Appendix B4

Soil and Surface Water CEMP Sub-plan

M6 Stage 1

December 2021

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Contents

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Dated	15/12/2021
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The document is uncontrolled when printed. One controlled hard copy of the CEMP and supporting documentation will be maintained by the Quality Manager at the Project office and on the Project website.

Copy number	Issued to	Version

Glossary/ Abbreviations

Abbreviations	Expanded text
ASS	Acid Sulfate Soil
CEMP	Construction Environmental Management Plan
CLMP	Contaminated Land Management Plan
CoA	Conditions of Approval
CSSI	Critical State Significant Infrastructure
DPIE	Department of Planning, Industry and Environment
EIS	Environmental Impact Statement
ESCP	Erosion and Sediment Control Plan
EMM	Environmental Management Measures
EMS	Environmental Management System
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EWMS	Environmental Work Method Statements
PIRMP	Pollution Incident Response Management Plan
POEO Act	*Protection of the Environment Operations Act 1997*
RUSLE	Revised Universal Soil Loss Equation
SSWMP	Soil and Surface Water Management Plan
TfNSW	Transport for New South Wales
TSC Act	*Threatened Species Conservation Act 1995*

1 Introduction

1.1 Context

This Soil and Surface Water Construction Environmental Management Plan (CEMP) Sub-plan (the SSWMP) forms part of the CEMP for the M6 Stage 1 (the Project).

The SSWMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Environmental Management Measures (EMM) listed in the M6 Stage 1 Environmental Impact Statement (EIS) and applicable legislation.

1.2 Background and project description

The Project comprises a new twin motorway tunnel (around four kilometres (km) in length) between the M8 Motorway at Arncliffe and President Avenue at Kogarah with a tunnel portal and entry and exit ramps connecting the tunnels to the surface Figure 1. Works will include a connection to the M8 Motorway, line marking of additional travel lanes between the St Peters interchange to the M6 Stage 1 tunnels, an intersection with President Avenue (including widening and raising of President Avenue), and intersection improvements at the President Avenue/Princes Highway intersection. Mainline tunnel stubs would be constructed to allow for connections to future stages of the M6 Extension.

The Project was declared Critical State Significant Infrastructure (CSSI) and was approved by the Minister for Planning and Public Spaces on 18 December 2019.

Key features of the Project include:

- Mainline tunnels approximately 3km in length, sized for three lanes of traffic and line marked for two lanes on opening of the motorway;
- Entry and exit ramp tunnels approximately 1.5km in length and a tunnel portal connecting the tunnels to a surface intersection with President Avenue;
- Provision of a new intersection at President Avenue including the widening and raising of President Avenue at this location;
- Upgrade of the President Avenue and Princes Highway intersection to improve capacity and network integration;
- Provision of a new shared cycle and pedestrian pathways;
- Mainline tunnel stubs for a future connection to extend the Project to the south;
- Two motorway operation complexes (MOCs) as follows:
    - Arncliffe: including mechanical and electrical fit-out of the ventilation facility built by the New M5 Motorway project, and provision of a new water treatment plant and substation.
    - Rockdale (south): including a ventilation building, Disaster Recover Site (DRS), substation and power supply, deluge tanks.
- A tunnel ventilation system, including ventilation facilities located at Marsh Street, Arncliffe and West Botany Street, Rockdale, and in-tunnel ventilation systems (jet fans and ventilation ducts);
- New Utility Services, and modifications and connections to existing Utility Services;
- A permanent power supply connection to the Rockdale Ventilation Facility Site MOC from Ausgrid's Canterbury Sub-Transmission Substation;
- Emergency access and evacuation facilities, including pedestrian and vehicular cross, long passages, fire and safety life systems;

- Ancillary infrastructure for motorway operations including operations management and control systems, permanent power supply, communications, lighting, electronic toll collection system, toll gantries and traffic control and signage (both fixed and variable signage);
- Drainage infrastructure to collect surface water and groundwater inflows for treatment;
- Reinstatement of Bicentennial Park and recreation facilities;
- Reinstatement and rehabilitation of construction leased areas within the Arncliffe Site;
- Minor adjustments to local roads in the Project area;
- Development and implementation of systems integration and operating procedures with WestConnex Motorways to ensure safe operation of the interfaces between the Project and the WestConnex Motorways; and
- Any other works as required under the D&C Deed and the SWTC.

The following six surface compounds will facilitate construction of the Project:

- Arncliffe construction ancillary facility (C1), an existing construction site which was used for the construction of the M8 Motorway;
- Rockdale construction ancillary facility (C2), within an existing Transport for New South Wales (TfNSW) depot;
- President Avenue construction ancillary facility (C3) at Rockdale, within Rockdale Bicentennial Park and an industrial area west of West Botany Street;
- Construction ancillary facilities (C4 and C5) near Muddy Creek to support construction of the Active Transport Corridor; and
- Princes Highway construction ancillary facility (C6) on the corner of Princes Highway and President Avenue, Kogarah to support the intersection surface works.

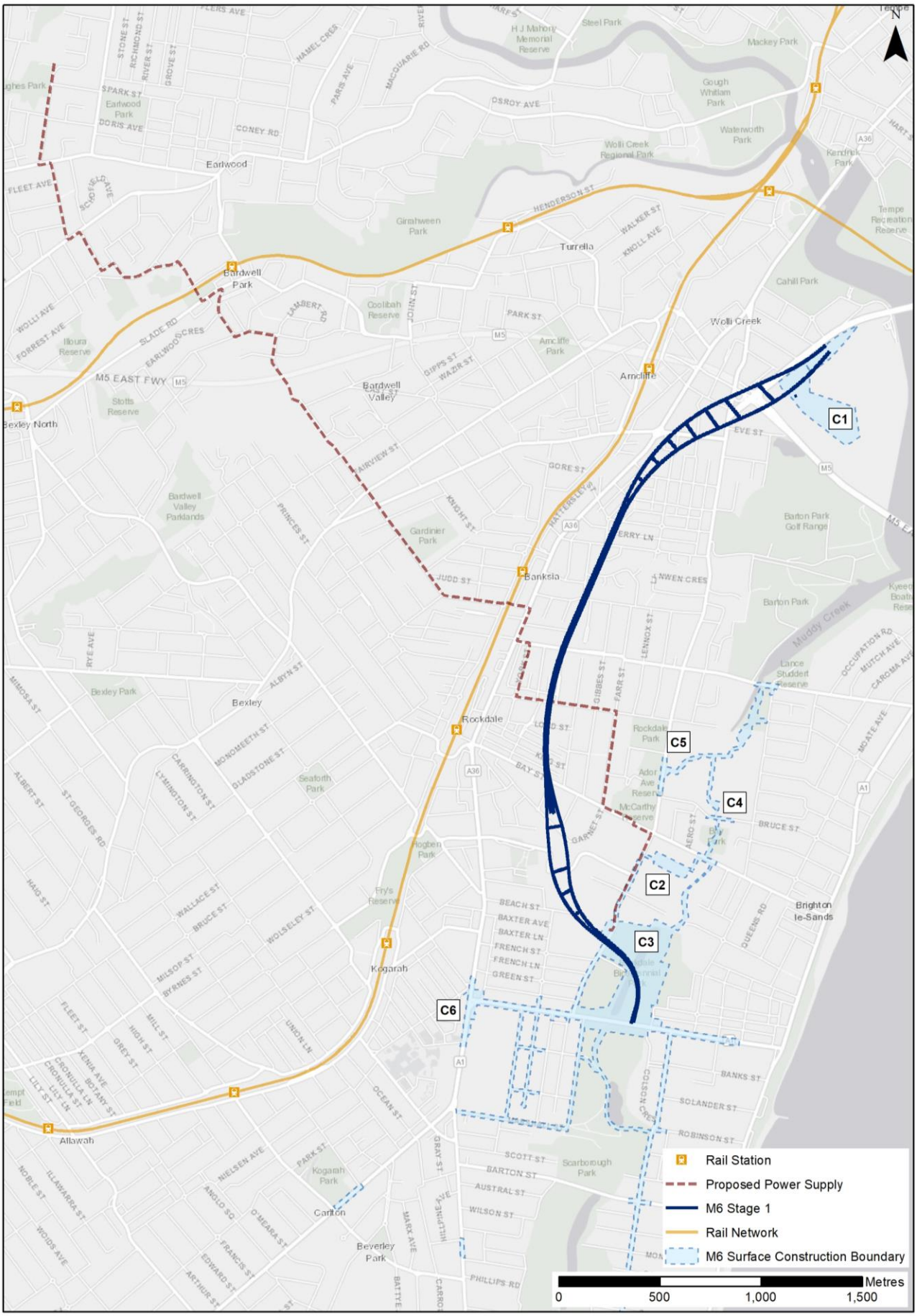

Figure 1 Project overview

1.3 Scope of SSWMP

The scope of this SSWMP is to describe how CPB Contractors, Ghella, UGL Engineering Joint Venture (CGU) proposes to manage potential soil and surface water quality impacts during construction of the Project. Operational impacts and operational measures do not fall within the scope of this SSWMP and are not included in this document. These will be included in the Operational Environmental Management Plan.

1.4 Environmental management system overview

The environmental management system is based on CPB Contractors Environmental Management System (EMS). An overview of the EMS is described in Section 1.5 of the CEMP.

1.5 Consultation for preparation of SSWMP

The SSWMP and associated monitoring program have been prepared in consultation with Department of Planning, Industry and Environment (DPIE) Water, NSW Environment, Energy and Science (EES), Sydney Water, Environmental Protection Authority (EPA) and relevant Councils (Bayside Council, Georges River Council and Canterbury-Bankstown Council).

DPIE Water is the agency responsible for providing advice on Groundwater Monitoring and Modelling Plans, and Surface Water and Groundwater Monitoring Plans; however, they have not commenced review despite several contact attempts. Further consultation will be carried out with DPIE Water and any comments will be incorporated into this plan (the Soil and Surface Water CEMP Sub-plan) and the Surface Water Monitoring Program.

Sydney Water, Georges River Council and Canterbury-Bankstown Council did not provide feedback specific to the SSWMP. For a summary of consultation refer to Table 1.

Table 1 Summary of consultation

Name of Stakeholder	Stakeholder Comments	CGU Response	Outstanding Issues
Bayside Council	Council noted that water from the WTP(s) will be reused for construction activities where possible.	N/A	None
	It is not clear whether the water from dewatering and other activities will be discharged into Sydney Waters Sewerage System or into Council's surface water system and creeks or the Cooks River and whether there is any groundwater recharge system at Bicentennial, and whether there at WTPs at all three sites being Arncliffe, West Botany Street Depot and Bicentennial Park.	Water treatment plants during the construction phase will be at all three tunnelling sites being C1 Arncliffe, C2 Rockdale depot and C3 Bicentennial Park. At the completion of construction, there will be one water treatment plant for operation (separate from the construction phase plants), which will be located at Arncliffe. Water will be reused as far as possible, minimising the amount of excess; however excess water will be discharged to surface waters in accordance with a project EPL. Water discharge impact assessments will be prepared for the EPA in accordance with their requirements.	CGU to prepare Detailed Water Discharge Impact Assessments according to EPA requirements.
	The Soil and Surface Water CEMP subplan (5.2) states that where possible stormwater and construction water from the project (including discharges from construction water treatment plants (WTPs) will be discharged into the existing stormwater system. Section 5.2.2 also states that a discharge impact assessment will be prepared for the EPA and discharge criteria negotiated for the project. Monitoring and reporting will be done in accordance with the Environment Protection Licence (EPL) and the Surface Water Monitoring Program (SWMP). There does not appear to be any notification or consultation with Council outlined in the CEMP for this discharge. Can it be assumed that there will be no discharge of water from groundwater dewatering or the water	It is not proposed to discharge into council assets, however if a connection to an asset is required, approval for the connection will be sought from the asset owner prior to the connection.	If a connection to council assets is required, CGU will seek approval from the council.

Name of Stakeholder	Stakeholder Comments	CGU Response	Outstanding Issues
	treatment plants into any of Councils stormwater system?		
	It is not clear whether there are treatment plants at all three sites being Arncliffe, Rockdale Depot and Bicentennial Park, whether there is going to be groundwater recharge at Bicentennial, and where it is going to be discharged for each site i.e. Sydney Waters sewerage system, Cooks River/Muddy Creek or Councils stormwater system, or a combination of these. Sydney Water do not permit water from dewatering to be discharged into their sewerage system. If it is proposed to discharge the water from dewatering, whether through the WTPs or not, into Council managed or Sydney Water managed stormwater system, what approval will be sought from the responsible party?	Water treatment plants during the construction phase will be at all three tunnelling sites being C1 Arncliffe, C2 Rockdale depot and C3 Bicentennial Park. At the completion of construction, there will be one water treatment plant for operation (separate from the construction phase plants), which will be located at Arncliffe. Water will be reused as far as possible, minimising the amount of discharge required. This reuse will include (where possible), groundwater recharge, further minimising disposal. It is not proposed to discharge into council assets (noting ownership cited in previous answer), however if a connection to an asset is required, approval for the connection will be sought from the asset owner prior to the connection.	If a connection to council assets is required, CGU will seek approval from the asset owner.
	Council asked that when considering the water quantity and quality parameters for the discharge into surface waters to ensure that the sensitive swimming environments/enclosures of Brighton Le Sands and Kyeemagh are considered when the quality parameter criteria are being approved by the EPA. They also asked for clarification of the maximum/average discharge at each site from the WTP into the stormwater system and timeframes of discharges proposed.	Detailed Water Discharge Impact Assessments will be prepared for EPA consideration. The Water Discharge Impact Assessments will consider the nature of the receiving waters (including the sensitive nature of the Scarborough wetlands, Botany Bay including Brighton Le Sands and the Cooks River at Kyeemagh), and the potential impact from the discharge quality and quantities. While information regarding discharge was included in the EIS, completing water discharge impact assessments is a further way of assessing detailed and specific information to ensure the protection of these environments.	CGU to prepare Detailed Water Discharge Impact Assessments for EPA consideration.

Name of Stakeholder	Stakeholder Comments	CGU Response	Outstanding Issues
Canterbury Bankstown Council	No comment	None	None
DPIE Water	The Natural Resources Access Register (NRAR) receives post approval requests for coordination with DPIE Water and requests should be directed to them.	Plan was sent to the NRAR on 11/10/21	None
EES	The SSWMP does not include the requirements and performance criteria for the assessment and management of flooding risks during the construction and operational stages of the infrastructure.	Flood Management Strategy Report dated 24 September 2021 was issued to EES for consultation. Reference to Flood Management Strategy Report updated in SSWMP	None
Georges River Council	Council has no objections	None	None
NRAR	Thank you for your enquiry about the progress of your enquiry: Reference number V15/3875-5#87. We apologise for the delay in providing our response to your enquiry, and any inconvenience this delay has caused. We are currently experiencing a high number of Enquiries which is affecting our response times. We are endeavouring to address all enquiries as soon as possible, in the order in which we have received the enquiries. An NRAR officer (Jessica Braden) has been assigned to your enquiry and we will update you as soon as possible regarding its progress.	N/A	NRAR and DPIE Water have been in receipt of the Soil and Surface water CEMP Sub-plan and Surface Water Monitoring Program for more than 5 weeks and have not commenced review (despite several contact attempts). The Soil and Surface water CEMP Sub-plan and Surface Water Monitoring Program are submitted for approval by DPIE while NRAR delays continue, however the Project commits to receiving and responding to NRAR feedback on the Soil and Surface water CEMP Sub-plan and Surface Water Monitoring Program when/if it is received. If amendment of either document is required following NRAR's feedback, the documents will be updated and submitted to the ER for endorsement

Name of Stakeholder	Stakeholder Comments	CGU Response	Outstanding Issues
			within 4 weeks of receipt of feedback (and sent to DPIE for approval if/where required)
Sydney Water	Concerns about Sydney Water's Muddy Creek works (restoration and naturalisation) limiting the capacity of the area to receive water while there is ongoing work	CGU continues to work with Sydney Water on matters regarding the Muddy Creek Naturalisation Project.	Consultation will be undertaken with the Sydney Heritage Advisor if it becomes evident that any Sydney Water Heritage items may be impacted

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how CGU proposes to manage and protect soils and surface water quality during construction of the Project.

2.2 Objectives

The key objective of the SSWMP is to ensure all CoA, EMM and licence/permit requirements relating to soil and surface water including water quality are described, scheduled and assigned responsibility as outlined in:

- The environmental assessment prepared for the Project, including the EIS, the Response to Submissions on the EIS, the PIR and Response to Submissions on the PIR;
- CoA granted to the Project on 18th December 2019 (SSI 8931);
- TfNSW specifications G36, G38 and G40;
- Environmental Protection Licence (EPL) 21600; and
- All relevant legislation and other requirements described in Appendix A1 of the CEMP.

2.3 Environmental performance outcomes and targets

Environmental performance outcomes for soil and water management, as outlined and addressed in the EIS are detailed in Table 2, which summarises how CGU will meet relevant to targets to achieve the required performance outcomes.

Table 2 Project performance outcomes

Performance Outcome	Project Outcome	Reference
Long term impacts to surface water quality are minimised. Environmental values of nearby, connected and affected water sources, groundwater and groundwater dependent ecosystems including Muddy Creek, Cooks River, Rockdale Park Ponds, Scarborough Ponds and Botany Bay are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources.	Establish water quality discharge criteria with consideration of NSW Water Quality Objectives. Effectively treat water to meet water quality discharge criteria. Potential impacts to surface water hydrology, geomorphology and water resources are considered to be confined to the construction footprint with the application of the proposed management measures. Treated construction wastewater will be discharged to highly disturbed, less sensitive, estuarine environments. Baseline and continuous surface water and groundwater level monitoring will be conducted prior to and during construction works	Section 7.4 Table 11 SWMM3 Table 3 Section 5.2.2 Appendix E

Performance Outcome	Project Outcome	Reference
	The project will aim to maximise reuse of treated water.	
The Project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the Project to the extent of the Project impact including estuarine and marine waters (if applicable)	Erosion and sediment controls will be implemented in accordance with Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (DECCW 2008), commonly referred to as the 'Blue Book'. Potential impacts to surface water quality during construction of the project are considered to be managed with the application of the proposed management measures. Potential impacts to surface water quality during operation of the project are able to be mitigated by the proposed design and application of the proposed management measures.	Table 11 Appendix A – Erosion and Sediment Control Procedure Sections 5.2.3, 5.2.5, 7.3 and 7.7
Environmental values of land, including soils, subsoils and landforms are protected. Risks arising from disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination	Risks arising from the disturbance of soil and groundwater contaminated and acid sulfate soils would be mitigated during construction and operation through investigation and identification during construction, with implementation of appropriate management measures. Acid sulfate soils and other contamination will be managed in accordance with good practice measures to protect environmental values and humans health.	Table 11 Appendix D – Acid Sulfate Soil Management Plan Sections 5.2.3, 5.2.5, 7.3 and 7.7

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

All legislation relevant to this SSWMP is included in Appendix A1 of the CEMP.

3.1.2 Guidelines and standards

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

- Acid Sulfate Soil Manual (ASSMAC 1998);
- Acid Sulfate Soil and Rock – Victorian EPA Publication 655.1 – July 2009;
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000);
- Default Guideline Values Toxicant default guideline values for protecting aquatic ecosystems (ANZG 2018);
- 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);
- Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries;
- *NSW Fisheries, November 2003. Fishnote – Policy and Guidelines for Fish Friendly* Waterway Crossings (Ref: NSWF – 1181);
- Road and Maritime Dewatering Guideline (2011);
- Roads and Maritime Management of Wastes on Roads and Maritime Services Land (2014);
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (2004);
- RTA’s Code of Practice for Water Management – Road Development and Management (1999);
- Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze (RTA 2005);
- Roads and Maritime Environment Direction Management of Tannins from Vegetation Mulch (2012);
- Roads and Maritime Stockpile Site Management Guideline (2011); and
- Environmental Best Management Practice Guideline for Concreting Contractors, DEC (2004);
- Controlled Activities on Waterfront Land guidelines (DPI 2012);
- Site Investigations for Urban Salinity (DLWC 2002).

3.2 Minister's Conditions of Approval

CoA relevant to this Plan are listed in Table 3. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documents.

Table 3 Conditions of Approval relevant to SSWMP

<table>
<tr><th>CoA No.</th><th>Condition Requirements</th><th>Document Reference</th></tr>
<tr><td>C4</td><td>CEMP Sub-plans must be prepared in consultation with the relevant government agency(s) and council(s) as identified for each CEMP Sub-plan in Table 4.
Table 4: CEMP Sub-plan and relevant public authorities
<table>
<tr><th></th><th>Required CEMP Sub-plan</th><th>Relevant government agencies and council(s) to be consulted for each CEMP Sub-plan</th></tr>
<tr><td>(e)</td><td>Soil and Surface Water</td><td>DPIE Water, EES, Sydney Water (if Sydney Water's assets are affected) and relevant council(s)</td></tr>
</table></td><td>Section 1.5</td></tr>
<tr><td rowspan="3">C5</td><td>The CEMP Sub-plans must state how:
(a) the environmental performance outcomes identified in the documents listed in Condition A1 as modified by these conditions will be achieved;</td><td>Table 1</td></tr>
<tr><td>(b) the mitigation measures identified in the documents listed in Condition A1 as modified by these conditions will be implemented;</td><td>Section 6</td></tr>
<tr><td>(c) the relevant terms of this approval will be complied with; and</td><td>Section 5
Section 6
Section 7
Section 8</td></tr>
</table>

CoA No.	Condition Requirements	Document Reference
	(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.	Section 5 Section 5.2 Table 11 Section 7
C8	The Soil and Surface Water CEMP Sub-plan must include an Acid Sulfate Soils Management Plan to address those areas where acid sulfate soils are known to occur or potentially occur. The Acid Sulfate Soils Management Plan must include measures for the management, handling, treatment and disposal of acid sulfate soils, including monitoring of water quality at acid sulfate soils treatment areas in accordance with the Acid Sulfate Soil Manual (NSW ASSMAC, 1998) and with regard to the Waste Classification Guidelines (NSW EPA, 2014). The Acid Sulfate Soils Management Plan must be reviewed and considered satisfactory by an EPA accredited site auditor.	Appendix C
C12	Construction must not commence until the CEMP and all relevant CEMP Sub-plans for such construction activities to which they apply have been approved by the Planning Secretary. The CEMP and CEMP Sub-plans, as approved by the Planning Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. Where construction is staged, construction of a stage must not commence until the relevant CEMP and CEMP Sub-plans for that stage have been endorsed by the ER and approved by the Planning Secretary.	Section 1.5, Section 2 of the CEMP
C14	Construction Monitoring Programs must provide:	
	(a) details of baseline data available;	Section 3.1.3 of the Surface Water Monitoring Program (SWMP)
	(b) details of baseline data to be obtained and when;	Section 3.1.1 of SWMP
	(c) details of all monitoring that will be undertaken;	Sections 3.1.3, 3.2 and 4 of SWMP

CoA No.	Condition Requirements	Document Reference
	(d) the parameters of the project to be monitored;	Table 4 of SWMP
	(e) the frequency of monitoring;	Section 3.2.4 of SWMP
	(f) the location of monitoring;	Table 3 of SWMP
	(g) the reporting of monitoring and analysis results against relevant criteria, including details of the timing and frequency for reporting the results to the Planning Secretary and relevant government agencies;	Section 3.2.6 and Section 5.5 of SWMP
	(h) details of the methods that will be used to analyse the monitoring data;	Sections 4.1 – 4.6 of SWMP
	(i) procedures to identify and implement additional mitigation measures where results of monitoring indicate adverse impacts or levels above relevant criteria;	Section 3.2.6 of the SWMP
	(j) any consultation to be undertaken in relation to the monitoring programs; and	Section 2.3 of the SWMP
	(k) any specific requirements as required by Conditions C15 to C18, as relevant.	N/A
C19	The Construction Monitoring Programs must be developed in consultation with the relevant government agencies as identified in Condition C13 of this approval, and must identify information, including monitoring parameters, requested by a relevant agency to be included in a monitoring program.	Section 2.3 of the SWMP
C20	The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Planning Secretary for approval at least one (1) month prior to the commencement of construction.	Section 2 of CEMP
C21	Construction, which is required to be monitored under the Construction Monitoring Programs, must not commence until the Planning Secretary has approved all of the required Construction Monitoring Programs and all relevant baseline data for the specific construction activity has been collected.	Section 2 of CEMP

CoA No.	Condition Requirements	Document Reference
C22	The Construction Monitoring Programs, as approved by the Planning Secretary and including any minor amendments approved by the ER, must be implemented for the duration of construction and for any longer period set out in the monitoring program or specified by the Planning Secretary, whichever is the greater.	Section 3.2.3 of SWMP
C23	The results of the Construction Monitoring Programs must be made publicly available in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program. Note: Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	Table 7 of SWMP
E111	All reasonably practicable erosion and sediment controls must be installed and appropriately maintained to minimise water pollution. When implementing such controls, any relevant guidance in the Managing Urban Stormwater series must be considered.	Table 11 SWMM5, SWMM8 - SWMM18, SWMM29 – SWMM31, SWMM53
E168	The CSSI must be designed, constructed and operated so as to maintain the NSW Water Quality Objectives where they are being achieved as at the date of this approval, and contribute towards achievement of the NSW Water Quality Objectives over time where they are not being achieved as at the date of this approval, unless an EPL in force in respect of the CSSI contains different requirements in relation to the NSW Water Quality Objectives, in which case those requirements must be complied with. Note: Discharge criteria for construction water treatment plant discharges will be included in the EPL for the project.	Table 13 SWMM3 Section 5.2.2
E170	Drainage feature crossings (permanent and temporary watercourse crossings and stream diversions) and drainage swales and depressions must be carried out in accordance with relevant guidelines and designed by a suitably qualified and experienced person.	Table 13 SWMM19
E171	Works on waterfront land must be carried out in accordance with controlled activity guidelines.	Table 13 SWMM55

3.3 Environmental Management Measures

Relevant EMMs are detailed in Table 4. This includes reference to required outcomes, the timing of when the commitment applies, relevant documents or sections of the environmental assessment influencing the outcome and implementation.

