbody a site specific ASS Management Plan may be required. Contact TransGrid HSE for advice.



When excavating in areas known to contain ASS, replace soils at the same depth from which they were excavated. Avoid mixing soils from different depths.

Appendix 2 – NSW ASS Manual Liming Rates Matrix

TABLE 4.5 Treatment categories and lime required to treat a weight of disturbed acid sulfate soils – based on soil analysis

The tonnes (t) of pure fine lime required to fully treat the total weight/volume of ASS can be read from the table at the intersection of the weight of disturbed soil (row) with the soil sulfur analysis (column). Where the exact weight or soil analysis figure does not appear in the heading of the row or column, use the next highest value (or calculate values exactly using factors from Table 4.6).

Disturbed soil (tonnes)	**Soil Analysis - Oxidisable Sulfur (S %)** or equivalent TPA/TAA													
	0.03	***0.06***	***0.1***	***0.2***	***0.4***	***0.6***	***0.8***	***1***	***1.5***	***2***	***2.5***	***3***	***4***	***5***
1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.1	0.1	0.1	0.2	0.2
5	0.05	0.05	0.05	0.05	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9	1.2
10	0.05	0.05	0.05	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.9	2.3
15	0.05	0.05	0.1	0.1	0.3	0.4	0.6	0.7	1.1	1.4	1.8	2.1	2.8	3.5
20	0.05	0.1	0.1	0.2	0.4	0.6	0.7	0.9	1.4	1.9	2.3	2.8	3.7	4.7
25	0.05	0.1	0.1	0.2	0.5	0.7	0.9	1.2	1.8	2.3	2.9	3.5	4.7	5.9
35	0.05	0.1	0.2	0.3	0.7	1.0	1.3	1.6	2.5	3.3	4.1	4.9	6.6	8.2
50	0.1	0.1	0.2	0.5	0.9	1.4	1.9	2.3	3.5	4.7	5.9	7.0	9.4	11.7
75	0.1	0.2	0.4	0.7	1.4	2.1	2.8	3.5	5.3	7.0	8.8	10.5	14.0	17.6
100	0.1	0.3	0.5	0.9	1.9	2.8	3.7	4.7	7.0	9.4	11.7	14.0	18.7	23.4
200	0.3	0.6	0.9	1.9	3.7	5.6	7.5	9.4	14.0	18.7	23.4	28.1	37.5	46.8
500	0.7	1.4	2.3	4.7	9.4	14.0	18.7	23.4	35.1	46.8	58.5	70.2	93.6	117.1
750	1.1	2.1	3.5	7.0	14.0	21.1	28.1	35.1	52.7	70.2	87.8	105.3	140.5	175.6
1,000	1.4	2.8	4.7	9.4	18.7	28.1	37.5	46.8	70.2	93.6	117.1	140.5	187.3	234.1
2,000	2.8	5.6	9.4	18.7	37.5	56.2	74.9	93.6	140.5	187.3	234.1	280.9	374.6	468.2
5,000	7.0	14.0	23.4	46.8	93.6	140.5	187.3	234.1	351.2	468.2	585.3	702.3	936.4	1170.5
10,000	14.0	28.1	46.8	93.6	187.3	280.9	374.6	468.2	702.3	936.4	1170.5	1404.6	1872.8	2341.0

L	**Low treatment**: (<0.1 t lime). Apply 0.05 t (1 bag) or 0.1 t (2 bags) of lime to prevent some soil acidity from the ASS disturbance.
M	**Medium treatment:** (>0.1 to 1 t lime).
H	**High treatment**:(>1 to 5 t lime).
VH	**Very High treatment:** (>5 tonne lime).

A detailed management plan is required if disturbing > 1,000 tonnes of ASS (oxidisable S $\geq$ 0.03 %S or equivalent TPA or TAA.)

Lime rates are for pure fine $CaCO_3$ using a safety factor of 1.5. A factor that accounts for Effective Neutralising Value is needed for commercial grade lime (see Management Guidelines).

An approximate volume (cubic m) can be obtained by dividing weight (tonne) by bulk density (t/m^3).

Appendix 6 – Contaminated Land Management Plan (CLMP)

taihan

TEA-PSF-MP-004.560

TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit

CONTAMINATION LAND MANAGEMENT PLAN
(CLMP)

taihan

Document Control

Document Details:

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7	03/08/20	For Submission to DPIE	Taihan

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Abbreviations and acronyms

Abbreviation/ Acronym	Expanded term
AASS	Actual Acid Sulfate Soil
ACM	Asbestos Containing Material
AEI	Area of Environmental Interest
ANZECC	Australian and New Zealand Environmental and Conservation Council
ANZG	Australian and New Zealand Governments
AMP	Asbestos Management Plan
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASS	Acid Sulfate Soil
ASSMAC	Acid Sulfate Soil Management Advisory Committee
ASSMP	Acid Sulfate Soils Management Plan
BTEX	Benzene, Toluene, Ethylbenzene, total Xylene
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CMS	Complaints Management System
CNVMP	Construction Noise and Vibration Management Plan
COPC	Contaminants of Potential Concern
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DBYD	Dial Before You Dig
DMP	Dewatering Management Plan
DPIE	Department of Planning Infrastructure and Environment
DQI	Data Quality Indicator
DQO	Data Quality Objective
EC	Electric Conductivity
ECM	Environmental Control Measure
EIL	Ecological Investigation Levels
EIS	Environmental Impact Statement
EMMM	Environmental Management and Mitigation Measures
EMS	Environmental Management System
ENM	Excavated Natural Material
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
ESL	Ecological Screening Levels
FMP	Flood Management Plan
FMS	Flood Management Strategy
GMS	Groundwater Management Strategy
GSW	General Solid Waste
GWS	Groundwater Sampling
HASP	Health and Safety Plan
HEPA	Heads of EPAs Australia and New Zealand
HIL	Health Investigation Levels
HSL	Health Screening Levels
JSA	Job Safety Analyses
LEL	Lower Explosive Limit
LFG	Landfill Gas
MAH	Monocyclic Aromatic Hydrocarbons
MAH	Monocyclic Aromatic Hydrocarbons

Abbreviation/ Acronym	Expanded term
mbgl	metres below ground level
NEMP	National Environmental Management Plan
NEPC	National Environmental Protection Council
NOHSC	National Occupational Health and Safety Commission
OCP	Organochloride Pesticide
OOHW Protocol	Out-of-hours work Protocol
OPP	Organophosphate Pesticide
PASS	Potential Acid Sulfate Soil
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated biphenyl
PFAS	Per- and polyfluoroalkyl substances
POEO Act	Protection of the Environmental Operations Act 1997
PPE	Personal Protective Equipment
PSF	Powering Sydney's Future
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
RMS	Roads and Maritime Service
SAQP	Sampling and Analysis Quality Plan
SSLGMP	Site Specific Landfill Gas Management Plan
SVOC	Semi-Volatile Organic Compound
SWMP	Surface Water Management Plan
SWMS	Safe Work Method Statement
TBC	To Be Confirmed
TransGrid	Proponent
TCP	Traffic Controls Plans
TRHs	Total Recoverable Hydrocarbons
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure
UST	Underground Storage Tank
VENM	Virgin Excavation Natural Material
VOC	Volatile Organic Compound

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction and installation of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

As part of the Conditions of Approval (CoA) associated with the project from the New South Wales (NSW) Department of Planning, Infrastructure and Environment (DPIE), a Contaminated Land Management Plan (CLMP) is required to be developed to document the requirements to mitigate exposure to contamination and the potential health related risks to personnel working on or visiting the project area and surrounding environment during construction.

1.1 Context

This CLMP has been prepared to document the procedures to be undertaken to manage the potential risk from known, suspected or unexpected occurrences of contamination in the project area. The CLMP forms part of the Construction Soils and Water Management Plan (CSWMP), which in turn forms part of the Construction Environmental Management Plan (CEMP).

The CLMP has been developed in accordance with:

- the requirements of the Minister's CoA for:
    - E20 (e), being for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area;
    - E18, being appropriate to manage contaminated soils, groundwater and/or landfill gas in (a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters and (b) any additional or unexpected areas of contamination identified during the development.
- the Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) (AECOM, 2019) as documented in the Amendments Report (AECOM, 2020);
- relevant legislation;
- NSW Environmental Protection Authority (EPA) made or approved guidelines (including the waste guidelines); and
- industry codes of practice.

1.2 Objectives and Scope of the CLMP

The CLMP describes the procedures and protocols TransGrid will implement for investigating, assessing, and managing contaminated soil, groundwater and/or landfill gas in the project area.

Specifically, this CLMP describes the requirements for the management of contamination and provides control measures for mitigating the exposure to contamination and the potential risks to personnel working on or visiting the project area and the surrounding environment.

This CLMP applies for any work carried out by workers and/or contractors where contamination is or may be present within the project area. Work undertaken in the project area involving contaminated soil, groundwater and/or landfill gas shall be conducted in accordance with the relevant legislation and in conjunction with the requirements of this CLMP and other related environmental management plans – these include:

- Asbestos Management Plan (AMP);
- Acid Sulfate Soil Management Plan (ASSMP);
- Site-Specific Landfill Gas Management Plans (SSLGMP); and
- Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP).

All staff and sub-contractors are required to operate under the requirements of this CLMP and other related environmental management plans, over the duration of the construction program.

1.3 Project Environmental Management System Overview

The project Environmental Management System (EMS) is described in **Figure 1-1**.

To achieve the intended environmental performance outcomes, TransGrid has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, procedures, protocols and tools as set out below and illustrated in **Figure 1-1**.

1.4 Consultation for preparation of the CLMP

Stakeholder consultation with relevant councils has been completed as documented in the Construction Soil and Water Management Plan (CSWMP). All comments have been addressed.

1.5 Site Audit Statement

Conditions of Approval E18 requires a Site Audit Statement to be prepared by an EPA accredited Site Auditor to:

> *"…prepare a Site Audit Statement(s) in accordance with the Contaminated Land Management Act 1997, confirming that the proposed measures in the Contaminated Land Management Plan required under Condition E20 are appropriate to manage contaminated soils, groundwater and/or landfill gas in:*
>
> *(a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters; and*
>
> *(b) any additional or unexpected areas of contamination identified during the development..."*

A copy of the Site Audit Statement has been submitted to the Planning Secretary and the relevant council(s) for information and this has occurred prior to the commencement of construction in the area to which the Statement applies (refer CoA E18 and E19).

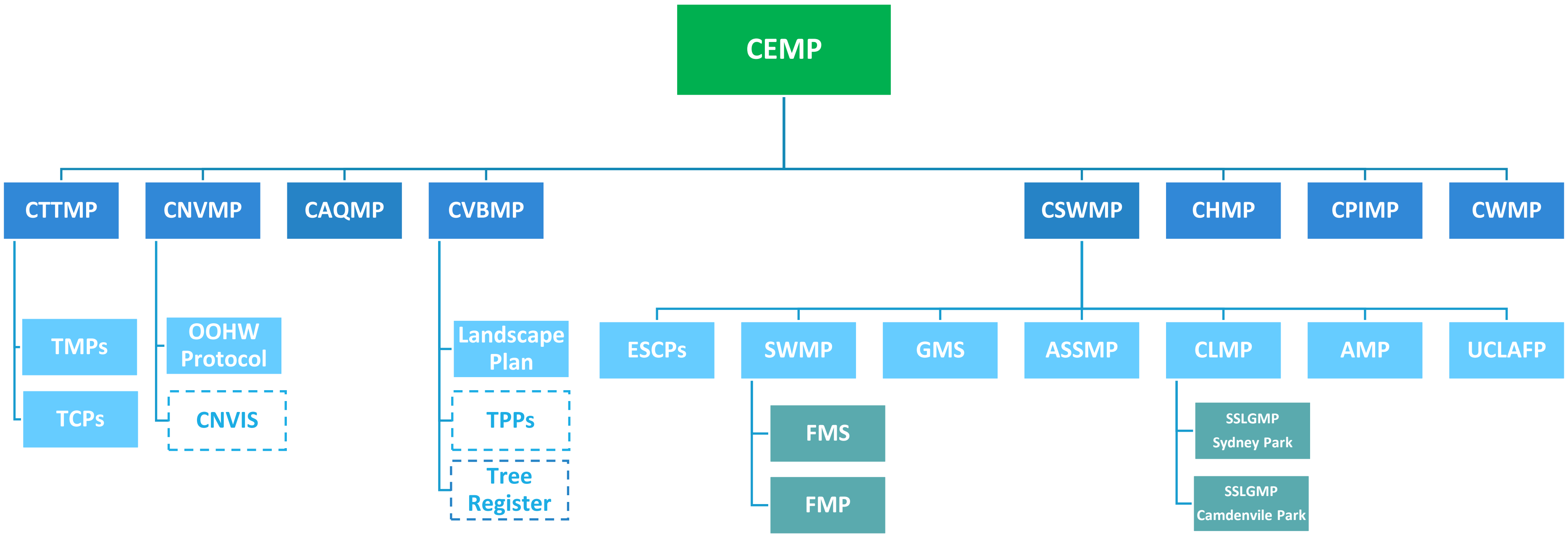

Figure 1-1: Project Environmental Management System

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the CLMP include:

- Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998. *NSW Acid Sulfate Soils Manual* (NSW ASS Manual).
- Australian and New Zealand Governments (ANZG), 2018. *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.
- Heads of EPAs Australia and New Zealand (HEPA), 2020. *PFAS National Environmental Management Plan* 2.0 (PFAS NEMP).
- National Environment Protection Council (NEPC), 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment* (ASC NEPM).
- New South Wales Environment Protection Authority (NSW EPA), 2014. *Waste Classification Guidelines.*
- NSW EPA, 2015. *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.*
- NSW EPA, 2017. *Guidelines for the NSW Site Auditor Scheme*. 3rd edition.
- NSW EPA, 2019. *Assessment and management of hazardous ground gases: Contaminated Land Guidelines*.
- NSW EPA, 2020. *Guidelines for Consultants Reporting on Contaminated Sites*.
- TransGrid, 2016. *Environmental Handbook.*
- TransGrid Guidelines and Procedures.

2.3 Conditions of Approval

The CLMP has been developed in accordance with the conditions in Infrastructure Approval SSI 8583 DPIE (2020) as described below.

E20 (e) Contaminated Land Management Plan, for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area.

In addition, TransGrid have engaged an EPA accredited site auditor to review the CLMP and prepare a Site Audit Statement to meet the Conditions of Approval from the Infrastructure Approval SSI 8583 DPIE (2020) described below.

E18 Contaminated Land, The Proponent must engage an EPA accredited site auditor to prepare a **Site Audit Statement(s)** in accordance with the *Contaminated Land Management Act 1997*, confirming that the proposed measures in the **Contaminated Land Management Plan** required under **Condition E20** are appropriate to manage contaminated soils, groundwater and/or landfill gas in: (a) the former landfill areas in Sydney Park and Camdenville Park in St Peters and (b) any additional or unexpected areas of contamination identified during the development.

E19 Contaminated Land, A copy of the **Site Audit Statement** must be submitted to the Planning Secretary and the relevant council(s) for information prior to the commencement of construction in the area to which the Statement applies.

2.4 Environmental Mitigation and Management Measures

The CLMP has been developed to include the EMMMs detailed in the EIS Amendment Report and presented in **Table 2-1** below.

Table 2-1: Environmental Mitigation and Management Measures

Impact	ID	Environmental Mitigation and Management Measure	Section Addressed
Assessment of excavation areas	CT1	Soil investigations will be undertaken prior to construction along the project area to: • assess the presence of contamination and risks posed to project workers and the environment, so that appropriate controls can be implemented during construction; • chemically classify the soil *in-situ,* for potential re-use or off-site disposal to licensed landfill or re-use facility in accordance with the applicable land use criteria, Waste Classification Guidelines (NSW EPA, 2014) or applicable Resource Recovery exemption and order; and • assess for the presence of acid sulfate soils and liming rates, so Acid Sulfate Soils Management Plans (ASSMPs) can be prepared and waste classified in accordance with Waste Classification Guidelines (NSW EPA, 2014a). A Sampling Analysis Quality Plan (SAQP) will be prepared for soil investigation in accordance with the NEPM (ASC NEPM, 2013). The SAQP will detail: • data quality objectives (DQOs) and data quality indicators (DQIs); • justification of the number, density and location of sampling locations based on the potential for contamination, excavation extent and quantities requiring off-site disposal; • analytical suite and schedule, including contaminants of concern identified; • assessment criteria for on-site reuse or off-site disposal (waste classification); and • sampling and laboratory methodologies, field and laboratory quality assurance and control. Following the completion of the soil investigations a report will be prepared for each construction precinct providing conclusions on waste classification and recommendations for health and environmental controls during construction. The reports will provide clear commentary on the classification of the waste in accordance with the Waste Classification Guidelines (NSW EPA, 201a).	Section 5.1
Assessment of imported Virgin Excavated Natural Material (VENM)	CT2	Prior to the backfilling of trenches during construction with VENM, the VENM source(s) will be identified and assessed against the definition of VENM in the Waste Classification Guidelines (NSW EPA, 2014) and *Protection of the Environment Operations Act 1997* (POEO Act). The VENM source(s) will be assessed by an appropriately qualified contaminated land consultant, which will entail: • identifying whether the current and past activities at the source site that had potential to contaminate the land, whether actual acid sulfate soils (AASS) or potential acid sulfate soils (PASS) is present and that the site is not within an area mapped as containing naturally occurring asbestos; and • undertaking chemical assessment to ascertain that the material is not contaminated. The NSW EPA VENM certificate will be completed and signed by the consultant (or supplier) and provided to TransGrid prior to importation and use of the VENM. The VENM will also be inspected at the work site to check the imported VENM is from the same source assessed.	Section 5.2
Construction laydown areas	CT3	Limited baseline soil investigations and site inspections will be undertaken for each construction laydown area to manage identified risks during construction. The investigations will include limited sampling to identify and assess contamination in surface soil. A baseline report will be prepared for each construction laydown area. Where	Section 5.3

Impact	ID	Environmental Mitigation and Management Measure	Section Addressed
		contamination is identified, a site-specific management plan will be implemented prior to construction to inform the management of asbestos or chemical contamination in soil while the construction laydown area is in use. Following demobilisation of the construction laydown area, a post–construction report will be prepared for each construction laydown area. The post-construction report will compare to the baseline report and confirm whether or not conditions are the same and if remedial works are required to clean up contamination from the project works within the construction laydown areas.	

Contaminated soil management during construction	CT4	Protocols for the management of contaminated soil during construction will be included in the CEMP for all construction works and will:
		• detail requirements for safety controls including the following where required:
		  • air monitoring;
		  • exclusion zones and decontamination;
		  • excavation ventilation;
		  • dust suppression and containment;
		  • odour suppression and monitoring;
		  • personnel protective equipment; and
		  • training and supervision.
		• detail requirements for environmental controls including the following:
		  • sediment and erosion control;
		  • management of surface water runoff around the excavation areas and prevention of surface water entering excavations;
		  • stockpile management and separation; and
		  • materials tracking and records.
		Sediment and erosion mitigation measures will be implemented in accordance with ESCPs.
			Section 5.4
			Table 5-3

Spoil waste management and transport	CT5	Spoil which has been assessed as not suitable for reuse or cannot be reused will be classified in accordance with the Waste Classification Guidelines (NSW EPA, 2014a). The spoil will be transported to an appropriate waste disposal facility licensed to receive such waste. Approval will be obtained from the respective landfill facility prior to transport and will require an estimate of the likely volume of waste to be disposed. The following material handling requirements will be implemented for trucks transporting materials off-site: • a licensed transporter will be used to transport material to an appropriately licensed NSW EPA waste facility; • all truck loads will be filled to the correct level and not over filled; • trucks carrying waste materials will be covered prior to exiting the work site and will remain covered until authorised to unload at the destination (NSW EPA licensed waste facility); • trucks will be fitted with seals to ensure that the movement of potentially saturated materials is undertaken appropriately. The integrity of the seals will be inspected and tested prior to commencement of each day's	Section 5.5

Impact	ID	Environmental Mitigation and Management Measure	Section Addressed
		haulage works; • in the event that materials are tracked or spilt outside of the construction zone, soil will be immediately cleaned up in a way that prevents contamination of land, the stormwater or waterways; and • all truckloads and landfill waste tickets/dockets will be tracked and a register completed to reconcile and check spoil has been lawfully disposed. Temporary spoil stockpiles may be stored at select construction laydown areas. As all spoil will be classified in- situ prior to excavation, the stockpiled material will already be classified in accordance with the NSW EPA guidelines. Stockpiles will be kept separate based on their classification. All stockpiles will be tracked in accordance with protocols within the CEMP for material tracking. Stockpiles will be managed with appropriate sediment and erosion controls as outlined in an ESCP.	
Asbestos management	CT6	An Asbestos Management Plan (AMP) will be developed for areas identified during pre-construction investigations as containing Asbestos Containing Materials (ACM), areas suspected of containing ACM and to address unexpected finds of ACM during construction. Specifically, protocols will be stipulated for separation, monitoring, validation and clearance of asbestos. The AMP and associated Standard Work Procedures will satisfy the requirements of: • Work Health and Safety Regulation 2011; • the Safe Work Australia Asbestos Codes of Practice and Guidance Notes: - Code of Practice: How to Manage and Control Asbestos in the Workplace; - Code of Practice: How to Safely Remove Asbestos; and - Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre, 2nd Edition [NOHSC: 3003 (2005)]. An Occupational Hygienist (Hygienist) will be on-site for the duration of the excavation works where ACM has been identified from pre-construction or where unexpected finds of ACM are encountered. The Hygienist will: • undertake air monitoring for asbestos during excavation; • provide on-site visual inspection, identification of asbestos impacted material and clearance of non-asbestos impacted surfaces; and • supervise works to ensure compliance with the AMP and NSW regulatory requirements for asbestos containing material management and disposal. In the event that friable asbestos is detected, a suitably licensed Asbestos Removal Contractor (licensed to undertake friable asbestos (Class A) removal) will be required to undertake and oversee all the asbestos removal and disposal works outlined in the AMP. All persons performing the works will be required to undertake a suitable risk assessment and develop a Safe Work Method Statement (SWMS) for all of their work activities prior to commencing work in ACM impacted areas. Identified ACM will be segregated, managed and disposed of as Special Waste and transported and disposed in accordance with Protection of the Environment Operations (Waste) Regulation (2014). Where more than 100 kg of asbestos waste or more than 10 square metres of asbestos sheeting is transported the NSW EPA online tool	Section 5.6

Impact	ID	Environmental Mitigation and Management Measure	Section Addressed
		WasteLocate will be used. The handling and disposal of asbestos waste will be tracked and recorded.	
Acid sulfate soils	CT7	ASSMPs will be prepared in accordance with the ASSMAC (1998) guidelines based on the results of the pre-construction investigations for locations within Precinct 2, 3, 4 and 5. The ASSMPs will incorporate the following procedures: • soil will be treated with lime in accordance with the ASSMP where PASS is not able to be loaded and transported to a landfill licensed to receive untreated PASS within 24 hours of excavation or if AASS are identified and excavated; • exposure of PASS material within an excavated trench or excavation site will be minimised to reduce the potential for oxidation and acid leachate generation; • excavation will be done under dry conditions, where possible using a truck and shovel (tracked excavator) operation and the water table will be lowered within excavation areas, as part of excavation dewatering; • excavated fill will be monitored for colour and leachate quality; • no PASS material will be placed and left at the surface untreated; • soil will be placed into an appropriately bunded treatment area (pads) and treated with a neutralising agent (e.g. lime). Leachate water from the PASS material will be managed and treated to ensure no acid is released to the environment; • leachate generated during the ASS treatment operations will be captured. Any water potentially affected by leachate collecting within the excavation will be treated with hydrated lime or equivalent prior to discharge. Water potentially affected by leachate accumulating within the work site will not be discharged until it meets acceptable water quality standards or collected and disposed at a licensed liquid waste treatment facility; and • PASS materials will be kept separate from non-PASS materials at all times to reduce the volume of material requiring treatment. Acid is transported by water; therefore, excavation works in PASS will be conducted during dry periods (where practical) to minimise the risk of overflow associated with sudden or heavy rain and to allow better control of treated waters for discharge.	Section 5.7
Unexpected finds	CT8	An unexpected finds procedure will be included in the CEMP. An unexpected find is potential contamination that was not previously identified during this PSI or pre-construction investigations. Project workers will be trained in identifying the following: • soil that appears to be contaminated based on visual and olfactory (odour) observations; • ACM (i.e. either bonded or friable asbestos); • groundwater that appears to be contaminated based on visual and olfactory (odour) observations (including potential hydrocarbon sheens on the water surface, free phase liquids such as petroleum fuel, discolouration etc.); • drums or underground storage tanks (USTs); and • fill containing wastes (e.g. slag, refuse, demolition materials). In the event of an unexpected find: • excavation works will temporarily be suspended at the location of the unexpected find, the environment	Section 5.8

Impact	ID	Environmental Mitigation and Management Measure	Section Addressed
		manager contacted and the area of concern appropriately isolated; • the area will be inspected by a contaminated land consultant and if required, appropriate sampling and analysis will be undertaken, the sampling works will be documented in a report; • the requirement for additional controls will be assessed by the consultant and implemented by the proponent; and • workplace health and safety and environmental protection requirements will be reviewed, depending on the type of unexpected finds encountered.	
Former landfill management	CT9	Site-specific management plans for former landfill sites will be required for excavation works in Sydney Park and Camdenville Park. A plan may also be required for Henson Park following the outcome of investigations (see CT1). The development of the plans will include consultation with the relevant councils. Approval will be sought from the NSW EPA in all areas where exhumation of landfill waste is required in accordance with Clause 110A of the *Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation).* Where there are existing environmental management plans, such as for Camdenville Park, site-specific mitigation measures outlined in these plans will be reviewed and implemented as required. The plan will be prepared by a contaminated land consultant and occupational hygienist. The plan will specify: • an excavation plan specifying areas classified as per in-situ waste classification and suitability for reuse; • trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (also refer to AQ12); • ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds; • action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented; • exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh fences with bracing, where required; • geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable; • final capping layer above the concrete cable conduit casing as per the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016), unless otherwise specified or agreed with City of Sydney and Inner West Council: - compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic conductivity of less than 1 x 10–9 metres/s (where subsurface waste either side of the trench is less than; - a revegetating layer from the top of the capping layer to the surface comprising clean soils with 200 mm of topsoil (in landscaped areas); and • the construction of joint bays, link boxes and sensor pits within former landfill areas will be designed to prevent the accumulation of landfill gases. Inner West Council and City of Sydney will be consulted on the design, monitoring and location of the pits within Sydney Park, Camdenville Park, and Henson Park (if required).	Section 5.9

Impact	ID	Environmental Mitigation and Management Measure	Section Addressed
Sydney Park	CT10	TransGrid will undertake additional investigations at Sydney Park on leachate and methane risks prior to or during construction and will report these findings to the City of Sydney.	Section 5.1 Section 5.9.2
Drilling slurry	CT11	TransGrid will investigate and adopt good practice measures for the management of drilling slurry during horizontal directional drilling, where used, taking into consideration the volume of slurry that will be generated.	Section 5.11

3 Contamination Status

The sub-sections below provide a summary of contamination identified in the EIS.

3.1 Contamination Assessment

A soils and contamination assessment for the project was undertaken during preparation of the EIS, with subsequent intrusive soil investigations along the majority of the transmission cable route completed for waste classification purposes.

A Preliminary Site Investigation (PSI), which identified areas of concern from a contamination perspective along the transmission cable route and at the proposed construction laydown areas, was included as Appendix K in the EIS. Details of the areas of environmental interest (AEI) and contaminants of potential concern (COPC) identified during the EIS are presented in Table 16-4 of the EIS (transmission cable route) and in Table 16-5 (for the construction laydown areas). The AEIs are areas that could potentially be contaminated as a result of historic and/or current activities. The locations of the AEIs are presented on Figure 16-3, Figure 16-4, Figure 16-5 and Figure 16-6 of the EIS.

Existing contamination underlying the transmission cable route and ancillary facilities has the potential to be exposed or disturbed by construction activities. Activities with the highest level of risk include excavation, earthworks and demolition. The key risk pathways during construction are outline below.

- Direct contact to contaminated soils or hazardous materials within the project area - project worker and visitor health.
- Direct contact to contaminated groundwater within deep excavations below the water table in the project area - project worker health.
- Inhalation of hazardous ground gases and formation of hazardous atmospheres within the project area – project worker and visitor health.
- Direct impact to project structures.
- Migration from the project area and impact to the surrounding environment or structures.

The majority of the potential AEIs identified during the PSI were assessed as being a low risk of exposure to COPC during construction of the project. However, there was deemed a medium or high risk associated with:

- Sections of the project area were assessed as medium contamination risk where historical and current potentially contaminating land uses were located in close proximity to the transmission cable route. These land uses included service stations, dry cleaners, mechanical workshops, manufacturing sites, areas of historically filled land including Muir Road in Chullora and former infilled brick pits at Arlington Oval, Marrickville Park and Henson Park. These areas are listed in Table 16-7 of the EIS.
- Sections of the project area were assessed as high contamination risk where known contamination was identified from previous site investigations. These areas included:
  - Where the project area would intersect the former landfill in Camdenville Park; and
  - The project area starting from Sydney Park at the Princes Highway to (and including) Beaconsfield West substation.

Of the five locations identified as construction laydown areas, Beaconsfield West substation laydown area was assessed as low risk due to the existence of pavement covering the site. All other laydown areas were assessed as medium risk based on the potential for existing soil contamination, associated with former land uses, and the potential for complete pathways between the contamination and sensitive human and ecological receptors.

3.2 Soil Contamination

Intrusive soil investigations will be completed along the majority of the current transmission cable alignment, principally for waste classification purposes (refer to **Section 5.1.2**). The analytical results of those waste classification investigations will be compared to health investigation level (HILs), health screening levels (HSL), ecological investigation levels (EIL) and ecological screening levels (ESL) for a commercial/industrial land use setting or an open space land use setting (as appropriate) in the ASC NEPM or NSW EPA made or approved guidance. Screening the available data against these criteria will provide a preliminary assessment of the level of controls required to minimise risk to project workers and the surrounding environment during project construction and provide an indication of the suitability of the soils for re-use after excavation.

3.2.1 Asbestos

Table 3-1 below provides a summary of project areas identified in the EIS where asbestos has been confirmed or is suspected to occur.

Table 3-1: Known and suspected areas containing asbestos

Site	Address	Type	Status	Reference
Rookwood Road Substation	Rookwood Road, Potts Hill	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Along Muir Road	Muir Road, Chullora	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Former railways under Muir Road	Muir Road, Chullora	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Arlington Oval (former landfill)	Williams Parade, Dulwich Hill	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Marrickville Park (former landfill)	Frazer Street, Marrickville	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Henson Park (former landfill)	Centennial Street, Marrickville	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Galserv Galvanising Services	117-153 Rookwood Road, Yagoona	TBC	Identified	NSW EPA
Australian Refined Alloys	202-212 Euston Road, Alexandria	Friable asbestos containing material (ACM)	Identified	Remedial Action Plan (RAP, ERM, 2017)
Camdenville Park (former landfill)	St Peters	Asbestos fibres	Suspected	EIS (Table 4-14 of PSI, Appendix K) URS (2010) GHD (2013)
Sydney Park (former landfill)	Sydney Park Road, St Peters	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Precinct 3, potential filling of unknown source	Various locations between Brighton Avenue,	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)

Site	Address	Type	Status	Reference
	Campsie and Illawarra Road, Marrickville			
Precinct 5, disturbed terrain	Between the Princes Highway, St Peters and Alexandra Canal	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Beaconsfield West Substation	Burrows Road, Alexandria	TBC	Identified	EIS (Section 4.2 of PSI, Appendix K)
Sydney South substation	925A Henry Lawson Drive, Picnic Point	TBC	Suspected	EIS (Section 4.2 of PSI, Appendix K)
12 Muir Road	12 Muir Road, Chullora	TBC	Suspected	EIS (Section 4.3 of PSI, Appendix K)
Cooke Park	Chisholm Street, Belfield	TBC	Suspected	EIS (Section 4.3 of PSI, Appendix K)
Peace Park	Trevenar Street, Ashbury	TBC	Suspected	EIS (Section 4.3 of PSI, Appendix K)
Notes: TBC – to be confirmed				

3.2.2 Acid Sulfate Soils

Acid sulfate soils (ASS) is the common name given to a range of soil types containing iron sulfides. ASS may be present as actual ASS (AASS) or potential ASS (PASS). When exposed to air, the iron sulfides (commonly pyrite) within ASS can oxidise, producing sulfuric acid. These soils may become exposed to air by either excavation or dewatering and may cause the generation of acidic runoff and/or the increased acidity of groundwater, which can impact on water quality in receiving ecosystems and surrounding structures.

The ASS risk class within the study area is largely Class 5, indicating no risk of intercepting acid sulfate soils for activities not resulting in the lowering of the water table by more than 1 metre, with the exception of the areas listed in Table 16-1 of the EIS (repeated below in **Table 3-2**) and shown on Figure 16-2 of the EIS. Analysis for ASS will be carried out at the locations where ASS is suspected when waste classification sampling is being undertaken.

Table 3-2 Acid sulfate soil risk and class

Site	Location	Type	Status	Reference
Precinct 2, 3	Along Omaha St, east of Baltimore St, Seventh Ave, Campsie to Hay St/Harmony St intersection in Canterbury (2.2 km length)	PASS	Class 4 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 3	Cooks River crossing (35 metre length)	AASS or PASS	Class 1 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 3	Centennial St, Sydenham Rd and Neville St, Marrickville (130m length)	PASS	Class 4 - Suspected	EIS (Table 4-2 of PSI, Appendix K)

Site	Location	Type	Status	Reference
Precinct 4	Transmission cable route along Edgeware Rd between Darley St, Marrickville and May St, St Peters (360m length)	PASS or AASS	Class 2 - Suspected	EIS (Table 4-2 of PSI, Appendix K)
Precinct 5	Transmission cable route between Princes Hwy to Alexandra Canal and Beaconsfield West substation (1.3km length)	PASS	Class 3 – Suspected	EIS (Table 4-2 of PSI, Appendix K)

3.2.3 Waste Classification

Preliminary *in-situ* waste classification along the majority of transmission cable route will be undertaken.

Samples will generally be analysed for the following parameters, as well as for ASS in areas where ASS is suspected, to assist in waste classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*:

- Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc (metals);
- Total Recoverable Hydrocarbons (TRHs);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Benzene, Toluene, Ethylbenzene, total Xylene (BTEX);
- pH/ electrical conductivity (EC);
- Foreign material; and
- Asbestos ID.

3.3 Hazardous Ground Gas

Ground gases include both gases and vapours within the pore space of soils and rock, though in this plan they generally refer to typical landfill gases (LFG), including methane and carbon dioxide. The principal hazardous ground gas risks are considered to be associated with LFG migration into the project area from former landfills intersected by, or adjacent to, the project area. Naturally occurring hazardous ground gases could also be present in 'swampy' locations of the project area, such as at Cooks River or adjacent to Alexandra Canal.

The below provides a summary of areas with potential LFG issues identified in Section 16.2.1 of the EIS.

3.3.1 Qualitative Risk Assessment of Henson Park, Marrickville Park and Arlington Oval

Henson Park, formerly Daley's brick pit quarry, was filled between 1914 and 1933, likely with municipal waste and spoil of unknown sources across Sydney. The filling works also included levelling the site that allowed for the creation of Henson Park. The transmission cable route option chosen in this location traverses along Neville Street and Surrey Street, which is at least one row of residential properties to the west and north of the park. The footprint of the former brick pit quarry, and hence extent of filling, is not known. However, in the 1943 aerial photograph of this location, houses are present along the eastern and southern sides of Neville and Surry Streets, indicating that the boundary of the park has not changed in over 75 years. If these houses were also present prior to 1933, then it is possible that the filling does not extend to under those houses. The potential presence and extent of landfill gas at this location is unknown. However, given the age of the former landfill, the likelihood of landfill gas risk is considered low.

Marrickville Park was a former brick pit quarry filled prior to 1910 with municipal waste and is located about 50 metres north of the transmission cable route, which traverses along Pile Street. The park is separated from Pile Street by at least one row of properties, which appear to be a mix of low density residential, medium density residential (a retirement community) and recreational facilities (basketball courts). In the 1943 aerial photograph, the properties between Marrickville Park and Pile Street also appeared to have been residential or recreational. This indicates that the boundary of the park has not changed in over 75 years. If these houses were also present prior to 1910, then it is possible that the filling does not extend to under those houses. The potential presence and extent of landfill gas at this location is unknown. However, given the age of the former landfill, the likelihood of landfill gas risk is considered low.

Arlington Oval was a former brick pit quarry filled prior to 1932. It is located about 40 metres south of the transmission cable route, which passes along Constitution Road. The park is separated from Constitution Road by at least one row of residential properties. The footprint of the former brick pit quarry, and hence extent of filling in the area, is not known. However, in the 1943 aerial photograph of this location, houses are present along the northern edge of the park adjoining Constitution Road, indicating that the northern boundary of the park has not changed in over 75 years. If these houses were also present prior to 1932, then it is possible that the filling does not extend to under those houses. Three of the properties between Arlington Oval and Constitution Road were vacant (i.e. not developed) in the 1943 aerial photograph, so it is equally possible that the adjoining houses are relatively new and were not present prior to 1932 and, hence, the landfill may extend under those houses. The potential presence and extent of landfill gas at this location is also unknown. Given the age of the former landfill, the likelihood of landfill gas risk is considered low. However, given the uncertainty surrounding the northern extent of the landfill and due to the partial overlapping operational period with Camdenville Park, where LFG has previously been confirmed to be present (refer to **Section 3.3.3** below), there is still considered potential for LFG to occur along the transmission cable route at this location.

Despite the low likelihood of landfill gas risks at the above locations, general controls to manage the potential risks in these areas are identified in **Section 5.9.1**.

3.3.2 Sydney Park

Sydney Park, formerly the Bedford Brick Works quarries, was filled with municipal waste between 1948 and 1976. Plans were made to convert the area into a park in 1982, and extensive landscaping and modifications were consequently undertaken to create Sydney Park as it is today.

Sydney Park is listed on the NSW EPA Record of Notices. An investigation along the proposed transmission cable route through Sydney Park (Douglas Partners, 2017) found that fill material along the length of the transmission cable route is likely to be variable, but typically comprised of sand and gravel with some building waste (bricks, glass, concrete, ceramic, metal), sandstone and some clay. Domestic waste (from the former landfill) would also be encountered within the excavation areas. Although landfill gas screening in this investigation recorded very low to negligible detections, Sydney Park was declared significantly contaminated land by the NSW EPA on 25 February 2019 due to methane and carbon dioxide concentrations in ground gas from its former use as a landfill.

The EIS stated that TransGrid will undertake additional investigations at Sydney Park on leachate and methane risks prior to or during construction and will report these findings to the City of Sydney. These additional investigations are yet to be completed, which constitutes a data gap. The sampling strategy to address this data gap is discussed in **Section 5.1.4**.

The transmission cable route traverses the western and southern boundaries of Sydney Park and it is also proposed to underbore through the south-eastern portion of the park.

3.3.3 Camdenville Park

Camdenville Park was filled in with municipal waste and incinerator waste between the early 1920s and 1950s. The site is listed on the NSW EPA record of notified sites.

In a 2012 survey conducted by GHD, methane was detected in high concentrations in boreholes in Camdenville Park, indicating the presence of LFG (GHD, 2013). In addition, the site was considered to be contaminated by waste materials (lead and petroleum hydrocarbons).

The transmission cable route passes through the western portion of Camdenville Park and traverses along the southern boundary of the eastern portion of the park. Camdenville Park also forms one of the construction laydown areas for the project and will be utilised for the duration of the project, estimated to be around 24 months.

3.4 Groundwater

Groundwater quality across the project area is variable and dependent upon the lithology of the aquifer, tidal influences and current and previous land uses. Groundwater quality within fill is dependent upon the quality and origin of the fill material (i.e. if the fill comprises contamination, groundwater quality could potentially be contaminated). Groundwater quality can also be affected by the presence of actual ASS.

Waste and fill materials placed within the former brick pits / quarries represent a source of impact to groundwater. It is likely that fill materials are present at depth to either just above or below the groundwater table. Decomposition or degradation of certain wastes and infiltration of surface water through the fill material is likely to have generated contaminated leachate, which can migrate downward impacting groundwater. Dissolution of contaminants as groundwater flows through the fill material is also likely to have occurred. At Sydney Park, for example, waste infilling of the former quarries/brick pits has resulted in leachate generation and impact of groundwater.

Elsewhere along the transmission cable route, the unconfined alluvial aquifers are susceptible to contamination from former and current land use practices such as leakage from industrial sites, leaky sewage systems or the application of fertilizers. Contaminated groundwater may have originated from previous activities undertaken on land overlying the project area or hydraulically up-gradient of the project area. Current potentially contaminating land uses identified within 50 metres of the transmission cable route are largely petrol stations, dry cleaners, workshops and industrial manufacturing sites. These are listed in Table 16-2 of the EIS and presented in Figure 16-3, Figure 16-4, Figure 16-5 and Figure 16-6 of the EIS.

Groundwater quality within the Botany Sands aquifer in Precinct 5, under natural conditions, is generally of low salinity. However, due to the shallow unconfined nature of the aquifer, it is susceptible to groundwater contamination from a variety of historic and current land uses such as tanneries, metal platers, service stations, light industry, landfills, dry cleaners, petrol stations and leaky sewage pipes. Groundwater use in Precinct 5 is restricted in accordance with *Temporary Water Restriction Order for the Botany Sands Groundwater Source 2018* (the Order) under the *Water Management Act 2000*. Groundwater within the parts of the

Botany Sands Groundwater Source identified within the Order has been identified by the NSW Government as being contaminated. The transmission cable route passes through Area 2 of the Order. The taking of groundwater from within this Area for human consumption, consumption by animals, domestic purposes and any other purpose is prohibited. However, if the water is fit for purpose, or the water is being taken for remediation, temporary construction dewatering, testing or monitoring, then the prohibition does not apply. Therefore, any groundwater that might be encountered by the project in Precinct 5 is potentially contaminated (unless shown otherwise), but is permitted to be removed for temporary construction dewatering purposes under the Order. Water that is collected during dewatering of excavations will be discharged of or disposed of in accordance with the *POEO Act* and relevant NSW waste regulations following the decision flow process shown in **Figure A** of **Appendix 2** of the GMS.

The anticipated depth to groundwater and process to identify and manage potential for intercepting contaminated groundwater during excavation along the transmission cable route is outlined in the GMS. Areas with the highest potential to intersect groundwater are immediately adjacent to the Cooks River, in Precinct 3, and at special crossing locations that require underboring, including within Sydney Park in Precinct 5. There is also potential for shallow groundwater to intersect portions of the trench excavation in low lying areas, or filled areas where perched groundwater may be present, such as in and near Sydney Park. The GMS outlines the required investigations to be undertaken to identify and assess project areas that are predicted to require dewatering. Where dewatering is assessed as being required, then site-specific details will be documented in a Dewatering Management Plan (DMP).

4 Environmental Aspects and Impacts

4.1 Construction activities

Key aspects of the project that could affect contaminated land include, but are not limited, to the following:

- Site access provisions.
- Vegetation clearing and topsoil stripping.
- Utility relocation and alignment works (all utility providers).
- Slope or embankment stabilisation.
- Bridge construction and piling (in-stream works).
- General earthworks, trenching and excavated material stockpiling.
- Exhumation of landfill waste.
- Ancillary facility operation including fuel and chemical storage, refuelling and chemical handling.
- Construction of site compounds and laydown areas.
- Concrete paving activities and concrete cutting.
- Asphalt paving and bitumen sprayers.
- Dewatering of excavations and sediment basins.
- Underboring.

Refer also to the Environmental Risk Register included in Appendix A2 of the CEMP.

4.2 Impacts

The potential exposure to unexpected and/or known contamination is a risk to human health and the environment. This CLMP has been developed to inform all construction personnel of the management measures to be implemented when working in areas of known contaminated land within the project area during construction. The procedure to follow when unexpected contamination is encountered on site is documented in the UCLAFP.

Potential impacts from contamination attributable to project construction, or potential impacts from existing contamination on the project (e.g. workers or structures), are addressed in this CLMP and include:

- Interception of groundwater aquifers, resulting in cross-contamination.
- Construction worker exposure to contaminated soil, leachate or groundwater, potentially resulting in health impacts.
- Disturbance of asbestos, either bonded or friable, resulting in potential human health risks.
- Migration and accumulation of landfill gases and volatile organic compounds in trenches and pits, resulting in potential human health and explosive risks.
- Exposure to odorous soils, groundwater or leachate, resulting in aesthetic impacts and community complaints.
- Disturbance of ASS resulting in generation of acidic leachate entering underlying groundwater or receiving surface waters.
- Mobilisation of contaminants or leachate, potentially resulting in contamination of receiving ecological receptors.

Potential impacts from contamination attributable to project construction that are addressed via controls and procedures in other plans under the CEMP (e.g. Construction Waste Management Plan, Erosion and Sediment Control Plan, Surface Water Management Plan) might include:

- Erosion and sediment mobilisation from disturbed areas or stockpiles resulting in increased turbidity in receiving waters and/or deposition of sediment in stormwater pits and drainage.
- Discharge of turbid water from excavations and sediment basins impacting receiving waters.
- Amenity impacts to sensitive receivers when dust is deposited on surfaces resulting in community complaints.
- Mud tracking on public roads resulting in road safety issues and community complaints.
- Chemical spills resulting in pollution of surface waters or contamination of groundwater.
- Hydrocarbon runoff from asphalt paving or bitumen seals.
- Concrete works and washout resulting in discharge of cementitious water contaminating land, groundwater or surface waters.

Some potential impacts on soil and water attributable to the project were anticipated in the EIS. **Section 5** (below) provides mitigation measures that will be implemented to avoid or minimise those impacts.

5 Environmental Control Measures

A range of environmental procedures and control measures are identified in the various environmental planning documents, TransGrid specifications and guidelines and EIS. Project specific Environmental Control Measures (ECMs) to meet the objectives of this CLMP and to address potential impacts from contamination are detailed in subsequent sections.

5.1 Assessment of Excavation Areas (CT1)

As identified in **Section 3.1**, actual contamination or the potential for contamination has been identified along sections of the transmission cable route. Assessment of these areas is required to evaluate:

- The potential risks to human health and the environment that require management during construction.
- Waste classification.
- Support management of materials excavated within the project site, which will include:
  - Possible reuse within the project site - excavated soils may be used to backfill the trenches where the soils have been assessed to be either VENM, ENM and/or suitable for commercial / industrial land use or open space use (as appropriate to the site setting) (refer to **Section 3.2**). Soils along the majority of the transmission cable route are likely suitable for commercial / industrial use, but confirmatory sampling as part of the waste classification investigations is required. Additional assessment is required in the areas identified as posing a medium to high risk in the EIS to confirm their suitability for re-use as backfill and potential risk to human health and/or the environment during construction or operation of the project. This is due to the potential presence of contaminants that will not be assessed during the waste classification investigations in these areas. These assessments are detailed in **Section 5.1.4**.
  - Disposal off-site at a facility lawfully able to receive the material.

Where unexpected finds are encountered, these soils should also be assessed in accordance with the UCLAFP to determine suitability for re-use or off-site disposal.

The following sections detail the ECMs to address EMMM CT1 (Assessment of Excavation Areas) in the EIS. However, in general prior to the commencement of any intrusive ground works, TransGrid must:

- Adhere to the responsibilities outlined in **Section 6.1**.
- Adhere to all site access and permitting requirements (refer to **Section 6.8**).
- Undertake underground service clearance, review of available surveyed underground services figures and dial-before-you-dig (DBYD) information prior to excavation.
- Protect any stormwater networks in accordance with the ESCP.
- Implement necessary controls included in other environmental management plans (refer to CEMP and CSWMP).

5.1.1 Waste Classification

Where soils along the transmission cable route cannot be reused, they will be assessed and disposed off-site in accordance with the NSW EPA (2014) *Waste Classification Guidelines* (refer to **Sections 3.2.3** and **5.1.2**).

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Areas that were identified as medium to high risk of contamination in the EIS, where COPC may be present in addition to those being assessed as part of the waste classification (refer to the data gaps identified in **Table 5-1**), will require additional sampling of surplus soils prior to, or during, construction in accordance with **Section 5.1.4** and the results considered in the final waste classification.

Where unexpected finds are encountered, the procedures outlined in the UCLAFP will be followed.

5.1.2 Waste Classification Procedure

Waste classification will be undertaken in accordance with the NSW EPA (2014) *Waste Classification Guidelines: Part 1 Classifying Waste* and/or the *Excavated Natural Material Order* 2014.

The preferred approach is to conduct in-situ classification prior to bulk excavation. The sampling strategy will be developed by a suitably qualified and experienced Contamination and Landfill Gas Environmental Professional but will include:

- In-situ sampling and analysis of possible ENM required in the ENM Order/Exemption 2014.
- In-situ waste classification in accordance with NSW EPA (2014) *Waste Classification Guidelines* via collection of soil samples from test pits excavated at not more than 100 m intervals along the transmission cable route with soil samples collected at the surface and at 0.5 m depth intervals or at least one per lithological strata. Selected samples will be submitted for analysis at a laboratory NATA accredited for the analyses:
    - For the majority of areas, the following parameters will be analysed: Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc (metals); Total Recoverable Hydrocarbons (TRHs); Polycyclic Aromatic Hydrocarbons (PAHs); Benzene, Toluene, Ethylbenzene, total Xylene (BTEX); pH/ electrical conductivity (EC); Foreign material; and Asbestos ID.
    - In areas that were identified as medium to high risk of contamination in the EIS, soil samples will be analysed for the full suite of COPC identified in **Table 5-1** (this is in addition to waste classification sampling).
    - In areas where elevated ASS risks have been identified, additional analysis will be undertaken in accordance with the ASSMP.

Material classifications will be documented in accordance with NSW EPA (2020) *Guidelines for Consultants Reporting on Contaminated Sites*.

The classification of waste excavated materials as an exempt waste under the *Protection of the Environment Operations (Waste) Regulation 2014*, may also be assessed. Possible exempt wastes for the project include:

- *The reclaimed asphalt pavement order/exemption 2014*
- *The excavated public road material exemption 2014*
- *The treated drilling mud order/exemption 2014*

5.1.3 Presence of Acid Sulfate Soil

Refer to **Section 5.7** and ASSMP.

5.1.4 Sampling and Analysis Quality Plan

A Sampling and Analysis Quality Plan (SAQP) will be prepared to detail the additional investigations to address data gaps identified in **Table 5-1** below for:

- Waste classification.
- Re-use suitability.
- Contamination risks at medium- and high-risk areas identified in the EIS, including LFG and leachate near Sydney Park.

The SAQP will be prepared in general accordance with the ASC NEPM and NSW EPA (2020) and will detail the following:

- Refinement of data gaps based on the final cable route alignment and excavations, and further review of available waste classification reports, contamination reports or other information.
- Data quality objectives (DQOs) and data quality indicators (DQIs).
- Justification of the number, density and location of sampling locations based on the potential for contamination, excavation extent and quantities requiring off-site disposal.
- Analytical suite and schedule, which is anticipated to include COPC identified in **Table 5-1** and **Table 5-2** below.
- Assessment criteria for on-site reuse or off-site disposal (waste classification).
- Sampling and laboratory methodologies, field and laboratory quality assurance and control.

Following the completion of the soil investigations, a report will be prepared for each area providing conclusions on material classification and any recommendations for health and environmental controls during construction that are different to those outlined in **Section 5.4** below. The reports will provide clear commentary on the classification of the waste in accordance with the NSW EPA (2014) *Waste Classification Guidelines* or relevant waste exemption/order.

Table 5-1 below also identifies possible groundwater quality data gaps. However, these are only relevant at locations where dewatering is predicted to be required as part of project construction or the project infrastructure intersects a whole aquifer and could interfere with groundwater flow. Identification of the areas where groundwater is anticipated to be intercepted and discussion of appropriate health and environmental management measures will be provided in the DMP, which will be prepared following completion of the investigations outlined in the GMS. As mentioned in **Section** Error! Reference source not found., areas with the highest potential to intersect groundwater are immediately adjacent to the Cooks River, in Precinct 3, and special crossing locations that require underboring, including within Sydney Park in Precinct 5. There is also the possibility of trench excavations intersecting the water table in low lying areas, or filled areas where perched groundwater may be present, with possible reduced groundwater quality, such as in and near Sydney Park – these areas will also be considered as outlined in the GMS. **Table 5-1** below provides a preliminary indication of whether dewatering is considered unlikely, possible or likely at each medium and high contamination risk area.

Table 5-1: Identification of possible contamination data gaps along transmission cable alignment

Precinct / substation	Section of precinct	COPC	Qualitative risk in EIS	Possible Data gaps (and COPC) following Waste Classification
Precinct 1 and Rookwood substation	All (special crossing location)	Heavy metals, TRH, BTEX, ammonia, cyanide, pH, PCB, SVOC[1], VOC[2], PFAS and asbestos	Medium	Soil: Cyanide, PCB, selected SVOC and VOC and PFAS GW (if dewatering is to occur – considered unlikely): TRH, BTEX, ammonia, cyanide, pH, selected SVOC, VOC and PFAS
Precinct 2	24 Rawson Road, Greenacre (15 metre length) PH24 – PH25	Lead, TRH, BTEX and PAHs	Medium	No data gaps[1]
	Wangee Road between Punchbowl Road to Yangoora Road, Lakemba TH04 – TH08	Heavy metals (including hexavalent chromium), TRH, BTEX, SVOC[1] and VOC[2]	Medium	Soil: Cr6+, selected SVOC and VOC GW (if dewatering is to occur – considered unlikely): Heavy metals (including hexavalent chromium), TRH, BTEX, selected SVOC and VOC
	Walker Street, Belmore and Carter Street, Belfield (special crossing location) TH18 – TH20	Heavy metals, TRH, BTEX, PAH and VOC[2]	Medium	Soil: Selected VOCs GW (if dewatering is to occur – considered possible): Heavy metals, TRH, BTEX, PAH and selected VOC
Precinct 3	Eastern approach to Cooks River crossing TH40 – TH44	Heavy metals, TRH, BTEX, PAH, ASS, asbestos, foreign matter	Low[2]	Soil: All COPC GW (if dewatering is to occur – considered likely): Heavy metals, TRH, BTEX, PAH and selected VOC
	Cooks River Crossing TH44 – TH45	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], and asbestos	Medium	Soil: all COPC, ASS indicators GW (dewatering considered likely): Heavy metals, nutrients, pH, TRH, BTEX, PFAS, selected SVOC and VOC
	128 Livingstone Road, Marrickville TH77 – TH78	Heavy metals, phenols	Medium	Soil: Phenols GW (if dewatering is to occur – considered unlikely): Heavy metals and phenols
	Henson Park PH16 – TH86	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS, asbestos, ammonia, pH, and landfill gases	Medium	Soil: PCB, PFAS, selected SVOC and VOC GW (if dewatering is to occur – considered unlikely): Heavy metals, TRH, BTEX, PCB, selected SVOC and VOC, PFAS, ammonia and pH LFG
Precinct 4	Addison Road/Illawarra Road/Agar Street intersection to Enmore Road/Addison Road intersection, Marrickville PH17 to TH93	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS and asbestos Acid sulfate soils	Medium	Soil: PCB, selected SVOC and VOC, PFAS All COPC between SI10 – TH92) GW (if dewatering is to occur – considered unlikely): TRH, BTEX, selected SVOC and VOC and PFAS
	Newington Road between Philpott Street and Enmore Road, Marrickville SI11 – TH93	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS and asbestos Acid sulfate soils	Medium	Soil: PCB, selected SVOC and VOC, PFAS GW (if dewatering is to occur – considered unlikely): TRH, BTEX, selected SVOC, VOC and PFAS
	Llewellyn Street between Juliett Street and Edgeware Road, Marrickville TH97 – SI43	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS and asbestos Acid sulfate soils	Medium	Soil: PCB, selected SVOC and VOC, PFAS GW (if dewatering is to occur – considered unlikely): TRH, BTEX, selected SVOC, VOC and PFAS
	Edgeware Road between Smidmore Street and Illawarra Railway, Marrickville SI44 – PH141	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS and asbestos Acid sulfate soils	Medium	Soil: PCB, selected SVOC and VOC, PFAS GW (if dewatering is to occur – considered unlikely): TRH, BTEX, selected SVOC, VOC and PFAS

[1] Edit made post Site Audit Statement 0503-2010 dated 27 July 2020
[2] Edit made post Site Audit Statement 0503-2010 dated 27 July 2020

Precinct / substation	Section of precinct	COPC	Qualitative risk in EIS	Possible Data gaps (and COPC) following Waste Classification
Precinct 5 and Beaconsfield West substation	Within Camdenville Park	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS, asbestos, ammonia, pH, and landfill gases	High	Soil: All COPC GW (if dewatering is to occur – considered possible): TRH, BTEX, selected SVOC, VOC, PFAS, ammonia and pH LFG
	Bedwin Road and May Street PH141 – PH145	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS, asbestos, nutrients, ammonia, pH, and landfill gases	Medium	Soil: PCB, selected SVOC and VOC, PFAS GW (if dewatering is to occur – considered unlikely): Heavy metals, TRH, BTEX, selected SVOC, VOC, PFAS, nutrients and pH LFG
	Princes Highway to Beaconsfield West substation though Sydney Park	Heavy metals, TRH, BTEX, PCB, SVOC[1], VOC[2], PFAS, asbestos, nutrients, ammonia, pH, and landfill gases	High	Soil: PCB, selected SVOC and VOC, PFAS GW (dewatering considered likely): Heavy metals, TRH, BTEX, selected SVOC, VOC, PFAS, nutrients and pH LFG
Sydney South substation	-	Heavy metals, TRH, asbestos and PCB	Medium	Soil: All COPC GW (if dewatering is to occur – considered possible): Heavy metals, TRH, BTEX

5.2 Assessment of Imported Virgin Excavated Natural Material (CT2)

This section addresses the ECM for EMMM CT2 (Assessment of Imported Virgin Excavated Natural Material [VENM]) in the EIS.

Where imported VENM is required for the reinstatement of excavations or to achieve final ground levels, the fill must be certified to be VENM before it is imported to site for the intended purpose. Prior to the backfilling of trenches during construction with VENM, the VENM source(s) will be identified and assessed against the definition of VENM in the NSW EPA (2014) *Waste Classification Guidelines* and the *Protection of the Environment Operations Act 1997* (POEO Act). The VENM will be assessed by a suitably qualified and experienced Contamination and Landfill Gas Environmental Professional, which will entail:

- Identifying whether the current and past activities at the source site had potential to contaminate the land, whether AASS or PASS is present, and that the site is not within an area mapped as containing naturally occurring asbestos.
- Undertaking adequate sampling and analysis to ascertain that the material is not contaminated.
- Source site inspection.
- Preparing a VENM certificate for each source site. The VENM certificate should include a summary of the history of the source site, the findings of any environmental investigations previously undertaken at the source site, the results of any previous soil investigations undertaken, and a clear statement whether the materials meets the legal definition of VENM.

The VENM received at the project site should be inspected by a suitably qualified and experienced Contamination Environmental Professional to verify that the imported VENM material is visually consistent with the material certified.

If any soil, mulch or aggregate material other than VENM is to be imported to the site, then it must:

- Comprise material that meets the definition of Excavated Natural Material (ENM) or another NSW EPA approved resource recovery order/exemption under *Protection of the Environment Operations (Waste) Regulation 2014*.
- Have been assessed by a suitably qualified and experienced Contamination Environmental Professional prior to import to site to certify that the material meets the definition of resource recovery order/exemption, including that it is free of asbestos and visual or olfactory indicators of contamination. Sampling and analysis of the source material should be undertaken to ascertain that the material is not contaminated.

The imported material classification, material tracking and location of placement of the imported material will be recorded into a material tracking register.

5.3 Construction Laydown Areas (CT3)

This section addresses the ECM for EMMM CT3 (Construction Laydown Areas) in the EIS.

Of the five construction laydown areas preliminary assessed in the EIS, only Camdenville Park will be utilised during construction. To comply with the EMMM, limited baseline soil investigations will be completed at the proposed laydown area at Camdenville Area prior to construction, then again at the completion of the project.

The limited soil investigations will be completed in accordance with the ASC NEPM and will assess the potentially complete source-pathway-receptor linkages and COPC identified in the EIS and presented in **Table 5-2** below. The sampling and analysis design will be developed by a suitably qualified and experienced Contamination Environmental Professional.

Table 5-2: COPC for baseline investigations at construction laydown areas

Site	COPC	Exposure Pathway	Receptor
Camdenville Park	Heavy metals, hydrocarbons, asbestos, SVOC, PCB in soil LFG	Direct contact, inhalation, ingestion	Workers
		Erosion as dust	Workers, public
		Erosion into surface runoff	Cooks River
		Movement by vehicles	Public, Cooks River
		Diffusion or preferential migration of LFG	Workers

5.4 Contaminated Soil Management During Construction (CT4)

The below ECMs address EMMM CT4 (Contaminated soil management during construction) in the EIS. In addition to the general ECMs for assessment of excavation areas outlined in **Section 5.1**, at a minimum, the ECMs in **Table 5-3** will be adopted. These ECMs apply to contamination AEIs – the UCLAFP, and general controls and procedures in the AQMP, ESCP and SWMP apply elsewhere.

Table 5-3: Environmental control measures for contaminated soil management during construction

ID	Category	ECM
1	Air monitoring	• Refer to AQMP and asbestos air monitoring requirements in AMP. • Refer to Sydney Park and Camdenville Park SSLGMPs (**Appendix 1** and **Appendix 2** respectively).
	Exclusion zones and decontamination	A precautionary approach should be adopted, with work areas that have not been assessed for contamination assumed to be contaminated unless shown otherwise for the purposes of environmental and worker health controls: • Establish a safe work zone (exclusion zone) around the work areas that clearly defines the work zone and restricts public access and intruders after hours (i.e. fencing). • Provide adequate signage at the boundary of the safe work zone to deter entry, provide contact details for any enquiries and identify areas where asbestos may be present (refer to AMP). • Provide first aid, washing, toilet, changing, eating, drinking and smoking facilities away from work areas. • Workers should wash their hands and face prior to eating, drinking, smoking and leaving the work zone. • Workers will change clothes daily and wash clothes separately from other clothes. Clothes and personal protective equipment (PPE) that are visually dirty should not be worn outside of the work zone. Soils entrained in boot treads should be physically removed and boots washed in a boot wash bath prior to leaving the work zone. • If the excavator bucket or other plant becomes contaminated during trenching works (e.g. soils known or suspected to be contaminated stick to the excavator bucket), then the plant will be decontaminated before the trenching continues into uncontaminated soils or plant is transported off-site. • Decontamination of plant will include hosing down of impacted parts of the machine with clean water in a designated wash bay / wheel wash area. Decontamination will be carried out in a bunded area where dirty water runoff can be collected and disposed of in accordance with the SWMP to prevent migration offsite. Detergent-based cleansers may be required.
2	Excavation ventilation	• Refer to SSLGMP. • Refer to **Section 5.9**. • Personnel will not enter trenches immediately following excavation. Monitoring inside the trench with a landfill gas meter, and PID and/or will be undertaken prior to entry. Trigger points for non-entry are provided in **Section 5.9.1**.
3	Dust suppression and containment	• Refer to AMP. • Refer to AQMP. • The length of trench open at any particular location at any time is to be minimised to limit the opportunity for loose, exposed soils being present at the surface for extended periods of time that may result in generation of dust and. Trenches will be progressively rehabilitated throughout the day. • If required, the open trench will be watered down to minimise the generation of dust. In addition, regularly water all exposed unpaved surfaces at construction laydown areas (excluding stockpiles) or special crossing work sites when conditions are dry and windy, through the use of water sprays, sprinkler

ID	Category	ECM
		systems, a water cart or other suitable methods. Frequency would be determined by how quickly the surface dries out again, with higher frequency watering required on hot, dry, windy days. • Disturbed ground and exposed soils, such as inside trenches or at construction laydown areas, will be temporarily stabilised (e.g. with geotextile) prior to extended periods of site inactivity and permanently stabilised as soon as possible to minimise the potential for erosion. • Minimise drop heights from excavators when placing spoil into trucks or onto stockpiles to reduce the potential for dust generation. • Refer to surface runoff controls in the SWMP.
4	Odour suppression and monitoring	• Refer to AQMP. • If odours from impacted soils are encountered during excavation works, monitoring of ambient air with a volatile organic compound gas detector (e.g. photoionisation detector [PID]) will be conducted in accordance with the SWMS/JSA. • In excavations adjacent to (Arlington Oval, Marrickville Park, Henson Park) or within former landfills (Camdenville Park and Sydney Park), then additional monitoring with a landfill gas meter will be undertaken (Refer to Section 5.9.1 and SSLGMP). • Excessive odour emissions may be mitigated by odour suppression controls, such as covering odorous materials or perimeter misting systems.
5	Personal protection equipment (PPE)	• Use PPE to minimise direct contact with soils, inhalation of dust or LFG generated during the handling of contaminated soil or excavation in landfill material. Appropriate PPE will be detailed in the SWMS/JSAs and include, at a minimum, PPE (and procedures for proper use of PPE) to minimise direct contact with contaminated media including gloves, long-sleeved tops, long trousers and safety glasses. Additional PPE may be required where asbestos is present (refer to the AMP). • Refer to AMP and SSLFGMP for specific PPE requirements.
6	Training and supervision	• Refer to **Section 6.2** (training and induction), **Section 6.1** (roles and responsibilities) and specific training requirements in CSWMP and CEMP.
7	Sediment and erosion control	• Refer to ESCP.
8	Management of surface water runoff	• Refer to ESCP and SWMP.
9	Stockpile management and separation	• Excavated contaminated materials will be placed on temporary, impermeable barriers (e.g. builders' plastic) or pavement to protect underlying surface soils from potential cross-contamination. • Excavated materials will be stored in stockpiles in accordance with guidelines in the TransGrid Environmental Handbook. • Soils that appear different (e.g. inclusion of anthropogenic material, different colour, different texture, different odour) should be stockpiled separately.

ID	Category	ECM
		• Suspected or identified ASS material stockpiles will be segregated and managed in accordance with the ASSMP. • Non-active (i.e. not in use for more than 24 hours) stockpiles will be covered with a tarpaulin or alternative geotextile to prevent generation of dust and limit runoff from soil stockpiles during rainfall events. • Fully cover and protect exposed stockpiles with plastic sheeting when the work area is not occupied to prevent generation of dust, reduce odours and provide protection during rainfall. • Provide a suitable barrier around stockpiles to minimise sediment runoff during rainfall. This will be in accordance with the ESCP.
10	Spoil and excavation management	• Excavated material from trenches assessed to be suitable for use (refer to **Section 5.1**) will be reinstated into its originating position if required for excavation backfill. Trenches will be backfilled immediately following laying of conduits. • If excess spoil requires off-site disposal, or excavated spoil comprises ASS or is not suitable for re-use, then waste classification of the spoil must be undertaken in accordance with **Section 5.1.1**. In the event that materials are to be disposed off-site, a waste and materials tracking log will be maintained (refer to **Section 5.5**). • If the volume of suitable site-won excavated soil is insufficient, then appropriately classified imported materials (refer to **Section 5.2)** will be used. • In areas of identified contamination, excavation works will continue to "chase out" contaminated materials, to the extent practicable, within the planned trench extent. • Contaminated soils or asbestos (if any) remaining at boundaries of excavations required for the project area will not be removed, but will be characterised by asbestos clearance and validation, with the nature and location of remaining contamination recorded. • As outlined in the AMP, a marker layer will be placed along the length of any walls or floor of the trench where residual asbestos or other contamination remains. This aims to provide a visual aid to future construction or maintenance workers that residual asbestos / contamination is present along the trench walls or floor and that appropriate health and safety protocol should be followed. • The surface of trenches in areas of potential landfill gas impact will be constructed as outlined in the SSLGMPs. In other areas, The surface of trenches will be pavement, imported VENM or, if site-won suitable soils, free of any anthropogenic material. •
11	Material tracking and records.	• Refer to **Section 5.5**. • Refer to AMP and ASSMP. • CWMP.
12	Situation responsiveness	• If unexpected contamination is encountered, then works are to cease, and the unexpected finds protocol is to be followed (refer to the UCLAFP). • Site works will be delayed during windy conditions (i.e. when airborne dust is visible and persistent at the works area boundary) to reduce the potential for unacceptable quantities of disturbed soils to become

ID	Category	ECM
		airborne. The forecast weather conditions will be included in daily toolbox talks and construction planning. Refer to the AQMP. • Site works will be delayed during heavy rainfall to reduce the potential for exposed soils to be washed away from the work area causing erosion and sedimentation. Rainfall forecasts will be monitored daily during construction and works rescheduled if necessary and as determined by the contractor.
13	Water management	• No uncontrolled discharge of any solid or liquid substances is to enter into gutters, stormwater inlets/ drains, drainage lines or watercourses. Refer to sediment and surface water procedures and controls in the ESCP and SWMP, respectively. • Water collected during construction (e.g. during dewatering or surface water inflows to the trench or pits) will be collected and discharged or disposed of in accordance with the procedures and water quality objectives outlined in the GMS. • Contaminated water captured during construction will be treated or disposed of at an appropriately licensed facility in accordance with the procedures and water quality objectives outlined in the GMS. • Dewatering of excavations in small portions of the project may be required to enable construction, particularly at select under-bore special crossings. Procedures and controls to assess dewatering requirements and mitigate possible impacts are outlined in the GMS.
14	Incident response	• Refer to **Section 6.5**.

5.5 Spoil Waste Management and Transport (CT5)

The below ECMs address EMMM CT5 (Spoil waste management and transport) in the EIS.

Spoil which has been assessed as not suitable for reuse or cannot be reused will be classified, transported, tracked and disposed in accordance with the NSW EPA (2014) *Waste Classification Guidelines* and *Protection of the Environment Operations (Waste) Regulation 2014*. The spoil will be transported to an appropriate waste disposal facility licensed to receive such waste. Approval will be obtained from the respective landfill facility prior to transport and will require an estimate of the likely volume of waste to be disposed.

Waste tracking of materials containing asbestos under *Protection of the Environment Operations (Waste) Regulation 2014* shall be conducted.

The following material handling requirements will be implemented for trucks transporting materials off-site:

- A licensed transporter will be used to transport material to an appropriately licensed NSW EPA waste facility.
- All truck loads will be filled to the correct level and not over filled.
- Trucks carrying waste materials will be covered prior to exiting the work site and will remain covered until authorised to unload at the destination.
- Trucks will be fitted with seals to ensure that the movement of potentially saturated materials is undertaken appropriately. The integrity of the seals will be inspected and tested prior to commencement of each day's haulage works.
- In the event that materials are tracked or spilt outside of the construction zone, soil will be immediately cleaned up in a way that prevents contamination of land, the stormwater or waterways.
- All truckloads and landfill waste tickets/dockets will be tracked and a register completed to reconcile and check spoil has been lawfully disposed.
- Construction vehicles and mobile plant will use designated haulage and access routes, where practicable, and traffic speeds at work sites will be restricted to limit the generation of dust from vehicle movements.

Temporary spoil stockpiles may be stored at the construction laydown area.. As the preference is to classify spoil in-situ prior to excavation, the stockpiled material will already be classified. If not, then further waste classification of the stockpiled material should be undertaken in accordance with NSW EPA (2014) *Waste Classification Guidelines.*

Stockpiles will be kept separate based on their classification and subject to material tracking.

Stockpiles will be managed with appropriate sediment and erosion controls (refer to the ESCP).

The material tracking system should allow identification of all excavations, stockpiles and filling areas, and enable soils to be tracked from 'cradle to grave'. The minimum requirements for each load of material should be as follows:

- Record the date of soil movement.
- Identify the source and location of the waste soil (excavation, stockpile or imported).
- Provide a description of the material type.
- Estimate the approximate volume.
- Identify the destination for material moved (backfill, stockpile or off-site disposal).

Should the material be disposed off-site, a certificate of disposal to landfill should be included with the material tracking system.

5.6 Asbestos Management (CT6)

This section addresses EMMM CT6 (asbestos management) in the EIS.

Asbestos containing material (ACM) has been identified during preliminary site investigations and is also suspected at certain locations along the transmission cable route (refer to **Section 3.2.1**). Risks from excavating, handling and disposing of these materials can be managed through following the ECMs provided in the AMP. The AMP includes additional air monitoring, clearance and waste disposal requirements specific to ACM – these are also outlined in ECMs above in **Sections 5.1, 5.4 and 5.5** (above).

If suspected ACM is identified in other locations along the transmission cable route, the procedures in the UCLAFP shall be implemented.

5.7 Acid Sulfate Soils (CT7)

This section addresses EMMM CT7 (acid sulfate soils) in the EIS.

ASS have been identified during preliminary site investigations and are also suspected at certain locations along the transmission cable route (refer to **Section 3.2.2**). Risks from excavating, handling and disposing these materials can be managed through following the procedures provided in the ASSMP. The ASSMP includes additional handling, treatment and waste disposal requirements specific to ASS – these are also outlined in ECMs above in **Sections 5.1, 5.4 and 5.5** (above)The ASSMP includes

5.8 Unexpected Finds (CT8)

This section addresses EMMM CT8 (unexpected finds) in the EIS.

An unexpected find is potential contamination that was not previously identified during the EIS or pre-construction investigations and includes observations of stained soils, odorous soils or groundwater, potential ACM or other anthropogenic inclusions, or hydrocarbon sheens / free phase liquids on groundwater.

If unexpected finds are encountered, then follow the procedures outlined in the UCLAFP.

5.9 Former Landfill Management (CT9)

The transmission cable route passes through and close to former landfills (refer to **Section 3.1**). Managing the risks associated with excavating in former landfills is discussed below and has been divided into areas with potential risks (**Section 5.9.1**) and known risks (**Sections 5.9.2** and **5.9.3**).

Methane can be one of the constituents of landfill gas. Methane is a colourless, odourless gas which is lighter than air. It is explosive at concentrations between 5-15 % in air. At these concentrations, methane can be easily ignited by sparks or flames (e.g. sparking equipment such as electrical equipment on excavators). Methane dilutes rapidly with the surrounding air, and concentration rapidly decreases with the distance from the emission source (e.g. a test pit or trench).

The one per cent of trace components found in landfill gas are what produces the distinctive odour that many people alike to rotten eggs. This is largely due to the presence of hydrogen sulphide.

Soil and groundwater / leachate contamination may also be present, dependent upon the nature of materials placed during filling.

This section addresses EMMM CT9 (former landfill management) in the EIS.

5.9.1 General Controls

Based on the location of the transmission cable route and Arlington Oval, Marrickville Oval and Henson Park, trenching in these areas is not expected to directly encounter landfill waste.

However, given the uncertainty of the exact boundaries of the former landfills in these locations, general ECMs to manage the potential risks during project construction in these areas include:

- No worker should be allowed to work alone at any time in or near to any excavation. At least one other worker should be available to assist with a rescue if needed or to seek further assistance.
- Smoking, naked flames and all other unauthorised sources of ignition sources are prohibited in the vicinity of any excavation near a former landfill. 'No smoking' and 'No naked flame' notices should be posted prominently on the construction site and, if necessary, special areas designated for smoking.
- Hot works should be avoided within and in close proximity to excavations unless conducted under a controlled 'permit to work' procedure - refer to the CEMP.
- Personnel entry to excavations should be minimised or eliminated, whenever possible.
- Work upwind of excavations whenever possible to reduce worker exposure to landfill gas.
- All excavations should be monitored for the presence of landfill gases. This can be done with an intrinsically safe electronic gas detection meter that measures methane, oxygen, hydrogen sulfide and carbon monoxide. Monitoring should be undertaken, at a minimum hourly, both within the trench, to assess potential risk to workers in the trench from accumulated vapours, as well as at the surface. The below table details the cease work and recommencement trigger levels for methane, carbon monoxide, oxygen and hydrogen sulphide.

Table 5-4: Landfill gas and VOC trigger levels

Constituent	Cease Work Trigger Level	Recommence Work Trigger Level	Measurement Device	Monitoring Frequency
Methane	≥5% LEL	<5% LEL	Inspectra Laser	Hourly
Oxygen	<19.5% or >23.5%	>19.5% and <23.5%	Inspectra Laser	Hourly
Carbon monoxide	>30 ppm	<30 ppm	Inspectra Laser	Hourly
Hydrogen Sulphide	≥ 10 ppm	< 5 ppm	Inspectra Laser	Hourly

- Should any trigger levels be exceeded, then work should cease, machinery switched off, personnel evacuate the area, the exceedance investigated and a risk assessment conducted.
- If gross contamination (e.g. anthropogenic materials, soil staining or hydrocarbon/solvent odours) are detected, then work will stop and follow the procedures outlined in the UCLAFP.

5.9.2 Sydney Park

Preliminary investigations along the transmission cable route through Sydney Park identified that building waste and domestic waste will likely be encountered (refer to **Section 3.3.2**). Although these investigations also indicated that landfill gas measurements were very low to negligible, potential inhalation and explosive risks remain given that Sydney Park was declared significantly contaminated land by the NSW EPA due to methane and carbon dioxide concentrations in ground gas.

Risks of excavating in Sydney Park can be managed through following the ECMs provided in the Sydney Park SSLGMP (**Appendix 1**).

TransGrid will undertake additional investigations at Sydney Park on leachate and methane risks during construction and will report these findings to the City of Sydney as required by EMMM CT10. [3]

5.9.3 Camdenville Park

Previous investigations at Camdenville Park have identified contamination by waste materials (refer to **Section 3.3.3**).

Risks of excavating in Camdenville Park can be managed through following the ECMs provided in the Camdenville Park LGMP (**Appendix 2**).

5.10 Groundwater

In locations where groundwater is encountered and dewatering is required, the ECMs outlined in the GMS will be followed. The principal goals of pre-construction ECMs are to:

- Identify the locations and nature of project excavations where groundwater may be intersected and assess:
    - dewatering requirements; and
    - nature of possible groundwater contamination.
- Incorporate design features that mitigate possible impacts to groundwater during operation.

Information from pre-construction ECMs and detailed design will be used to develop specific construction methods, refine the CSWMP, prepare DMP(s) and obtain associated licences / permits (if required) for dewatering. Groundwater management ECMs during construction will include implementation of the detailed design, construction methods and management plans developed in preceding stages, monitoring, documentation and compliance management.

5.11 Drilling Slurry

Drilling of monitoring bores (as may be required by the GMS) and underbore special crossings shall be undertaken by suitably qualified and experienced drillers in accordance with National Uniform Drillers Licensing Committee (2011) *Minimum Requirements for Water Bores in Australia*.

Drilling slurry generated during the underboring at Cooks River and Sydney Park will either be disposed off-site in accordance with the NSW EPA (2014) *Waste Classification Guidelines* or beneficially re-used through application to land in accordance with an appropriate NSW EPA approved resource recovery exemption, such as:

[3] Edit made post Site Audit Statement 0503-2010 dated 27 July 2020

- NSW EPA, 2014. *Resource Recovery Order: The treated drilling mud order 2014* and NSW EPA, 2014. *Resource Recover Exemption: The treated drilling mud exemption 2014*.

5.12 Summary of Contaminated Land Environmental Control Measures

Details on the ECMs to investigate, assess and manage contaminated soils, groundwater and/or landfill gas in the project area are provided in the preceding sections. **Table 5-5** provides a summary of each of the ECMs along with a reference to detail about each ECM and which CoA and/or EMMM is addressed. **Table 5-5** can be utilised as a 'quick guide' to ECMs to investigate, assess and manage contaminated land during the project.

Table 5-5: Summary of Contaminated Land ECMs

Description	ECM and/or Other Plan Reference	Timing	Addressed CoAs and EMMs
Assessment of excavation areas and SAQP	Section 5.1 Section 5.1.4	Pre-construction in specific areas	CoA E18 (a, b) CoA E20 (d, e, f, g) EMMM CT1
Waste classification	Section 5.1.1 Section 5.1.2	Pre-construction in specific areas	CoA E18 (a, b) EMMM CT1
Acid sulfate soil	Section 5.1.3 ASSMP	Pre-construction in specific areas	CoA E18 (b) CoA E20 (d) EMMM CT1
Assessment of VENM	Section 5.2	During construction	CoA E20 (e) EMMM CT2
Construction laydown areas	Section 5.3	Pre-construction	CoA E18 (a, b) CoA E20 (e) EMMM CT1, CT3
Contaminated soil management during construction			
Air monitoring	Table 5-3 AMP AQMP SSLFGMP	Construction	CoA E18 (a, b) CoA E20 (e, f) EMMM CT4, CT9
Exclusion zones and decontamination	Table 5-3 AMP	Construction	CoA E18 (a) CoA E20 (e, f) EMMM CT4, CT6
Excavation ventilation	Table 5-3 Section 5.9 Sydney Park SSLFGMP Camdenville Park SSLFGMP	Construction	CoA E18 (a, b) CoA E20 (e) EMMM CT4, CT9
Dust suppression and containment	Table 5-3 AMP AQMP	Construction	CoA E18 (b) CoA E20 (e, f) EMMM CT4
Odour suppression and monitoring	Table 5-3 AQMP	Construction	CoA E18 (b) CoA E20 (e) EMMM CT4

Description	ECM and/or Other Plan Reference	Timing	Addressed CoAs and EMMs
PPE	Table 5-3 AMP Sydney Park SSLGMP Camdenville Park SSLGMP	Construction	CoA E18 (b) CoA E20 (e) EMMM CT4
Training and supervision	Section 6.1 Section 6.2 CSWMP CEMP	Pre- and during construction	CoA E18 (b) CoA E20 (e) EMMM CT4
Sediment and erosion control	ESCP	Construction	CoA E18 (b) CoA E20 (a, b, e) EMMM CT4
Management of surface water	ESCP SWMP	Construction	CoA E18 (b) CoA E20 (a, b, e) EMMM CT4
Stockpile management and separation	Table 5-3	Construction	CoA E18 (b) CoA E20 (e) EMMM CT4
Spoil and excavation management	Table 5-3 Section 5.1.1 Section 5.2 Section 5.5	Construction	CoA E18 (b) CoA E20 (e) EMMM CT4
Material tracking and records	Section 5.5 AMP ASSMP	Construction	CoA E18 (b) CoA E20 (e) EMMM CT4
Situation responsiveness	Table 5-3 UCLAFP CSWMP CEMP	Construction	CoA E18 (b) CoA E20 (e, g) EMMM CT4
Water management	Table 5-3 GMS ESCP	Construction	CoA E18 (b) CoA E20 (a, b, e) EMMM CT4
Incident response	Section 6.5 CSWMP CEMP	Construction	CoA E18 (b) CoA E20 (e, g) EMMM CT4

Description	ECM and/or Other Plan Reference	Timing	Addressed CoAs and EMMs
Spoil waste management and transportation	Section 5.5 ASSMP AMP	Construction	CoA E18 (b) CoA E20 (e) EMMM CT4, CT5
Asbestos management	Section 5.6 AMP	Pre- and during construction	CoA E18 (b) CoA E20 (e, f) EMMM CT4, CT5, CT6
Acid sulfate soils	Section 5.7 ASSMP	Pre- and during construction	CoA E18 (b) CoA E20 (d, e) EMMM CT4, CT5, CT7
Unexpected finds	Section UCLAFP	Construction	CoA E18 (b) CoA E20 (e. g) EMMM CT8
Former landfill management			
General	Section 5.9.1	Construction	CoA E18 (b) EMMM CT9
Sydney Park	Section 5.9.2 SSLGMP	Pre- and during construction	CoA (E18 (a, b) EMMM CT9
Camdenville Park	Section 5.9.3 SSLGMP	Pre- and during construction	CoA (E18 (a, b) EMMM CT9
Groundwater	Section 5.10 GMS	Pre- and during construction	CoA E18 (a, b) CoA E20 (c, e) EMMM CT10
Drilling slurry	Section 5.11 CSWMP	Construction	EMMM CT11

6 Compliance Management

6.1 Roles and Responsibilities

The project organisational structure and overall roles and responsibilities are outlined in the CEMP.

Key roles and responsibilities relevant to the management of contamination are identified in **Table 6-1**.

Table 6-1 Roles and Responsibility

Role	Authority and Responsibility
Environment and Sustainability Manager	• Oversee implementation and compliance with this CLMP and other environmental management plans (AMP, ASSMP, UCLAFP, GMS). • Complete inspections and monitoring (**Section 6.4**). • Complete reporting. • Identify additional controls relevant to work activities involved with construction activities. • Facilitate an induction and training program for all key personnel. • Carry out environmental audits during construction work to verify compliance with this CLMP, and report findings to the Project Manager. • Respond to contamination or pollution incidents and non-conformances. • Update CLMP as required.
Contamination and Landfill Gas Environmental Professional	• Prepare site-specific landfill gas management plans for Camdenville Park and Sydney Park. • Prepare information for Site Audit Statement (refer to CoA E18). • Undertake landfill gas or vapour monitoring, where required.
Site Auditor	• Prepare a Site Audit Statement in accordance with CoA E18. *"…prepare a Site Audit Statement(s) in accordance with the Contaminated Land Management Act 1997, confirming that the proposed measures in the Contaminated Land Management Plan required under Condition E20 are appropriate to manage contaminated soils, groundwater and/or landfill gas in:* *(a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters; and* *(b) any additional or unexpected areas of contamination identified during the development..."*
Civil Project Manager	• Review and provide resources to implement the controls identified in this CLMP.
Site Manager	• Install and maintain environmental control in accordance with CLMP and other relevant environmental management plans. • Attend inspections with the Environment and Sustainability Manager, Contamination and Landfill Gas Environmental Professional or other stakeholders, as required. • Implement corrective actions raised during environmental inspections in agreed timeframes. • Obtain and comply with Water Discharge Permits prior to any discharge of water from site.

Role	Authority and Responsibility
	• Notify the Environment and Sustainability Manager of any observations or indications of contamination, such as staining, odours, sheens or presence of potential asbestos.
All personnel	• Notify the Site Manager of any observations or indications of contamination, such as staining, odours, sheens or presence of potential asbestos. • Carry out work in accordance with the requirements of this CLMP in conjunction with the latest drawings issued for construction. • Exercise due care, skill and foresight when carrying out assigned tasks. • Immediately report all contamination or pollution incidents to Site Manager. • Comply with all permits, approvals and subsequent plans associated with these works. • Be able to confirm attendance at training and locate a copy of this CLMP on site, if requested. • Implement corrective actions which have been approved by Environment and Sustainability Manager and Site Manager.

6.2 Training & Induction

All project personnel (including TransGrid's staff and subcontractors) will only be permitted to perform project works if they have had the following trained and inducted. All project personnel are required to:

- complete a full site-specific induction from TransGrid, including an environmental component.
- agreed to work under the constraints of this CLMP.
- have read and understood all relevant TransGrid site-specific SWMS for the project site work.
- relevant construction staff attended the daily pre-start toolbox talk where aspects of environmental protection and worker's safety are discussed.

The induction training will address elements related to contamination management, including:

- Existence and requirements of this CLMP.
- Relevant legislation and regulations.
- Environmental and occupational health and safety risks associated with contaminated materials.
- Roles and responsibilities for contamination management.
- The location of known or suspected contaminated soil and management protocols (refer to **Section 5**).
- The location of known or suspected asbestos and management protocols (refer to AMP).
- The location of known or suspected potential or actual ASS and management protocols (refer to ASSMP).
- Landfill gas trigger levels, actions and management protocols (**Section 5.9.1** and SSLGMP [**Appendix 1** and **Appendix 2**]).
- Unexpected finds protocol.
- Complaints response and reporting.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in contamination management; including but not limited to.

- Erosion and sediment control planning and installation methodology.
- Dust and air quality control planning.
- Noise control planning.

In areas where contamination is known or considered possible (refer to sections of precincts identified in Table 5 1) or should contamination be unexpectedly discovered during the project, personnel involved in the investigation, remediation and/or management of the contamination will receive a toolbox informing them of the site-specific controls required for the works, including:

- Site access restrictions.
- Correct use of PPE.
- Decontamination procedures.
- Use of monitoring equipment.
- Waste handling procedures.
- Water quality and leachate controls.
- Dust control and performance measures.

Daily pre-start meetings conducted by the Site Manager will inform the site personnel of any environmental issues relevant to contamination that could potentially be impacted by, or impact on, the day's activities.

Further details regarding staff induction and training are outlined in the CEMP.

6.3 Complaints Management

TransGrid has developed a Complaints Management System (CMS) to document the overall approach to complaints management for the Project. TransGrid will adopt the requirements of the CMS, including reporting requirements. The CMS includes a Complaints Register which will record the details of all complaints relating to the Project.

Further detail about the CMS is provided in of the CEMP.

6.4 Monitoring, Inspections and Testing

Monitoring, inspections and testing requirements relevant to the management of contamination will include, but not be limited to:

- Investigation of the locations identified in **Table 5-1** and **Table 5-2** in accordance with the ASC NEPM and requirements of the EIS.
- if required under the AMP, asbestos fibre monitoring and personal exposure asbestos fibre air monitoring for workers in accordance with NOHSC (2005) and Safe Work Australia (2018).
- Landfill gas monitoring (SSLGMP)
- Water discharge quality monitoring (GWS)
- Sampling and analysis of excess soil prior to removal in accordance with Waste Classification Guidelines (2014).
- Sampling and analysis of potential or actual ASS to determine liming rates.
- End of use investigation at construction laydown areas.
- Sampling of leachate, groundwater or collected surface water prior to off-site disposal or permitted discharge.

Regular inspections of areas with known or suspected contaminated soil, asbestos, ASS will occur for the duration of the Project. Informal daily visual monitoring of excavation activities will be carried out by the plant operators and supervisors for any signs of previously unidentified contamination for the duration of the Project. Contaminated land inspections will be undertaken as part of the weekly environmental inspections.

Overarching requirements and responsibilities in relation to monitoring and inspections are documented in the CEMP.

Inspections to be carried out are outlined in **Table 6-2**.

Table 6-2: Contamination Inspection Program

Inspection	Responsibility	Frequency
Inspect all plant and equipment for leakages of fuel, oil of other liquid. Request that any leaks are repaired before plant and equipment is used. Record of inspections is to be maintained.	Site Manager	Daily
Complete inspections and testing of VENM source site and delivered loads of VENM to confirm consistency of material in accordance with **Section 5.2**.	Contaminated Land Consultant/Professional	As required
Inspection of waste disposal activities and review of disposal documentation. Inspection and sampling of excess spoil for waste classification purposes.	Contaminated Land Consultant/Professional	Daily As required
Complete inspections to confirm completion of asbestos removal works and allow issuance of asbestos clearance certificates.	Qualified Asbestos Occupational Hygienist	As required
Setup and inspection/sampling of asbestos monitoring equipment during excavation works in known or suspected asbestos impacts areas. Refer to **Table 3-1** and AMP.	Qualified Asbestos Occupational Hygienist	Daily (in asbestos areas)
Inspection of bunded areas, ASS treatment areas and stockpile locations.	Environment and Sustainability Manager Site Manager	Weekly Daily during ASS treatment.
Inspection of unexpected contamination or asbestos finds	Contaminated Land Consultant Environment and Sustainability Manager	As required.

6.5 Incident Response

Response to incidents will be undertaken as described in the CEMP and in accordance with the TransGrid Environmental Incident Classification and Reporting Procedure (refer to Appendix A7 of the CEMP).

A Pollution Incident Response Management Plan (CEMP - Appendix B11) has been developed to minimise the impact of spills including details on the requirements for managing, cleaning up and reporting.

6.6 Audits

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental control measures, compliance with this CLMP, CoA and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in the CEMP.

6.7 Non-Conformances

A non-conformance is the failure or refusal to comply with the requirements of project system documentation, including this CLMP. Any member of the Project team may raise a non-conformance or improvement opportunity.

The TransGrid Quality Plan describes the process for managing non-conforming work practices and initiating corrective / preventative actions or system improvements in accordance with the process outlined in the CEMP.

6.8 Licenses and permits

The relevant council and adjacent landowners should be notified (as set out in the project's communication plan) prior to construction in their particular area.

The designated Contaminated Land Consultant should be a qualified Certified Environmental Practitioner (Contamination Specialist). Other specific licenses and permit requirements are detailed in the AMP and ASSMP.

7 Review and Improvement

7.1 Continuous improvement

The program for continuous improvement is contained within the CEMP.

Continuous improvement of this CLMP will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for identifying opportunities for improvement.

7.2 Update and Amendment

The program for continuous improvement is contained within the CEMP.

This CLMP will be updated as required. Updates or revision may be triggered by:

- receipt of results from additional investigations conducted prior to commencement of works in areas with data gaps;
- result of any investigations into any exceedances or non-conformances that determine changes to this plan are required to prevent recurrences;
- to take into account changes to the environment or generally accepted environmental management practices, new risks to the environment or changes in law;
- where requested or required by the NSW Department of Planning and Environment or any other Authority; or
- in response to internal or external audits.

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Appendix 1 – Sydney Park Landfill Gas Management Plan

[To be submitted following Site Auditor endorsement]

TransGrid PSF Project

330kV Feeder Replacement

Appendix 4 – Sydney Park: Site Specific Landfill Gas Management Plan

Amendments Register

Rev	Date	Description	Prepared	Reviewed	Approved
0	9-Jun-20	Draft	Senversa	TransGrid	-
1	19-Jun-20	Draft	Senversa	Site Auditor	-
2	30-Jun-20	Draft	TransGrid	-	-
3	14-Jul-20	Draft	Senversa	Site Auditor	-
4	31-Jul-20	Final – For Information Removal of draft watermark and update to header	Taihan	Taihan	Taihan

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Abbreviations and Acronyms

Abbreviation/ Acronym	Expanded term
AMP	Asbestos Management Plan
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASSMP	Acid Sulfate Soils Management Plan
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CH_4	Methane
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoA	Conditions of Approval
COPC	Contaminants of Potential Concern
CNVMP	Construction Noise and Vibration Management Plan
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DPIE	Department of Planning Infrastructure and Environment
ECM	Environmental Control Measures
EIS	Environmental Impact Statement
EMMM	Environmental Management and Mitigation Measure
EMS	Environmental Management System
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Management Strategy
GMS	Groundwater Management Strategy
H_2S	Hydrogen Sulphide
HDPE	High Density Polyethylene
LEL	Lower Explosive Limit
NSW	New South Wales
OOHW Protocol	Out-of-hours work Protocol
ppm	parts per million
PSF	Powering Sydney's Future
SPLGMP	Sydney Park Landfill Gas Management Plan
STEL	Short Term Exposure Limit
SWMP	Surface Water Management Plan
TCP	Traffic Controls Plans
TWA	Time Weighted Average
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure
UEL	Upper Explosive Limit
VOC	Volatile Organic Compounds
v/v	volume/volume

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction and installation of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

As part of the Conditions of Approval (CoA) associated with the project from the New South Wales (NSW) Department of Planning, Infrastructure and Environment (DPIE), a Contaminated Land Management Plan (CLMP) is required to be developed to document the requirements to mitigate exposure to contamination and the potential health related risks to personnel working on or visiting the area and surrounding environment during construction.

This Sydney Park Site Specific Landfill Gas Management Plan (SPLGMP) has been prepared to complement the overarching CLMP, specifically to document requirements to mitigate and manage the health and explosion risks posed by landfill gas during construction and installation of the 330kV underground cables in the former landfill area of Sydney Park (project area). Appendix A contains the monitoring data considered in the preparation of this CPLGMP and Appendices B and C contain the 'Transmission cable trench design' and the 'Transmission cable route' respectively.

1.1 Context

This SPLGMP has been prepared to document the procedures to be undertaken to manage landfill gas when encountered during construction works, and is an appendix to the CLMP. The CLMP forms part of the Construction Soil and Water Management Plan (CSWMP), which in turn forms part of the Construction Environment Management Plan (CEMP). Implementation of the SPLGMP will ensure that landfill gas encountered during construction of the project is managed in such a way as to avoid harm to human health and the environment.

This SPLGMP has been developed in accordance with:

- the requirements of the Minister's CoA for:
  - E20 (e), being for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area.
  - E18, being appropriate to manage contaminated soils, groundwater and/or landfill gas in (a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters (b) any additional or unexpected areas of contamination identified during the development;
- the Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) as documented in the Amendments Report.
- relevant legislation;
- NSW Environmental Protection Authority (EPA) made or approved guidelines (including the waste guidelines); and
- industry codes of practice.

1.2 Objectives and Scope of the SPLGMP

This SPLGMP describes the procedures and protocols TransGrid will implement for assessing and managing landfill gas in the project area.

Specifically, this SPLGMP describes the requirements for management of risk from landfill gas as well as monitoring requirements, action levels and measures for managing exceedances of the action levels.

This SPLGMP applies for any work carried out by workers and/or contractors within the project area. All work undertaken in the project area shall be conducted in accordance with the relevant legislation and in conjunction with the requirements of this SPLGMP over the full duration of the construction program.

1.3 Project Environmental Management System Overview

The Project Environmental Management System (EMS) is described in **Figure 1-1: Project Environmental Management System Figure 1-1: Project Environmental Management System.**

To achieve the intended environmental performance outcomes, TransGrid has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, including this SPLGMP, procedures, protocols and tools as set out below and illustrated in **Figure 1-1: Project Environmental Management System**.

1.4 Consultation for Preparation of SPLGMP

Consultation between TransGrid and stakeholders, the community and relevant agencies will be undertaken prior to and during construction of the project as required. The process and frequency for consultation is documented in the CEMP.

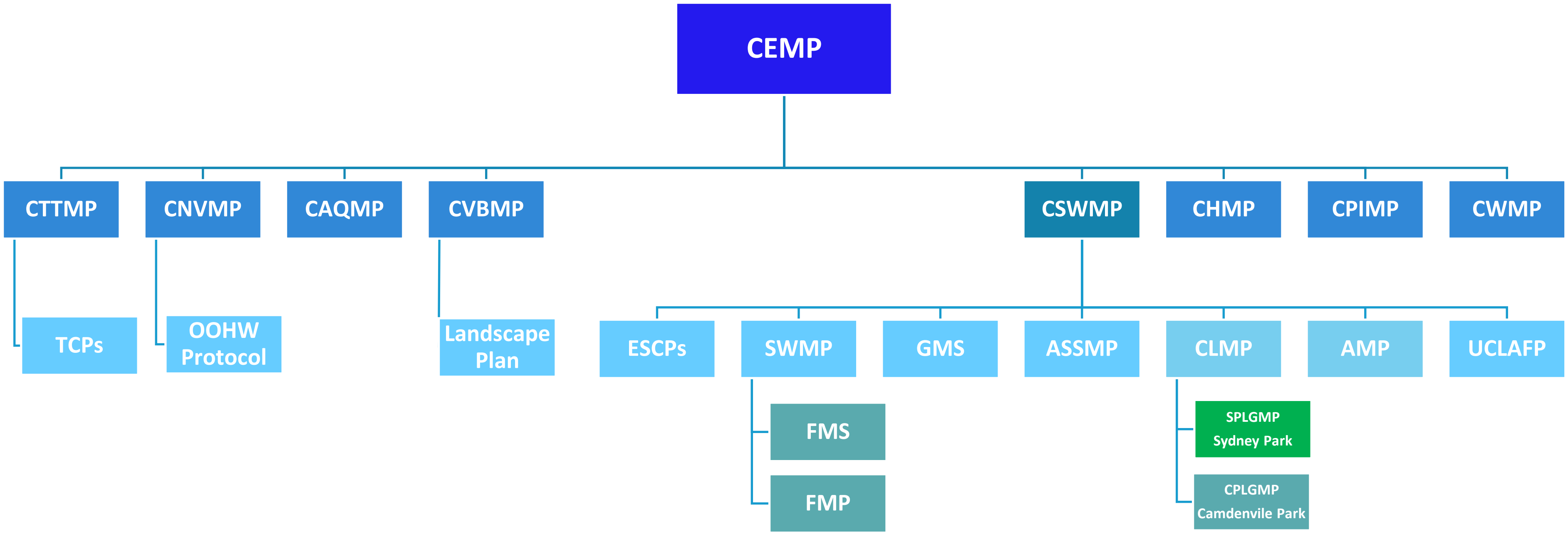

Figure 1-1: Project Environmental Management System

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the SPLGMP include:

- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment* (ASC NEPM).
- NSW EPA, 2019. *Assessment and management of hazardous ground gases: Contaminated Land Guidelines*.
- NSW EPA, 2016. *Environmental Guidelines, Solid Waste Landfills*.
- NSW EPA, 2014. *Waste Classification Guidelines.*
- NSW Government, 2019. Code of Practice – Confined Spaces
- NSW Government, 2019. Code of Practice – Construction Work
- Safe Work Australia, 2019. Workplace Exposure Standards for Airborne Contaminants
- TransGrid, 2016. *Environmental Handbook*
- TransGrid Guidelines and Procedures

2.3 Condition of Approval

The SPLGMP is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 (e) Contaminated Land Management Plan, for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area.

Specifically, the SPLGMP will be one of the documents reviewed by the EPA accredited site auditor engaged by TransGrid, who will prepare a Site Audit Statement to meet the Conditions of Approval from the DPIE (2020) described below.

E18 Contaminated Land, The Proponent must engage an EPA accredited site auditor to prepare a **Site Audit Statement(s)** in accordance with the *Contaminated Land Management Act 1997*, confirming that the proposed measures in the **Contaminated Land Management Plan** required under **Condition E20** are appropriate to manage contaminated soils, groundwater and/or landfill gas in: (a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters; and (b) any additional or unexpected areas of contamination identified during the development.

E19 Contaminated Land, A copy of the **Site Audit Statement** must be submitted to the Planning Secretary and the relevant council(s) for information prior to the commencement of construction in the area to which the Statement applies.

2.4 Environmental Mitigation and Management Measures

The SPLGMP has been developed to include the EMMMs detailed in the EIS Amendment Report and presented in **Table 2-1** below.

Table 2-1: Environmental Mitigation and Management Measures

Impact	ID	Measure
Former landfill management	CT9	Site-specific management plans for former landfill sites will be required for excavation works in Sydney Park and Camdenville Park. A plan may also be required for Henson Park following the outcome of investigations (see CT1). The development of the plans will include consultation with the relevant councils. Approval will be sought from the NSW EPA in all areas where exhumation of landfill waste is required in accordance with Clause 110A of the *Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation)*. Where there are existing environmental management plans, such as for Camdenville Park, site-specific mitigation measures outlined in these plans will be reviewed and implemented as required. The plan will be prepared by a contaminated land consultant and occupational hygienist. The plan will specify: • an excavation plan specifying areas classified as per in-situ waste classification and suitability for reuse; • trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (also refer to AQ12); • ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds; • action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented; • exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh fences with bracing, where required; • geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable; • final capping layer above the concrete cable conduit casing as per the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016), unless otherwise specified or agreed by with City of Sydney and Inner West Council: ○ compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic

Impact	ID	Measure
		conductivity of less than 1 x 10–9 metres/s (where subsurface waste either side of the trench is less than; ○ a revegetating layer from the top of the capping layer to the surface comprising clean soils with 200 mm of topsoil (in landscaped areas); and ○ the construction of joint bays, link boxes and sensor pits within former landfill areas will be designed to prevent the accumulation of landfill gases. Inner West Council and City of Sydney Council will be consulted on the design, monitoring and location of the pits within Sydney Park, Camdenville Park, and Henson Park (if required).
Sydney Park	CT10	TransGrid will undertake additional investigations at Sydney Park on leachate and methane risks prior to or during construction and will report these findings to the City of Sydney.
Landfill gas	AQ12	Site-specific landfill gas management plans will be prepared for works at locations with landfill gas (including Camdenville Park and Sydney Park) prior to any trenching and excavation. Further site investigations will be undertaken within the project area closest to Arlington Oval and Marrickville Park and where the project traverses Henson Park, in accordance with the *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012), to assess the presence and risk of landfill gas. If landfill gas is detected, a site-specific landfill gas management plan will be developed for any excavation works in these areas (also refer to CT9). The plans will be prepared by a suitably qualified landfill gas management specialist. The management plans will include mitigation measures to prevent human health exposure and explosive risks posed by landfill gas and nuisance odours from exposed leachate or landfill wastes. The plans will detail the type and frequency of monitoring required during the works and will outline the triggers that could stop works or require a step up in controls. Controls may include the use of odour suppressant mists and foams, and other measures deemed suitable for the local conditions of the site

3 Landfill Gas

3.1 Composition of Landfill Gas

Landfill gas is typically produced by the decomposition of organic compounds in anaerobic conditions with the composition of the gas changing depending on the stage of degradation of the organic matter and conditions within the landfill. Landfill gas associated with a putrescible landfill generally consists of approximately 60% to 70% methane and 30% to 40% carbon dioxide with a wide variety of trace gases also present. Landfill gas is a mixture and under most conditions its components do not separate into layers. However, consideration must be given to the separation of different gasses when preparing a monitoring plan. The following **Table 3-1** provides a summary of key components of landfill gas:

Table 3-1: Key components of landfill gas

Component of Landfill Gas	Characteristics
Methane (CH_4)	Methane is an odourless, flammable gas at normal atmospheric temperatures and pressures. It is explosive at concentrations of between 5.1 %volume/volume (v/v), the Lower Explosive Limit (LEL), and 16.5 %v/v, the Upper Explosive Limit (UEL). The LEL and UEL must be treated as a guide as the presence of other components within landfill gas can alter the explosive range. Methane is lighter than air.
Carbon Dioxide (CO_2)	Carbon dioxide is a colourless, odourless, non-combustible gas that is denser than air and can accumulate in confined spaces. Accumulations of carbon dioxide can create an unbreathable atmosphere in confined spaces by excluding oxygen.
Carbon Monoxide (CO)	Trace gas – colourless, odourless and toxic upon inhalation
Hydrogen Sulphide (H_2S)	Trace gas – colourless, 'rotten egg' odour (up to 0.5 parts per million (ppm) then odourless), toxic upon inhalation and flammable at concentrations ranging between 4.5% v/v and 45.5% v/v.

3.2 Hazards Associated with Landfill Gas

The key hazards associated with landfill gas are discussed below.

3.2.1 Asphyxiation

Asphyxiation is a condition of a deficient supply of oxygen to the body. An asphyxiation risk can be present when an oxygen deficient environment exists, caused by the replacement of oxygen by bulk landfill gases such as methane and carbon dioxide. The risk of an oxygen deficient environment can be increased in conditions where gases may collect due to poor ventilation, such as in excavations.

Physiological effects arising from respiration in oxygen deficient environments are provided in

[1]:

[1] LFTGN 03 – Guidance on the management of landfill gas, UK Environment Agency

Table 3-2: Physiological effects from respiration in oxygen deficient environments

Oxygen concentration (%)	Physiological effects
21	Ambient air concentration.
18	Blood saturation adequate for resting, walking and heavy work.
17	Faster, deeper breathing, slight impairment of judgement.
16	First signs of anoxia, dizziness, buzzing in ears.
12 – 16	Increased breathing and pulse rate. Muscular co-ordination impaired.
10 – 14	Emotional upset. Abnormal fatigue upon exertion.
6 – 10	Nausea, vomiting unconsciousness. Collapse may reoccur with person unable to move or cry out.
<6	Convulsions, gasping respiration, death.

3.2.2 Toxicity

The toxicity of a gas depends on the degree, nature and length of exposure to the gas. Carbon dioxide and a number of trace gases can have toxic effects if present in high enough concentrations.

A summary of toxic gases and guidance on occupational exposure levels is summarised in **Table 3-3**:

Table 3-3: Toxic Gas Occupational Exposure Levels

Component of Landfill Gas	Characteristics
Carbon Dioxide	Exposure to carbon dioxide • >3% v/v laboured breathing / headaches • 5 – 6% v/v Heavily laboured breathing and headache • 12 – 25% v/v unconsciousness • > 25% v/v death Source: *'Industry Code of Practice – The Management of Landfill Gas'*, dated March 2012.
Hydrogen Sulphide	• Repeated exposures may cause headaches, anorexia, insomnia, paralysis, meningitis, psychic troubles, slowed heart rate, bronchitis and a grey-green line on the gums. • The national exposure limits as outlined in the Safe Work Australia document titled '*Workplace Exposure Standards for Airborne Contaminants*' (18 April 2013) for hydrogen sulphide are 10ppm (8 Hour Time Weighted Average[2]) and 15ppm (Short Term Exposure Limit[3]). • Hydrogen sulphide at 200 ppm can cause immediate loss of consciousness and death in 30 - 60 minutes.

[2] During periods of daily exposure to an airborne contaminant, exposure above this value is permitted for short periods, if they are compensated for by equivalent exposures below the exposure standard during the working day. If there is a short term exposure limit (STEL) and a time weighted average (TWA) exposure standard, the STEL must also be observed.

[3] The STEL is a 15 minute TWA exposure limit which must not be exceeded at any time during an 8-hour working day, even if the exposure during the full day is less than the eight-hour TWA exposure standard. Exposures at the STEL must not be longer than 15 minutes and must not be repeated more than four times per day. There must be at least 60 minutes between successive exposures at the STEL.

Component of Landfill Gas	Characteristics
	• At 700 ppm respiratory paralysis and death can occur in seconds.
Carbon Monoxide	• Inhalation of low levels of carbon monoxide can cause headache, dizziness, light-headedness, and fatigue. Exposure to higher concentrations of carbon monoxide can cause sleepiness, hallucinations, convulsions, collapse, loss of consciousness and death. • Carbon monoxide is a poisonous gas. The national exposure limits as outlined in the Safe Work Australia document titled '*Workplace Exposure Standards for Airborne Contaminants*' (18 April 2013) for carbon monoxide is 30ppm (Time Weighted Average – 8 hours[2]).

3.2.3 Flammable/Explosive Hazards

Landfill gas potentially contains several flammable gas components, the concentration ranges at which these gases pose a risk are as follows:

- Hydrogen Sulphide flammable limits: LEL 4.5% v/v – UEL 45.5% v/v
- Methane is a flammable gas with an explosive range: LEL 5.1% - UEL 16.5%.

Concentrations of methane and hydrogen sulphide within the explosive ranges in the presence of oxygen and an ignition source (e.g. heat, sparks or a flame) can lead to a fire or explosion.

It should be noted that a methane fire is invisible and the only indication of a fire may be a heat haze effect.

4 Site Conditions and Construction Details

Sydney Park, formerly the Bedford Brick Works quarries, was filled with municipal waste between 1948 and 1976. Plans were made to convert the area into a park in 1982, and extensive landscaping and modifications were consequently undertaken to create Sydney Park as it is today.

Sydney Park is listed on the NSW EPA Record of Notices. An investigation along the proposed transmission cable route through Sydney Park (Douglas Partners, 2017) found that fill material along the length of the transmission cable route is likely to be variable, but typically comprised of sand and gravel with some building waste (bricks, glass, concrete, ceramic, metal), sandstone and some clay. Domestic waste (from the former landfill) would also be encountered within the excavation areas. Sydney Park was declared significantly contaminated land by the NSW EPA on 25 February 2019[4] due to methane and carbon dioxide concentrations in ground gas from its former use as a landfill. The Declaration states that the NSW EPA has reason to believe that the land is contaminated and that the contamination is significant enough to warrant regulation under the Act due to the following:

- The site is a former landfill and was used for the disposal of municipal waste over many years;
- The decomposition of wastes contained in the landfill are a source of ground gases, including methane and carbon dioxide;
- Concentrations of methane and carbon dioxide measured in subsurface monitoring wells at the perimeter of the park are high compared to nominated assessment criteria;
- Whilst low reported gas flow rates indicate a low risk or very low risk classification, there is the potential for offsite migration of methane and carbon dioxide via preferential pathways due to the geology of the site; and,
- Refinement of exposure pathways, more accurate calculations of flow rates and ongoing management is required to better define and manage any risks.

4.1 Presence of Landfill Gas

City of Sydney provided TransGrid with several GHD Australia Pty Ltd (GHD) quarterly monitoring reports, as well as JBS&G interim audit advice, that outline peak methane and carbon dioxide concentrations recorded within landfill gas monitoring bores located across the project area in May 2018, November 2018, February 2019, August 2019, September 2019, January 2020 and May 2020.

A summary of the maximum methane concentrations data from the reports provided is as follows:

Monitoring Event	Location	Max. Methane concentration (ppm)	Atmospheric Pressure (9am)	Atmospheric Pressure (3pm)
Nov-18	103A	239	1022.4	1018.6
Feb-19	BH14	829,000	1023	1017.2
Aug-19	T005	9,430	1023.1	1021.2
Sep-19	T002	7,800	1028.2	1026.2
Dec-19	T00C	91,000	-	-
Jan-20	T00K	534,000	1011.5	1007.1

[4] Declaration Number 20181108; Area Number 3433.

Feb-20	T008	5,500	1010.7	1011.2
Mar-20	T00K	20,000	1027.8	1026.3

Data was also provided for monitoring within sub-surface services as well as Sydney Park surface emissions. The monitoring information is provided in **Appendix A**. A review of the report in its entirety has not been possible and therefore the methodology of data collection, meteorological conditions present during data collection and the construction of the monitoring bores including the screened interval, geology screened and water levels within the monitoring bores is unknown. Senversa understands that previous audit advice has identified that there is uncertainty in whether the landfill gas monitoring data is representative of worst case conditions due to inappropriate construction and location of some monitoring bores, as well as inadequate demonstration that monitoring methodologies (including not capturing worst case meteorological conditions) were appropriate..

A summary of the monitoring data provided is as follows:

- Maximum methane and carbon dioxide concentrations of 82.9% v/v (BH14, Feb 19) and 31.1% v/v (BH14, Feb 19) were measured, respectively. No flow rate measurements were presented. It is assumed, based on the site plan presented, that all monitoring bores are installed as perimeter monitoring bores in the natural geology adjacent to the landfilled waste within Sydney Park.
- Surface emissions monitoring undertaken on the surface of Sydney Park measured a maximum concentration of 534,000 ppm (53.4% v/v) (Jan 2020).
- Monitoring within subsurface services along the alignment of the transmission cable alignment measured maximum methane concentrations of:
    - Euston Road measured concentrations up to 7,800 ppm (Feb 2020).
    - Barwon Park Road measured concentrations up to 110.8 ppm (Mar 2020).
    - Sydney Park Road measured concentrations up to 280,000 ppm (28.0% v/v) (Mar 2020).

4.2 Trench Construction Details

TransGrid provided a file titled 'Typical Trench Design and Rating Tables for 330kV' ref. TEA-PSF-DR-005, dated 27 May 2020 (presented in **Appendix B**), that presents information relating to the dimensions of the trench to be excavated. The dimensions are variable along the length of the transmission cable placement, in summary:

- The largest trench sizing is 2,650 mm width and 2,565 mm depth.
- The smallest trench size is 1,550 mm width and 1,578 mm depth.

In terms of the risk associated with accumulation of landfill gas a narrow and deep trench is likely to present an increased risk. The trench with dimensions closest to the maximum depth and width identified above is 1,650 mm wide and 2,478 mm deep.

4.3 Ventilation Estimates

To provide a preliminary indication of whether hazardous methane or carbon dioxide concentrations are expected to occur within trenches during the proposed works, potential landfill gas concentrations within the trenches were estimated by considering:

1. The potential concentration and volumetric flow rate of landfill gas (methane and/or carbon dioxide) into the trench; and
2. The extent of dilution that would occur within the trench due to ambient wind / airflow.

Specifically, from first principles and application of a simple mixing and dilution model, if it is assumed that:

- A landfill gas bore has a zone of influence of 10 m^2 lateral ground surface area (Pecksen relationship).
- The wind speed within the trench is 1/10th of that at ground level.
- Emitted gases will be mixed within a 15 m length of trench (beyond this length it is expected that gases would disperse above the trench; see CRC CARE, 2010).

Then the gas concentration within the trench can be estimated by the following equation:

$$C_{gt} = \frac{C_{gb} \times F_{bh} \times L \times CF_1}{ZI \times D \times u_t \times CF_2}$$

Equation 1

Where:

C_{gt}	=	Estimated gas concentration in trench (% v/v)
C_{gb}	=	Measured gas concentration in relevant LFG monitoring bore (% v/v)
F_{bh}	=	Measured gas flow rate in relevant monitoring bore (L/hr)
ZI	=	Lateral zone of influence of landfill gas bore flow (m^2)
L	=	Length of trench within which emitted vapours are mixed (m)
D	=	Depth of trench (m)
CF_1	=	Conversion factor (0.001 m^3/L)
U_t	=	Wind speed within trench (km/hr)
CF_2	=	Conversion factor (1,000 m/km)

The assumed parameter values and outputs of the above calculation for the project are detailed in the following table (utilising worst-case conservative assumptions from available data and information):

Parameter	Value	Source / Justification
C_{gb}	82.9% v/v (CH_4) 31.1% v/v (CO_2)	Maximum reported concentrations in landfill gas bores across the project area
F_{bh}	10 L/hr	Conservative assumption. No gas borehole flow data is reported, but value is considered likely to represent maximum / worst-case typically reported in the vicinity of older closed landfills.
ZI	10 m^2	Based on Pecksen (1986) methodology, which assumes a landfill gas bore / standpipe has zone of influence of 10 square metres[5]
L	15 m	Maximum length beyond which gases are expected to disperse above the trench (Friebel and Nadebaum, 2010)

[5] As described/discussed in CIRIA (2007), *Assessing risks posed by hazardous ground gases to buildings*, Publication C665, 2007.

D	2.5 m	Maximum depth as per project-specific trench dimensions
U_t	0.66 km/hr	10% of ambient wind speed of 6.6 km/hr, which is the minimum monthly average windspeed at 9 am reported at Bankstown Airport station 066137 (note 9 am wind speeds are much lower / more conservative than 3 pm wind speed). Bankstown Airport station is the closest weather station to the project area (~5 km from Potts Hill).
C_{gt}	**0.00075% v/v (CH_4)** **0.00028% v/v (CO_2)**	Estimated gas concentrations in trench following dilution/mixing with outdoor air based on above analysis.

The maximum estimated landfill gas concentrations above (<0.001% v/v for both methane and carbon dioxide) are negligible in comparison to relevant trigger levels or levels of concern (see **Section 5.3.3**). This suggests that natural ventilation will likely dissipate landfill gas within the trenches. However, as gas behaviour within and adjacent to landfills is unpredictable, and concentrations may vary depending on weather conditions and trench characteristics, gas monitoring and management during the works is still considered prudent.

It is acknowledged that the ventilation calculations appear potentially inconsistent with surface emission monitoring results, which indicate much higher peak methane concentrations (up to 53% v/v) at the ground surface (5 cm height). However, it is important to note that the elevated surface emission results reflect peak (not sustained) levels in close proximity to surface cracks. Ambient methane readings at each surface emission monitoring location were much lower (2–11 ppm and predominantly below 5 ppm) and are therefore consistent with the estimated trench methane concentration of 0.00075% v/v (7.5 ppm). This suggests that while isolated localised elevated methane concentrations may occur directly adjacent the ground or trench surface, emitted gases would be expected to rapidly dissipate in outdoor air (including within an open trench). However, as noted above, gas behaviour within and adjacent to landfills is unpredictable, thus gas monitoring during the works is recommended.

5 Landfill Gas Control Measures

A range of environmental procedures and control measures are identified in the various environmental planning documents, TransGrid specifications and guidelines and EIS. Project specific Environmental Control Measures (ECMs) to meet the objectives of this SPLGMP and to address potential impacts from landfill gas are detailed in subsequent sections.

5.1 Landfill Gas Management During Construction

The below ECMs address EMMMs CT9 (Former landfill management) and AQ12 (landfill gas) in the EIS, specifically for Sydney Park. **Table 5-1** below identifies the components of the SPLGMP required in EMMM CT9 and AQ12 and where each component has been addressed.

The EIS also identified EMMM CT10 (Sydney Park), which relates to additional investigations to be undertaken at Sydney Park on leachate and methane risks prior to or during construction. This additional investigation is discussed in Section 5.1.4 of the CLMP.

Table 5-1: Required Components of the SPLGMP

Required Components	References
Excavation plan specifying areas classified as per in-situ waste classification and suitability for re-use (CT9).	• Waste classification investigations will be undertaken along the route of the transmission cable through Sydney Park (refer to Section 5.1.2 of the CLMP). Given that Sydney Park was identified in the EIS as an area of high contamination risk, and contaminants of potential concern (COPC) may be present in addition to those being analysed during the waste classification investigations, additional investigations will be undertaken and are outlined in Section 5.1.4 of the CLMP. The COPC required to be analysed in conjunction with or in addition to waste classification are identified in Table 5-1 of the CLMP. • Suitability for re-use against recreational / open space criteria should be undertaken following the investigations outlined in Section 5.1.4 of the CLMP.
Trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (CT9).	• Trench ventilation calculations presented in **Section 4.3** of this SPLGMP. • ECMs presented in **Section 5.3.4** of this SPLGMP.
Ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds (VOCs) (CT9 and AQ12).	• Monitoring for landfill gases discussed in **Section 5.3.2** of this SPLGMP.
Action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented (CT9 and AQ12).	• Trigger levels presented in **Section 5.3.3** of this SPLGMP. • Additional controls to allow work to recommence following exceedance of trigger levels presented in **Section 5.3.4** of this SPLGMP.
Exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh	• Refer to Table 5-3 in the CLMP.

Required Components	References
fences with bracing, where required (CT9).	
Geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable (CT9).	• General design considerations discussed in **Section**Error! Reference source not found. **6.3** of this SPLGMP.
Final capping layer above the concrete cable conduit casing as per the *Environmental Guidelines Solid Waste Landfills* (NSW EPA, 2016), unless otherwise specified or agreed by with City of Sydney and Inner West Council (CT9).	• General requirements for capping per NSW EPA, 2016 presented in **Section 6.1** of this SPLGMP. • Considerations for the construction of pits within former landfill areas are presented in **Section 6.2** of this SPLGMP.
Mitigation measures to prevent human health exposure risks posed by nuisance odours from exposed leachate or landfill wastes (AQ12).	• Refer to **Section 5.4** of this SPLGMP.

5.2 General

Construction contractors must be made aware that landfill gas may be present in the subsurface at the site and gas may enter any excavations or other below ground structures.

Due to the propensity of landfill gas to migrate to areas with increased void space, any significant ground disturbance activity will likely increase the potential for encountering landfill gas at that location, especially in the vicinity of locations where high concentrations of subsurface landfill gas have been detected in the past.

It should be noted that gas levels can change quickly and will vary both within the excavation and in the area immediately surrounding an excavation. Gas concentrations may vary depending on the location, depth and type of excavation. Meteorological conditions can also influence migration of landfill gas, e.g. rainfall can cause surface sealing and promote lateral migration and decreasing atmospheric pressure can also cause gas to expand and migrate. The potential for the concentrations of landfill gas to move in and out of the explosive range can vary significantly in an open excavation. Landfill gas has been detected underground at concentrations well above the upper explosive limit of methane of 15% v/v. At these concentrations, methane is not explosive at depth due to the landfill gas mixture being too 'rich' and unlikely to have sufficient oxygen to be combustible. However, an open excavation provides opportunity for the presence of significantly increased oxygen content and a relative reduction in the elevated methane concentrations recorded at depth, which means that at some point in time the concentration of landfill gas could be within the explosive range for methane (i.e. between 5 %v/v and 15 %v/v).

Therefore, additional precautions must be taken to ensure that workers are aware of the hazard and the increased risks associated with conducting their work. It is the responsibility of the developer and their contractors to implement appropriate controls to manage the risk to workers when conducting activities at the site. The following risk controls must be implemented:

- All personnel who work on site and all visitors to the site must be made aware of the possibility of the presence of landfill gas in the vicinity of excavations.

- No worker is allowed to work alone at any time in or near to any excavation. At least one other worker must be available to assist with a rescue if needed. Under no circumstances shall the additional worker enter the trench to assist the worker who is in the trench.
- Smoking, naked flames and all other unauthorised sources of ignition are prohibited in the vicinity of any excavation. 'No smoking' and 'No naked flame' notices must be posted prominently on the construction site and, if necessary, special areas designated for smoking.
- Any electrical equipment used within excavations, such as motors and extension cords, must be intrinsically safe.
- Welding, oxy-cutting or other hot works must be avoided within and in close proximity to excavations. Welding, flame-cutting or other hot works may only be carried out in trenches or confined spaces when controlled by a 'permit to work' procedure and a specific risk assessment has been undertaken.
- The permit to work procedure must clearly detail the requirements for continuous monitoring for methane, carbon dioxide and oxygen throughout the period during which the hot works are in progress.
  The procedure must also require the presence of an appropriately qualified person, in attendance outside the 'confined area', who shall be responsible for reviewing the gas measurements as they are made, and who shall have responsibility for suspending the work in the event of unacceptable or hazardous conditions. Only those workers who are appropriately trained and fully aware of the potentially hazardous conditions that may arise should be permitted to carry out hot works in confined areas.
- All excavations must be monitored for the presence of landfill gas (See **Section 5.3**). It should be noted that the presence of elevated concentrations of landfill gas in an excavation may satisfy the definition of a confined space as defined in the NSW Code of Compliance – Confined Spaces (refer **Section 5.3.2** below) and additional controls will be required to be implemented).
- Entry to excavations must be minimised or eliminated, whenever possible.
- Work upwind of excavations whenever possible to reduce worker exposure to landfill gas.

5.3 Gas Monitoring Requirements

The NSW *Work Health and Safety Act 2011*, *Work Health and Safety Regulation* and associated NSW Government documents, '*Code of Practice – Construction Work*' (August 2019) and '*Code of Practice – Confined Spaces*' (August 2019) provide a basis that can be applied to assessing the risk associated with any excavation. The '*Code of Practice – Confined Spaces*' states:

'A safe atmosphere in a confined space is one that:

- *has a safe oxygen level*
- *is free of airborne contaminants or any airborne contaminants are in concentrations below their allowable exposure standard (if any), and*
- *any flammable gas, vapour or mist in the atmosphere is at concentrations below 5% of its lower explosive level (LEL).'*

Assessment of a safe atmosphere can be undertaken using electronic portable gas detection meters, which are further discussed in **Section 5.3.1**.

5.3.1 Gas Monitoring Equipment

The gas detection meters must be intrinsically safe and fitted with sensors for flammable gas (such as methane), oxygen, hydrogen sulphide, carbon monoxide and ammonia. An intrinsically safe PID meter (assumes 10.6 eV lamp) must be used to measure VOCs.

The meters must be appropriately calibrated in accordance with the manufacturer's requirements and operated by someone trained and deemed competent in the use of the gas detection equipment and landfill gas-related hazards. This person must be present on site when excavation works are conducted.

5.3.2 Monitoring Methodology

The concentration of landfill gas with regard to toxicity and explosivity must be assessed, using the gas detection meters prior to work commencing, and at regular intervals throughout the course of the work.

Based on the trench construction details outlined in **Section 4.2** the shallowest trench excavation will be 1,578 mm. As a result, gas monitoring must be undertaken as follows:

Excavation of the Trench

- At the ground surface before excavation commences, monitoring must be undertaken continuously along the length of the trench at a height of approximately 10 mm above the surface.
- Within the trench during excavation works or once the trench is at depth and remains open:
    - At the beginning of each working day.
    - Hourly throughout the working day while the excavation remains open both within the trench and at ground (breathing) level.

Monitoring must be conducted for (at a minimum) the gases identified in **Section 5.3.3** by inserting the gas detection devices or sample probes along the length of the open excavation as well as at ground level including in the breathing zone of workers. As there is the potential for different gases to settle at different levels, each part of the excavation must be tested – side to side and top to bottom.

Worker Entering the Trench

If a worker is required to enter an excavation the following procedure must be followed:

- Pre-entry testing: Prior to entering the trench monitoring must be conducted by someone trained and deemed competent for (at a minimum) the gases identified in **Section 5.3.3** by inserting the gas detection devices or sample probes along the length of the open excavation. As there is the potential for different gases to settle at different levels, each part of the excavation must be tested – side to side and top to bottom.
- Continuous Monitoring: The portable gas detection devices must be operated by someone trained and deemed competent and fastened where practicable within the workers breathing zone during entry to and whilst in the trench. The portable gas detection devices are required to monitor for the gases identified in **Section 5.3.3** and alarm at the trigger levels. Any exceedance of the trigger levels and the worker must exit the trench and not re-enter until the pre-entry testing shows the atmosphere within the trench has returned to safe levels for occupancy.

The monitoring methodologies presented only consider the risk posed by landfill gas, all other risks associated with working within trenches/confined spaces must be assessed and managed in accordance with the applicable regulations and associated guidance.

5.3.3 Trigger Levels

The trigger levels for monitoring presented below in **Table 5-2** must be adopted based on the requirements of the *'Code of Practice – Confined Spaces'*. Exceedance of any of the identified trigger levels / action levels must result in cessation of works and evacuation of the work zone.

Table 5-2: Trigger levels for cessation of works

Element	Trigger Level	Reference
Flammable Atmosphere	> 0.25% v/v (5% LEL)	*Code of Practice – Confined Spaces*
Oxygen	< 19.5% or >23.5%	*p.17 Code of Practice – Confined Spaces: 'Air normally contains 21 per cent oxygen by volume, although oxygen levels of 19.5 per cent to 23.5 per cent by volume are considered to be safe.'*
Hydrogen Sulphide	> 10ppm	*Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average[1].*
Carbon Monoxide	> 30ppm	*Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average[1].*
Ammonia	> 25ppm	*Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average[1].*
VOCs	> 25ppm (in the breathing zone)	*50% of Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average for Toluene[1]* This is to be used as a screening number to guide the requirement for further investigation (see **Section 5.3.4**). Toluene is considered to a contaminant of potential concern, 50% of the TWA provides a degree of conservatism to the trigger level.

5.3.4 Exceedances of Trigger Levels

Exceedance of any of the identified trigger levels must result in cessation of works, evacuation of the work zone, an assessment of risk and, if required, development of additional mitigation measures. Work must not continue until gas levels have reduced to concentrations below the trigger levels.

If the VOC trigger level is exceeded in the breathing zone further investigation will be required to characterise the composition of the VOCs followed by adoption of trigger levels for specific VOCs.

If additional mitigation / management measures are required to reduce concentrations of landfill gas within and around an excavation, then consideration must be given to:

- Ventilation with fresh air, by natural, forced or mechanical means.

  The calculations presented in **Section 4.3** indicate that it is likely natural ventilation will dissipate any contaminants that may accumulate within the trenches, however mechanical ventilation may be required in some instances. The ventilation system must be designed by a competent person to provide adequate ventilation levels throughout the excavation during construction.

- Purging using an inert gas such as nitrogen to clear flammable gases or toxic vapours.

  Purging is a method used to displace a contaminant. Following, purging the trench must be ventilated with sufficient fresh air to ensure that oxygen has returned to a normal level of 21% v/v. Consideration needs to be given as to where the contaminants being removed will be expelled to ensure they no longer present a risk.

- Use of air supplied respiratory protection equipment if it isn't possible to maintain safe oxygen / contaminant levels. Further guidance is available in AS/NZS 1715:2009: Selection, use and maintenance of respiratory protective equipment.

  Note that respirators are only to be worn by trained individuals who have their own respirators, have conducted a qualitative fit test, and can obtain an effective face seal.

  It should also be noted that respiratory protection is not suitable when the risk relates to flammable atmospheres.

- Ceasing works until conditions change or risk can be mitigated.

5.4 Nuisance Odours

The one per cent of trace components found in landfill gas are what produces the distinctive odour that many people alike to rotten eggs. This is largely due to the presence of hydrogen sulphide. The human 'smell' threshold (odour threshold) of these trace components is very low (1 – 5 ppm).

The presence of this odour at such low levels does not usually cause health effects (TWA exposure limit of 10 ppm and IDLH [immediately dangerous to life and health] of 100 ppm). However, these odours can lead to complaints from the public. Measurements of hydrogen sulphide should be monitored as outlined in **Section 5.3**. Personnel in the field who might have continuous, low-level exposure to hydrogen sulphide will temporarily lose their ability to smell the gas even though it is still present, due to olfactory fatigue. At high concentrations olfactory fatigue occurs rapidly, and the ability to respond to levels associated with health hazards is impaired. It is therefore necessary to always monitor for the presence of hydrogen sulphide with the gas detection meter.