Table 4 EMMS relevant to SSWMP

Outcome	Ref #	Commitment	Timing	Reference
Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material	SC1	A Construction Soil and Water Management Plan (CSWMP) will be prepared for the project. The plan will detail the process and measures to manage and monitor soil and water impacts associated with the construction works, including contaminated land. The CSWMP will: • Describe measures to minimise and /or manage sediment and erosion within the project footprint, including overland flow, including requirements for Erosion and Sediment Control Plans (ESCP).	Prior to construction	Table 13 Appendix A - Erosion and Sediment Control Procedure Appendix E – Water Reuse and Discharge Management Procedure
		• Describe stockpile management measures, including location restrictions, separation of waste types, stabilisation and sediment controls	Prior to construction	Table 13 SWMM29 to SWMM33
		• Describe measures for managing waste, including spoil classification and handling	Prior to construction	Waste CEMP Sub-plan
		• Describe procedures for managing unexpected contamination finds	Prior to construction	Contamination CEMP Sub-plan Appendix A Unexpected Finds Procedure

Outcome	Ref #	Commitment	Timing	Reference
		• Describe procedures for managing groundwater impacts including treatment requirements	Prior to construction	Appendix E – Water Reuse and Discharge Management Procedure Groundwater CEMP Sub-plan
		• Describe procedures for dewatering accumulated water on site and within sediment basins, including discharge criteria and sign off	Prior to construction	Appendix E – Water Reuse and Discharge Management Procedure
		• Describe spill management procedures including requirements for locating and maintaining spill response materials such as spill kits	Prior to construction	SWMM46 Appendix D - Spill Management Procedure
		• Detail surface water and groundwater monitoring requirements, including discharge criteria.	Prior to construction	Appendix E – Water Reuse and Discharge Management Procedure
		• Measures are to be consistent with the Blue Book (Landcom 2004) and relevant Roads and Maritime guidelines.	Prior to construction	Appendix A – Erosion and Sediment Control Procedure

Outcome	Ref #	Commitment	Timing	Reference
Soil and surface water quality	SC4	Construction water treatment plants will be established and operated at the Arncliffe Construction Ancillary Facility (C1), Rockdale Construction Ancillary Facility (C2) and President Avenue Construction Ancillary Facility (C3) to treat water from the tunnel works. Discharge from these plants will be managed to achieve the applicable ANZECC criteria. Where feasible, water from the water treatment plants will be reused for construction activities.	Construction	Section 4.3.1 Appendix E – Water Reuse and Discharge Management Procedure
Acid sulfate soils	SC5	An Acid Sulfate Management Plan will be prepared detailing processes to manage actual and potential acid sulfate soils disturbed during construction.	Construction	Appendix C – Acid Sulfate Soil Management Plan
Erosion and sedimentation	SC7	A soil conservation specialist will be engaged for the duration of construction to provide advice regarding erosion and sediment control.	Construction	Table 13 SWMM9 Sections 5.2.3 and 5.2.5
Salinity	SC8	Prior to ground disturbance in areas of very high potential soil salinity, testing will be carried out to confirm the presence of saline soils. If saline soils are encountered, they will be managed in accordance with Site Investigations for Urban Salinity (DLWC 2002).	Construction	Section 4.2.1
Impacts on surface water quality	SWF1	A program to monitor potential surface water quality impacts of the project will be developed and included in a Construction Soil and Water Management Plan (CSWMP). The program will include the water quality monitoring parameters (including pH, turbidity, dissolved oxygen, nitrogen and metals) and the monitoring locations (including Muddy Creek, Rockdale	Prior to construction Construction	Appendix B – SWMP Appendix B5 Groundwater CEMP Sub-plan (Appendix

Outcome	Ref #	Commitment	Timing	Reference
		Bicentennial Park, North Scarborough Ponds and Cooks River) identified in Annexure G of Appendix L (Surface water technical report) Continuous surface water level and groundwater level monitoring will be undertaken within Bicentennial Park Pond and surrounding area for at least 12 months prior to the commencement of construction. Monthly groundwater quality would also be undertaken in the surrounding area. The data would be used as a baseline to monitor impacts on surface and groundwater levels and groundwater quality within the Pond during construction. In the instance that during detailed design it cannot be demonstrated that treated construction wastewater would meet the discharge criteria for Scarborough Ponds, in particular nutrient concentrations, treated construction wastewater from C2 and C3 will be discharged to the Muddy Creek stormwater catchment.		A – Groundwater Monitoring Program)
Impacts on surface water quality	SWF2	If treated construction wastewater (including extracted groundwater) originating from the President Avenue construction ancillary facility (C3) is found to be of a higher temperature than the adjacent surface water receiving bodies that would be discharged to, the potential risk of disrupting thermal stratification in Northern Scarborough Pond will be mitigated by storing and buffering this water in the treatment basin at the C3 facility (until it reaches ambient water temperature) prior to release into Bicentennial Park Pond (at the surface).	Construction	Table 13 SWMM18

Outcome	Ref #	Commitment	Timing	Reference
Impacts on surface water quality	SWF4	The surface water monitoring program will continue for a minimum of three years following the completion of construction, or until the affected waterways are certified by a suitably qualified and experienced independent expert as being appropriately rehabilitated (or otherwise required by any project conditions of approval).	Operation	Appendix B – SWMP Section 3.2.1
Impacts on water bodies	SWF6	All works within watercourses or on waterfront land will be managed in accordance with the Controlled Activities on Waterfront Land guidelines (DPI 2012). The following specific measures are required to manage impacts within Bicentennial Park Pond: Installation of a temporary barrier to isolate the excavation works from the rest of the pond and prevent mobilisation of sediment and pollutants into adjacent areas. Water within the construction zone will be treated by the construction water treatment plant. Sediment mobilised during installation of the barrier will also be managed Retention of hydrologic connectivity through Bicentennial Park Pond throughout construction.	Construction	Table 13 SWMM55 - SWMM58
Impacts on water bodies	SWF8	If the design identifies the risk of scour due to excessive velocities during construction and operation, the appropriate scour and erosion protection measures will be implemented at drainage outlets for both temporary and permanent works.	Prior to construction	Table 13 SWMM19

4 Existing Environment

4.1 Topography

As described in the EIS, the Project is located within the Cooks River catchment, which covers an area of about 10,200 hectares. Wolli Creek is a major waterway located to the immediate north of the project. Wolli Creek is tidal in its lower reaches and is a tributary of the Cooks River. The main surface water features in the vicinity of the project are the Cooks River and its tributaries; the Marsh Street, Eve Street Wetlands and Landing Lights Wetland at Arncliffe; and Kings Wetland and Rockdale Wetlands at Kogarah. The Towra Point Wetlands, which are Ramsar listed, are located outside of the study area, around 7km to the south-east. The project extends across low lying and elevated areas from the New M5 Motorway at Arncliffe to President Avenue, Kogarah.

Elevated ground (considered to be about relative level (RL) +10 metres Australian Height Datum (AHD) to RL+30 metres AHD) is generally underlain by shallow Hawkesbury Sandstone. Low areas (about RL+3 metres AHD to RL+10 metres AHD) generally cross Quaternary Alluvium.

Low lying areas are located:

- At the intersection of the Project with New M5 Motorway at Arncliffe; and
- South of Rockdale.

Elevated areas are located from:

- Wickham Street to Spring Street at Arncliffe; and
- Tabrett Street, Banksia to around Bay Street, Brighton-Le-Sands.

4.2 Soil landscapes

As described in the EIS, the Project is underlain by seven soil landscapes summarised in Table 5 and shown in Figure 2.

Table 5 Soil characteristics and erosion potential

Soil landscape name	Occurrence/ characteristics	Erosion potential	Mitigation measures
Tuggerah	Gently undulating to rolling coastal dunefields. Extreme wind erosion hazard, non-cohesive, highly permeable soil, very low soil fertility, localised flooding and permanently high-water tables	Low to moderate erosion hazard for non-concentrated flows. Very high to extreme erosion hazard for concentrated flows.	SWMM5 – SWMM11
Warriewood	Level to gently undulating swales, depressions and infilled lagoons on Quaternary sands. Localised flooding and run-on, high water tables, highly permeable soil	The erosion hazard for non-concentrated flows is low. The erosion hazard for concentrated flows is moderate to high and for wind erosion is low to moderate.	SWMM5 – SWMM11

Soil landscape name	Occurrence/ characteristics	Erosion potential	Mitigation measures
Newport	Gently undulating plains to rolling rises of Holocene sands mantling other soil materials or bedrock. Very high soil erosion hazard, localised steep slopes, very low soil fertility, non-cohesive topsoils.	Erosion hazard for non-concentrated flows is generally high but ranges from high to extreme. Erosion hazard for concentrated flows and wind is high.	SWMM5 – SWMM11
Lambert	Undulating to rolling rises and low hills on Hawkesbury Sandstone. Very high soil erosion hazard, rock outcrop, seasonally perched water tables, shallow, highly permeable soil, very low soil fertility.	The soil erosion hazard for non-concentrated flows is usually very high but ranges from low to extreme. The soil erosion hazard from concentrated flow is extreme.	SWMM5 – SWMM11
Gymea	Undulating to rolling rises and low hills on Hawkesbury Sandstone Localised steep slopes, high soil erosion hazard, rock outcrop, shallow highly permeable soil, very low soil fertility	Erosion hazard for non-concentrated flows is generally high to very high but can range from moderate to extreme. Soil erosion hazard for concentrated flows is high to extreme	In addition to the following mitigation measures for high soil erosion hazard areas, planning will have a focus on erosion prevention, by minimising exposed ground, (use of mulches and ground cover and staging hardstand removal) in addition to sediment control. SWMM5 – SWMM11
Disturbed Terrain	Level plain to hummocky terrain, extensively disturbed by human activity, including complete disturbance, removal or burial of soil. Characteristics are dependent on nature of fill. Can include mass movement hazard, unconsolidated low wet strength materials,	Erodibility and erosion hazard is variable depending on nature of the fill and surface cover.	SWMM5 – SWMM11

Soil landscape name	Occurrence/ characteristics	Erosion potential	Mitigation measures
	impermeable soil, poor drainage, localised very low fertility and toxic materials.		
Hawkesbury	Rugged, rolling to very steep hills on Hawkesbury Sandstone. Extreme soil erosion hazard, steep slopes, rock outcrop, shallow, stony, highly permeable soil, low soil fertility.	Erosion hazard for non-concentrated flows is generally very high and ranges from moderate to extreme. The soil erosion hazard for concentrated flows is extreme.	SWMM5 – SWMM11

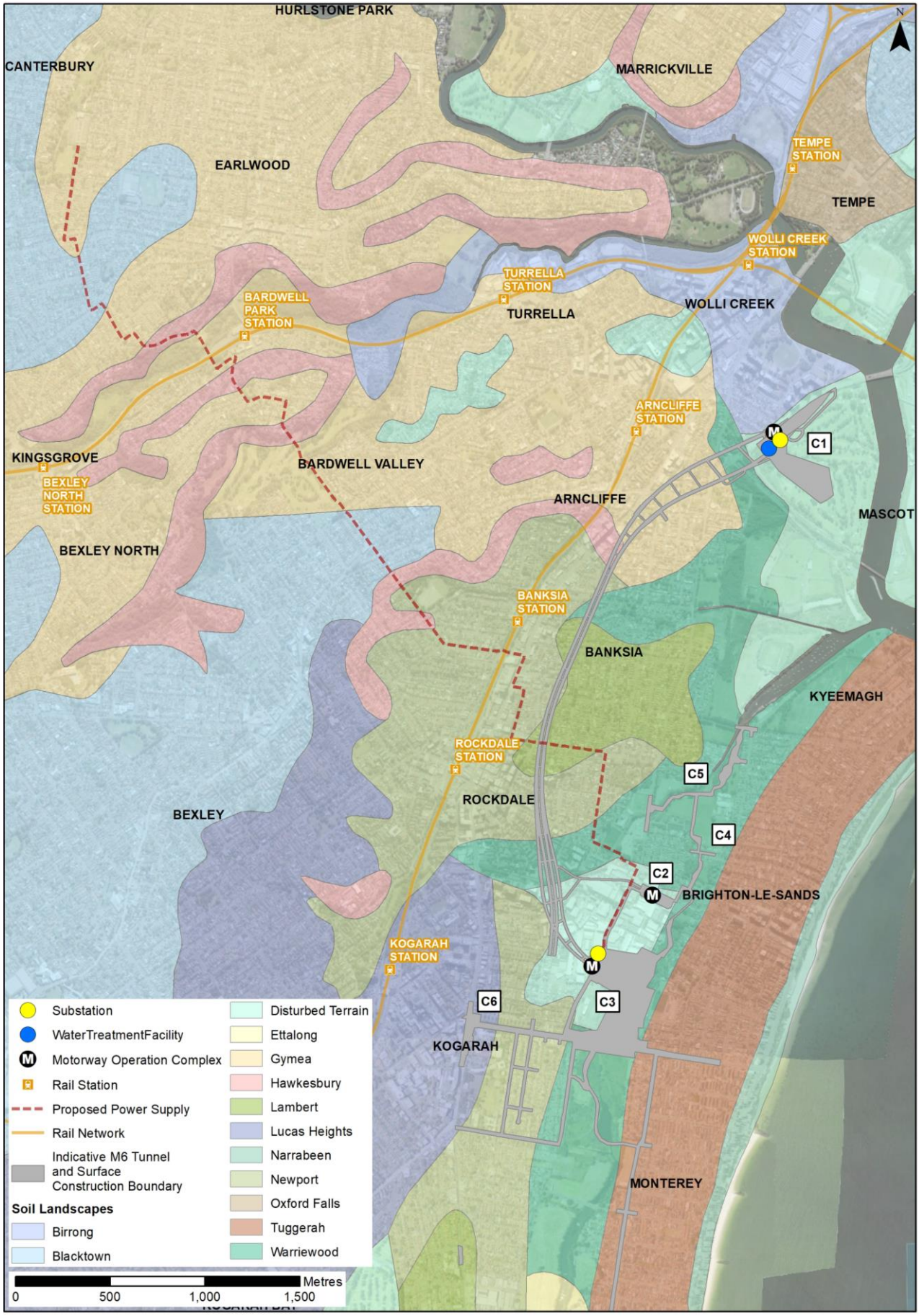

Figure 2 Soil landscapes

4.2.1 Soil salinity

Soil salinity hazard mapping in relation to the Project footprint is shown in Figure 3, which indicates areas of the Project are located within zones depicted as having high risk of saline soils. Prior to ground disturbance in areas identified as having a high risk of saline soils, site investigations will be undertaken in accordance with Site Investigations for Urban Salinity (DLWC 2002) and include:

- Site walkover;
- Site analysis including test pits or installing piezometers; and
- Sample analysis of soil and water samples.

Sample analysis results will assist in determining appropriate management and evaluation techniques.

Construction ancillary facilities at C1, C2, C3, C4 and C5 are situated in areas of very high salinity hazard, closely related to the acid sulfate soil settings where low lying and waterlogged estuarine sediments are present. Regular inundation from brackish tidal water contributes to salt storage in these areas. Whilst minor shallow earthworks are unlikely to give rise to salt contents and in turn increase salinity risks, the following aspects will be managed:

- Concrete and steel structures will be managed in accordance with durability recommendations from structural engineers.
- In areas near fresh/saline water interface, dewatering activities to facilitate shaft and tunnel decline excavations may lead to groundwater drawdown which has the potential to result in saline water intrusion and will need to be further assessed and managed.

Risk of works resulting in adverse impacts is low. However, the Acid Sulfate Soil and Salinity Assessment Report (ASSSAR) has been developed to further characterise potential soil salinity risk for the Project. This Report is iterative and will continue to be developed during the design phase of the Project.

Groundwater in the coastal deposit aquifer is fresh with TDS concentrations typically below 500 mg/L. Under existing conditions groundwater discharges to the wetlands to the east of the project alignment or continues to the coast. Many of these wetlands are tidally influenced and contain saline or brackish water.

Project modelling, including particle tracking, has been used to show the predicted movement of saline water as it is drawn into the aquifer and towards the drained structures. Groundwater drawdown of 0.5 m or more has been assumed as a trigger for potentially reversing hydraulic gradients at saline surface water features leading to saline groundwater intrusion.

In accordance with ASSAR, at locations of moderate or higher salinity risk, a Site Contamination Report/s will be prepared by a suitably qualified and experienced person and completed in accordance with the Site Investigations for Urban Salinity (DLWC 2002). If saline soils are encountered, they will be managed in accordance with the Site Contamination Report and/or RAP. The ASSSAR will continue to be updated with this information and utilised in the management of Saline Soils.

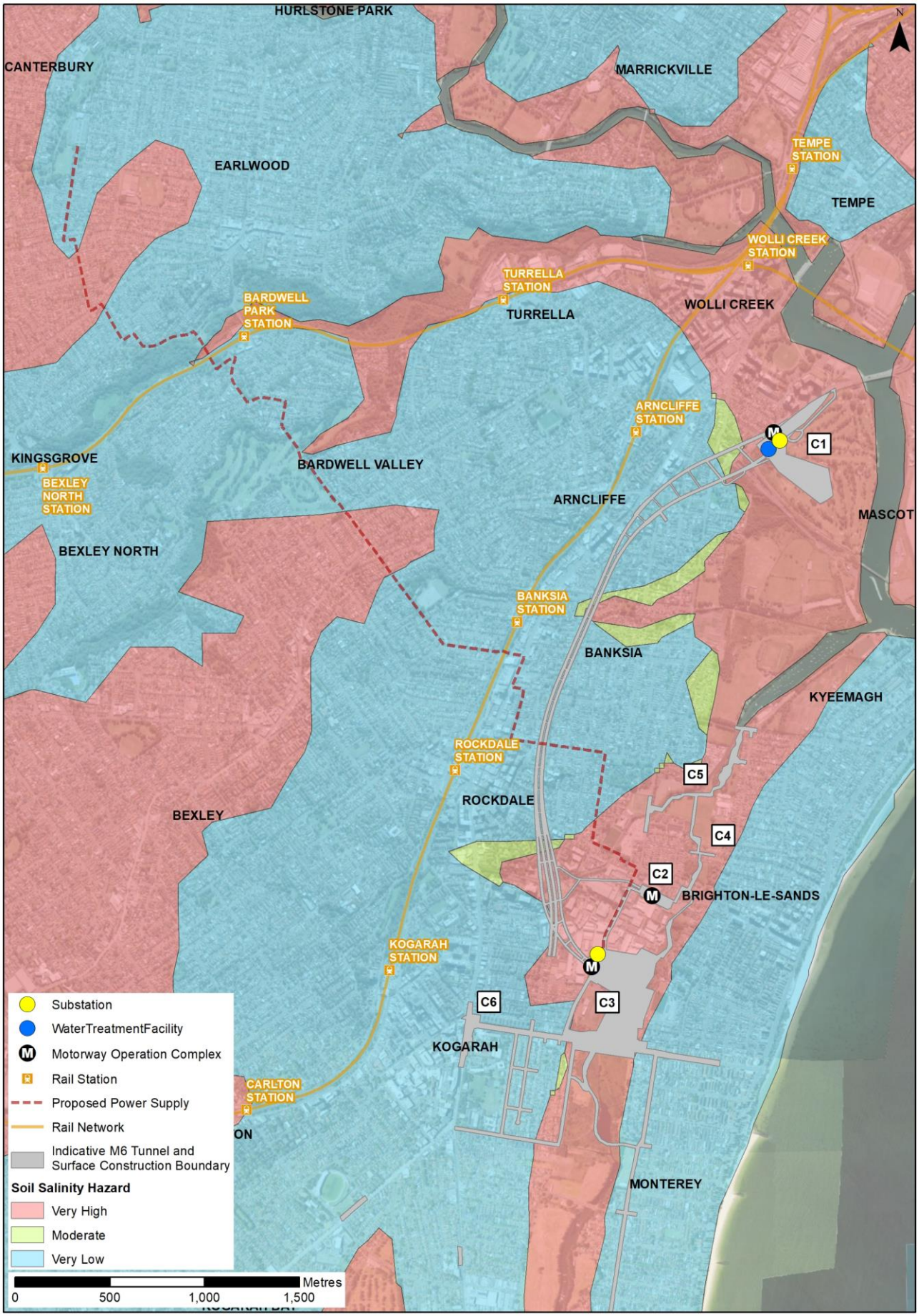

Figure 3 Soil salinity hazard

4.2.2 Acid sulfate soils

Acid Sulfate Soils (ASS) are naturally occurring soils containing iron sulphides which on exposure to air, oxidise and create sulfuric acid. Disturbance of ASS and/or Potential Acid Sulfate Soils (PASS) can result in adverse impacts on surface and groundwater quality, flora and fauna and their habitats.

In NSW, land is classified based on the likelihood of ASS being present in certain areas and at certain depths. In accordance with the *Guidelines for the Use of Acid Sulfate Soils Risk Maps*, there are five classifications:

- Class 1: ASS are likely to be found on and below the natural ground surface. Any works would trigger the requirement for assessment and may require management;
- Class 2: ASS are likely to be found below the natural ground surface. Any works beneath the natural ground surface, or works which are likely to lower the water table, would trigger the requirement for assessment and may require management;
- Class 3: ASS are likely to be found more than one metre below the natural ground surface. Any works that extend beyond one metre below the natural ground surface, or works which are likely to lower water table beyond one metre below the natural ground surface, would trigger the requirement for assessment and may require management;
- Class 4: ASS are likely to be found more than two metres below the natural ground surface. Any works that extend beyond two metres below the natural ground surface, or works which are likely to lower the water table beyond two metres below the natural ground surface, would trigger the requirement for assessment and may require management; and
- Class 5: ASS are not typically found in Class 5 areas. Areas classified as Class 5 are located within 500 metres of adjacent Class 1, 2, 3 or 4 land. Works in a Class 5 area that are likely to lower the water table below one metre AHD on adjacent Class 1, 2, 3 or 4 land would trigger the requirement for assessment and may require management.

The following areas present a high risk of encountering ASS:

- An area surrounding the drainage line running south and perpendicular to Spring Street (Class 3) into Muddy Creek. It is noted that only hard ground tunnelling will occur at this location, and therefore ASS/PASS will not be disturbed;
- The low-lying areas along Muddy Creek and in the industrial area at Rockdale (Class 3). Works at these locations include construction and bulk excavation of the temporary shaft at C2, and construction of the ATC (C4 and C5) which will involve shallow excavation and some bored piling;
- The low-lying areas surrounding the Rockdale Park Ponds (located within Rockdale Bicentennial Park) (Class 2) and Scarborough Ponds further east (Class 3 and Class 4). Works at within this area will include President Avenue upgrade works and bulk excavation of the cut and cover, temporary shaft and MOC3 at C3 as well as soft soil tunnelling; and
- An area within and around the eastern extent of the Bardwell Valley Golf Club at Bardwell Park. The route for the permanent power will travel through this area and while a small section will be bored through Bardwell Valley Golf Club, a majority of the alignment is through road corridors.

ASS risk is shown in Figure 4. With the exception of soft ground tunnelling at C3, no tunnel excavation will take place within areas mapped as Class 1, 2 or 3 ASS/PASS. Where ASS/PASS is encountered it will be managed through the ASS Management Plan (ASSMP) and the mitigation measures detailed in Section 6.

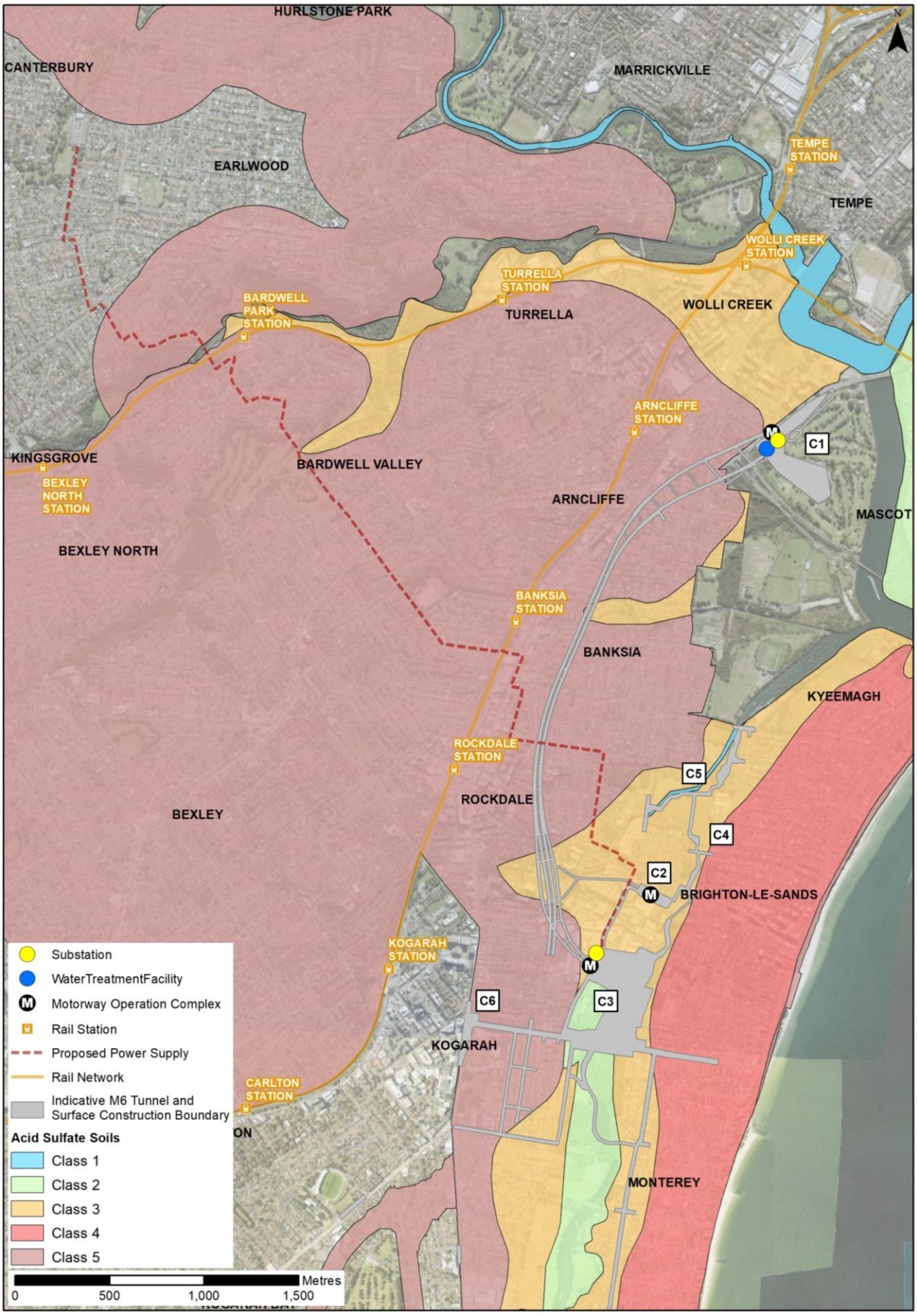

Figure 4 Mapped ASS/PASS

4.3 Surface water

4.3.1 Catchments and subcatchments

The Project is located within Cooks River catchment, and Muddy Creek and Scarborough Ponds subcatchments as shown in Figure 5. A brief description of these and a summary of the water quality data obtained to inform the EIS are shown in Table 6.