ECMs may include:

- works may be suspended if weather conditions play a role in emitting or transporting any potential odour emissions outside of the work zone towards local sensitive receptors. For example, if there is a potential for odour on any given day to be emitted locally on site and the site is experiencing strong winds that may transport the odours offsite then works will be suspended until mitigation measures are put in place.

- use of odour suppressant mists and foams, either directly onto the odorous materials or as a perimeter misting system.
- covering odorous materials.
- other measures deemed suitable for the local conditions of the site.

6 Trench Design Considerations

As the alignment of the transmission cable passes through landfilled waste typical trench design considerations that can assist in inhibiting gas migration generally consist of barriers and vents. The following discussion is general in nature and project specific design drawings must be prepared should TransGrid decide to proceed with any trench design mitigation measures.

6.1 Gas Barriers

Where the transmission cable passes directly through the landfill, consideration should be given to the following methods of preventing the migration of landfill gas:

- Completely lining the trench with a naturally gas resistant material such as clay or a synthetic material such as a high-density polyethylene (HDPE) membrane. This will limit gas migration into the permeable backfill surrounding the transmission cable which could present a preferential pathway for migration of landfill gas from landfilled waste.
- Use of a natural gas resistant material such as clay or a soil-bentonite mixture as a cut-off barrier. This option won't necessarily stop landfill gas migrating into the permeable backfill surrounding the transmission cable but could potentially stop it leaving the landfill subject to appropriate placement of the cut-off barrier. The area installed within the waste could be identified as 'hazard zone' and persons who require access to that area would need to do so under a specific safety management plan.
- Even in the absence of permeable backfill material there is the potential for landfill gas to migrate along the interface between the pipe and the backfilled soil. To mitigate migration of landfill gas into structures located away from the landfilled waste it is important that the annulus around any entry points is effectively blocked by means of sealant, collars, or other method deemed appropriate.

Note that the final capping specified in NSW EPA (2016) of general and restricted solid waste landfills, from bottom to top, should comprise:

- a seal-bearing surface consisting of a properly designed and engineered layer of material at least 300 millimetres thick. Note that EMMM CT9 considers that the concrete cable conduit is a suitable substitute for this layer.
- compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic conductivity of less than 1×10^{-9} metres/s; and
- a revegetating layer at least 1000 mm thick and comprising clean soils and vegetation with root systems that will not penetrate lower layers. The upper 200 mm should be a topsoil layer, which can include compost to help with vegetation establishment and growth. Note that although NSW EPA (2016) specifies that this layer should be at least 1000 mm thick, EMMM CT9 specifies that from the top of the capping layer (compacted clay layer) to the surface should comprise clean soils (potentially excavated material suitable for reuse or suitable imported material) with 200 mm of topsoil (in landscaped areas).

It is noted that waste landfill materials have historically been reported at, or very near, the surface in some areas of Sydney Park. Waste landfill materials will not be re-used during backfilling of trenches and excavated waste material will be disposed of in accordance with the CLMP. Spoil that is suitable for re-use that has been excavated from other sections of the transmission cable route, or imported VENM, ENM or material that meets the definition of a NSW EPA approved resource recovery order/exemption, may be used as backfill in these locations above the capping layer. Where subsurface waste on either side of the trench is shallower than the final depth of the trench, or where capping in accordance with NSW EPA (2016) is not practical, then completely lining the trench should be considered.

6.2 Gas Vents

Vent pipes can be utilised to prevent the build-up of landfill gases within sealed service pits or to reduce landfill gas accumulation on the landfill side of a cut off barrier (See **Section 6.1**).

- Venting sealed service pits, may consist of a simple stack arrangement built into the side of a service pit that vents to atmosphere approximately 2 m – 3 m above ground level.
- Reducing gas accumulation on the landfill side of a cut-off barrier can be achieved by placement of a high permeability gas drainage layer on the landfill side of the cut-off barrier that is vented to atmosphere through a stack arrangement.

The construction of joint bays, link boxes and sensor pits within former landfill areas of Sydney Park will be designed to prevent the accumulation of landfill gases giving consideration to the options presented above. City of Sydney will be consulted on the design, monitoring and location of the pits within Sydney Park.

6.3 Geotechnical Considerations

The installation of the transmission cable over the former landfill needs to carefully consider both total and differential settlement resulting from ongoing decomposition of the underlying waste. These settlements could induce issues associated with increased strain in the installed infrastructure, or potential pooling of surface or perched groundwater (due to changes in grade) which may impact the embedment conditions.

At this stage it is difficult to estimate the rate or magnitude of the settlement so an assessment will be required as part of the detailed geotechnical design. This will likely require intrusive works to define the condition of the landfill, including depth and composition.

Options to reduce the impact of differential settlement, noting it will not stop total settlements from occurring, include the adoption of an appropriately designed geosynthetic reinforced foundation for the pipe bedding, consisting of single or multiple layers of reinforcement geosynthetic and crushed rock.

7 Compliance Management

7.1 Roles and Responsibilities

In addition to those detailed in the CSWMP and CLMP, the roles and responsibilities presented in **Table 7-1** are relevant to the SPLGMP.

Table 7-1: SPLGMP Roles and Responsibilities

Role	Authority and Responsibility
Contaminated Land Professional	General advice in relation to implementation of this SPLGMP and general environmental issues on Site.

7.2 Training & Induction

Refer to CEMP.

7.3 Complaints Management

Refer to CEMP.

7.4 Incident Response

Refer to CEMP.

7.5 Audits

Refer to CEMP.

7.6 Non-Conformances

Refer to CEMP.

7.7 Records and Documentation

The Records of trench works including final design, capping layer composition and thickness etc will be captured using the 'Former Landfill Area as Built Report' in Appendix D. Refer to CEMP and relevant Subplans for other records and documentation requirements.

7.8 Licenses, Permits and Qualifications

Refer to CLMP.

7.9 Review and Improvement

This plan may be updated or revised if required. The procedure for review and approval of any updates or revisions will be in accordance with the procedure described in the CSWMP.

8 References

AS/NZS 1715:2009: *Selection, use and maintenance of respiratory protective equipment*.

Garde, 2020. *Typical Trench Design and Rating Tables for 330kV*' ref. TEA-PSF-DR-005

Industry Code of Practice – *The Management of Landfill Gas*, March 2012

LFTGN 03 – *Guidance on the management of landfill gas*, UK Environment Agency

NSW EPA, 2016. *Environmental Guidelines, Solid Waste Landfills*.

NSW EPA, 2014. *Waste Classification Guidelines.*

NSW Government, 2019. *Code of Practice – Confined Spaces*

NSW Government, 2019. *Code of Practice – Construction Work*

Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation)

Safe Work Australia, 2019. *Workplace Exposure Standards for Airborne Contaminants*

Work Health and Safety Act 2011 (NSW) No 10.

Work Health and Safety Regulation 2017 (NSW).

Appendix A – Monitoring Data

Table A - Summary Ground Gas Surface Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Surface Monitoring Results (A)

Transect Information		Wind Speed	Peak	Ambient Readings
Transect ID	Monitoring Date	Ambient	Methane (CH_4) (max)	Methane (CH_4)
		m/s	ppm	ppm
Instrument Limit		0.1	1	1
Assessment Criteria		N/A	500	500
T001	22/01/2020	0.29	2.6	2
T001	20/02/2020	0.03	2.9	2.5-2.7
T001	18/03/2020	2.1	480	2.6
T002	22/01/2020	0.57	6.6	2.3
T002	20/02/2020	0.28	13.9	2.6-3.0
T002	18/03/2020	0	**586**	2.9 - 3.0
T003	22/01/2020	0.34	3	2.1
T003	20/02/2020	0.59	202	2.3-3.0
T003	18/03/2020	0.28	19.1	2.6 - 3.0
T004	22/01/2020	0.41	9	2.2
T004	20/02/2020	0.93	2.3	2.1-2.3
T004	18/03/2020	2.2	4.6	2.2
T005	22/01/2020	0.53	11.3	2.2
T005	20/02/2020	1.18	2.5	2.1-2.3
T005	18/03/2020	2	3.6	2.4
T006	22/01/2020	0.32	83	2.1
T006	20/02/2020	1.62	2.4	2.1-2.4
T006	18/03/2020	1	2.4	2
T007	22/01/2020	0.26	2.4	1.8
T007	20/02/2020	0.07	2.3	2.1-2.3
T007	18/03/2020	1.8	65	2.6
T008	22/01/2020	0.59	2.6	1.6
T008	20/02/2020	0.97	**5500**	2.3
T008	18/03/2020	1.1	6.8	2.2
T009	22/01/2020	0.16	63	1.6
T009	20/02/2020	0.7	2.4	2.2-2.4
T009	18/03/2020	0.5	4.2	2.4
T00A	22/01/2020	0.00	3.2	2.5 - 3.2
T00A	20/02/2020	0	2.1	1.9-2.1
T00A	18/03/2020	0.05	148	3.3 - 3.7
T00B	22/01/2020	0.40	188.0	2.3 - 2.7
T00B	20/02/2020	0	15.8	1.9-2.1
T00B	18/03/2020	1.49	14.8	2.4 - 2.9
T00C	22/01/2020	0.25	**8000.0**	2.5 - 2.8
T00C	20/02/2020	0	8	1.9-2.2
T00C	18/03/2020	0.28	**1500**	2.4 - 2.7
T00D	22/01/2020	0.70	8.6	1.8 - 2.5
T00D	20/02/2020	0.53	2.1	1.9-2.1
T00D	18/03/2020	1.08	4	3.3 - 4.0
T00E	22/01/2020	0.16	3.3	1.8 - 2.7

Table A - Summary Ground Gas Surface Monitoring Results

2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_
SydneyPark_LFG_Results_Ongoing.xls]Surface Monitoring Results (A)

Transect Information		Wind Speed	Peak	Ambient Readings
Transect ID	Monitoring Date	Ambient	Methane (CH_4) (max)	Methane (CH_4)
		m/s	ppm	ppm
Instrument Limit		0.1	1	1
Assessment Criteria		N/A	500	500
T00E	20/02/2020	0.32	**1500**	1.9-2.1
T00E	18/03/2020	1.2	3.7	3.0 - 3.7
T00F	22/01/2020	0.17	11.6	2.0 - 3.0
T00F	20/02/2020	0	1.9	1.8-1.9
T00F	18/03/2020	0.3	**2300**	2.6 - 3.0
T00G	22/01/2020	0.46	2.4	1.8 - 2.3
T00G	20/02/2020	0	1.9	1.9-2.1
T00G	18/03/2020	0.37	2.9	2.6 - 2.7
T00H	22/01/2020	1.20	2.0	1.3 - 1.8
T00H	20/02/2020	0.05	1.9	1.9
T00H	18/03/2020	1.96	2.5	2.4 - 2.5
T00I	22/01/2020	0.21	3.3	1.0 - 1.8
T00I	20/02/2020	0	1.9	1.9
T00I	18/03/2020	0	2.5	2.5
T00J	22/01/2020	1.20	2.3	1.5 - 2.0
T00J	20/02/2020	0.32	1.9	1.9
T00J	18/03/2020	0.38	2.9	2.4 - 2.9
T00K	22/01/2020	2.30	**534000.0**	2.0 - 11.0
T00K	20/02/2020	0.18	2	1.8-2.0
T00K	18/03/2020	0.39	**20000**	2.2 - 2.5
T00L	22/01/2020	1.55	5.3	4.0 - 5.0
T00L	20/02/2020	0	1.9	1.9
T00L	18/03/2020	0.42	6.5	2.2 - 2.5
T00M	22/01/2020	0.27	2.7	1.6
T00M	20/02/2020	0.78	2.2	2.2
T00M	18/03/2020	0	2.6	2.4
T010	22/01/2020	1.81	2.8	2
T010	20/02/2020	0.95	2.3	2.2-2.3
T010	18/03/2020	1.1	2.6	2.3
T011	22/01/2020	0.86	1.8	1.6
T011	20/02/2020	0.77	2.3	2.3-2.4
T011	18/03/2020	0.8	2.4	2.4
T012	22/01/2020	1.84	1.7	1.6
T012	20/02/2020	1.07	2.2	2.2
T012	18/03/2020	1	28	2.4
T013	22/01/2020	1.05	1.6	1.5
T013	20/02/2020	2.34	2.3	2.3
T013	18/03/2020	0.8	2.4	2.3
T014	22/01/2020	0.66	2.6	1.6
T014	20/02/2020	1.47	**2500**	2.2-2.3

Table A - Summary Ground Gas Surface Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_SydneyPark_LFG_Results_Ongoing.xls]Surface Monitoring Results (A)

Transect Information		Wind Speed	Peak	Ambient Readings
Transect ID	Monitoring Date	Ambient	Methane (CH_4) (max)	Methane (CH_4)
		m/s	ppm	ppm
Instrument Limit		0.1	1	1
Assessment Criteria		N/A	500	500
T014	18/03/2020	0.7	15	2.5
T015	22/01/2020	1.89	1.9	1.5
T015	20/02/2020	0.32	2.6	2.3-2.5
T015	18/03/2020	0.5	2.4	2.3
T016	22/01/2020	2.1	1.6	1.5
T016	20/02/2020	0.3	2.4	2.3-2.4
T016	18/03/2020	0	20.4	2.4
T017	22/01/2020	2.18	1.7	1.6
T017	20/02/2020	2.43	2.3	2.3
T017	18/03/2020	0	20.4	2.4
T018	22/01/2020	1.01	1.8	1.6
T018	20/02/2020	1.87	2.3	2.1-2.3
T018	18/03/2020	0.7	2.7	2.5
T019	22/01/2020	1.12	1.7	1.6
T019	20/02/2020	1.47	2.3	2.3
T019	18/03/2020	0	2.6	2.5
T020	22/01/2020	0.23	1.6	1.6
T020	20/02/2020	0.3	2.3	2.3
T020	18/03/2020	0	2.5	2.5
T021	22/01/2020	1.40	1.4	1.0 - 1.4
T021	20/02/2020	0.13	1.9	1.9
T021	18/03/2020	1.3	2.1	2.1
T022	22/01/2020	not accessible - construction		
T022	20/02/2020	0	1.9	1.9
T022	18/03/2020	1.9	90	2.6
T023	22/01/2020	0.54	1.6	1.6
T023	20/02/2020	0.61	2.4	2.3-2.4
T023	18/03/2020	0.9	2.3	2.3
T024	22/01/2020	1.94	1.9	1.6
T024	20/02/2020	0.54	2.4	2.3-2.4
T024	18/03/2020	0.4	2.7	2.7

Above max	Above maximum allowable reading of instrument (2)
bold	Exceeds Assessment Criteria
N/A	No NSW/VIC EPA Endorsed Criteria
*	Not accessible, located or destroyed
-	Transect not monitored for this parameter

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations
https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S1	18/03/2020	BARWON PARK RD	3.3	
S1	22/01/2020	BARWON PARK RD	2.4	
S1	20/02/2020	BARWON PARK RD	2	
S2	18/03/2020	BARWON PARK RD	3.5	
S2	22/01/2020	BARWON PARK RD	2.3	
S2	20/02/2020	BARWON PARK RD	2	
S3	18/03/2020	BARWON PARK RD	3.3	
S3	22/01/2020	BARWON PARK RD	2.4	
S3	20/02/2020	BARWON PARK RD	2	
S4	18/03/2020	BARWON PARK RD	3.6	
S4	22/01/2020	BARWON PARK RD	2.5	
S4	20/02/2020	BARWON PARK RD	2.1	
S5	18/03/2020	BARWON PARK RD	3.2	
S5	22/01/2020	BARWON PARK RD	3.2	
S5	20/02/2020	BARWON PARK RD	2.1	
S6	18/03/2020	BARWON PARK RD	2.1	
S6	22/01/2020	BARWON PARK RD	2.5	
S6	20/02/2020	BARWON PARK RD	1.9	
S7	18/03/2020	BARWON PARK RD	3.2	
S7	22/01/2020	BARWON PARK RD	2.5	
S7	20/02/2020	BARWON PARK RD	2.1	
S8	18/03/2020	BARWON PARK RD	110.8	
S8	22/01/2020	BARWON PARK RD	2.8	
S8	20/02/2020	BARWON PARK RD	1.9	
S100	22/01/2020	EUSTON RD	1.4	
S100	20/02/2020	EUSTON RD	1.9	
S100	18/03/2020	EUSTON RD	2.5	
S101	22/01/2020	EUSTON RD	1.4	
S101	20/02/2020	EUSTON RD	1.9	
S101	18/03/2020	EUSTON RD	2.5	
S101A	22/01/2020	EUSTON RD	1.3	
S101A	20/02/2020	EUSTON RD		NOT MONITORED
S101A	18/03/2020	EUSTON RD	2.5	
S102	22/01/2020	EUSTON RD	1.3	
S102	20/02/2020	EUSTON RD	1.9	
S102	18/03/2020	EUSTON RD	2.5	
S103	22/01/2020	EUSTON RD	1.4	
S103	20/02/2020	EUSTON RD	1.9	
S103	18/03/2020	EUSTON RD	2.5	
S104	22/01/2020	EUSTON RD	1.4	
S104	20/02/2020	EUSTON RD	1.9	
S104	18/03/2020	EUSTON RD	2.5	
S105	22/01/2020	EUSTON RD	1.4	
S105	20/02/2020	EUSTON RD	2	
S105	18/03/2020	EUSTON RD	2.5	
S106	22/01/2020	EUSTON RD	1.3	
S106	20/02/2020	EUSTON RD	1.9	
S106	18/03/2020	EUSTON RD	2.5	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations
https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S107	22/01/2020	EUSTON RD	1.3	
S107	20/02/2020	EUSTON RD	1.9	
S107	18/03/2020	EUSTON RD	2.4	
S108	22/01/2020	EUSTON RD	1.3	
S108	20/02/2020	EUSTON RD	1.9	
S108	18/03/2020	EUSTON RD	2.4	
S108A	22/01/2020	EUSTON RD	1.3	
S108A	20/02/2020	EUSTON RD	1.9	
S108A	18/03/2020	EUSTON RD	2.4	
S109	22/01/2020	EUSTON RD	1.3	
S109	20/02/2020	EUSTON RD	1.9	
S109	18/03/2020	EUSTON RD	2.4	
S109A	22/01/2020	EUSTON RD	1.3	
S109A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S109A	18/03/2020	EUSTON RD	2.4	
S109B	22/01/2020	EUSTON RD	1.3	
S109B	20/02/2020	EUSTON RD	1.8	
S109B	18/03/2020	EUSTON RD	2.4	
S110	22/01/2020	EUSTON RD	1.3	
S110	20/02/2020	EUSTON RD	1.8	
S110	18/03/2020	EUSTON RD	2.4	
S110A	22/01/2020	EUSTON RD	1.3	
S110A	20/02/2020	EUSTON RD	1.8	
S110A	18/03/2020	EUSTON RD	2.4	
S110B	22/01/2020	EUSTON RD	1.4	
S110B	20/02/2020	EUSTON RD	1.8	
S110B	18/03/2020	EUSTON RD	2.4	
S111	22/01/2020	EUSTON RD	1.3	
S111	20/02/2020	EUSTON RD	1.9	
S111	18/03/2020	EUSTON RD	2.4	
S112	22/01/2020	EUSTON RD	1.3	
S112	20/02/2020	EUSTON RD	1.8	
S112	18/03/2020	EUSTON RD	2.4	
S113	22/01/2020	EUSTON RD	1.3	
S113	20/02/2020	EUSTON RD	1.9	
S113	18/03/2020	EUSTON RD	2.5	
S114	22/01/2020	EUSTON RD	1.4	
S114	20/02/2020	EUSTON RD	1.9	
S114	18/03/2020	EUSTON RD	2.6	
S115	22/01/2020	EUSTON RD	1.3	
S115	20/02/2020	EUSTON RD	1.9	
S115	18/03/2020	EUSTON RD	2.4	
S116	22/01/2020	EUSTON RD	9.1	
S116	20/02/2020	EUSTON RD	2	
S116	18/03/2020	EUSTON RD	6.6	
S117	22/01/2020	EUSTON RD	1.4	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S117	20/02/2020	EUSTON RD	1.9	
S117	18/03/2020	EUSTON RD	3.8	
S117A	22/01/2020	EUSTON RD	1.3	
S117A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S117A	18/03/2020	EUSTON RD	2.6	
S118	22/01/2020	EUSTON RD	1.4	
S118	20/02/2020	EUSTON RD	1.9	
S118	18/03/2020	EUSTON RD	2.7	
S118A	22/01/2020	EUSTON RD	1.4	
S118A	20/02/2020	EUSTON RD	1.9	
S118A	18/03/2020	EUSTON RD	2.4	
S119	22/01/2020	EUSTON RD	1.5	
S119	20/02/2020	EUSTON RD	2	
S119	18/03/2020	EUSTON RD	2.5	
S119A	22/01/2020	EUSTON RD	1.6	
S119A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S119A	18/03/2020	EUSTON RD	2.4	
S119B	22/01/2020	EUSTON RD	1.2	
S119B	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S119B	18/03/2020	EUSTON RD	2.4	
S119C	22/01/2020	EUSTON RD	1.4	
S119C	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S119C	18/03/2020	EUSTON RD	2.4	
S120	22/01/2020	EUSTON RD	1.3	
S120	20/02/2020	EUSTON RD	1.9	
S120	18/03/2020	EUSTON RD	2.4	
S121	22/01/2020	EUSTON RD	1.4	
S121	20/02/2020	EUSTON RD	2.1	
S121	18/03/2020	EUSTON RD	2.4	
S122	22/01/2020	EUSTON RD	1.4	
S122	20/02/2020	EUSTON RD	1.9	
S122	18/03/2020	EUSTON RD	2.4	
S122A	22/01/2020	EUSTON RD	1.4	
S122A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S122A	18/03/2020	EUSTON RD	2.4	
S123	22/01/2020	EUSTON RD	1.5	
S123	20/02/2020	EUSTON RD	1.9	
S123	18/03/2020	EUSTON RD	2.7	
S124	22/01/2020	EUSTON RD	1.4	
S124	20/02/2020	EUSTON RD	2	
S124	18/03/2020	EUSTON RD	2.5	
S125	22/01/2020	EUSTON RD	11.4	
S125	20/02/2020	EUSTON RD	2	
S125	18/03/2020	EUSTON RD	2.9	
S126	22/01/2020	EUSTON RD	1.5	
S126	20/02/2020	EUSTON RD	1.9	
S126	18/03/2020	EUSTON RD	2.5	
S127	22/01/2020	EUSTON RD	7.9	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations
https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S127	20/02/2020	EUSTON RD	2	
S127	18/03/2020	EUSTON RD	18.7	
S127A	22/01/2020	EUSTON RD	1.6	
S127A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S127A	18/03/2020	EUSTON RD	2.7	
S128	22/01/2020	EUSTON RD	7	
S128	20/02/2020	EUSTON RD	1.9	
S128	18/03/2020	EUSTON RD	2.9	
S128A	22/01/2020	EUSTON RD	1.2	
S128A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S128A	18/03/2020	EUSTON RD	2.7	
S128B	22/01/2020	EUSTON RD	65	
S128B	20/02/2020	EUSTON RD	1.9	
S128B	18/03/2020	EUSTON RD	3.8	
S129	22/01/2020	EUSTON RD	5.1	
S129	20/02/2020	EUSTON RD	1.9	
S129	18/03/2020	EUSTON RD	5.1	
S129A	22/01/2020	EUSTON RD	**12000**	1.2%
S129A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S129A	18/03/2020	EUSTON RD	**17000**	1.7%
S129B	22/01/2020	EUSTON RD	**28000**	2.8%
S129B	20/02/2020	EUSTON RD	7800	
S129B	18/03/2020	EUSTON RD	4135	
S129C	22/01/2020	EUSTON RD	3.9	
S129C	20/02/2020	EUSTON RD	2	
S129C	18/03/2020	EUSTON RD	4.6	
S130	22/01/2020	EUSTON RD	58.8	
S130	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S130	18/03/2020	EUSTON RD	65.9	
S130A	22/01/2020	EUSTON RD	4.1	
S130A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S130A	18/03/2020	EUSTON RD	360	
S130B	22/01/2020	EUSTON RD	2450	
S130B	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S130B	18/03/2020	EUSTON RD	1960	
S130C	22/01/2020	EUSTON RD	58	
S130C	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S130C	18/03/2020	EUSTON RD	3300	
S131	22/01/2020	EUSTON RD	6.3	
S131	20/02/2020	EUSTON RD	550	
S131	18/03/2020	EUSTON RD	11.7	
S131A	22/01/2020	EUSTON RD	58.8	
S131A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S131A	18/03/2020	EUSTON RD	157	
S132	22/01/2020	EUSTON RD	4.6	
S132	20/02/2020	EUSTON RD	14.6	
S132	18/03/2020	EUSTON RD	159	
S133	22/01/2020	EUSTON RD	2.9	

Table B - Summary Service Pits Monitoring Results

2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S133	20/02/2020	EUSTON RD	6.6	
S133	18/03/2020	EUSTON RD	2.8	
S134	22/01/2020	EUSTON RD	1.9	
S134	20/02/2020	EUSTON RD	1.9	
S134	18/03/2020	EUSTON RD	3.5	
S135	22/01/2020	EUSTON RD	1.8	
S135	20/02/2020	EUSTON RD	1.9	
S135	18/03/2020	EUSTON RD	4.8	
S135A	22/01/2020	EUSTON RD	10.2	
S135A	20/02/2020	EUSTON RD	700	
S135A	18/03/2020	EUSTON RD	404	
S136	22/01/2020	EUSTON RD	1.8	
S136	20/02/2020	EUSTON RD	2	
S136	18/03/2020	EUSTON RD	2.9	
S137	22/01/2020	EUSTON RD	1.8	
S137	20/02/2020	EUSTON RD	2	
S137	18/03/2020	EUSTON RD	660	
S138	22/01/2020	EUSTON RD	1.8	
S138	20/02/2020	EUSTON RD	2.3	
S138	18/03/2020	EUSTON RD	2.7	
S139	22/01/2020	EUSTON RD	1.8	
S139	20/02/2020	EUSTON RD	212	
S139	18/03/2020	EUSTON RD	3	
S140	22/01/2020	EUSTON RD	1.8	
S140	20/02/2020	EUSTON RD	5960	
S140	18/03/2020	EUSTON RD	4.9	
S140A	22/01/2020	EUSTON RD	1.8	SW
S140B	22/01/2020	EUSTON RD	1.8	SW
S141	22/01/2020	EUSTON RD	1.8	
S141	20/02/2020	EUSTON RD	2	
S141	18/03/2020	EUSTON RD	4.5	
S141A	22/01/2020	EUSTON RD	1.8	
S141A	20/02/2020	EUSTON RD	2	
S141A	18/03/2020	EUSTON RD	2.7	
S142	22/01/2020	EUSTON RD	1.8	
S142	20/02/2020	EUSTON RD	2	
S142	18/03/2020	EUSTON RD	2.6	
S143	22/01/2020	EUSTON RD	1.8	
S143	20/02/2020	EUSTON RD	1.9	
S143	18/03/2020	EUSTON RD	2.7	
S144	22/01/2020	EUSTON RD	1.8	
S144	20/02/2020	EUSTON RD	1.9	
S144	18/03/2020	EUSTON RD	2.7	
S71	22/01/2020	EUSTON RD	1.6	
S71	20/02/2020	EUSTON RD	1.9	
S71	18/03/2020	EUSTON RD	2.7	
S72	22/01/2020	EUSTON RD	1.5	
S72	20/02/2020	EUSTON RD	1.9	

Table B - Summary Service Pits Monitoring Results

2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S72	18/03/2020	EUSTON RD	2.6	
S73	22/01/2020	EUSTON RD	1.5	
S73	20/02/2020	EUSTON RD	1.9	
S73	18/03/2020	EUSTON RD	2.6	
S74	22/01/2020	EUSTON RD	1.6	
S74	20/02/2020	EUSTON RD	1.9	
S74	18/03/2020	EUSTON RD	2.6	
S75	22/01/2020	EUSTON RD	1.5	
S75	20/02/2020	EUSTON RD	1.9	
S75	18/03/2020	EUSTON RD	2.6	
S75A	22/01/2020	EUSTON RD	1.6	
S75A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S75A	18/03/2020	EUSTON RD	2.6	
S75B	22/01/2020	EUSTON RD	1.6	
S75B	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S75B	18/03/2020	EUSTON RD	2.5	
S76	22/01/2020	EUSTON RD	1.6	
S76	20/02/2020	EUSTON RD	1.9	
S76	18/03/2020	EUSTON RD	2.5	
S77	22/01/2020	EUSTON RD	1.5	
S77	20/02/2020	EUSTON RD	1.9	
S77	18/03/2020	EUSTON RD	2.5	
S77A	22/01/2020	EUSTON RD	1.5	
S77A	20/02/2020	EUSTON RD	1.9	
S77A	18/03/2020	EUSTON RD	2.5	
S78	22/01/2020	EUSTON RD	1.5	
S78	20/02/2020	EUSTON RD	1.9	
S78	18/03/2020	EUSTON RD	2.5	
S78A	22/01/2020	EUSTON RD	1.5	
S78A	20/02/2020	EUSTON RD	1.9	
S78A	18/03/2020	EUSTON RD	2.4	
S78B	22/01/2020	EUSTON RD	1.5	
S78B	20/02/2020	EUSTON RD	1.9	
S78B	18/03/2020	EUSTON RD	2.4	
S79	22/01/2020	EUSTON RD	1.5	
S79	20/02/2020	EUSTON RD	1.9	
S79	18/03/2020	EUSTON RD	2.4	
S80	22/01/2020	EUSTON RD	1.5	
S80	20/02/2020	EUSTON RD	1.9	
S80	18/03/2020	EUSTON RD	2.4	
S80A	22/01/2020	EUSTON RD	1.5	
S80A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S80A	18/03/2020	EUSTON RD	2.4	
S81	22/01/2020	EUSTON RD	1.5	
S81	20/02/2020	EUSTON RD	1.9	
S81	18/03/2020	EUSTON RD	2.4	
S82	22/01/2020	EUSTON RD	1.5	
S82	20/02/2020	EUSTON RD	1.9	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations
https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S82	18/03/2020	EUSTON RD	2.4	
S83	22/01/2020	EUSTON RD	1.5	
S83	20/02/2020	EUSTON RD	1.9	
S83	18/03/2020	EUSTON RD	2.4	
S84	22/01/2020	EUSTON RD	1.5	
S84	20/02/2020	EUSTON RD	1.9	
S84	18/03/2020	EUSTON RD	2.4	
S85	22/01/2020	EUSTON RD	1.6	
S85	20/02/2020	EUSTON RD	1.9	
S85	18/03/2020	EUSTON RD	2.5	
S86	22/01/2020	EUSTON RD	1.6	
S86	20/02/2020	EUSTON RD	1.9	
S86	18/03/2020	EUSTON RD	2.5	
S86A	22/01/2020	EUSTON RD	1.6	
S86A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S86A	18/03/2020	EUSTON RD	2.4	
S87	22/01/2020	EUSTON RD	1.6	
S87	20/02/2020	EUSTON RD	1.9	
S87	18/03/2020	EUSTON RD	2.4	
S88	22/01/2020	EUSTON RD	1.5	
S88	20/02/2020	EUSTON RD	1.9	
S88	18/03/2020	EUSTON RD	2.4	
S88A	22/01/2020	EUSTON RD	1.6	
S88A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S88A	18/03/2020	EUSTON RD	2.4	
S89	22/01/2020	EUSTON RD	1.4	
S89	20/02/2020	EUSTON RD	1.9	
S89	18/03/2020	EUSTON RD	2.4	
S90	22/01/2020	EUSTON RD	1.5	
S90	20/02/2020	EUSTON RD	1.9	
S90	18/03/2020	EUSTON RD	2.4	
S90A	22/01/2020	EUSTON RD	1.5	
S90A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S90A	18/03/2020	EUSTON RD	2.5	
S90B	22/01/2020	EUSTON RD	1.4	
S90B	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S90B	18/03/2020	EUSTON RD	2.4	
S90C	22/01/2020	EUSTON RD	1.4	
S90C	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S90C	18/03/2020	EUSTON RD	2.4	
S90D	22/01/2020	EUSTON RD	1.5	
S90D	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S90D	18/03/2020	EUSTON RD	2.4	
S91	22/01/2020	EUSTON RD	1.5	
S91	20/02/2020	EUSTON RD	1.9	
S91	18/03/2020	EUSTON RD	2.4	
S92	22/01/2020	EUSTON RD	1.6	
S92	20/02/2020	EUSTON RD	1.9	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations
https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
S92	18/03/2020	EUSTON RD	2.4	
S93	22/01/2020	EUSTON RD	1.6	
S93	20/02/2020	EUSTON RD	1.9	
S93	18/03/2020	EUSTON RD	2.4	
S94	22/01/2020	EUSTON RD	1.5	
S94	20/02/2020	EUSTON RD	1.9	
S94	18/03/2020	EUSTON RD	2.4	
S95	22/01/2020	EUSTON RD	1.6	
S95	20/02/2020	EUSTON RD	1.9	
S95	18/03/2020	EUSTON RD	2.4	
S95A	22/01/2020	EUSTON RD	1.4	
S95A	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S95A	18/03/2020	EUSTON RD	2.5	
S95B	22/01/2020	EUSTON RD	1.4	
S95B	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S95B	18/03/2020	EUSTON RD	2.4	
S95C	22/01/2020	EUSTON RD	1.4	
S95C	20/02/2020	EUSTON RD		NOT MONITORED, MAINTENANCE
S95C	18/03/2020	EUSTON RD	2.4	
S96	22/01/2020	EUSTON RD	1.4	
S96	20/02/2020	EUSTON RD	1.9	
S96	18/03/2020	EUSTON RD	2.5	
S97	22/01/2020	EUSTON RD	1.4	
S97	20/02/2020	EUSTON RD	1.9	
S97	18/03/2020	EUSTON RD	2.5	
S98	22/01/2020	EUSTON RD	1.4	
S98	20/02/2020	EUSTON RD	1.9	
S98	18/03/2020	EUSTON RD	2.5	
S99	22/01/2020	EUSTON RD	1.4	
S99	20/02/2020	EUSTON RD	311.6	
S99	18/03/2020	EUSTON RD	2.5	
S99A	22/01/2020	EUSTON RD	1.4	
S99A	20/02/2020	EUSTON RD		NOT MONITORED
S99A	18/03/2020	EUSTON RD	2.5	
S99B	22/01/2020	EUSTON RD	1.4	
S99B	20/02/2020	EUSTON RD		NOT MONITORED
S99B	18/03/2020	EUSTON RD	2.5	
SP01	18/03/2020	SYDNEY PARK		Could not access (construction works)
SP01	20/02/2020	SYDNEY PARK		NOT ACCESSIBLE, CONSTRUCTION SITE
SP02	18/03/2020	SYDNEY PARK		Could not access (construction works)
SP02	20/02/2020	SYDNEY PARK		NOT ACCESSIBLE, CONSTRUCTION SITE
SP03	18/03/2020	SYDNEY PARK	12	
SP03	20/02/2020	SYDNEY PARK	2.3	
SP04	18/03/2020	SYDNEY PARK	2.8	
SP04	20/02/2020	SYDNEY PARK	2.4	
SP05	18/03/2020	SYDNEY PARK	2.8	
SP05	20/02/2020	SYDNEY PARK	2.3	
SP06	18/03/2020	SYDNEY PARK	74	

Table B - Summary Service Pits Monitoring Results

2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP06	20/02/2020	SYDNEY PARK	2600	
SP07	18/03/2020	SYDNEY PARK	650	
SP07	20/02/2020	SYDNEY PARK	2.2	
SP08	18/03/2020	SYDNEY PARK	4800	
SP08	20/02/2020	SYDNEY PARK	2.2	
SP09	18/03/2020	SYDNEY PARK	2.5	
SP09	20/02/2020	SYDNEY PARK	2.4	
SP10	18/03/2020	SYDNEY PARK	2.6	
SP10	20/02/2020	SYDNEY PARK	2.3	
SP100	20/02/2020	SYDNEY PARK	2.3	
SP100	18/03/2020	SYDNEY PARK		Could not locate
SP101	20/02/2020	SYDNEY PARK	2.3	
SP101	18/03/2020	SYDNEY PARK	2.6	
SP102	20/02/2020	SYDNEY PARK	2.3	
SP102	18/03/2020	SYDNEY PARK	2.6	
SP103	20/02/2020	SYDNEY PARK	2.3	
SP103	18/03/2020	SYDNEY PARK	2.6	
SP104	20/02/2020	SYDNEY PARK	2.3	
SP104	18/03/2020	SYDNEY PARK	2.5	
SP11	20/02/2020	SYDNEY PARK	2.4	
SP11	18/03/2020	SYDNEY PARK	2.5	
SP12	20/02/2020	SYDNEY PARK	2.4	
SP12	18/03/2020	SYDNEY PARK	2.3	
SP13	20/02/2020	SYDNEY PARK	2.4	
SP13	18/03/2020	SYDNEY PARK	4	
SP14	20/02/2020	SYDNEY PARK	2.4	
SP14	18/03/2020	SYDNEY PARK	2.3	
SP15	20/02/2020	SYDNEY PARK	5.21	
SP15	18/03/2020	SYDNEY PARK	2.3	
SP16	20/02/2020	SYDNEY PARK	2.1	
SP16	18/03/2020	SYDNEY PARK	2.3	
SP17	20/02/2020	SYDNEY PARK	2.2	
SP17	18/03/2020	SYDNEY PARK	220	
SP18	20/02/2020	SYDNEY PARK	2.1	
SP18	18/03/2020	SYDNEY PARK	14	
SP19	20/02/2020	SYDNEY PARK	2.1	
SP19	18/03/2020	SYDNEY PARK	1100	
SP20	20/02/2020	SYDNEY PARK	2.1	
SP20	18/03/2020	SYDNEY PARK	12	
SP21	20/02/2020	SYDNEY PARK	2.1	
SP21	18/03/2020	SYDNEY PARK	4.3	
SP22	20/02/2020	SYDNEY PARK	2.1	
SP22	18/03/2020	SYDNEY PARK	2.3	
SP23	20/02/2020	SYDNEY PARK		NOT MONITORED, MISSING PHOTO FROM LOG, NOT LOCATED
SP23	18/03/2020	SYDNEY PARK		no photo, could not locate
SP24	20/02/2020	SYDNEY PARK	2.4	
SP24	18/03/2020	SYDNEY PARK	2.4	

Table B - Summary Service Pits Monitoring Results

2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP25	20/02/2020	SYDNEY PARK	2.4	
SP25	18/03/2020	SYDNEY PARK	2.3	
SP26	20/02/2020	SYDNEY PARK	2.3	
SP26	18/03/2020	SYDNEY PARK	2.2	
SP27	20/02/2020	SYDNEY PARK	2.3	
SP27	18/03/2020	SYDNEY PARK	2.2	
SP28	20/02/2020	SYDNEY PARK	2.3	
SP28	18/03/2020	SYDNEY PARK	2.2	
SP29	20/02/2020	SYDNEY PARK	2.1	
SP29	18/03/2020	SYDNEY PARK	2300	
SP30	20/02/2020	SYDNEY PARK	2.4	
SP30	18/03/2020	SYDNEY PARK	180	
SP31	20/02/2020	SYDNEY PARK	2.4	
SP31	18/03/2020	SYDNEY PARK	3	
SP32	20/02/2020	SYDNEY PARK	2.3	
SP32	18/03/2020	SYDNEY PARK	2.3	
SP33	20/02/2020	SYDNEY PARK	2.4	
SP33	18/03/2020	SYDNEY PARK	2.3	
SP34	20/02/2020	SYDNEY PARK	2.3	
SP34	18/03/2020	SYDNEY PARK	2.4	
SP35	20/02/2020	SYDNEY PARK	5	
SP35	18/03/2020	SYDNEY PARK	2.3	
SP36	20/02/2020	SYDNEY PARK	2.4	
SP36	18/03/2020	SYDNEY PARK	2.3	
SP37	20/02/2020	SYDNEY PARK	2.3	
SP37	18/03/2020	SYDNEY PARK	2.7	
SP38	20/02/2020	SYDNEY PARK	2.4	
SP38	18/03/2020	SYDNEY PARK	90	
SP39	20/02/2020	SYDNEY PARK	2.3	
SP39	18/03/2020	SYDNEY PARK	3.1	
SP40	20/02/2020	SYDNEY PARK	2.1	
SP40	18/03/2020	SYDNEY PARK	20	
SP41	20/02/2020	SYDNEY PARK	2.1	
SP41	18/03/2020	SYDNEY PARK		Could not locate
SP42	20/02/2020	SYDNEY PARK	2.4	
SP42	18/03/2020	SYDNEY PARK		Could not locate
SP43	20/02/2020	SYDNEY PARK	2.3	
SP43	18/03/2020	SYDNEY PARK	2.3	
SP44	20/02/2020	SYDNEY PARK	2.4	
SP44	18/03/2020	SYDNEY PARK	2.3	
SP45	20/02/2020	SYDNEY PARK	2.4	
SP45	18/03/2020	SYDNEY PARK	2.3	
SP46	20/02/2020	SYDNEY PARK	2.1	
SP46	18/03/2020	SYDNEY PARK	2.1	
SP47	20/02/2020	SYDNEY PARK	2.1	
SP47	18/03/2020	SYDNEY PARK	2.1	
SP48	20/02/2020	SYDNEY PARK	2.1	
SP48	18/03/2020	SYDNEY PARK	2.1	

Table B - Summary Service Pits Monitoring Results

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Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP49	20/02/2020	SYDNEY PARK	2.1	
SP49	18/03/2020	SYDNEY PARK	2.1	
SP50	20/02/2020	SYDNEY PARK	2.1	
SP50	18/03/2020	SYDNEY PARK	2.2	
SP51	20/02/2020	SYDNEY PARK	2.4	
SP51	18/03/2020	SYDNEY PARK	2.3	
SP52	20/02/2020	SYDNEY PARK	2.3	
SP52	18/03/2020	SYDNEY PARK	3.9	
SP53	20/02/2020	SYDNEY PARK	2.4	
SP53	18/03/2020	SYDNEY PARK	2.2	
SP54	20/02/2020	SYDNEY PARK	2.5	
SP54	18/03/2020	SYDNEY PARK	11.1	
SP55	20/02/2020	SYDNEY PARK	2.2	
SP55	18/03/2020	SYDNEY PARK	2.2	
SP56	20/02/2020	SYDNEY PARK	2.2	
SP56	18/03/2020	SYDNEY PARK	2.2	
SP57	20/02/2020	SYDNEY PARK	2.2	
SP57	18/03/2020	SYDNEY PARK	2.2	
SP58	20/02/2020	SYDNEY PARK	2.1	
SP58	18/03/2020	SYDNEY PARK	2.2	
SP59	20/02/2020	SYDNEY PARK	2.1	
SP59	18/03/2020	SYDNEY PARK	5.2	
SP60	20/02/2020	SYDNEY PARK	2.1	
SP60	18/03/2020	SYDNEY PARK	2.8	
SP61	20/02/2020	SYDNEY PARK	2.2	
SP61	18/03/2020	SYDNEY PARK	2.3	
SP62	20/02/2020	SYDNEY PARK	2.2	
SP62	18/03/2020	SYDNEY PARK	2.4	
SP63	20/02/2020	SYDNEY PARK	2.1	
SP63	18/03/2020	SYDNEY PARK	5	
SP64	20/02/2020	SYDNEY PARK	2.1	
SP64	18/03/2020	SYDNEY PARK	2.2	
SP65	20/02/2020	SYDNEY PARK	2.1	
SP65	18/03/2020	SYDNEY PARK	2.5	
SP66	20/02/2020	SYDNEY PARK	2.1	
SP66	18/03/2020	SYDNEY PARK	51	
SP67	20/02/2020	SYDNEY PARK	24.1	
SP67	18/03/2020	SYDNEY PARK	3.1	
SP68	20/02/2020	SYDNEY PARK	2.3	
SP68	18/03/2020	SYDNEY PARK	2.3	
SP69	20/02/2020	SYDNEY PARK	2.4	
SP69	18/03/2020	SYDNEY PARK	2.6	
SP70	20/02/2020	SYDNEY PARK	3.4	
SP70	18/03/2020	SYDNEY PARK	27	
SP71	20/02/2020	SYDNEY PARK	2.8	
SP71	18/03/2020	SYDNEY PARK	2.3	
SP72	20/02/2020	SYDNEY PARK	4	
SP72	18/03/2020	SYDNEY PARK	2.2	

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Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP73	20/02/2020	SYDNEY PARK	2.3	
SP73	18/03/2020	SYDNEY PARK	2.2	
SP74	20/02/2020	SYDNEY PARK	2.3	
SP74	18/03/2020	SYDNEY PARK	2.3	
SP75	20/02/2020	SYDNEY PARK	134	
SP75	18/03/2020	SYDNEY PARK	2.4	
SP76	20/02/2020	SYDNEY PARK	114	
SP76	18/03/2020	SYDNEY PARK	2.2	
SP77	20/02/2020	SYDNEY PARK	3.7	
SP77	18/03/2020	SYDNEY PARK	2.2	
SP78	20/02/2020	SYDNEY PARK	184	
SP78	18/03/2020	SYDNEY PARK	4.9	
SP79	20/02/2020	SYDNEY PARK	2.3	
SP79	18/03/2020	SYDNEY PARK	2.5	
SP80	20/02/2020	SYDNEY PARK	2.3	
SP80	18/03/2020	SYDNEY PARK	2.5	
SP81	20/02/2020	SYDNEY PARK	2.3	
SP81	18/03/2020	SYDNEY PARK	2.5	
SP82	20/02/2020	SYDNEY PARK	2.3	
SP82	18/03/2020	SYDNEY PARK	2.5	
SP83	20/02/2020	SYDNEY PARK	2.3	
SP83	18/03/2020	SYDNEY PARK	2.5	
SP84	20/02/2020	SYDNEY PARK	2.3	
SP84	18/03/2020	SYDNEY PARK	2.8	
SP85	20/02/2020	SYDNEY PARK	2.3	
SP85	18/03/2020	SYDNEY PARK	2.2	
SP86	20/02/2020	SYDNEY PARK	14.5	
SP86	18/03/2020	SYDNEY PARK	460	
SP87	20/02/2020	SYDNEY PARK	3.8	
SP87	18/03/2020	SYDNEY PARK	6	
SP88	20/02/2020	SYDNEY PARK	2.2	
SP88	18/03/2020	SYDNEY PARK		Could not locate
SP89	20/02/2020	SYDNEY PARK	2.4	
SP89	18/03/2020	SYDNEY PARK	2.5	
SP90	20/02/2020	SYDNEY PARK	2.2	
SP90	18/03/2020	SYDNEY PARK	455	
SP91	20/02/2020	SYDNEY PARK	2.2	
SP91	18/03/2020	SYDNEY PARK	2.1	
SP92	20/02/2020	SYDNEY PARK	2.4	
SP92	18/03/2020	SYDNEY PARK	2.2	
SP93	20/02/2020	SYDNEY PARK	2.2	
SP93	18/03/2020	SYDNEY PARK	10.9	
SP94	20/02/2020	SYDNEY PARK	2.2	
SP94	18/03/2020	SYDNEY PARK	2.4	
SP95	20/02/2020	SYDNEY PARK	2.7	
SP95	18/03/2020	SYDNEY PARK	3.6	
SP96	20/02/2020	SYDNEY PARK	2.2	
SP96	18/03/2020	SYDNEY PARK	2.3	

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https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP97	20/02/2020	SYDNEY PARK	2.2	
SP97	18/03/2020	SYDNEY PARK	2.8	
SP98	20/02/2020	SYDNEY PARK	2.2	
SP98	18/03/2020	SYDNEY PARK	2.4	
SP99	20/02/2020	SYDNEY PARK	20	FALLEN TREE ON DRAIN, LIMITED ACCESS
SP99	18/03/2020	SYDNEY PARK		Could not locate
SP01	22/01/2020	SYDNEY PARK	2.3	
SP02	22/01/2020	SYDNEY PARK	2	
SP03	22/01/2020	SYDNEY PARK	2.1	
SP04	22/01/2020	SYDNEY PARK	2	
SP05	22/01/2020	SYDNEY PARK	2.3	
SP06	22/01/2020	SYDNEY PARK	-	No access, construction works
SP07	22/01/2020	SYDNEY PARK	2.2	
SP08	22/01/2020	SYDNEY PARK	2.9	
SP09	22/01/2020	SYDNEY PARK	2.5	
SP10	22/01/2020	SYDNEY PARK	1.7	
SP100	22/01/2020	SYDNEY PARK	1.7	
SP101	22/01/2020	SYDNEY PARK	3.8	
SP103	22/01/2020	SYDNEY PARK	2.9	
SP104	22/01/2020	SYDNEY PARK	1.8	
SP11	22/01/2020	SYDNEY PARK	1.8	
SP12	22/01/2020	SYDNEY PARK	2	
SP13	22/01/2020	SYDNEY PARK	2	
SP14	22/01/2020	SYDNEY PARK	2	
SP15	22/01/2020	SYDNEY PARK	1.9	
SP16	22/01/2020	SYDNEY PARK	1.9	New photo
SP17	22/01/2020	SYDNEY PARK	3.2	
SP18	22/01/2020	SYDNEY PARK	4.2	
SP19	22/01/2020	SYDNEY PARK	1.8	
SP20	22/01/2020	SYDNEY PARK	4.2	
SP21	22/01/2020	SYDNEY PARK	1.7	
SP23	22/01/2020	SYDNEY PARK	1.9	
SP24	22/01/2020	SYDNEY PARK	1.7	
SP25	22/01/2020	SYDNEY PARK	1.6	
SP26	22/01/2020	SYDNEY PARK	1.9	Closer
SP27	22/01/2020	SYDNEY PARK	1.8	Middle on Pic
SP28	22/01/2020	SYDNEY PARK	1.8	Far
SP29	22/01/2020	SYDNEY PARK	1.9	
SP30	22/01/2020	SYDNEY PARK	2	
SP31	22/01/2020	SYDNEY PARK	10.3	
SP32	22/01/2020	SYDNEY PARK	1.8	
SP33	22/01/2020	SYDNEY PARK	1.8	
SP34	22/01/2020	SYDNEY PARK	1.8	
SP35	22/01/2020	SYDNEY PARK	1.7	
SP36	22/01/2020	SYDNEY PARK	1.8	
SP37	22/01/2020	SYDNEY PARK	1.9	
SP38	22/01/2020	SYDNEY PARK	2.7	
SP39	22/01/2020	SYDNEY PARK	2.7	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations
https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP40	22/01/2020	SYDNEY PARK	1.7	Pic at 9:39
SP41	22/01/2020	SYDNEY PARK	1.7	
SP42	22/01/2020	SYDNEY PARK	1.7	
SP43	22/01/2020	SYDNEY PARK	1.7	
SP44	22/01/2020	SYDNEY PARK	1.7	
SP45	22/01/2020	SYDNEY PARK	1.7	
SP46	22/01/2020	SYDNEY PARK	1.6	
SP47	22/01/2020	SYDNEY PARK	1.7	
SP48	22/01/2020	SYDNEY PARK	1.6	Close
SP49	22/01/2020	SYDNEY PARK	1.7	Mid, pic at 9:53
SP50	22/01/2020	SYDNEY PARK	1.7	Far
SP51	22/01/2020	SYDNEY PARK	1.7	
SP52	22/01/2020	SYDNEY PARK	1.7	
SP53	22/01/2020	SYDNEY PARK	1.7	
SP54	22/01/2020	SYDNEY PARK	1.7	
SP55	22/01/2020	SYDNEY PARK	1.6	
SP56	22/01/2020	SYDNEY PARK	1.7	
SP57	22/01/2020	SYDNEY PARK	1.7	
SP58	22/01/2020	SYDNEY PARK	1.6	
SP59	22/01/2020	SYDNEY PARK	1.7	
SP60	22/01/2020	SYDNEY PARK	1.7	
SP61	22/01/2020	SYDNEY PARK	1.7	
SP62	22/01/2020	SYDNEY PARK	1.8	
SP63	22/01/2020	SYDNEY PARK	1.7	
SP64	22/01/2020	SYDNEY PARK	1.9	Pic at 10:04
SP65	22/01/2020	SYDNEY PARK	1.9	
SP66	22/01/2020	SYDNEY PARK	2.6	
SP67	22/01/2020	SYDNEY PARK	1.9	
SP68	22/01/2020	SYDNEY PARK	1.7	
SP69	22/01/2020	SYDNEY PARK	1.5	
SP70	22/01/2020	SYDNEY PARK	2.6	
SP71	22/01/2020	SYDNEY PARK	1.6	
SP72	22/01/2020	SYDNEY PARK	1.5	
SP73	22/01/2020	SYDNEY PARK	1.6	
SP74	22/01/2020	SYDNEY PARK	1.4	
SP75	22/01/2020	SYDNEY PARK	1.7	
SP76	22/01/2020	SYDNEY PARK	63	
SP77	22/01/2020	SYDNEY PARK	10.5	
SP78	22/01/2020	SYDNEY PARK	1.6	
SP79	22/01/2020	SYDNEY PARK	1.6	
SP80	22/01/2020	SYDNEY PARK	1.6	
SP81	22/01/2020	SYDNEY PARK	61.4	
SP82	22/01/2020	SYDNEY PARK	1.6	
SP83	22/01/2020	SYDNEY PARK	1.7	
SP84	22/01/2020	SYDNEY PARK	1.6	
SP85	22/01/2020	SYDNEY PARK	1.6	
SP86	22/01/2020	SYDNEY PARK	2.9	
SP87	22/01/2020	SYDNEY PARK	3.8	

Table B - Summary Service Pits Monitoring Results
2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
SP88	22/01/2020	SYDNEY PARK	9.9	
SP89	22/01/2020	SYDNEY PARK	1050	
SP90	22/01/2020	SYDNEY PARK	1.6	
SP91	22/01/2020	SYDNEY PARK	1.5	
SP92	22/01/2020	SYDNEY PARK	1.6	
SP93	22/01/2020	SYDNEY PARK	1.5	
SP94	22/01/2020	SYDNEY PARK	1.6	
SP95	22/01/2020	SYDNEY PARK	1.6	
SP96	22/01/2020	SYDNEY PARK	1.6	
SP97	22/01/2020	SYDNEY PARK	1.7	
SP98	22/01/2020	SYDNEY PARK	3.6	
SP99	22/01/2020	SYDNEY PARK	1.8	
A1	22/01/2020	SYDNEY PARK RD	750	
A1	20/02/2020	SYDNEY PARK RD	8850	
A1	18/03/2020	SYDNEY PARK RD	69000	6.9 % V/V
A10	22/01/2020	SYDNEY PARK RD	2.2	
A10	20/02/2020	SYDNEY PARK RD	2	
A10	18/03/2020	SYDNEY PARK RD	96.3	
A11	22/01/2020	SYDNEY PARK RD	7.2	
A11	20/02/2020	SYDNEY PARK RD	2	
A11	18/03/2020	SYDNEY PARK RD	7.8	
A12	22/01/2020	SYDNEY PARK RD	400	
A12	20/02/2020	SYDNEY PARK RD	112	
A12	18/03/2020	SYDNEY PARK RD	2.9	
A13	22/01/2020	SYDNEY PARK RD	8.2	
A13	20/02/2020	SYDNEY PARK RD	2	
A13	18/03/2020	SYDNEY PARK RD	5.8	
A14	22/01/2020	SYDNEY PARK RD	7.4	
A14	20/02/2020	SYDNEY PARK RD	2	
A14	18/03/2020	SYDNEY PARK RD	21.6	
A15	22/01/2020	SYDNEY PARK RD	7.1	
A15	20/02/2020	SYDNEY PARK RD	8.8	
A15	18/03/2020	SYDNEY PARK RD	2.4	
A16	22/01/2020	SYDNEY PARK RD	6.6	
A16	20/02/2020	SYDNEY PARK RD	167	
A16	18/03/2020	SYDNEY PARK RD	7880	
A17	22/01/2020	SYDNEY PARK RD	5.5	
A17	20/02/2020	SYDNEY PARK RD		NOT LOCATED
A17	18/03/2020	SYDNEY PARK RD		NOT FOUND, DESTROYED? LOOSE DIRT EVERYWHEI
A18	22/01/2020	SYDNEY PARK RD	3.2	
A18	20/02/2020	SYDNEY PARK RD	2	
A18	18/03/2020	SYDNEY PARK RD	40.4	
A2	22/01/2020	SYDNEY PARK RD	89.4	
A2	20/02/2020	SYDNEY PARK RD	6800	
A2	18/03/2020	SYDNEY PARK RD	**35000**	3.5 % V/V
A3	22/01/2020	SYDNEY PARK RD	5.9	
A3	20/02/2020	SYDNEY PARK RD	31.5	
A3	18/03/2020	SYDNEY PARK RD	313	

Table B - Summary Service Pits Monitoring Results

2127590 - Sydney Park Landfill Gas Investigations

https://projectsportal.ghd.com/sites/pp15_04/year6monitoringandre/ProjectDocs/LFG/[12522077_ SydneyPark_LFG_Results_Ongoing.xls]Service Pits Results (B)

Service Pit Information			Peak	Notes
Service Pit ID	Monitoring Date	Location	Methane (CH_4) (max)	
			ppm	
Instrument Limit			1	
Assessment Criteria			10000	
A4	22/01/2020	SYDNEY PARK RD	3.6	
A4	20/02/2020	SYDNEY PARK RD	9.7	
A4	18/03/2020	SYDNEY PARK RD	10.7	
A6	22/01/2020	SYDNEY PARK RD	2	
A6	20/02/2020	SYDNEY PARK RD	2.4	
A6	18/03/2020	SYDNEY PARK RD	2.2	
A7	22/01/2020	SYDNEY PARK RD	2300	
A7	20/02/2020	SYDNEY PARK RD	2.2	
A7	18/03/2020	SYDNEY PARK RD	88.3	
A8	22/01/2020	SYDNEY PARK RD	28.8	
A8	20/02/2020	SYDNEY PARK RD	6.3	
A8	18/03/2020	SYDNEY PARK RD	258	
A9	22/01/2020	SYDNEY PARK RD	400	
A9	20/02/2020	SYDNEY PARK RD	**50000**	5.00%
A9	18/03/2020	SYDNEY PARK RD	780	
N	22/01/2020	SYDNEY PARK RD	7	
N	20/02/2020	SYDNEY PARK RD	2.1	
N	18/03/2020	SYDNEY PARK RD	10.2	
O	22/01/2020	SYDNEY PARK RD	39.6	
O	20/02/2020	SYDNEY PARK RD	4	
O	18/03/2020	SYDNEY PARK RD	279	
P	22/01/2020	SYDNEY PARK RD	30.02	
P	20/02/2020	SYDNEY PARK RD	57.8	
P	18/03/2020	SYDNEY PARK RD	1138	SURFACE METHANE FROM MULCHED AREA DRIFTING IN? STREET CAMERA ADJACENT IS 28% V/V
Q	22/01/2020	SYDNEY PARK RD		NOT SAFE TO MONITOR - LIVE TRAFFIC
Q	20/02/2020	SYDNEY PARK RD		NOT MONITORED, DANGEROUS TRAFFIC
Q	18/03/2020	SYDNEY PARK RD		NOT MONITORED, DANGEROUS TRAFFIC
X1	22/01/2020	SYDNEY PARK RD	24.4	
X1	20/02/2020	SYDNEY PARK RD	2.3	SAME AS A5
X1	18/03/2020	SYDNEY PARK RD	8.9	
X2	22/01/2020	SYDNEY PARK RD	**13600**	
X2	20/02/2020	SYDNEY PARK RD	**15000**	1.50%
X2	18/03/2020	SYDNEY PARK RD	**211000**	21.1% V/V
X3	22/01/2020	SYDNEY PARK RD	1836	
X3	20/02/2020	SYDNEY PARK RD	700	
X3	18/03/2020	SYDNEY PARK RD	373	
X4	22/01/2020	SYDNEY PARK RD	512	
X4	20/02/2020	SYDNEY PARK RD	97.8	
X4	18/03/2020	SYDNEY PARK RD	38000	3.8% V/V
X5	18/03/2020	SYDNEY PARK RD	280000	Street camera

Table 2.2 LFG monitoring bores – assessment criteria exceedances

Methane concentration exceedances of peak readings	Carbon dioxide concentration exceedances of peak readings	Hydrogen sulphide concentration exceedances of stabilised readings
Assessment criterion (1% v/v)	Assessment criterion (1.5% v/v)	Assessment criterion (10 ppm)
101 103A BH14	101 102 110 103A 108B 111A BH12 BH14 BH15	Nil

The concentrations of methane and carbon dioxide did not exceed the nominated assessment criteria in any other monitored LFG monitoring bore during this round.

It is noted that GHD advised CoS of these exceedances following their detection. GHD understands that CoS subsequently notified the NSW EPA of these exceedances.

The exceedances of methane and/or carbon dioxide detected at a number of the bores presented in Table 2.2 have also been observed during a number of previous monitoring rounds.

2.3.2 Comparison of results with previous monitoring round results

Table 2.3 summarises the concentrations of methane and carbon dioxide detected during this round and compares them to data from the previous monitoring round.

Table 2.3 Comparison of methane and carbon dioxide concentrations

LFG monitoring bore ID	Peak methane concentration (% v/v)		Peak carbon dioxide concentration (% v/v)	
	Nov-18	Feb-19	Nov-18	Feb-19
101	0.0	9.0	3.8	4.8
102	0.3	0.0	7.8	6.4
103A	28.3	20.8	6.7	16.1
104A	0.8	N/A	17.1	N/A
108B	0.0	0.0	8.2	2.2
110	0.0	0.0	1.5	6.5
111A	0.0	0.0	2.2	6.0
B2	0.5	N/A	2.4	N/A
BH1	N/A	N/A	N/A	N/A
BH3	N/A	N/A	N/A	N/A
BH4	0.0	N/A	2.6	N/A
BH8	N/A	N/A	N/A	N/A
BH12	0.0	0.3	6.0	7.3
BH14	4.3	82.9	1.5	31.1
BH15	0.0	0.0	0.5	5.2

LFG monitoring bore ID	Peak methane concentration (% v/v)		Peak carbon dioxide concentration (% v/v)	
	Nov-18	Feb-19	Nov-18	Feb-19
BH23	0.4	0.0	4.0	0.9
BH24	N/A	N/A	N/A	N/A
BH26	N/A	N/A	N/A	N/A
BR01	0.0	N/A	0.9	N/A
BR02	0.0	N/A	0.1	N/A
BR03	0.0	N/A	0.5	N/A
BR04	0.1	N/A	0.1	N/A
GA06	0.1	N/A	1.4	N/A
GA08	N/A	N/A	N/A	N/A
SKM03-03	10.5	N/A	16.5	N/A
Unknown	66.2	N/A	26.9	N/A

Notes:

NA Monitoring location not accessible, located or destroyed

No comparison made as the monitoring location could not be monitored in one or both of the rounds

Change in concentration between the two monitoring rounds is within 5% v/v and deemed relatively consistent

The most recent monitoring round result is more than a 5 % v/v increase relative to the previous result

The most recent monitoring round result is more than a 5 % v/v decrease relative to the previous result

The results in Table 2.3 identifies that the concentrations of methane and carbon dioxide detected in the monitored LFG bores during the last two rounds have generally remained comparable in the majority of monitored LFG bores. However, methane concentrations have increased by more than 5 % v/v at two locations (bores 101 and BH14) and decreased by more than 5 % v/v at one location (bore 103A). In relation to the carbon dioxide concentrations, these have increased more than 5% at three locations (bores 103A, 110 and BH14) and decreased by more than 5 % v/v at one location (bore 108B).

The general conditions at the site appear to be relatively stable over the short-term, with a few areas of potential activity where certain gas concentrations appear to be changeable.

The variations in methane and carbon dioxide concentrations could be due to many factors potentially working in combination with the following:

- Atmospheric pressure differences;
- Release of accumulated subsurface gas at other locations at the site;
- Variation/inconsistencies in waste degradation; and
- Instrument reading variations.

2.4 Risk classification and assessment

2.4.1 Overview

As per the NSW EPA's *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (2012), the LFG monitoring data obtained during this round was used to develop preliminary gas screening values (GSVs) and characteristic gas situations (CS) for the site. GSV and CS values are used to identify potential levels of ground gas risk associated with a site and to identify the level of ground gas protection measures that may be required.

The formula used to calculate the GSVs is as follows:

Gas Screening Value (GSV) = maximum stabilised borehole flow rate (L/h) x the maximum gas concentration of methane or carbon dioxide (% v/v)

The gas concentration used in the GSV calculation is determined by the greater of the following:

- The maximum (peak) methane concentration; or
- The maximum (peak) carbon dioxide concentration.

For this assessment, GHD has identified the maximum stabilised borehole gas flow rate and maximum (peak) methane and carbon dioxide concentrations detected at each LFG monitoring bore during this round of sampling.

In accordance with the above noted guidelines (NSW EPA, 2012), the lower measurement limit of the instrument was used where there was no detectable flow. The specification sheet of the GA5000 contained in Appendix C indicates the recordable flow of the instrument ranges from 0 to 20 L/h.

The specification also indicates that the flow from borehole accuracy is +/- 0.3 L/h. As such, a gas flow of 0.3 L/h was used in calculating the GSV values for any bores, which detected gas flow at 0 L/h during the February 2019 monitoring round. The use of this updated approach is assessed as part of the findings in below Sections 2.4.1 and Table 2.5.

Preliminary CS values for each LFG monitoring bore have been developed using the modified Wilson and Card classification detailed in Table 6 on page 31 of the NSW EPA's *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (2012).

A modified version of the Wilson and Card classification is shown in Table 2.4.