Construction water treatment plants (WTP) will be established and operated at the Arncliffe Construction Ancillary Facility (C1), Rockdale Construction Ancillary Facility (C2) and President Avenue Construction Ancillary Facility (C3) to treat water from construction and tunnelling works. Where feasible, water from the water treatment plants will be reused for construction activities. Water discharge will be to natural water bodies via the stormwater drainage system or to groundwater. Discharges from WTPs will be in accordance with the parameters of the EPL.

In accordance with EPL 21600, CGU will complete a Water Discharge Impact Assessments for each WTP on the project. In the interim, discharge targets are for pollutants to meet the following discharge criteria:

a) The relevant physical and chemical stressors set out in of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000);
b) The ANZG (2018) 90 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which will be treated to meet the ANZG (2018) 95 per cent species protection levels;
c) less than 0.13ug/L for Perfluorooctane sulphonate (PFOS); and
d) less than 220ug/L for Perfluorooctanoic acid (PFOA).

Monitoring of surface water will be undertaken as per Appendix B Surface Water Monitoring Program to ensure an appropriate management regime is implemented to identify and address potential impacts and maintain local surface water quality.

Table 6 Catchments and subcatchments relevant to Project

Catchment	Interaction with Project
Cooks River catchment covers an area of around 10,000 hectares (ha) in SW Sydney. Cooks River discharges into Botany Bay at Mascot.	Arncliffe construction ancillary facility (C1) and Water Treatment Plant (WTP).
Muddy Creek subcatchment covers an area of approximately 615 ha. Muddy Creek flows in a north-easterly direction until it meets Cooks River.	Construction WTP located at Rockdale (C2) construction ancillary facility would discharge to stormwater drainage ultimately draining to Muddy Creek.
Rockdale Park Ponds located within Rockdale Bicentennial Park.	Tunnel portals, construction of cut and cover, shaft at MOC3 and temporary shaft at C3. A construction WTP will be located at C3.
Scarborough Ponds catchment covers an area of approximately 400 ha and comprises a series of pond systems including Northern Scarborough Pond and Southern Scarborough Pond.	Works associated with road upgrades along President Avenue (C3) and the construction of the ATC (C4 and C5). Stormwater from this area and water from the Rockdale Park Ponds will ultimately drain into Scarborough Ponds.

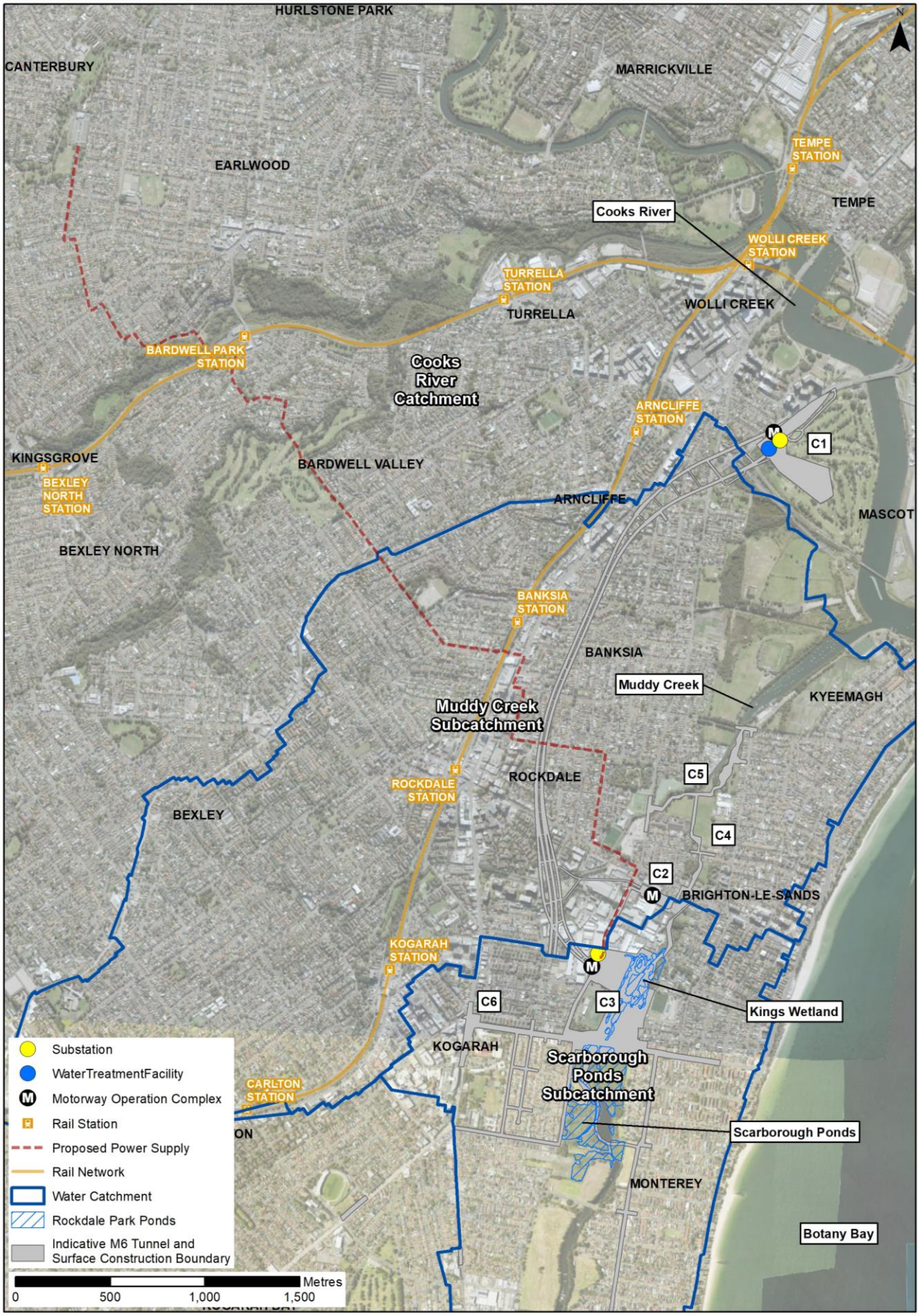

Figure 5 Catchments and waterbodies

4.4 Water quality

Surface water quality surrounding the Project may be influenced by:

- Current and former polluting land uses;
- Stormwater and sewer overflows;
- Leachate from contaminated and/or reclaimed land;
- Urban stormwater runoff; and
- Illegal dumping or discharge.

The EIS (AECOM, 2018) provides a summary of water quality data available from various sources, including data gathered as part of the Project EIS. The results are summarised in Table 7.

Table 7 Water quality

Waterbody	Description of water quality[1]	Condition	Sensitivity
Lower Cooks River	Estuarine, anthropogenic banks, poor water quality, limited riparian vegetation in reach within study area, key fish habitat, some recreational use. Median concentrations for total nitrogen, total phosphorus, reactive phosphorus, cadmium, chromium, copper, lead and zinc were above ANZECC (2000) slightly to moderately disturbed trigger levels with nitrate, arsenic, mercury and nickel also exceeding on some occasions. The limit of reporting for cadmium, copper and chromium was set above the slightly to moderately disturbed trigger level on some occasions. Median lead concentrations were also above the ANZECC (2000) 80% species protection level and zinc consistently exceeded the aquatic foods criteria. Median concentrations of ammonia exceeded the ANZECC (2000) recreational water quality criteria with iron also exceeding the respective criteria on some occasions.	Highly disturbed	Low
Muddy Creek	Estuarine, anthropogenic channel, poor water quality, limited riparian vegetation, some ecological value in estuarine reach, some recreational use. Median concentrations of total nitrogen, total phosphorus, reactive phosphorus, copper and zinc exceeded ANZECC (2000) slightly to moderately disturbed trigger levels with lead, nitrate and ammonia also exceeding on some occasions. Median zinc concentrations exceeded the aquatic foods criteria and zinc, copper, lead and ammonia concentrations were also above the 80% species protection level on some occasions.	Highly disturbed	Low

Waterbody	Description of water quality[1]	Condition	Sensitivity
	Median ammonia and zinc concentrations exceeded recreational water quality criteria on some occasions. Zinc consistently exceeded the aquatic foods criteria. The pH was below the ANZECC (2000) slightly to moderately disturbed low range level on one occasion at SW1.		
Rockdale Park Ponds	Freshwater, modified open water body, poor water quality with tendency for algal blooms, provides ecological habitat and passive recreational use. In Rockdale Park Ponds, median concentrations of ammonia, total nitrogen, total phosphorus, reactive phosphorus, copper and zinc exceeded ANZECC (2000) freshwater trigger levels with chromium, nitrate and lead also exceeding on some occasions. Iron and manganese concentrations also exceeded the ANZECC (2000) recreational water quality criteria. Ammonia, copper, lead and zinc concentrations exceeded the 80% species protection level on some occasions. All iron concentrations exceeded the recreational water quality criteria as did the median ammonia concentrations.	Highly disturbed	Low
Scarborough Ponds	Tidally influenced, modified open water body, provides ecological habitat and passive recreational use. In Northern Scarborough Ponds, median concentrations of total nitrogen, total phosphorus, copper and zinc exceeded the estuarine/marine trigger levels. All ammonia concentrations exceeded the recreational water quality criteria and iron concentrations exceeded recreational water quality criteria on some occasions. The pH was outside the trigger levels range on some occasions.	Highly Disturbed	Moderate

[1]AECOM, 2018

4.5 Groundwater

Groundwater impacts and management measures are detailed in the Groundwater CEMP Sub-plan, refer Appendix B5 of CEMP.

4.6 Rainfall

Rainfall data recorded at Sydney Airport indicates average annual rainfall is approximately 1079 millimetres (mm) based on data collected between 1929 and 2021.

Table 8 Climate statistics from Sydney Airport (BoM station ID: 066037)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean max temp (ºC)	26.7	26.5	25.4	23	20.2	17.7	17.2	18.4	20.7	22.7	24.2	25.9
Mean min temp (ºC)	19	19.1	17.6	14.3	11.1	8.8	7.3	8.2	10.6	13.4	15.6	17.6
Mean Rainfall (mm)	93.8	114.3	120.7	105	95.2	124.5	68.9	75.6	59.7	70.1	79.5	72.8
Mean no. of days >1mm rain	8.1	8.6	9.5	8.3	8.2	8.9	6.6	6.8	6.8	7.8	8.3	7.7
Mean 9am wind speed (kmh)	14.4	13.8	12.9	12.9	12.6	13.4	14.4	15.5	16.3	16	14.8	14.2
Mean 3pm wind speed (kmh)	24.1	23	21	19.3	17.1	17.8	18.2	20.8	23.1	24.6	25.3	25.2

4.7 Rainfall erosivity factor

Rainfall erosivity factor is a measure of capacity of rainfall to create erosion (referred as “R” in the Revised Universal Soil Loss Equation RUSLE). Rainfall erosivity factor is used to determine soil loss in tonnes per hectare over one year and is used in calculations when sizing construction sediment basins.

For the purposes of managing erosion the Rainfall Erosivity Factor Erosion Index (EI) of 3,480 EI has been selected, based on the Rainfall Erosivity maps in the Blue Book, refer Table 9. Specific R values for specific sites will be listed in the site-specific ESCPs.

The risk of rainfall erosion will be slightly higher during summer months due to the risk of higher intensity storms, although significant rainfall can occur at any time of year. Increased use of certain controls such as soil binders and temporary ground covers would be required in addition to considering how activities are scheduled. Storm intensity and frequency would also be considered when planning controls and scheduling high risk work activities.

Storm intensity and frequency would also be considered when planning controls.

Table 9 Month % and annual rainfall erosivity (R- factor) values for Project

Monthly % and annual rainfall erosivity (R – factor) values													
	Dec	Jan	Feb	Mar	Apr	Mar	Jun	July	Aug	Sep	Oct	Nov	Year
%	12	15	16	11	9	5	4	4	4	5	7	8	100
R-Value	418	522	557	383	313	174	139	139	139	174	244	278	3,480

4.8 Flooding

The EIS (AECOM, 2018) identified Project areas prone to flooding as shown in Table 10. The extent to which proposed construction activities would increase inundations is subject to further hydraulic assessment during detailed design.

Table 10 Flood prone areas

Waterbody	Associated compound	Flood behaviour and overland flows
Cooks River	C1	Kogarah Golf Course is affected during flood events. A ponding area forms in the northern portion of the golf course. High hazard flooding conditions and floodway areas are generally confined to the main channel of the Cooks River in the vicinity of the golf course and M5 East Motorway.
Muddy Creek	C2	Several locations between Bay Street and Bestic Street are affected during flood events. High hazard flooding conditions are generally confined to the main channel of Muddy Creek where it runs between West Botany Street and Bestic Street, adjacent to the alignment of the proposed shared cycle and pedestrian pathway. A section of West Botany Street and Bruce Street to the south of Muddy Creek acts as a floodway during a flood event.
Rockdale Park Ponds	C3	There are constraints due to capacity of the stormwater drainage system which runs along West Botany Road and due to the stormwater pipe entering the Rockdale Park Ponds. As a result, several commercial / industrial properties which are located on the western side of West Botany Street experience flooding. Existing commercial / industrial development located at the eastern end of Bermill Street have also been impacted by flooding during storms The Rockdale Park Ponds have historically acted as a flood storage area for flood events.
Scarborough Ponds	C3	Flooding occurs regularly on President Avenue adjacent to Scarborough Ponds. Some residential properties to the eastern and western sides of the open space corridor (where the Ponds are located) are impacted during a flooding event.

All construction ancillary facilities are located within a floodplain and are required to manage flood risk. If flooding is predicted by BoM, reference will be made to the Flood Management Strategy which will be developed prior to construction commencing to determine how flooding risks will be mitigated through construction and operation of the Project. This will be developed in consultation with affected landowners, Sydney Water, EES, State Emergency Services, Bayside Council, Georges River Council and Canterbury-Bankstown Council. Outcomes of consultation activities will be used to inform design of the construction ancillary facilities.

The Project will also design and install erosion and sediment control measures in accordance with the Blue Book (Chapter 5 Erosion Control: Management of Water, Landcom, 2004 and DECC, 2008).

5 Environmental aspects and impacts

5.1 Construction activities

Key aspects of the Project which may result in impacts to soils and water include:

- Vegetation clearing and topsoil stripping;
- Bulk earthworks;
- Bulk excavation;
- Construction and use of site access;
- Culvert and drainage works;
- Material stockpiling including the treatment of ASS/PASS and rock;
- Wetland diversion
- Paving activities;
- Water use;
- Assembly and commissioning of construction WTP;
- Compound operation including fuel and chemical storage, refuelling and chemical handling; and
- Restoration and rehabilitation works.

A comprehensive Aspects and Impacts Register is included in Appendix A2 of the CEMP.

5.2 Impacts

The potential for impacts to soil and surface water is dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction include:

- Changes to surface water quality due to:
  - Spill and incidents;
  - Discharges of treated water from construction WTP;
  - Wetland diversion; and
  - Mobilisation of sediments and pollutants during surface works.
- Impacts to soils due to:
  - Erosion and sedimentation;
  - Soil salinity;
  - ASS/PASS;
  - Scour and changes to channel geomorphology;
  - Topsoil removal;
  - Soil compaction and soil structure decline; and
  - Impacts from earthworks and construction machinery, such as compaction / loss of air voids and water holding capacity, aggregate breakdown and pulverisation. These impacts are less pronounced in existing roadways, under buildings and brownfield sites.

Some impacts to soil and water attributable to the Project are anticipated. Relevant aspects and potential for related impacts have been considered in the risk assessment included in Appendix A2 of the CEMP. Mitigation measures to avoid or minimise those impacts are outlined in Section 6.

Cumulative impacts to soil and surface water are not anticipated to occur from staging of the Project or during construction of the Project. Where unexpected cumulative impacts are identified during works, they will be managed through compliance with relevant CoAs, coordination with external stakeholders including utility providers, and implementation of EMMs related to key environmental impacts. The mechanism for identifying any potential unexpected cumulative impacts will be through monitoring, inspections, reporting and auditing.

5.2.1 Spills and incidents

Throughout construction of the Project, there is risk of spills involving oils, lubricants, hydraulic fluids and chemicals from vehicles, plant and equipment. Spills can occur from leakages, vehicle crashes, refuelling activities and mechanical failures of plant and equipment. Spills or leaks within the Project footprint pose the risk of polluting downstream waterways (via stormwater network) and the contamination of soil.

The risks to soil and surface water as a result of such incidents would be mitigated through the preventative mitigation measures outlined in Section 6. Where a spill does occur, the CGU Spill Management Procedure (Appendix D) will be implemented. Transport of dangerous goods and hazardous substances will be conducted in accordance with relevant legislation and codes.

Activities within construction ancillary facility of C3 are proximate to waterfront land. Refuelling and small volume short term chemical storage within 40m of a waterway can only occur under an approved Environmental Work Method Statement (EWMS), refer Section 3.3.2 of CEMP. Some measures that will be implemented will include:

- Refuelling will be undertaken in an area designated in the EWMS which shall be at the furthest useable location from the water way;
- The refuelling location will have a spill kit; and
- All chemicals will be stored in bunds.

5.2.2 Discharge from construction WTPs

Construction water that is processed through the construction WTPs (located at all tunnelling construction compounds) contain a combination of potable water, groundwater, sediment and traces of elements from tunnel construction processes (i.e. shotcrete, grout etc.). The baseline groundwater monitoring carried out during the EIS phase and tender of the Project established that the groundwater has characteristics typical to that of Hawkesbury Sydney Sandstone and ASS. Dissolved heavy metals such as iron, manganese, zinc and copper are present and the pH is lower than receiving waters.

If construction water is poorly treated, it has potential to impact receiving waterways, reduce visual amenity and may also impact aquatic species. Further information on groundwater composition is provided in the Groundwater CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000411).

A discharge impact assessment will be prepared for the EPA in accordance with EPL 21600 and consistent with CoA E168 which requires the project to maintain the NSW Water Quality Objectives where they are being achieved as at the date of this approval, and contribute towards achievement of the NSW Water Quality Objectives over time where they are not being achieved. Construction WTPs will be procured and/or existing WTPs upgraded to ensure approved discharge concentrations can be met. Each plant will be operated by personnel who will:

- Undergo training from the WTP manufacturer trained specifically in the successful operation of the plant;

- Receive training from the environmental team, including briefing on the requirements under the Project EPL and this Plan and incident management;
- Provided ongoing support from the WTP manufacturer; and
- Receive feedback in the form of results of water quality monitoring undertaken at the plant and from the SWQMP.

Monitoring and reporting will be undertaken in accordance with the Surface Water Monitoring Program (SWMP), refer Appendix B. Discharge events from construction WTPs will be managed through, a monthly Permit to Dewater and the Project EPL.

Stormwater and construction water from the Project (including discharges from the construction WTPs) will be discharged to natural water bodies via the existing stormwater system. The existing stormwater system includes concrete lined drainage pipes, concrete lined creeks and channels. It is not expected that discharges of treated construction water will impact on the geomorphology of affected waterways. In accordance with Appendix L of the EIS (Surface Water Technical Report) discharges will be of relatively low volume compared to existing flow regimes. Where required, effective and sufficient outlet scour protection and energy dissipation will be implemented prior to release of water from the Project.

If detailed design identifies the risk of scour due to excessive velocities during construction and operation, appropriate scour and erosion protection measures will be implemented at drainage outlets for both temporary and permanent works.

5.2.3 Erosion and sedimentation

Surface construction activities (featured in Section 5.1) have potential to result in erosion and sediment migration, in particular:

- Clearing of vegetation in areas of high erosion potential (refer to Table 5);
- Uncompacted or unconsolidated materials stored within construction boundaries have the potential to migrate during rain;
- Disturbance of soils and stockpiling occur in close proximity to waterway or bodies; and
- Migration of sediment on haul roads and public roads, from wheels of plant and equipment which have the potential to migrate during rainfall events.

Strategies to manage these risks are outlined in site-specific Erosion and Sediment Control Plans (ESCPs) are developed from the outcomes of the Erosion Hazard Assessment, *RUSLE = R x K x LS x P x C:*

R = Rainfall factor

K = Soil erodibility factor

LS= Slope length and gradient factor

P = Conservation practices factor

C= Ground cover factor

Site specific ESCPs will be prepared in accordance with Blue Book Volumes 1 and 2D (Landcom, 2004 and DECC, 2008) and Erosion and Sediment Control Procedure (Appendix A) for specific stages or parcels of work, prior to commencing construction activities. These plans will be developed in consultation with construction teams and where required the Project Soil Conservationist. ESCPs will be signed off by the Site Environment Manager and Site Supervisor (or their representatives) and copies kept on premise for the duration of the Project.

Under G38 Section 3.1.1, any ESCP developed for a new work area must be submitted for a Hold Point Release. Once the erosion and sediment controls have been installed as per the approved

ESCP, a Witness Hold Point will then be raised to allow ground disturbance activities to occur. Refer to Appendix A1 of the CEMP for further information.

Erosion and sediment control would be focused on areas of surface disturbance (i.e. surface road works, construction ancillary facility sites and areas of excavation and vegetation removal). Emphasis would be given to areas of surface disturbance near waterways, including at Rockdale Bicentennial Park (C3). These measures minimise the potential for sedimentation impacts to occur in Scarborough Ponds catchment.

Along with ESCPs, mitigation measures outlined in Section 6 also will be implemented to prevent, mitigate and manage the risks of erosion and sedimentation. Risk-based inspections by the Project Soil Conservationist be undertaken to monitor the performance of these management strategies and where required, will be updated upon advice from the Project Soil Conservationist. For further details on the management strategies, refer Section 6.

5.2.4 Acid sulfate soils

Based on testing conducted during the EIS and tender phase, construction activities will encounter ASS and PASS, with locations identified in Section 4.2.2. ASS/PASS will be managed in accordance with the Acid Sulfate Soil Management Plan (ASSMP, refer Appendix c) which has been developed from the Acid Sulfate Soil Manual (1998).

If a fall in groundwater levels is experienced the disturbance of PASS may result in the formation of actual acid sulfate soils (AASS). In this event the ASSMP will be utilised to treat and manage the material.

Field testing parameters (pHF and pHFOX) will be undertaken during contamination investigations to identify the presence of Actual ASS or PASS. Parameters include:

- Field pH measurements:
    - pH readings of pH less than 4, indicate that AASS are likely to be present; and
    - pH readings of pH >4, indicate the absence of AASS, however does not give any indication of the PASS.
- Field peroxide measurements will be undertaken and where a positive peroxide test indicating one of more of the following may indicate the presence of PASS:
    - Change in colour of the soil from grey to brown tones;
    - Effervescence;
    - Release of sulfur smelling gases such as sulfur dioxide and hydrogen sulfide;
    - A lowering of the soil pH by at least one unit; and
    - A final pH less than 3.0.

Laboratory sampling will be undertaken to validate the presence of Actual ASS or PASS. Advice of estimated lime treatment rates will be issued to CGU by the lab based on the outcome of the SPOCAS test, who will then undertake treatment in accordance with the ASSMP. This will include setting up a suitable ASS/PASS treatment stockpile area. CGU will then facilitate disposal of this material in accordance with the Waste CEMP Sub-plan (Appendix B9 of CEMP).

Regular monitoring of areas where ASS is expected will be undertaken to identify signs of sulfide oxidation. Visual and olfactory cues include:

- Yellow / orange / red staining on upper sediments and surrounding surfaces;
- Rust coloured deposits on plants and on the banks of drains, water bodies and watercourses indicating iron precipitates;
- Waterlogged soils with a hydrogen sulfide, ‘rotten egg’ smell;

- Area of black ooze (potentially indicating monosulfidic black oozes) typically in drains and low-lying areas;
- Unexplained scalding, degradation or death of surrounding vegetation;
- Unexplained death or disease or aquatic organisms;
- Areas of green-blue water or extremely clear water indicating high concentrations of aluminium; and
- Black to very dark coloured waters indicating de-oxygenation.

An Acid Sulfate Soil and Salinity Assessment Report (ASSSAR) (M6S1-COF-NWW-ENEV-RPT-680400) has been prepared which assesses acid sulfate soil and soil salinity status across the Project to assist with development of site specific management/mitigation measures.

5.2.5 Mobilisation of sediments and pollutants during surface works

Surface construction activities that may disturb soils and other materials have potential to impact water quality, soil and adjacent land if not effectively managed. Table 11 summarises the potential water quality and soil impacts during construction of the Project. Management and mitigation measures to minimise the risk of potential impacts are provided in Section 6. In accordance with the SWMP (Appendix B), routine surface water monitoring and analysis will occur at specific downstream locations during construction to monitor effectiveness of mitigation measures, in conjunction with inspections from the site environmental team and Project Soil Conservationist.

Table 11 Summary of potential construction soil and surface water quality impacts

Construction activity / source of pollutants	Pollutants of concern	Potential impact	Receiving waterways
Impacts to ambient water quality as a result of poorly treated discharges from the construction WTP.	Heavy metals, pH, oil and grease, sediment, ammonia, nutrients.	Impacts to aquatic species through: • Increased turbidity which lowers dissolved oxygen levels; • Increases to nutrients and metals to a toxicant concentration; and/or • Increased alkalinity. Lower visual amenity and recreational values.	Cooks River Muddy Creek Rockdale Park Pond Northern Scarborough Pond
Erosion and mobilisation of exposed soils from open cuts, batter slopes and stockpiles by stormwater runoff and wind, leading to sedimentation of receiving waterways or into adjacent land.	Sediment, contaminants, gross pollutants.	Impacts to aquatic species through increased turbidity which lowers dissolved oxygen levels. Reduced visual amenity, habitat and recreational values.	Muddy Creek Rockdale Park Pond Northern Scarborough Pond Kogarah Golf Course
Dust, litter and other pollutants associated with building materials and demolition waste being mobilised by wind and stormwater runoff into waterways.	Sediment, gross pollutants.	Reduced visual amenity and recreational values. Potential impacts to bird species and aquatic species.	Muddy Creek Rockdale Park Pond Northern Scarborough Pond
Mechanical failure of vehicle, plant or equipment, refuelling which results in leaks and/or spills.	Hydrocarbons, hydraulic fluids, oil and grease, other hazardous chemicals.	Oil sheen on water surface and increases in toxicant concentration which could lead to impacts to aquatic species and bird life.	Cooks River Muddy Creek Rockdale Park Pond Northern Scarborough Pond

Construction activity / source of pollutants	Pollutants of concern	Potential impact	Receiving waterways
		Reduced visual amenity, habitat and recreational values. Contamination of soil (within and outside Project boundary).	Kogarah Golf Course
Wash-down water from construction plant washing being discharged into waterways.	Sediment, hydrocarbons, oil and grease, hydraulic fluids, heavy metals and landfill material.	Oil sheen on water surface and increases in toxicant concentration which could lead to impacts to aquatic species and bird life. Increased nutrient levels leading to worsening algae blooms. Reduced visual amenity and recreational values.	Muddy Creek Rockdale Park Pond Northern Scarborough Pond
Concrete washout water being discharged into waterways.	High pH and chromium.	Increases in alkalinity and toxicant concentration which could lead to impacts on aquatic species.	Muddy Creek Rockdale Park Pond Northern Scarborough Pond
Increase in alkalinity in waterways due to transport of chemicals used in treatment and curing of concrete and mobilisation of concrete dust to waterways through wind, runoff	High pH.	Increases in alkalinity and toxicant concentration which could lead to impacts on aquatic species.	Muddy Creek Rockdale Park Pond Northern Scarborough Pond
Mobilisation of sediment into local stormwater drainage network via vehicles transferring material to roads adjacent to construction sites.	Sediment, nutrients.	Impacts to aquatic species through: • increased turbidity which lowers dissolved oxygen levels.	Cooks River Muddy Creek Rockdale Park Pond Northern Scarborough Pond

Construction activity / source of pollutants	Pollutants of concern	Potential impact	Receiving waterways
		• Increases to nutrients to a toxicant concentration. Reduced visual amenity and recreational values. Sedimentation of water way and ponds which can cause dieback to vegetation on banks of water bodies.	
Soil and bank erosion and mobilisation of sediments into receiving waterways during the wetland diversion.	Sediment, nutrients and heavy metals stored in bed sediments.	Impacts to aquatic species through: • increased turbidity which lowers dissolved oxygen levels. • Increases to nutrients to a toxicant concentration. • Increased nutrient levels leading to worsening algae blooms Reduced visual amenity and recreational values.	Rockdale Park Pond Northern Scarborough Pond
Impacts to ambient water quality as a result of poorly treated rainwater and/or groundwater in permanent power alignment trench.	Sediment, heavy metals, oil and grease.	Reduced visual amenity and recreational values. Impacts to aquatic species through: • Increased turbidity which lowers dissolved oxygen levels. • Increased presence of metals to a toxicant concentration.	Cup and Saucer Creek Wolli Creek Bardwell Creek Spring Street Drain Muddy Creek Rockdale Park Pond

Construction activity / source of pollutants	Pollutants of concern	Potential impact	Receiving waterways
		Oil sheen on water surface and increases in toxicant concentration which could lead to impacts to aquatic species and bird life.	
Changes in salinity load in receiving waterways due to treated construction wastewater discharges.	Concentration of salinity.	Changes in salinity concentration could lead to impacts to aquatic species and flora species surrounding water way.	Rockdale Bicentennial Park Pond Northern Scarborough Pond Muddy Creek Cooks River
Excavation and treatment of Actual ASS and/or PASS.	Sulfuric acid.	Reduced visual amenity and recreational values in area. Impacts to aquatic species through: • Acidification of water body • Increased presence of metals to a toxicant concentration Impacts to vegetation. Impacts to frog habitat.	Rockdale Bicentennial Park Pond Northern Scarborough Pond Muddy Creek Rockdale Bicentennial Park Kogarah Golf Course

6 Environmental control measures

Specific measures and requirements to meet objectives of this SSWMP and to address potential impacts to soil and water are outlined in Table 13.

Table 12 Environmental Control Measures

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
General						
SWMM1	Environmental incidents where material harm to the environment is caused or threatened will be managed in accordance with the Pollution Incident Response Management Plan (PIRMP) and the Project EPL.	Project induction	Construction	Environment and Sustainability Manager (or delegate)	Protection of the Environment Operations Act 1997 (POEO Act) Section 3.8 of the CEMP	PIRMP Environmental incident report
SWMM2	Environmental incidents that do not trigger SWMM1 will be managed and reported in accordance with the Project CEMP.	Project induction	Construction	Environment and Sustainability Manager (or delegate)	CEMP Section 3.8 and 3.9.5	Environmental incident report
SWMM3	Except as may be provided by an EPL, the Project shall be constructed and operated to comply with Section 120 of the POEO Act, which prohibits the pollution of waters.	Project induction	Construction	Environment and Sustainability Manager (or delegate)	POEO Act CoA E168	Construction compliance reports Water quality records Environmental incident reports

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
SWMM4	All activities taking place in, on or under waterfront land, as defined in the Water Management Act 2000 will be conducted in accordance with the DPIE Water's *Guidelines for Controlled Activities.*	EWMS	Construction	Environment and Sustainability Manager (or delegate)	Water Management Act 2000	Site inspection reports and other site work records
SWMM5	ESCPs will be prepared for all work sites will be modified as part of the Project in accordance with the 'Blue Book' (Landcom 2004) and Erosion and Sediment Control Procedure (Appendix A). ESCPs will be implemented in advance of site disturbance and will be updated as required as the work progresses, and the sites change.	ESCP	Construction	Environment and Sustainability Manager (or delegate)	Landcom 2004 CoA E111	ESCPs Inspection reports Hold Point Release Soil Conservationist Inspections
SWMM6	Training will be provided to relevant Project personnel, including relevant sub-contractors on sound erosion and sediment control practices and the requirements from this Plan through inductions, toolboxes, or targeted training.	Project induction Toolbox Targeted training	Construction	Environment and Sustainability Manager (or delegate)	G36 / G38 CoA E111	Training, inductions, and toolbox records
SWMM7	EWMS will be prepared prior to commencing high risk activities.	EWMS	Construction	Environment and Sustainability Manager (or delegate)	This plan G36/G38 CoA E111	EWMS Hold Point Release

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
Erosion and sediment control						
SWMM8	All erosion and sediment controls will be installed in accordance with best-practice guidelines such as the Blue Book and Erosion. This may include (but not limited to): • Key management structures such as sediment traps and clean water diversions will be installed as interim measures to assist in effective site management before more permanent controls are installed; • Turbid construction runoff will be directed into surface control structures (sumps, temporary controls including sediment fences and other sediment traps; • Slope lengths will be maintained at appropriate lengths to slow flows down and minimise erosion; • Temporary diversions will be implemented during construction to divert 'clean' offsite run-on so it doesn't come into contact with disturbed soils or sediment; • Geotextile linings, soil binders, tarps or similar will be used to	ESCP	Construction	Environment and Sustainability Manager (or delegate)	G38 Best practice CoA E111	Site inspection reports ER inspection reports Soil Conservationist Inspections ESCPs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	provide temporary surface protection where appropriate (e.g. batter drains, fills, cut faces); • Use geotextile linings, black plastics, organic fibre matting, rock or similar to provide temporary surface protection in areas of concentrated flows (e.g. batter drains, piling platforms etc.) or in areas where sediment basins are required or are desirable to meet water quality objectives but cannot be provided due to space restrictions / current activities. Alternative erosion control measures should be selected consistent with Managing Urban Stormwater – Soils and Construction Volumes 1 and 2, 4th Edition (Landcom, 2004) and advice from the Project Soil Conservationist; and • Mulch bunds will not be used in concentrated flow areas, or if they have the potential to result in tannin leachate into waterways.					
SWMM9	A Soil Conservation Specialist will be engaged and retained for the Project duration to provide advice regarding	Soil conservationist	Construction	Environment and Sustainability	G38 EMM SC7	Soil Conservationist reports

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	erosion and sediment control and undertake risk-based inspections.			Manager (or delegate)	CoA E111	ESCP reviews
SWMM10	The extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion.	ESCP	Construction	Area Manager	G38 CGU Manage Soil and Water procedure CoA E111	Site inspection reports ER inspection reports ESCPs Construction methodology
SWMM11	Disturbed ground and exposed soils will be temporarily stabilised during periods of site inactivity, for more than 10 days, to minimise the potential for erosion.	ESCP	Construction	Area Manager	Best Practice CoA E111	Site inspection reports ER inspection reports Shutdown inspections ESCPs
SWMM12	Disturbed ground and exposed soils will be permanently stabilised and proposed landscaped areas suitably profiled and vegetated as soon as practicable following disturbance to minimise the potential erosion: • Re-spread topsoil over completed areas prior to revegetating.	ESCP	Post-Construction	Area manager	CGU Manage Soil and Water procedure CoA E111	Site inspection reports ER inspection reports ESCPs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	Ensure topsoil is properly keyed with subsoil, especially on slopes, to avoid slippage/slumping; • Sediment controls will remain in place until their upslope catchment is stabilised as per the Blue Book (Landcom, 2004): and • Revegetated areas will be maintained as required.					
SWMM13	Erosion and sediment control structures shall remain installed, inspected and maintained until sufficient stabilisation is achieved in the catchment.	CGU Environmental team	Construction	Environment and Sustainability Manager (or delegate)	G38 CGU Manage Soil and Water procedure CoA E111	Site inspection reports ER inspection reports ESCPs
SWMM14	Measures will be implemented to minimise dust, soil or mud from being deposited by vehicles on public roads. This will be achieved by implementing mitigation measures such as rumble grids; large aggregate at entry/exit points; or wheel wash facilities.		Pre-construction and during construction	Area Manager Superintendent	G38 CoA E111	Site inspection reports ER inspection reports Vehicle Management Plan Site Environment Plan

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
SWMM15	Hardstand areas and surrounding public roads will be cleaned as required, using methods including brooms, bobcat attachments or street sweepers.		Pre-construction and during construction	Area manager Superintendent	G38 CoA E111	Site inspection reports ER inspection reports Vehicle Management Plan Site Environment Plan
SWMM16	Where flocculation is necessary to settle suspended sediments in excavations, calcium sulfate (gypsum) will be utilised unless the use of alternative chemicals is approved in consultation with TfNSW.	Alternative Flocculant and Coagulant Report	Design and construction	Area manager	G38	Design report Site inspection report Alternative Flocculation and Coagulant Report
Drainage and waterways						
SWMM17	Where required, scour protection shall be installed within and at the base of permanent or temporary drainage features. Scour protection will be appropriately selected and may include (but is not limited to): • Rock lining. • Concrete lining.		Construction, prior to discharge	Design Manager Area Manager	G36/G38 SWF8	Site inspection reports ER inspection reports ESCPs Permit to Dewater

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	• Jute-mesh lining. • Jute-matting. • Geo-fabric lining • Revegetation. • Appropriate grade selection. • Appropriately sized drains. Scour protection and energy dissipaters will be integrated where feasible into current banks to minimise impacts as soon as possible following the completion of any works within these areas.					
SWMM18	Treated construction water from construction WTP at C3 will measure temperature of discharged water. If water is found to be of a higher temperature than the adjacent surface water receiving bodies that would be discharged to, it will be stored and buffered in treatment basin at the C3 facility (until it reaches ambient water temperature) prior to release into Bicentennial Park Pond (at the surface).	CGU Environmental team	Construction	Environment and Sustainability Manager (or delegate)	SWF2	Permit to Dewater
SWMM19	Drainage swales, depressions and drainage feature crossings, including the wetland diversion at C3 will be	Project Ecologist	Construction	Design Manager Environment and	E170	Design Report Review Report

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	designed by a suitably qualified and experienced person and works will be carried out in accordance with the Blue Book, Controlled Activity Guidelines and other current, relevant guidelines. If the design identifies the risk of scour due to excessive velocities during construction and operation, the appropriate scour and erosion protection measures will be implemented at drainage outlets for both temporary and permanent works.	Hydrologist		Sustainability Manager (or delegate)		Site inspection
SWMM20	Treated water from construction WTPs will be used for dust suppression.		Construction	Environment and Sustainability Manager (or delegate) Supervisor	CGU Manage Soil and Water Procedure Best Practice	Inspection reports Sustainability Reporting
SWMM21	All water used or reused on the site will be tracked and recorded.		Construction	Environment and Sustainability Manager (or delegate) Area Manager	CGU Manage Soil and Water Procedure CGU Water Reuse and Discharge	Inspection reports Permit to Dewater Tracking registers

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
					Management Procedure Sustainability Management Plan	
Acid sulfate soils						
SWMM22	An Acid Sulfate Management Plan will be prepared detailing processes to manage actual and potential acid sulfate soils disturbed during construction of the project.		Construction	Environmental and Sustainability Manager	CGU Manage Acid Sulfate Soils Procedure EMM SC5	Appendix C - Acid Sulfate Management Plan
SWMM23	Ensure water runoff from contaminated land or areas of ASS/PASS (including stockpile areas) is contained, treated or disposed to minimise the risk of pollution of land or waterways.		Construction	Environmental and Sustainability Manager Superintendent	CGU Manage Acid Sulfate Soils Procedure	Site inspection Site Environment Plans Surface Water Quality Monitoring
SWMM24	Ensure all workers likely to be involved with the management of ASS/PASS are trained in the identification and management of the material.		Construction	Support Services Director / Construction Manager / Environmental and Sustainability Manager	CGU Manage Acid Sulfate Soils Procedure	Training and induction records

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
SWMM25	Communicate all known areas of ASS/PASS to all workers via inductions, toolbox talks, pre starts and Site Environmental Plans.		Construction	Construction Manager / Environmental and Sustainability Manager	CGU Manage Acid Sulfate Soils Procedure	Inductions Pre starts Tool box talks Work Packs
SWMM26	Immediately notify the site supervisor and/or Environmental Manager if ASS/PASS material has been deposited outside the storage/ treatment areas, or if there is evidence of impacts on waterways.		Construction	All	CGU Manage Acid Sulfate Soils Procedure	Incident Report Site Environmental Inspection
SWMM27	Ensure all vehicles, plant and other machinery that have been in contact with contaminated soil or ASS/PASS are cleaned prior to leaving site. .	Washdown facilities	Construction	Area Manager Superintendent Mechanical Team	CGU Manage Contaminated Land Procedure CGU Manage Acid Sulfate Soils Procedure	Subcontractor agreement Mechanical Inspection
SWMM28	ASS/PASS Stockpile areas to have a purpose built lime guard layer at the base of the stockpile.		Construction	Area Manager Superintendent	ASS Manual (1998)	Temporary Design Drawings Inspection Test Procedure
Soil stockpiles						
SWMM29	Spoil stockpiles will be managed to reduce potential impacts associated	Polymer	Construction	Environment and Sustainability	G38	ESCPs

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	with dust generation, erosion and sedimentation including by battering slopes, covering stockpiles, use of polymer binders or wetting to keep moist. or wetting to keep moist.			Manager (or delegate)		
SWMM30	Stockpiles of soil material will be sited within the Project boundary in low-hazard areas outside of waterfront corridors, away from the dripline of any retained trees, away from any drainage areas, and away from locations likely to receive run-off wherever possible.		Construction	Environment and Sustainability Manager (or delegate)	G38 CGU Manage Soil and Water Procedure	ESCPs Site Environment Plan
SWMM31	Stockpiles left exposed and undisturbed for longer than 10 days will be contoured to minimise loss of material in flood or rainfall events and stabilised by: • Spraying with suitable tackifier; • Covering with anchored fabrics; or • Seeding with sterile grass (topsoil only).	Polymer Hydromulch	Construction	Environment and Sustainability Manager (or delegate)	G38	Site inspection report Inspection Test Plan
SWMM33	Weed-free topsoils will be used for rehabilitation purposes wherever possible.		Construction	Project Engineer	G38	Subcontractor pack Inspection Test Plan

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
Chemicals, fuels, hazardous materials and concrete use						
SWMM34	A Pollution Incident Response Management Plan (PIRMP) will be prepared for the project. The PIRMP will be prepared in accordance with legislative requirements and include measures to manage hazardous substances and dangerous goods including storage, handling and spill response.		Construction	Environment and Sustainability Manager (or delegate)	HS1	PIRMP
SWMM35	Transport of dangerous goods and hazardous substances will be conducted in accordance with relevant legislation and codes.		Construction	Safety Manager	HS3	Site inspection report Safety audits
SWMM36	An Incident Response Protocol will be developed as part of the Emergency Response Plan for the project and implemented in the event of an accident or incident. The protocol is to detail operational management measures associated with the storage, handling and transport of hazardous substances and dangerous goods, including spill response.		Construction	Safety Manager Environment and Sustainability Manager (or delegate)	HS4	Incident Response Protocol
SWMM37	Storage of dangerous goods and hazardous materials will occur in		Construction	Area manager	Best practice	Site inspection report

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	accordance with suppliers' instructions and relevant Australian Standards and legislation including the: • Work Health and Safety Act 2011 (NSW); • Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW 2005); • Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (EPA 1997); and • Incompatible chemicals will be stored separately in accordance with manufactures specifications and compatibility chart.					Safety Observation
SWMM38	Not used					
SWMM39	Secure, bunded areas will be provided around storage areas for oils, fuels and other hazardous liquids. Impervious bunds will be of sufficient capacity to contain at least 110 per cent of the volume of the largest stored container.		Construction	Area manager	CGU Manage Hazardous Chemicals Procedure	Site inspection report Design Report Site Environment Plan SWMS

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
SWMM40	Hazardous substances will be stored onsite in lockable containers or on a bund within a secure area, in their original receptacles.		Construction	Safety Manager	Best practice	Site inspection report Site Environment Plan SWMS
SWMM41	All hazardous substances will be clearly labelled and will have Safety Data Sheets affixed or available nearby.		Construction	Area Manager	Best practice	Site inspection report SWMS Safety Observation
SWMM42	An up-to-date register of hazardous substances will be kept onsite at all times.		Construction	Safety manager	Best practice	Register Safety Observation
SWMM43	Any concrete washout areas will be adequately sized and regularly maintained. Where possible, washouts will be located in covered areas. They will be outside of riparian areas and well away from stormwater system inlets in a position where wastewater will not enter any drainage lines or waterways.		Construction	Environment and Sustainability Manager (or delegate)	Best practice	Site inspection report Site Environment Plan Work Packs
SWMM44	Hazardous substances will only be used onsite as required, in accordance with the		Construction	Safety Manager Supervisor	Best practice	Safety Observation

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	manufacturer/supplier instructions. The use hazardous substances inside tunnels will be minimised as much as possible.					SWMS
SWMM45	Ensure all workers who will be required to purchase, use, store or dispose of hazardous chemicals are trained in the Hazardous Materials & Dangerous Goods Risk Assessment and SDS including: • The use, storage and disposal of the Hazardous Chemical; • The signage and emergency provisions; and • Any health surveillance or atmospheric monitoring required.		Construction	Safety Manager Supervisor	CGU Manage Hazardous Chemicals Procedure	Training register
SWMM46	Spill containment kits will be placed at locations with a high concentration of plant or machinery, at hazardous substance storage locations and at refuelling points. Vehicles will be properly maintained to minimise the risk of fuel/oil leaks and routine inspections of construction equipment will be undertaken to identify any fuel/oil leaks and repairs made as required. Ensure spill kits identified:		Construction	Environmental, Approvals and Sustainability Manager Supervisor Plant Manager	CGU Manage Hazardous Chemicals Procedure Best practice	Site Environment Plan Environmental Inspections Safety Observations Incident report Site Environmental Plan

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	• Are of adequate type and volume for materials stored; • Are located adjacent to all hazardous substance storage units, in refuelling and maintenance areas; and • At worksites in close proximity to waterways are specific for aquatic use.					SWMS
SWMM47	Minor spills or leakages will be responded to and managed in accordance with the Spill Management Procedure and reported in line with the TfNSW Incident Reporting Procedure.		Construction	All	Best practice CGU Spill Management Procedure	Incident report Spill Response Procedure
SWMM48	Not used					
SWMM49	Any refuelling undertaken on site shall be undertaken in designated areas only, outside of waterfront areas and well away from stormwater system inlets.		Construction	Area Manager Supervisor	Best practice	Safety Observation Site Environment Plan Environmental Inspection
SWMM50	Not used					
Site inspections, maintenance and rainfall events						

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
SWMM51	All environmental control measures across the site will be inspected at least weekly, prior to forecast rainfall of 10mm and within 24 hours of rainfall causing runoff (if safe to do so), and prior to any site shut-down / closure greater than 48 hours. Records of these inspections will be kept, and appropriate action taken to repair any damage, maintain (clean out) controls and/or install additional controls as required.		Construction	Environment and Sustainability Manager (or delegate)	G36	Environmental Inspection
SWMM52	Concrete wash out points; • are not to be used once full; • usage is to be supervised by foreman/leading hands; • will be regularly inspected by environment team; and • must be regularly cleaned out (and handled in accordance with the POEO Waste Regulation.		Construction	Site supervisor	G36	Site Environment Plan SWMS Safety Observation Environmental Inspection
SWMM53	Prior to forecast rainfall events of 10mm, end-of-day controls will be implemented throughout the worksite to help reduce erosion and sediment control. These will be listed on the		Construction	Site Supervisor Environment, Approvals and Sustainability	G36	Site inspection report

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	ESCP and may include one or more of the following: • Check dams; • Slope breaks; • Batter chutes; • Fill windrows; and • Temporary ground covers.			Manage (or Delegate)		
SWMM54	Prior to forecast heavy rainfall (>20mm), the site will be inspected to identify any areas requiring additional management measures, such as: • Dewatering (discharge or reuse) water holding tanks to lower water level; • Place additional line of sediment fencing, gravel bags/coir logs, sand bags, sediment traps as required; and • Construct additional clean stormwater catch drains, slope break, diversions as required.		Construction	Environment, Approvals and Sustainability Manage (or Delegate)	G36	Site inspection report
Waterfront land						
SWMM55	All works within watercourses or on waterfront land will be managed in		Construction	Area Manager	E171	Work Pack

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	accordance with the Controlled Activities on Waterfront Land guidelines (DPI 2012).			Superintendent	SWF6 DPI 2012	SWMS Environmental Inspection
SWMM56	Construction methodology within the Bicentennial Pond will isolate the Ponds from the cut and cover excavation works to prevent mobilisation of sediment and pollutants as detailed in the Construction Management Plan.		Construction	Superintendent	SWF6	Work Pack SWMS Environmental Inspection Design Report
SWMM57	Dewatering from the Cut and Cover at C3 will be processed through the construction water treatment plant. Treated water will be discharged in accordance with the Project EPL or disposed to a licenced waste receiving facility.		Construction	Environment and Sustainability Manager (or delegate)	SWF6	Permit to Dewater Work Pack SWMS
SWMM58	A diversion will be maintained to allow for hydrologic connectivity within the Bicentennial Park Pond system.		Construction	Design Manager Area Manager	SWF6	Design Report Work Pack Site Inspection Reports
SWMM59	Risk of algal blooms during construction will be managed through treatment and maintenance		Construction	Environment and Sustainability Manager (or delegate)	SWF3	Site inspection report Work Pack

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
	measures outlined in the Wetland Monitoring Program.					Site Environment Plan

7 Compliance management

7.1 Roles and responsibilities

The CGU Project Team organisational structure and overall roles and responsibilities are outlined in Section 3.4 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

7.2 Training

All employees, contractors and utility staff working onsite will undergo site induction training relating to soil and surface water management. Induction training will address elements related to soil and water management including:

- Requirements of this SSWMP;
- Relevant legislation;
- Roles and responsibilities for soil and water management;
- Procedures to be implemented in the event of an unexpected discovery of contaminated land;
- Water quality management and protection measures;
- Flood mitigation measures; and
- Emergency response procedures (spills to soils and water).

Targeted training in the form of toolbox talks and specific onsite ESC training will also be provided to personnel with a key role in soil and water management. Further details regarding staff induction and training are outlined in Section 3.6 of the CEMP.