Table 2.4 Characteristic Gas Situations (based on the Wilson and Card classification)

Characteristic gas situation (CS)	Risk classification	GSV (gas %v/v) x flow (L/h))	Typical factors
1	Very Low	< 0.07	Methane <1% or carbon dioxide <5%; otherwise increase to Situation 2
2	Low	< 0.7	Air flow rate < 70 L/h; otherwise increase to Situation 3
3	Moderate	< 3.5	-
4	Moderate to High	< 15	Consider need for level 3 risk assessment
5	High	< 70	Quantitative risk assessment (level 3 required)
6	Very High	> 70	

2.4.1 Calculation of GSV and CS values

Using the method detailed in Section 2.4.1, GHD calculated and collated GSV and CS values for each LFG monitoring bore monitored during this round. Table 2.5 lists the calculated GSV and CS values and provides a comparison for this round with those previously calculated, as part of the preceding three rounds.

Table 2.5 Comparison of GSV and CS values

LFG monitoring bore ID	Feb 2018 GSV (L/h)	May 2018 GSV (L/h)	Nov 2018 GSV (L/h)	Feb 2019 GSV (L/h)	Feb 2018 CS	May 2018 CS	Nov 2018 CS	Feb 2019 CS
101	0.009	0.0034	0.0038	0.018	1 - Very Low	1 - Very Low	1 - Very Low	2 - Low
102	0.0201	0.0057	0.0234	0.0192	2 - Low	2 - Low	2 - Low	2 - Low
103A	0.0126	0.0462	0.0849	0.0208	2 - Low	2 - Low	2 - Low	2 - Low
104A	0.0084	0.0083	0.0246	Not calculated – Ex-cap incompatible	2 - Low	2 - Low	2 - Low	Not calculated – Ex-cap incompatible
108B	0.0024	0.0048	0.0045	0.0022	1 - Very Low	1 - Very Low	1 - Very Low	1 - Very Low
110	0.0126	0.0144	0.0067	0.0065	1 - Very Low	1 - Very Low	2 - Low	2 - Low
111A	0.0066	0.0066	0.0066	0.0006	1 - Very Low	1 - Very Low	1 - Very Low	2 - Low
B2	0.0012	0.0003	0.0072	Not calculated – Ex-cap missing	1 - Very Low	1 - Very Low	1 - Very Low	Not calculated – Ex-cap missing
BH1	Bore removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located
BH3	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located
BH4	0.0063	0.0075	0.0026	Not calculated – Not located	1 - Very Low	1 - Very Low	1 - Very Low	Not calculated – Not located
BH8	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located	Not calculated – Removed	Not calculated – Removed	Not calculated – Not accessible	Not calculated – Not located
BH12	0.0017	0.009	0.006	0.0146	1 - Very Low	2 - Low	2 - Low	2 - Low
BH14	0.0003	0.123	0.0129	0.1658	1 - Very Low	2 - Low	2 - Low	2 - Low
BH15	0.0083	0.0039	0.0015	0.0052	2 - Low	1 - Very Low	1 - Very Low	2 - Low
BH23	0.0163	0.006	0.012	0.0018	2 - Low	1 - Very Low	1 - Very Low	1 - Very Low

LFG monitoring bore ID	Feb 2018 GSV (L/h)	May 2018 GSV (L/h)	Nov 2018 GSV (L/h)	Feb 2019 GSV (L/h)	Feb 2018 CS	May 2018 CS	Nov 2018 CS	Feb 2019 CS
BH24	Not calculated – Not accessible	Not calculated – Not accessible	Not calculated – Not accessible	Not calculated – Not accessible	Not calculated – Not accessible	Not calculated – Not accessible	Not calculated – Not accessible	Not calculated – Not accessible
BH26	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not accessible	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not accessible
BR01	0.0001	0.0417	0.0009	Not calculated – Ex-cap incompatible	1 - Very Low	2 - Low	1 - Very Low	Not calculated – Ex-cap incompatible
BR02	0.0006	0.0042	0.0003	Not calculated – Not located	1 - Very Low	2 - Low	1 - Very Low	Not calculated – Not located -
BR03	0.0006	0.0018	0.0015	Not calculated – Ex-cap incompatible	1 - Very Low	2 - Low	1 - Very Low	Not calculated – Ex-cap incompatible
BR04	0.0003	0.0012	0.0001	Not calculated – Not located	1 - Very Low	1 - Very Low	1 - Very Low	Not calculated – Not located
GA06	0.0066	0.0114	0.0014	Not calculated – Not located	1 - Very Low	1 - Very Low	1 - Very Low	Not calculated – Not located
GA08	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located	Not calculated – Removed	Not calculated – Removed	Not calculated – Removed	Not calculated – Not located
SKM03-03	0.0153	0.0056	0.0495	Not calculated – well could not be opened	2 - Low	2 - Low	2 - Low	Not calculated – Well could not be opened
Unknown	0.1854	0.0606	0.0662	Not calculated – Ex-cap incompatible	2 - Low	2 - Low	2 - Low	Not calculated – Ex-cap incompatible

taihan

Appendix B– Transmission Cable Trench Design Details

Client:

180 Thomas Street Sydney NSW 2000

Project Name:

Contract No. 1595

Powering Sydney's Future – Supply and Installation of Integrated Cable Systems Rookwood to Beaconsfield

Contractor:

Subcontractor:

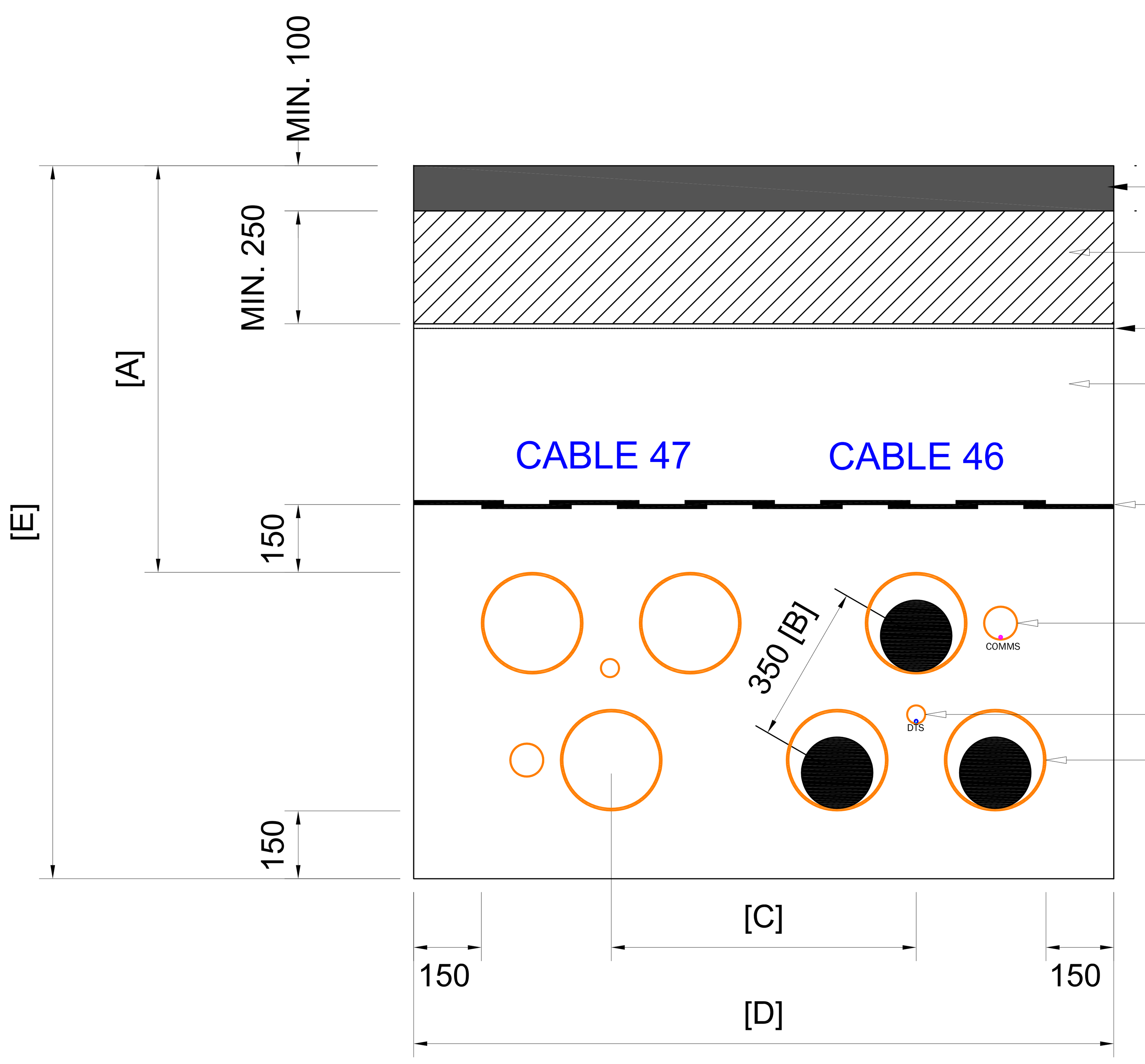
R3	14/04/2020	Revised	JS Yoo	David Kim	CS Han
R2	20/03/2020	Revised	JS Yoo	David Kim	CS Han
R1	27/02/2020	Revised	JS Yoo	David Kim	CS Han
R0	23/01/2020	Issue For Review	JS Yoo	David Kim	CS Han
Rev. No.	Date	Descriptions	Prepared	Reviewed	Approved

Document Title:

Typical Trench Design and Rating Tables for 330kV

Drawing / Document Number:	Page Number:	Size:	Revision Number:
TEA-PSF-DR-005	**1** OF **15**	**A3**	**R3**

Subcontractor Name:	Subcontractor's Document Number:
GARDE	**-**



AC20 (100mm MINIMUM) OR MATCH EXISTING WHICHEVER IS GREATER

COMPACTED ROAD BASE DGB20 TO RMS 3051 (TR LESS THAN 1.2K.m/W)

150mm WIDE WARNING TAPE TO AS2648.1 (FULL TRENCH WIDTH)

THERMALLY STABLE BACKFILL (Min. 550mm TSB ABOVE CONDUITS) :NOTE 2
(LESS THAN TR VALUE 0.9Km/W IN FULLY DRIED OUT CONDITION)

300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702 (FULL TRENCH WIDTH)

2 X 80mm HDPVC TO AS/NZS 2053.2 FOR COMMUNICATION OPTIC FIBRE

2 X 32mm HDPVC TO AS/NZS 2053.2 FOR DTS FIBRE

6 X DN200 CLASS PN6 CONDUITS TO AS/NZS 1477 Table 4.1
FOR 330kV POWER CABLE

POWER CABLE
- 330kV 1C 2500SQ ENAMEL COATED COPPER CONDUCTOR / XLPE INSULATION / SMOOTH ALUMINIUM SHEATH / MDPE, NYLON, HDPE OVERSHEATH (Doc.No TEA-PSF-DR-007)

COMMUNICATION FIBRE - 48 SINGLE MODE FIBRE CABLE
(Doc.No TEA-PSF-DR-013)

DTS FIBRE - 8MM/4SM BROWN FIBRE IN 8/6MM 1 WAY MICRO DUCT
(Doc.No TEA-PSF-DR-012)

TYPICAL TRENCH DESIGN TYPE A

SCALE 1:10
POWER CABLE IN 200mm CONDUIT WITH 350mm
DISTANCE SPACER
TYPICAL DUAL CIRCUIT OF 330kV TRENCH SECTION
BETWEEN ROOKWOOD RD AND BEACONSFIELD
LOOKING TO BEACONSFIELD

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance
[D] : Trench width
[E] : Trench height

NOTES.
1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. 0.9 Km/W TR VALUE OF TSB HAS BEEN CONSIDERED FOR DESIGN.
3. RELEVANT CONDUIT SPACES IS SELECTED BY REFERENCING THE RATINGS TABLES TO Doc.No TEA-PSF-DR-005.
4. IF ADDITIONAL SEPARATION BETWEEN CIRCUITS IS REQUIRED TO SATISFY THE RATINGS REQUIREMENTS, THEN 100mm CONDUIT SPACES IS REQUIRED.
5. DETAILED TRENCH SIZE SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

CHECK PRINT	BACKDRAFT REQUIRED	READY TO ISSUE
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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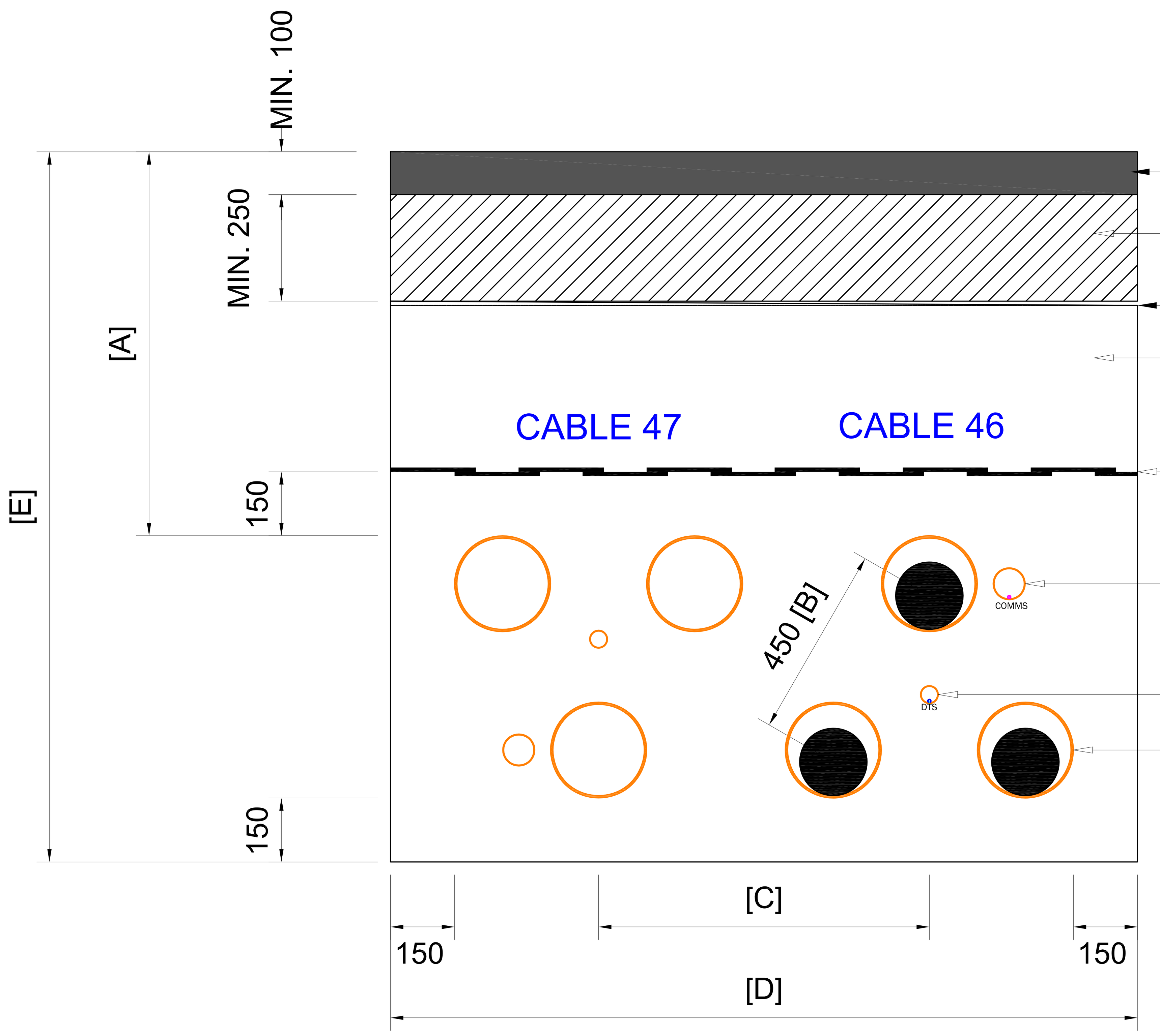
PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL TRENCH DESIGN TYPE A

A1	TEA-PSF-CD-D-010	B
	DRAWING NUMBER	AMDT

566x801mm



AC20 (100mm MINIMUM) OR MATCH EXISTING WHICHEVER IS GREATER

COMPACTED ROAD BASE DGB20 TO RMS 3051 (TR LESS THAN 1.2K.m/W)

150mm WIDE WARNING TAPE TO AS2648.1 (FULL TRENCH WIDTH)

THERMALLY STABLE BACKFILL (Min. 550mm TSB ABOVE CONDUITS) : NOTE 2
(LESS THAN TR VALUE 0.9Km/W IN FULLY DRIED OUT CONDITION)

300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702 (FULL TRENCH WIDTH)

2 X 80mm HDPVC TO AS/NZS 2053.2 FOR COMMUNICATION OPTIC FIBRE

2 X 32mm HDPVC TO AS/NZS 2053.2 FOR DTS FIBRE

6 X DN200 CLASS PN6 CONDUITS TO AS/NZS 1477 Table 4.1
FOR 330kV POWER CABLE

POWER CABLE
- 330kV 1C 2500SQ ENAMEL COATED COPPER CONDUCTOR / XLPE INSULATION / SMOOTH ALUMINIUM SHEATH / MDPE, NYLON, HDPE OVERSHEATH (Doc.No TEA-PSF-DR-007)

COMMUNICATION FIBRE - 48 SINGLE MODE FIBRE CABLE
(Doc.No TEA-PSF-DR-013)

DTS FIBRE - 8MM/4SM BROWN FIBRE IN 8/6MM 1 WAY MICRO DUCT
(Doc.No TEA-PSF-DR-012)

TYPICAL TRENCH DESIGN TYPE B

SCALE 1:10
POWER CABLE IN 200mm CONDUIT WITH 450mm
DISTANCE SPACER
TYPICAL DUAL CIRCUIT 330kV CABLE TRENCH
BETWEEN ROOKWOOD ROAD AND BEACONSFIELD WEST
WHERE BURIAL DEPTH AND/OR HIGH NATIVE TR
REQUIRE TRENCH TO BE 1750mm WIDE OR GREATER.
LOOKING TO BEACONSFIELD WEST

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance
[D] : Trench width
[E] : Trench height

NOTES.
1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. 0.9 Km/W TR VALUE OF TSB HAS BEEN CONSIDERED FOR DESIGN.
3. RELEVANT CONDUIT SPACES IS SELECTED BY REFERENCING THE RATINGS TABLES TO Doc.No TEA-PSF-DR-005.
4. IF ADDITIONAL SEPARATION BETWEEN CIRCUITS IS REQUIRED TO SATISFY THE RATINGS REQUIREMENTS, THEN 100mm CONDUIT SPACES IS REQUIRED.
5. DETAILED TRENCH SIZE SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

CHECK PRINT	BACKDRAFT REQUIRED ☐ READY TO ISSUE ☐	
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL TRENCH DESIGN TYPE B

A1 | TEA-PSF-CD-D-020 (DRAWING NUMBER) | B (AMDT)

566x801mm

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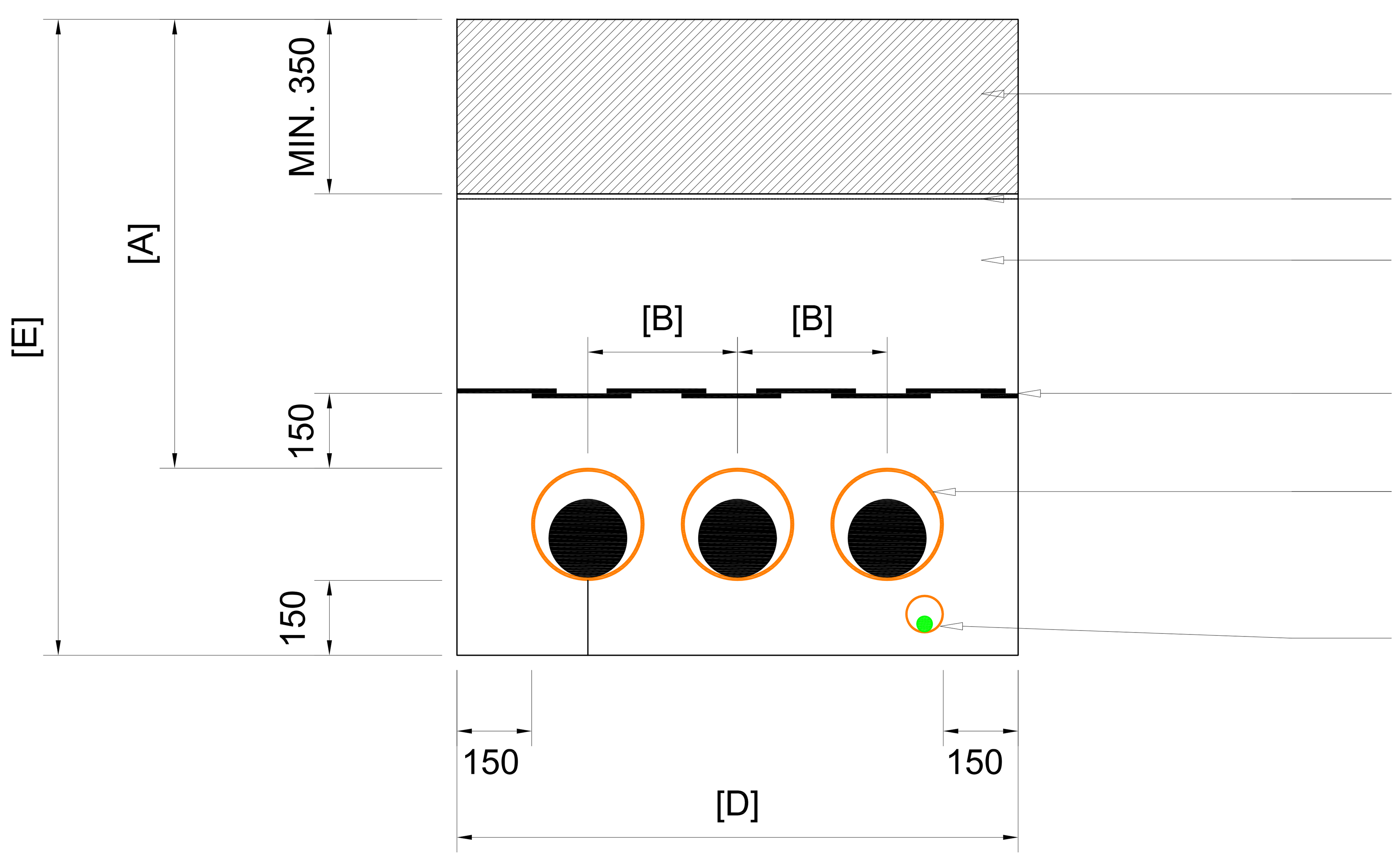

MATCH EXISTING SURFACE MATERIAL (TR LESS THAN 1.2K.m/W)

150mm WIDE WARNING TAPE TO AS2648.1 (FULL TRENCH WIDTH)

THERMALLY STABLE BACKFILL (Min. 550mm TSB ABOVE CONDUITS)
(LESS THAN TR VALUE 0.9Km/W IN FULLY DRIED OUT CONDITION)

300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702 (FULL TRENCH WIDTH)

3 X DN200 CLASS PN6 CONDUITS TO AS/NZS 1477 Table 4.1 FOR 330kV POWER CABLE

1 X 80mm LDPVC TO AS/NZS 2053.2 FOR ECC CABLE

POWER CABLE
- 330kV 1C 2500SQ ENAMEL COATED COPPER CONDUCTOR / XLPE INSULATION / SMOOTH ALUMINIUM SHEATH / MDPE, NYLON, HDPE OVERSHEATH (Doc.No TEA-PSF-DR-007)

ECC CABLE - 300SQ SINGLE BONDING CABLE
(Doc.No TEA-PSF-DR-010)

TYPICAL TRENCH DESIGN TYPE C

SCALE 1:10
POWER CABLE IN 200mm CONDUIT
FLAT FORMATION OF 330kV TRENCH SECTION FOR
BEACONSFIELD TIE CABLE

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance (Not Applied)
[D] : Trench width
[E] : Trench height

NOTES.
1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. 0.9 Km/W TR VALUE OF TSB HAS BEEN CONSIDERED FOR DESIGN.
3. DETAILED TRENCH SIZE SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

CHECK PRINT	BACKDRAFT REQUIRED ☐ / READY TO ISSUE ☐	
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL TRENCH DESIGN TYPE C

	DRAWING NUMBER	AMDT
A1	TEA-PSF-CD-D-030	B

Last saved by: TEC(2020-04-09) Last Plotted: 2020-04-09
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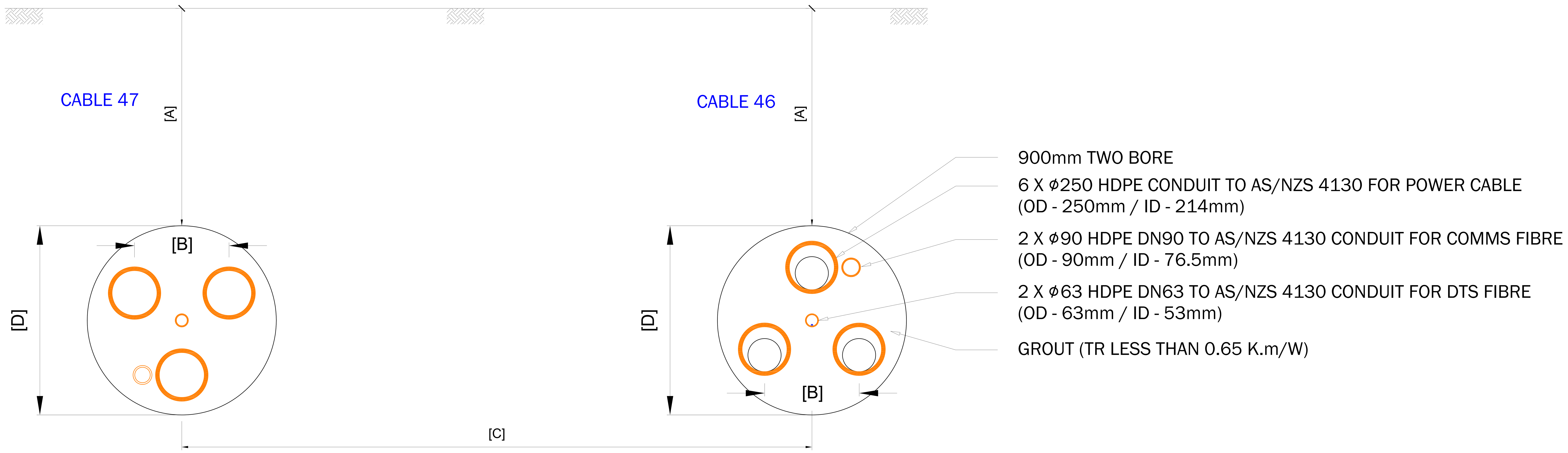
566x801mm



TYPICAL HDD DESIGN TYPE A

SCALE 1:10
HDD SECTION FOR 330kV DOUBLE CIRCUIT
THE PROPOSED HDD SECTION IS

1. THE NATIVE SOIL DESIGN TR VALUE ARE 1.10 K.m/W AT 2% MOISTURE CONTENT AND 1.45 K.m/W AT FULLY DRIED.

NOTES.

1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. RELEVANT CONDUIT SPACES IS SELECTED BY REFERENCING THE RATINGS TABLES TO Doc.No TEA-PSF-DR-005.
3. DETAILED DIMENTIONS SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance
[D] : Bore hole size

CHECK PRINT	INITIAL	DATE
BACKDRAFT REQUIRED / READY TO ISSUE		
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL HDD DESIGN TYPE A

A1 | DRAWING NUMBER: TEA-PSF-CD-D-050 | AMDT: B

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Filename: C:\USERS\TEC\DESKTOP\REVISED TRENCH\TEA-PSF-CD-D-050.DWG
566x801mm

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Circuit Rating Tables

-. Rookwood Rd to Beaconsfield substations
-. 330kV Tie cable within Beaconsfield

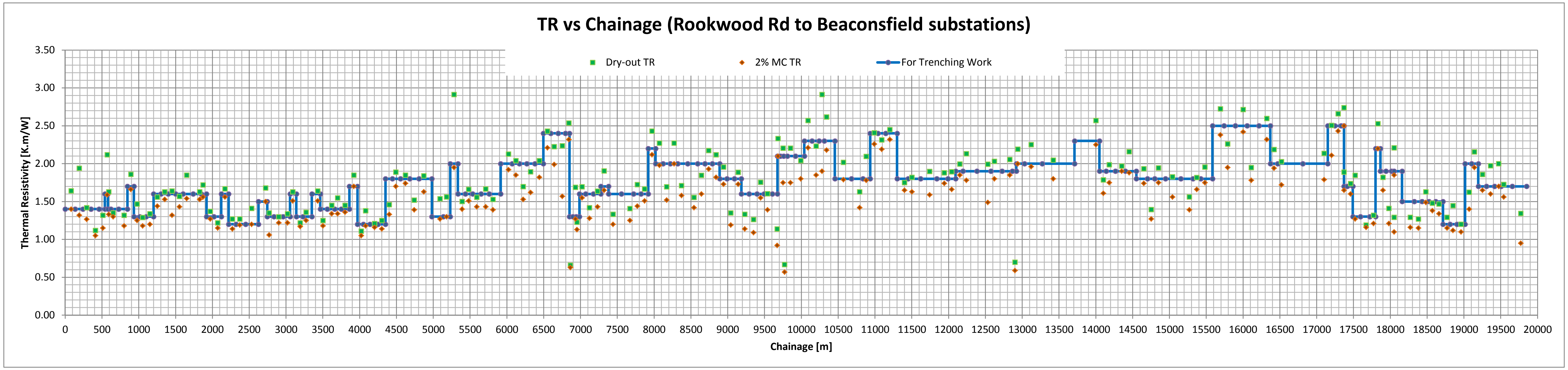
Rev / Date:	Rev.2 / Mar 20, 2020
Docu. No.	TEA-PSF-DR-005

Cable	Trench Type	Soil TR (2% MC)	Soil TR (Dried out)	Ambient Temperature	"Cover" depth [A]	Phase distance [B]	Circuit distance [C]	Trench width [D]	Trench height [E]	Backfill height [F]	Continuous Cyclic Normal Rating (Double Circuit)	Continuous Cyclic Normal Rating (Single Circuit)
330kV 2500 sqmm	Section A & Section A-1	1.2 K.m/W	1.45 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1417.3 amps	1705.5 amps
				29.6 °C	1300 mm	350 mm	675 mm	1550 mm	1978 mm	1628 mm	1361.1 amps	1664.9 amps
				28.8 °C	1800 mm	350 mm	775 mm	1650 mm	2478 mm	2128 mm	1327.9 amps	1626.4 amps
		1.3 K.m/W	1.85 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1375.8 amps	1663.8 amps
				29.6 °C	1300 mm	350 mm	675 mm	1550 mm	1978 mm	1628 mm	1317.6 amps	1621.4 amps
				28.7 °C	1800 mm	450 mm	775 mm	1750 mm	2565 mm	2215 mm	1331.7 amps	1650.2 amps
		1.4 K.m/W	1.94 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1361.4 amps	1650.1 amps
				29.6 °C	1300 mm	350 mm	775 mm	1650 mm	1978 mm	1628 mm	1325.0 amps	1609.2 amps
				28.7 °C	1800 mm	450 mm	875 mm	1850 mm	2565 mm	2215 mm	1332.2 amps	1632.2 amps
		1.5 K.m/W	1.68 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1371.5 amps	1661.7 amps
				29.6 °C	1300 mm	350 mm	775 mm	1650 mm	1978 mm	1628 mm	1331.5 amps	1617.8 amps
				28.7 °C	1800 mm	450 mm	875 mm	1850 mm	2565 mm	2215 mm	1333.9 amps	1637.2 amps
		1.6 K.m/W	2.12 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1335.3 amps	1625.3 amps
				29.6 °C	1300 mm	350 mm	875 mm	1750 mm	1978 mm	1628 mm	1316.1 amps	1582.2 amps
				28.7 °C	1800 mm	450 mm	1075 mm	2050 mm	2565 mm	2215 mm	1335.7 amps	1606.7 amps
		1.7 K.m/W	2.00 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1335.6 amps	1626.4 amps
				29.6 °C	1300 mm	350 mm	875 mm	1750 mm	1978 mm	1628 mm	1313.7 amps	1581.3 amps
				28.7 °C	1800 mm	450 mm	1075 mm	2050 mm	2565 mm	2215 mm	1331.0 amps	1604.0 amps
		1.8 K.m/W	2.10 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1323.3 amps	1614.5 amps
				29.4 °C	1300 mm	450 mm	775 mm	1750 mm	2065 mm	1715 mm	1328.2 amps	1635.7 amps
				28.7 °C	1800 mm	450 mm	1175 mm	2150 mm	2565 mm	2215 mm	1327.5 amps	1590.0 amps
		1.9 K.m/W	2.21 K.m/W	30.8 °C	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1314.2 amps	1604.5 amps
				29.4 °C	1300 mm	450 mm	875 mm	1850 mm	2065 mm	1715 mm	1337.1 amps	1624.9 amps
				28.7 °C	1800 mm	450 mm	1275 mm	2250 mm	2565 mm	2215 mm	1331.9 amps	1579.6 amps
		2.0 K.m/W	2.27 K.m/W	30.8 °C	900 mm	350 mm	775 mm	1650 mm	1578 mm	1228 mm	1328.5 amps	1596.8 amps
				29.4 °C	1300 mm	450 mm	875 mm	1850 mm	2065 mm	1715 mm	1326.7 amps	1614.8 amps
				28.7 °C	1800 mm	450 mm	1275 mm	2250 mm	2565 mm	2215 mm	1322.7 amps	1570.1 amps
		2.0 K.m/W	2.92 K.m/W	30.8 °C	900 mm	350 mm	875 mm	1750 mm	1578 mm	1228 mm	1328.7 amps	1573.1 amps
		Chainage [m]	Chainage [m]	29.4 °C	1300 mm	450 mm	975 mm	1950 mm	2065 mm	1715 mm	1325.1 amps	1591.6 amps
		5230 ~ 5335	5230 ~ 5335	28.7 °C	1800 mm	450 mm	1475 mm	2450 mm	2565 mm	2215 mm	1323.2 amps	1542.1 amps
		2.1 K.m/W	2.33 K.m/W	30.8 °C	900 mm	350 mm	775 mm	1650 mm	1578 mm	1228 mm	1320.4 amps	1589.0 amps
				29.4 °C	1300 mm	450 mm	975 mm	1950 mm	2065 mm	1715 mm	1337.6 amps	1607.8 amps
				28.7 °C	1800 mm	450 mm	1375 mm	2350 mm	2565 mm	2215 mm	1323.3 amps	1559.3 amps
		2.2 K.m/W	2.53 K.m/W	30.8 °C	900 mm	350 mm	875 mm	1750 mm	1578 mm	1228 mm	1334.0 amps	1580.7 amps
				29.4 °C	1300 mm	450 mm	975 mm	1950 mm	2065 mm	1715 mm	1323.7 amps	1593.3 amps
				28.7 °C	1800 mm	450 mm	1475 mm	2450 mm	2565 mm	2215 mm	1323.2 amps	1546.8 amps
		2.3 K.m/W	2.92 K.m/W	30.4 °C	900 mm	450 mm	775 mm	1750 mm	1665 mm	1315 mm	1342.2 amps	1627.9 amps
				29.4 °C	1300 mm	450 mm	1075 mm	2050 mm	2065 mm	1715 mm	1323.8 amps	1576.9 amps
				28.7 °C	1800 mm	450 mm	1675 mm	2650 mm	2565 mm	2215 mm	1331.0 amps	1529.7 amps
		2.4 K.m/W	2.54 K.m/W	30.8 °C	900 mm	350 mm	900 mm	1775 mm	1578 mm	1228 mm	1324.6 amps	1572.3 amps
				29.4 °C	1300 mm	450 mm	1075 mm	2050 mm	2065 mm	1715 mm	1328.6 amps	1584.2 amps
				28.7 °C	1800 mm	450 mm	1575 mm	2550 mm	2565 mm	2215 mm	1323.8 amps	1538.4 amps
		2.5 K.m/W	2.74 K.m/W	30.4 °C	900 mm	450 mm	775 mm	1750 mm	1665 mm	1315 mm	1337.9 amps	1624.9 amps
				29.4 °C	1300 mm	450 mm	1075 mm	2050 mm	2065 mm	1715 mm	1317.1 amps	1572.5 amps
				28.7 °C	1800 mm	450 mm	1675 mm	2650 mm	2565 mm	2215 mm	1325.1 amps	1526.9 amps
	Section HDD-1	1.1 K.m/W	1.45 K.m/W	25.0 °C	4000 mm	450 mm	2000 mm	Bore hole size : 900mm	-	-	1337.2 amps	1568.6 amps
				25.0 °C	5000 mm	450 mm	3000 mm	Bore hole size : 900mm	-	-	1344.9 amps	1534.0 amps
				25.0 °C	6000 mm	450 mm	4000 mm	Bore hole size : 900mm	-	-	1343.0 amps	1506.7 amps
				25.0 °C	7000 mm	450 mm	5000 mm	Bore hole size : 900mm	-	-	1338.3 amps	1485.4 amps
				25.0 °C	8000 mm	450 mm	7000 mm	Bore hole size : 900mm	-	-	1346.7 amps	1467.0 amps
	Section B	4.85 K.m/W at 10% MC	5.88 K.m/W	32.0 °C	900 mm	300 mm	-	1125 mm	1275 mm	925 mm	-	1399.5 amps
				30.4 °C	1300 mm	350 mm	-	1225 mm	1675 mm	1325 mm	-	1374.1 amps
				29.2 °C	1800 mm	400 mm	-	1325 mm	2175 mm	1825 mm	-	1338.9 amps

- TR Value of Backfill Material : **0.9 K.m/W**
- TR value of Grout for HDD section : **0.65 K.m/W**
- Conduit Diameter : **I.D 214mm / O.D 225mm for trench section & I.D 214mm / O.D 250mm for HDD section**
- Trench Design could be cahanged depending on the Site Condition.

Selected Soil TR Value

Chainage [m]	TR Value (2% MC) [K.m/W]	Chainage [m]	TR Value (2% MC) [K.m/W]	Chainage [m]	TR Value (2% MC) [K.m/W]	Chainage [m]	TR Value (2% MC) [K.m/W]
0 ~ 540	1.4	3350 ~ 3465	1.6	7380 ~ 7920	1.6	14050 ~ 14550	1.9
540 ~ 580	1.6	3465 ~ 3860	1.4	7920 ~ 8020	2.2	14550 ~ 15585	1.8
580 ~ 845	1.4	3860 ~ 3970	1.7	8020 ~ 8890	2.0	15585 ~ 16370	2.5
845 ~ 933	1.7	3970 ~ 4350	1.2	8890 ~ 9185	1.8	16370 ~ 17150	2.0
933 ~ 1200	1.3	4350 ~ 4980	1.8	9185 ~ 9675	1.6	17150 ~ 17370	2.5
1200 ~ 1920	1.6	4980 ~ 5230	1.3	9675 ~ 10040	2.1	17370 ~ 17490	1.7
1920 ~ 2120	1.3	5230 ~ 5335	2.0	10040 ~ 10455	2.3	17490 ~ 17800	1.3
2120 ~ 2220	1.6	5335 ~ 5915	1.6	10455 ~ 10935	1.8	17800 ~ 17865	2.2
2220 ~ 2625	1.2	5915 ~ 6495	2.0	10935 ~ 11300	2.4	17865 ~ 18160	1.9
2625 ~ 2745	1.5	6495 ~ 6850	2.4	11300 ~ 12095	1.8	18160 ~ 18715	1.5
2745 ~ 3055	1.3	6850 ~ 6985	1.3	12095 ~ 12920	1.9	18715 ~ 19015	1.2
3055 ~ 3140	1.6	6985 ~ 7275	1.6	12920 ~ 13710	2.0	19015 ~ 19195	2.0
3140 ~ 3350	1.3	7275 ~ 7380	1.7	13710 ~ 14050	2.3	19195 ~ 19850	1.7



Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
80	1.64	1.40	1.4
190	1.94	1.32	1.4
290	1.42	1.27	1.4
410	1.12	1.05	1.4
510	1.32	1.15	1.4
570	2.12	1.59	1.6
590	1.63	1.33	1.4
650	1.35	1.30	1.4
800	1.32	1.18	1.4
890	1.86	1.66	1.7
975	1.47	1.25	1.3
1050	1.29	1.18	1.3
1150	1.34	1.20	1.3
1250	1.56	1.44	1.6
1350	1.63	1.53	1.6
1450	1.64	1.32	1.6
1550	1.57	1.43	1.6
1650	1.85	1.54	1.6
1825	1.63	1.53	1.6
1870	1.72	1.56	1.6
1970	1.37	1.27	1.3
2070	1.22	1.15	1.3
2170	1.67	1.56	1.6
2270	1.27	1.14	1.2
2370	1.27	1.19	1.2
2530	1.41	1.20	1.2
2720	1.68	1.50	1.5
2770	1.35	1.06	1.3
2900	1.30	1.22	1.3
3020	1.34	1.22	1.3
3090	1.63	1.51	1.6
3190	1.22	1.17	1.3
3270	1.36	1.25	1.3
3430	1.64	1.51	1.6

Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
3500	1.25	1.18	1.4
3620	1.45	1.34	1.4
3700	1.55	1.34	1.4
3800	1.45	1.36	1.4
3920	1.85	1.70	1.7
4020	1.11	1.05	1.2
4080	1.38	1.18	1.2
4200	1.21	1.16	1.2
4300	1.25	1.14	1.2
4400	1.46	1.33	1.8
4490	1.89	1.70	1.8
4620	1.85	1.74	1.8
4740	1.52	1.39	1.8
4870	1.84	1.63	1.8
5090	1.54	1.27	1.3
5180	1.56	1.30	1.3
5280	2.92	1.95	2.0
5390	1.50	1.40	1.6
5480	1.66	1.51	1.6
5590	1.56	1.43	1.6
5710	1.67	1.43	1.6
5810	1.53	1.39	1.6
6020	2.13	1.92	2.0
6120	2.04	1.85	2.0
6220	1.70	1.53	2.0
6320	1.89	1.62	2.0
6440	2.04	1.82	2.0
6550	2.43	2.21	2.4
6640	2.23	1.99	2.4
6750	2.24	1.57	2.4
6840	2.54	2.32	2.4
6860	0.66	0.63	1.3
6930	1.69	1.27	1.3
6950	1.23	1.13	1.3

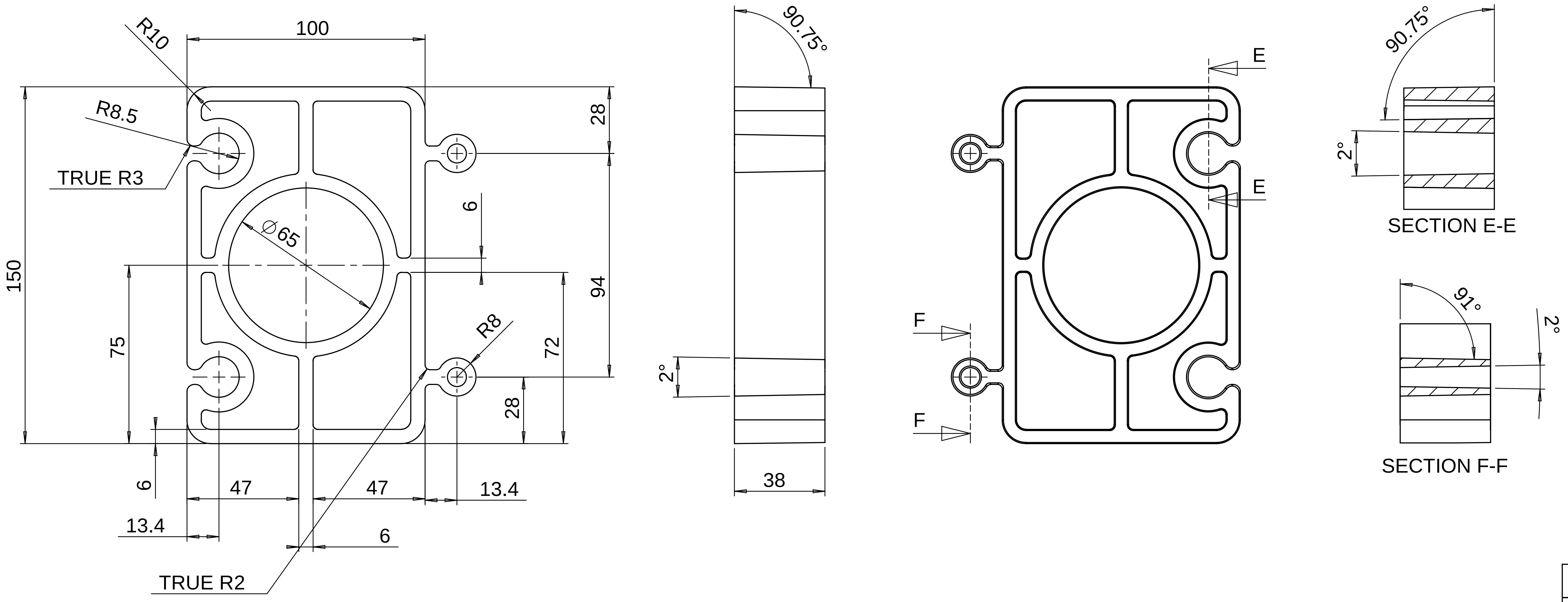
Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
7020	1.70	1.55	1.6
7120	1.42	1.28	1.6
7230	1.64	1.43	1.6
7320	1.91	1.65	1.7
7440	1.33	1.20	1.6
7670	1.41	1.25	1.6
7770	1.72	1.44	1.6
7870	1.67	1.51	1.6
7970	2.43	2.12	2.2
8070	2.27	1.98	2.0
8170	1.70	1.52	2.0
8270	2.27	2.00	2.0
8370	1.71	1.58	2.0
8540	1.56	1.42	2.0
8640	1.85	1.60	2.0
8740	2.17	1.93	2.0
8840	2.12	1.82	2.0
8940	1.96	1.73	1.8
9040	1.35	1.19	1.8
9140	1.89	1.73	1.8
9230	1.33	1.14	1.6
9350	1.27	1.09	1.6
9445	1.76	1.55	1.6
9540	1.61	1.39	1.6
9670	1.14	0.92	1.6
9680	2.33	2.10	2.1
9750	2.21	1.75	2.1
9770	0.67	0.57	2.1
9850	2.21	1.75	2.1
9990	2.04	1.80	2.1
10090	2.57	2.21	2.3
10200	2.23	1.85	2.3
10280	2.92	1.90	2.3
10340	2.62	2.18	2.3

Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
10570	2.02	1.79	1.8
10790	1.63	1.42	1.8
10880	2.10	1.78	1.8
10990	2.41	2.26	2.4
11090	2.32	2.19	2.4
11200	2.45	2.32	2.4
11400	1.75	1.65	1.8
11500	1.82	1.63	1.8
11740	1.90	1.59	1.8
11940	1.88	1.74	1.8
12040	1.89	1.66	1.8
12150	2.00	1.85	1.9
12240	2.13	1.78	1.9
12530	1.99	1.49	1.9
12620	2.03	1.80	1.9
12830	2.06	1.85	1.9
12900	0.70	0.59	1.9
12940	2.19	2.00	2.0
13120	2.25	1.96	2.0
13420	2.05	1.80	2.0
14000	2.57	2.25	2.3
14100	1.79	1.61	1.9
14180	1.99	1.75	1.9
14350	1.97	1.90	1.9
14450	2.16	1.88	1.9
14650	1.93	1.74	1.8
14750	1.40	1.27	1.8
14850	1.95	1.75	1.8
15040	1.83	1.56	1.8
15270	1.56	1.39	1.8
15370	1.82	1.66	1.8
15480	1.96	1.75	1.8
15690	2.73	2.38	2.5
15790	2.26	1.95	2.5

Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
16000	2.72	2.42	2.5
16110	1.95	1.78	2.5
16320	2.60	2.32	2.5
16420	2.19	1.94	2.0
16520	2.03	1.72	2.0
17100	2.14	1.79	2.0
17200	2.51	2.11	2.5
17290	2.66	2.43	2.5
17370	2.74	2.50	2.5
17370	1.89	1.65	1.7
17460	1.74	1.60	1.7
17520	1.85	1.27	1.3
17670	1.19	1.16	1.3
17770	1.32	1.21	1.3
17830	2.53	2.20	2.2
17900	1.82	1.65	1.9
17980	1.41	1.21	1.9
18050	1.29	1.10	1.9
18050	2.21	1.85	1.9
18270	1.29	1.16	1.5
18380	1.27	1.15	1.5
18480	1.63	1.49	1.5
18570	1.48	1.38	1.5
18660	1.47	1.34	1.5
18770	1.29	1.15	1.2
18850	1.45	1.12	1.2
18960	1.20	1.10	1.2
19070	1.62	1.40	2.0
19140	2.16	1.95	2.0
19250	1.86	1.65	1.7
19360	1.97	1.60	1.7
19470	2.00	1.70	1.7
19540	1.73	1.56	1.7
19770	1.35	0.95	1.7

Appendix A

(Spacer Drawings)



NOTE:
UNLESS OTHERWISE STATED ALL EDGES TO BE R0.2
COMPONENT MASS 185g.
GENERAL WALL SECTION 5.4mm.
REMOVE ALL FLASH, BURRS & SHARP EDGES.

Revision	Description	Date
A	DIMENSIONS CHANGE	9/12/08
0	Original Issue	26/11/08

Project	AUSTRALIAN VERSION CONDUIT BRACKET & SPACER
Client	ENERGY AUSTRALIA

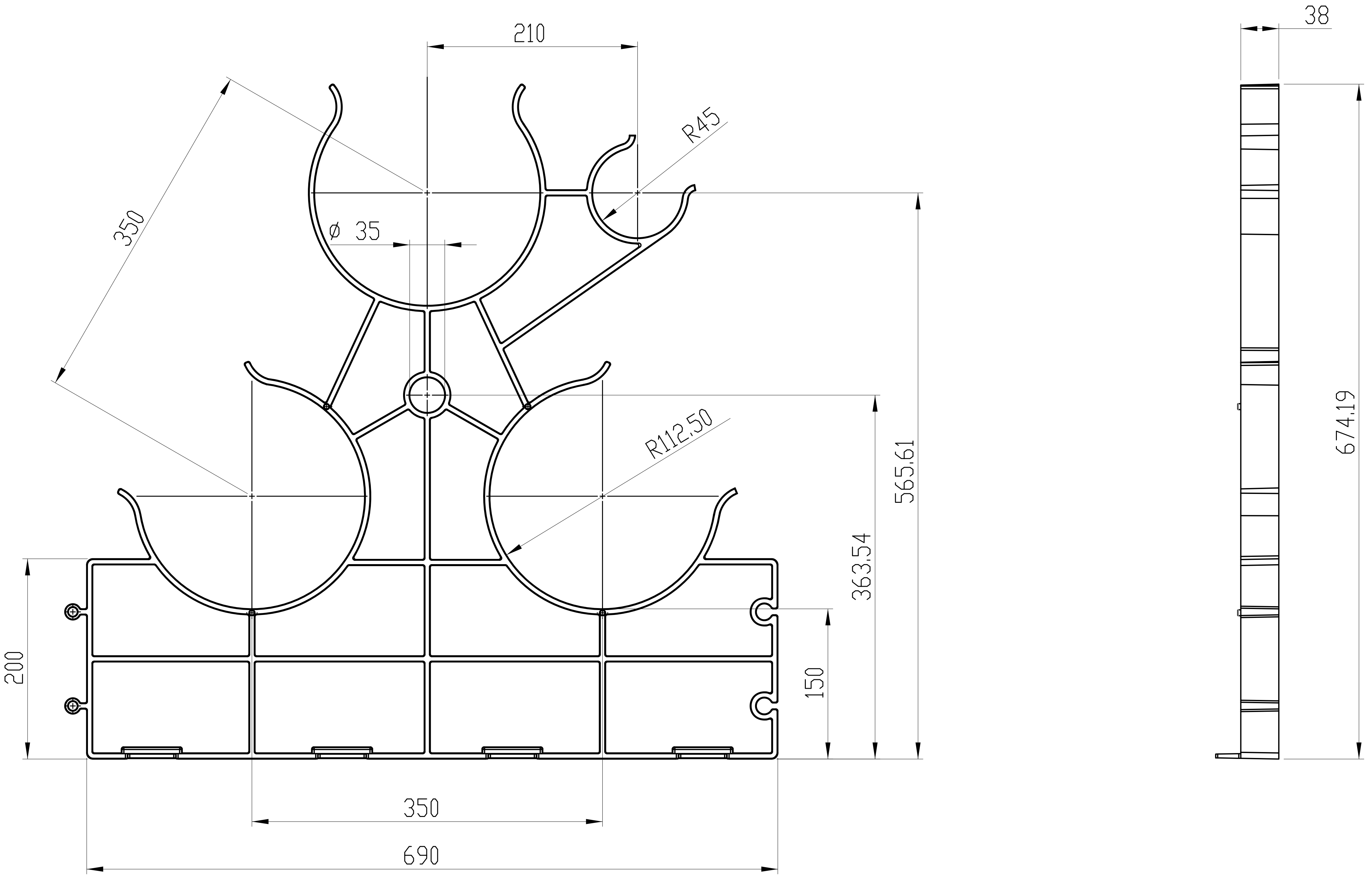
Drawn	Date	Checked	Date
HL	26/11/08	PM	09/12/08
Approved By			Date
Drawing Number	DE005/002B	Issued By	Issue Date
Scale 1:2	Sheet Size A3	Issue 0	Sheet 3 of 5

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified	
LINEAR ± 0.25 ANGULAR ± 0.5° DRAFT 1°	Material: HIPS Finish: COMMERCIAL POLISH

ASP Plastics Pty Ltd
17 Harris Street
St. Marys, N.S.W. 2760
Australia
Ph: (02) 9623 7677
Fax: (02) 9673 4032
ASP PLASTICS

REF	REV	DESCRIPTION	BY	CHK	DATE
	A	NAME & COLOUR CHANGED	HL		20/03/20
	B	ADED RIBS	HL		23/03/20



NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1160 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: NATURAL

Project: 225 TREFOIL CONDUIT BRACKET 350 SPACING
Client: GARDE SERVICES

Drawn: HL Date: 06/02/20
Checked: Date:
Approved By: Date:
Drawing Number: DG014/004 Issued By: Issue Date:
Scale: NTS Sheet Size: A3 Issue: 0 Sheet: 1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS
Finish: MACHINE FINISH

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17 Harris Street
St. Marys, N.S.W. 2760
Australia
Ph: (02) 9623 7677
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE
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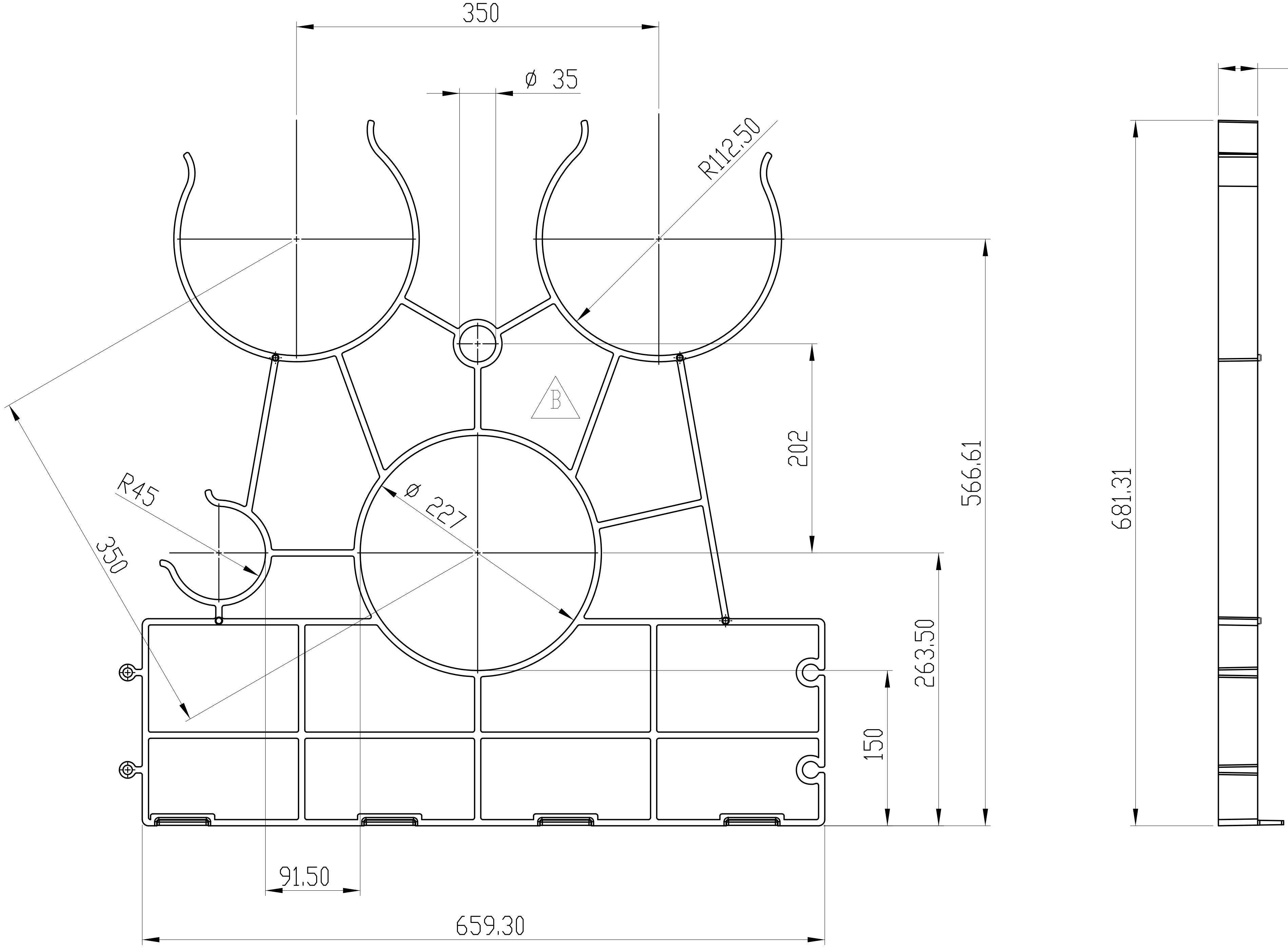
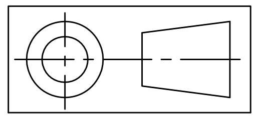
	B	ADDED RIBS	HL		23/03/20



NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1306 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: NATURAL



Project: 225 INVERTED TREFOIL BRACKET 350 SPACING
Client: GARDE SERVICES
Drawn: HL Date: 06/02/20 Checked: Date:
Approved By: Date:
Drawing Number: DG014/005 Issued By: Issue Date:
Scale: NTS Sheet Size: A3 Issue: 0 Sheet: 1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS
Finish: FINE POLISH

ASP Plastics Pty Ltd
17 Harris Street
St. Marys, N.S.W. 2760
Australia
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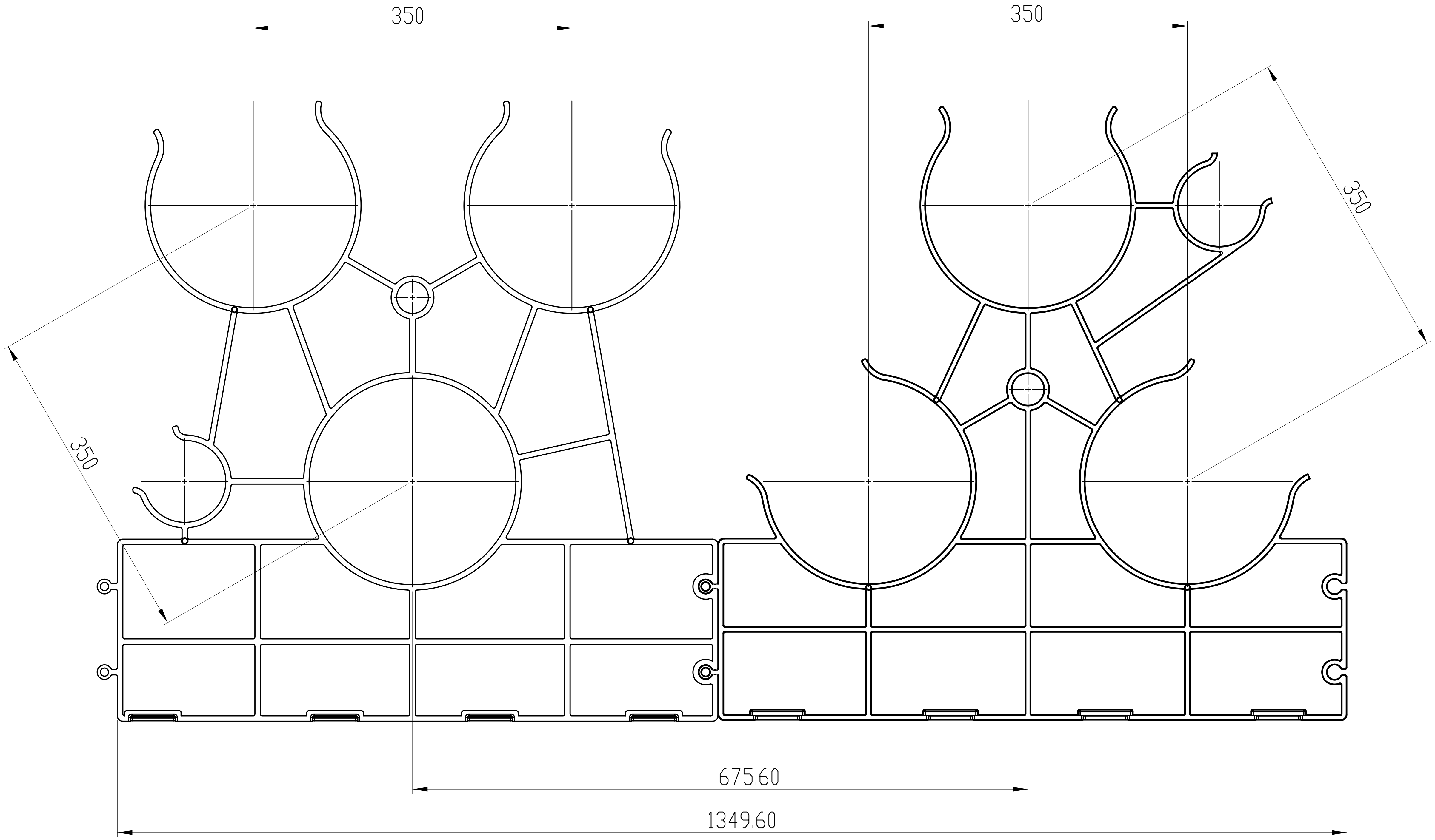
Fax: (02) 9673 4032



Project	225 CONDUIT 350 SPACING COMPARISON
Client	GARDE SERVICES

Drawn	Date	Checked	Date
HL	06/02/20		
Approved By			Date
Drawing Number		Issued By	Issue Date
NOT FOR PRODUCTION			

Scale	Sheet Size	Issue	Sheet
NTS	A3	0	1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified	
LINEAR ± 0.25	
ANGULAR ± 0.5°	
DRAFT 1°	
Material	HIPS
Finish	FINE POLISH

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17 Harris Street
St. Marys, N.S.W. 2760
Australia

Ph: (02) 9623 7677
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE
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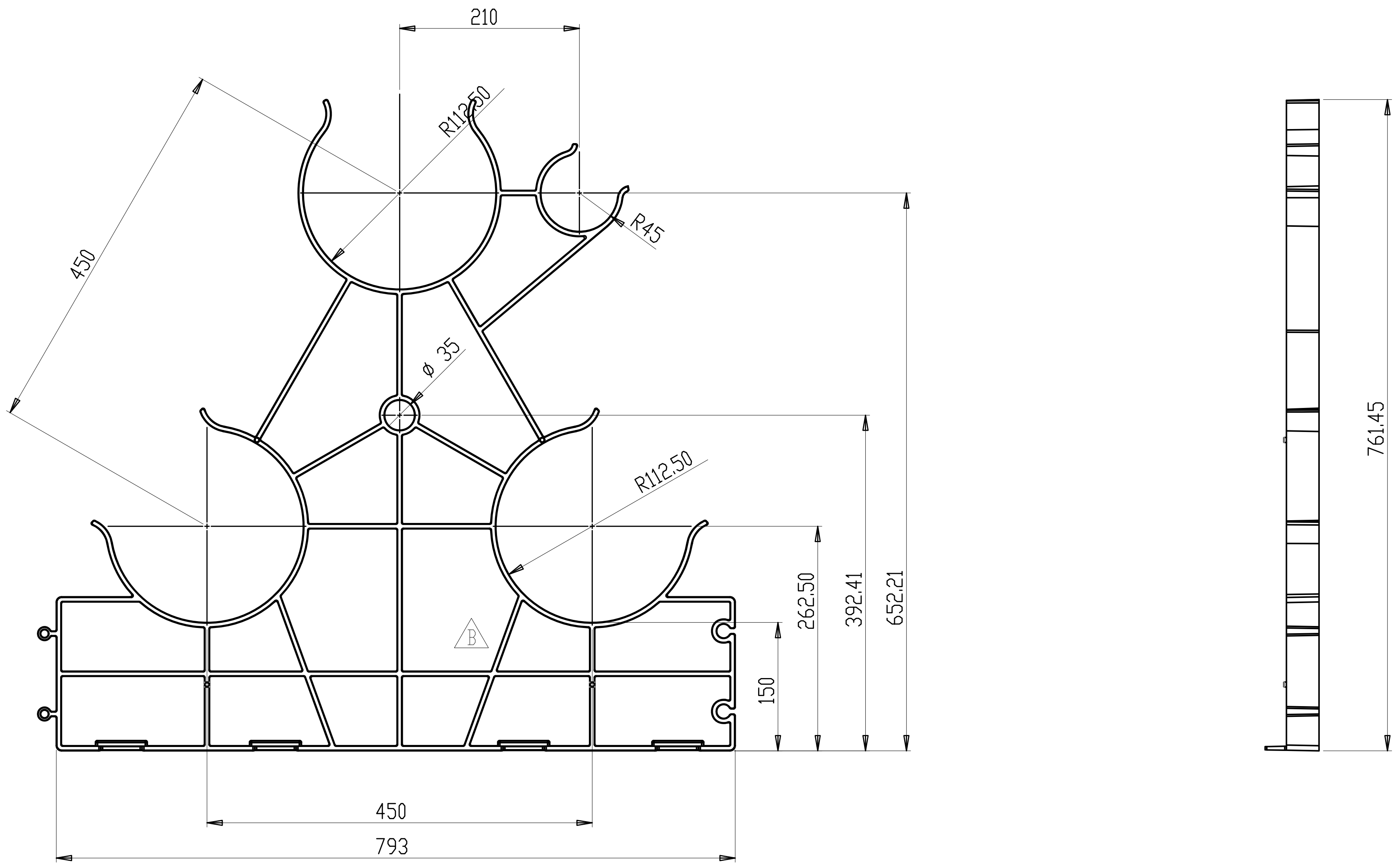
	B	ADD EXTRA RIBS	HL		23/03/20



NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1410 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: BLACK

Project: 225 TREFOIL BRACKET 450 SPACING

Client: GARDE SERVICES

Drawn	Date	Checked	
HL	07/02/20		26/05/14
Approved By			Date
Drawing Number		Issued By	Issue Date
DG014/001			
Scale	Sheet Size	Issue	Sheet
NTS	A3	0	1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified

LINEAR ± 0.5
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS

Finish: COMMERCIAL FINISH

ASP Plastics Pty Ltd
17 Harris Street
St. Marys, N.S.W. 2760
Australia

Ph: (02) 9623 7677
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE
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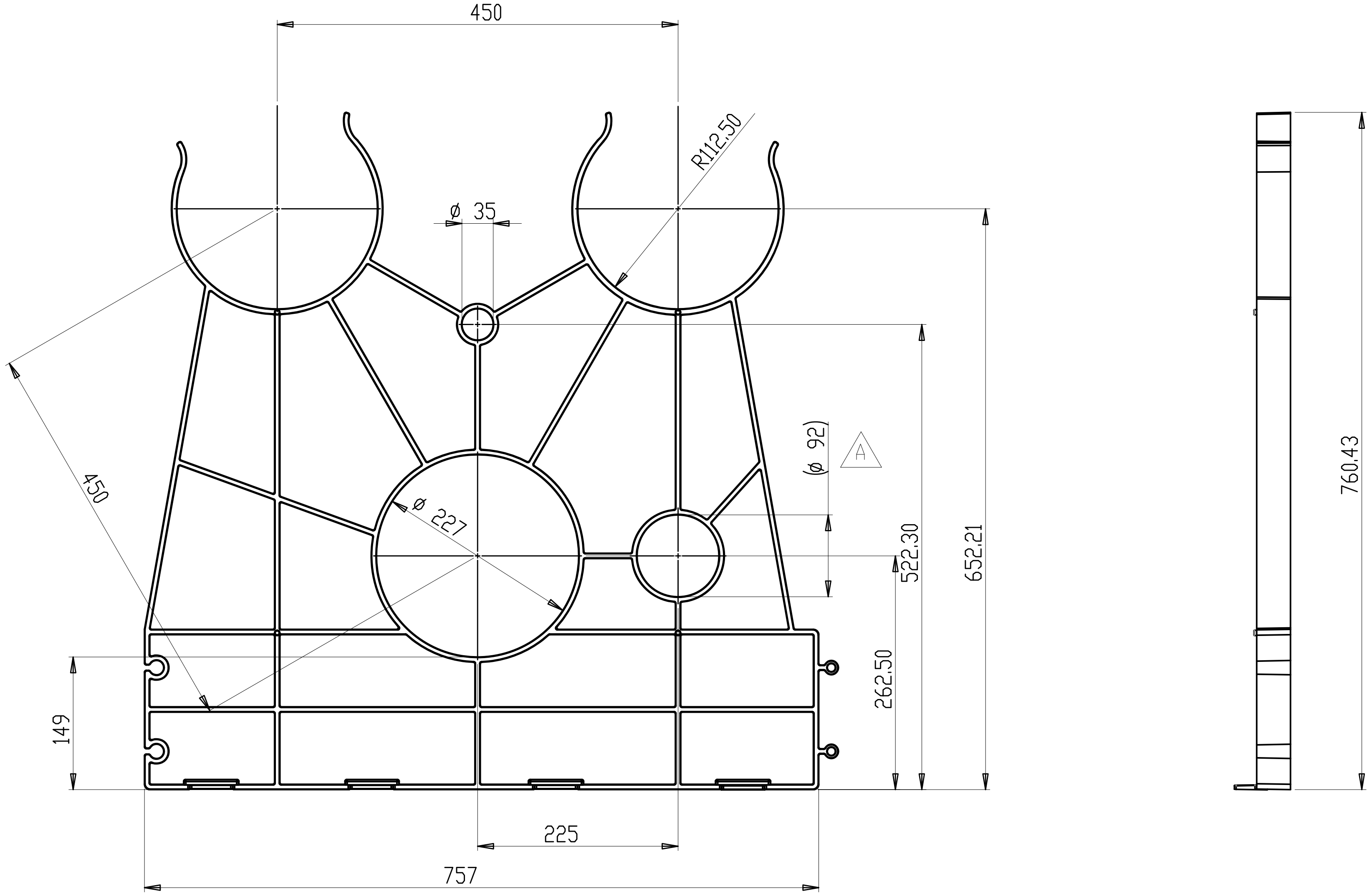

NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1682 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: BLACK

Project: INVERTED 225 TREFOIL BRACKET 450 SPACING

Client: GARDE SERVICES

Drawn	Date	Checked	Date
HL	07/02/20		

Approved By	Date

Drawing Number	Issued By	Issue Date
DG014/002		

Scale	Sheet Size	Issue	Sheet
NTS	A3	0	1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.5
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS

Finish: COMMERCIAL FINISH

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St. Marys, N.S.W. 2760
Australia

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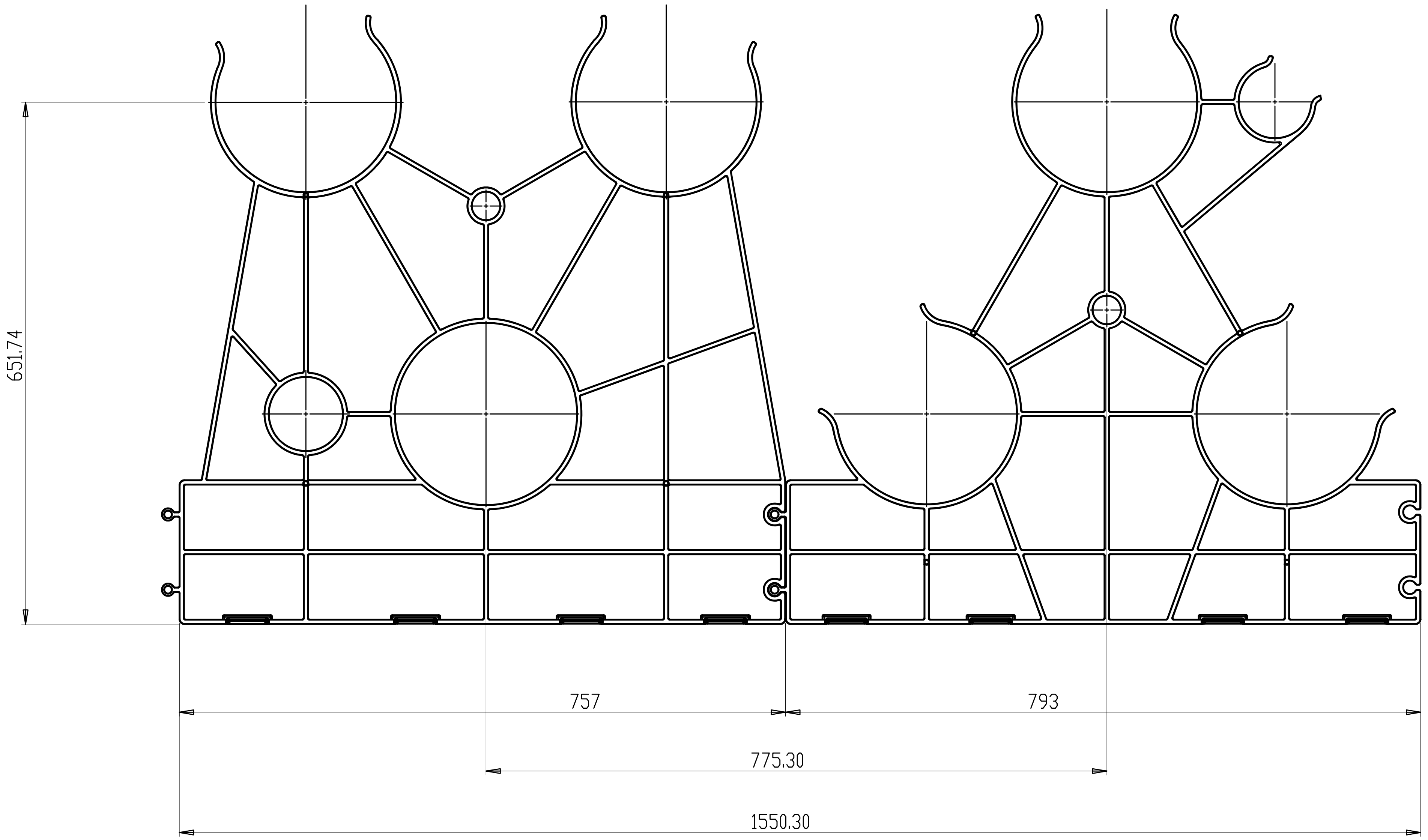
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE



Project	225 CONDUIT 450 SPACING COMPARISON
Client	GARDE SERVICES

Drawn: HL	Date: 05/08/19	Checked	Date
Approved By			Date
Drawing Number: DRAFT		Issued By	Issue Date
Scale: NTS	Sheet Size: A3	Issue: 0	Sheet: 1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

Material	HIPS
Finish	FINE POLISH

ASP Plastics Pty Ltd
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St. Marys, N.S.W. 2760
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Appendix C– Transmission Cable Route Details

Legend

- Centreline RevC
- Boundary Project EIS

Analysis

- Potential clash - Trench & SRZ
- Potential clash - Trench & TPZ
- Potential clash work zone & TPZ

Vegetation

- Tree Protection Area (Conditions of Consent)

Structural Root Zone (SRZ)

- SRZ High
- SRZ Medium
- SRZ Low
- SRZ Other

Tree Protection Zone (TPZ)

- TPZ High
- TPZ Medium
- TPZ Low
- TPZ Other

Classification

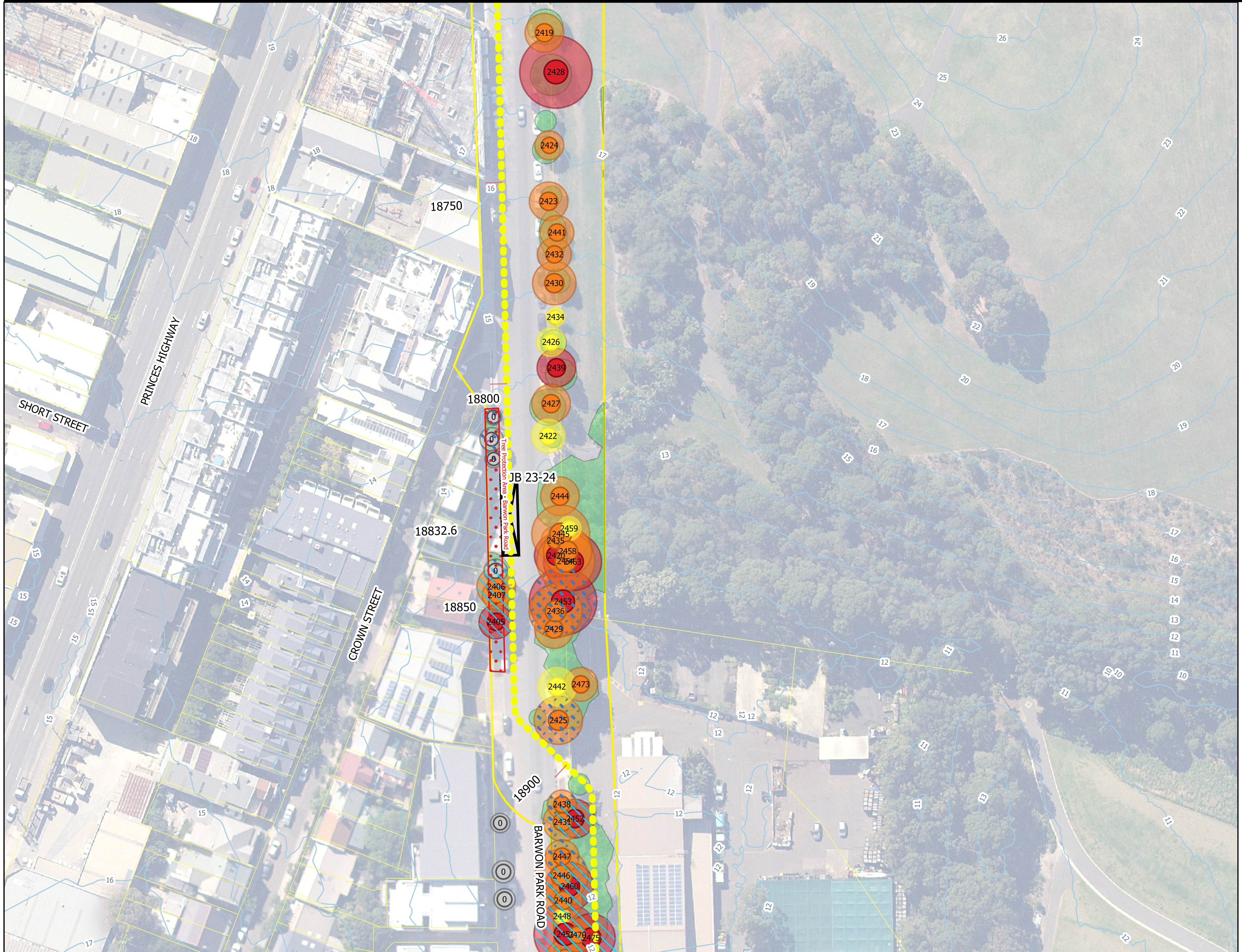
- Urban Exotics

N
25 0 25 50 75 100 m

GARDE taihan

Landscape Plans
Vegetation and Biodiversity Management Plan

Powering Sydney's Future
Supply and Installation of Integrated Cable Systems Rookwood to Beaconsfield



Legend

- Centreline RevC
- Boundary Project EIS

Analysis

- Potential clash - Trench & SRZ
- Potential clash - Trench & TPZ
- Potential clash work zone & TPZ

Vegetation

- Tree Protection Area (Conditions of Consent)

Structural Root Zone (SRZ)

- SRZ High
- SRZ Medium
- SRZ Low
- SRZ Other

Tree Protection Zone (TPZ)

- TPZ High
- TPZ Medium
- TPZ Low
- TPZ Other

Classification

- Urban Exotics

N

25 0 25 50 75 100 m

GARDE taihan

Legend

- Centreline RevC
- Boundary Project EIS

Analysis

- Potential clash - Trench & SRZ
- Potential clash - Trench & TPZ
- Potential clash work zone & TPZ

Vegetation

- Tree Protection Area (Conditions of Consent)

Structural Root Zone (SRZ)

- SRZ High
- SRZ Medium
- SRZ Low
- SRZ Other

Tree Protection Zone (TPZ)

- TPZ High
- TPZ Medium
- TPZ Low
- TPZ Other

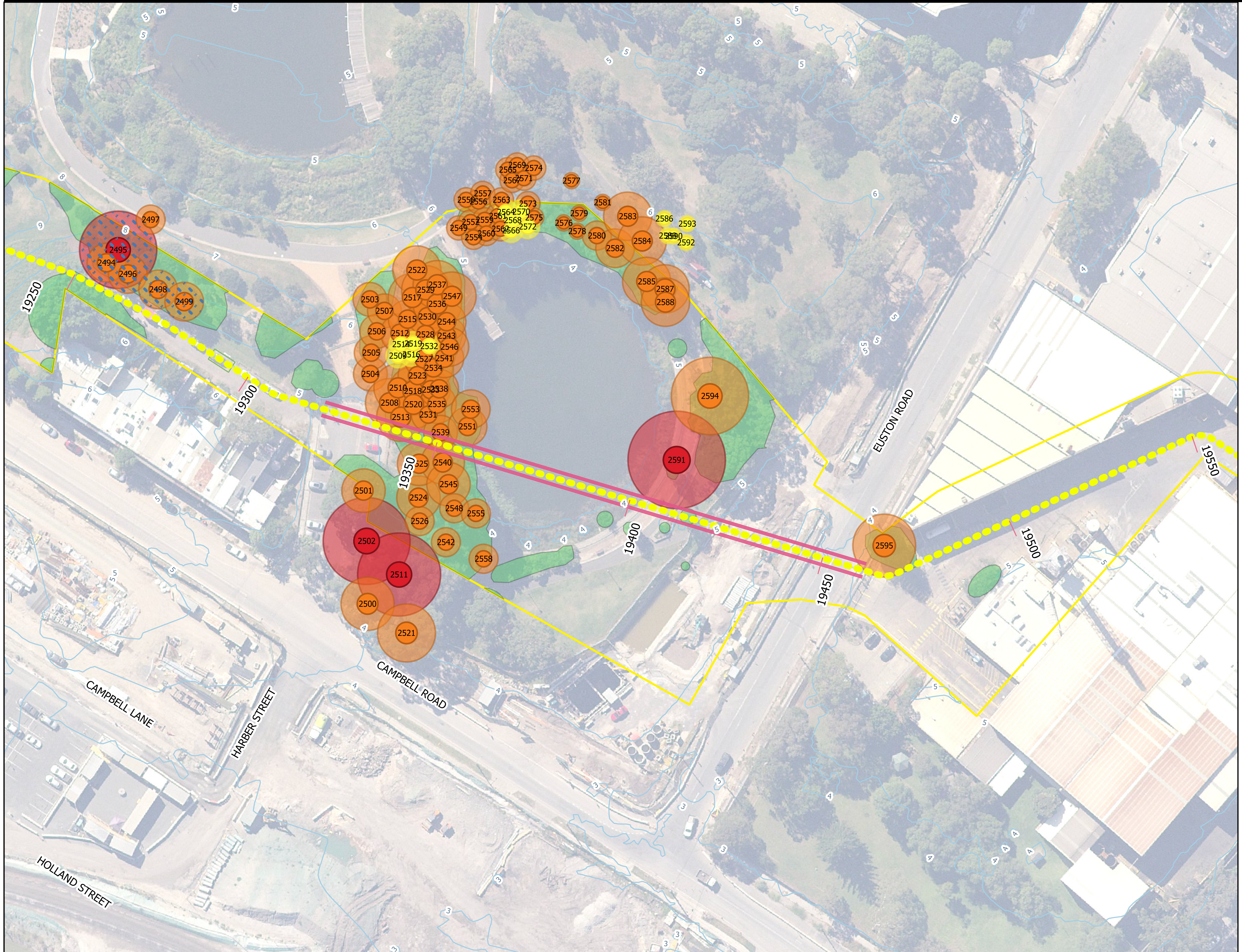
Classification

- Urban Exotics

N

25 0 25 50 75 100 m

GARDE taihan



Legend

- Centreline RevC
- HDD RevC
- Boundary Project EIS

Analysis

- Potential clash work zone & TPZ

Vegetation

Structural Root Zone (SRZ)

- SRZ High
- SRZ Medium
- SRZ Low

Tree Protection Zone (TPZ)

- TPZ High
- TPZ Medium
- TPZ Low

Classification

- Urban Exotics

N

25 0 25 50 75 100 m

GARDE taihan

Appendix D– Former Landfill Area as Build Trench Report

TransGrid PSF Project

330kV Feeder Replacement

Former Landfill Area as Built Trench Report – Sydney Park

1. As built Trench Details

1.1. Damaged Infrastructure Impact description.

1.2. Infrastructure remedial works description

1.3. Description: As built landfill gas infrastructure

1.4. Design drawing as built landfill gas infrastructure

2. Landfill Gas Infrastructure

2.1. Damaged Infrastructure Impact description.

2.2. Infrastructure remedial works description

2.3. Description: As built landfill gas infrastructure

2.4. Design drawing as built landfill gas infrastructure

taihan

Appendix A– Final As built Trench Design Drawings

Appendix 2 – Camdenville Park Landfill Gas Management Plan

[To be submitted following Site Auditor endorsement]

TransGrid PSF Project

330kV Feeder Replacement

Appendix 4 – Camdenville Park: Site Specific Landfill Gas Management Plan

Amendments Register

Rev	Date	Description	Prepared	Reviewed	Approved
0	9-Jun-20	Draft	Senversa	TransGrid	-
1	19-Jun-20	Draft	Senversa	Site Auditor	-
2	01-Jul-20	Draft	TransGrid	-	-
3	13-Jul-20	Draft	Senversa	Site Auditor	-
4	31-Jul-20	Final – For Information Removal of draft watermark and update to header	Taihan	Taihan	Taihan

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Abbreviations and Acronyms

Abbreviation/ Acronym	Expanded term
AMP	Asbestos Management Plan
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASSMP	Acid Sulfate Soils Management Plan
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CH_4	Methane
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoA	Conditions of Approval
COPC	Contaminants of Potential Concern
CNVMP	Construction Noise and Vibration Management Plan
CPIMP	Construction Public Infrastructure Management Plan
CPLGMP	Camdenville Park Site Specific Landfill Gas Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DPIE	Department of Planning Infrastructure and Environment
ECM	Environmental Control Measures
EIS	Environmental Impact Statement
EMMM	Environmental Management and Mitigation Measure
EMS	Environmental Management System
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Management Strategy
GMS	Groundwater Management Strategy
H_2S	Hydrogen Sulphide
HDPE	High Density Polyethylene
LEL	Lower Explosive Limit
NSW	New South Wales
OOHW Protocol	Out-of-hours work Protocol
ppm	parts per million
PSF	Powering Sydney's Future
STEL	Short Term Exposure Limit
SWMP	Surface Water Management Plan
TCP	Traffic Controls Plans
TWA	Time Weighted Average
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure
UEL	Upper Explosive Limit
VOC	Volatile Organic Compounds
v/v	volume/volume

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction and installation of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

As part of the Conditions of Approval (CoA) associated with the project from the New South Wales (NSW) Department of Planning, Infrastructure and Environment (DPIE), a Contaminated Land Management Plan (CLMP) is required to be developed to document the requirements to mitigate exposure to contamination and the potential health related risks to personnel working on or visiting the area and surrounding environment during construction.

This Camdenville Park Site-Specific Landfill Gas Management Plan (CPLGMP) has been prepared to complement the overarching CLMP, specifically to document requirements to mitigate and manage the health and explosion risks posed by landfill gas during construction and installation of the 330kV underground cables in the former landfill area of Camdenville Park (project area). Appendix A contains the monitoring data considered in the preparation of this CPLGMP and Appendices B and C contain the 'Transmission cable trench design' and the 'Transmission cable route' respectively.

1.1 Context

This CPLGMP has been prepared to document the procedures to be undertaken to manage landfill gas when encountered during construction works, and is an appendix to the CLMP. The CLMP forms part of the Construction Soil and Water Management Plan (CSWMP), which in turn forms part of the Construction Environment Management Plan (CEMP). Implementation of the CPLGMP will ensure that landfill gas encountered during construction of the project is managed in such a way as to avoid harm to human health and the environment.

This CPLGMP has been developed in accordance with:

- the requirements of the Minister's CoA for:
  - E20 (e), being for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area.
  - E18, being appropriate to manage contaminated soils, groundwater and/or landfill gas in (a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters (b) any additional or unexpected areas of contamination identified during the development;
- the Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) as documented in the Amendments Report.
- relevant legislation;
- NSW Environmental Protection Authority (EPA) made or approved guidelines (including the waste guidelines); and .
- industry codes of practice.

1.2 Objectives and Scope of the CPLGMP

This CPLGMP describes the procedures and protocols TransGrid will implement for assessing and managing landfill gas in the project area.

Specifically, this CPLGMP describes the requirements for management of risk from landfill gas as well as monitoring requirements, action levels and measures for managing exceedances of the action levels.

This CPLGMP applies for any work carried out by workers and/or contractors within the project area. All work undertaken in the project area shall be conducted in accordance with the relevant legislation and in conjunction with the requirements of this CPLGMP over the full duration of the construction program.

1.3 Project Environmental Management System Overview

The Project Environmental Management System (EMS) is described in **Figure 1-1: Project Environmental Management System**.

To achieve the intended environmental performance outcomes, TransGrid has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, including this CPLGMP, procedures, protocols and tools as set out below and illustrated in **Figure 1-1: Project Environmental Management System**.

1.4 Consultation for Preparation of CPLGMP

Consultation between TransGrid and stakeholders, the community and relevant agencies will be undertaken prior to and during construction of the project as required. The process and frequency for consultation is documented in the CEMP.

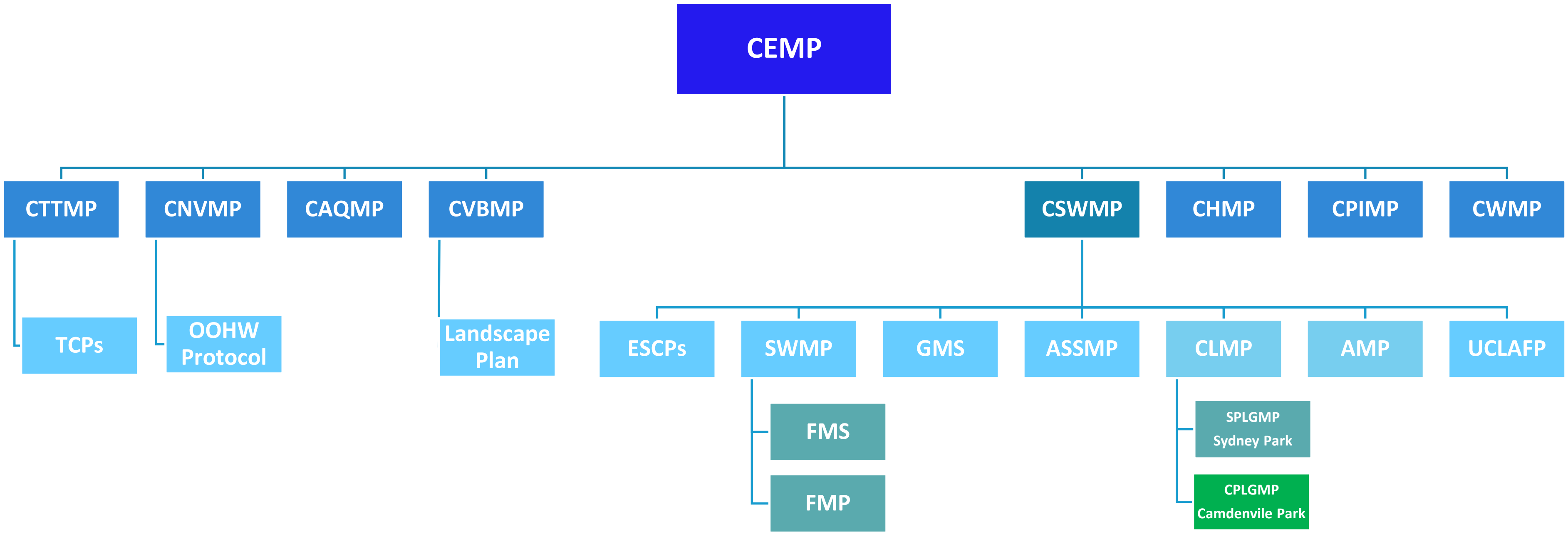

Figure 1-1: Project Environmental Management System

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the CPLGMP include:

- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment* (ASC NEPM).
- NSW EPA, 2019. *Assessment and management of hazardous ground gases: Contaminated Land Guidelines*
- NSW EPA, 2016. *Environmental Guidelines, Solid Waste Landfills*
- NSW EPA, 2014. *Waste Classification Guidelines.*
- NSW Government, 2019. Code of Practice – Confined Spaces
- NSW Government, 2019. Code of Practice – Construction Work
- Safe Work Australia, 2019. Workplace Exposure Standards for Airborne Contaminants
- TransGrid, 2016. *Environmental Handbook*
- TransGrid Guidelines and Procedures

2.3 Condition of Approval

The CPLGMP is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 (e) Contaminated Land Management Plan, for investigating, assessing and managing contaminated soils, groundwater and/or landfill gas in the project area.

Specifically, the CPLGMP will be one of the documents reviewed by the EPA accredited site auditor engaged by TransGrid, who will prepare a Site Audit Statement to meet the Conditions of Approval from the DPIE (2020) described below.

E18 Contaminated Land, The Proponent must engage an EPA accredited site auditor to prepare a Site Audit Statement(s) in accordance with the Contaminated Land Management Act 1997, confirming that the proposed measures in the Contaminated Land Management Plan required under Condition E20 are appropriate to manage contaminated soils, groundwater and/or landfill gas in: (a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters; and (b) any additional or unexpected areas of contamination identified during the development.

E19 Contaminated Land, A copy of the **Site Audit Statement** must be submitted to the Planning Secretary and the relevant council(s) for information prior to the commencement of construction in the area to which the Statement applies.

2.4 Environmental Mitigation and Management Measures

The CPLGMP has been developed to include the EMMMs detailed in the EIS Amendment Report and presented in **Table 2-1** below.

Table 2-1: Environmental Mitigation and Management Measures

Impact	ID	Measure
Former landfill management	CT9	Site-specific management plans for former landfill sites will be required for excavation works in Sydney Park and Camdenville Park. A plan may also be required for Henson Park following the outcome of investigations (see CT1). The development of the plans will include consultation with the relevant councils. Approval will be sought from the NSW EPA in all areas where exhumation of landfill waste is required in accordance with Clause 110A of the *Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation)*. Where there are existing environmental management plans, such as for Camdenville Park, site-specific mitigation measures outlined in these plans will be reviewed and implemented as required. The plan will be prepared by a contaminated land consultant and occupational hygienist. The plan will specify: • an excavation plan specifying areas classified as per in-situ waste classification and suitability for reuse; • trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (also refer to AQ12); • ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds; • action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented; • exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh fences with bracing, where required; • geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable; • final capping layer above the concrete cable conduit casing as per the Environmental Guidelines Solid Waste Landfills (NSW EPA, 2016), unless otherwise specified or agreed by with City

Impact	ID	Measure
		of Sydney and Inner West Council: ○ compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic conductivity of less than 1 x 10–9 metres/s (where subsurface waste either side of the trench is less than; ○ a revegetating layer from the top of the capping layer to the surface comprising clean soils with 200 mm of topsoil (in landscaped areas); and ○ the construction of joint bays, link boxes and sensor pits within former landfill areas will be designed to prevent the accumulation of landfill gases. Inner West Council and City of Sydney Council will be consulted on the design, monitoring and location of the pits within Sydney Park, Camdenville Park, and Henson Park (if required).
Landfill gas	AQ12	Site-specific landfill gas management plans will be prepared for works at locations with landfill gas (including Camdenville Park and Sydney Park) prior to any trenching and excavation. Further site investigations will be undertaken within the project area closest to Arlington Oval and Marrickville Park and where the project traverses Henson Park, in accordance with the *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA, 2012), to assess the presence and risk of landfill gas. If landfill gas is detected, a site-specific landfill gas management plan will be developed for any excavation works in these areas (also refer to CT9). The plans will be prepared by a suitably qualified landfill gas management specialist. The management plans will include mitigation measures to prevent human health exposure and explosive risks posed by landfill gas and nuisance odours from exposed leachate or landfill wastes. The plans will detail the type and frequency of monitoring required during the works and will outline the triggers that could stop works or require a step up in controls. Controls may include the use of odour suppressant mists and foams, and other measures deemed suitable for the local conditions of the site

3 Landfill Gas

3.1 Composition of Landfill Gas

Landfill gas is typically produced by the decomposition of organic compounds in anaerobic conditions with the composition of the gas changing depending on the stage of degradation of the organic matter and conditions within the landfill. Landfill gas associated with a putrescible landfill generally consists of approximately 60% to 70% methane and 30% to 40% carbon dioxide with a wide variety of trace gases also present. Landfill gas is a mixture and under most conditions its components do not separate into layers. However, consideration must be given to the separation of different gasses when preparing a monitoring plan. The following **Table 3-1** provides a summary of key components of landfill gas:

Table 3-1: Key components of landfill gas

Component of Landfill Gas	Characteristics
Methane (CH_4)	Methane is an odourless, flammable gas at normal atmospheric temperatures and pressures. It is explosive at concentrations of between 5.1 %volume/volume (v/v), the Lower Explosive Limit (LEL), and 16.5 %v/v, the Upper Explosive Limit (UEL). The LEL and UEL must be treated as a guide as the presence of other components within landfill gas can alter the explosive range. Methane is lighter than air.
Carbon Dioxide (CO_2)	Carbon dioxide is a colourless, odourless, non-combustible gas that is denser than air and can accumulate in confined spaces. Accumulations of carbon dioxide can create an unbreathable atmosphere in confined spaces by excluding oxygen.
Carbon Monoxide (CO)	Trace gas – colourless, odourless and toxic upon inhalation
Hydrogen Sulphide (H_2S)	Trace gas – colourless, 'rotten egg' odour (up to 0.5 parts per million (ppm) then odourless), toxic upon inhalation and flammable at concentrations ranging between 4.5% v/v and 45.5% v/v.

3.2 Hazards Associated with Landfill Gas

The key hazards associated with landfill gas are discussed below.

3.2.1 Asphyxiation

Asphyxiation is a condition of a deficient supply of oxygen to the body. An asphyxiation risk can be present when an oxygen deficient environment exists, caused by the replacement of oxygen by bulk landfill gases such as methane and carbon dioxide. The risk of an oxygen deficient environment can be increased in conditions where gases may collect due to poor ventilation, such as in excavations.

Physiological effects arising from respiration in oxygen deficient environments are provided in Table 3-2.

Table 3-2: Physiological effects from respiration in oxygen deficient environments

Oxygen concentration (%)	Physiological effects
21	Ambient air concentration.
18	Blood saturation adequate for resting, walking and heavy work.
17	Faster, deeper breathing, slight impairment of judgement.
16	First signs of anoxia, dizziness, buzzing in ears.
12 – 16	Increased breathing and pulse rate. Muscular co-ordination impaired.
10 – 14	Emotional upset. Abnormal fatigue upon exertion.
6 – 10	Nausea, vomiting unconsciousness. Collapse may reoccur with person unable to move or cry out.
<6	Convulsions, gasping respiration, death.

3.2.2 Toxicity

The toxicity of a gas depends on the degree, nature and length of exposure to the gas. Carbon dioxide and a number of trace gases can have toxic effects if present in high enough concentrations.

A summary of toxic gases and guidance on occupational exposure levels is summarised in **Table 3-3**:

Table 3-3: Toxic Gas Occupational Exposure Levels

Component of Landfill Gas	Characteristics
Carbon Dioxide	Exposure to carbon dioxide • >3% v/v laboured breathing / headaches • 5 – 6% v/v Heavily laboured breathing and headache • 12 – 25% v/v unconsciousness • > 25% v/v death Source: *'Industry Code of Practice – The Management of Landfill Gas'*, dated March 2012.
Hydrogen Sulphide	• Repeated exposures may cause headaches, anorexia, insomnia, paralysis, meningitis, psychic troubles, slowed heart rate, bronchitis and a grey-green line on the gums. • The national exposure limits as outlined in the Safe Work Australia document titled '*Workplace Exposure Standards for Airborne Contaminants*' (18 April 2013) for hydrogen sulphide are 10ppm (8 Hour Time Weighted Average[2]) and 15ppm (Short Term Exposure Limit[3]). • Hydrogen sulphide at 200 ppm can cause immediate loss of consciousness and death in 30 - 60 minutes.

[2] During periods of daily exposure to an airborne contaminant, exposure above this value is permitted for short periods, if they are compensated for by equivalent exposures below the exposure standard during the working day. If there is a short term exposure limit (STEL) and a time weighted average (TWA) exposure standard, the STEL must also be observed.

[3] The STEL is a 15 minute TWA exposure limit which must not be exceeded at any time during an 8-hour working day, even if the exposure during the full day is less than the eight-hour TWA exposure standard. Exposures at the STEL must not be longer than 15 minutes and must not be repeated more than four times per day. There must be at least 60 minutes between successive exposures at the STEL.

Component of Landfill Gas	Characteristics
	• At 700 ppm respiratory paralysis and death can occur in seconds.
Carbon Monoxide	• Inhalation of low levels of carbon monoxide can cause headache, dizziness, light-headedness, and fatigue. Exposure to higher concentrations of carbon monoxide can cause sleepiness, hallucinations, convulsions, collapse, loss of consciousness and death. • Carbon monoxide is a poisonous gas. The national exposure limits as outlined in the Safe Work Australia document titled '*Workplace Exposure Standards for Airborne Contaminants*' (18 April 2013) for carbon monoxide is 30ppm (Time Weighted Average – 8 hours[2]).

3.2.3 Flammable/Explosive Hazards

Landfill gas potentially contains several flammable gas components, the concentration ranges at which these gases pose a risk are as follows:

- Hydrogen Sulphide flammable limits: LEL 4.5% v/v – UEL 45.5% v/v; and
- Methane is a flammable gas with an explosive range: LEL 5.1% - UEL 16.5%.

Concentrations of methane and hydrogen sulphide within the explosive ranges in the presence of oxygen and an ignition source (e.g. heat, sparks or a flame) can lead to a fire or explosion.

It should be noted that a methane fire is invisible and the only indication of a fire may be a heat haze effect.

4 Site Conditions and Construction Details

Camdenville Park was filled with municipal waste and incinerator waste between the early 1920s and 1950s. The site is listed on the NSW EPA record of notified sites.

In a 2012 survey conducted by GHD, methane was detected in high concentrations in boreholes in Camdenville Park, indicating the presence of landfill gas (GHD, 2013). In addition, the site was considered to be contaminated by waste materials (lead and petroleum hydrocarbons).

The transmission cable route passes through the western portion of Camdenville Park and traverses along the southern boundary of the eastern portion of the park. Camdenville Park also forms a construction laydown areas for the project and will be utilised for the duration of the project, estimated to be around 24 months.

4.1 Presence of Landfill Gas

The GHD Australia Pty Ltd report titled '*Remediation and Construction Environmental Management Action Plan, Camdenville Park, May Street, St Peters, NSW'*, dated September 2013 (presented in **Appendix A**) summarises the results of landfill gas monitoring completed between January 2011 and May 2012.

In summary landfill gas concentrations measured within monitoring bores installed within the landfilled waste were as follows:

- Methane ranged between 0.1% v/v and 73.1% v/v.

- Carbon dioxide ranged between 4.0% v/v and 35.3% v/v.
- Flow readings ranged from 0.1 l/hr to 0.2 l/hr.

Landfill gas concentrations measured within monitoring bores installed outside of the landfilled waste in natural geology were as follows:

- Methane ranged between <0.1% v/v and 2.4% v/v.
- Carbon dioxide ranged between 2.6% v/v and 69.8% v/v.
- Flow readings ranged from <0.1 l/hr to 0.4 l/hr.

It is noted that the GHD report recommends additional monitoring is undertaken to account for seasonal variation in landfill gas concentrations.

While no monitoring results were provided for service and surface emission monitoring GHD provided the following statement:

'No exceedances of the nominated actions (sic) levels for methane and / or carbon dioxide were observed during the period in monitored sub-surface services, across the site's surface or within the on-site building. These results suggest that significant emissions of landfill gas are not occurring from the site.'

As the GHD report summarises monitoring undertaken previously there is no information relating to the methodology of data collection and meteorological conditions present during data collection. It is also noted that the monitoring data in GHD (2013) is over eight years old, and it is possible that current landfill gas conditions are different due to changes in climate (e.g. subsequent droughts and seasonal variations) and meteorological conditions (e.g. local weather).

4.2 Trench Construction Details

TransGrid provided a file titled 'Typical Trench Design and Rating Tables for 330kV' ref. TEA-PSF-DR-005, dated 27 May 2020 (presented in **Appendix B**), that presents information relating to the dimensions of the trench to be excavated. The dimensions are variable along the length of the transmission cable placement, in summary:

- The largest trench sizing is 2,650 mm width and 2,565 mm depth.
- The smallest trench size is 1,550 mm width and 1,578 mm depth.

In terms of the risk associated with accumulation of landfill gas a narrow and deep trench is likely to present an increased risk. The trench with dimensions closest to the maximum depth and width identified above is 1,650 mm wide and 2,478 mm deep.

4.3 Ventilation Estimates

To provide a preliminary indication of whether hazardous methane or carbon dioxide concentrations are expected to occur within trenches during the proposed works, potential landfill gas concentrations within the trenches were estimated by considering:

1. The potential concentration and volumetric flow rate of landfill gas (methane and/or carbon dioxide) into the trench; and
2. The extent of dilution that would occur within the trench due to ambient wind / airflow.

Specifically, from first principles and application of a simple mixing and dilution model, if it is assumed that:

- A landfill gas bore has a zone of influence of 10 m^2 lateral ground surface area (Pecksen relationship);

- The wind speed within the trench is 1/10th of that at ground level; and
- Emitted gases will be mixed within a 15 m length of trench (beyond this length it is expected that gases would disperse above the trench; see CRC CARE, 2010).

Then the gas concentration within the trench can be estimated by the following equation:

$$C_{gt} = \frac{C_{gb} \times F_{bh} \times L \times CF_1}{ZI \times D \times u_t \times CF_2}$$

Equation 1

Where:

C_{gt}	=	Estimated gas concentration in trench (% v/v)
C_{gb}	=	Measured gas concentration in relevant LFG monitoring bore (% v/v)
F_{bh}	=	Measured gas flow rate in relevant monitoring bore (L/hr)
ZI	=	Lateral zone of influence of landfill gas bore flow (m^2)
L	=	Length of trench within which emitted vapours are mixed (m)
D	=	Depth of trench (m)
CF_1	=	Conversion factor (0.001 m^3/L)
U_t	=	Wind speed within trench (km/hr)
CF_2	=	Conversion factor (1,000 m/km)

The assumed parameter values and outputs of the above calculation for the project are detailed in the following table (utilising worst-case conservative assumptions from available data and information):

Parameter	Value	Source / Justification
C_{gb}	73.1% v/v (CH_4) 69.8% v/v (CO_2)	Maximum reported concentrations in landfill gas bores across the project area.
F_{bh}	0.4 L/hr	Maximum flow measured within landfill gas bores across the project area.
ZI	10 m^2	Based on Pecksen (1986) methodology, which assumes a landfill gas bore / standpipe has zone of influence of 10 square metres[4].
L	15 m	Maximum length beyond which gases are expected to disperse above the trench (Friebel and Nadebaum, 2010).
D	2.5 m	Maximum depth as per project-specific trench dimensions.

[4] As described/discussed in CIRIA (2007), *Assessing risks posed by hazardous ground gases to buildings*, Publication C665, 2007.

U_t	0.66 km/hr	10% of ambient wind speed of 6.6 km/hr, which is the minimum monthly average windspeed at 9 am reported at Bankstown Airport station 066137 (note 9 am wind speeds are much lower / more conservative than 3 pm wind speed). Bankstown Airport station is the closest weather station to the project area (~5 km from Potts Hill).
C_{gt}	**0.000027% v/v (CH_4)** **0.000025% v/v (CO_2)**	Estimated gas concentrations in trench following dilution/mixing with outdoor air based on above analysis.

4: As described/discussed in CIRIA (2007), *Assessing risks posed by hazardous ground gases to buildings*, Publication C665, 2007

The maximum estimated landfill gas concentrations above (<0.0001% v/v for both methane and carbon dioxide) are negligible in comparison to relevant trigger levels or levels of concern (see **Section 5.3.3**). This suggests that natural ventilation will likely dissipate landfill gas within the trenches. However, as gas behaviour within and adjacent to landfills is unpredictable, and concentrations may vary depending on weather conditions and trench characteristics, gas monitoring and management during the works is still considered prudent.

5 Landfill Gas Control Measures

A range of environmental procedures and control measures are identified in the various environmental planning documents, TransGrid specifications and guidelines and EIS. Project specific Environmental Control Measures (ECMs) to meet the objectives of this CPLGMP and to address potential impacts from landfill gas are detailed in subsequent sections.

5.1 Landfill Gas Management During Construction

The below ECMs address EMMMs CT9 (Former landfill management) and AQ12 (landfill gas) in the EIS, specifically for Camdenville Park. **Table 5-1** below identifies the components of the CPLGMP required in EMMM CT9 and AQ12 and where each component has been addressed.

Table 5-1: Required Components of the CPLGMP

Required Components	References
Excavation plan specifying areas classified as per in-situ waste classification and suitability for re-use (CT9).	• Waste classification investigations will be undertaken along the route of the transmission cable through Camdenville Park (refer to Section 5.1.2 of the CLMP). Given Camdenville Park was identified in the EIS as an area of high contamination risk and May Street was identified in the EIS as an area of medium contamination risk, contaminants of potential concern (COPC) may be present in addition to those being analysed during the waste classification investigations. Therefore, additional investigations will be undertaken and are outlined in Section 5.1.4 of the CLMP. The COPC required to be analysed in conjunction with or in addition to waste classification for spoil from Camdenville Park and May Street are identified in Table 5-1 of the CLMP.

Required Components	References
	• Suitability for re-use against recreational / open space or commercial / industrial criteria (as appropriate to the site setting) should be undertaken following the investigations outlined in Section 5.1.4 of the CLMP.
Trench ventilation during excavation to prevent the accumulation of landfill gases within the trench (CT9).	• Trench ventilation calculations presented in **Section 4.3** of this CPLGMP. • ECMs presented in **Section 5.3.4** of this CPLGMP.
Ambient and in-trench monitoring for landfill gases (methane, carbon dioxide, hydrogen sulfide and carbon dioxide), ammonia and volatile organic compounds (VOCs) (CT9 and AQ12).	• Monitoring for landfill gases discussed in **Section 5.3** of this CPLGMP.
Action levels for evacuation of the work zone where health and lower explosive limit (LEL) levels are exceeded and additional controls to allow work to re-commence once implemented (CT9 and AQ12).	• Trigger levels presented in **Section 5.3.3** of this CPLGMP. • Additional controls to allow work to recommence following exceedance of trigger levels presented in **Section 5.3.4** of this CPLGMP.
Exclusion zone around the work area on either side of the trench, including fully fenced security chain mesh fences with bracing, where required (CT9).	• Refer to Table 5-3 in the CLMP.
Geotechnical considerations for the base of the trench to mitigate the risk of subsidence of the installed cable (CT9).	• General design considerations discussed in **Section 6** of this CPLGMP.
Final capping layer above the concrete cable conduit casing as per the *Environmental Guidelines Solid Waste Landfills* (NSW EPA, 2016), unless otherwise specified or agreed by with City of Sydney and Inner West Council (CT9).	• General requirements for capping per NSW EPA, 2016 presented in **Section 6.1** of this CPLGMP. • Considerations for the construction of pits within former landfill areas are presented in **Section 6.2** of this CPLGMP.
Mitigation measures to prevent human health exposure risks posed by nuisance odours from exposed leachate or landfill wastes (AQ12).	• Refer to **Section 5.4** of this CPLGMP.

5.2 General

Construction contractors must be made aware that landfill gas may be present in the subsurface at the site and gas may enter any excavations or other below ground structures.

Due to the propensity of landfill gas to migrate to areas with increased void space, any significant ground disturbance activity will likely increase the potential for encountering landfill gas at that location, especially in the vicinity of locations where high concentrations of subsurface landfill gas have been detected in the past.

It should be noted that gas levels can change quickly and will vary both within the excavation and in the area immediately surrounding an excavation. Gas concentrations may vary depending on the location, depth and type of excavation. Meteorological conditions can also influence migration of landfill gas, e.g. rainfall can cause surface sealing and promote lateral migration and decreasing atmospheric pressure can also cause gas to expand and migrate. The potential for the concentrations of landfill gas to move in and out of the explosive range can vary significantly in an open excavation. Landfill gas has been detected underground at concentrations well above the upper explosive limit of methane of 15% v/v. At these concentrations, methane is not explosive at depth due to the landfill gas mixture being too 'rich' and unlikely to have sufficient oxygen to be combustible. However, an open excavation provides opportunity for the presence of significantly increased oxygen content and a relative reduction in the elevated methane concentrations recorded at depth, which means that at some point in time the concentration of landfill gas could be within the explosive range for methane (i.e. between 5 %v/v and 15 %v/v).

Therefore, additional precautions must be taken to ensure that workers are aware of the hazard and the increased risks associated with conducting their work. It is the responsibility of the developer and their contractors to implement appropriate controls to manage the risk to workers when conducting activities at the site. The following risk controls must be implemented:

- All personnel who work on site and all visitors to the site must be made aware of the possibility of the presence of landfill gas in the vicinity of excavations.
- No worker should be allowed to work alone at any time in or near to any excavation. At least one other worker must be available to assist with a rescue, if needed. Under no circumstances shall the additional worker enter the trench to assist the worker who is in the trench.
- Smoking, naked flames and all other unauthorised sources of ignition are prohibited in the vicinity of any excavation. 'No smoking' and 'No naked flame' notices must be posted prominently on the construction site and, if necessary, special areas designated for smoking.
- Any electrical equipment used within excavations, such as motors and extension cords, must be intrinsically safe.
- Welding, oxy-cutting or other hot works must be avoided within and in close proximity to excavations. Welding, flame-cutting or other hot works may only be carried out in trenches or confined spaces when controlled by a 'permit to work' procedure and a specific risk assessment has been undertaken.
- The permit to work procedure must clearly detail the requirements for continuous monitoring for methane, carbon dioxide and oxygen throughout the period during which the hot works are in progress. The procedure must also require the presence of an appropriately qualified person, in attendance outside the 'confined area', who shall be responsible for reviewing the gas measurements as they are made, and who shall have responsibility for suspending the work in the event of unacceptable or hazardous conditions. Only those workers who are appropriately trained and fully aware of the potentially hazardous conditions that may arise must be permitted to carry out hot works in confined areas.
- All excavations must be monitored for the presence of landfill gas (See **Section 5.3**). It should be noted that the presence of elevated concentrations of landfill gas in an excavation may satisfy the definition of a confined space as defined in the NSW Code of Compliance - Confined Spaces (refer **Section 5.3.2** and additional controls will be required to be implemented).
- Entry to excavations must be minimised or eliminated, whenever possible.

- Work upwind of excavations whenever possible to reduce worker exposure to landfill gas.

5.3 Gas Monitoring Requirements

The NSW *Work Health and Safety Act 2011*, *Work Health and Safety Regulation* and associated NSW Government documents, '*Code of Practice – Construction Work*' (August 2019) and '*Code of Practice – Confined Spaces*' (August 2019) provide a basis that can be applied to assessing the risk associated with any excavation. The '*Code of Practice – Confined Spaces*' states:

'A safe atmosphere in a confined space is one that:

- *has a safe oxygen level*
- *is free of airborne contaminants or any airborne contaminants are in concentrations below their allowable exposure standard (if any), and*
- *any flammable gas, vapour or mist in the atmosphere is at concentrations below 5% of its lower explosive level (LEL).'*

Assessment of a safe atmosphere can be undertaken using electronic portable gas detection meters, which are further discussed in **Section 5.3.1**.

5.3.1 Gas Monitoring Equipment

The gas detection meters must be intrinsically safe and fitted with sensors for flammable gas (such as methane), oxygen, hydrogen sulphide, carbon monoxide and ammonia. An intrinsically safe PID meter (assumes 10.6 eV lamp) must be used to measure VOCs.

The meters must be appropriately calibrated in accordance with the manufacturer's requirements and operated by someone trained and deemed competent in the use of the gas detection equipment and landfill gas-related hazards. This person must be present on site when excavation works are conducted.

5.3.2 Monitoring Methodology

The concentration of landfill gas with regard to toxicity and explosivity must be assessed, using the gas detection meters prior to work commencing, and at regular intervals throughout the course of the work.

Based on the trench construction details outlined in **Section 4.2** the shallowest trench excavation will be 1,578 mm. As a result, gas monitoring must be undertaken as follows:

Excavation of the Trench

- At the ground surface before excavation commences, monitoring must be undertaken continuously along the length of the trench at a height of approximately 10 mm above the surface.
- Within the trench during excavation works or once the trench is at depth and remains open:
  - At the beginning of each working day.
  - Hourly throughout the working day while the excavation remains open both within the trench and at ground (breathing) level.

Monitoring must be conducted for (at a minimum) the gases identified in **Section 5.3.3** by inserting the gas detection devices or sample probes along the length of the open excavation as well as at ground level including in the breathing zone of workers. As there is the potential for different gases to settle at different levels, each part of the excavation must be tested – side to side and top to bottom.

Worker Entering the Trench

If a worker is required to enter an excavation the following procedure must be followed:

- Pre-entry testing: Prior to entering the trench monitoring must be conducted by someone trained and deemed competent for (at a minimum) the gases identified in **Section 5.3.3** by inserting the gas detection devices or sample probes along the length of the open excavation. As there is the potential for different gases to settle at different levels, each part of the excavation must be tested – side to side and top to bottom.
- Continuous Monitoring: The gas detection devices must be operated by someone trained and deemed competent and fastened where practicable within the workers breathing zone during entry to and whilst in the trench. The gas detection devices are required to monitor for the gases identified in **Section 5.3.3** and alarm at the trigger levels. Any exceedance of the trigger levels and the worker must exit the trench and not re-enter until the pre-entry testing shows the atmosphere within the trench has returned to safe levels for occupancy.

The monitoring methodologies presented only consider the risk posed by landfill gas, all other risks associated with working within trenches/confined spaces must be assessed and managed in accordance with the applicable regulations and associated guidance.

5.3.3 Trigger Levels

The trigger levels for monitoring presented below in **Table 5-2** must be adopted based on the requirements of the *'Code of Practice – Confined Spaces'*. Exceedance of any of the identified trigger levels / action levels must result in cessation of works and evacuation of the work zone.

Table 5-2: Trigger levels for cessation of works

Element	Trigger Level	Reference
Flammable Atmosphere	> 0.25% v/v (5% LEL)	*Code of Practice – Confined Spaces*
Oxygen	< 19.5% or >23.5%	*p.17 Code of Practice – Confined Spaces: 'Air normally contains 21 per cent oxygen by volume, although oxygen levels of 19.5 per cent to 23.5 per cent by volume are considered to be safe.'*
Hydrogen Sulphide	> 10ppm	*Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average[1].*
Carbon Monoxide	> 30ppm	*Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average[1].*
Ammonia	> 25ppm	*Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average[1].*
VOCs	> 25ppm (in the breathing zone)	*50% of Workplace Exposure Standards for Airborne Contaminants – 8 Hour Time Weighted Average for Toluene[1]*

		This is to be used as a screening number to guide the requirement for further investigation (see **Section 5.3.4**). Toluene is considered to a contaminant of potential concern, 50% of the TWA provides a degree of conservatism to the trigger level.

5.3.4 Exceedances of Trigger Levels

Exceedance of any of the identified trigger levels must result in cessation of works, evacuation of the work zone, an assessment of risk and, if required, development of additional mitigation measures. Work must not continue until gas levels have reduced to concentrations below the trigger levels.

If the VOC trigger level is exceeded in the breathing zone further investigation will be required to characterise the composition of the VOCs followed by adoption of trigger levels for specific VOCs.

If additional mitigation / management measures are required to reduce concentrations of landfill gas within and around an excavation, then consideration must be given to:

- Ventilation with fresh air, by natural, forced or mechanical means.

  The calculations presented in **Section 4.3** indicate that it is likely natural ventilation will dissipate any contaminants that may accumulate within the trenches, however mechanical ventilation may be required in some instances. The ventilation system must be designed by a competent person to provide adequate ventilation levels throughout the excavation during construction.

- Purging using an inert gas such as nitrogen to clear flammable gases or toxic vapours.

  Purging is a method used to displace a contaminant. Following, purging the trench must be ventilated with sufficient fresh air to ensure that oxygen has returned to a normal level of 21% v/v. Consideration needs to be given as to where the contaminants being removed will be expelled to ensure they no longer present a risk.

- Use of air supplied respiratory protection equipment if it isn't possible to maintain safe oxygen / contaminant levels. Further guidance is available in AS/NZS 1715:2009: Selection, use and maintenance of respiratory protective equipment.

  Note that respirators are only to be worn by trained individuals who have their own respirators, have conducted a qualitative fit test, and can obtain an effective face seal.

  It should also be noted that respiratory protection is not suitable when the risk relates to flammable atmospheres.

- Ceasing works until conditions change or risk can be mitigated.

5.4 Nuisance Odours

The one per cent of trace components found in landfill gas are what produces the distinctive odour that many people alike to rotten eggs. This is largely due to the presence of hydrogen sulphide. The human 'smell' threshold (odour threshold) of these trace components is very low (1 – 5 ppm).

The presence of this odour at such low levels does not usually cause health effects (TWA exposure limit of 10 ppm and IDLH [immediately dangerous to life and health] of 100 ppm). However, these odours can lead to complaints from the public. Measurements of hydrogen sulphide should be monitored as outlined in **Section 5.3**. Personnel in the field who might have continuous, low-level exposure to hydrogen sulphide will temporarily lose their ability to smell the gas even though it is still present, due to olfactory fatigue. At high concentrations olfactory fatigue occurs rapidly, and the ability to respond to levels associated with health hazards is impaired. It is therefore necessary to always monitor for the presence of hydrogen sulphide with the gas detection meter.

ECMs may include:

- works may be suspended if weather conditions play a role in emitting or transporting any potential odour emissions outside of the work zone towards local sensitive receptors. For example, if there is a potential for odour on any given day to be emitted locally on site and the site is experiencing strong winds that may transport the odours offsite then works will be suspended until mitigation measures are put in place.
- use of odour suppressant mists and foams, either directly onto the odorous materials or as a perimeter misting system.
- covering odorous materials.
- other measures deemed suitable for the local conditions of the site.

6 Trench Design Considerations

As the alignment of the transmission cable passes through landfilled waste typical trench design considerations that can assist in inhibiting gas migration generally consist of barriers and vents. The following discussion is general in nature and project specific design drawings must be prepared should TransGrid decide to proceed with any trench design mitigation measures.

6.1 Gas Barriers

Where the transmission cable passes directly through the landfill, consideration should be given to the following methods of preventing the migration of landfill gas:

- Completely lining the trench with a naturally gas resistant material such as clay or a synthetic material such as a high-density polyethylene (HDPE) membrane. This will limit gas migration into the permeable backfill surrounding the transmission cable which could present a preferential pathway for migration of landfill gas from landfilled waste.
- Use of a natural gas resistant material such as clay or a soil-bentonite mixture as a cut-off barrier. This option won't necessarily stop landfill gas migrating into the permeable backfill surrounding the transmission cable but could potentially stop it leaving the landfill subject to appropriate placement of the cut-off barrier. The area installed within the waste could be identified as 'hazard zone' and persons who

require access to that area would need to do so under a specific safety management plan.

- Even in the absence of permeable backfill material there is the potential for landfill gas to migrate along the interface between the pipe and the backfilled soil. To mitigate migration of landfill gas into structures located away from the landfilled waste it is important that the annulus around any entry points is effectively blocked by means of sealant, collars, or other method deemed appropriate.

Note that the final capping specified in NSW EPA (2016) of general and restricted solid waste landfills, from bottom to top, should comprise:

- a seal-bearing surface consisting of a properly designed and engineered layer of material at least 300 millimetres thick. Note that EMMM CT9 considers that the concrete cable conduit is a suitable substitute for this layer.
- compacted clay layer at least 600 mm thick, with an in situ saturated hydraulic conductivity of less than 1 x 10^{-9} metres/s; and
- a revegetating layer at least 1000 mm thick and comprising clean soils and vegetation with root systems that will not penetrate lower layers. The upper 200 mm should be a topsoil layer, which can include compost to help with vegetation establishment and growth. Note that although NSW EPA (2016) specifies that this layer should be at least 1000 mm thick, EMMM CT9 specifies that from the top of the capping layer (compacted clay layer) to the surface should comprise clean soils (potentially excavated material suitable for reuse or suitable imported material) with 200 mm of topsoil (in landscaped areas).

It is noted that there is the potential for waste landfill materials to be present in shallow soils in some areas of Camdenville Park. Waste landfill materials will not be re-used during backfilling of trenches and excavated waste material will be disposed of in accordance with the CLMP. Spoil that is suitable for re-use that has been excavated from other sections of the transmission cable route, or imported VENM, ENM or material that meets the definition of a NSW EPA approved resource recovery order/exemption, may be used as backfill in these locations above the capping layer. Where subsurface waste on either side of the trench is shallower than the final depth of the trench, or where capping in accordance with NSW EPA (2016) is not practical, then completely lining the trench should be considered.

6.2 Gas Vents

Vent pipes can be utilised to prevent the build-up of landfill gases within sealed service pits or to reduce landfill gas accumulation on the landfill side of a cut off barrier (See **Section 6.1**).

- Venting sealed service pits, may consist of a simple stack arrangement built into the side of a service pit that vents to atmosphere approximately 2 m – 3 m above ground level.
- Reducing gas accumulation on the landfill side of a cut-off barrier can be achieved by placement of a high permeability gas drainage layer on the landfill side of the cut-off barrier that is vented to atmosphere through a stack arrangement.

The construction of joint bays, link boxes and sensor pits within former landfill areas of Camdenville Park will be designed to prevent the accumulation of landfill gases giving consideration to the options presented above.

6.3 Geotechnical Considerations

The installation of the transmission cable over the former landfill needs to carefully consider both total and differential settlement resulting from ongoing decomposition of the underlying waste. These settlements could induce issues associated with increased strain in the installed infrastructure, or potential pooling of surface or perched groundwater (due to changes in grade) which may impact the embedment conditions.

At this stage it is difficult to estimate the rate or magnitude of the settlement so an assessment will be required as part of the detailed geotechnical design. This will likely require intrusive works to define the condition of the landfill, including depth and composition.

Options to reduce the impact of differential settlement, noting it will not stop total settlements from occurring, include the adoption of an appropriately designed geosynthetic reinforced foundation for the pipe bedding, consisting of single or multiple layers of reinforcement geosynthetic and crushed rock.

7 Compliance Management

7.1 Roles and Responsibilities

In addition to those detailed in the CSWMP and CLMP, the roles and responsibilities presented in **Table 7-1** are relevant to the CPLGMP.

Table 7-1: CPLGMP Roles and Responsibilities

Role	Authority and Responsibility
Contaminated Land Professional	General advice in relation to implementation of this CPLGMP and general environmental issues on Site.

7.2 Training & Induction

Refer to CEMP.

7.3 Complaints Management

Refer to CEMP.

7.4 Incident Response

Refer to CEMP.

7.5 Audits

Refer to CEMP.

7.6 Non-Conformances

Refer to CEMP.

7.7 Records and Documentations

The Records of trench works including final design, capping layer composition and thickness etc will be captured using the 'Former Landfill Area as Built Report' in Appendix D. Refer to CEMP and relevant Subplans for other records and documentation requirements.

7.8 Licenses, Permits and Qualifications

Refer to CLMP.

7.9 Review and Improvement

This plan may be updated or revised if required. The procedure for review and approval of any updates or revisions will be in accordance with the procedure described in the CSWMP.

8 References

AS/NZS 1715:2009: *Selection, use and maintenance of respiratory protective equipment*.

Garde, 2020. *Typical Trench Design and Rating Tables for 330kV*' ref. TEA-PSF-DR-005

GHD, 2013. *Camdenville Park, May Street, St Peters, NSW: Remedial and Construction Environmental Management Action Plan.*

Industry Code of Practice – *The Management of Landfill Gas*, March 2012

LFTGN 03 – *Guidance on the management of landfill gas*, UK Environment Agency

NSW EPA, 2016. *Environmental Guidelines, Solid Waste Landfills*.

NSW EPA, 2014. *Waste Classification Guidelines.*

NSW Government, 2019. *Code of Practice – Confined Spaces*

NSW Government, 2019. *Code of Practice – Construction Work*

Protection of the Environment Operations Legislation Amendment (Waste) Regulation 2018 (Amendment Regulation)

Safe Work Australia, 2019. *Workplace Exposure Standards for Airborne Contaminants*

Work Health and Safety Act 2011 (NSW) No 10.

Work Health and Safety Regulation 2017 (NSW).

Appendix A – Monitoring Data

Tuesday, 13 April 2010
Project No. 43167742

Energy Australia
25 Pomeroy Street
Homebush
NSW 2140

Attention: Peter Robinson and Diana Charteris

Dear Peter, Diana,

Subject: Replacement of 132kV Cable Route 91L and 91M
Soil Gas Investigation at Camdenville Park, St Peters (Site H)

1 Introduction and Background

URS has prepared a design for a railway crossing at St Peters for Energy Australia as part of their program for the installation of new 132kV cables. The planned cable route traverses through Camdenville Park before entering a pair of microtunnels to cross below the railway lines and exit into Edgeware Rd. The anticipated activities for the construction of the microtunnels will include piling, excavation, concrete placement, dewatering (using pumps), jacking of precast pipe segments, crane operations, backfilling of shafts and pulling of conduits and cables into the tunnels. Excavation of a trench will also be required through Camdenville Park, followed by the laying of conduits and backfilling.

In reviewing previous environmental assessments conducted at Camdenville Park, URS noted that high concentrations of methane (an explosive gas) were present in the headspace of groundwater wells throughout the site (GHD, 2008). Whilst it is known that the area was formerly a landfill, and it is likely that the gases measured in the groundwater well headspace were derived from the old landfill, the source of the methane could not be confirmed. In addition, the concentrations of methane along the proposed cable route were not established, thus necessitating further measurements.

To further establish the extent and magnitude concentrations of soil gases, specifically methane (CH_4), carbon dioxide (CO_2), oxygen (O_2) and Total Volatile Organic Compounds (TVOC) along the proposed cable route, soil gas sampling was undertaken. This report discusses the method and findings of soil gas measurement along the proposed cable route, in order to assist in developing recommendations for site works to minimise the potential hazards from explosive or hazardous gas release during construction works.