7.3 Monitoring and inspection

Monitoring requirements are outlined in the SWMP (Appendix B). Inspection requirements are outlined in Table 13. Additional requirements and responsibilities in relation to inspections are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

Table 13 Monitoring and inspection requirements

Monitoring details	Location	Record	Responsibility	Frequency
Inspection of erosion and sedimentation controls	All compounds	Weekly Inspection Records	Environment Officer	Weekly
Inspection of erosion and sedimentation controls	All	Pre-rainfall Inspection Records	Environment Officer	Rainfall events (forecast >10mm)
Inspection of erosion and sedimentation controls	All	Post Rainfall Inspection Records	Environment Officer	Rainfall events (forecast >10mm)
Risk based inspections and ESCP sign off	All	Soil Conservationist Reports	Environment, Approvals and	Outset of activities and ad hoc as required

Monitoring details	Location	Record	Responsibility	Frequency
			Sustainability Manager	based on risk (e.g. rainfall forecasts, high risk activities)
Meteorological data including daily rainfall, hourly temperature, relative humidity, wind (direction and speed) and barometric pressure	All	Daily rainfall records from closest BOM station (Sydney Airport)	Environment Officer	Daily
Surface water monitoring as per SWMP	As per Surface Water Monitoring Program	Physicochemical Parameters	Environment, Approvals and Sustainability Manager	Monthly and wet weather monitoring (>25mm in 24hrs)
Wetland Monitoring Program	As per Wetland Monitoring Program	Physicochemical Parameters, flora and fauna health	Environment, Approvals and Sustainability Manager	Monthly and wet weather monitoring (>25mm in 24hrs)

7.4 Licences and permits

Project construction activities will be regulated under an EPL issued by the EPA. The EPL will prescribe water quality parameters to be measured and associated discharge criteria/concentrations for licenced discharge points.

No other relevant licences or permits relating to soil and water will be obtained for the Project.

7.5 Weather monitoring

To provide data to assess water quality trends, rainfall and weather forecasts will be monitored during the construction phase utilising the Bureau of Meteorology (BoM) Sydney Airport weather station.

Weather conditions and forecasts (including rainfall prediction maps) will be monitored daily based on surrounding BoM weather stations and relevant information passed on to site personnel to allow for adequate planning for significant rain events.

7.6 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this CEMP Sub-plan, CoA and other relevant approvals, licences and guidelines. Audit requirements are detailed in Section 3.9.3 of the CEMP.

7.7 Reporting

Reporting requirements and responsibilities are documented in Section 3.9.4 and 3.9.5 of the CEMP. Additional reporting will also be generated as required in assessment documents and the SWMP (Appendix B). A summary of Reporting Requirements associated with this Plan are outlined in Table 14.

Table 14 Reporting Requirements

Item	Frequency	Standards	External reporting	Responsibility
Incidents	At each occurrence	As required by the CoA, EPL, PIRMP, TfNSW Environmental Incident Classification and Reporting procedure, and TfNSW Environment incident report.	Appropriate authority dependant on the nature of the incident (e.g. EPA, the Secretary) (refer to Section 3.8 of CEMP & CEMP Appendix A7)	Project Manager Supervisor Environmental and Sustainability Manager
Complaints	Daily (ER, EPA) Weekly (DPIE)	As required by the CoA and EPL. Communication, notification and complaints handling requirements regarding soil and surface water matters will be managed through the Complaints Management System and the Communication Strategy.	ER (CoA A27(a)) EPA (in accordance with the EPL conditions) DPIE (as requested by the Secretary; CoA B10)	Supervisor Project Manager Environmental and Sustainability Manager
Construction Surface Water Monitoring Results	Monthly (EPL data) 6-monthly reporting Annually (12 months)	Refer to Appendix B (Surface Water Monitoring Program) Section 5.5 EPL Annual Return	EPA (in accordance with the EPL conditions) DPIE (as required by CoA C23)	Environmental and Sustainability Manager

8 Review and improvement

8.1 Continual improvement

Section 3.2.2 of the CEMP describes the process for the continual improvement of project documents.

Continual improvement of this Plan will be achieved by ongoing evaluation of environmental management performance outcomes against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continual improvement process is 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;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

This is outlined further in Section 3.2.2 of the CEMP and will be facilitated through the Project EMS.

8.2 SSWMP update and amendment

Processes described in Section 3.9 to Section 3.13 of the CEMP may result in the need to update or revise this Plan. This will occur on an as needed basis.

Only the Environment Manager, or delegate, has the authority to change any of the environmental management documentation.

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 3.12 of the CEMP.

Appendix A – Erosion and Sediment Control Procedure

EROSION AND SEDIMENT CONTROL PROCEDURE

MANAGEMENT AND RESPONSIBILITY

INTERNAL HOLD POINT

- Are works commencing in a new area?
- Have current works changed?
- Has there been significant rainfall (i.e. >10mm/24hours)?
- Will the ground be disturbed?
- Does the Permit to Excavate need to be revalidated?
- Are works to recommence after a shutdown period?

Project Manager
Project Engineer
Site Supervisor

INTERNAL HOLD POINT RELEASE
No further action required, works can commence

INTERNAL HOLD POINT
Excavation works cannot commence. Develop or review/update existing Erosion and Sediment Control Plan (ESCP) to commence/recommence works.

Project Manager
Environmental Advisor
Site Supervisor

CONSULTATION AND INSPECTION
Site supervisor and Environmental Advisor or to conduct site inspection to obtain understanding of any constraints and if any additional environmental controls are required.

Environmental Advisor
Project Engineer
Site Supervisor

DEVELOP AND FINALISE ESCP

- Environmental Advisor to develop/ update ESCP in consultation with Site Supervisor/ Project Engineers. ESCP to comply with Blue Book Volume 1 (Managing Urban Storm water: Soils and Construction) requirements
- Engage with Project Soil Conservationist where required
- ESCP MUST be signed by a representative of the Environment & Sustainability Team, Project Engineer and Site Supervisor

Environmental Advisor
Project Engineer
Site Supervisor

EXTERNAL HOLD POINT
As per TfNSW G38, the Environmental Advisor must send the finalised or updated ESCP must through to the TfNSW Representative for approval 10 working days before soil disturbance activities commence.

Environmental Advisor
TfNSW Representative

EXTERNAL HOLD POINT RELEASE
Works can commence subject to external witness/hold point release

TfNSW Representative

IMPLEMENTATION OF ESCP
Site Supervisor ensures ESC are installed as per the approved ESCP

Environmental Advisor
TfNSW Representative

EXTERNAL WITNESS POINT NOTIFICATION
TfNSW Representative to be notified 5 days prior to the commencement of soil disturbing works (other than progressive installation of ESC).

Environmental Advisor
TfNSW Representative

EXTERNAL HOLD POINT RELEASE
TfNSW Representative releases witness point and soil disturbing works can commence

TfNSW Representative

- ESC to be inspected weekly and post rainfall events by Environmental Advisor and maintained where required.
- Project Soil Conservationist to be consulted throughout periods of high ESC risk.
- ESC risks to be highlighted in inductions and targeted toolbox training.

Appendix B – Surface Water Monitoring Program

Surface Water Monitoring Program

Project Name: M6 Stage 1

Project number:	M6S1
Document number:	M6S1-CGU-NWW-ENPE-PLN-000410
Revision date:	14/12/2021
Revision:	02

Document approval

Rev	Date	Prepared by	Reviewed by	Remarks	
A.01	29/09/2021	S Beitel	C Griffiths		
A.02	08/10/2021	S Beitel	C Griffiths		
00	12/11/2021	S Beitel	C Griffiths		
01	17/11/2021	S Beitel	C Griffiths		
02	14/12/2021	S Beitel	C Griffiths		

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1. Introduction

1.1. Context

This Surface Water Monitoring Program (SWMP or the Program) has been prepared for the M6 Stage 1 Motorway (the Project). The Program forms Appendix B of the Soil and Surface Water CEMP Sub-plan (SSWMP).

The SWMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Environmental Management Measures (EMMs) listed in the M6 Stage 1 Environmental Impact Statement (EIS) and all applicable legislation.

1.2. Scope of SWMP

The scope of this Program is to describe how the CPB Contractors Ghella UGL (CGU) joint venture proposes to monitor potential impacts to surface water during construction of the Project.

Operational monitoring does not fall within the construction phase and is not discussed in this Program.

1.3. Consultation

The SWMP was uploaded to the DPIE Portal and distributed to available relevant government agencies. DPIE Water is the agency responsible for providing advice on Groundwater Monitoring and Modelling Plan, and Surface Water and Groundwater Monitoring Plans; however, they have not commenced review despite several contact attempts. Further consultation will be carried out with DPIE Water and any comments will be incorporated into this document (the Surface Water Monitoring Program) and the Soil and Surface Water CEMP Sub-plan.

The SWMP was sent to Sydney Water (City Growth & Development, Business Development) by email and included an offer of briefing on the Project and Plan. Correspondence was received from Sydney Water and the EPA confirming that the SWMP had been reviewed and feedback would be provided. Table 1 includes summary details of the consultation.

Ongoing consultation with relevant councils and other stakeholders, including any unique local receivers, will be undertaken for issues pertaining to the Project's impact on soil and surface water as required by CoA C4(e) and C13(a). Community feedback and complaints relating to surface water quality will be managed in accordance with the Communication Strategy and Complaints Management System (refer to Section 3.7 of CEMP).

Table 1 Summary of consultation

Name of Stakeholder	Stakeholder Comments	CGU Response	Outstanding Issues
DPIE Water	The Natural Resources Access Register (NRAR) receives post approval requests for coordination with DPIE Water and requests should be directed to them.	Plan was sent to the NRAR on 11/10/21	None
EPA	The EPA recommends that the monitoring suite/s include all pollutants that could potentially be discharged at non-trivial levels from the premises, including in relation to potential runoff from contaminated areas and wastewater treatment plant discharges.	The monitoring suite in Table 4 of the SWMP is now in accordance with the EPL requirements which addresses monitoring of potential pollutants of concern during the initial phase of the project, prior to Water Treatment Plants (WTPs) coming on line. The program will be updated based on the outcomes of the Water Discharge Impact Assessments and this commitment has been added to the program underneath Table 4.	None
	The EPA considers that the Surface Water Quality Monitoring Program would benefit from a review of the monitoring locations to ensure these are the most appropriate to detect water pollution impacts and trigger management actions, including sites closer to the project site.	A review of available locations was undertaken to see if closer sites were feasible. One closer site is available and represents the closest available downstream location where samples can safely and efficiently be collected. It is noted access to this site is reliant upon access being granted by Kogarah Golf Course/ Further, the adopted sites are consistent with the baseline monitoring locations established during the EIS process. If different sites were adopted now, meaningful comparisons would not be feasible with the baseline data from those sites. One additional monitoring location has been included downstream of CSW01 where the Kogarah Golf Course carpark ends. The location has been added to the Surface Water Monitoring Program and is subject to access being granted as it is on private property. These changes have been made to Section 3.2.3 and Table 3 of SWMP.	None
	The EPA recommends that frequency of wet weather monitoring should be increased to support timely detection and management of potential water pollution risks. For example, monthly wet weather sampling during runoff events may be appropriate.	The proposed frequency of sampling is consistent with that adopted on other SSI projects such as WestConnex Rozelle Interchange. CGU intend to focus on proactive management of pollution risks (i.e. focus on prevention) rather than being reactive. Monitoring is considered to be an important "check" that the adopted proactive approach is working, but is undertaken as a feedback loop rather than as a primary control measure.	None

Name of Stakeholder	Stakeholder Comments	CGU Response	Outstanding Issues
		Wet weather sampling during runoff events will be undertaken in each instance where rainfall exceeds 25mm in a 24-hour period, or for complaint.	
	The EPA recommends the performance criteria section in the SWMP be revised to remove references to 'discharge criteria'. If the 'performance criteria' are intended for use as receiving waterway management criteria, the proponent should ensure the criteria are appropriate to detect potential water pollution risks and trigger management responses.	Reference to discharge criteria has been removed from Section 3.2.6 of the SWMP as discharge will occur in accordance with the Project EPL.	None
NRAR	None	None	None
Sydney Water	No comments relating to surface water monitoring Concerns about Sydney Water's Muddy Creek works (restoration and naturalisation) limiting the capacity of the area to receive water while there is ongoing work	CGU continues to work with Sydney Water on matters regarding the Muddy Creek Naturalisation Project.	Consultation will be undertaken with the Sydney Heritage Advisor if it becomes evident that any Sydney Water Heritage items may be impacted

2. Purpose and objectives

2.1. Purpose

The purpose of this Program is to describe how CGU will monitor surface water quality during construction of the Project.

The Program will be implemented to monitor the effectiveness of mitigation measures applied during the construction phase of the Project. Monitoring of surface water will be undertaken to identify potential impacts and ensure an appropriate management regime can be implemented to address those impacts and manage local surface water quality.

The Program provides details of the surface water monitoring network, frequency of monitoring, and test parameters. This Program supplements the SSWMP, which itself is an Appendix to the Construction Environmental Management Plan (CEMP) and is based on baseline studies undertaken for the Project EIS (AECOM, 2018), and ongoing baseline monitoring completed until Project commencement.

2.2. Objectives

Key objectives of the SWMP are to ensure all CoA, EMM, and licence/permit requirements relating to surface water monitoring are described, scheduled, and assigned responsibility as outlined in:

- The environmental assessment prepared for the Project, including the EIS, the Response to Submissions on the EIS, the PIR and Response to Submissions on the PIR;
- CoA granted to the Project on 18 December 2019 (SSI 8931);
- TfNSW specifications G36, G38 and G40;
- Environmental Protection Licence (EPL) 21600; and
- All relevant legislation and other requirements described in Appendix A1 of the CEMP.

2.3. Relationship with Wetland Monitoring Program

In accordance with CoA C13(g) and CoA C18 a Wetland Monitoring Program (WMP) will be developed and implemented on the Project. The SWMP has taken into consideration requirements outlined in the WMP.

3. Surface water monitoring

3.1. Baseline monitoring

3.1.1. Overview

In September 2017 a baseline surface water monitoring program commenced as part of the EIS to determine the state of the existing surface water environment. The Program was based on a desktop assessment involving a review of the existing surface water environment across the Project area, including:

- Information and previous studies pertaining to surface water; and
- Other technical reports included in the EIS including groundwater, flooding, contamination and biodiversity.

The baseline surface water monitoring program was designed to:

- Present the state of the existing surface water environment;
- Identify potential impacts that may arise from the construction of the Project; and
- Develop measures to manage potential impacts.

Following publication of the EIS, Transport for NSW (TfNSW) have continued to obtain baseline samples from one location in close proximity to the project.

The current baseline monitoring program will continue until commencement of Project construction in accordance with EMM SWF1 (refer Table 3 of SSWMP). Baseline water quality monitoring locations are in potential receiving environments of surface water run-off, proposed water discharge environments, and upstream and downstream of the creek diversion works in Bicentennial Park.

Water quality monitoring locations were selected to provide characterisation of waterways in the vicinity of the Project. Baseline and ongoing sampling locations are detailed in Table 2. Ongoing baseline sampling will continue until construction commencement on the Project.

Baseline monitoring of surface water level has been undertaken since September 2020 at the following two locations (marked on Figure 1):

- Fixed point at Bicentennial Park and Bicentennial Park East bridge (328544.057,6239291.228 MGA)
- Fixed point at Barton Street Bridge (328698.838,6240367.819 MGA)

Baseline surface water level is ongoing and surface water levels are presented in Table 3.

Table 2 Baseline surface water quality monitoring information

EIS sampling ID	Number of samples	Start of baseline monitoring	Location	Easting	Northing
Site 3	20	June 2015	Cooks River North	329895.9	6243717.3
Site 4	20	June 2015	Cooks River South	329955.9	6242592.2
SW1	19	September 2017	Muddy Creek North	329524.6	6242066.7
SW2	19	September 2017	Muddy Creek South	329026.3	6241461.4
SW3	12	August 2020	Bicentennial Park Pond	328697.1	6240373.3
N/A	39	September 2017	Northern Scarborough Pond	328574.2	6240071.9
N/A	12	August 2020	Patmore Swamp	328571.2	6239704.6
SW4	12	August 2020	Patmore Swamp	328642.2	6239565.4
N/A	12	August 2020	Southern Scarborough Pond	328546.7	6239305.3

Table 3 Baseline surface water level monitoring information

Surface Water Level ID	Date	Recorded Surface Water Level (m)	Fixed Point (mAHD)	Surface Water Level (mAHD)
SWL01	23/09/2020	1.40	1.83	0.43
SWL01	21/10/2020	1.35		0.48
SWL01	19/11/2020	1.34		0.49
SWL01	17/12/2020	1.27		0.56
SWL01	14/01/2021	1.39		0.44
SWL01	18/02/2021	1.41		0.42
SWL01	26/05/2021	1.36		0.47
SWL01	23/06/2021	1.40		0.43
SWL01	04/08/2021	1.41		0.42
SWL01	31/08/2021	1.39		0.44
SWL01	28/09/2021	1.35		0.48
SWL01	26/10/2021	1.38		0.45
SWL01	23/11/2021	1.45		0.38
SWL01	07/12/2021	1.41		0.41
SWL02	23/09/2020	2.79	3.97	1.18
SWL02	20/10/2020	2.79		1.18
SWL02	19/11/2020	2.79		1.18
SWL02	17/12/2020	2.78		1.19
SWL02	14/01/2021	2.78		1.19
SWL02	18/02/2021	2.82		1.15
SWL02	26/05/2021	2.79		1.18
SWL02	23/06/2021	2.78		1.19
SWL02	04/08/2021	2.80		1.17
SWL02	31/08/2021	2.76		1.21

Surface Water Level ID	Date	Recorded Surface Water Level (m)	Fixed Point (mAHD)	Surface Water Level (mAHD)
SWL02	28/09/2021	2.77		1.20
SWL02	26/10/2021	2.78		1.19
SWL02	23/11/2021	2.86		1.11
SWL02	07/12/2021	2.83		1.14

3.1.2. Available baseline water quality data

Baseline surface water quality sampling program was undertaken in multiple phases between June 2015 and August 2021.

Testing of the following analytes was generally undertaken during the baseline monitoring program:

- Physio-chemical (field) parameters (pH, temperature, electrical conductivity (EC), oxidation / reduction potential, dissolved oxygen, and turbidity);
- Total Recoverable Hydrocarbons;
- Benzene, Toluene, Ethyl-Benzene, Xylenes and Naphthalene (BTEXN);
- Dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc, ferrous iron, total iron and total Manganese);
- Inorganics (calcium, magnesium, potassium, sodium, CaCO3, chloride, sulfate);
- Nutrients (Total Nitrogen, TKN, NOx, NO2, NO3, Total Phosphorus and Filterable Reactive Phosphorus); and
- Ammonia.

A high level summary of baseline water quality data is provided in Appendix A of this Program and an interpretation of this data is presented in Table 4. Baseline monitoring shows that surface water quality parameters are generally consistent with a disturbed, urban environment. This is expected given the highly urbanised and disturbed area and receiving waterways surrounding the project.

Table 4 Baseline water quality summary

Waterway	Description of water quality
Cooks River (Cooks River Catchment)	The Cooks River catchment is highly urbanised and has been subject to long term anthropogenic development and degradation. Most watercourses within the Cooks River catchment are anthropogenic channels Elevated concentrations of total nitrogen, total phosphorus, reactive phosphorus, cadmium, chromium, copper, lead and zinc were detected during the baseline assessment. On some occasions nitrate, arsenic, mercury and nickel exceeded guideline levels.
Muddy Creek (Cooks River Catchment)	The Muddy Creek channel has been highly modified as a result of urbanisation and includes a series of concrete and brick lined channels and closed box culvert structures Elevated concentrations of total nitrogen, total phosphorus, reactive phosphorus, copper and zinc were detected during the baseline assessment. On some occasions pH, nitrate, arsenic, mercury and nickel exceeded guideline levels.
Bicentennial Park Ponds (Botany Bay Catchment)	Former landfills lie to the east and west of the Ponds which may be impacting nitrogen in groundwater. The Ponds are also subject to duckweed infestations and algal blooms. Elevated concentrations of ammonia, total nitrogen, total phosphorus, reactive phosphorus, copper and zinc were detected during the baseline assessment. On some occasions pH, chromium, nitrate and lead exceeded guideline levels.

Waterway	Description of water quality
North Scarborough Ponds (Botany Bay Catchment)	The Ponds are subject to duckweed infestations and algal blooms. Elevated concentrations of total nitrogen, total phosphorus, copper and zinc were detected during the baseline assessment. On some occasions pH and lead exceeded guideline levels.
South Scarborough Ponds (Botany Bay Catchment)	Scum and plastic rubbish have been noted during baseline sampling. Elevated concentrations of nitrogen total phosphorus, reactive phosphorous and copper were detected during the baseline assessment

3.2. Construction surface water quality monitoring

3.2.1. Overview

The mobilisation of sediments and pollutants during construction works is identified as a potential impact to surface water within the already highly urbanised and disturbed catchments and waterways. This Program will be implemented to monitor the potential impacts and assess whether the proposed environmental mitigation measures are effective.

Construction water treatment plants (WTPs) are proposed at the construction ancillary facilities C1, C2, and C3 (Arncliffe, Rockdale, and Bicentennial Park). Water from dewatering and other activities will be reused for construction purposes where possible and excess water discharged to surface waters. It is anticipated that discharge from C1 will be into the Marsh Street stormwater culvert. The location of discharges from C2 and C3 are subject to further design but will likely be into Muddy Creek from C2 and into surface waters at C3.

Treated water at Rockdale Depot and Bicentennial Park may also be used as part of a recharge program (subject to detailed design). Refer to the Groundwater CEMP Sub-plan and monitoring program (Appendix B5 of the CEMP).

Monitoring will continue for a minimum of three years following the completion of construction, or until the affected waterways are certified by a suitably qualified and experienced independent expert as being appropriately rehabilitated (or otherwise required by any project conditions of approval).

3.2.2. Rainfall monitoring

Rainfall will be monitored during construction at the Bureau of Meteorology (BoM) automated weather station at Sydney Airport. The Sydney Airport weather station is 1.8km south-east of C1 and 4.6km north-east of C3.

3.2.3. Construction surface water quality monitoring locations

Construction surface water quality monitoring will be carried out during construction at the sites detailed in Table 5 and shown in Figure 1. Sample sites were adopted to be consistent with the baseline monitoring locations established during the EIS to enable meaningful comparisons to baseline data.

Monitoring will be conducted in order to assess trends in water quality, including natural variations. The collection of sufficient samples is required to enable assessment of any potential impacts from construction.

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Figure 1 Sampling locations

Table 5 Construction surface water sampling locations

Construction sampling ID	Location	Direction from Project	Easting	Northing
CSW01	Cooks River North	Upstream of C1	329895.9	6243717.3
CSW02	Cooks River South	Downstream of C1	329955.9	6242592.2
CSW03	Muddy Creek North (estuarine)	Downstream of C2, C4 and C5	329524.6	6242066.7
CSW04	Muddy Creek South (canal)	Downstream of C2, C4 and C5	329026.3	6241461.4
CSW05	Muddy Creek South West (canal)	Upstream of C2, C4 and C5	328313.9	6240980.4
CSW06	Northern Bicentennial Park Pond	Upstream of wetland diversion at C3	328793.5	6240586.9
CSW07	Kings Wetland	Upstream of wetland diversion at C3	328892.6	6240574.9
CSW08	Bicentennial Park Pond (temporary)	Cut and Cover location at C3	328697.1	6240373.3
CSW09	Southern Bicentennial Park Pond	Downstream of wetland diversion at C3	328634.3	6240221.8
CSW10	Northern Scarborough Pond	Immediately downstream from President Avenue at C3	328574.2	6240071.9
CSW11	Patmore Swamp	Open water body, downstream of roadworks on President Avenue at C3 and Active Transport Corridor works at C4	328571.2	6239704.6
CSW12	Patmore Swamp	Open water body, downstream of roadworks on President Avenue at C3 and Active Transport Corridor works at C4	328642.2	6239565.4
CSW13	Southern Scarborough Pond	Downstream of all works	328546.7	6239305.3
CSW14	Cooks River	Downstream of CSW01 and upstream of CSW02	330010.7	6243484.6

It is noted that CSW14 is located on private property and sampling at this site will only be undertaken subject to access being granted by Kogarah Golf Course.

3.2.4. Sampling frequency

During the construction phase, water quality sampling will be undertaken monthly. Wet weather monitoring will be carried out once a month when a continuous rainfall event of >25 mm is received in the local catchment during a 24-hour period (as recorded at the nearest BoM weather station), or once per 3 months where rainfall does not exceed 25mm and has generated runoff from site.

For safety reasons sampling may not be undertaken during peak stormflows. Following a wet weather event sampling will be completed as soon as reasonably practicable and safe to do so.

The monitoring program will continue for the duration of construction and until the affected waterways are rehabilitated to an acceptable condition as certified by a suitably qualified and experienced independent expert.

3.2.5. Surface water quality parameters

Table 6 details the analytes that will be monitored during the construction phase surface water monitoring, at the locations listed in Table 3 and illustrated in Figure 1.

Table 6 Analytical suite

Category	Parameter	Unit of measure
Field measurements (physio-chemical parameters)	Temperature	˚C
	Dissolved Oxygen	mg/L
	Electrical Conductivity	µS/cm
	Reduction-Oxidation Potential (Redox)	mV
	pH	pH units-
	Turbidity	NTU
	Odour, colour and surface sheen	Visible-
Laboratory analysis	Total suspended solids (TSS)	mg/L
	Total recoverable hydrocarbons (TRHs)	µg/L
	Benzene, toluene, ethylbenzene, xylene, and naphthalene (BTEXN)	µg/L
	Dissolved metals (arsenic (total), cadmium, chromium (total), copper, lead, manganese, mercury (inorganic), nickel and zinc)	µg/L
	Ferrous iron and total iron	µg/L
	Nutrients (Total Nitrogen, TKN, NOx, NO2, NO3, Total Phosphorus and Filterable Reactive Phosphorus)	µg/L or mg/L
	Ammonia	µg/L
	Volatile Organic Compounds (including chloroform)	mg/L

Surface water results will be assessed for compliance in accordance with the performance criteria. Initial results will be screened against the ANZG default values. Where ANZG default values are exceeded, data will be assessed in consideration of location (upstream/downstream) and other relevant results as follows:

- An assessment of other results collected within the catchment on the same day (results downstream that are 20% or greater than the upstream value will trigger an investigation)
- Results will be assessed in accordance with baseline data (SSTV) where 24 months of data is available. The 20th Percentile will be adopted for dissolved oxygen, the 80th percentile has been adopted for all other analytes.
- A three-month rolling average will be utilised where 24 months of data is not available (results that are greater than 20% of the three month rolling average will trigger an investigation).

4. Monitoring methodology and sampling protocol

4.1. Sampling collection

Grab samples will be collected manually from the sampling locations identified in Figure 1 and Table 5. Volumes of sample collected will be sufficient for the required laboratory analysis. Field measurements for physio-chemical parameters will also be undertaken at the same time using appropriate calibrated multiprobe equipment.

4.2. Field measurements

Field physico-chemical parameters including EC, pH, DO, ORP, temperature, and turbidity will be measured at each sampling location using a fully calibrated multi-probe water quality meter(s) or provided for laboratory analysis. Observations relating to odour, colour and surface sheen will also be recorded.

The multi-probe field water quality meter(s) will be calibrated against known standards, as supplied by the manufacturer, at the start and completion of each day of water quality sampling.

4.3. Recording of field results

Results for each monitoring location will be recorded on appropriate field sheets (hard copy or digital) using unique sampling identification nomenclature consisting of the sample date, time, location, weather information (e.g. wet/dry, flow/no flow) and identify personnel collecting the samples.

4.4. Laboratory analysis

A NATA accredited laboratory will be used for analyses of all grab samples requiring laboratory analysis. Samples for laboratory analysis will be collected in the required laboratory supplied sampling containers. The required containers for laboratory analysis are specified in Table 7.

Table 7 Laboratory sample preservation

Analyte	Container
Metals	60 ml plastic bottle with nitric acid preservation. Field filtration for dissolved metals
Ferrous Iron	60 ml plastic bottle with hydrochloric Acid preservation.
NOx, TKN/TP, TN, Ammonia	60 ml plastic bottle with hydrochloric Acid preservation.
VOC, BTEXN and TRH C6-C10	Pair of 40mL Amber Glass Vials with Teflon Lined Septa and Sulfuric Acid (H2 SO4) preservation
TRH C10-C40	100mL Amber Glass Bottle with Teflon Lined Cap

4.5. Decontamination

Sampling equipment will be cleaned (decontaminated) between each sample. Where a sample site shows evidence of contamination (e.g. an algal bloom, or strong odours) equipment will need to be cleaned thoroughly. In addition, equipment will need to be cleaned periodically to prevent a build-up of dirt.

The following decontamination method will be followed:

- Rinse the equipment in tap water;
- Clean with De-Con 90 (a phosphate free detergent), or equivalent;
- Rinse again with tap water;

- Rinse three times with de-ionised water; and
- Allow to dry.

De-ionised and tap water will be available for washing equipment in the field.

4.6. Quality assurance and documentation

Any sample to be sent to a laboratory will be subject to quality assurance protocols. As part of sampling the following will be undertaken:

- Rinsate blanks (one per sampling event only).

Samples are to be transported to a NATA-accredited laboratory under documented chain-of custody protocols. Monitoring will only be conducted by person/s trained in the use of equipment and appropriate sample handling techniques. Field results will be checked for accuracy before leaving the site and errors or discrepancies will be cross-checked, and further investigation initiated if required. Monitoring and calibration records will be maintained in accordance with the appropriate standard.

5. Compliance management

5.1. Roles, responsibility and training

The CGU Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.4 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in the SWMP.

All employees, contractors and utility staff working on site will undergo site induction and targeted training relating to surface water management issues, detailed in the SSWMP.

Further details regarding staff induction and training are outlined in Section 3.6 of the CEMP.

All surface water quality monitoring required by this Monitoring Program will be undertaken by the project Environment Team.

5.2. Monitoring and inspection

This Program details the monitoring requirements for surface water. Additional soil and surface water inspection requirements (including weekly site inspections) are detailed in the SSWMP Section 7.3.

In accordance with Section 3.3.1 of the CEMP, the CGU Environmental and Sustainability Manager is responsible for ensuring monitoring activities are undertaken.

Additional requirements and responsibilities in relation to inspections are documented in Section 3.9.2 of the CEMP.

5.3. Data analysis and management response

A management response would be initiated if the performance criteria outlined in Section 3.2.5 are not met or are exceeded. A review will be initiated to determine the significance of the exceedance(s) and possible causes. The review will assess available surface water data, baseline data for the relevant waterway, recent rainfall records, and recent activities or recorded erosion/sediment control incidents occurring in the catchment.

Results and any investigations of exceedances from the monthly construction monitoring program will be collated and described in the 6 monthly Surface Water Monitoring Report as described in Section 5.5.

If the exceedance is determined to be attributable to Project works, the event will be treated as an environmental incident and managed in accordance with the requirements in Sections 3.8 and 3.10 of the CEMP. Corrective and preventative actions will be identified and implemented as part of that process.

5.4. Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Program, CoA, and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 3.9.3 of the CEMP.

5.5. Reporting

Reporting requirements associated with the construction SWMP are detailed in Table 8.

Table 8 Reporting requirements

Schedule (during construction)	Requirements	Recipient (relevant authority)
Monthly Environmental Report (every month)	Monitoring program performance will be documented in the Monthly Environmental Report. Any incidents and key environmental issues will be documented.	TfNSW
Surface Water Monitoring Reports (every six months)	Data summary reports presenting tabulated surface water monitoring data collected during the reporting period. Applicable management responses will be documented.	EPA, DPIE and publicly available through the Project website
EPL Annual Return (every 12 months)	An annual return will be developed as per requirements of the EPL.	EPA

6. Review and improvement

6.1. Continual improvement

Monitoring data will be reviewed throughout the construction period to provide potential requirements to increase, or decrease, the number of sampling locations and/or the analytical suites.

This Program will be continually reviewed for appropriateness. Any alterations monitoring locations, analytical suites, or frequencies will be reported in Surface Water Monitoring Reports.

Continual improvement of this Program will be achieved through ongoing evaluation of performance against environmental policies, objectives and targets and Project performance outcomes of the EIS for the purposes of identifying opportunities for improvement.

The continual improvement process is 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;
- Document any changes in procedures resulting from process improvement; and
- Make comparisons with objectives and targets.

6.2. SWMP update and amendment

The processes described in Sections 3.12 and Section 3.13 of the CEMP may result in the need to update or revise the SWMP. Revisions will occur in accordance with the process outlined in Section 3.13 of the CEMP.

A copy of the updated Program and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure.

7. References

Acid Sulfate Soil Management Advisory Committee (ASSMAC),1998. Acid Sulfate Soil Manual

AECOM, 2018. F6 Extension Stage 1 New M5 Motorway at Arncliffe to President Avenue at Kogarah, Surface Water Technical Report, October 2018

ANZECC/ARMCANZ, 2000a. Australian and New Zealand Guidelines for Fresh and Marine Water Quality

ANZECC/ARMCANZ, 2000b. Australian Guidelines for Water Quality Monitoring and Reporting

Cardno, 2021, Surface Water Monitoring Report, M6 Groundwater Monitoring Services, 22 March 2021

EPA, 2004. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW

Landcom, 2004. Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2

NSW Department of Conservation and Land Management, 1989. Soil Landscapes of the Sydney 1:100,000 Sheet 9130

NSW Department of Infrastructure, Planning and Natural Resources, 2002. Salinity Potential in Western Sydney Map

RTA, 1999. Guideline for Construction Water Quality Monitoring. NSW Road and Traffic Authority

Appendix A – Interim site specific trigger values

Table 9 Interim site-specific trigger values based on the ongoing baseline monitoring

Parameter	Units	CSW01	CSW02	CSW03	CSW04	CSW05	CSW06	CSW07	CSW08	CSW09	CSW10	CSW11	CSW12	CSW13
Arsenic (total)	µg/L	0.02	<0.01	0.0022	0.0022	N/A	0.001	N/A	0.0018	0.0018	0.002	0.003	0.0025	0.0028
Cadmium	µg/L	0.0055	<0.001	<0.0002	<0.0002	N/A	<0.0002	N/A	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Chromium (total)	µg/L	0.018	<0.01	0.001	0.0027	N/A	<0.001	N/A	<0.001	<0.001	<0.001	<0.001	0.0015	<0.001
Copper	µg/L	0.086	<0.01	0.0084	0.012	N/A	0.0086	N/A	0.006	0.0048	0.011	0.004	0.005	0.003
Total Iron	µg/L	0.7	<0.5	0.48	0.64	N/A	0.86	N/A	2.5	1.1	1.15	0.17	0.33	0.13
Ferrous Iron	µg/L	0.2	0.26	0.1	0.13	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.18	N/A
Lead	µg/L	0.029	<0.01	0.005	0.0073	N/A	<0.001	N/A	<0.001	<0.001	<0.001	<0.001	0.0023	<0.001
Manganese	µg/L	0.031	0.012	0.035	0.037	N/A	0.17	N/A	0.26	0.39	0.22	0.049	0.041	0.039
Mercury (inorganic)	µg/L	<0.0001	<0.001	<0.00004	<0.00004	N/A	<0.0001	N/A	0.0002	0.0006	0.0003	<0.0001	<0.00004	<0.0001
Nickel	µg/L	0.016	<0.01	0.0012	0.0015	N/A	0.0022	N/A	0.002	0.0014	0.003	0.002	0.0011	0.001
Zinc	µg/L	0.1	<0.05	0.051	0.064	N/A	0.007	N/A	0.02	0.0094	0.023	0.01	0.030	0.0084
Ammonia	µg/L	N/A	N/A	1.69	0.74	N/A	1.7	N/A	2.2	3.8	10	0.98	0.29	0.57
Nitrate	µg/L	0.25	0.14	0.48	0.99	N/A	0.17	N/A	0.6	1.3	0.57	0.11	0.33	0.12
Total Nitrogen	mg/L	1300	640	2.6	2.4	N/A	2.6	N/A	5.1	5.8	10	1.6	1.9	1.1
Total Phosphorus	mg/L	0.1	0.14	0.16	0.2	N/A	0.25	N/A	0.36	0.35	0.33	0.056	0.13	0.07
Reactive	mg/L	0.02	0.024	0.056	0.066	N/A	0.09	N/A	0.12	0.11	0.21	0.042	0.05	0.07
TRH	µg/L	< LOR	< LOR	< LOR	< LOR	N/A	< LOR	N/A	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR
BTEXN	µg/L	< LOR	< LOR	< LOR	< LOR	N/A	< LOR	N/A	< LOR	< LOR	< LOR	< LOR	< LOR	< LOR
pH	units	7.5-7.9	7.6-7.9	7.1-7.7	7.6-7.9	N/A	7.2-7.6	N/A	7.4-7.8	7.3-7.8	7.3-7.6	7.5-7.9	7.4-7.9	7.3-7.8
Turbidity	NTU	15	4.4	5.0	6.42	N/A	6.1	N/A	8.5	18	7.3	4.3	5.9	1.7
Electrical	µS/cm	40000	44000	45000	45000	N/A	590	N/A	620	550	11000	23000	39000	27000
Redox	mV	110 –	80 – 110	320 –	320 - 390	N/A	-80 – 61	N/A	-112 – 43	-130 – 48	-190 - -	-38 - 57	290-380	8.2 – 71
Dissolved Oxygen [1]	mg/L	4.6	5.6	3.4	4.5	N/A	0.62		3.4	0.34	2.8	4.6	5.6	4.6
Temperature	°C	15-21	16-22	14-22	16 – 23	N/A	N/A		N/A	N/A	N/A	N/A	16 - 25	N/A

N/A = Not Assessed, baseline data not collected.

Data represents 20th percentile for dissolved oxygen and 80th percentile for all other analytes. SSTVs will not be used until they have been updated and assessed following the completion of 24 months of data collection.

Appendix C – Acid Sulfate Soil Management Plan

Acid Sulfate Soil Management Plan

Project Name: M6 Stage 1

Project number:	M6S1
Revision date:	14/12/2021
Revision:	Rev 02

Document approval

Rev	Date	Prepared by	Reviewed by	Remarks	
A.01	29/09/2021	M Malcolm	C Gibson		
A.02	08/10/2021	S Beitel	C Griffiths		
00	12/11/2021	V Yuan	C Griffiths		
01	17/11/2021	V Yuan	C Griffiths		
02	14/12/2021	S Beitel	C Griffiths		

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Abbreviations	Expanded text
AHD	Australian Height Datum
ANC	Acid Neutralizing Capacity
ASM	Acidic Sulfate Materials
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soils Management Plan
ASR	Acid Sulfate Rock
CAP	Construction Area Plan
CEMP	Construction Environmental Management Plan
CGU	CPB, Ghella, UGL joint venture
CoA	Conditions of Approval
CLM Act	*Contaminated Land Management Act 1997*
Construction Area	A separable portion of work that is identified early in construction Planning to help drive early definition of construction methodology and alignment of design activities. Work Areas will be listed in the overall construction methodology. The ASSM Planning document for a work area is called a Construction Area Plan.
DPIE	Department of Planning, Industry and Environment
EES	Environment, Energy and Science
EIS	M6 Stage 1 Environmental Impact Statement
EMMs	Environmental Management Measures, as outlined in the SPIR
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
H_2O_2	Hydrogen Peroxide
IC	Independent Certifier
MBO	Monosulphidic Black Ooze
POEO Act	*Protection of the Environment Operations Act 1997*
Project	M6 Stage 1
RRE	Resource Recovery Exemption
RRO	Resource Recovery Order
RAP	Remediation Action Plan
SDS	Safety Data Sheets
SPIR	M6 Stage 1 Submissions and Preferred Infrastructure Report
SSWMP	Soil and Surface Water CEMP Sub-plan
VENM	Virgin Excavated Natural Material

1. Purpose

The purpose of this Acid Sulfate Soils Management Plan (ASSMP) is to outline the management measures for handling, treatment and disposal of Acid Sulfate Soils (ASS). This Plan will interact with the following project management plans:

- Construction Environmental Management Plan (CEMP) (M6S1-CGU-NWW-ENPE-MPL-000400);
- Appendix B4 Soil and Surface Water CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000409);
- Appendix B7 Air Quality and Odour CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000407);
- Appendix B8 Contaminated Land Management CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000413); and
- Appendix B9 Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414).

A description of the proposed activities and key construction sites of the M6 Stage 1 Project (the Project) are outlined in Section 1.3 of the CEMP. Section 1.5 of the CEMP includes an overview of the Project Environmental Management System. Details of the existing environment, including topography, soil landscapes and surface water are detailed in Section 4 of the Soil and Surface Water CEMP Sub-plan (SSWMP).

This ASSMP was informed by the Acid Sulfate Soil and Salinity Assessment Report (M6S1-CGU-NWW-EV-RPT-680400) an internal document developed from geotechnical and contamination investigations.

This ASSMP will be reviewed by the Independent Certifier (IC) before use.

2. Acidic Sulfate Materials

The following Sections provide an overview of the different types of Acidic Sulfate Materials (ASM).

2.1. Acid Sulfate Soils

ASS are naturally occurring sediments that are deposited under anaerobic estuarine conditions. They contain iron sulfides and, when exposed to oxygen via dewatering, groundwater table decline or removal from beneath the water table, the soils can produce leachate that is highly acidic, contain sulfate salinity and heavy metals.

ASS are widespread along the NSW coast and are generally found in estuaries, mangrove flats, salt marshes tea-tree swamps and beneath low-lying coastal floodplains, including farmland and urban areas. ASS are typically located in areas with elevations less than 5 metres Australian Height Datum (m AHD). ASS can include Potential Acid Sulfate Soils (PASS) and Actual Acid Sulfate Soils (AASS).

2.1.1. Potential Acid Sulfate Soils (PASS)

PASS are soils most commonly beneath the water table with the potential to generate acidity due to the presence of iron sulfides or sulfidic material. In their undisturbed state, PASS may exhibit a pH of 4.5 or greater and may be slightly alkaline. When exposed to air, the sulfides in PASS oxidise and release significant quantities of acid. Following oxidation, the pH of these soils may fall considerably below pH 4.

2.1.2. Actual Acid Sulfate Soils (AASS)

Actual Acid Sulfate Soils are highly acidic soils resulting from oxidation of iron sulfides or sulfidic material present in the soil profile. AASS are formed through the disturbance of PASS, which may be a result of either natural disturbance (e.g. regional fall in groundwater levels which exposes PASS to oxygen) or human disturbances (e.g. excavating PASS or construction dewatering). AASS are typically characterised by pale yellow mottles, coating of soils with jarosite and pH of 4 or less.

2.2. Monosulphidic Black Ooze

Monosulphidic Black Ooze (MBO) is black coloured mud rich in the amorphous iron mono-sulfide FeS. MBO is often formed in ASS environments or coastal stormwater drainage systems, canals and water ways where conditions favour anaerobic bacteria and there is a significant influx of sulfate rich tidal water, dissolved iron and nutrients. FeS reacts with oxygen very rapidly and thus exposure of MBO to oxygen rich water can result in significant anoxia, acidification and release of elevated concentrations of metals and metalloids.

2.3. Acid Sulfate Rock

Acid Sulfate Rock (ASR) is rock material that contains a range of metal sulfide minerals. Elevated concentrations are generally associated with metalliferous ore deposits and coal units but can also occur in other forms such as uplifted marine sedimentary rocks and wind driven sediments containing pyrite. When fresh pyrite containing rock is disturbed and exposed to air and water it can produce significant loadings of acidity, sulfate salinity and metals/metalloids. The finer the particle size distribution of the rock, the greater the rate and severity of sulfide oxidation.

2.4. Soil Classifications

In NSW, land is classified based on the likelihood of ASS being present in particular areas and at certain depths. Following are five classifications (Department of Land and Water Conservation, 1998):

- Class 1: Acid Sulfate Soils are likely to be found on and below the natural ground surface. Any works would trigger the requirement for assessment and will require management;
- Class 2: Acid Sulfate Soils are likely to be found below the natural ground surface. Any works beneath thenatural ground surface, or works which are likely to lower the water table, would trigger the requirement for assessment and will require management;
- Class 3: Acid Sulfate Soils are likely to be found more than 1m below the natural ground surface. Any works that extend beyond one metre below the natural ground surface, or works which are likely to lowerwater table beyond 1m below the natural ground surface, would trigger the requirement for assessment and will require management; and
- Class 4: Acid Sulfate Soils are likely to be found more than 2m below the natural ground surface. Any works that extend beyond 2m below the natural ground surface, or works which are likely to lower the water table beyond 2m below the natural ground surface, would trigger the requirement for assessment and will require management.

The majority of the Project footprint is located on land which presents a low risk of encountering ASS or PASS (Class 5). However, construction ancillary facilities C2, C3, C4 and C5 are located within areas identified as Class 3 and Class 2 (refer Figure 1).

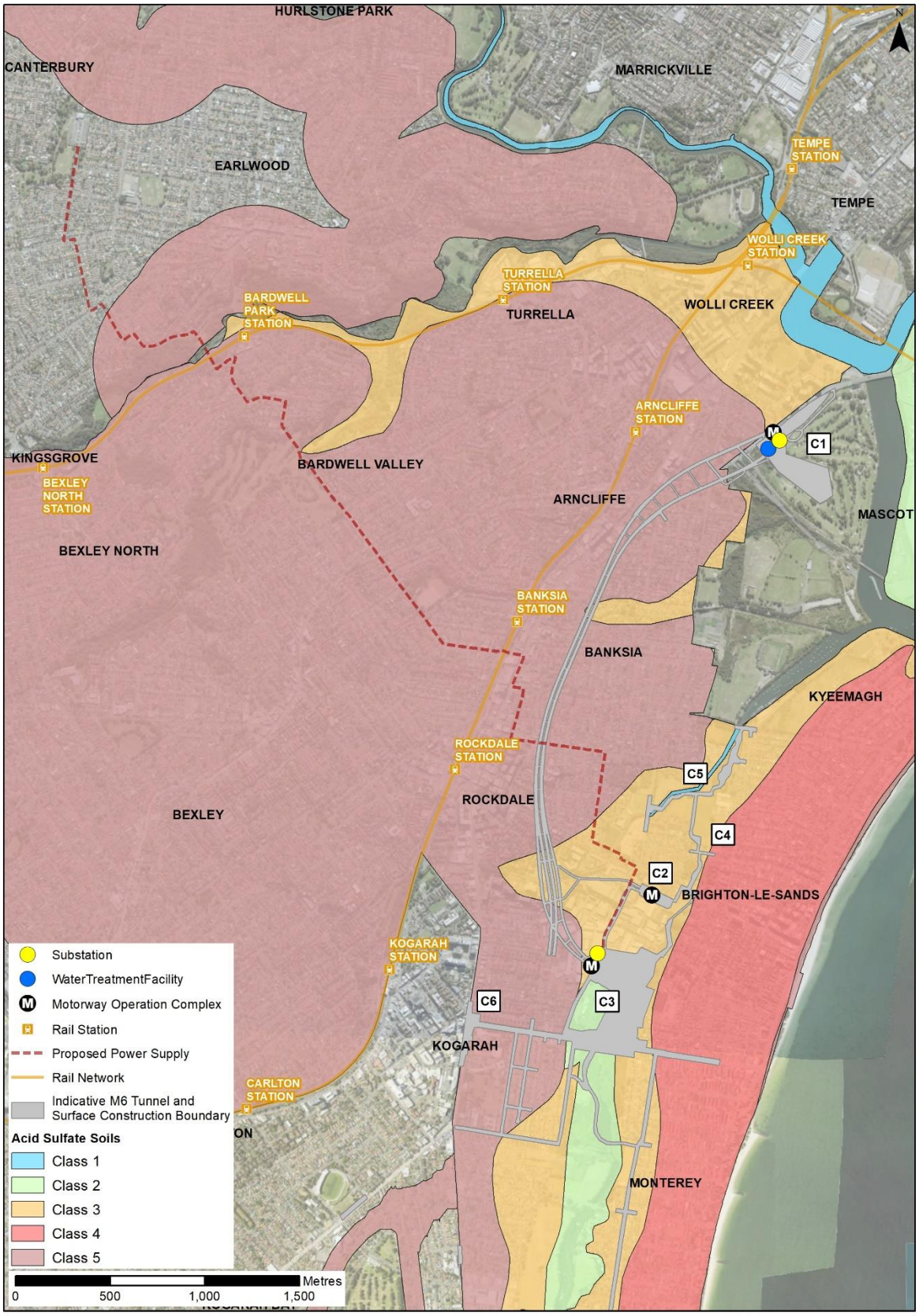

Figure 1 ASS/PASS Risk Mapping

3. Objectives and Targets

The key objective of the ASSMP is to ensure appropriate management measures are implemented to manage ASS and risks related to water quality during construction of the Project. This is outlined in Section 2.2 and Section 2.3 of the SSWMP. The designed performance targets for the management of ASS on the Project include:

- Minimising the disturbance of ASS where possible;
- Managing the risks which arise from the disturbance, excavation, treatment and disposal of ASS; and
- Avoiding pollution to land or waterways due to the mismanagement of ASS.

4. Training

All personnel, including employees, contractors and sub-contractors, are required to complete a Project induction containing relevant environmental information before they are authorised to work on the Project. The induction will include information on where ASS may be encountered, how to identify ASS, the risks of mismanaging ASS and where to find further information on where this material is stored and treated on site (i.e. Site Environment Plans). Relevant project personnel include Leading Hands, Supervisors, Superintendents, Environmental Team and Engineers will receive training and ongoing toolbox talks on:

- Project obligations including requirements to assess and manage ASS on site; and
- Responsibilities pertaining to the management of ASS under the Contaminated Land Management Act 1997 and the Protection of the Environment Operations Act 1997.

Specialist training will be carried out where required by a competent and experienced person.

Section 6 of this plan details the qualitative indicators of ASS impact and actions that shall be taken where unexpected actual or potential ASS are identified.

5. Legal and other requirements

This section provides the relevant legislation and Project requirements that apply to ASS aspects of construction.

5.1. Legislation

Legislation relevant to the management of ASS includes:

- Contaminated Land Management Act 1997; and
- Protection of the Environment Operations Act 1997.

5.2. Ministers Conditions of Approval

The Ministers Conditions of Approval (CoA) to this Plan are listed in Table 1 below.

Table 1 Conditions of Approval relating to Acid Sulfate Soils

CoA	Requirement	Where addressed
C8	The Soil and Surface Water CEMP Sub-plan must include an Acid Sulfate Soils Management Plan to address those areas where Acid Sulfate Soils are known to occur or potentially occur. The Acid Sulfate Soils Management Plan must include measures for the management, handling, treatment and disposal of Acid Sulfate Soils, including monitoring of water quality at Acid Sulfate Soils treatment areas in accordance with the Acid Sulfate Soil Manual (NSW ASSMAC, 1998) and with regard to the Waste Classification Guidelines (NSW EPA, 2014). The Acid Sulfate Soils Management Plan must be reviewed and considered satisfactory by an EPA accredited site auditor.	Soil and Surface Water CEMP Sub-plan This Plan

5.3. Environmental Management Measures

The Environmental Management Measures (EMMs) included in the EIS and SPIR relating to the management of ASS are included in Table 2.

Table 2 Environmental Management Measures for Acid Sulfate Soils

EMM	Requirement	Where addressed
SC5	An Acid Sulfate Management Plan will be prepared detailing processes to manage actual and potential Acid Sulfate Soils disturbed during construction.	This Plan

5.4. EPL Conditions

Project construction activities are regulated by an Environment Protection Licence (EPL 21600) issued by the NSW Environment Protection Authority. Any waste generated from construction activities, including disposal of untreated or treated ASS and/or PASS will be managed in accordance with EPL 21600 (condition O5 Waste Management).