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1.1 Objectives

The objective of this investigation was to measure the composition of the soil gas along the proposed 132kV cable route and assess the likelihood of potential hazards arising from excavation works. The information obtained should provide guidance in the form of a series of recommendations for the management of the gases during construction.

1.2 Scope of Work

The scope of work involved soil gas sampling of landfill gases (primarily methane) at a number of locations using a temporary drive probe soil gas implant at varying depths. Locations selected for soil gas sampling were located within close proximity (approximately 0.5m) to the following boreholes: BH H4;BH H5;BH H6;BH H7;BH H8.

2 Method

The sampling was conducted by URS personnel between 16th and 17th March 2010 at five locations, as shown in the Soil Gas Sampling Location Map (Refer **Appendix A**). Additionally, photographs showing soil gas sampling are provided in the **Plates Section** (Refer **Appendix B**).

2.1 Soil gas probe installation & sampling

The method employed for temporary soil gas probe installation involved driving a stainless steel rod into the soil to the required depth, after which, the rod was elevated revealing the implant and allowing exposure to the soil gas. A figure of the soil gas sampling probe is shown in **Figure 1**.

The inserted soil gas probe was connected to a gas monitors via Teflon® tubing. The parameters measured at each location included methane (%), carbon dioxide (%), oxygen (%), lower explosive limit (LEL[1])(%) and total volatile organic compounds (TVOC[2]) (ppm). Each location was sampled at verying depths between 0.5 and 2 metres below ground level (mbgl) and sampling was completed over two consecutive days. Soil gas sampling at selected locations was completed on both days to seek confirmation as to whether:

1. methane was being generated on site or was present in significant quantities throughout the site; or
2. the presence of methane was due to historical build-up that would rapidly dissipate when the surface when penetrated.

[1] The Lower Explosive Limit (LEL) is the lowest concentration of an explosive gas (in this case, methane) that could result in an explosion, given an ignition source.
[2] Total Volatile Organic Compounds are measured to provide an indication of the likely concentration of toxic or harmful gases, such as benzene.

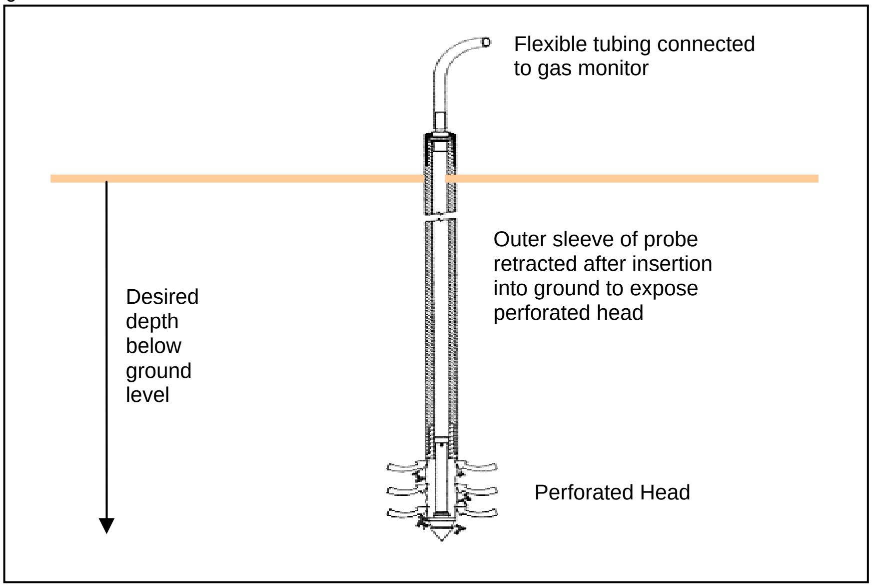

Figure 1: Cross section of soil gas sampling probe.

2.2 Integrity Testing

To confirm that the soil gas implants are effectively sealed and the likelihood of ambient air entering the sample line and diluting the sample is negligible, URS conducted leak testing using high purity helium as a tracer gas and by measuring the helium in the sampling line using a Dielectrics Model MGD-2002 handheld helium detector. The method adopted by URS generally adheres to the *New York State Department of Health (NYDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (NYDOH, 2006). NYDOH (2006) states that concentrations of the tracer gas in excess of 10% in the sampling line warrants modification of the sampling set up to reduce the concentration to less than 10%. Table 2-1 below shows the level of helium leak rates for a single soil gas location (BH H6) conducted at two depths.

Table 2-1: Gas Helium Leak Detection Results

Location	Date	Helium Concentration in Air Above Gas Well (ppm)	Allowed Limit of Helium in Sampling Line (ppm)	Measured Helium Concentration in Sampling Line (ppm)	Conformance	Comment
SV3 (BH H6) (1.0 m depth)	16/03/2010	920,000	92,000	71,000	Yes	Methane concentration of 450,000 ppm (45.1%).

Location	Date	Helium Concentration in Air Above Gas Well	Allowed Limit of Helium in Sampling Line	Measured Helium Concentration in Sampling Line	Conformance	Comment
SV3 (BH H6) (2.0 m depth)	16/03/2010	840,000	84,000	97,000	No	Methane concentration of 412,000 ppm (41.2%).

The high concentrations of helium are likely to result from interference of the methane, as very high concentrations of methane are incorrectly measured as helium. Notwithstanding this likely erroneous reporting of helium concentrations, the leak detection that was performed showed helium concentrations close to the 10% limit, suggesting the actual concentration of helium was significantly less. Thus, the sampling probes were considered to be adequately installed and that ambient air was unlikely to adversely influence the soil gas sample.

2.3 Site Sampling Conditions

A summary of the weather conditions prior to, and during the sampling program is shown in **Table 2-2**. The weather conditions were taken from the Australian Bureau of Meteorology (BoM) weather station at Mascot, which is the closest known station to the site.

Table 2-2: Summary of Weather Conditions at Mascot between 9 March 2010 and 17 March 2010 (Bureau of Meteorology, 2010)

Date	Day of the week	Maximum Temperature (^{0}C)	Rainfall (mm)
9/03/2010	Tuesday	31	0
10/03/2010	Wednesday	20.8	0.8
11/03/2010	Thursday	22.5	0
12/03/2010	Friday	24.4	0
13/03/2010	Saturday	24	0
14/03/2010	Sunday	24	4
15/03/2010	Monday	26.1	0
16/03/2010	Tuesday	26.8	0
17/03/2010	Wednesday	27.4	0

It should be noted that in certain situations, landfills can exhibit elevated emissions of gases within a few days after heavy rainfall due to increased biological activity (Cooper *et al.* 1992). As shown in **Table 2-2**, the sampling was conducted during periods of relatively dry weather and not immediately following heavy rain in order to capture representative gas concentrations.

3 Results

The results of the soil gas sampling are provided in **Table 3-1**. Results have indicated that large concentrations of methane were measured at all sampling locations, below a depth of approximately 0.5 m. The largest concentration of methane (56.6 %) was measured at a depth of 1.5 mbgl at BH_H4.

Table 3-1: Soil Vapour Sampling Results

Location	Date	Time	Depth (mbgl)	CH_4 (%)	CO_2 (%)	O_2 (%)	LEL (%)	TVOC (ppm)
BH H4	17/3/10	12:35	0.525	16.1	9.6	1.7	> 99.9	0.0
			1.025	43.0	14.5	0.6	> 99.9	0.0
			1.57	56.6	20.6	0.0	> 99.9	0.0
		15:55	1.85	53.0	18.7	0.0	> 99.9	0.0
BH H5	17/3/10	12:03	0.525	32.7	12.8	0	> 99.9	0.0
			1.025	30.3	9.6	2.0	> 99.9	0.0
BH H6	16/3/10	15:15	0.525	0.0	5.9	14.1	0.0	0.0
			1.025	45.1	14.1	0.7	> 99.9	0.0
			1.525	48.9	15.6	0.0	> 99.9	0.0
			2.025	41.2	13.8	2.2	> 99.9	0.0
	17/3/10	16:16	1.85	48.5	15.7	0.0	> 99.9	0.0
SV4 (BH H7)	16/3/10	9:27	0.525	0.0	1.2	19.7	0.0	0.0
			1.0	30.6	12.2	0.0	> 99.9	0.0
			1.55	31.0	13.0	0.0	> 99.9	0.0
			2.0	32.8	14.0	0.0	> 99.9	0.0
	17/3/10	16:30	1.85	9.5	3.9	14.3	> 99.9	0.0
BH H8	16/3/10	8:30	0.55	0.0	5.8	14.1	0.0	0.0
			1.05	0.0	7.7	10.4	0.0	0.0
			1.525	3.3	15.6	0.0	75.6	0.0
			2.0	7.1	14.2	0.0	> 99	0.0
	17/3/10	16:40	1.9	4.1	12.5	0.7	95.0	0.0

Notes: > indicates LEL was greater than the maximum quantity measureable by the landfill gas meter (i.e. the concentration was above the LEL for methane)

4 Discussion

4.1 Variability in Lateral and Vertical Soil Gas Concentrations

The composition of the soil gas sampled showed a higher proportion of methane compared with carbon dioxide, which is typical of soil gas in historical landfills. The horizontal profile of methane concentrations appeared consistent across the proposed trenching areas, with a slight decrease at the edge of the landfill (BH_H8), close to May Street. A maximum methane concentration of 7.1 % was reported at BH_H8, as compared with maximum concentrations of 56.6 %, 32.7 %, 48.9 %, and 32.8 % measured at BH_H4, BH_H5, BH_H6, and BH_H7 respectively. The vertical profile of methane showed an increase in concentration with depth, and concentrations appeared to stabilise around 1 to 1.5 mbgl. Carbon dioxide levels increased with depth and oxygen levels decreased with depth, which is consistent with an anaerobic landfill environment.

It should be noted that no detectable concentrations of TVOCs were measured suggesting the potential hazards arising from the gas is primarily confined to explosivity.

4.2 Changes in Soil Gas Concentrations with Time

Consecutive days of measurements were completed at locations BH_H6, BH_H7and BH_H8. Methane concentrations on the 17/3/10 (second day of sampling) were 48.5 %, 9.5 % and 4.1 % for locations BH_H6, BH_H7, BH_H8 respectively. This is compared with initial methane concentrations on the 16/3/10 (first day of sampling) of 48.9 %, 32.8 %, and 7.1 % for locations BH_H6, BH_H7, BH_H8 respectively. A decrease in methane concentration is noted at BH_H7 between the two sampling days; however BH_H6 and BH_H8 both show uniform concentrations of methane over the two days. The relatively uniform concentrations of landfill gas at the same location at various times after penetration of the soil suggest that the landfill is the source of continuous gas.

4.3 Explosivity of Soil Gas

The risks associated with landfill gas emissions include explosion, asphyxiation and fire. The elevated methane concentrations at this site indicate that methane is still being generated, probably from decaying waste within the landfill.

Lower Explosion Limit measurements taken during the sampling program were exceedingly high (i.e. the LEL was exceeded) at approximately 0.5 mbgl indicating that key management practices will need to be taken during and after the projects construction. The high LEL readings can be attributed to the high methane concentrations.

Methane is the constituent of landfill gas that is likely to pose the greatest explosive hazard. Methane gas is also highly flammable and pose asphyxiation hazard. Methane is explosive between its Lower Explosive Limit (LEL) - about 5% by volume (v/v) and its Upper Explosive Level (UEL) - about 15% by volume (v/v). At concentrations below its LEL and above its UEL, methane is not explosive but it is flammable above the UEL and will explode when sufficient mixture has burnt to bring the methane concentration down to the UEL. However, an explosion hazard may exist if methane is present in the air between the LEL and UEL and an ignition source is present.

The presence of landfill gas on a site adjacent to a landfill is not unusual; however it is important that monitoring of landfill gas concentrations be carried out during the trenching and tunnelling process to ensure that the concentration of methane does not exceed a threshold value of 20% of LEL or 1% by volume. This will ensure that the risk of explosion and fire is minimised.

5 Recommendations

Given the above findings, it is recommended that a Management Plan be prepared for all construction work that is planned on site. This will need to cover the processes and requirements needed to control potentially hazardous and explosive landfill gas releases. URS suggests that the Management Plan be prepared by the Contractor employed for construction of the works. This can then be reviewed by URS before any construction activities commence.

The Management Plan should incorporate the following safe work practices:

5.1 Gas Monitoring Protocol

During the trenching, excavation and tunnelling works, methane gas monitoring needs to be conducted. Methane gas monitoring can be carried out using an intrinsically safe gas meter (e.g. QRAE Plus). The threshold value of the gas meter should be set at 10% LEL (0.5% methane equivalent v/v) and an alarm (loud audible and bright visual alarm) will be set off at this level. The gas meter should be calibrated three times a day (before starting work, after lunch break and at the end of work day) to ensure the gas meter functioning properly. A suitable gas meter and calibration gas can be hired from an environmental equipment hire agent.

Gas monitoring should be conducted:

- By walk-through at the work site at the start of the day, before works begin;
- Before starting the engine of trucks, excavators, etc;
- During activities with the potential to cause ignition such as breaking of concrete slabs; and
- On and around excavations at the site.

The gas meter should be placed down wind (away from the wind direction) of the location where gas might be expected. At all the other work times, the gas meter should be either placed in the cab of the excavator or with the site supervisor.

In the event that flammable gas concentrations exceed the threshold level, all workers should leave the work area and wait until the gas disperses and the gas concentrations drop below the threshold level. It should be noted that methane has no odour and its absence must be confirmed with the gas meter.

Ignition sources, such as naked lights (matches, lighters) and mobile phones should be prohibited in the work area.

All the workers on site should wear the appropriate personal protection equipment required for the demolition site (such as hard hat, safety boots, safety glasses and cotton reflective clothing). Clothing that could generate static sparks should be avoided.

It is also recommended that work on site include the use of non-sparking buckets, blades and other instruments and intermittently covering exposed surface areas with water or a fire suppressant.

The risks associated with landfill gas will be most acute during the excavation process and during tunnelling. The recommended protocols for the construction process are as follows:

1. Hire a calibrated LEL meter and receive instruction from URS staff on how to use it.
2. Appoint a responsible person to be responsible for operation of the LEL meter. The site supervisor is the most likely person for this role.
3. The LEL meter has two principal components – the display which shows the concentrations of gases and the sampling tube which draws the gas sample into the machine for analysis.
4. The sampling tube of the meter is to be placed in the zone where there is risk of methane gas building up to concentrations at or above the trigger level.
5. During excavation:
   a. The gas meter is to be employed to record gas concentrations within any of the excavations.
   b. If concentrations exceed 1% vol/vol, work is to be stopped until concentrations of gas reduce to acceptable levels (ie. below 1% v/v).

6 References

Bureau of Meteorology 2010 *Sydney Airport, New South Wales March 2010 Daily Weather Observations*. http://www.bom.gov.au/climate/dwo/201003/html/IDCJDW2125.201003.shtml

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Yours sincerely
URS Australia Pty Ltd

Stephen Bowly
Senior Associate Air Quality Scientist

Mark Tooley
Project Manager

APPENDICES:

Appendix A: Map of Gas Sampling Locations

Appendix B: Site Photos of the Soil Gas Testing

Appendix A: Map of Gas Sampling Locations

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PLAN
SCALE 1: 400

SCALE	AS SHOWN
DESIGNED	MT
DRAWN	SD
CHECKED	-
APPROVED	-
DATE	APR10
PRJTRK No.	-
PROJECT NUMBER	-

NEW 132kV CABLE ROUTE 91L AND 91M
INVESTIGATIONS AT CAMDENVILLE PARK

SOIL GAS SAMPLING LOCATIONS

DRAWING No – SHEET – AMD – SIZE A1

URS
LEVEL 3, 116 MILLER STREET,
NORTH SYDNEY, N.S.W 2060.
TEL: (02) 89255500
FAX: (02) 89255555

URS PROJECT No. 43167742 - SITE H

EnergyAustralia®
DESIGN AND ENGINEERING BRANCH
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CAD DRAWING
AMENDMENTS

Appendix B: Site Photos of the Soil Gas Testing

URS Australia Pty Ltd (ABN 46 000 691 690)
Level 3, 116 Miller Street
North Sydney NSW 2060
Australia
T: 61 2 8925 5500
F: 61 2 8925 5555

Plate 1: Temporary soil gas probe installation at BH_H4.

Plate 2: Installed soil gas probe at BH_H6

Plate 3: Installed soil gas probe at BH_H7.

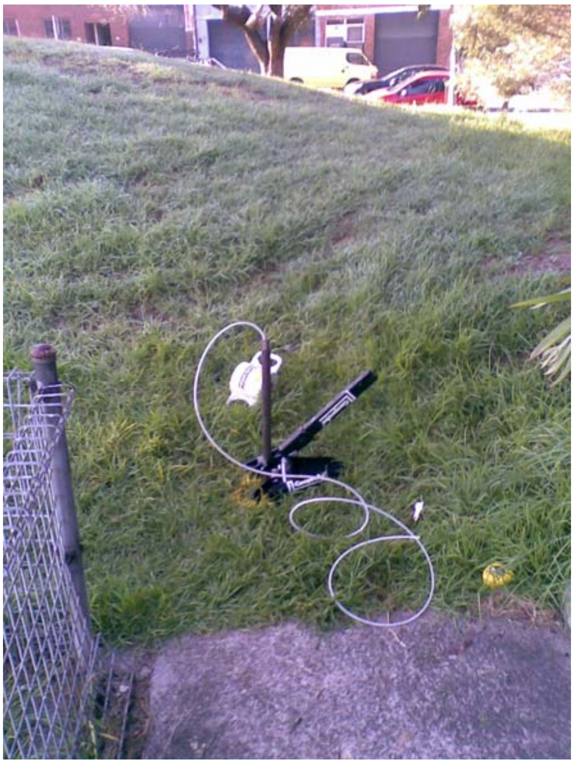


Plate 4: Installed soil gas probe at BH_H8

Appendix B– Transmission Cable Trench Design Details

Client:

180 Thomas Street Sydney NSW 2000

Project Name:

Contract No. 1595
Powering Sydney's Future – Supply and Installation of Integrated Cable Systems Rookwood to Beaconsfield

Contractor:

Subcontractor:

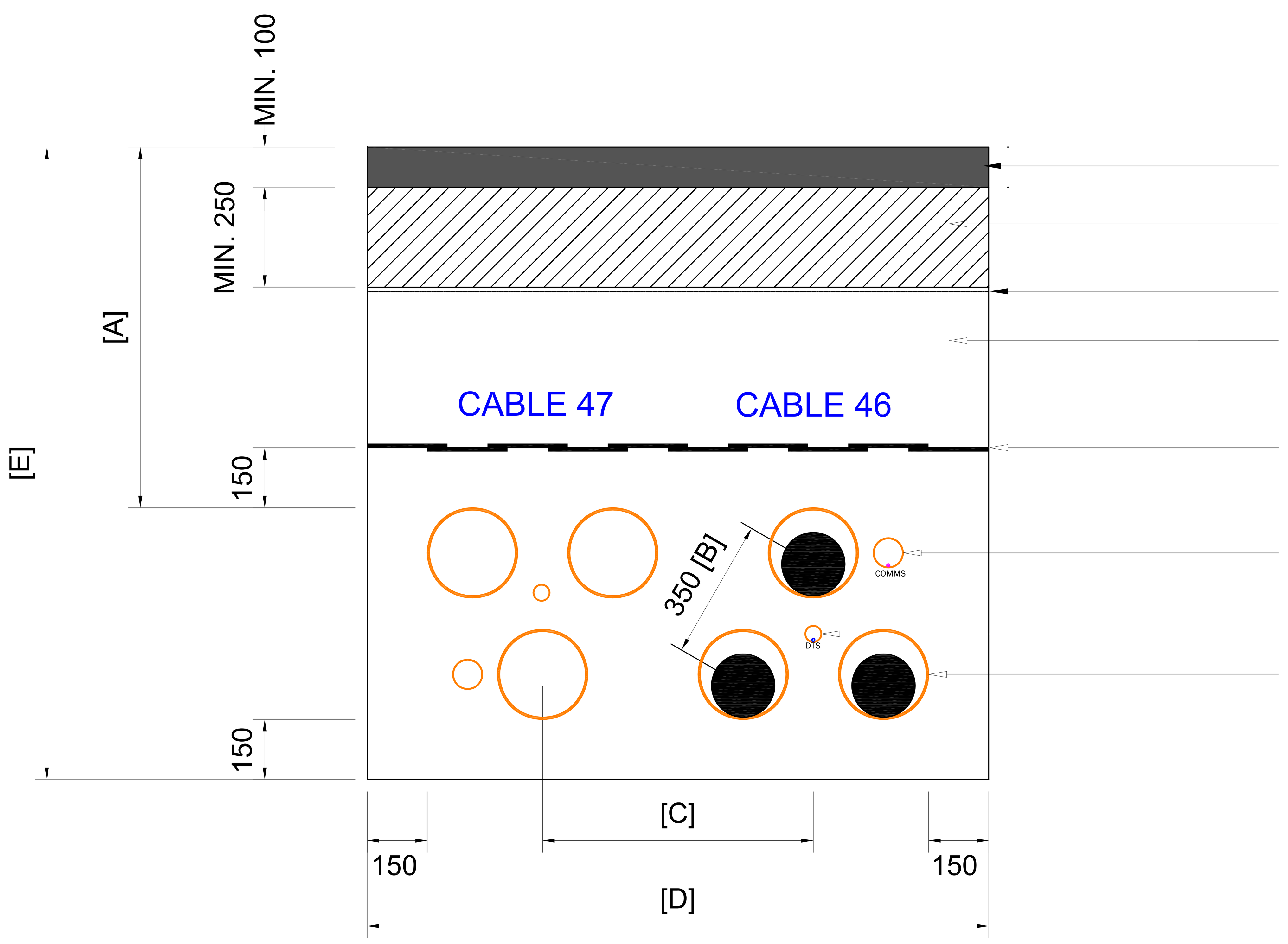
R3	14/04/2020	Revised	JS Yoo	David Kim	CS Han
R2	20/03/2020	Revised	JS Yoo	David Kim	CS Han
R1	27/02/2020	Revised	JS Yoo	David Kim	CS Han
R0	23/01/2020	Issue For Review	JS Yoo	David Kim	CS Han
Rev. No.	Date	Descriptions	Prepared	Reviewed	Approved

Document Title:

Typical Trench Design and Rating Tables for 330kV

Drawing / Document Number:	Page Number:	Size:	Revision Number:
TEA-PSF-DR-005	**1** OF **15**	**A3**	**R3**

Subcontractor Name:	Subcontractor's Document Number:
GARDE	**-**



AC20 (100mm MINIMUM) OR MATCH EXISTING WHICHEVER IS GREATER

COMPACTED ROAD BASE DGB20 TO RMS 3051 (TR LESS THAN 1.2K.m/W)

150mm WIDE WARNING TAPE TO AS2648.1 (FULL TRENCH WIDTH)

THERMALLY STABLE BACKFILL (Min. 550mm TSB ABOVE CONDUITS) :NOTE 2
(LESS THAN TR VALUE 0.9Km/W IN FULLY DRIED OUT CONDITION)

300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702 (FULL TRENCH WIDTH)

2 X 80mm HDPVC TO AS/NZS 2053.2 FOR COMMUNICATION OPTIC FIBRE

2 X 32mm HDPVC TO AS/NZS 2053.2 FOR DTS FIBRE

6 X DN200 CLASS PN6 CONDUITS TO AS/NZS 1477 Table 4.1
FOR 330kV POWER CABLE

POWER CABLE
- 330kV 1C 2500SQ ENAMEL COATED COPPER CONDUCTOR / XLPE INSULATION / SMOOTH ALUMINIUM SHEATH / MDPE, NYLON, HDPE OVERSHEATH (Doc.No TEA-PSF-DR-007)

COMMUNICATION FIBRE - 48 SINGLE MODE FIBRE CABLE
(Doc.No TEA-PSF-DR-013)

DTS FIBRE - 8MM/4SM BROWN FIBRE IN 8/6MM 1 WAY MICRO DUCT
(Doc.No TEA-PSF-DR-012)

TYPICAL TRENCH DESIGN TYPE A

SCALE 1:10
POWER CABLE IN 200mm CONDUIT WITH 350mm DISTANCE SPACER
TYPICAL DUAL CIRCUIT OF 330kV TRENCH SECTION BETWEEN ROOKWOOD RD AND BEACONSFIELD
LOOKING TO BEACONSFIELD

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance
[D] : Trench width
[E] : Trench height

NOTES.
1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. 0.9 Km/W TR VALUE OF TSB HAS BEEN CONSIDERED FOR DESIGN.
3. RELEVANT CONDUIT SPACES IS SELECTED BY REFERENCING THE RATINGS TABLES TO Doc.No TEA-PSF-DR-005.
4. IF ADDITIONAL SEPARATION BETWEEN CIRCUITS IS REQUIRED TO SATISFY THE RATINGS REQUIREMENTS, THEN 100mm CONDUIT SPACES IS REQUIRED.
5. DETAILED TRENCH SIZE SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

CHECK PRINT	BACKDRAFT REQUIRED / READY TO ISSUE	
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

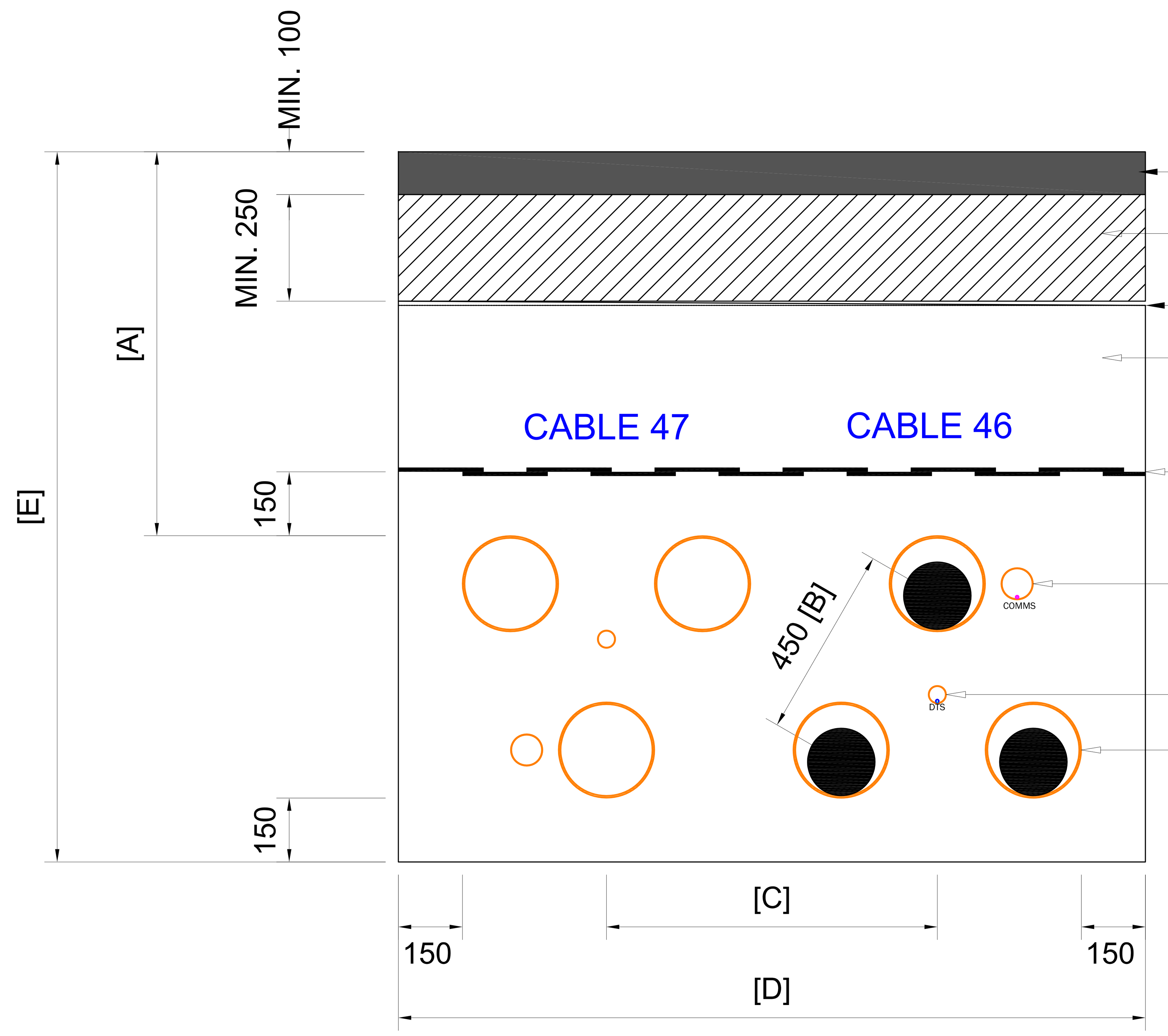
330kV CABLES 46 & 47 INSTALLATION
TYPICAL TRENCH DESIGN TYPE A

A1 | TEA-PSF-CD-D-010 (DRAWING NUMBER) | B (AMDT)

566x801mm

Last saved by: TEC(2020-04-09) Last Plotted: 2020-04-09
Filename: C:\USERS\TEC\DESKTOP\REVISED TRENCH\TEA-PSF-CD-D-010.DWG

Last saved by: TEC(2020-04-09)   Last Plotted: 2020-04-09
Filename: C:\USERS\TEC\DESKTOP\REVISED TRENCH\TEA-PSF-CD-D-020.DWG



AC20 (100mm MINIMUM) OR MATCH EXISTING WHICHEVER IS GREATER

COMPACTED ROAD BASE DGB20 TO RMS 3051 (TR LESS THAN 1.2K.m/W)

150mm WIDE WARNING TAPE TO AS2648.1 (FULL TRENCH WIDTH)

THERMALLY STABLE BACKFILL (Min. 550mm TSB ABOVE CONDUITS) : NOTE 2
(LESS THAN TR VALUE 0.9Km/W IN FULLY DRIED OUT CONDITION)

300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702 (FULL TRENCH WIDTH)

2 X 80mm HDPVC TO AS/NZS 2053.2 FOR COMMUNICATION OPTIC FIBRE

2 X 32mm HDPVC TO AS/NZS 2053.2 FOR DTS FIBRE

6 X DN200 CLASS PN6 CONDUITS TO AS/NZS 1477 Table 4.1
FOR 330kV POWER CABLE

POWER CABLE
- 330kV 1C 2500SQ ENAMEL COATED COPPER CONDUCTOR / XLPE INSULATION / SMOOTH ALUMINIUM SHEATH / MDPE, NYLON, HDPE OVERSHEATH (Doc.No TEA-PSF-DR-007)

COMMUNICATION FIBRE - 48 SINGLE MODE FIBRE CABLE
(Doc.No TEA-PSF-DR-013)

DTS FIBRE - 8MM/4SM BROWN FIBRE IN 8/6MM 1 WAY MICRO DUCT
(Doc.No TEA-PSF-DR-012)

TYPICAL TRENCH DESIGN TYPE B

SCALE 1:10
POWER CABLE IN 200mm CONDUIT WITH 450mm
DISTANCE SPACER
TYPICAL DUAL CIRCUIT 330kV CABLE TRENCH
BETWEEN ROOKWOOD ROAD AND BEACONSFIELD WEST
WHERE BURIAL DEPTH AND/OR HIGH NATIVE TR
REQUIRE TRENCH TO BE 1750mm WIDE OR GREATER.
LOOKING TO BEACONSFIELD WEST

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance
[D] : Trench width
[E] : Trench height

NOTES.
1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. 0.9 Km/W TR VALUE OF TSB HAS BEEN CONSIDERED FOR DESIGN.
3. RELEVANT CONDUIT SPACES IS SELECTED BY REFERENCING THE RATINGS TABLES TO Doc.No TEA-PSF-DR-005.
4. IF ADDITIONAL SEPARATION BETWEEN CIRCUITS IS REQUIRED TO SATISFY THE RATINGS REQUIREMENTS, THEN 100mm CONDUIT SPACES IS REQUIRED.
5. DETAILED TRENCH SIZE SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

CHECK PRINT	BACKDRAFT REQUIRED / READY TO ISSUE	
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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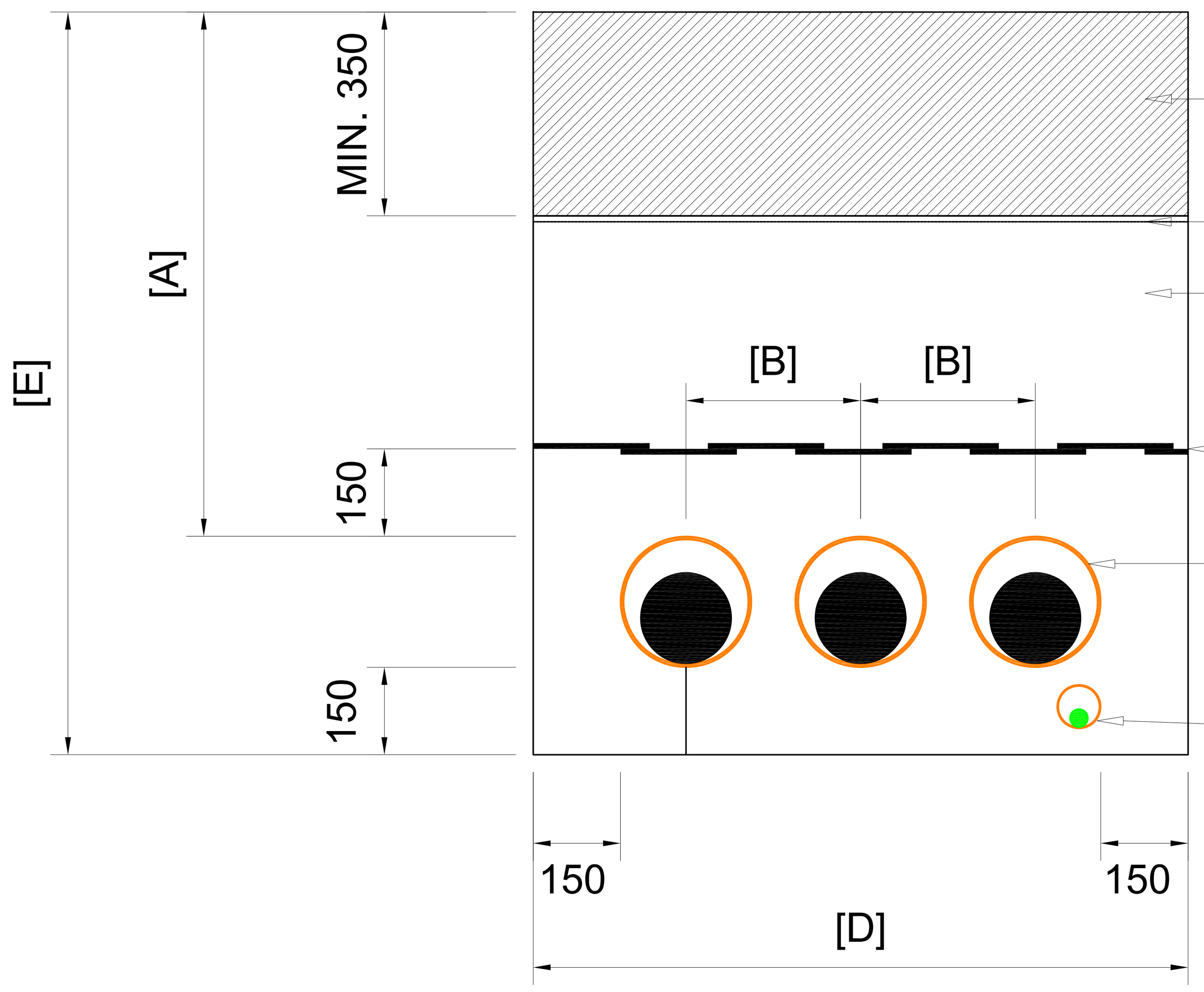
PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL TRENCH DESIGN TYPE B

A1 | TEA-PSF-CD-D-020 (DRAWING NUMBER) | B (AMDT)

566x801mm

Last saved by: TEC(2020-04-09) Last Plotted: 2020-04-09
Filename: C:\USERS\TEC\DESKTOP\REVISED TRENCH\TEA-PSF-CD-D-030.DWG



MATCH EXISTING SURFACE MATERIAL (TR LESS THAN 1.2K.m/W)

150mm WIDE WARNING TAPE TO AS2648.1 (FULL TRENCH WIDTH)

THERMALLY STABLE BACKFILL (Min. 550mm TSB ABOVE CONDUITS)
(LESS THAN TR VALUE 0.9Km/W IN FULLY DRIED OUT CONDITION)

300mm WIDE POLYMERIC CABLE COVER STRIPS TO AS4702 (FULL TRENCH WIDTH)

3 X DN200 CLASS PN6 CONDUITS TO AS/NZS 1477 Table 4.1 FOR 330kV POWER CABLE

1 X 80mm LDPVC TO AS/NZS 2053.2 FOR ECC CABLE

POWER CABLE
- 330kV 1C 2500SQ ENAMEL COATED COPPER CONDUCTOR / XLPE INSULATION / SMOOTH ALUMINIUM SHEATH / MDPE, NYLON, HDPE OVERSHEATH (Doc.No TEA-PSF-DR-007)

ECC CABLE - 300SQ SINGLE BONDING CABLE
(Doc.No TEA-PSF-DR-010)

TYPICAL TRENCH DESIGN TYPE C

SCALE 1:10
POWER CABLE IN 200mm CONDUIT
FLAT FORMATION OF 330kV TRENCH SECTION FOR BEACONSFIELD TIE CABLE

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance (Not Applied)
[D] : Trench width
[E] : Trench height

NOTES.
1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. 0.9 Km/W TR VALUE OF TSB HAS BEEN CONSIDERED FOR DESIGN.
3. DETAILED TRENCH SIZE SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

CHECK PRINT	BACKDRAFT REQUIRED ☐	READY TO ISSUE ☐
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
F						
E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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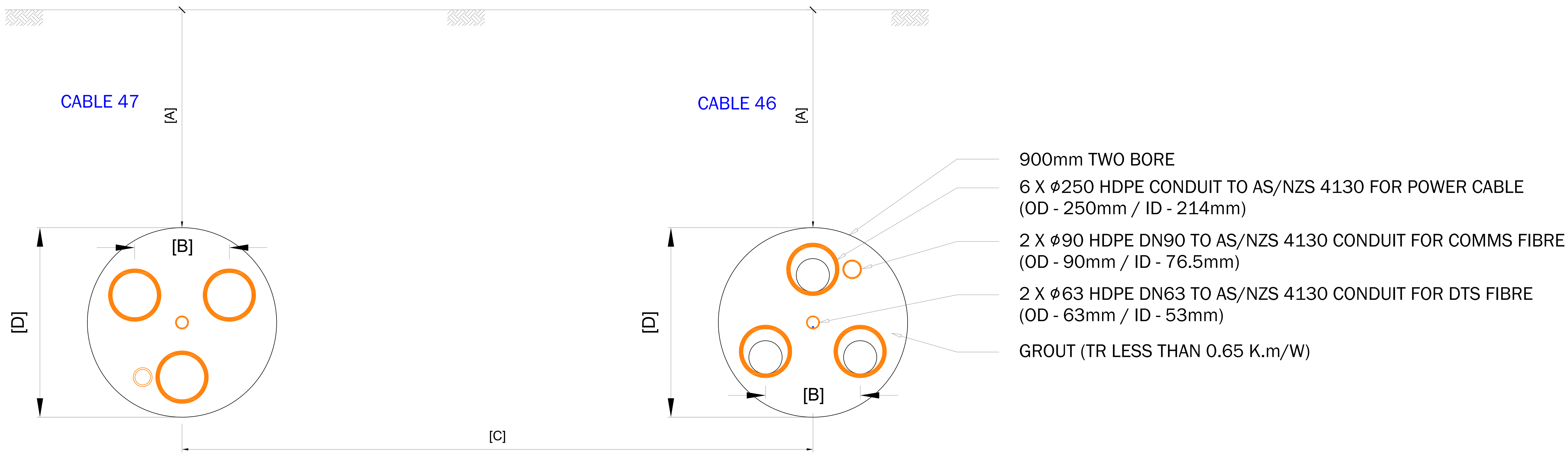
PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL TRENCH DESIGN TYPE C

A1 | TEA-PSF-CD-D-030 | B
DRAWING NUMBER | AMDT

566x801mm



TYPICAL HDD DESIGN TYPE A

SCALE 1:10
HDD SECTION FOR 330kV DOUBLE CIRCUIT
THE PROPOSED HDD SECTION IS

1. THE NATIVE SOIL DESIGN TR VALUE ARE 1.10 K.m/W AT 2% MOISTURE CONTENT AND 1.45 K.m/W AT FULLY DRIED.

NOTES.

1. CONDUIT SHALL BE TEMPORARY SEALED DURING CONSTRUCTION TO PREVENT WATER AND DEBRIS INGRESS.
2. RELEVANT CONDUIT SPACES IS SELECTED BY REFERENCING THE RATINGS TABLES TO Doc.No TEA-PSF-DR-005.
3. DETAILED DIMENTIONS SHOULD BE CHECKED FROM RATING TABLES TO Doc.No TEA-PSF-DR-005.

Dimension of belows can be referred through Doc.No TEA-PSF-DR-005.
[A] : "Cover" depth
[B] : Phase distance
[C] : Circuit distance
[D] : Bore hole size

CHECK PRINT	BACKDRAFT REQUIRED ☐ READY TO ISSUE ☐	
	INITIAL	DATE
SELF CHECK		
DRAFTING		
DESIGN ENGINEER		
LEAD DESIGN		
VERIFIER		
BACKDRAFTED/CORRECTED		
CONFIRMED		

PRELIMINARY

PROJECT No. C1595

AMDT	AMENDMENT DETAILS	DRN	DESIGN	CHK'D	APP'D	DATE
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E						
D						
C						
B	REVISED	JSY	JSY	DK	JK	09-04-2020
A	INITIAL DRAFT FOR REVIEW/COMMENT	JSY	JSY	DK	JK	23-03-2020

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PROJECT
POWERING SYDNEY'S FUTURE
ROOKWOOD RD SUBSTATION TO BEACONSFIELD WEST SUBSTATION

330kV CABLES 46 & 47 INSTALLATION
TYPICAL HDD DESIGN TYPE A

	DRAWING NUMBER	AMDT
A1	TEA-PSF-CD-D-050	B

566x801mm

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Circuit Rating Tables

-. Rookwood Rd to Beaconsfield substations
-. 330kV Tie cable within Beaconsfield

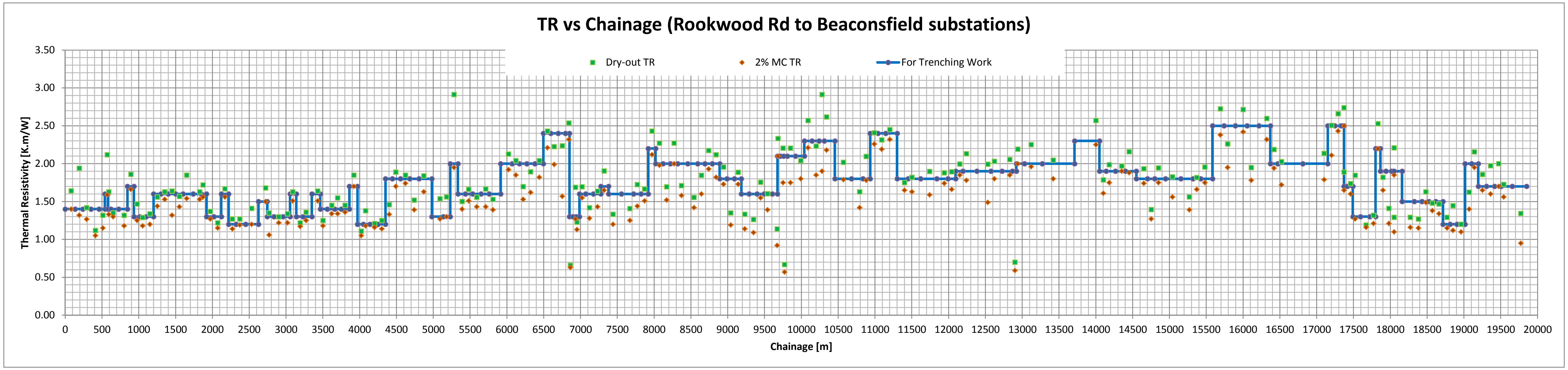
Rev / Date:	Rev.2 / Mar 20, 2020
Docu. No.	TEA-PSF-DR-005

Cable	Trench Type	Soil TR (2% MC)	Soil TR (Dried out)	Ambient Temperature	"Cover" depth [A]	Phase distance [B]	Circuit distance [C]	Trench width [D]	Trench height [E]	Backfill height [F]	Continuous Cyclic Normal Rating (Double Circuit)	Continuous Cyclic Normal Rating (Single Circuit)
330kV 2500 sqmm	Section A & Section A-1	1.2 K.m/W	1.45 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1417.3 amps	1705.5 amps
				29.6 ℃	1300 mm	350 mm	675 mm	1550 mm	1978 mm	1628 mm	1361.1 amps	1664.9 amps
				28.8 ℃	1800 mm	350 mm	775 mm	1650 mm	2478 mm	2128 mm	1327.9 amps	1626.4 amps
		1.3 K.m/W	1.85 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1375.8 amps	1663.8 amps
				29.6 ℃	1300 mm	350 mm	675 mm	1550 mm	1978 mm	1628 mm	1317.6 amps	1621.4 amps
				28.7 ℃	1800 mm	450 mm	775 mm	1750 mm	2565 mm	2215 mm	1331.7 amps	1650.2 amps
		1.4 K.m/W	1.94 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1361.4 amps	1650.1 amps
				29.6 ℃	1300 mm	350 mm	775 mm	1650 mm	1978 mm	1628 mm	1325.0 amps	1609.2 amps
				28.7 ℃	1800 mm	450 mm	875 mm	1850 mm	2565 mm	2215 mm	1332.2 amps	1632.2 amps
		1.5 K.m/W	1.68 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1371.5 amps	1661.7 amps
				29.6 ℃	1300 mm	350 mm	775 mm	1650 mm	1978 mm	1628 mm	1331.5 amps	1617.8 amps
				28.7 ℃	1800 mm	450 mm	875 mm	1850 mm	2565 mm	2215 mm	1333.9 amps	1637.2 amps
		1.6 K.m/W	2.12 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1335.3 amps	1625.3 amps
				29.6 ℃	1300 mm	350 mm	875 mm	1750 mm	1978 mm	1628 mm	1316.1 amps	1582.2 amps
				28.7 ℃	1800 mm	450 mm	1075 mm	2050 mm	2565 mm	2215 mm	1335.7 amps	1606.7 amps
		1.7 K.m/W	2.00 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1335.6 amps	1626.4 amps
				29.6 ℃	1300 mm	350 mm	875 mm	1750 mm	1978 mm	1628 mm	1313.7 amps	1581.3 amps
				28.7 ℃	1800 mm	450 mm	1075 mm	2050 mm	2565 mm	2215 mm	1331.0 amps	1604.0 amps
		1.8 K.m/W	2.10 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1323.3 amps	1614.5 amps
				29.4 ℃	1300 mm	450 mm	775 mm	1750 mm	2065 mm	1715 mm	1328.2 amps	1635.7 amps
				28.7 ℃	1800 mm	450 mm	1175 mm	2150 mm	2565 mm	2215 mm	1327.5 amps	1590.0 amps
		1.9 K.m/W	2.21 K.m/W	30.8 ℃	900 mm	350 mm	675 mm	1550 mm	1578 mm	1228 mm	1314.2 amps	1604.5 amps
				29.4 ℃	1300 mm	450 mm	875 mm	1850 mm	2065 mm	1715 mm	1337.1 amps	1624.9 amps
				28.7 ℃	1800 mm	450 mm	1275 mm	2250 mm	2565 mm	2215 mm	1331.9 amps	1579.6 amps
		2.0 K.m/W	2.27 K.m/W	30.8 ℃	900 mm	350 mm	775 mm	1650 mm	1578 mm	1228 mm	1328.5 amps	1596.8 amps
				29.4 ℃	1300 mm	450 mm	875 mm	1850 mm	2065 mm	1715 mm	1326.7 amps	1614.8 amps
				28.7 ℃	1800 mm	450 mm	1275 mm	2250 mm	2565 mm	2215 mm	1322.7 amps	1570.1 amps
		2.0 K.m/W	2.92 K.m/W	30.8 ℃	900 mm	350 mm	875 mm	1750 mm	1578 mm	1228 mm	1328.7 amps	1573.1 amps
		Chainage [m]	Chainage [m]	29.4 ℃	1300 mm	450 mm	975 mm	1950 mm	2065 mm	1715 mm	1325.1 amps	1591.6 amps
		5230 ~ 5335	5230 ~ 5335	28.7 ℃	1800 mm	450 mm	1475 mm	2450 mm	2565 mm	2215 mm	1323.2 amps	1542.1 amps
		2.1 K.m/W	2.33 K.m/W	30.8 ℃	900 mm	350 mm	775 mm	1650 mm	1578 mm	1228 mm	1320.4 amps	1589.0 amps
				29.4 ℃	1300 mm	450 mm	975 mm	1950 mm	2065 mm	1715 mm	1337.6 amps	1607.8 amps
				28.7 ℃	1800 mm	450 mm	1375 mm	2350 mm	2565 mm	2215 mm	1323.3 amps	1559.3 amps
		2.2 K.m/W	2.53 K.m/W	30.8 ℃	900 mm	350 mm	875 mm	1750 mm	1578 mm	1228 mm	1334.0 amps	1580.7 amps
				29.4 ℃	1300 mm	450 mm	975 mm	1950 mm	2065 mm	1715 mm	1323.7 amps	1593.3 amps
				28.7 ℃	1800 mm	450 mm	1475 mm	2450 mm	2565 mm	2215 mm	1323.2 amps	1546.8 amps
		2.3 K.m/W	2.92 K.m/W	30.4 ℃	900 mm	450 mm	775 mm	1750 mm	1665 mm	1315 mm	1342.2 amps	1627.9 amps
				29.4 ℃	1300 mm	450 mm	1075 mm	2050 mm	2065 mm	1715 mm	1323.8 amps	1576.9 amps
				28.7 ℃	1800 mm	450 mm	1675 mm	2650 mm	2565 mm	2215 mm	1331.0 amps	1529.7 amps
		2.4 K.m/W	2.54 K.m/W	30.8 ℃	900 mm	350 mm	900 mm	1775 mm	1578 mm	1228 mm	1324.6 amps	1572.3 amps
				29.4 ℃	1300 mm	450 mm	1075 mm	2050 mm	2065 mm	1715 mm	1328.6 amps	1584.2 amps
				28.7 ℃	1800 mm	450 mm	1575 mm	2550 mm	2565 mm	2215 mm	1323.8 amps	1538.4 amps
		2.5 K.m/W	2.74 K.m/W	30.4 ℃	900 mm	450 mm	775 mm	1750 mm	1665 mm	1315 mm	1337.9 amps	1624.9 amps
				29.4 ℃	1300 mm	450 mm	1075 mm	2050 mm	2065 mm	1715 mm	1317.1 amps	1572.5 amps
				28.7 ℃	1800 mm	450 mm	1675 mm	2650 mm	2565 mm	2215 mm	1325.1 amps	1526.9 amps
	Section HDD-1	1.1 K.m/W	1.45 K.m/W	25.0 ℃	4000 mm	450 mm	2000 mm	Bore hole size : 900mm	-	-	1337.2 amps	1568.6 amps
				25.0 ℃	5000 mm	450 mm	3000 mm	Bore hole size : 900mm	-	-	1344.9 amps	1534.0 amps
				25.0 ℃	6000 mm	450 mm	4000 mm	Bore hole size : 900mm	-	-	1343.0 amps	1506.7 amps
				25.0 ℃	7000 mm	450 mm	5000 mm	Bore hole size : 900mm	-	-	1338.3 amps	1485.4 amps
				25.0 ℃	8000 mm	450 mm	7000 mm	Bore hole size : 900mm	-	-	1346.7 amps	1467.0 amps
	Section B	4.85 K.m/W at 10% MC	5.88 K.m/W	32.0 ℃	900 mm	300 mm	-	1125 mm	1275 mm	925 mm	-	1399.5 amps
				30.4 ℃	1300 mm	350 mm	-	1225 mm	1675 mm	1325 mm	-	1374.1 amps
				29.2 ℃	1800 mm	400 mm	-	1325 mm	2175 mm	1825 mm	-	1338.9 amps

- TR Value of Backfill Material : **0.9 K.m/W**
- TR value of Grout for HDD section : **0.65 K.m/W**
- Conduit Diameter : **I.D 214mm / O.D 225mm for trench section & I.D 214mm / O.D 250mm for HDD section**
- Trench Design could be cahanged depending on the Site Condition.

Selected Soil TR Value

Chainage [m]	TR Value (2% MC) [K.m/W]	Chainage [m]	TR Value (2% MC) [K.m/W]	Chainage [m]	TR Value (2% MC) [K.m/W]	Chainage [m]	TR Value (2% MC) [K.m/W]
0 ~ 540	1.4	3350 ~ 3465	1.6	7380 ~ 7920	1.6	14050 ~ 14550	1.9
540 ~ 580	1.6	3465 ~ 3860	1.4	7920 ~ 8020	2.2	14550 ~ 15585	1.8
580 ~ 845	1.4	3860 ~ 3970	1.7	8020 ~ 8890	2.0	15585 ~ 16370	2.5
845 ~ 933	1.7	3970 ~ 4350	1.2	8890 ~ 9185	1.8	16370 ~ 17150	2.0
933 ~ 1200	1.3	4350 ~ 4980	1.8	9185 ~ 9675	1.6	17150 ~ 17370	2.5
1200 ~ 1920	1.6	4980 ~ 5230	1.3	9675 ~ 10040	2.1	17370 ~ 17490	1.7
1920 ~ 2120	1.3	5230 ~ 5335	2.0	10040 ~ 10455	2.3	17490 ~ 17800	1.3
2120 ~ 2220	1.6	5335 ~ 5915	1.6	10455 ~ 10935	1.8	17800 ~ 17865	2.2
2220 ~ 2625	1.2	5915 ~ 6495	2.0	10935 ~ 11300	2.4	17865 ~ 18160	1.9
2625 ~ 2745	1.5	6495 ~ 6850	2.4	11300 ~ 12095	1.8	18160 ~ 18715	1.5
2745 ~ 3055	1.3	6850 ~ 6985	1.3	12095 ~ 12920	1.9	18715 ~ 19015	1.2
3055 ~ 3140	1.6	6985 ~ 7275	1.6	12920 ~ 13710	2.0	19015 ~ 19195	2.0
3140 ~ 3350	1.3	7275 ~ 7380	1.7	13710 ~ 14050	2.3	19195 ~ 19850	1.7



Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
80	1.64	1.40	1.4
190	1.94	1.32	1.4
290	1.42	1.27	1.4
410	1.12	1.05	1.4
510	1.32	1.15	1.4
570	2.12	1.59	1.6
590	1.63	1.33	1.4
650	1.35	1.30	1.4
800	1.32	1.18	1.4
890	1.86	1.66	1.7
975	1.47	1.25	1.3
1050	1.29	1.18	1.3
1150	1.34	1.20	1.3
1250	1.56	1.44	1.6
1350	1.63	1.53	1.6
1450	1.64	1.32	1.6
1550	1.57	1.43	1.6
1650	1.85	1.54	1.6
1825	1.63	1.53	1.6
1870	1.72	1.56	1.6
1970	1.37	1.27	1.3
2070	1.22	1.15	1.3
2170	1.67	1.56	1.6
2270	1.27	1.14	1.2
2370	1.27	1.19	1.2
2530	1.41	1.20	1.2
2720	1.68	1.50	1.5
2770	1.35	1.06	1.3
2900	1.30	1.22	1.3
3020	1.34	1.22	1.3
3090	1.63	1.51	1.6
3190	1.22	1.17	1.3
3270	1.36	1.25	1.3
3430	1.64	1.51	1.6

Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
3500	1.25	1.18	1.4
3620	1.45	1.34	1.4
3700	1.55	1.34	1.4
3800	1.45	1.36	1.4
3920	1.85	1.70	1.7
4020	1.11	1.05	1.2
4080	1.38	1.18	1.2
4200	1.21	1.16	1.2
4300	1.25	1.14	1.2
4400	1.46	1.33	1.8
4490	1.89	1.70	1.8
4620	1.85	1.74	1.8
4740	1.52	1.39	1.8
4870	1.84	1.63	1.8
5090	1.54	1.27	1.3
5180	1.56	1.30	1.3
5280	2.92	1.95	2.0
5390	1.50	1.40	1.6
5480	1.66	1.51	1.6
5590	1.56	1.43	1.6
5710	1.67	1.43	1.6
5810	1.53	1.39	1.6
6020	2.13	1.92	2.0
6120	2.04	1.85	2.0
6220	1.70	1.53	2.0
6320	1.89	1.62	2.0
6440	2.04	1.82	2.0
6550	2.43	2.21	2.4
6640	2.23	1.99	2.4
6750	2.24	1.57	2.4
6840	2.54	2.32	2.4
6860	0.66	0.63	1.3
6930	1.69	1.27	1.3
6950	1.23	1.13	1.3

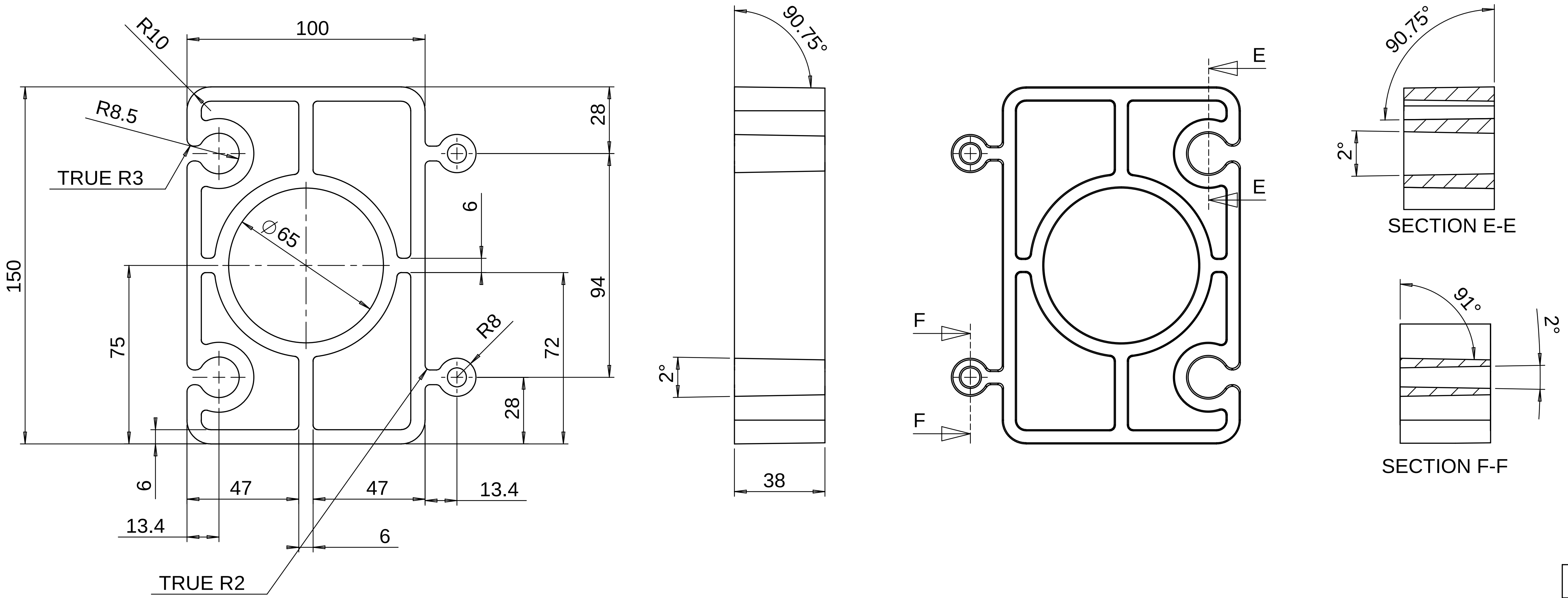
Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
7020	1.70	1.55	1.6
7120	1.42	1.28	1.6
7230	1.64	1.43	1.6
7320	1.91	1.65	1.7
7440	1.33	1.20	1.6
7670	1.41	1.25	1.6
7770	1.72	1.44	1.6
7870	1.67	1.51	1.6
7970	2.43	2.12	2.2
8070	2.27	1.98	2.0
8170	1.70	1.52	2.0
8270	2.27	2.00	2.0
8370	1.71	1.58	2.0
8540	1.56	1.42	2.0
8640	1.85	1.60	2.0
8740	2.17	1.93	2.0
8840	2.12	1.82	2.0
8940	1.96	1.73	1.8
9040	1.35	1.19	1.8
9140	1.89	1.73	1.8
9230	1.33	1.14	1.6
9350	1.27	1.09	1.6
9445	1.76	1.55	1.6
9540	1.61	1.39	1.6
9670	1.14	0.92	1.6
9680	2.33	2.10	2.1
9750	2.21	1.75	2.1
9770	0.67	0.57	2.1
9850	2.21	1.75	2.1
9990	2.04	1.80	2.1
10090	2.57	2.21	2.3
10200	2.23	1.85	2.3
10280	2.92	1.90	2.3
10340	2.62	2.18	2.3

Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
10570	2.02	1.79	1.8
10790	1.63	1.42	1.8
10880	2.10	1.78	1.8
10990	2.41	2.26	2.4
11090	2.32	2.19	2.4
11200	2.45	2.32	2.4
11400	1.75	1.65	1.8
11500	1.82	1.63	1.8
11740	1.90	1.59	1.8
11940	1.88	1.74	1.8
12040	1.89	1.66	1.8
12150	2.00	1.85	1.9
12240	2.13	1.78	1.9
12530	1.99	1.49	1.9
12620	2.03	1.80	1.9
12830	2.06	1.85	1.9
12900	0.70	0.59	1.9
12940	2.19	2.00	2.0
13120	2.25	1.96	2.0
13420	2.05	1.80	2.0
14000	2.57	2.25	2.3
14100	1.79	1.61	1.9
14180	1.99	1.75	1.9
14350	1.97	1.90	1.9
14450	2.16	1.88	1.9
14650	1.93	1.74	1.8
14750	1.40	1.27	1.8
14850	1.95	1.75	1.8
15040	1.83	1.56	1.8
15270	1.56	1.39	1.8
15370	1.82	1.66	1.8
15480	1.96	1.75	1.8
15690	2.73	2.38	2.5
15790	2.26	1.95	2.5

Chainage [m]	Dried TR [K.m/W]	2% MC TR [K.m/W]	Design TR [K.m/W]
16000	2.72	2.42	2.5
16110	1.95	1.78	2.5
16320	2.60	2.32	2.5
16420	2.19	1.94	2.0
16520	2.03	1.72	2.0
17100	2.14	1.79	2.0
17200	2.51	2.11	2.5
17290	2.66	2.43	2.5
17370	2.74	2.50	2.5
17370	1.89	1.65	1.7
17460	1.74	1.60	1.7
17520	1.85	1.27	1.3
17670	1.19	1.16	1.3
17770	1.32	1.21	1.3
17830	2.53	2.20	2.2
17900	1.82	1.65	1.9
17980	1.41	1.21	1.9
18050	1.29	1.10	1.9
18050	2.21	1.85	1.9
18270	1.29	1.16	1.5
18380	1.27	1.15	1.5
18480	1.63	1.49	1.5
18570	1.48	1.38	1.5
18660	1.47	1.34	1.5
18770	1.29	1.15	1.2
18850	1.45	1.12	1.2
18960	1.20	1.10	1.2
19070	1.62	1.40	2.0
19140	2.16	1.95	2.0
19250	1.86	1.65	1.7
19360	1.97	1.60	1.7
19470	2.00	1.70	1.7
19540	1.73	1.56	1.7
19770	1.35	0.95	1.7

Appendix A

(Spacer Drawings)



NOTE:
UNLESS OTHERWISE STATED ALL EDGES TO BE R0.2
COMPONENT MASS 185g.
GENERAL WALL SECTION 5.4mm.
REMOVE ALL FLASH, BURRS & SHARP EDGES.