5.5. Guidelines and Relevant Documents

The main guidelines, specification and policy documents relevant to this ASSMP include:

- Acid Sulfate Soil Manual, Acid Sulfate Soil Management Advisory Committee (1998);

- National Acid Sulfate Soils Guidance (NASSG): National Acid Sulfate Soils sampling and identification methods manual, Department of Agriculture and Water Resources (2018);
- Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads and Traffic Authority, 2005);
- Waste Classification Guidelines - Part 1: Classifying Waste (NSW EPA, 2014); and
- Waste Classification Guidelines – Part 4: Acid Sulfate Soils (NSW EPA, 2014b).

6. Construction Aspects and Environmental Impacts

Aspects and impacts associated with the ASMs are shown in Table 3 below which has been developed based on information assessed in Section 7 of the Acid Sulfate Soil and Salinity Assessment Report (ASSSAR).

The nature and extent of acid sulfate soils and groundwater acidification have been assessed in ongoing detailed design particularly through design reports including the ASSSAR and the Hydrogeological and Groundwater Interpretive Report. These design reports indicate that:

- There is a high probability that the project will interact with potentially acid generating soils at the Arncliffe area, Spring Street palaeochannel, and Muddy Creek palaeochannel.
- In the Arncliffe area, groundwater drawdown within the coastal deposit aquifer has occurred due to the M8 construction, and it is not anticipated that significant additional drawdown will occur within the coastal deposits associated with the M6S1 construction.

Risk associated with drawdown related acidification of acid sulfate materials has been addressed in design which has included provision of temporary recharge systems at the Bicentennial Park and West Botany Street depot sites during construction.

Post-construction groundwater drawdown of up to 2.5 m is predicted at the western limits of the Muddy Creek and Spring Street palaeochannel (as a result of adjacent drained tunnel construction) and may result in acidification of the groundwater at these areas. Additional investigations are being undertaken in these areas as part of the detailed design stage to enable appropriate mitigation measures to be developed.

The outcome of additional investigations including management recommendations will be discussed in the ASSSAR and the Hydrogeological and Groundwater Interpretive Reports.

Table 3 Probability of encountering ASS during construction

Construction ancillary facility	Primary use during construction	Class of ASS	Lines of Evidence	Possible Impacts	Reference
C1 Arncliffe construction ancillary facility	Compound established during construction of M8 Motorway. Project activities which will disturb PASS include the foundation works for piling of operational site building, water treatment plant and substation.	High probability of Class 3	Acidic Sulfate Material (ASM) detected in alluvial and marine sediments Section 3 of the Acid Sulfate Soils and Salinity Assessment Report	Establishment of stockpile area and water management	Refer to Section 9.1 and Section 9.2
				Treatment of PASS and verification of neutralisation	Refer to Section 9.2
				Disposal and/or reuse of PASS	Section 9.2, Section 9.3 and Section 9.4 Refer to Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414)
				Tracking of material in accordance with Waste CEMP Sub-plan	Refer to Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414)
C2 Rockdale Depot construction ancillary facility Piling and/or diaphragm wall construction Bulk excavation of Temporary Shaft	The temporary shaft at C2 will provide access and support to the construction and fit out of the underground ramps which lead to the portal at C3.	High probability of Class 3	ASM detected in alluvial and marine sediments Section 3 of the Acid Sulfate Soils and Salinity Assessment Report	Establishment of stockpile area and management including water management	Refer to Section 9.1 and Section 9.2
				Treatment of PASS and verification of neutralisation	Refer to Section 9.2
				Disposal and/or reuse of PASS	Refer to Section 9.2, Section 9.3 and Section 9.4 Refer to Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414)
				Tracking of material in accordance with Waste CEMP Sub-plan	Refer to Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414)
				Possible nuisance odour impacts to surrounding sensitive receivers from excavation of ASM	Refer to Section 9.5 Refer to Air Quality Monitoring Program (M6S1-CGU-NWW-ENPE-PLN-000408-AQMP)

Construction ancillary facility	Primary use during construction	Class of ASS	Lines of Evidence	Possible Impacts	Reference
C3 Rockdale Bicentennial Park construction ancillary facility Piling and/or diaphragm wall construction Bulk excavation of Cut and Cover, Temporary Shaft and MOC3 Shaft Soft ground tunnelling under West Botany Road Road, drainage and utility upgrades along President Avenue and local roads	Construction of the Cut and Cover and completion of the road, drainage and utility upgrades along President Avenue will result in being able to traffic to enter the M6 Stage 1 Motorway and allow CGU to meet Deed and Contract requirements for TfNSW. Construction of the temporary shaft will provide access and support to the soft ground tunnelling activities. Soft ground tunnelling under West Botany Street reduces impacts to road users and the local community and connects the Cut and Cover into the tunnel ramps.	Bicentennial Park high probability of Class 2 MOC3: High probability of Class 3	ASM detected in alluvial and marine sediments Section 3 of the Acid Sulfate Soils and Salinity Assessment Report	Establishment of stockpile area and management including water management	Refer to Section 9.1 and Section 9.2
				Treatment of PASS and verification of neutralisation	Refer to Section 9.2
				Disposal and/or reuse of PASS	Refer to Section 9.2, Section 9.3 and Section 9.4 Refer to Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414)
				Tracking of material in accordance with Waste CEMP Sub-plan	Refer to Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414)
				Possible nuisance odour impacts to surrounding sensitive receivers from excavation of ASM	Refer to Section 9.5 Refer to Air Quality Monitoring Program (M6S1-CGU-NWW-ENPE-PLN-000408-AQMP)
C4 and C5 Active Transport Corridor (ATC) construction ancillary facility Bored piling at depth for bridge structures for the	Construction for ATC, specifically the footings of bridge structures.	Mixture of high and low probability of Class 3	ASM detected in alluvial and marine sediments Section 3 of the Acid Sulfate Soils and Salinity Assessment Report	Identification of unexpected ASM	Refer to Contamination CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000413) Appendix A Unexpected Finds Procedure. Refer to Section 8.1 and Section 8.2 for sampling and analysis procedure

Construction ancillary facility	Primary use during construction	Class of ASS	Lines of Evidence	Possible Impacts	Reference
Active Transport Corridor.					
C6 Intersection of Princes Hwy and President Avenue construction ancillary facility President Avenue Widening	Upgrade and widening of intersection at Princes Hwy Widening and increasing height of road along President Avenue	Low probability of encountering ASS Partially high probability of Class 2, 3 and 5 for widening of President Avenue		Identification of unexpected ASM	Refer to Contamination CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000413) Appendix A Unexpected Finds Procedure Refer to Section 8.1 and Section 8.2 for sampling and analysis procedure
Tunnel alignment	Excavation of drives and ramps	Low probability	No known occurrence of ASS or PASS along alignment. Section 3 of the Acid Sulfate Soils and Salinity Assessment Report	Identification of unexpected ASM	Refer to Contamination CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000413) Appendix A Unexpected Finds Procedure Refer to Section 8.1 and Section 8.2 for sampling and analysis procedure
Permanent Power Supply*	Under boring in specified areas (e.g. Wolli Creek and in Bardwell Valley) Excavation of trenches	Partially high probability of Class 2, 3 and 5	Section 3 of the Acid Sulfate Soils and Salinity Assessment Report	Identification of unexpected ASM	Refer to Contamination CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000413) Appendix A Unexpected Finds Procedure Refer to Section 8.1 and Section 8.2 for sampling and analysis procedure

*contamination investigations ongoing

7. Mitigation and Management Measures

7.1. General principles

The following general principals will be adopted in relation to all ASM materials:

- Investigate and monitor expected areas of ASSM as per process provided in Section 8.2;
- Identify the ASM as per the process provided in Section 8.1;
- Avoid the disturbance of ASM beneath the water table where practicable;
- Avoid dewatering / dredging of ASM containing water bodies where practicable;
- Minimise the depth of excavation where practicable;
- Minimise the period and depth of dewatering where practicable;
- Minimise the depth of drainage channels;
- Avoid directing significant volumes of stormwater into areas that are suspected to contain ASM;
- All surface water that has contacted ASM materials will require capture and water treatment prior to discharge;
- Keep ASS material wet at all times during excavation and subsequent handling;
- Treat confirmed ASM materials as per the process in Section 9.2;
- If not treated insitu, ASM can be immediately re-used at the same works area or transported to another works area for treatment provided the conditions are met (refer to Section 9.3);
- Off-site re-use of treated PASS to an approved site pending approval of a Specific Resource Recovery Exemption and Order by the EPA; and
- Off-site disposal to an EPA licensed waste facility requires protocols specified in Section 9.4.

These principles will be incorporated into Design Packages, Construction Area Plans and Work Packs where risks of encountering ASSM has been identified.

7.2. Investigate and monitor areas where ASM is expected

The presence of ASM has and will be investigated as part of soil contamination investigations which include laboratory testing. In accordance with CoA E112, soil contamination investigations will occur, and Site Contamination Report/s will be prepared. Details of these investigations are described in Section 4.2 of the Contamination CEMP Sub-plan. The results of these investigations will include the required liming rates and refer to management practices of this ASSMP.

Regular monitoring of areas where ASM is expected will be undertaken to identify signs of sulfide oxidation. Section 8.1 provides guidance on identification.

7.3. Permanent drain construction

The following strategies for permanent drain construction are recommended:

- Minimise the design depth of permanent drainage channels by constructing wide, shallow drains where possible;
- Installation of in-drain water control structures, such as drop-boards (to maximise water coverage of ASM materials); and
- The base and sides of permanent drains or basins in ASS areas will have one or more of the following implemented:
  - Installation of an impervious water shedding cover upon the exposed walls and base; and/or
  - Use of limed sandbags upon the exposed walls and base.

8. Identifications of ASM

The locations of ASM have been identified through findings in the Acid Sulfate Soil and Salinity Assessment Report. The following procedures will also be used where there is a risk on encountering ASM.

Types of sample collection equipment, whether it be manual or mechanical, will dependant on the ground conditions. Refer to Figure 2 *ASSMAC Assessment Guidelines* (August 1998) Table 4.2 as a guide.

Table 4.2 Soil sampling equipment and their suitability for sampling acid sulfate soils

Manual sampling equipment	
Jarret auger	▪ use only to sample the upper profile of dry and moist soil ▪ not generally suitable for sands
Tapered gouge auger	▪ suitable for soft muds, but not sands
Push tube with tapered tip	▪ limited use due to sample loss as suction is created on extraction (adding a sealable cap before extraction improves retention) ▪ limited use with sticky soils as it is hard to remove sample from the tube ▪ generally not suited for saturated sands
Piston sampler	▪ acceptable for many wet soils ▪ good for saturated sands but limited by the length of the piston as walls collapse as it is withdrawn. Using a suitable size poly pipe for casing can increase the depth of excavation on saturated sands but care is needed to limit contamination or sample mixing. ▪ allows only one extraction per hole
Mechanical sampling equipment	
Hydraulic push tube	▪ limited use due to sample loss as suction is created on extraction (adding a sealable cap before extraction improves retention) ▪ limited use on sticky soils because hard to remove sample from tube ▪ limited use on wet sands because of sample loss
Spiral auger	▪ generally unsatisfactory as it mixes the sample
Hollow flight screw auger incorporating an internal 'split tube' sampler. In addition a Standard Penetration Test (SPT) sampler or thin walled 50 mm diameter tube designated U50 (undisturbed, 50mm diameter) can sample within the hollow auger.	▪ acceptable for most soils ▪ some difficulties may be experienced with compression of muds ▪ some difficulties may be experienced with saturated sands with loss of sample on sands below the watertable. A catcher may improve sand retention.
Wash bore drilling combined with a driven Standard Penetration Test (SPT) split tube sampling	▪ may have a limited use for deep drilling particularly on saturated sands ▪ with a bentonite and polymer solution continually pumped under pressure, the borehole walls may remain sufficiently intact for reasonable sampling. ▪ contamination of samples can be a problem even when the upper part of the core is rejected
Core sampling employing a suction and vibrating technique	▪ recommended and ideal on wet sands, muds and soft soils, giving accurate depths and intact cores. Compressed air is used to remove the sample from the tube into a 'clean plastic sausage'. ▪ If the upper profile is hard and dry, a hydraulic push tube or auguring device may be required until soft moist material lower in the profile is encountered.

Figure 2 ASSMAC Assessment Guidelines (August 1998) Table 4.2

8.1. Procedure for identifying ASMs

The procedure for the identification of ASMs and treatment options are provided in Figure 3, Figure 4, Table 4, Table 5 and Table 6.

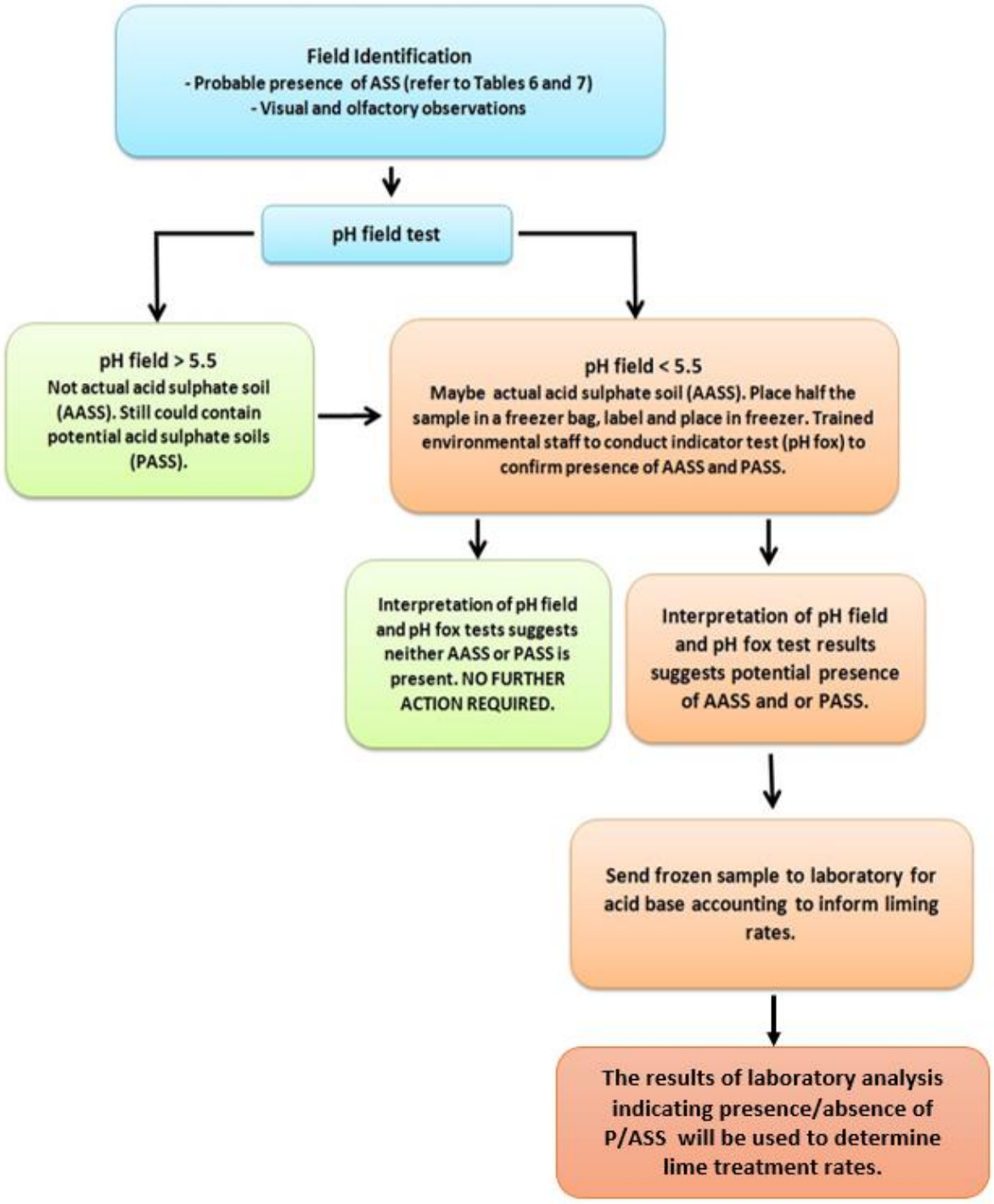

Figure 3 Process for identifying ASS and MBO

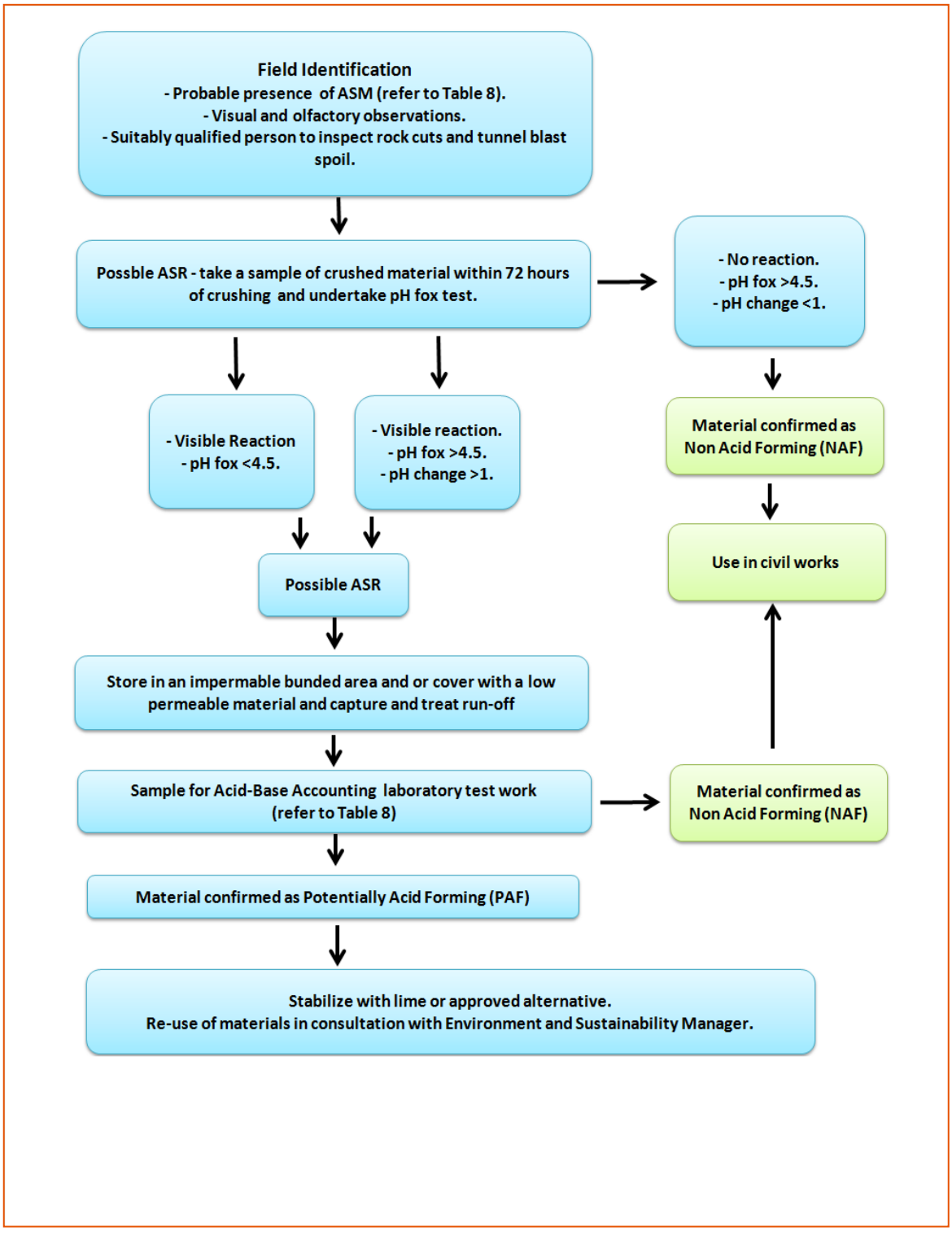

Figure 4 Process for identifying ASR

Table 4 Methods for identifying ASS

ASS Identification Methods					
Examples					
	A – Yellow / Orange Stained upper sediments	B – Orange / brown residue in surface water	C - Orange / brown staining of surfaces.	D - Exposed ASS material in excavation	E – Orange stained upper layer (oxic zone) and grey / black lower layer (reduced zone)
Visual and Olfactory Observations	▪ Yellow / Orange / Red stained upper sediments and surrounding surfaces; ▪ Waterlogged soils with a hydrogen sulfide, 'rotten egg' smell; ▪ Distinct colour change with depth, where lower water-logged soils become blue-green / grey / black; ▪ Orange / brown residue forming within excavations and surface water run-off areas; and ▪ Orange / brown staining of surfaces.				
Field Methods to Screen Potential for Actual ASS and PASS	▪ pH_{field} and pH_{fox} test as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). ▪ A pH_{field} value below 5.5 is the screening criteria for probable presence of AASS (Actual Acid Sulfate Soils). ▪ A pH_{fox} value below 4.5 and or a difference between pH_{field} and pH_{fox} greater than 1 is the screening criteria for probable presence of PASS (Potential Acid Sulfate Soils). ▪ This will be used as a preliminary screening tool to identify materials that require laboratory test work (i.e. not to be solely relied upon to inform management or treatment options). ▪ Sampling and tests will be undertaken by an appropriately qualified person. ▪ The pH meter must be calibrated.				
Laboratory test methods to confirm as ASS	Full acid-base accounting methods [(Potential Acidity (TPA or SCR) and Actual Acidity (s-TAA)] as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). Sampling will be undertaken by an appropriately qualified person. Laboratory test work will be undertaken by a NATA accredited laboratory.				

ASS Identification Methods

Action Criteria (i.e. a management strategy or treatment is required)

Type of Material		***Action Criteria* if 1 to 1000 tonnes of material is disturbed**		***Action Criteria* if more than 1000 tonnes of material is disturbed**	
		Existing + Potential Acidity		**Existing + Potential Acidity**	
Texture range (McDonald *et al.* 1990)	Approx clay content (%)	Equivalent sulphur (%S) (oven-dry basis)	Equivalent acidity (mol H^+/tonne) (oven-dry basis)	Equivalent sulphur (%S) (oven-dry basis)	Equivalent acidity (mol H^+/tonne) (oven-dry basis)
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

Reference: Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads Traffic Authority, April 2005).

Table 5 Methods for identifying MBO

MBO Identification Methods					
Examples					
	A – MBO in highly saturated sediment.	B – MBO covered drainage ditch	C - MBO in wetland environment.	D - Equipment covered in fresh MBO.	E – Shell covered in fresh MBO.
Visual and Olfactory Observations	▪ Black viscous appearance; ▪ Strong 'rotten egg' smell; and ▪ Found in highly water-logged sediments / wetland areas / open canals and drainage culverts.				
Field Methods to Screen Potential for Actual ASS and PASS	▪ pHfield and pHfox test as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). ▪ A pHfield value below 5.5 is the screening criteria for probable presence of AASS (Actual Acid Sulfate Soils). ▪ A pHfox value below 4.5 and or a difference between pHfield and pHfox greater than 1 is the screening criteria for probable presence of PASS (Potential Acid Sulfate Soils). ▪ This will be used as a preliminary screening tool to identify materials that require laboratory test work (i.e. not to be solely relied upon to inform management or treatment options). ▪ Sampling and tests will be undertaken by an appropriately qualified person. ▪ ▪ The pH meter must be calibrated.				
Laboratory Test Methods to Confirm as ASS	Full acid-base accounting methods [Potential Acidity (TPA or SCR) and Actual Acidity (s-TAA)] as prescribed by the Acid Sulfate Soil Manual (ASSMAC 1998). Sampling will be undertaken by an appropriately qualified person. Laboratory test work will be undertaken by a NATA accredited laboratory.				

MBO Identification Methods

Action Criteria (i.e. a management strategy or treatment is required)

Type of Material		***Action Criteria* if 1 to 1000 tonnes of material is disturbed**		***Action Criteria* if more than 1000 tonnes of material is disturbed**	
		Existing + Potential Acidity		**Existing + Potential Acidity**	
Texture range (McDonald *et al.* 1990)	Approx clay content (%)	Equivalent sulphur (%S) (oven-dry basis)	Equivalent acidity (mol H^+/tonne) (oven-dry basis)	Equivalent sulphur (%S) (oven-dry basis)	Equivalent acidity (mol H^+/tonne) (oven-dry basis)
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

Reference: Technical Guideline: Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze (Roads Traffic Authority, April 2005).

Table 6 Methods for identifying ASR

ASR Identification Methods					
Examples					
	A – Red / brown staining of metamorphic rock as a result of pyrite oxidation	B – Yellow / orange staining of a quartz vein as a result of pyrite oxidation	C - Red / brown staining of Ashfield Shale as a result of pyrite oxidation.	D - Red / brown staining of a rock cut of Hawkesbury Sandstone as a result of pyrite oxidation	E – Pyrite crystals within quartz vein of igneous rock.
Visual and Olfactory Observations	▪ Yellow / Orange / Red / brown stained rock; ▪ Presence of quartz veins together with yellow crystals and or Yellow / Orange / Red / brown stained rock surfaces; and ▪ Orange / brown residue forming within excavations and surface water run-off areas.				
Field Methods to Screen Potential for Actual ASS and PASS	▪ pH of drainage water or a 1:5 (crushed rock: distilled water) < 5.5 (AASS) ▪ pHfox upon crushed sample <4.5 and difference between pHfield and pHfox >1 (PASS) ▪ This will be used as a preliminary screening tool to identify materials that require laboratory test work (i.e. not to be solely relied upon to inform management or treatment options). ▪ Sampling and tests will be undertaken by an appropriately qualified person. ▪ The pH meter must be calibrated				
Laboratory Test Methods to Confirm as ASS	Full acid-base accounting methods (Total sulphur by Leco method, Non-sulfide sulphur by acid leach, and paste pH) and Net Acid Generation (NAG) Test (for pH and Electrical Conductivity) as prescribed by the ARD. Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage (AMIRA 2002). Sampling will be undertaken by an appropriately qualified person. Laboratory test work will be undertaken by a NATA accredited laboratory.				