Revision	Description	Date
A	DIMENSIONS CHANGE	9/12/08
0	Original Issue	26/11/08

Project	AUSTRALIAN VERSION CONDUIT BRACKET & SPACER
Client	ENERGY AUSTRALIA

Drawn	Date	Checked	Date
HL	26/11/08	PM	09/12/08
Approved By			Date
Drawing Number: DE005/002B		Issued By	Issue Date
Scale: 1:2	Sheet Size: A3	Issue: 0	Sheet: 3 of 5

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

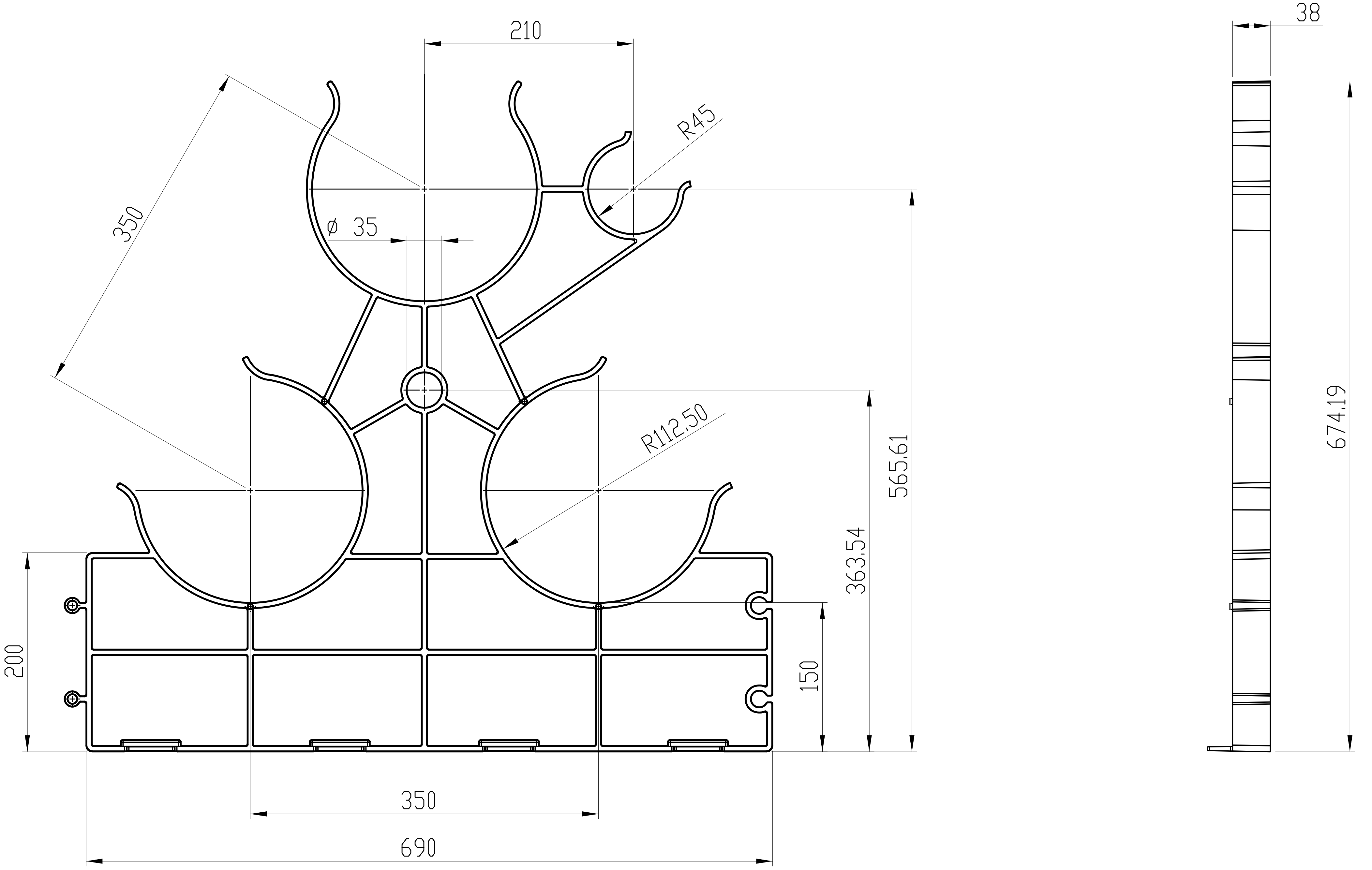
Tolerence as specified	
LINEAR ± 0.25 ANGULAR ± 0.5° DRAFT 1°	Material: HIPS Finish: COMMERCIAL POLISH

ASP Plastics Pty Ltd
17 Harris Street
St. Marys, N.S.W. 2760
Australia

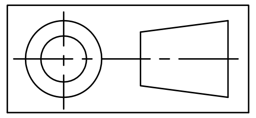
Ph: (02) 9623 7677
Fax: (02) 9673 4032

ASP PLASTICS

REF	REV	DESCRIPTION	BY	CHK	DATE
	A	NAME & COLOUR CHANGED	HL		20/03/20
	B	ADED RIBS	HL		23/03/20



NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1160 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: NATURAL



Project: 225 TREFOIL CONDUIT BRACKET 350 SPACING
Client: GARDE SERVICES

Drawn	Date	Checked	Date
HL	06/02/20		
Approved By			Date
Drawing Number: DG014/004		Issued By	Issue Date
Scale: NTS	Sheet Size: A3	Issue: 0	Sheet: 1 of 1

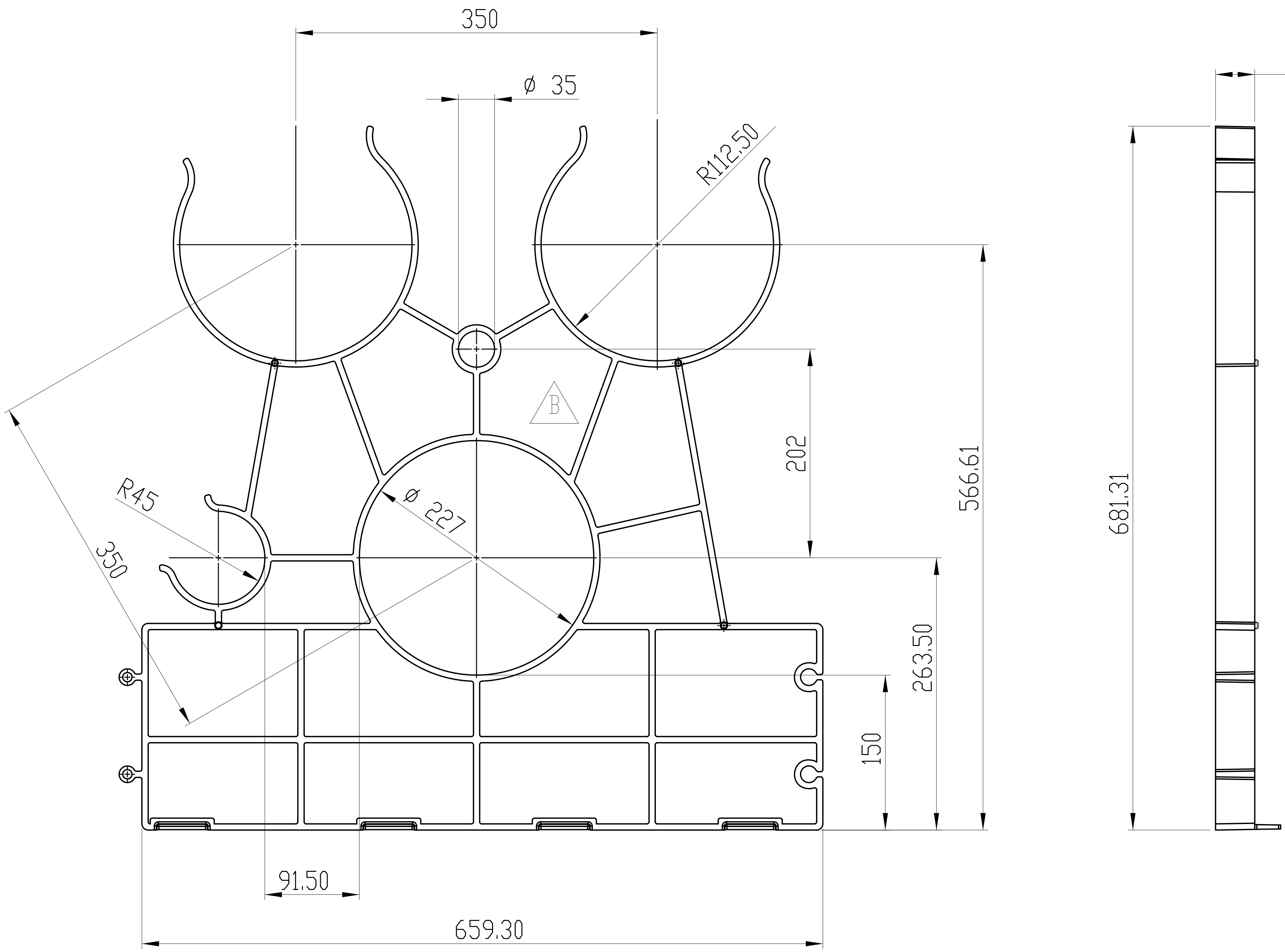
Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

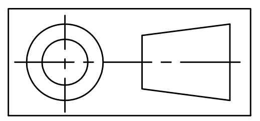
Material: HIPS
Finish: MACHINE FINISH

ASP Plastics Pty Ltd
17 Harris Street
St. Marys, N.S.W. 2760
Australia
Ph: (02) 9623 7677
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE
	A	NAME & COLOUR CHANGED	HL		20/03/20
	B	ADDED RIBS	HL		23/03/20



NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1306 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: NATURAL



Project	225 INVERTED TREFOIL BRACKET 350 SPACING
Client	GARDE SERVICES
Drawn / Date	HL 06/02/20
Checked / Date	
Approved By / Date	
Drawing Number	DG014/005
Issued By / Issue Date	
Scale	NTS
Sheet Size	A3
Issue	0
Sheet	1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS
Finish: FINE POLISH

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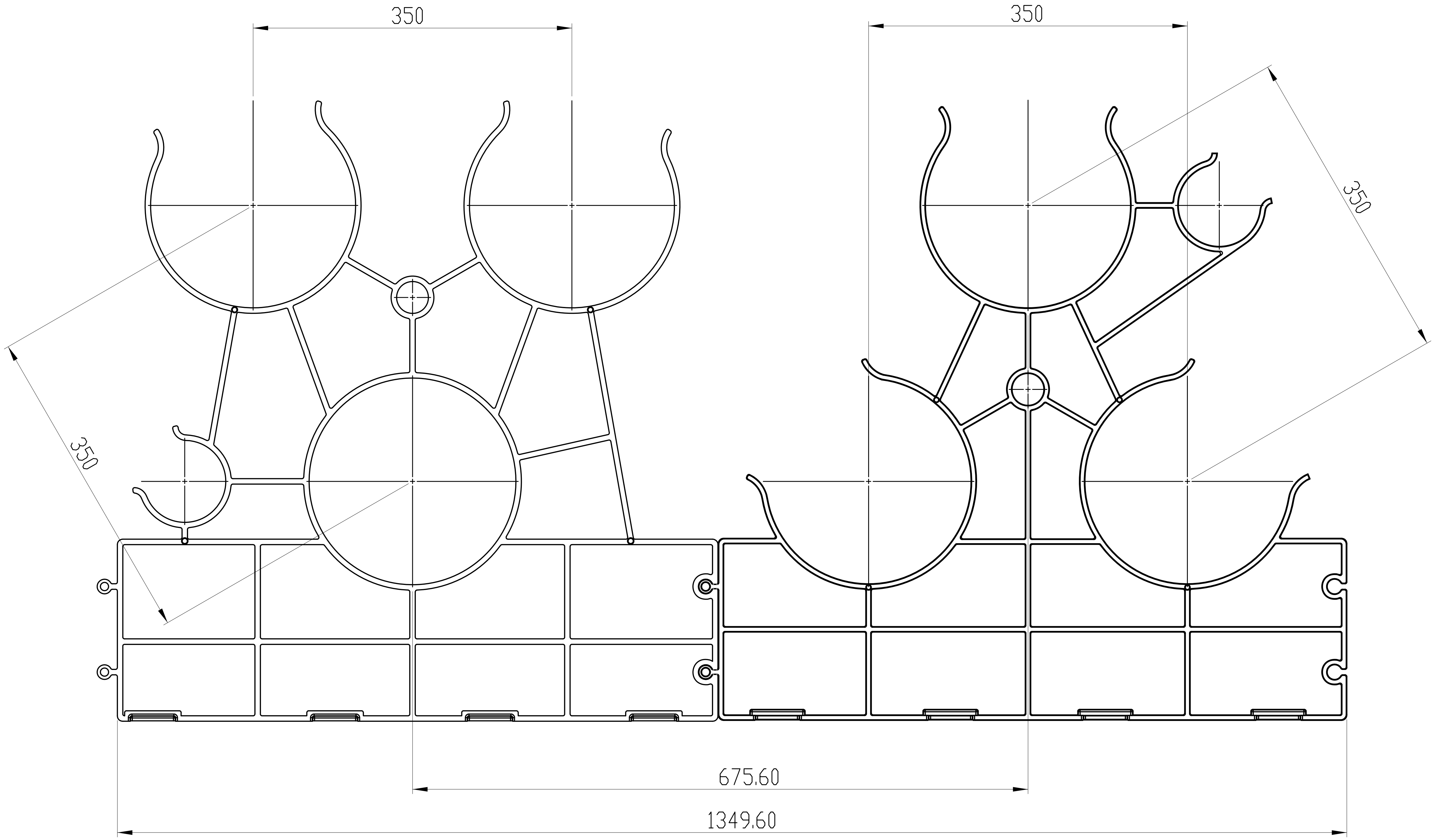
17 Harris Street
St. Marys, N.S.W. 2760
Australia
Ph: (02) 9623 7677
Fax: (02) 9673 4032



Project	
225 CONDUIT 350 SPACING COMPARISON	
Client: GARDE SERVICES	
Drawn: HL — Date: 06/02/20	Checked — Date
Approved By — Date	
Drawing Number: NOT FOR PRODUCTION	Issued By — Issue Date
Scale: NTS — Sheet Size: A3	Issue: 0 — Sheet: 1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS
Finish: FINE POLISH

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Australia

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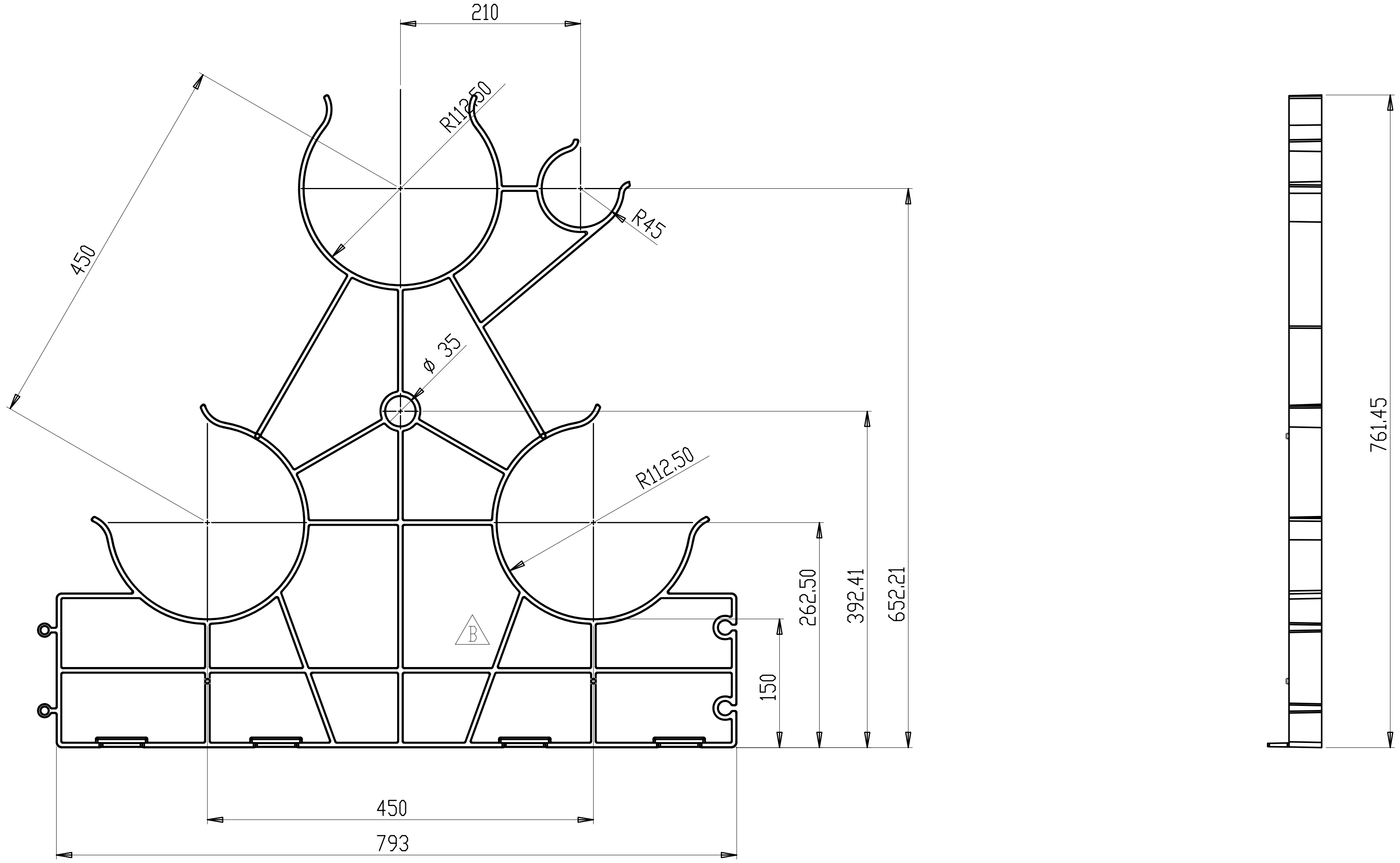
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE
	A	NAME CHANGED	HL		20/03/20
	B	ADD EXTRA RIBS	HL		23/03/20



NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1410 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: BLACK

Project: 225 TREFOIL BRACKET 450 SPACING

Client: GARDE SERVICES

Drawn	Date	Checked	
HL	07/02/20		26/05/14
Approved By			Date
Drawing Number	DG014/001	Issued By	Issue Date
Scale: NTS	Sheet Size: A3	Issue: 0	Sheet: 1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.5
ANGULAR ± 0.5°
DRAFT 1°

Material: HIPS
Finish: COMMERCIAL FINISH

ASP Plastics Pty Ltd
17 Harris Street
St. Marys, N.S.W. 2760
Australia

Ph: (02) 9623 7677
Fax: (02) 9673 4032

asp PLASTICS

REF	REV	DESCRIPTION	BY	CHK	DATE
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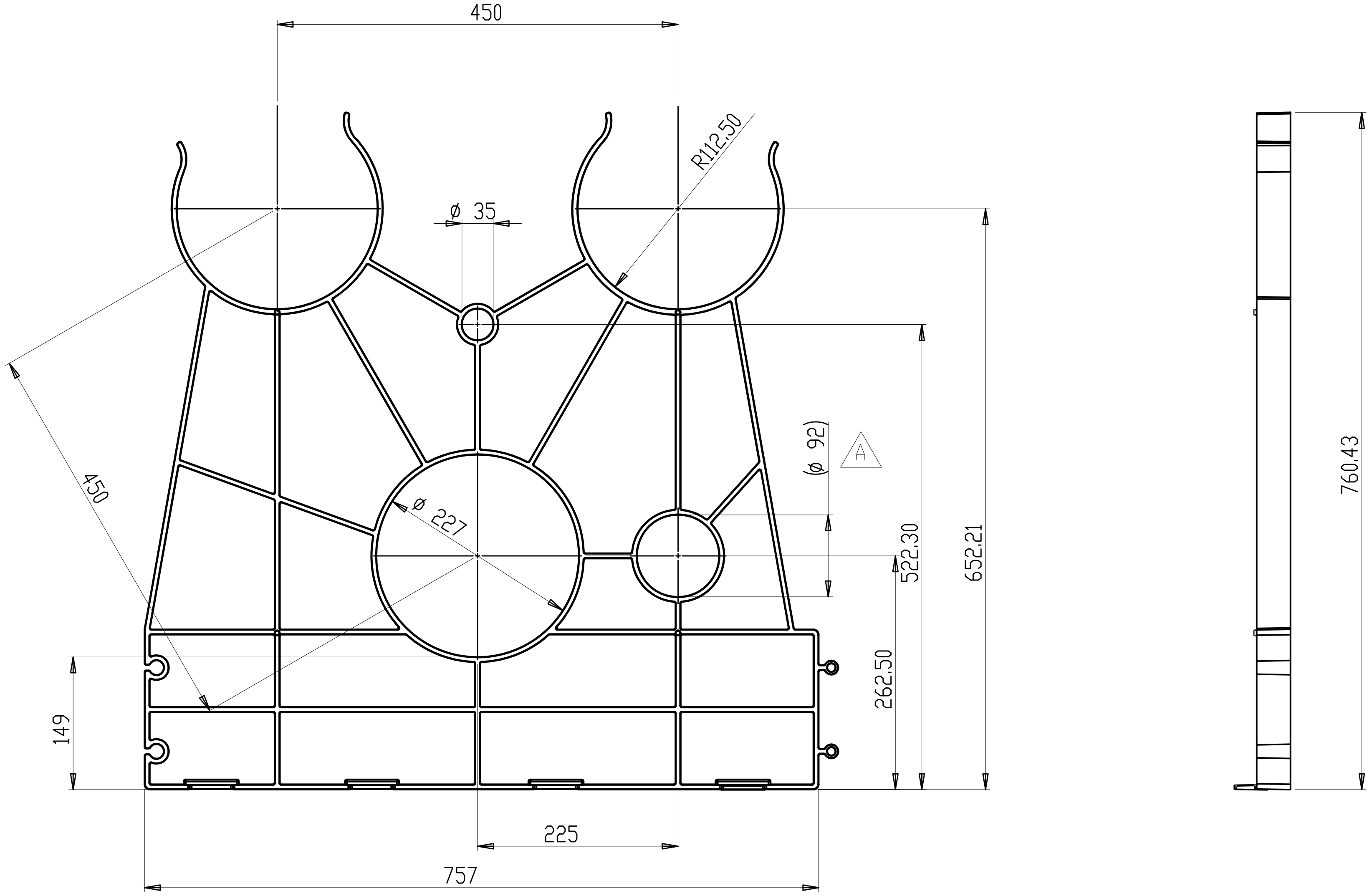

NOTES: UNLESS NOTED OTHERWISE ON DRAWING
1 ALL SURFACES TO HAVE A HIGH GLOSS FINISH, UNLESS NOTED
2 MAXIMUM FLASH OF 0.05mm ALLOWABLE
3 ALL SURFACES TO BE FREE FROM VISUAL DEFECTS,
NO SHORT SHOTS, NO FOREIGN MATTER, NO TOOLING MARKS
NO SCUFFING, NO DULL FINISH, NO COLOUR SEPERATION.
NO FLOW MARKS. NO WELD LINES. NO BURN MARKS.
4 ALL SHARP CORNERS TO BE BROKEN WITH 0.2mm RADII
5 NO CONTAMINATION ALLOWED WITHIN PACKAGING.
6 MAXIMUM STEP ON TOOLING JOIN LINES OF 0.05mm ALLOWABLE.
7 PART WEIGHT: 1682 GRAMS (EST ONLY)
8 MATERIAL: HIPS
9 ETCHED FINISH REQUIRED ON ALL FACES
10 Colour: BLACK

Project	INVERTED 225 TREFOIL BRACKET 450 SPACING
Client	GARDE SERVICES
Drawn	HL
Date	07/02/20
Checked	
Date	
Approved By	
Date	
Drawing Number	DG014/002
Issued By	
Issue Date	
Scale	NTS
Sheet Size	A3
Issue	0
Sheet	1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified
LINEAR ± 0.5
ANGULAR ± 0.5°
DRAFT 1°

Material	HIPS
Finish	COMMERCIAL FINISH

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17 Harris Street
St. Marys, N.S.W. 2760
Australia
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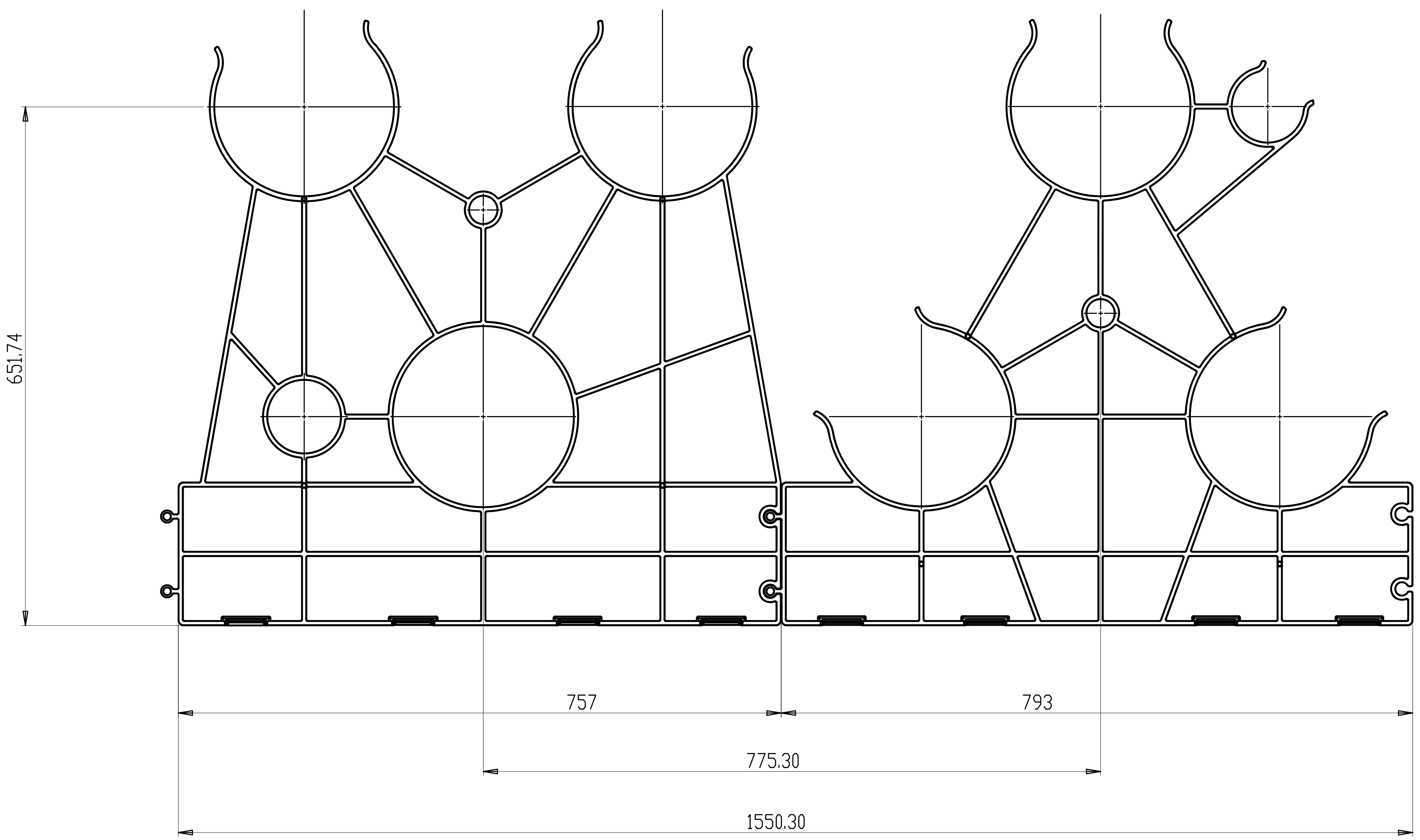
Fax: (02) 9673 4032

REF	REV	DESCRIPTION	BY	CHK	DATE



Project	
225 CONDUIT 450 SPACING COMPARISON	
Client	
GARDE SERVICES	

Drawn	Date	Checked	Date
HL	05/08/19		
Approved By			Date
Drawing Number	DRAFT	Issued By	Issue Date
Scale: NTS	Sheet Size: A3	Issue: 0	Sheet: 1 of 1

Third Angle Projection
All dimensions in millimetres unless otherwise stated.
Do not scale, all dimensions to be checked before starting work.

Tolerence as specified

LINEAR ± 0.25
ANGULAR ± 0.5°
DRAFT 1°

Material	HIPS
Finish	FINE POLISH

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Appendix C– Transmission Cable Route Details

Legend

- Centreline RevC
- Boundary Project EIS

Analysis

- Potential clash - Trench & SRZ
- Potential clash - Trench & TPZ
- Potential clash work zone & TPZ

Vegetation

Structural Root Zone (SRZ)

- SRZ High
- SRZ Medium
- SRZ Low

Tree Protection Zone (TPZ)

- TPZ High
- TPZ Medium
- TPZ Low

Classification

- Urban Exotics

Joint bay 22 -23

N

25 0 25 50 75 100 m

GARDE taihan

Appendix D– Former Landfill Area as Build Trench Report

TransGrid PSF Project

330kV Feeder Replacement

Former Landfill Area as Built Trench Report – Camdenville Park

1. As built Trench Details

1.1. Damaged Infrastructure Impact description.

1.2. Infrastructure remedial works description

1.3. Description: As built landfill gas infrastructure

1.4. Design drawing as built landfill gas infrastructure

2. Landfill Gas Infrastructure

2.1. Damaged Infrastructure Impact description.

2.2. Infrastructure remedial works description

2.3. Description: As built landfill gas infrastructure

2.4. Design drawing as built landfill gas infrastructure

Appendix A– Final As built Trench Design Drawings

Appendix 7 – Asbestos Management Plan (AMP)

TEA-PSF-MP-004.570

TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit

ASBESTOS MANAGEMENT PLAN

(AMP)

taihan

Document Control

Document Details:

Project No:	**1595**
Project Name:	PSF - Supply and Installation of Integrated Cable Systems Rookwood to Beaconsfield
Document Name:	Asbestos Management Plan (AMP)
Document No:	TEA-PSF-MP-004.570
File Name:	TEA-PSF-MP-004.570 PSF AMP_rev4 - FOR SUBMISSION

Revision Status:

Revision	Date	Description	Revised by
1	02/06/20	For Consultation	Senversa
4	06/07/20	For Submission to DPIE	Taihan

Document Approvals:

	Name	Signature	Date
Prepared by:	Senversa		02/06/2020
Reviewed by:	Tete Awotedu		06/07/2020
	Mark Favetta		06/07/2020
	Ian Garrard		06/07/2020
Approved by:	John Klaser		06/07/2020

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Abbreviations and Acronyms

Abbreviation/ Acronym	Expanded Term
ACM	Asbestos Containing Material/s
ACD	Asbestos Contaminated Dust or Debris
AEI	Area of Environmental Interest
AMP	Asbestos Management Plan
ARCP	Asbestos Removal Control Plan
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASSMP	Acid Sulfate Soils Management Plan
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environmental Management Plan
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CoA	Conditions of Approval
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DPIE	Department of Planning Infrastructure and Environment
EIS	Environmental Impact Statement
EMMM	Environmental Management and Mitigation Measure
EMS	Environmental Management Systems
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Management Strategy
GMS	Groundwater Management Strategy
NATA	National Association of Testing Authorities
NOHSC	National Occupational Health and Safety Commission
NSW	New South Wales
OOHW Protocol	Out-of-hours work Protocol
PPE	Personal protective Equipment
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
SSLGMP	Site Specific Landfill Gas Management Plan
SWMP	Surface Water Management Plan
SWMS	Safe Work Method Statements
TBC	To Be Confirmed
TransGrid	The Principal
TCP	Traffic Controls Plan
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction and installation of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

As part of the Conditions of Approval (CoA) associated with the project from the New South Wales (NSW) Department of Planning, Infrastructure and Environment (DPIE), an Asbestos Management Plan (AMP) is required to be developed to document requirements to mitigate exposure to asbestos and the potential health related risks to personnel working on or visiting the project area during construction.

1.1 Context

This AMP has been prepared to document the procedures to be undertaken in the event that asbestos containing material (ACM) or actual asbestos is uncovered during construction works, and forms part of the Construction Soil and Water Management Plan (CSWMP), which in turn forms part of the Construction Environment Management Plan (CEMP). Implementation of the AMP will ensure that asbestos is managed in such a way as to avoid harm to site personnel, visitors and the community.

This AMP has been developed in accordance with:

- the requirements of the Minister's CoA for E20 (f), being for investigating, assessing and managing the potential for asbestos and other hazardous materials in the project area;
- the Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) as documented in the Amendments Report;
- relevant legislation;
- NSW Environmental Protection Authority (EPA) made or approved guidelines (including the waste guidelines); and
- industry codes of practice.

1.2 Objectives and Scope of the AMP

The AMP describes the procedures and protocols TransGrid and its contractors will implement for investigating, assessing, and managing the potential for asbestos and other hazardous materials in the project area.

Specifically, this AMP describes the requirements for the effective management of asbestos and provides control measures for mitigating exposure to asbestos and the potential health related risks to personnel working on or visiting the project area.

This AMP applies for any work carried out by workers and/or contractors where asbestos may be present within the project area. Work undertaken in the project area involving asbestos shall be conducted in accordance with the relevant legislation and in conjunction with the requirements of this AMP. All staff and sub-contractors are required to operate fully under the requirements of this AMP and related environmental management plans, over the full duration of the construction program.

1.3 Project Environmental Management System Overview

The Project Environmental Management System (EMS) is described in **Figure 1-1**.

To achieve the intended environmental performance outcomes, TransGrid and its contractors has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, including the AMP, procedures, protocols and tools as set out below and illustrated in **Figure 1-1**.

1.4 Consultation for Preparation of AMP

Stakeholder consultation with relevant councils has been completed as documented in the Construction Soil and Water Management Plan (CSWMP). All comments have been addressed.

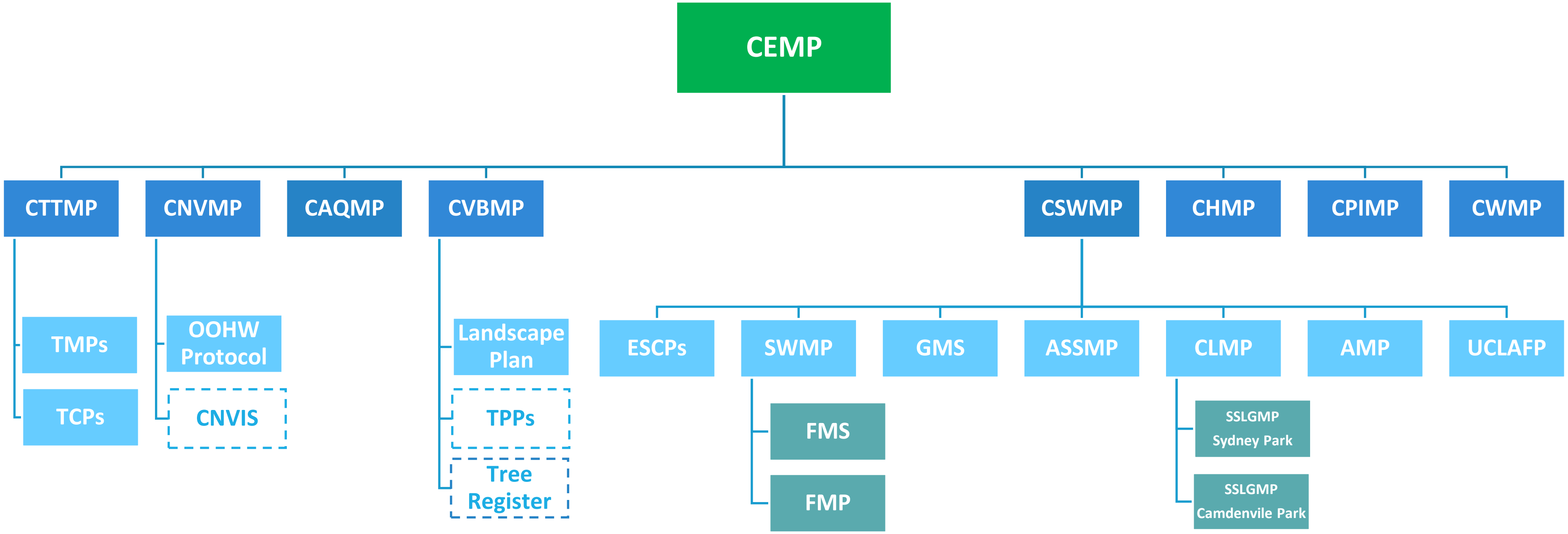

Figure 1-1: Project Environmental Management System

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the AMP include:

- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment* (ASC NEPM).
- NSW EPA, 2014. *NSW Waste Classification Guidelines*.
- NSW Government, 2014, *Managing asbestos in or on soil*, March 2014, Workcover NSW
- NSW Government, 2019. *Code of Practice: How to Manage and Control Asbestos in the Workplace*.
- Safe Work Australia, 2018. *Code of Practice*: *How to safely remove asbestos.*
- TransGrid, 2016. *Environmental Handbook*
- TransGrid Guidelines and Procedures
    - TransGrid Work Instruction – Sampling of Asbestos
    - TransGrid Work Instruction – Removal of Asbestos
    - TransGrid Work Instruction – Disposal of Asbestos
    - TransGrid Form - Record of Potential Exposure to Asbestos
    - TransGrid Procedure – Contaminated Land Management
- Work Health and Safety Act 2011 (NSW)
- Work Health and Safety Regulation 2017 (NSW)
- Australian Standard – AS 1319 – Safety signs in the occupational environment
- Australian Standard – AS 1216 – 2006 – Class labels for Dangerous Goods
- National Occupational Health and Safety Commission (NOHSC), 1995. *National Guidelines for Health Surveillance*
- NOHSC, 2005. *Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre, 2nd Edition*

2.3 Minister's Condition of Approval

The AMP is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

E20 (f) Asbestos Management Plan, for investigating, assessing and managing the potential for asbestos and other hazardous materials in the project area.

2.4 Environmental Mitigation and Management Measures

The AMP has been developed to include the EMMMs detailed in the EIS Amendment Report and presented in **Table 2-1** below.

Table 2-1: Environmental Mitigation and Management Measures

Impact	ID	Measure
Asbestos management	CT6	An Asbestos Management Plan (AMP) will be developed for areas identified during pre-construction investigations as containing Asbestos Containing Materials (ACM), areas suspected of containing ACM and to address unexpected finds of ACM during construction. Specifically, protocols will be stipulated for separation, monitoring, validation and clearance of asbestos.

<table>
<tr><th>Impact</th><th>ID</th><th>Measure</th></tr>
<tr><td></td><td></td><td>
The AMP and associated Standard Work Procedures will satisfy the requirements of:

Work Health and Safety Regulation 2011;
the Safe Work Australia Asbestos Codes of Practice and Guidance Notes:

Code of Practice: How to Manage and Control Asbestos in the Workplace;
Code of Practice: How to Safely Remove Asbestos; and
Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibre, 2nd Edition [NOHSC: 3003 (2005)].

An Occupational Hygienist (Hygienist) will be on-site for the duration of the excavation works where ACM has been identified from pre-construction or where unexpected finds of ACM are encountered. The Hygienist will:

undertake air monitoring for asbestos during excavation;
provide on-site visual inspection, identification of asbestos impacted material and clearance of non- asbestos impacted surfaces; and
supervise works to ensure compliance with the AMP and NSW regulatory requirements for asbestos containing material management and disposal.

In the event that friable asbestos is detected, a suitably licensed Asbestos Removal Contractor (licensed to undertake friable asbestos (Class A) removal) will be required to undertake and oversee all the asbestos removal and disposal works outlined in the AMP.
All persons performing the works will be required to undertake a suitable risk assessment and develop a Safe Work Method Statement (SWMS) for all of their work activities prior to commencing work in ACM impacted areas.
Identified ACM will be segregated, managed and disposed of as Special Waste and transported and disposed in accordance with Protection of the Environment Operations (Waste) Regulation (2014). Where more than 100 kg of asbestos waste or more than 10 square metres of asbestos sheeting is transported the NSW EPA online tool WasteLocate will be used. The handling and disposal of asbestos waste will be tracked and recorded.
</td></tr>
<tr><td>Air monitoring action levels</td><td></td><td>
The air monitoring action levels that will be applied during asbestos management are outlined in the nested table below:
Air Monitoring action levels
<table>
<tr><th>Action level</th><th>Control</th><th>Action</th></tr>
<tr><td>Less than
0.01 fibres/mL</td><td>No new control measures
are necessary</td><td>Continue with control measures.</td></tr>
<tr><td rowspan="3">At 0.01 fibres/ml or
more than
0.01 fibres/mL but
less than or equal to
0.02 fibres/mL</td><td>1. Review</td><td>Review control measures.</td></tr>
<tr><td>2. Investigate</td><td>Investigate the cause.</td></tr>
<tr><td>3. Implement</td><td>Implement controls to eliminate or minimize exposure and prevent further release.</td></tr>
<tr><td rowspan="2">More than
0.02 fibres/mL</td><td>1. Stop removal work</td><td>Stop removal work.</td></tr>
<tr><td>2. Notify regulator</td><td>Notify the relevant regulator by phone
followed by a written statement that work has ceased and the</td></tr>
</table>
</td></tr>
</table>

Impact	ID	Measure		
				results of the air monitoring.
			3. Investigate the cause	For example, conduct a thorough visual inspection of the enclosure (if used) and associated equipment in consultation with all workers involved with the removal work.
			4. Implement controls to eliminate or minimize exposure and prevent further release.	For example, extend the isolated/barricaded area around the removal area/enclosure as far as reasonably practicable until fibre levels are at or below 0.01 fibres/mL, wet wipe and vacuum the surrounding area, seal any identified leaks (e.g. with expandable foam or adhesive (cloth or duct) tape) and smoke test the enclosure until it is satisfactorily sealed.
			5. Do not recommence removal work until further air monitoring is conducted	Do not recommence until fibre levels are at or below 0.01 fibres/mL.

3 Status of Asbestos Contamination

3.1 Areas of Environmental Interest (AEI)

A preliminary site investigation (PSI), which identified areas of concern from a contamination viewpoint in each precinct of the cable transmission route and at the proposed construction laydown areas, was included as Appendix K in the EIS (AECOM, 2019). Details of the areas of environmental interest (AEI) that were identified during the EIS are presented in Table 16-4 of the EIS (within the defined precincts of the transmission cable alignment and at Sydney South substation) and in Table 16-5 (for the construction laydown areas). The AEIs are described as areas that could potentially be contaminated (including by asbestos or other potential contaminants) as a result of historic and/or current activities. The locations of the AEIs are presented on Figure 16-3, Figure 16-4, Figure 16-5 and Figure 16-6 of the EIS.

The EIS identified asbestos as a contaminant of potential concern in portions of all precincts of the project, particularly in the general road reserve areas. Any existing asbestos contamination underlying the project and ancillary facilities areas has the potential to be exposed or disturbed by construction activities. Activities with the highest level of risk include excavation of fill above the water table, associated earthworks and demolition.

The majority of the potential AEIs relating to asbestos contamination identified during the EIS were assessed as being of low risk (of exposure to a concentration of concern) during construction of the project. However, there was deemed a medium or high risk associated with several areas, which are discussed below.

Sections of the project area were assessed as medium contamination risk (asbestos and other contaminants) where historical and current potentially contaminating land uses were located in close proximity to the transmission cable route. These land uses included power sub-stations, service stations, road construction and maintenance, manufacturing sites, areas of historically filled land, including Muir Road in Chullora and former infilled brick pits at Arlington Oval, Marrickville Park and Henson Park.

Sections of the project area were assessed as high contamination risk (asbestos and other contaminants) where known contamination was identified from previous site investigations. These areas included:

- Where the project area would intersect the former landfill in Camdenville Park; and
- The project area starting from Sydney Park at the Princes Highway to (and including) Beaconsfield West substation.

Of the five locations identified as potential construction laydown areas, Beaconsfield West substation laydown area was assessed as low risk due to the existence of pavement covering the site. However, as listed above, during excavation of the trench for the transmission cable at Beaconsfield West substation, asbestos could be encountered in soil. All other laydown areas were assessed as medium risk based on the potential for existing soil contamination, associated with former land uses, and the potential for complete pathways between the contamination and sensitive human and ecological receptors due to generally unsealed site surfaces.

3.2 Waste Classification

Individual *in-situ* waste classification reports will be prepared for each section of the transmission cable route prior to excavation commencing. Waste classification sampling is expected to further identify and confirm the absence or presence of asbestos through the transmission cable route and provide guidance for the assessment of suitability of soils for re-use.

3.3 Potential Asbestos Impacted Areas

A summary of listed areas, within or near the project area, where asbestos has either been previously identified or suspected to be encountered during construction, based on the EIS are listed below in **Table 3-1**. Refinement of these areas, and revision of **Table 3-1,** will be conducted as part of pre-construction investigations outlined in the CLMP.

Excavation activities in these locations should be undertaken assuming that asbestos will be encountered within sub-surface fill soils.

Table 3-1: Summary of Known and Suspected Asbestos Impacted Areas

Site	Address	Type	Status	Reference
Rookwood Road Substation	Rookwood Road, Greenacre	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Along Muir Road	Muir Road, Chullora	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Arlington Oval (former landfill)	Williams Parade, Dulwich Hill	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Marrickville Park (former landfill)	111 Frazer St, Marrickville	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Henson Park (former landfill)	22 Centennial St, Marrickville	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Galserv Galvanising Services	117-153 Rookwood Road, Yagoona	TBC	Identified	NSW EPA
Australian Refined Alloys	202-212 Euston Road, Alexandria	Friable ACM	Identified	RAP (ERM, 2017)
Camdenville Park (former landfill)	St Peters	Asbestos fibres	Suspected	EIS (Table 4-14 of PSI, Appendix K) URS (2010) GHD (2013)
Sydney Park (former landfill)	St Peters	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Precinct 3 (potential filling of unknown source)	Brighton Ave, Campsie to Illawarra Rd, Marrickville	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Precinct 5 (disturbed terrain/fill)	Camdenville Park to Sydney Park	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Beaconsfield West Substation	Burrows Road, Alexandria	TBC	Identified	EIS (Section 4.2)
Sydney South substation	925A Henry Lawson Drive, Picnic Point	TBC	Suspected	EIS (Section 4.2 of PSI, Appendix K)
12 Muir Road	12 Muir Road,	TBC	Suspected	EIS (Section 4.3 of PSI,

Site	Address	Type	Status	Reference
	Chullora			Appendix K)
Cooke Park	Belfield	TBC	Suspected	EIS (Section 4.3 of PSI, Appendix K)
Peace Park	Ashbury	TBC	Suspected	EIS (Section 4.3 of PSI, Appendix K)
Notes: TBC = to be confirmed.				

Materials not previously identified as ACM in the workplace that are suspected of containing asbestos must be presumed to contain asbestos until otherwise confirmed by sampling and analysis.

4 Asbestos Control Measures

Asbestos-contaminated material encountered within the project area during project construction work will be identified, managed, and/or removed and disposed off-site at a licenced waste facility. TransGrid and its contractors will engage only appropriately licensed, accredited, and insured asbestos removalists to handle, remove and dispose of asbestos contaminated material in accordance with relevant legislation (**Section 2**).

4.1 Types of Asbestos

Asbestos containing material (ACM) means any material or thing that, as part of its design, contains asbestos.

The potential for ACM to generate airborne asbestos fibres (at which point asbestos may become a human health risk) varies significantly depending upon whether the material is non-friable or friable asbestos.

Non-friable asbestos is asbestos bound in a matrix such as cement or resin, and commonly referred to as bonded asbestos or bonded ACM. 'Fibro' is the most common form of non-friable asbestos, which describes compressed asbestos cement sheeting. When in a sound condition, the potential for these materials to release fibres is low.

Friable asbestos is usually in the form of loose fibres or fibre bundles that are not bound together with a bonding agent such as cement. The most common forms of friable asbestos are thermal lagging used on steampipes and boilers, as fire protection, and raw asbestos waste from asbestos products manufacturing. Friable asbestos can usually be broken up or crumbled using hand pressure to generate free fibres. If it is disturbed, friable asbestos has the potential to generate significant quantities of airborne fibres, and because of this requires a high level of control.

A slightly different definition of friable (or non-bonded) asbestos is provided in applicable contaminated land guidance (e.g. ASC NEPM), and includes fibrous asbestos and asbestos fines, which also include small pieces (less than 7 mm by 7 mm) of bonded ACM.

Expert advice by a suitably qualified occupational hygienist should be sought if asbestos is encountered during construction activities.

4.2 Risk Controls

The following risk control methods for asbestos will be used during project work and construction:

- identify and assess ACM impacts;
- removal and disposal of asbestos by a licensed asbestos removal contractor (refer to **Section 4.4.3**);
- implementation of safe work practices;
- provision of appropriate personal protective equipment (PPE), including Tyvek suit and P2 (or equivalent) respirator when working in locations with known asbestos;
- decontamination processes (for friable asbestos only);
- monitoring
- validation and clearance; and
- implementation of an unexpected finds protocol – this is documented in the UCLAFP.

All persons performing construction works around asbestos contamination will be required to undertake a suitable risk assessment and develop a Safe Work Method Statement (SWMS) for all of their work activities prior to commencing work in asbestos impacted areas.

4.3 Identify and Assess ACM Impacts

A summary of listed areas, within or near the project area, where asbestos has either been previously identified or suspected to be encountered during construction, based on the EIS , is provided above in **Table 3-1**.

A suitably qualified occupational hygienist or Contaminated Land Professional will review the final cable route alignment design, laydown areas and the available asbestos information listed above to identify any data gaps in the understanding of the nature and extent of asbestos within the project area. Data gaps will be addressed via:

- Pre-construction investigations described in the CLMP. Refinement of the identified or suspected asbestos impacted areas will be conducted based on the additional information collected.
- Management controls described in this AMP.

4.4 Asbestos Management

Factors that influence how asbestos in soil is managed include:

- the form of the asbestos and the likelihood that it will release fibres into the air;
- the location, lateral extent and depth of asbestos-impacts within the project; and
- the current and future uses of the project, and whether these uses could affect the risk posed by asbestos.

The presence of other contaminants may also affect the option selected to manage asbestos.

Where there is uncertainty in how to assess these factors, advice should be sought from a contaminated land consultant or qualified asbestos occupational hygienist.

4.4.1 Inspection

In accordance with the EMMMs detailed in the EIS Amendment Report, a suitably qualified occupational hygienist (or competent person or asbestos assessor as defined in SafeWork NSW Codes of Practice) shall be on-site for the duration of the excavation works where ACM has been identified from pre-construction or where unexpected finds of ACM are encountered. The occupational hygienist will:

- undertake air monitoring for asbestos (refer **Section 4.4.4**);
- provide on-site visual inspection, identification of asbestos impacted material and clearance of non-asbestos impacted surfaces; and
- supervise works to ensure compliance with the AMP and NSW regulatory requirements for asbestos containing material management and disposal.

4.4.2 Signage and Labelling

All work areas and laydown areas where asbestos is likely to be encountered (refer to **Table 3-1**) must, where reasonably practicable, be labelled or signposted with cautionary warning signs (in accordance with the SafeWork Australia's Code of Practice – *How to Manage and Control Asbestos in the Workplace* and AS 1319 – *Safety Signs for the Occupational Environment*) to ensure that the potential asbestos is not knowingly disturbed without correct precautions being taken.

Signs should be located at all entrances to the work areas where asbestos is or presumed or identified to be present. Where it is not reasonably practicable to label (i.e. within a trench), there should be an assessable sign which states that asbestos may be in the trench and to refer to this AMP before undertaking any work.

The location of the label should be consistent with the location of the asbestos. A competent person should determine the number and positioning of labels required.

4.4.3 Removal of Asbestos

Prior to the removal of soil material in the areas listed in **Table 3-1**, a suitably qualified occupational hygienist (a competent person as defined in relevant NSW regulations and SafeWork NSW Codes of Practice) will inspect and document the presence or absence of visible asbestos at the ground surface or within the sub-surface of the soil or excavation. If asbestos contamination is visible or considered likely to be present, TransGrid and its contractors will propose management or remediation measures for the asbestos prior to disturbance (e.g. use of laydown areas) or removal of the impacted soil material required for the project.

An appropriately licensed asbestos contractor will be required for removal works where there is friable asbestos, or the contaminated area for non-friable asbestos (ACM) is greater than 10 m^2. There are two types of asbestos removal licences: Class A and Class B. The type of licence required depends on the type and quantity of asbestos or ACM to be removed, as outlined in **Table 4-2**.

Table 4-2: Asbestos Removal Licence Classes

Licence type	What asbestos can be removed
Class A	Can remove any amount or quantity of asbestos or ACM, including: • any amount of friable asbestos or ACM • any amount of asbestos-contaminated dust or debris (ACD) • any amount of non-friable asbestos or ACM.
Class B	Can remove: • any amount of non-friable asbestos or ACM. • ACD associated with the removal of non-friable asbestos or ACM
No licence required	Can remove: • up to 10 m^2 of non-friable asbestos or ACM • ACD that is associated with the removal of less than 10 m^2 of non-friable asbestos or ACM.

The licensed asbestos contractor will prepare an Asbestos Removal Control Plan (ARCP) prior to the removal of any asbestos. The ARCP should document the specific control measures to be implemented to ensure site personnel and others are not at risk when asbestos removal work is being conducted in accordance with relevant NSW regulations and SafeWork NSW Codes of Practice. The ACRP should meet requirements in SafeWork NSW Codes of Practice.

The Site Manager will be informed prior to excavation or removal of asbestos or ACM. If the removal activity is to occur in the vicinity of any occupied residence or business, TransGrid and its contractors will notify the affected resident/s or business owner/s in accordance with the relevant communication and stakeholder engagement strategy.

Appropriate notification and licenses for removal of asbestos (e.g. from SafeWork NSW) shall be obtained prior to removal works.

4.4.4 Control and Monitoring of Airborne Fibres

A suitably qualified occupational hygienist or other suitably qualified person must undertake air monitoring to monitor the potential generation of any airborne fibres in active excavation work areas where friable asbestos has already been identified during pre-construction investigations (refer to **Table 4-1** below) or if unexpected finds of friable asbestos are encountered. The hygienist must be a licensed asbestos assessor when undertaking air monitoring for friable asbestos removal. Waste classification sampling along the transmission cable route will be undertaken prior to commencement of works and will identify whether asbestos air monitoring will be required in other areas as well as those identified in **Table 4-1** below.

Air monitoring shall be conducted in accordance with NOHSC (2005). Air monitors are to be placed directly in, or near the work zone and the asbestos designated stockpiling area where dust generation may be likely and where workers and site personnel occupy regularly.

Table 4-1: Locations for Asbestos Air Monitoring

Site	Address	Type	Status	Reference
Galserv Galvanising Services	117-153 Rookwood Road, Yagoona	TBC	Identified	NSW EPA
Australian Refined Alloys	202-212 Euston Road, Alexandria	Friable ACM	Identified	Remedial Action Plan (RAP, ERM, 2017)
Camdenville Park (former landfill)	St Peters	Asbestos fibres	Identified	EIS (Table 4-14 of PSI, Appendix K) URS (2010) GHD (2013)
Sydney Park (former landfill)	St Peters	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Beaconsfield West Substation	Burrows Road, Alexandria	TBC	Identified	EIS (Section 4.2)
Table Notes: TBC = to be confirmed.				

To mitigate the creation of airborne fibres, techniques including wet spraying method, saturation or water injection should be implemented to assist in the control of dust creation. TransGrid and its contractors personnel will follow the directions provided by the licenced asbestos contractor and/or qualified occupational hygienist.

Site	Address	Type	Status	Reference
Galserv Galvanising Services	117-153 Rookwood Road, Yagoona	TBC	Identified	NSW EPA
Australian Refined Alloys	202-212 Euston Road, Alexandria	Friable ACM	Identified	Remedial Action Plan (RAP, ERM, 2017)
Camdenville Park (former landfill)	St Peters	Asbestos fibres	Identified	EIS (Table 4-14 of PSI, Appendix K) URS (2010) GHD (2013)
Sydney Park (former landfill)	St Peters	TBC	Suspected	EIS (Table 4-14 of PSI, Appendix K)
Beaconsfield West Substation	Burrows Road, Alexandria	TBC	Identified	EIS (Section 4.2)
Table Notes:				

Site	Address	Type	Status	Reference
TBC = to be confirmed.				

4.4.5 Separation of Asbestos Contaminated Material

All excavated asbestos contaminated soils and bulk ACM material must be either disposed off-site immediately, or temporarily segregated and stockpiled within a designated area not directly interfering with the active work zone or part of a remediated or cleared work area. This designated stockpiling area must display clear and appropriate signage as described in **Section 4.4.1** of this AMP, and if practicable, be fenced off using temporary fencing lined with geofabric material to inhibit site personnel coming into direct contact with the asbestos contaminated materials or any potential airborne fibres within the area.

Excavated suspected or confirmed asbestos contaminated soils and/or materials must be placed on geofabric and covered once stockpiling is complete to mitigate generation and dispersal of airborne fibres. No material should be added or removed to a stockpile if laboratory testing has been undertaken until the results of the testing have been issued, and the soil material classified. Stockpiles of soil material of the same classification can be merged prior to loading, if being disposed off-site to a suitably licensed disposal facility.

Asbestos contaminated soils in project areas not requiring excavation, such as laydown areas, may be managed via suitable physical separation and management. This shall be evaluated by a suitable qualified person (e.g. Contaminated Land Consultant or competent person).

4.4.6 Disposal of Asbestos

The licensed asbestos contractor will classify and dispose of any asbestos waste at a suitably licensed waste disposal facility listed on the NSW EPA website[1] as Special Waste (Asbestos Waste) as described in **Section 4.5**. The ARCP prepared by the licensed asbestos contractor should include a waste disposal program that will detail material tracking requirements, the method of transport, and the licenced disposal facilities.

Records should be kept detailing the location, and extent of the asbestos contamination from which the disposed material originated, and photographs should be taken of the material and kept on record for validation purposes.

4.4.7 Clearance and Validation

Asbestos clearance and validation of residual ground and excavation surfaces will be conducted to determine:

- removal of asbestos from the ACM impacted area within the project area (i.e. within the cable trench or pit); or
- in the case of excavation surfaces at the project areas boundary (e.g. excavation faces of trenches and pits) or surfaces, whether controls and procedures in this AMP are required and for documentation purposes.

Asbestos clearance and validation within the project area shall be conducted:

- For all excavations from which the excavated soil materials contained ACM.

[1] NSW EPA web address: *https://www.epa.nsw.gov.au/your-environment/household-building-and-renovation/dealing-with-household-asbestos/facilities-accept-household-asbestos*.

- For the footprints of any temporary stockpiles containing ACM that are not placed on geofabric.
- For any surfaces where ACM has been identified in active work zones (e.g. laydown areas).

The clearance inspection and validation should be completed in accordance with the requirements outlined in the ASC NEPM and SafeWork NSW Codes of Practice.

Within the project area following removal of ACM, the excavated surface/s will undergo a visual clearance inspection and/or validation sampling to assess whether the asbestos contamination has been adequately removed and the remaining surfaces are clear of asbestos. Where ACM is still detected or identified, excavation works will continue to "chase out" contaminated materials, to the extent practicable, within the planned trench extent.

Asbestos remaining at boundaries of excavations in the project area will not be removed, but will be characterised by the clearance and validation, with the nature and location recorded on the asbestos register. In addition, a marker layer will be placed along the length of any walls or floor of the trench where residual asbestos remains. This provides a visual aid to future construction workers that residual asbestos is present along the trench walls or floor and that appropriate health and safety protocol should be followed.

Asbestos clearances and validation shall be conducted by a suitably qualified person (licensed asbestos assessor for any Class A asbestos removal work or competent person for other removal works).

Procedures and controls in this AMP shall be implemented until a written clearance certificate, confirming that an area is free of asbestos, is issued by the suitably qualified person. Once a clearance certificate has been issued, the area for which the clearance certificate denotes should not come into contact with any contaminated materials.

4.5 Waste Classification and Materials Tracking

If off-site disposal of excavated materials is required, this will be undertaken in accordance with the Protection of the Environment Operations (Waste) Regulation (2014) and NSW EPA (2014) *Waste Classification Guidelines: Part 1 Classifying Waste.*

Transportation and disposal of all contaminated soil material should be recorded in a material tracking register, and any receipt/certificate issued by the facility/disposal authority should be obtained.

Where more than 100 kg of asbestos waste or more than 10 m^2 of asbestos material is transported for disposal, the NSW EPA online tool WasteLocate (https://wastelocate.epa.nsw.gov.au/) must be used.

4.6 Asbestos Register

An asbestos register that documents all identified or suspected asbestos in the project area will also be managed. The asbestos register will contain the following information:

- Information included in this AMP (Table 3-1)
- Identification of any ACM remaining
- Location, type and condition of the ACM remaining
- Date when the asbestos was identified
- Labelling of the asbestos
- Maps, photographs or diagrams detailing the location of the asbestos within the project area.

The asbestos register will be made available to all project workers and be retained to manage worker health risks during project operation.

4.7 Unexpected Asbestos Finds

In the event that a person onsite identifies or disturbs asbestos that is not already identified or suspected (**Table 3-1**) or included in the project asbestos register, TransGrid and its contractors will implement the unexpected finds procedure documented in the UCLAFP. The persons responsible for assessing, monitoring of clearance of unexpected asbestos shall be suitably qualified as defined in this AMP.

5 Compliance Management

5.1 Roles and Responsibilities

In addition to those detailed in the CSWMP and CLMP, the roles and responsibilities presented in **Table 5-1** are relevant to the AMP.

Table 5-1: AMP Roles and Responsibilities

Role	Authority and Responsibility
Civil Project Manager	Implementation of this AMP.
Environment and Sustainability Manager	Confirmation that AMP is being implemented through regular inspections.
Asbestos Occupational Hygienist	Person who conducts asbestos clearances and air monitoring. Must be a Competent Person or Licensed Asbestos Assessor as defined in SafeWork NSW Codes of Practice
Contaminated Land Professional	Person who conducts assessments of contaminated land, including asbestos.
Asbestos Removal Contractor	Suitably licensed person who removes asbestos

5.2 Training & Induction

Refer to training and inductions requirements in the CLMP.

5.3 Complaints Management

Refer to complaints' management requirements in the CLMP.

5.4 Incident Response

Refer to incident response requirements in the CLMP.

5.5 Audits

Refer to audit requirements in the CLMP.

5.6 Non-Conformances

Refer to non-conformance requirements in the CLMP.

5.7 Licenses, Permits and Qualifications

Refer to Section 4.4.3 for details on the require license for the asbestos removal contractor.

The qualified asbestos occupational hygienist must hold an asbestos assessor licence from Work Safe NSW and be from an organisation with a NATA accreditation for the required asbestos monitoring.

5.8 Revisions

This AMP will be revised and updated at completion of pre-construction investigations and/or any further data gap analysis conducted.

6 References

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- TransGrid Work Instruction – Sampling of Asbestos
- TransGrid Work Instruction – Removal of Asbestos
- TransGrid Work Instruction – Disposal of Asbestos
- TransGrid Form - Record of Potential Exposure to Asbestos
- TransGrid Procedure – Contaminated Land Management
- TransGrid Procedure – Health and Safety Incident Management
- TransGrid procedure – Environmental Incident Management

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Appendix 8 – Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP)

TEA-PSF-MP-004.580

TransGrid: State Significant Infrastructure - Powering Sydney's Future - Development and operation of a new 330 kV underground cable circuit

Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP)

Document Control

Document Details:

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Document Approvals:

	Name	Signature	Date
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Abbreviations and Acronyms

Abbreviation/ Acronym	Expanded term
ACM	Asbestos Containing Material
AMP	Asbestos Management Plan
ASC NEPM	National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment*
ASS	Acid Sulphate Soils
ASSMP	Acid Sulfate Soils Management Plan
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CAQMP	Construction Air Quality Management Plan
CEMP	Construction Environment Management Plan
CH4	Methane
CHMP	Construction Heritage Management Plan
CLMP	Contaminated Land Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CO2	Carbon Dioxide
CoA	Conditions of Approval
CPIMP	Construction Public Infrastructure Management Plan
CSWMP	Construction Soil and Water Management Plan
CTTMP	Construction Traffic and Transport Management Plan
CVBMP	Construction Vegetation and Biodiversity Management Plan
CWMP	Construction Waste Management Plan
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
EMMMs	Environmental Management and Mitigation Measures
EMS	Environmental Management System
EPA	Environmental Protection Authority
ESCP	Erosion and Sediment Control Plan
FMP	Flood Management Plan
FMS	Flood Management Strategy
GMS	Groundwater Management Strategy
H2S	Hydrogen Sulphide
MSDS	Material Safety Data Sheet
NSW	New South Wales
OOHW Protocol	Out-of-hours work Protocol
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulphate Soils
PFAS	Per- and Polyfluoroalkyl Substances
PPE	Personal Protective Equipment
PSI	Preliminary Site Investigation
SSLGMP	Site Specific Landfill Gas Management Plan
SWMP	Surface Water Management Plan
TransGrid	The Principal
TCPs	Traffic Controls Plans
TRH	Total Recoverable Hydrocarbons
UCLAFP	Unexpected Contaminated Land and Asbestos Finds Procedure
UST	Underground Storage Tank

1 Introduction

The Powering Sydney's Future – Potts Hill to Alexandria transmission cable project (the project) involves the construction of 330kV underground cables between TransGrid's Rookwood Road substation in Potts Hill and the Beaconsfield West substation in Alexandria.

As part of the Conditions of Approval (CoA) associated with the project from the New South Wales (NSW) Department of Planning, Industry and Environment (DPIE), an Unexpected Contaminated Land and Asbestos Finds Procedure (UCLAFP) is required to be developed.

1.1 Context

This UCLAFP has been prepared to document the procedures to be undertaken in the event that unexpected contamination is encountered during construction works, and forms part of the Construction Soil and Water Management Plan (CSWMP), which in turn forms part of the Construction Environment Management Plan (CEMP). Implementation of the UCLAFP will ensure that contamination encountered in areas not previously identified as potentially contaminated is managed in such a way as to avoid harm to site workers, visitors, and the surrounding community and environment.

This UCLAFP has been developed in accordance with:

- the requirements of the Minister's Conditions of Approval (CoA) for E20 (g), being for managing any unexpected contaminated land or asbestos (or suspected contaminated land or asbestos) excavated or otherwise discovered during construction;
- the Environmental Management and Mitigation Measures (EMMMs) listed in the *Powering Sydney's Future Potts Hill to Alexandria transmission cable project* Environmental Impact Statement (EIS) as documented in the Amendments Report;
- relevant legislation;
- NSW Environmental Protection Authority (EPA) made or endorsed guidelines (including waste guidelines); and
- industry codes of practice.

1.2 Objectives and Scope of the UCLAFP

The UCLAFP describe the procedures and controls TransGrid and its contractors will implement for managing contaminated land and asbestos that have not been previously identified or suspected in the project area.

Specifically, this UCLAFP describes the requirements and procedures for the effective management of encountered contamination and provides control measures for mitigating exposure to contaminated land and potentially hazardous materials.

This UCLAFP applies for any work within the project area that has the potential to encounter unexpected contaminated land or asbestos during project construction, such as during excavation, underboring, dewatering and other intrusive construction activities. The UCLAFP is applicable to all project workers and/or contractors undertaking or managing these works.

Work undertaken in the project area involving an unexpected find shall be conducted in accordance with the relevant legislation and in conjunction with the requirements of this UCLAFP.

All staff and sub-contractors are required to operate fully under the requirements of this UCLAFP and related environmental management plans, over the full duration of the construction program.

1.3 Project Environmental Management System Overview

The Project Environmental Management System (EMS) is described in **Figure 1-1**.

To achieve the intended environmental performance outcomes, TransGrid and its contractors has established, implemented, maintained and will continue to improve the EMS during the project, as required.

The EMS consists of environmental plans, including the UCLAFP, procedures, protocols and tools as set out below and illustrated in **Figure 1-1**.

1.4 Consultation for Preparation of UCLAFP

Stakeholder consultation with relevant councils has been completed as documented in the Construction Soil and Water Management Plan (CSWMP). All comments have been addressed.

1.5 Site Audit Statement

Conditions of Approval E18 requires a Site Audit Statement to be prepared by an EPA accredited Site Auditor to:

> *"…prepare a Site Audit Statement(s) in accordance with the Contaminated Land Management Act 1997, confirming that the proposed measures in the Contaminated Land Management Plan required under Condition E20 are appropriate to manage contaminated soils, groundwater and/or landfill gas in:*
>
> *(a) the former landfill areas in Sydney Park in Alexandria and Camdenville Park in St Peters; and*
>
> *(b) any additional or unexpected areas of contamination identified during the development..."*

A copy of the Site Audit Statement must be submitted to the Planning Secretary and the relevant council(s) for information prior to the commencement of construction in the area to which the Statement applies (refer CoA E19).

The Auditor's response to E18 is under preparation and will be the subject of follow up documentation for submission to DPIE and relevant councils for information.

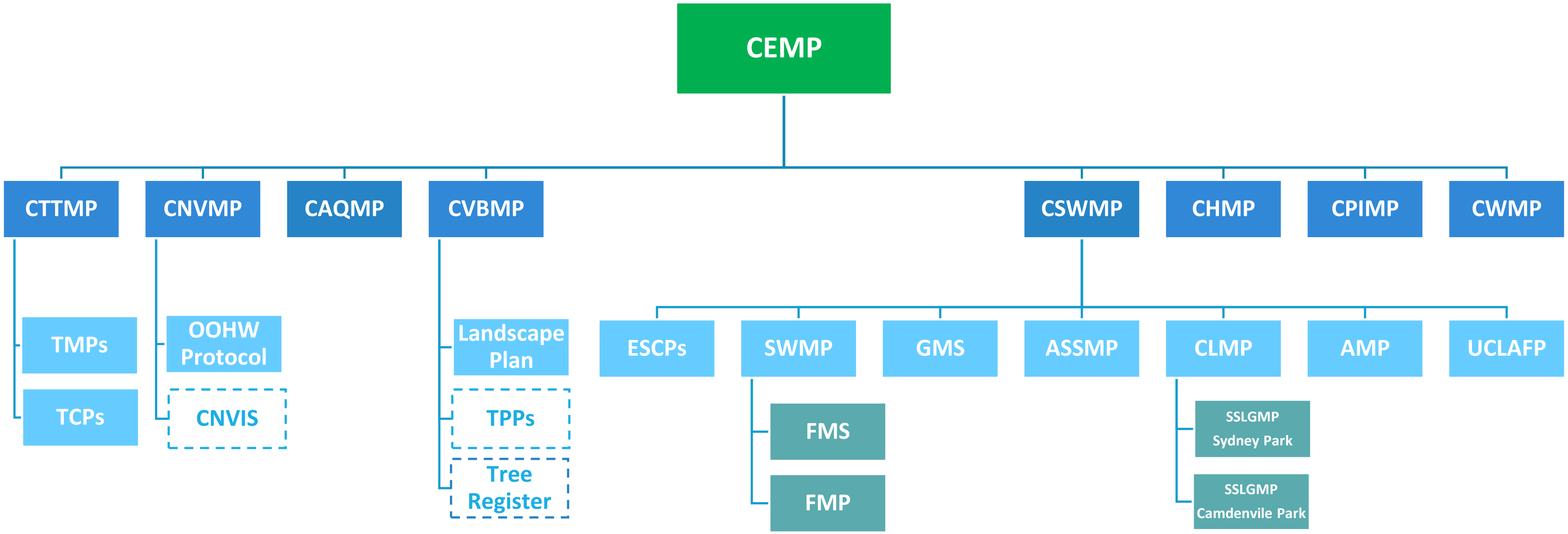

Figure 1-1: Project Environmental Management System

2 Environmental Requirements

2.1 Legislation

Refer to the CEMP Appendix A1 Legal Requirements Register.

2.2 Guidelines and Standards

The main guidelines, specifications and policy documents relevant to the UCLAFP include:

- National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure 2013 amendment* (ASC NEPM).
- NSW EPA, 2014. *NSW Waste Classification Guidelines*.
- Safe Work Australia, 2018. *Code of Practice*: *How to safely remove asbestos.*
- TransGrid, 2016. *Environmental Handbook*
- TransGrid Guidelines and Procedures
    - TransGrid Work Instruction – Sampling of Asbestos
    - TransGrid Work Instruction – Removal of Asbestos
    - TransGrid Work Instruction – Disposal of Asbestos
    - TransGrid Form - Record of Potential Exposure to Asbestos
    - TransGrid Procedure – Contaminated Land Management
    - TransGrid Procedure – Health and Safety Incident Management
    - TransGrid procedure – Environmental Incident Management

Reference should be made to the CLMP, AMP and ASSMP for other relevant guidelines and standards for addressing potential unexpected finds in the project area.

2.3 Minister's Condition of Approval

The UCLAFP is developed in accordance with the Conditions of Approval from the DPIE (2020) as described below.

> **E20 (g) Unexpected Contaminated Land and Asbestos Finds Procedure**, for managing any unexpected contaminated land or asbestos (or suspected contaminated land or asbestos) excavated or otherwise discovered during construction.

2.4 Environmental Mitigation and Management Measures

The UCLAFP has been developed to include the revised environmental mitigation and management measures detailed in the EIS Amendment Report.

Table 2-1: Environmental Mitigation and Management Measures

Impact	ID	Measure
Unexpected Finds	CT8	An unexpected finds procedure will be included in the CEMP. An unexpected find is potential contamination that was not previously identified during this PSI (preliminary site investigation) or pre-construction investigations. Project workers will be trained in identifying the following: • soil that appears to be contaminated based on visual and olfactory (odour) observations; • ACM (i.e. asbestos containing material, either bonded or friable asbestos); • groundwater that appears to be contaminated based on visual and olfactory (odour) observations (including potential hydrocarbon sheens on the water surface, free phase liquids such as petroleum fuel, discolouration etc.); • drums or underground storage tanks (USTs); and • fill containing waste (e.g. slag, refuse, demolition materials).

Impact	ID	Measure
		In the event of an unexpected find: • excavation works will temporarily be suspended at the location of the unexpected find, the environment manager contacted and the area of concern appropriately isolated; • the area will be inspected by a contaminated land consultant and if required, appropriate sampling and analysis will be undertaken, the sampling works will be documented in a report; • the requirement for additional controls will be assessed by the consultant and implemented by the proponent; and • workplace health and safety and environmental protection requirements will be reviewed, depending on the type of unexpected finds encountered.

3 Potential Unexpected Finds and Characteristics

3.1 Unexpected Find Definition

An unexpected find is defined as potential contaminated land or asbestos that was not previously identified in the EIS, CSWMP (and sub-plans) or during pre-construction investigations.

For the purposes of this plan, contaminated land comprises land within the project area that meets the definition of contamination in *Contaminated Land Management Act 1997*. This includes asbestos.

Identified contaminated land, and pre-construction investigations to further assess contaminated land, in the project area is described in the CLMP and (for acid sulfate soils, ASS) ASSMP. Identified asbestos in the project area is described in the AMP.

3.2 Potential Unexpected Finds Characteristics

A summary and description of the types of unexpected finds that may be encountered during construction work in the project area is presented in **Table 3-1** below.

Table 3-1: Unexpected Finds and Characteristics of Contamination

Potential Unexpected Find	Observed Characteristic	Type of Contaminant / Issue
Petroleum hydrocarbons (e.g. fuels, oils and lubricants)	May be identified by either odour and/or visual indications of contamination. Petroleum hydrocarbon contamination may be identified by characteristic petrol, diesel or 'oily' odours (e.g. hydraulic oil) which may vary in strength from weak (just detectable) to very strong (easily detectable at a distance from the source). In soils, the odour may or may not be accompanied by specific areas of dark staining (black-grey) or larger scale discolouration of strata from a previously identified 'natural colour' (e.g. staining of orange and brown clay to dark grey and green.) May also be visible as a distinct coloured sheen on water within an excavation.	TRH, BTEX, PAH, lead
Buried dry waste materials	May include a variety of construction and demolition waste materials including wood, plastic, metal fragments, building rubble (e.g. concrete, brick, asphalt, asbestos containing materials etc.).	Asbestos, heavy metals
Buried or surface bonded ACM, asbestos fines/friable asbestos	Cement-bound asbestos containing material (ACM) (e.g. compressed cement sheeting) may be present in building waste or pipes. Friable forms of asbestos including lagging and insulation may be evidenced fibrous material which crumbles under hand pressure. Textured coatings and vinyl floor tiles may also contain asbestos. Asbestos fines and asbestos fibres are not visible to the unaided eye. Laboratory analysis is required to identify asbestos in soil.	Asbestos
Buried organic materials	Such materials may be associated with decomposed plant matter found within the natural alluvial soils.	Nutrients (ammonia, sulphates, phosphates), gaseous emissions (CH4, CO2, H2S)

Potential Unexpected Find	Observed Characteristic	Type of Contaminant / Issue
Potential or actual acid sulfate soils	May be associated with sulphurous odours from disturbed soils. Visual indications of acid sulphate soils (ASS) is the presence of jarosite (a yellow mineral staining) or iron oxide (rusty red staining) and/or corrosion of concrete or steel structures.	PASS, AASS, low pH
Structures or conduits containing or being surrounded by possible hazardous materials	Could be identified as follows: • A buried storage tank or former pipelines (typically metal, concrete or plastic). • Deeper sand fill sometimes with visual/olfactory indications of contamination. Presence of small concrete footings surrounding by odorous of visually impacted soils and/or groundwater.	TPH, BTEX, PAH, lead
Ash or slag deposits	Ash materials are described as typically light weight, grey and white sand and gravel sized particles (1mm to 10mm). Slag materials can be varied in consistency and colour and may comprise pale grey to blue/green/grey, and be loose or cemented. Slag gravels can be very angular and appear to have a vesicular (i.e. 'honeycomb') shape.	PAH, heavy Metals
Landfill type material	Mix of disposed material, which could include a combination of the other categories detailed in this table along with domestic (e.g. rag, clothing), clinical (e.g. sharps, human tissue or hair, laboratory specimens or culture), and/or putrescible waste (e.g. food scraps, nappies, animal waste).	Heavy metals, acids, ammonia, sulfides
Other unusual odours	Other unusual odours that a different from surrounding soils. For instance, a sweet odour could indicate the presence of chlorinated hydrocarbon contamination.	Various
Per- and polyfluoralkyl substances (PFAS)	Foaming in waters (e.g. in excavations, dewatering sumps or discharge) with little agitation and minimal dissipation.	PFAS

4 Unexpected Finds Procedure

The TransGrid and its contractors Site Manager will retain the overall responsibility for implementing the unexpected finds procedure for all construction works undertaken within, or near, the project area.

4.1 Training and Awareness of Personnel

Personnel involved in construction works in the project area will be made aware of, and trained, in the recognition of potential unexpected finds. Training will be undertaken as a part of general site induction and refreshed periodically at toolbox meetings.

Training will provide general awareness for recognition of potential contamination and hazardous materials, so that works can be suspended temporarily to allow evaluation by an appropriately qualified person. Project workers will be trained in identifying the following:

- Soil that appears to be contaminated based on visual and olfactory indicators.
- Asbestos (i.e. either bonded or friable).
- Groundwater or surface water that appears to be contaminated based on visual and olfactory observations (including potential hydrocarbon sheens on the water surface, free phase liquids such as petroleum fuel, discolouration etc.).
- Drums or underground storage tanks (USTs).
- Fill containing waste (e.g. ash, slag, refuse, demolition materials).

Contaminated land, ASS and/or asbestos is expected in some project areas (refer to CLMP, AMP and ASSMP). The TransGrid and its contractors Project Manager and/or Environmental and Sustainability Manager will be responsible for making the Site Manager aware of the nature of these prior to construction activities commencing in those areas.

4.2 Management of Unexpected Finds

Where unexpected contamination is identified or suspected by personnel involved in construction works within or near the project area, works will be temporarily suspended in the affected area. This area will be isolated to minimise the potential for disturbance of the affected material, soil and/or water. The TransGrid and its contractors field personnel are to notify the TransGrid and its contractors Site Manager or Project Manager who will then contact the TransGrid and its contractors Environmental and Sustainability Manager who will be responsible for evaluation of the nature of the unexpected find.

Due to the potential variability in both the nature and extent of an unexpected find, it is not possible to define specific remedial strategies for potential contamination associated with an unexpected find. However, the procedure described in **Section 4.3** details a process for identifying and evaluating feasible options to manage an unexpected find.

4.3 Unexpected Finds Procedure

In the event that a person on-site identifies an unexpected find, TransGrid and its contractors will undertake the actions presented in **Table 4-1** below.

Table 4-1: Unexpected Finds Procedure

Step No.	Description	Action
1	Potential contaminated soil, groundwater or surface water, or ACM, is encountered during construction activities.	Cease work in the potentially impacted area as soon as it is safe to do so and move away from the area. Assess the potential immediate risk to worker health and surrounding environment posed by the unexpected find and assess if evacuation or assistance of

Step No.	Description	Action
		emergency services is required.
2	Environmental management and work health safety management	Delineate an exclusion zone around the impacted area using fencing and/or appropriate barriers and signage. Additional control measures may be required for: • Odours and/or volatile compounds: odours suppression and no flames/sparks signage. • Potential asbestos containing materials: if area is small cover with weighted plastic sheeting or geofabric. For larger areas, use regular dust suppression as conditions require – refer to the AMP for required controls. Install environmental controls around the site to contain the contaminated material including diversion of water to minimise potential spread via surface water runoff in accordance with the ESCP. Personal Protective Equipment (PPE) will be worn if conditions have changed as per the relevant Material Safety Data Sheet (MSDS) and TransGrid and its contractors worker safety requirements.
3	Assess the unexpected find	A Contaminated Land Consultant should assess the unexpected find and provide: ○ Preliminary assessment of the nature of suspected contamination and immediate management controls if needed. ○ Advise what further assessment and/or remediation works are required and how such works are to be undertaken in accordance with contaminated site regulations and guidelines – refer to the CLMP. The assessment may include a requirement to undertake a targeted site investigation to sample and analyse contaminated media. Suspected or identified contamination will be characterised with consideration of ASC NEPM (NEPC, 2013) and soil material will be classified in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014). Actions to be undertaken in the management of unexpected finds will inputted into the Action Tracking Register. Refer to CEMP section 9.1.2
4	Management or mitigation action and reporting	Based on advice of the Contaminated Land Consultant, implement necessary management or mitigation actions to minimise risk to human health and the environment and to allow the construction activities to recommence. Record details of the unexpected find and the actions undertaken, including the following, and notify the landowner; local council and/or NSW EPA: ○ Location, nature and extent of unexpected find ○ Scope, methodology and results of any investigation. ○ Scope, methodology and outcomes from any

Step No.	Description	Action
		remedial activities completed. ○ Results of any validation sampling or clearance certificates (i.e. for asbestos). Implemented changes to risk control measures.
5	Recommence works	The Contaminated Land Consultant will provide relevant information and recommendations to the TransGrid and its contractors Environment and Sustainability Manager, particularly for considering any changes to existing site management plans. Recommence construction works once mitigation or remediation works have been implemented, sampling has validated that the remediation strategy has been successful and if it is then deemed safe to do so by the TransGrid and its contractors Environment and Sustainability Manager.
6	Recording	Records of unexpected finds will be undertaken as follows: • Unexpected finds will be record in the environmental incident register.

Refer to the AMP attached as Appendix F of the CSWMP for additional management controls and procedures specific to the identification of asbestos contamination.

5 Compliance Management

5.1 Roles and responsibilities

Refer to roles and responsibilities in the CLMP.

5.2 Training & Induction

Refer to training and inductions requirements in the CLMP.

5.3 Complaints Management

Refer to complaints management requirements in the CLMP.

5.4 Incident Response

Refer to incident response requirements in the CLMP.

5.5 Audits

Refer to audit requirements in the CLMP.

5.6 Non-Conformances

Refer to non-conformance requirements in the CLMP.

5.7 Licenses, Permits and Qualifications

Refer to license, permits and qualification requirements in the CLMP and AMP.

5.8 Review and Improvement

This plan may be updated or revised if required. The procedure for review and approval of any updates or revisions will be in accordance with the procedure described in the CSWMP.

6 References

AECOM Australia Pty Ltd, 2019. *Powering Sydney's Future Potts Hill to Alexandria transmission cable project*. Amendment Report, February 2020.

Contaminated Land Management Act 1997 No 140.

National Environment Protection Council, 1999. *National Environment Protection (Assessment of Site Contamination) Measure,* as amended 15 May 2013.

NSW EPA, 2014. *Waste Classification Guidelines – Part 1: Classifying Waste.*

Safe Work Australia, 2018. *How to Safely Remove Asbestos Code of Practice*. October 2018.

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- TransGrid Procedure – Health and Safety Incident Management
- TransGrid procedure – Environmental Incident Management

Appendix 9 – TransGrid Guidance Notes

Environmental Guidance Note
Excavation & Machine Work

Authorised by:	Krista Fogarty	Issue date:	22/3/19	HP TRIM No.	D2019/01101

Activities using mobile plant that removes vegetation & down to mineral earth may require site specific environmental controls to mitigate potential erosion & reduce the risk of sediment discharge off work sites &/or into waterways/ drainage.

The following controls are mandatory for all *Excavation & Machine Work*:

Mandatory Control Measures

Work in accordance with *Environmental Guidance Note: Minor Civil Works – Erosion & Sediment Control* (attach to Work Pack).

All disturbed soils (i.e. stockpiles, graded material, ripped road surfaces) to be consolidated or protected from erosion prior to daily shutdown or prior to any predicted rainfall.

Install sediment controls where there is a risk of sediment entering waterways, stormwater or drainage channels.

Additional sediment controls must be considered for all drainage outlets where site water is not discharged as sheet flow into stable vegetation.

Locate stockpiles away from drainage lines & high hazard areas (>10% slope) & protect from erosion & loss of sediment.

All plant & equipment must be clean, i.e. free of soil, mud & vegetative matter, prior to delivery to & removal from site.

Erosion & Sediment Controls must be implemented in accordance with Managing Urban Stormwater, Soil & Construction Volume 1, 2A Installation of Services & Volume 2C Unsealed Roads (Blue Books).

Once works are finished, all disturbed areas must be rehabilitated prior to leaving the site, i.e. gravel replaced or top soil replaced, compacted (where necessary) protected from erosion & rehabilitated using mulch, brush matting &/or seeding or other suitable stabilisation method.

Additional Controls for Machine Work*

- E5 review & approval required,
- *Machine Work* should not be undertaken on land mapped as Vulnerable Land (generally where slopes exceeding 18° or where there is a risk of land slip or erosion),
- Avoid clearing large areas of vegetation on steep slopes >12°, leave some vegetation other than just ground cover to assist soil stability,
- Avoid sharp turns to minimise soil disturbance,
- Minimise damage to ground covers e.g. grasses & very low growing plants/ground covers, &
- An ESCP may be required where soil disturbance >250m^2

Machine Work is any action that involves the use of mobile plant such as excavators, graders, bulldozers, backhoes & similar large equipment for the following activities:

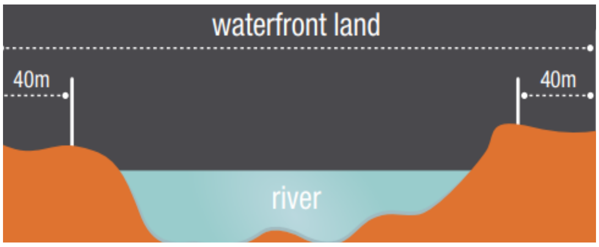
1. Excavation using mobile plant,
2. Vegetation removal &/or maintenance works for the purpose of removing vegetation / ground cover down to mineral earth, &
3. Construction/maintenance of access tracks, safe work platforms or construction benches.

NOTE: mulching/trittoring & slashing of vegetation is NOT considered to be *Machine Work* so long as ground cover is retained & vegetation is not removed down to mineral earth.

Authorised by:	Krista Fogarty	Issue date:	22/3/19	HP TRIM No.	D201901106

Working in/near watercourses that are on waterfront land or on Protected Riparian Areas (PRA), may require site specific practices / controls to mitigate potential impacts & comply with legislation.

Any earthworks on waterfront land must be assessed by E5 staff to determine if Fisheries or Department of Primary Industry (DPI) permits are required.



The following controls are mandatory for all work near watercourses:

EARTHWORKS

Earthworks on or in the bed or banks of a watercourse may require a Permit or Controlled Activity Approval. Contact the local TransGrid Environmental Officer before proceeding

Erosion control & sediment controls must be implemented in a manner consistent with currently accepted Best Management Practice (Blue Books)

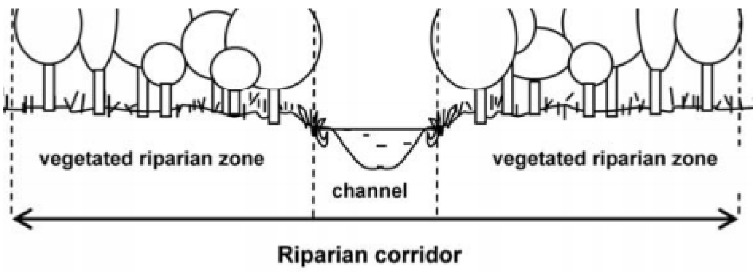
All controls must be maintained in good working order during the works & maintained until the site has been stabilised

Undertake instream works during low or nil flow where possible

Do not remove, realign, or relocate rocks, snags/large woody debris without first consulting environmental staff

Minimise impacts in the vegetated riparian zone (VRZ) i.e. leave understory vegetation where electrical clearance allows

All work must be done in accordance with DPI & NSW Fisheries Guidelines (attach as required)



Watercourse type	VRZ width (each side of watercourse)	Total RC width
1st order	10 metres	20 m + channel width
2nd order	20 metres	40 m + channel width
3rd order	30 metres	60 m + channel width
4th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

VEGETATION MANAGEMENT

Do not use machinery to clear vegetation below top of bank.

Where safe to do so, leave stumps of trees ≥500mm high when clearing below the top of the bank.

Do not poison or remove trees/stumps below the top of the bank as root systems are critical fort bank stability.

PROTECTED RIPARIAN LAND (PRA)

Contact your local Transgrid Environmental Officer for guidance if vegetation management is required on Protected Riparian Areas (refer to Regulated Land Guidance Note)

Clearing limits of 15m applies from the outside conductor (measured from blow-out)

Where PRA is flagged refer to & work in accordance with the Regulated Land Guidance Note

PESTICIDE USE – ALWAYS READ THE LABEL

If applying within 20m of waterways a field risk assessment must be done (add details to *Pesticide Application Record*)

Ensure wind direction (& spray application) is away from waterways. DO NOT SPRAY across waterbodies

Refer to product label rain-fast times if rainfall is predicted

DO NOT store or mix pesticides in proximity to waterways or stormwater

DO NOT saturate soil with herbicide over-spray.

Unless specified or permitted by the product label:

> Use RoundUp Biactive within 5m of waterways,

> DO NOT apply foliar sprays onto vegetation in or over water or drainage channels, &

> Avoid adding detergent based wetting agents / surfactants.

Environmental Guidance Note
Minor Civil Works-Dewatering

Authorised by:	Krista Fogarty	Issue date:	22/3/19	HP TRIM No.	D201901110

Discharge and Dirty Water

When undertaking minor civil / excavation works in existing switchyards, *premises* or tower sites, dewatering is generally only required for small quantities of dirty water (>2m³).

Dewatering must be undertaken so that discharge doesn't:

> Cause pollution or erosion, and / or

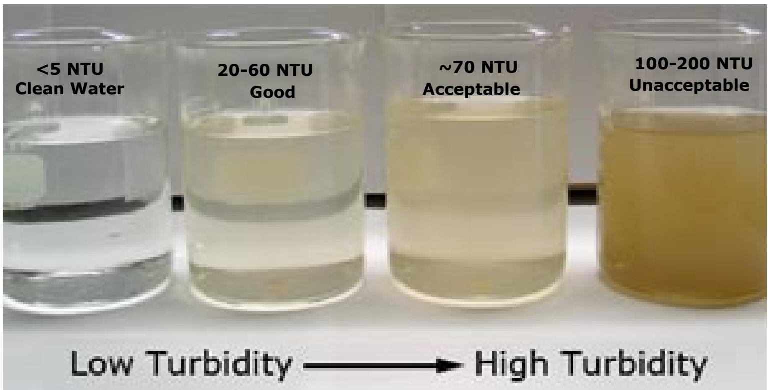
> Create any safety hazards.

Any water discharged must meet the following criteria (as a minimum) before it enters any creeks or stormwater:

1. pH between 6.5-8.5;
2. TSS <50mg/L (generally correlates to field turbidity of less than 70 NTU); &
3. No visible oil & grease.

What is 'dirty' water?

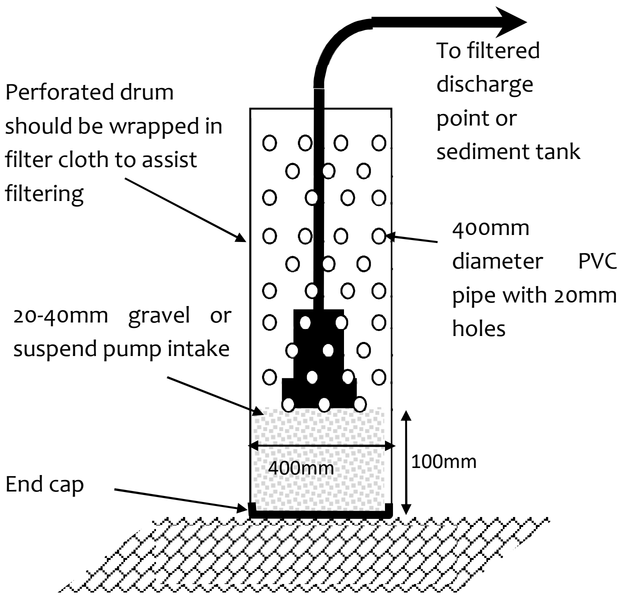
Sediment in water is measured as total suspended solids (TSS) or turbidity (NTU). The diagram below gives a representation of turbidity in terms of the discharge water quality you should aim for.



Pumping from excavations

When pumping from sumps, pits or any excavation the pump intake **must** be separated from the bottom to avoid drawing up settled sediment or mud into the pump.

The diagram below shows a suggested set up for pumping out 'dirty water'.



Pump intake must set approx. 100mm above the base of the excavation or sediment/sludge level. A sump may be required. Pump the cleanest water on top first, and then gradually lower the intake.

Maintenance Considerations:

- Check filter cloth for damage & blockages
- Keep intake off base of excavation

Discharging water containing TYPE C (Coarse/Sandy Soils) using Vegetated Filter Strips / Buffers

Vegetated areas where water can be discharged, filtered by vegetation & infiltrate into the soil are known a buffer strips, they can be used as a primary filter for coarse (Type C/Sandy) soils.

Buffer strips must be managed:

> So the vegetation buffer is wider as slope increases.

> So water is discharged as a sheet.

> So they do not cause erosion, flooding / inundation or damage.

Maintenance Considerations:

- Check discharge sheets the water,
- Discharge does not cause erosion, flooding or safety issues.

Discharging water containing TYPE F &D (Fine & Dispersible/Clay Soils) – Using Filter Bags, Tubes / Silt Socks

> Filter bags & socks are made of geotextile & water is pumped through at very low pressure to filter sediment.

> They must be used for F & D soils even where filtered water is discharged on to vegetation buffers (see above).

> Locate them away from drainage lines to allow for water to infiltrate soil or through vegetation,

> Ensure collection of sediment from bags is considered.

> Useful for 2 stage dewatering where water is discharged on to a vegetated filter strip or through secondary filter.

> Can be placed in a skip or bunded area to make clean-up easier.

Maintenance Considerations:

> Do not move or disturb filter bags when operational as the filter crust will be broken

> Generally one use only but can be cleaned for reuse when dry

Authorised by:	Krista Fogarty	Issue date:	22/3/19	HP TRIM No.	D2019/01111

To manage & mitigate soil erosion / sedimentation during construction activities (involving minor civil / earthworks) the following steps must be undertaken & controls implemented where required.

STEP 1: FOLLOW THE PROCESS BELOW, MAKE SURE TO:

1. **Plan** - Assess the soil & water risks present or potential on the worksite, prior to commencement of the work,
2. **Minimise** - area disturbed / exposed, Stabilise / rehabilitate disturbed areas progressively,
3. **Conserve** - topsoil / spoil / gravel where required for re-use,
4. **Control** - Water flow around & through site & sediment controls,
5. **Maintain** - Inspect & maintain all controls through the life of the project until site is stable i.e. minimum 70% cover established protecting the soil. Remove controls only once the site is stabilised.

STEP 2: IMPLEMENT THE FOLLOWING MITIGATION MEASURES WHERE REQUIRED

Site Plans:

For excavation works <250m^2 of disturbed area, a site plan may not be required.

Where works are >250m^2 or varied (e.g. excavation + concreting + stockpiling) compile an environmental site map / plan (such as a Site Environmental Plan (SEP) or ESCP) showing (as a minimum):

- North Point,
- Soil & water risks (e.g. disturbed areas, limit of works, water-flow/fall, receiving waters),
- Access / egress routes & works locations,
- Parking, laydown areas & stockpiles, type of erosion & sediment controls (when they are to be used), &
- Concrete washout location.

Seek advice from TransGrid HSE if the work requires a Site Plan or ESCP.

If works will disturb an area >2500m², involve sediment basins, works in riparian areas or larger scale stormwater works, a specific design / plan may be required.

Stockpiles:

Excess spoil must be stockpiled & stabilised to minimise erosion (such as covering or compacting).

Locate stockpiles clear of drainage & steep areas. Ensure they are protected from erosion & do not encroach upon any waterway, footpath, nature strip or road.

Waste spoil must be classified & disposed of in accordance with EPA requirements & TransGrid's Waste Management Procedure / Spoil Management Work Instruction.

Sediment Management:

Sediment filters should be used where there is a risk of sediment entering drainage structures or migrating off site.

Remove collected sediment ASAP & dispose to prevent re-mobilisation (you can reuse, stockpile or dispose of).

Control vehicle access / egress to prevent tracking of material onto paved surfaces / roads, particularly during wet weather or when the sites are muddy. Where sediment is on hard surfaces it must be removed by means other than washing.

Access:

Stabilise unformed access routes if heavy damage is anticipated. Where required, new access routes, driveways & parking areas must be stabilised with suitable capping material as soon as possible after their formation.

Site Stabilisation:

Stabilise surfaces to original condition or as designed.

All disturbed areas where works are complete must be progressively stabilised so that within 60 days no completed areas remain exposed to potential erosion damage.

Erosion Management:

Minimising erosion will decrease sediment loads & confine soil disturbance to the work site only (including stockpiles).

Limit ground disturbance to 2-4m beyond the limit of excavations where possible.

Avoid concentrating water flow (where possible).

Avoid directing water over batters.

Disturbed areas that are inactive or shut down for more than 20 days (works may continue later) must be stabilised to prevent erosion. Measures should be put in place to achieve 60% ground cover (or equivalent).

For works involving the use of concrete:

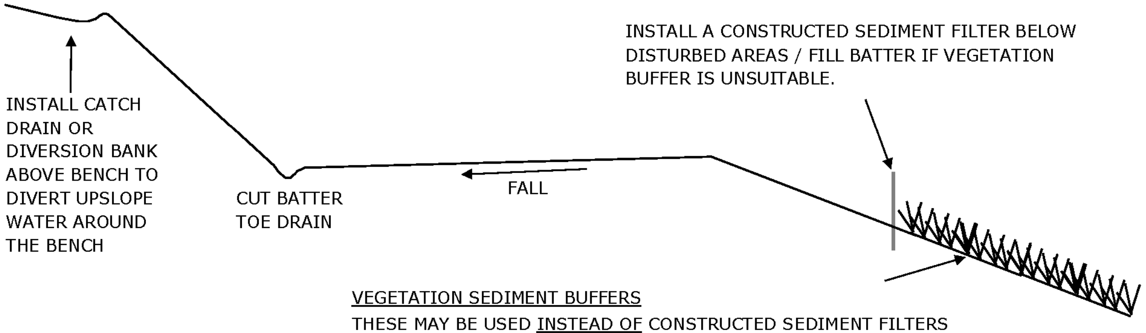
Agitator washout is not permitted on TransGrid sites, 'flick wet wiping' of chutes only; residual concrete must be returned to the supplier.

Install a sealed receptacle on site to allow for residues from chutes. Concrete may be discharged into prepared excavations/formwork or designated waste receptacles only.

Monitoring: All controls must be inspected & maintained regularly (min weekly) & / or after 10mm of rain.

Weekly Inspections must be documented.

BENCHING DETAILS (GENERAL)



VEGETATION SEDIMENT BUFFERS

THESE MAY BE USED INSTEAD OF CONSTRUCTED SEDIMENT FILTERS (LIKE SEDIMENT FENCE /COIR LOGS) ONLY WHERE:

a. SOILS ARE STABLE, SAND &/OR GRAVELLY, &
b. VEG FILTERS ARE >20M WIDE & ON SLOPES GENERALLY <5% &
c. DISTURBED / BENCH AREA MUST BE A MIN OF 40M FROM ANY WATERWAYS, INCLUDING DAMS & GULLIES.

CONSIDERATIONS FOR WORKS IN RURAL AREAS

STABILISATION WITH VEGETATION AND/OR USE OF STRAWMULCH SHOULD CONSIDER THE PRESCENCE OF STOCK.

SEDIMENT FENCES AND COIR LOGS ARE PRONE TO STOCK DAMAGE

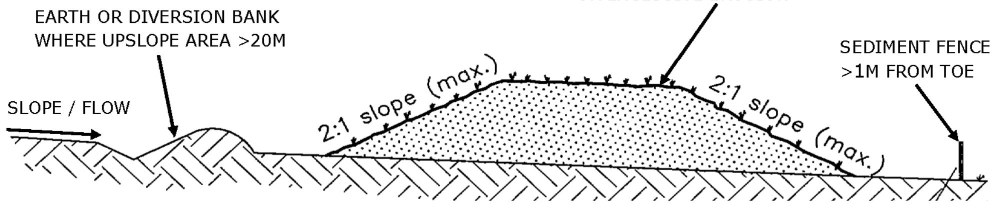
BENCHING NOTES:

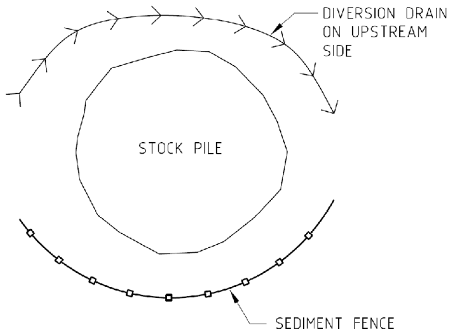
1. EROSION AND SEDIMENT CONTROL MEASURES SHOWN IS FOR A TYPICAL SLOPED TRANSMISSION STRUCTURE CONSTRUCTION SITE LAYOUT, WHERE CONSTRUCTION BENCHING IS REQUIRED.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN (CEMP) OR ESCP.
3. WHERE POSSIBLE, ALL EROSION AND SEDIMENT CONTROL MEASURES SHALL BE INSTALLED AS THE FIRST STEP IN THE CONSTRUCTION SEQUENCE.
4. CONTROL WATER FROM UPSTREAM OF THE SITE SUCH THAT IT DOES NOT ENTER THE DISTUBED SITE (VIA AN EARTH BANK OR CATCH DRAIN TO A STABLE LOCATION).
5. CONSIDER LEVEL SPREADERS OR ROCK ARMOUR AT DRAINAGE OUTLETS TO MITIGATE EROSION.
6. ALL TOPSOIL TO BE PLACED IN SHORT TERM STOCKPILES AND RE-SPREAD ON BATTERS AND DISTURBED AREAS PRIOR TO CONSTRUCTION COMPLETION (OR STOCKPILED SEPERATELY IF BENCHES ARE TEMPORARY)
7. BATTERS SHOULD BE INSTALLED AT THE LEAST STEEP GRADE POSSIBLE (≥ 1 IN 3)
8. RUNOFF FROM ALL DISTURBED AREAS SHOULD BE DIRECTED THROUGH SEDIMENT CONTROLS WHERE VEGETATED FILTERS ARE INADEQUATE
9. ALL SEDIMENT CONTROL STRUCTURES SHOULD BE CLEANED OUT AFTER EACH SIGNIFICANT RAINFALL EVENT.
10. STABILISE BATTERS & DRAINS & APPLY SEED & EROSION CONTROL (I.E. STRAW / HYDRO MULCH, JUTE MATTING OR BINDER) AS SOON AS DESIGN GRADES ARE ACHIEVED. EROSION & SEDIMENT CONTROLS SHALL REMAIN IN PLACE AND NOT BE DECOMMISSIONED UNTIL GROUND SURFACES ARE STABILISED AND/OR REVEGETATED.
11. ALL WORK SHALL BE GENERALLY CARRIED OUT IN ACCORDANCE WITH:
    a. NSW DEPARTMENT OF HOUSING MANUAL "MANAGING URBAN STORMWATER, SOILS AND CONSTRUCTION", 4th EDITION, MARCH 2004. (THE BLUE BOOK).
    b. EPA-POLLUTION CONTROL MANUAL FOR URBAN STORMWATER (ACT).
    c. ANY LOCAL AUTHORITY REQUIREMENTS.

STOCKPILE DETAILS

STOCKPILE NOTES

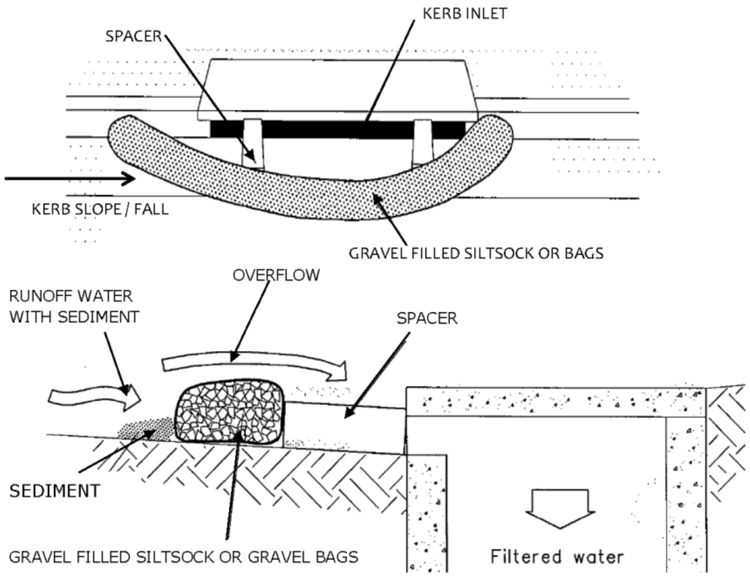
1. PLACE STOCKPILES >10m FROM DRAINAGE OR HAZARD AREAS.
2. CONSTRUCT ON CONTOUR IN LOW FLAT MOUND (≤2m HIGH IF TOPSOIL).
3. DIVERT 'CLEAN WATER' AROUND WHERE NECESSARY.
4. IF STATIC >10 DAYS OR MOD-HIGH RAINFALL PREDICTED STABILISE TO MITIGATE EROSION
5. AVOID PLACING SPOIL DIRECTLY ON TO SWITCHYARD GRAVEL OR GRASS WHERE POSSIBLE
6. REHABILITATE STOCKPILE SITES AS PER SWMP / ESCP.



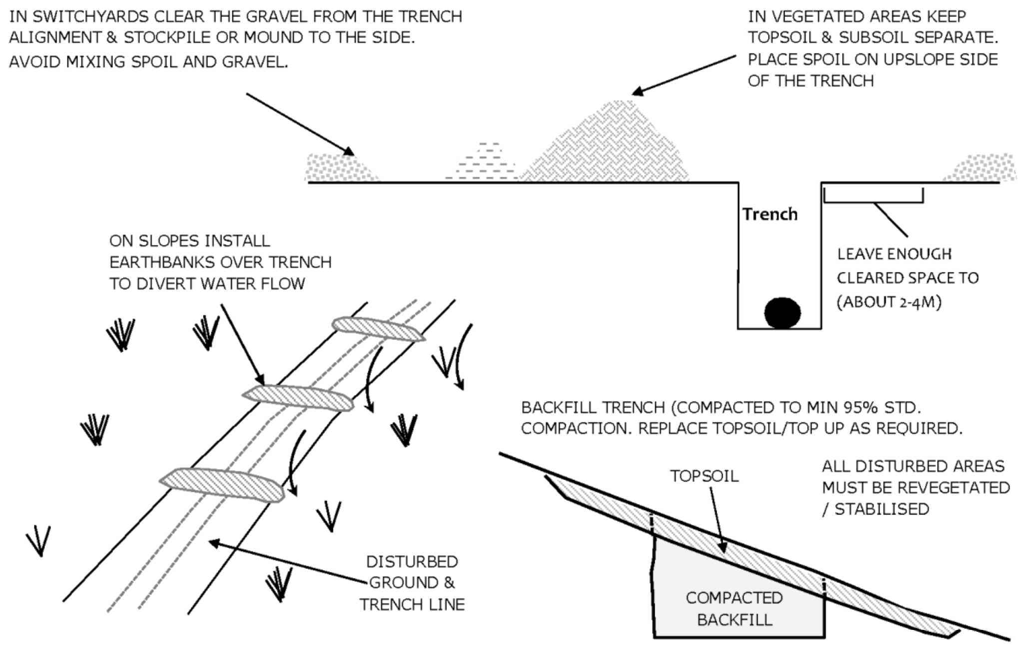


Warning: A printed copy of this document may not be the current version. Please refer to the Wire to verify the current version

INLET SEDIMENT CONTROL (GENERAL)



TRENCHING CONTROLS (GENERAL)



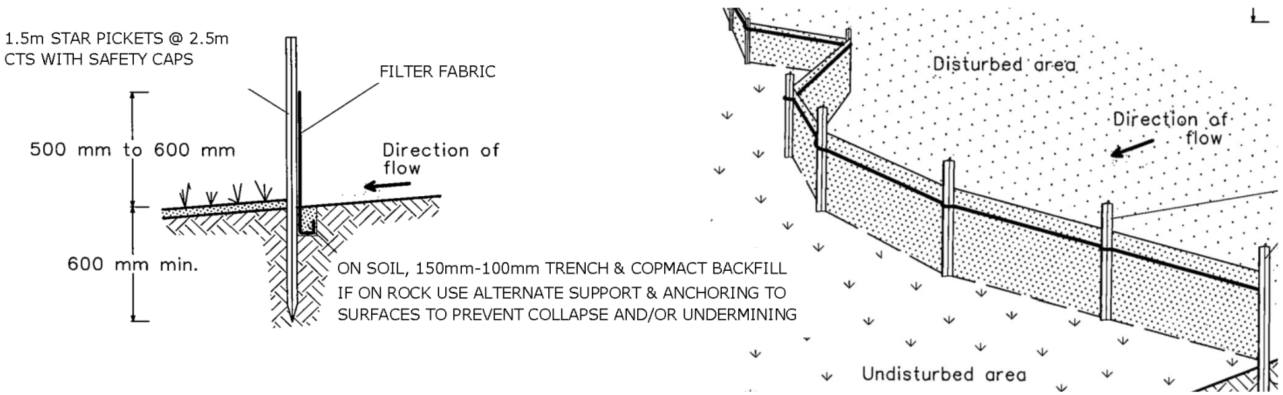
INLET FILTER NOTES

1. FABRICATE FILTER LONGER THAN PIT & USE 20-40MM GRAVEL.
2. INSTALL WITH ELLIPTICAL CROSS-SECTION ABOUT 150MM HIGH.
3. USE SPACERS IF REQUIRED TO PREVENT BLOCKAGE.
4. SEAL ENDS TO KERB TO PREVENT BYPASS.

TRENCHING NOTES

1. DO NOT PLACE SPOIL ON SWITCHYARD GRAVEL (UNLESS ON GEOFABRIC) OR WITHIN 10M OF STORMWATER DRAINAGE I.E. NEXT TO KERB AND GUTTER (UNLESS OPERATIONS WILL ONLY OCCUR DURING DRY WEATHER).
2. INSTALL SEDIMENT FILTERS AT THE ENDS OF SPOIL BUNDS ON SLOPING SITES TO FILTER DIVERTED WATER.
3. TRENCHES RUNNING DOWN GRADE MAY REQUIRE WEIRS OR TRENCH STOPS (USE GRAVEL OR SAND BAGS) IN THE TRENCH TO PREVENT WATER RUNNING DOWN THE TRENCH.

SEDIMENT FENCE (GENERAL)



SEDIMENT FENCE NOTES

1. INSTALL AS CLOSE AS POSSIBLE TO PARALLEL TO SITE CONTOURS
2. USE 1.5m STAR PICKETS @ 2.5m CTS WITH SAFETY CAPS
3. DIG 150mm DEEP 100mm WIDE TRENCH ALONG THE LINE OF THE FENCE FOR THE BOTTOM OF THE FILTER FABRIC
4. BACKFILL AND COMPACT TRENCH
5. FIX FILTER FABRIC TO UPSLOPE SIDE OF PICKETS WITH WIRE TIES OR AS RECOMMENDED BY MANUFACTURER
6. JOINS/OVERLAPS SHOUILD BE AT A POST AND MINIMUM 0.5 m TO PREVENT BYPASS

Environmental Guidance Note
Transportation of Harmful Materials & Spill Response

Authorised by:	Krista Fogarty	Issue date:	22/3/19	HP TRIM No.	D2019/0199

Transport of material that has potential to cause harm requires compliance with TransGrid procedures, legislation, Codes of Practice & TransGrid's Pollution Incident Response Management Plan (PIRMP). This guidance note outlines the minimum requirements for transporting bulk oil, PCB material, and SF6 gas, in addition to the emergency requirements in the event of an incident such as a spill.

Transport Requirements

- Oil / PCB checklist must be compiled & approved for all oil handling & transport for >3000L outside premises or any quantity of known PCB material,
- Vehicles used must be constructed & maintained so as to prevent the spillage of waste. Vehicles are to be equipped with a radio or mobile phone & be roadworthy & clean.
- Ensure requirements for transporting dangerous goods & placarding are implemented.

Transport vehicles must carry a folder containing copies of:

- Approved OIL / PCB checklist including NATA Certificate (where required),
- Emergency Procedures documentation (this Guidance Note),
- Safety Data Sheet (SDS)

If the material is *trackable waste* the folder must also have copies of:

- PIRMP Transportation of Waste,
- Environmental Protection Licence 7153,
- Waste Transport Certificate/Consignment Authorisation.

Additionally, vehicles carrying bulk oil / PCBs must be equipped with a kit containing:

- Electric torch;
- 1 x 204 litre wheeled garbage bin or equivalent to house the kit & retrieve a spill;
- A supply of oil absorbing material (at least 2 bags of dri-sorb granules & 1 roll of oil absorbing mat) sufficient to contain a volume of oil at least equal to that of the largest container being carried (excluding bulk tankers);
- 1 x shovel & 1 x rake;
- Protective clothing including 2 x disposable overalls, 2 x overshoes/gumboots, 2 x PVC gloves, 2 x goggles or face shields;
- 1 x dry chemical fire extinguisher;
- 2 x foam fire extinguisher; &
- Double sided road reflectors.

General Emergency / Spill Response

In the event of a leak or spill of oil or PCB material incident response must occur in accordance with the following key requirements:

STOP THE SPILL: Stop the source of the spill immediately, if it is safe to do so, in a way that is appropriate to the chemicals involved. This will reduce the level of possible contamination to the environment.

CONTAIN THE SPILL: Control the flow of the spill & contain the spill appropriate to the type of liquid involved (Refer to SDS). Prevent the spill from entering any stormwater drains by isolating drain inlets.

CLEAN UP THE SPILL: Clean up the spill by referring to the SDS for the type of chemical(s) involved. Cleaning up a spill promptly will help to protect the local environment.

NOTIFY: Once the site is safe/secure report incident to your Team Leader/Manager (refer to table overleaf).

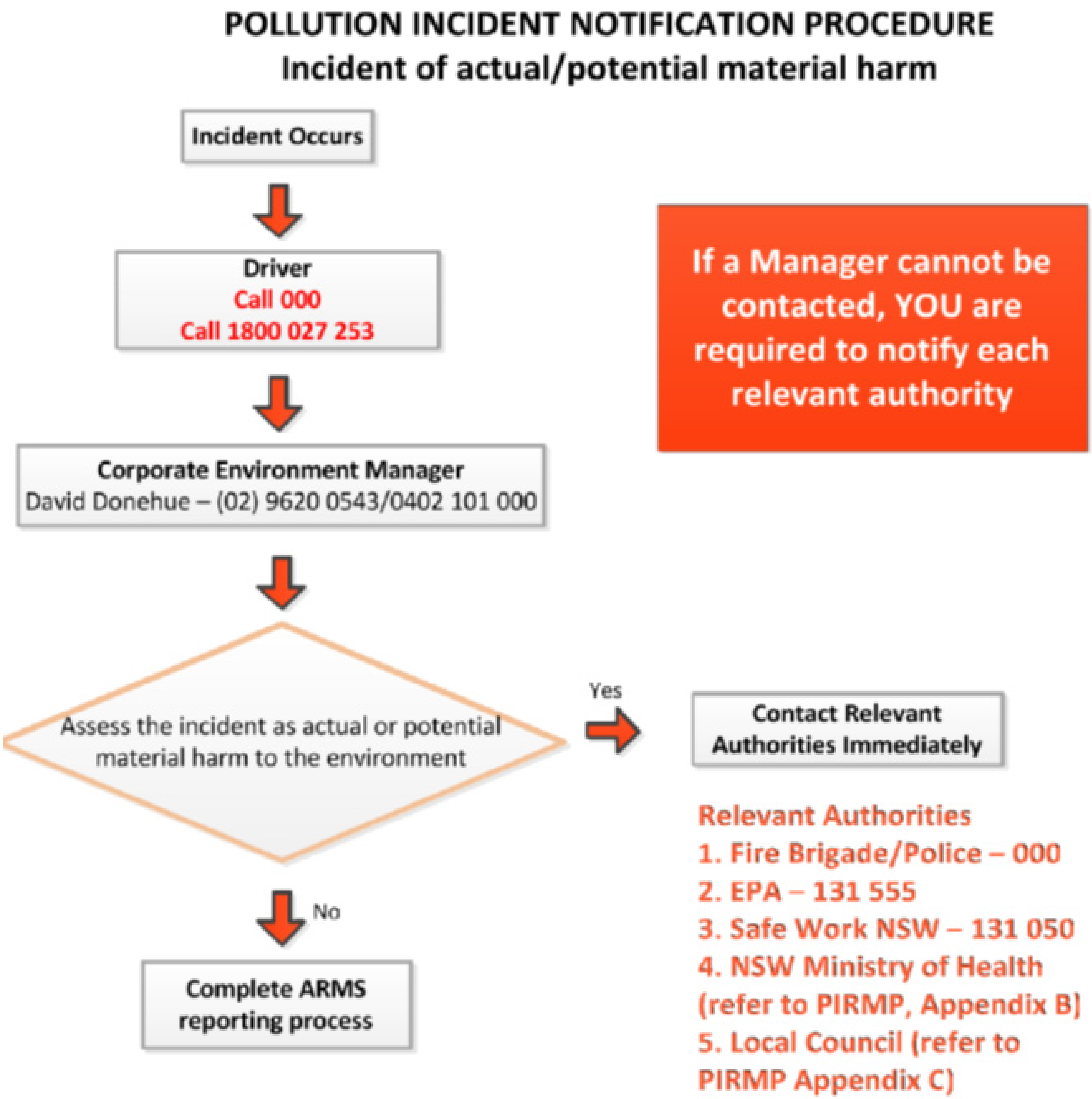
ENSURE THAT:

- Notifiable incidents are managed in accordance with TransGrid's Pollution Incident Notification Procedure, refer to excerpt overleaf).
- The incident is entered into ARMS.
- Sealable drums are to be used for storing contaminated wastes. The drums shall be labelled.
- Liquids are contained using absorbent materials, earth bunds or other viable methods & must not be permitted to flow into drains or waterways. Place used absorbent material in appropriately labelled drums / durable plastic bags.
- Any sand, gravel, paving, etc., that has been contaminated by a spill of PCB-contaminated oil, samples of the soil, sand, gravel, etc., & of the oil must be tested to determine the appropriate method of disposal.
- Any clothing (including aprons, gloves, overalls, wet weather gear, boots, mask filters, etc.) that comes in contact with PCB is treated as PCB waste.

VEHICLE BREAKDOWN: driver to operate flashing hazard lights or parking lights & Place double sided reflector signals in the appropriate positions (one placed 50m to 150m in front of the vehicle; one placed 50m to 150m to the rear & one beside the vehicle).

FOR MATERIAL SPECIFIC EMERGENCY PROCEDURES REFER TO THE ATTACHED *RESPONSE GUIDES.*

TransGrid Contacts	**Contact Number**	**Alternate Number**
TransGrid Emergency	1800 027 253	-
Corporate Environment Manager *David Donehue*	(02) 9620 0543	0402 101 000
Maintenance Manager *Ian Davidson*	(02) 9620 0600	0438 765732
Substations Manager *Richard Manderson*	(02) 6226 9625	0427 409 165
External Emergency Contacts (excerpt from TransGrid PIRMP)		
Emergency Services – 000 (or 112 from a mobile phone)		
Fire Brigade / Fire & Rescue NSW	000	(02) 9265 2999
Ambulance	000	112
Police	000	112
State Emergency Service	132 500	-
Relevant Authorities		
Environment Protection Authority (EPA)	Environment Line 131 555	-
SafeWork NSW	13 10 50 – 24 hour	-
NSW Office of Water	(02) 8281 7777	-



MATERIALS GENERALLY TRANSPORTED BY TRANSGRID

Description	Waste Code	UN Number	GHS Class	DG Class	Hazchem Code	Packing Group	EPL Transport	Response Guide (attached)
Transformer Oil (new)	NA	NA		NA Note: Classed C1 Combustible liquid	NA	NA	NA	**47**
Waste hydrocarbons (PCB Free oil).	J100	30XY		Note: Classed C1 Combustible liquid	NA	NA	7153	**47**
Waste oils & water mixtures or emulsions, & hydrocarbon & water mixtures or emulsions (PCB Free).	J120	30XY		NA	NA	NA	7153	**47**
Scheduled PCB oil waste (liquid) Polychlorinated biphenyls (PCBs) (PCBs >50 mg per kg).	M100	2315			2X	II	7153	**47 & 48**
Scheduled PCB material waste (solid) Waste substances & articles containing or contaminated with PCBs ([PCBs] >50 mg per kg).	M100	3432			2X	II	7153	**47 & 48**
Non-Scheduled PCB waste Solvents, oils & materials contaminated with PCBs ([PCBs] >2 mg per kg & [PCBs] <50 mg per kg).	M100	3082			•3Z	III	7153	**47**
Sulphur Hexafluoride (SF6) gas- new	N/A	1080			2TE	NA	NA	**06**
Sulphur Hexafluoride (SF6) gas - used	D110	3308			2XE	N/A	N/A	**07**

Notes:
C1 Combustible Liquids are not classified as dangerous goods for transport purposes. No placarding is required by this Code on a portable tank or tank vehicle transporting only C1 liquid. However, industry practice is often to display "Combustible Liquid" in the area normally used for placarding a tanker.

 **GHS08 – Health Hazard:** Chronic health hazards; this includes aspiratory & respiratory

 **GHS04 – Gas cylinder:** Gases under pressure

 **GHS05 – Corrosive:** Causes severe burns & eye damage

RESPONSE GUIDES

The following information has been adapted from the *SAA/SNZ HB 76:2010 Dangerous Goods – Initial Emergency Response Guide* to provide the information relevant to the emergency response procedures / protocols for materials commonly transported by TransGrid.

Attached Guides:

GUIDE 47 – LOW TO MODERATE HAZARD SUBSTANCES

GUIDE 48 – POLYCHLORINATED BIPHENYLS (PCBs)

GUIDE 06 – GASES – SLIGHTLY TOXIC AND/OR CORROSIVE & FLAMMABLE

GUIDE 07 – GASES – TOXIC AND/OR CORROSIVE

REMEMBER

- **RESIST RUSHING IN.**
- **APPROACH INCIDENT FROM UPWIND.**
- **STAY CLEAR OF ALL SPILLS, VAPOURS, FUMES, SMOKE & SUSPICIOUS SOURCES WITHOUT APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT.**

GUIDE 47 | LOW TO MODERATE HAZARD SUBSTANCES

HAZARDS

Fire or explosion	• May burn but do not ignite readily. • Runoff may pollute waterways. • Fire may produce irritating, toxic, and/or corrosive fumes. • Containers may explode when heated.
Health	• Inhalation or contact with substance may be harmful. • Inhalation of asbestos dust may damage the lungs. • Runoff from fire control or dilution water may pollute waterways. • Substances may be stored or transported hot – Contact with substance may result in severe burns.

PROTECTIVE CLOTHING

- Wear SCBA and chemical splash suit.
- SCBA and structural firefighter's uniform may provide limited protection.

PUBLIC SAFETY

- Spill or leak area should be isolated immediately for at least 10 m in all directions.
- Keep unauthorised personnel away.
- Keep upwind and to higher ground.

Evacuation	**Fire** • When a large quantity of this material is involved in a major fire, consider initial evacuation of areas within 100 m in all directions.

EMERGENCY RESPONSE

Fire	**Small fire** • Use dry chemical, CO_2, water spray or foam. **Large fire** • Use water spray, fog or foam. • If safe to do so, move undamaged containers from fire area. • Cool containers with flooding quantities of water until well after fire is out. **Fire involving tanks** • Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank. • ALWAYS stay away from tank ends.
Spill or leak	• Do not touch or walk through spilled material. • Stop leak if safe to do so – Prevent entry into waterways, drains or confined areas. • Water spray may be used to knock down or divert vapour clouds. • Prevent dust cloud. • Avoid inhalation of asbestos dust. • **SEEK EXPERT ADVICE ON HANDLING AND DISPOSAL.**
First aid	• Remove victim to fresh air – Apply resuscitation if victim is not breathing – Administer oxygen if breathing is difficult. • Remove contaminated clothing and shoes immediately. • Remove material from skin immediately. • In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. • Keep victim warm and quiet – Obtain immediate medical care. • Ensure that attending medical personnel are aware of the identity and nature of the product(s) involved, and take precautions to protect themselves.

GUIDE 48 | POLYCHLORINATED BIPHENYLS (PCBs)

HAZARDS

Fire or explosion	• May burn but do not ignite readily. • Fire may produce irritating, toxic, and/or corrosive fumes.
Health	• Inhalation or contact with substances may be harmful. • Runoff from fire control or dilution water may pollute waterways.

PROTECTIVE CLOTHING

- Wear SCBA and chemical splash suit.
- Structural firefighter's uniform will provide limited protection.

PUBLIC SAFETY

	• Spill or leak area should be isolated immediately for at least 15 m in all directions. • Keep unauthorised personnel away. • Keep upwind.
Evacuation	**Large spill** • Consider initial downwind evacuation of areas within at least 50 m. **Fire** • When a large quantity of this material is involved in a major fire, consider initial evacuation of areas within 100 m in all directions.

EMERGENCY RESPONSE	
Fire	**Small fire** • Use dry chemical, CO_2, water spray or foam. • If safe to do so, move undamaged containers from fire area. **Large fire** • Use water spray, fog or foam. • Cool containers with flooding quantities of water until well after fire is out. **Fire involving tanks** • Fight fire from protected position or use unmanned hose holders or monitor nozzles. • Dam fire control water for later disposal. • Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank. • ALWAYS stay away from tank ends.
Spill or leak	• ELIMINATE all ignition sources (no smoking, flares, sparks or flames) within at least 50 m. • Do not touch or walk through spilled material. • Stop leak if safe to do so – Prevent entry into waterways, drains or confined areas. **Small spill** • Absorb with earth, sand or other non-combustible material and transfer to container. • **SEEK EXPERT ADVICE ON HANDLING AND DISPOSAL.**
First aid	• Remove victim to fresh air – Apply resuscitation if victim is not breathing – Administer oxygen if breathing is difficult. • Remove contaminated clothing and shoes immediately. • Remove material from skin immediately. • In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. • Keep victim warm and quiet – Obtain immediate medical care. • Ensure that attending medical personnel are aware of the identity and nature of the product(s) involved, and take precautions to protect themselves.

GUIDE 06	GASES – SLIGHTLY TOXIC AND/OR CORROSIVE AND FLAMMABLE Compressed, liquefied or deeply refrigerated (cryogenic)
HAZARDS	
Fire or explosion	• Vapours from liquefied gas are usually heavier than air. • Containers may explode when heated – Ruptured cylinders may rocket. • May burn but do not ignite readily. • Fire may produce irritating, toxic, and/or corrosive gases.
Health	• High concentration of gas may cause asphyxiation without warning. • Some are irritants. • Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
PROTECTIVE CLOTHING	
	• Wear SCBA and fully encapsulated, gas-tight suit. • If a fully encapsulated, gas-tight suit is not available chemical splash suits should be a preferred option over structural firefighting uniform. • Structural firefighter's uniform will provide limited protection. • Always wear thermal protective clothing when handling cryogenic liquids and associated equipment.
PUBLIC SAFETY	
	• Spill or leak area should be isolated immediately for at least 50 m in all directions. • Keep unauthorised personnel away. • Many gases are heavier than air and will collect in low or confined areas (drains, basements, tanks). • Ventilate enclosed spaces before entering.
Evacuation	**Large spill** • Consider initial downwind evacuation of areas within at least 500 m. **Fire** • When any large containers (including rail and road tankers) are involved in a fire, consider initial evacuation of areas within 800 m in all directions.

GUIDE 06	GASES – SLIGHTLY TOXIC AND/OR CORROSIVE AND FLAMMABLE Compressed, liquefied or deeply refrigerated (cryogenic)
EMERGENCY RESPONSE	
Fire	• **DO NOT EXTINGUISH BURNING GAS UNLESS LEAK CAN BE STOPPED.** • CUT OFF SOURCE OF GAS IF SAFE TO DO SO – IF NOT POSSIBLE, LEAVE GAS TO BURN, PROTECT EXPOSURES, COOL CONTAINERS. • If safe to do so, move undamaged containers from fire area. • Extinguish secondary fire. **Small fire** • Use dry chemical, CO_2 or water spray to extinguish burning gas if absolutely necessary and safe to do so – Do not use water jets. **Large fire** • Cool container by directing flooding quantities of water into upper surface until well after fire is out – Do not direct water at source of leak or venting safety devices as icing may occur. • Cool container and fight secondary fire from protected position or use unmanned hose holders or monitor nozzles – When impossible withdraw immediately from hazard area and let burn. • Withdraw immediately in case of rising sound from venting safety devices or discolouration of tank – tank may explode. • ALWAYS stay away from tank ends. • Damaged containers should only be handled following expert advice.
Spill or leak	• ELIMINATE all ignition sources (no smoking, flares, sparks or flame) within at least 50 m – All equipment used when handling the product must be earthed. • Do not touch or walk through spilled material. • Stop leak if safe to do so – If possible, turn leaking container so that gas escapes rather than liquid – Prevent entry into waterways, drains and confined areas. • Use water spray, fog or vapour-suppressing foam to knock down vapours or divert vapour clouds – Do not direct water at source of leak or venting safety devices as icing may occur. • Allow substance to evaporate – Ventilate the area. **Caution:** When in contact with cryogenic liquids, most materials become brittle and are likely to break without warning.
First aid	• Remove victim to fresh air – Apply resuscitation if victim is not breathing. • Administer oxygen if breathing is difficult. • Remove contaminated clothing and shoes immediately – Clothing frozen to the skin should be thawed before being removed – In case of frostbite, thaw with lukewarm water. • Keep victim warm and quiet – Obtain immediate medical care – Ensure that attending medical personnel are aware of identity of product(s) involved, and take precautions to protect themselves. • CONTACT POISONS INFORMATION CENTRE/NATIONAL POISONS CENTRE FOR FURTHER ADVICE (SEE INSIDE BACK COVER).

GUIDE 07 | GASES – TOXIC AND/OR CORROSIVE
Compressed, liquefied or deeply refrigerated (cryogenic)

HAZARDS

Fire or explosion

- Vapours from liquefied gas are usually heavier than air.
- Containers may explode when heated – Ruptured cylinders may rocket.
- May react violently with water.
- Fire may produce irritating, toxic, and/or corrosive gases.

Health

- TOXIC, MAY BE FATAL IF INHALED, SWALLOWED OR ABSORBED THROUGH THE SKIN.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Runoff may pollute waterways.

PROTECTIVE CLOTHING

- Wear SCBA and fully-encapsulating, gas-tight suit when handling leaking or damaged cylinders or equipment.
- Chemical splash suit and structural firefighting uniform offer inadequate protection from this hazard.
- Always wear thermal protective clothing when handling cryogenic liquids and associated equipment.

PUBLIC SAFETY

- **IMMEDIATELY CONTACT POLICE OR FIRE BRIGADE (SEE INSIDE BACK COVER).**
- Spill or leak area should be isolated immediately for at least 100 m in all directions.
- Keep unauthorised personnel away.
- Many gases are heavier than air and will collect in low or confined areas (drains, basements, tanks).
- Keep upwind and to higher ground.
- Ventilate enclosed spaces before entering.

Evacuation

Large spill

- Consider initial downwind evacuation of areas within at least 800 m.

Fire

- When any large containers (including rail and road tankers) are involved in a fire, consider initial evacuation of areas within 1500 m in all directions.