ASR Identification Methods

Action Criteria (i.e. a management strategy or treatment is required)

Victorian EPA Criteria for Acid Sulfate Rock
(EPA Victoria 1999)

Final Net Acid Generation	Net Acid Generation Value (kg H_2 $S0_4$/tonne)	Net Acid Producing Potential (kg H_2 $S0_4$/tonne)
<4.5	>5	positive

Environment Australia Criteria for Acid Sulfate Rock
(EA 1997)

Classification	NAPP	Final NAG pH	Saturated Paste pH	Electrical conductivity (dS/m)
Potentially acid forming	Positive	4 or lower	<4	
Non acid forming	Zero or negative	>4		
High level of soluble constituents (indicative of oxidation)				>2

Reference: RTA 2005.

8.2. Field Tests for Identifying Probable AASS and PASS

8.2.1. pH Field Test

The pH field test comprises the following:

- Preparation of a 1 volumetric part soil: 5 volumetric parts distilled water solution in a glass or plastic vial;
- Allow approximately 10 minutes for solution to equilibrate; and
- Measure pH using a pH meter that has been calibrated as per the manufacturer's instructions.

A pH of 5.5 approximates the pH of pure water in equilibrium with atmospheric concentrations of carbon dioxide and represents a pH where laboratory derived 'total actual acidity' is zero. On that basis and as specified in Tables 4 to 6 above, it is used as a screening criteria for AASS. Preliminary screening criteria and pH value below 5.5 may be also as a result of one or more of the following:

- Naturally acidic soils (e.g. those dominated by various aluminium and iron sulfate minerals such as alunite and jarosite); and
- Organic rich sediments that often have significant concentrations of various organic acids (e.g. humic acid).

8.2.2. pHfox Test

The pHfox test comprises the following:

- Preparation of a 1 volumetric part soil: 5 volumetric parts 30% Hydrogen Peroxide (H_2O_2) solution in a glass or plastic vial. The hydrogen peroxide solution will be pre-prepared using laboratory grade hydrogen peroxide solution and adjusted to pH 5.5 with sodium hydroxide prior to use (refer to associated Safety Data Sheets (SDS) in terms of safe handling and personal protective equipment to be worn).

- Allow approximately 10 minutes for solution to react; and
- Measure pH using a pH meter that has been calibrated as per the manufacturer's instructions.

This test is based upon the premise that the pHfox value is as a result of the oxidation of sulfides by H_2O_2 within the plastic or glass vial. The screening criteria for the presence of PASS specified in Tables 4 through to 6 (pHfox value below 4.5 and or a difference between pHfield and pHfox greater than 1) is based upon the following:

- A pH of 4.5 is the threshold at which the buffering capacity of a material has been overcome by the initial stages of acidity release associated with sulfide oxidation (INAP 2014); and
- A difference between pHfield and pHfox greater than 1 has been adopted as a conservative indicator of the initial stages of acidity release associated with sulfide oxidation.

Preliminary screening criteria and a pHfox value below 4.5 and or a difference between pHfield and pHfox greater than 1 may be as a result of the oxidation of the organic content of a sample by H_2O_2 (e.g. presence of peat and/ or organic rich soils).

8.3. Laboratory Tests for Identifying AASS and PASS

8.3.1. Chromium Reducible Sulphur Test

The Chromium Reducible Sulfur (CRS) method measures the concentration of Reduced Inorganic Sulfur (RIS) compounds present in the soil. RIS compounds are the constituents of ASS materials that are of environmental concern due to their acid-generating potential. This method is not subject to

significant interferences from the sulfur in either organic matter or sulfate minerals and as such is recommended over SPOCAS or SPOS methods. The CRS method is based on the conversion of RIS to H2S by a hot acidic CrCl2 solution. The following tasks will be carried out when sending samples off to a laboratory for a CRS test:

1. Upon collection in the field, soil samples will be immediately placed in leak proof containers that minimise the sample's contact with air and to avoid moisture loss from the sample.
2. It is recommended that the polymer bags used will be of a thickness at least 30 µm and composed of High Density Polyethylene (HDPE) to minimise diffusion of oxygen into the sample. Bags are to be filled, with no headspace.
3. Soil materials will be immediately chilled and kept cold (less than 4 °C) in the field to aid preservation using either a portable 12 V car freezer or sealed cold box containing dry ice, freezer bricks or sealed cold boxes.
4. It is preferable that samples reach the selected laboratory within 24 h of collection. For transport and short- term storage during transit, samples will be kept chilled and stored in an insulated container so that they reach the laboratory at less than 4 °C.
5. It is important to inform the laboratory both prior to and when samples are about to be delivered for analysis to allow the laboratory to prepare for timely sample pre-treatment to minimise the potential for oxidisation of RIS in soil samples.

8.3.1.1. Chromium Reducible Sulphur Testing Grid

To confirm the neutralising rates required for the treatment of ASS on site, additional testing is to be undertaken by a person who is suitably qualified. Testing will be undertaken at the minimum density prescribed in ASSMAC (1998), with samples collected at surface, 0.5mbgl, 1.0mbgl and every half metre thereafter until 1.0m past the proposed depth of excavation. All samples collected will undergo field screening, with samples that exceed the field screening criteria in Table 4 through to Table 6 to undergo further analysis by CRS method. Neutralising rates will be calculated from the TAA derived from the CRS tests and will not include Acid Neutralising Capacity or fineness factors.

9. Treatment approaches

9.1. Dewatering of excavation in ASM

The following strategies are recommended when dewatering excavations are required in ASM:

- Background groundwater pH will be confirmed prior to the commencement of dewatering where practicable;
- pH will be measured within the excavation after neutralization. Appropriate pH must be within 1 pH unit below and above background surface / groundwater pH. Where no background pH data exists, use target range: 6.5 to 8.5;
- pH monitoring of extracted water will be undertaken over the duration of the dewatering period;
- Collection of extracted groundwater for temporary storage and treatment as necessary prior to appropriate disposal / release (in accordance with Project EPL); and
- Dose the base of the excavation at a rate of approximately 1 kg/m^2 of agricultural lime in order to counteract the generation of acidic leachate following groundwater recovery.

9.2. Onsite Treatment and Reuse of ASM

The ASM Treatment Area must be established prior to works that are likely to encounter ASM. Generally the treatment area will require the following:

- Located as close as possible to the source of the material or at construction compounds;
- Located, where practicable, at least 50 metres away from any surface water body, and away from any natural or engineered drainage lines;
- Located on top of a clay or impermeable surface;
- The treatment area must be appropriately bunded to contain runoff;
- Infiltration of water to the stockpile, such as run-on water from upslope, must be minimised with diversion banks and a leachate collection sump;
- The floor of the treatment pad must have agricultural lime applied (at the rate of 5 kilograms of fine aglime per m2 per vertical metre of fill); and
- The surface area of the stockpile exposed to oxidation must be minimised, & the stockpile must be covered in geo-textile fabric or 200 µm builders plastic when not in use.

Treated ASM that meet technical engineering specifications will be reused onsite. Treated ASM that do not meet engineering specifications will be made available for reuse offsite and/or disposed of at an appropriately licensed waste receiving facility.

9.2.1. Containment

Containment areas shall meet the following requirements:

- All ASM solids must be contained within a bunded area with an impermeable base and appropriately neutralised;
- Any leachate produced in the bunded area must be captured and sent to disposal and/or water treatment prior to discharge (in accordance with Project WPL);
- Where practicable the bunded area will be located at least 50 metres from waterways and above the 1 in a 20-year ARI flood levels;
- The leachate sump will be designed to store enough water for a 1 in 10-year (1 hour) storm event; and
- Alternative leachate collection systems will also be implemented using a system of drains within the base of the containment/treatment area that drain to a sump that can be pumped back to a holding cell prior to treatment through the construction water treatment plants.

Examples of containment and leachate capture options are provided in Figure 5 and Figure 6 below.

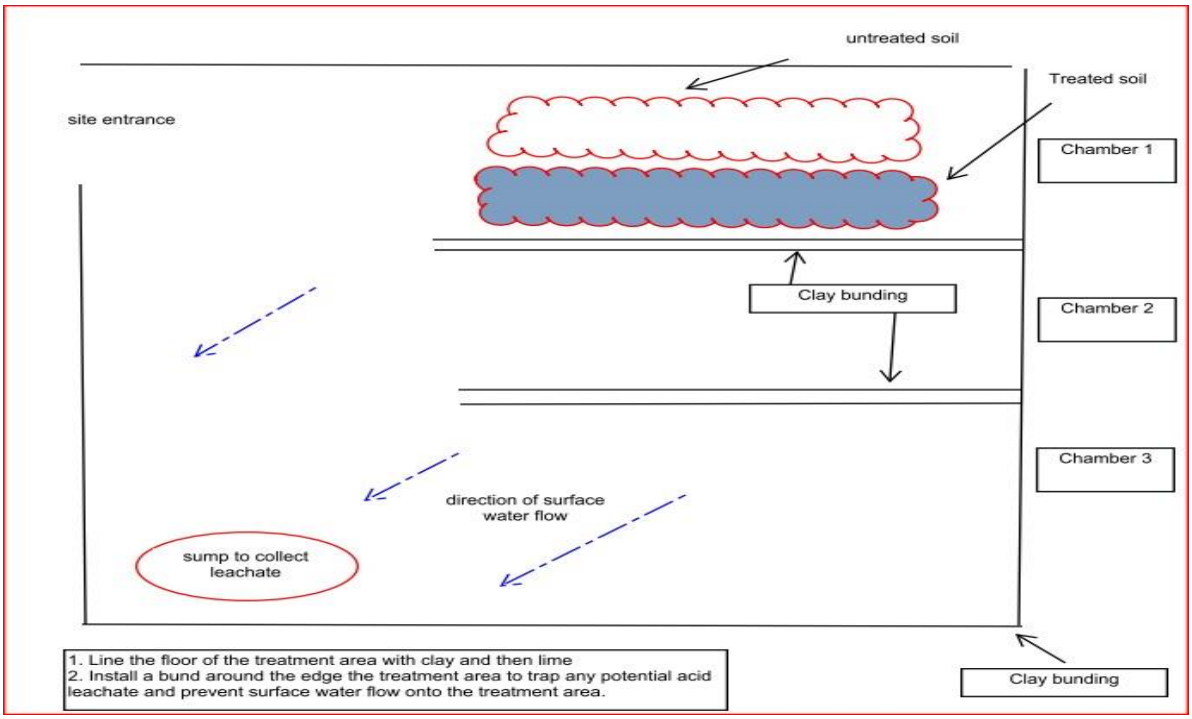

Figure 5 Schematic of bunded containment area

Figure 6 Example of bunded containment with drainage lines

9.2.2. Neutralisation of ASM solids

All ASM that is to be disposed of above the watertable must be neutralised prior to disposal. Suitable neutralization agents include:

- Natural alkaline materials such as agricultural lime (CaCO3) and dolomite; and
- More concentrated synthetic alkaline agents such as calcined magnesia (MgO or Mg(OH)2) and slacked lime (Ca(OH)2).

Natural alkaline materials are generally cheaper and less hazardous than synthetic alkaline agents, however use of natural alkaline materials will represent greater off-site disposal tonnages as a result of significantly greater amounts required to achieve neutralization.

Determination of the dosing rate required for neutralization will be determined from prescribed liming rates following CRS analytical testing (refer to Section 8.3). Waste classifications will be developed prior to excavation where reasonable and feasible. If waste classifications prior to excavation are not possible, material is to be stored within a containment area until results and liming rate are available.

For the purpose of estimating probable dosage rates, the following equation can be used:

Alkaline Agent Required (kg) per unit volume of soil (m3)

= [(%S x 623.7)/19.98] x [100/ENV(%)] x D x FOS

Where: %S = net acidity equivalent

D = Bulk Density (t/m3)

FOS = Factor of safety (usually 1.5)

[1]ENV = Effective Neutralization Capacity (e.g. 80% for agricultural lime)

The ENV is a calculated value based upon relative molar neutralization capacity of the reactive agent, particle size distribution and purity of the material.

The following protocols are recommended for when neutralizing materials:

- A soil pH targeted to be in the range: 6.5 to 8.5; and
- S% <0.03 and <18 mol H+/t.

9.2.3. Neutralisation of ASSM Leachate

ASM leachate will be processed through the construction water treatment plants located at each tunnelling construction ancillary facility. Standing leachate will be prevented as far as reasonably practicable. The leachate will be treated to meet discharge criteria outlined in the Project EPL. This process will be regulated through a Permit to Dewater.

9.2.4. Neutralisation Monitoring

The following inspection and monitoring procedures are recommended for monitoring neutralisation of ASM:

- Daily inspection of liming operations by an engineering team member during excavation;
- Daily visual monitoring of stockpiles for signs of ASS affected seepage (e.g. red/yellow/orange staining);
- Daily pH testing of any seepage from stockpiles by trained personnel. Appropriate pH mustbe between 6.5 and 8.5; and
- Sampling and testing after lime treatment by an environmental consultant or the Project Environmental Team.

9.2.5. Contingency Measures

The following contingency measures are recommended:

- If monitoring during treatment indicates pH too low, additional lime will be added and material re sampled;
- If monitoring during treatment indicates pH is too high, mix additional ASM or gypsum into batch and re sample; and
- If the volume of ASM exceeds capacity of treatment area, the excavation or dewatering schedule will need to be adjusted where practicable.

In the event of the unexpected discovery of ASS, in addition to the areas already identified within the project boundary. In the event ASM is suspected or encountered within soil material or seepage water found in excavations, the Unexpected Finds of Contaminated Land Procedure will be followed. Refer to Appendix A of the Contamination CEMP Sub-plan for further detail.

If neutralisation is not considered a feasible option, unexpected ASSM finds will be transported off site for treatment and disposal at a licenced waste facility. Disposal of material would be in accordance with Waste CEMP Sub-plan.

9.3. Non-treated reuse and transport of ASM

Non-treated reuse applies when there is a requirement for excavation of PASS and immediate re-use of the PASS material within a short time frame at the same site (e.g. trenching and backfilling within a day). If this is undertaken, the following conditions will be fulfilled:

- The pH of the material is greater than 6;
- The pH of the material has not yet dropped by more than 1 pH unit since excavation; and
- The material has been kept wet.

It is recommended that lime application occur prior to backfilling as a precautionary measure. The majority of situations are not suitable for immediate reuse and as such the decision for immediate reuse can only be made by the CGU Environmental and Sustainability Manager.

Where PASS material requires treatment at another works area this material will be transported in a waterproof trailer and the forementioned conditions will be met prior to transportation. Similarly, the waterproof trailer will be limed prior to transportation and the CGU Environmental and Sustainability Manager will be made aware of this activity prior to commencement.

9.4. Offsite disposal of ASM

The following protocols must be followed in relation to off-site disposal of ASM to an EPA licensed landfill for all materials not suitable for re-use:

- Landfills shall be licensed to accept the material;
- Consult the EPA's Environment Line in terms of facilities able to accept this waste: phone: 131 555; and
- Conventional disposal of treated ASSM to landfill (i.e. above the water table) requires classification of the material as per Part 1 of the Waste Classification Guidelines 'Classifying Waste' (EPA 2014) prior to haulage via an appropriately qualified person.

Potential re-use of treated PASS in accordance with a Specific Resource Recovery Exemption to be undertaken subject to the approval of the required exemption and order by NSW EPA. The process to

obtain the Specific Resource Recovery Exemption, including proposed proof of performance testing is outlined in Appendix A.

9.4.1. Handling PASS prior to offsite disposal

PASS must be kept wet at all times during excavation and subsequent handling, transport and storage, until it be safely disposed of. It must be received at the proposed disposal point within 16 hours of being excavated.

9.4.2. Disposal of PASS below the water table

The disposal of PASS in a landfill (below the water table) must be in accordance with the EPA Part 4 Waste Classification Guidelines (EPA 2014 b). This includes:

- Landfills must be licenced by the EPA to dispose PASS below the water table;
- Disposal occurs within 24 hours of excavation (before it has had a chance to oxidise);
- PASS must be disposed of within 8 hours of receipt at a landfill and kept wet at all times until burial at least two meters below the lowest historical level of the water table at the landfill;
- Material is kept wet at all times during excavation and subsequent handling and transport;
- With the exception of the presence of sulfides, material is suitable for classification as Virgin Excavated Natural Material (VENM) under the Protection of the Environment Operations Act 1997 by an appropriately qualified person;
- Documentation must be provided to the landfill for each truckload of material received, indicating that the soil's excavation, transport and handling have been in accordance with the Acid Sulfate Soil Manual (ASSMAC 1998) in terms of preventing significant sulfide oxidation; and
- The occupier of the disposal site must also test the pH of each load of soil received immediately prior to its placement under water. These details, together with the pH of the soil recorded at the time of its extraction, must be retained by the occupier of the landfill site. pH measurement must be as per the Acid Sulfate Soil Manual (ASSMAC 1998).

9.4.3. Disposal of PASS above the water table

Where PASS cannot be classified as VENM or suitable to be used under a Resource Recovery Order, the soil must be treated in accordance with the neutralising techniques in Section 9.2. After treatment the soil will be chemically assessed in accordance with Step 5 in Part 1 of the EPA Waste Classification Guidelines which will determine whether any other contaminants are present in the material. When the classification has been established, the soil will be disposed of at a landfill that can lawfully accept the waste.

9.4.4. Handling and Treatment of Actual ASS

Actual ASS contains highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in sulfides, primarily iron sulfide. This oxidation produces more hydrogen ions than the sediment is able to neutralise, resulting in soils with a pH of 5.5 or less when measured in dry season conditions. These soils can usually be identified by the presence of pale yellow mottles and coatings of jarosite. Actual ASS will be treated onsite in accordance with the neutralising techniques outlined in Section 9.2 before they can be considered for disposal and/or re-use.

9.4.5. ASS Treatment Trial

In the event the treatment methodology effectiveness is unclear an ASS treatment trail will be undertaken. The trail would test various methodologies for treating ASS to assist in identifying the most effective approach.

9.5. Odour management

To manage the risk of odour emissions during excavation of ASM the following measures must be implemented where appropriate.

Administrative controls:

- Where ASM has been identified in the Acid Sulfate Soil and Salinity Assessment Report (ASSSAR), sensitive receivers are in close proximity to the works, community notification to include the risk of odour during excavation of ASM.
  - Where ASM is encountered unexpectedly, community to be notified of risk of odour.
- During excavation ASM odour detection inspections to be undertaken at site boundaries.

Engineering controls:

- Where disposal of untreated ASM is taking place, work to be programmed to ensure ASM is removed from site promptly.
- Where neutralisation of ASM is taking place, works to be programmed to ensure neutralisation activities is undertaken promptly after excavation of ASM.
- ASM must be securely covered where practicable.
- ASM leachate to be managed in accordance with Section 9.2.3 to avoid odour emissions from ASM leachate.

Elimination controls:

- Avoid excavating ASM where possible.
- Consider location of stockpile treatment area and where practicable relocate stockpile area to an area away from sensitive receivers.

Where odour is detected at the site boundary either through an inspection and/or compliant, the following actions will be undertaken:

- A review is to be conducted to determine if the relevant management measure have been implemented correctly.
- Where all management measures have been correctly implemented, harder engineering and elimination controls are to be investigated. For example, avoiding excavation of ASM, relocation of stockpile area, removal of ASM from site, deodorisers etc.

10. Reuse as Backfill

10.1. Requirements

In accordance with the SWTC Appendix B.3 – Clause 7.5(l), backfill containing imported or site won material must conform to RMS D&C Specification B30 (Excavation and Backfill for Bridgeworks). As a minimum, material must achieve requirements for Earth Fill, except for backfill for Temporary Access Tunnels and shafts (including temporary access tunnels, declines and shafts handed over from the New M5 Motorway Works) which must conform to the following requirement.

Material classified as ASS or PASS will be used for backfilling Temporary Access Tunnels and shafts under the provision of an Acid Sulfate Management Plan (Plan) which has been approved by the IC as compliant with the Deed including the SWTC. Any additional testing or monitoring requirements identified in the approved Plan must be undertaken in accordance with the Plan.

10.2. Design Documentation

In accordance with the SWTC Main Body – Clause 6.14(d), where ASS, PASS or treated material originally classified as ASS or PASS is intended to be used as backfill, the relevant Design Documentation must include a detailed compliance matrix identifying compliance with, in order of precedence:

- The Deed (including the SWTC and its Appendices)
- The RTA Guidelines for the Management of Acid Sulphate Materials: Acid Sulphate Rock and Monosulfidic Black Ooze (April 2005)
- The NSW Acid Sulphate Soil Management Advisory Committee – Acid Sulphate Soils Manual (August 1998)

The Design Documentation must also clearly identify the decisions at each stage of the workflow associated with the use of ASS/PASS.

10.3. Scenarios where backfilling is not appropriate

In accordance with the SWTC Main Body – Clause 6.14(e), ASS, PASS or treated material originally classified as ASS or PASS will not be used as backfill adjacent to, within, or on top of structures including, but not limited to, cut and cover structures, Tunnel Approaches or Tunnel Exits (as defined in Appendix B.2 (Tunnels)), tunnels or shafts.

11. Monitoring

Inspections, observations, and monitoring requirements relevant to the management of ASSM are identified in Table 7 below:

Table 7 Monitoring measures

Monitoring measure	Frequency	Standards	Reporting	Responsibility
Inspections				
Site inspection	Daily	Visual/olfactory cues of ASSM	Site Supervisors Daily Diary	Site Supervisor
Site inspection	Weekly	Visual/olfactory cues of ASSM	Environment Inspection Checklist	Environmental Advisor
Odour detection inspection	Commencement of activity and weekly there after	Odour detection at site boundary	Environment Inspection Checklist	Environmental Advisor
Monitoring				
Monitoring of disturbed soils/ excavation that are in PASS or ASS	Daily	Visual until backfilled	Site Supervisors Daily Diary	Site Supervisor
Monitoring of ASSM Treatment Area	Daily	Visual Daily pH testing until results show ASSM or leachate has been neutralised.	Site Supervisors Daily Diary	Site Supervisor Site Engineer
Dewatering excavation in PASS/ASS material	Prior to planned discharge	Tested, treated, discharged, recorded and reported to meet the requirements of the Project EPLs.	Permit to Dewater	Environmental Advisor

12. Reporting

A record of treatment of acid generating materials and leachate will be kept and would include the following details:

- Location of monitoring site;
- Time of excavation, reuse or disposal of material;
- Neutralisation and treatment processes used;
- Lime application rates;
- Monitoring results for soil, leachate and groundwater, to be conducted by an Environmental team member; and
- Destination of treated material (i.e. offsite or onsite disposal) including waste tracking system and dockets from any receiving site.

If treated or untreated material is to be disposed of offsite, material tracking would be undertaken in accordance with the POEO Act 1997. Transport and disposal will be undertaken in accordance with the Protection of the Environment Operations (Waste) Regulation 2005 (POEO Waste Regulation) and the Waste Classification Guidelines (EPA, 2014). All contractors transporting waste from site must be licenced to transport the classification of waste and must only dispose of the waste at a facility that is licenced to accept the waste classification. For further information regarding material tracking, reuse and disposal refer to the Waste CEMP Sub-plan (M6S1-CGU-NWW-ENPE-PLN-000414).

A record of dewatering ‘in ASSM excavations’ activities would also be recorded and will include the following:

- pH at commencement of dewatering and prior to discharge to confirm adequate neutralisation.

For emergency and incident management process refer to Section 3.8 of the CEMP.

13. References

AMIRA. 2002. ARD Test Handbook: Project 387A Prediction and Kinetic Control of Acid Mine Drainage. Australian Minerals Industry Research Association, Ian Wark Research Institute and Environmental Geochemistry International Pty Ltd, May 2002.

ASSMAC. 1998. - Stone Y, Ahem, CR and Blunden, B 1998. Acid Sulfate Soils Manual 1998. Acid Sulfate Soils Management Advisory Committee (ASSMAC), Wollongbar, NSW.

EPA. 2014. Waste Classification Guidelines Part 1: Classifying Waste. November 2014. NSW EPA.

EPA. 2014. Waste Classification Guidelines Part 4 (b): Acid Sulfate Soils. November 2014. NSW EPA.

RTA. 2005. Guidelines for the Management of Acid Sulfate Materials: Acid Sulfate Soils, Acid Sulfate Rock and Monosulfidic Black Ooze, Roads Traffic Authority, April 2005.

Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, National Acid Sulfate Soils Guidance: National Acid Sulfate Soils sampling and identification methods manual, Department of Agriculture and Water Resources, Canberra ACT.

Appendix A Resource Recovery Requirements and Proof of Performance

Treatment methods

In situ treatment

ASSM from selected areas, generally drainage lines and areas of the site where transport to a designated treatment pad is not reasonable or feasible, will be treated in situ during excavation works to minimise amount of materials taken to the treatment pad and increase transport efficiency.

The process for in situ treatment of ASM is as follows:

- Estimate the volume of the untreated ASM batch. Each batch must have a minimum volume of 150 m^3, and a maximum volume of 380 m^3 and be confirmed using 3DGPS and/or on-site surveyors;
- Calculate the appropriate liming rate based on laboratory results, with the highest adjacent net acidity concentration of the treatment batch adopted;
- Mix agricultural lime with the batch of ASM to generate an in-situ treated area to a maximum depth of 0.75m;
- Excavate treated materials in benches no deeper than 0.5m to ensure a 0.25 m buffer of treated materials;
- Repeat the above steps until the minimum/maximum volume or depth of excavation is achieved;
- Collect samples from the in-situ treated materials for chromium reducible sulfur suite testing as per Section 8.3; and
- Store the ASM in situ until test results are validated as compliant, with exposed edges of the excavation neutralised with 1kg/m^2 of agricultural lime and covered with geofabric or plastic.

If a future Resource Recovery Order (RRO) is obtained for the treated ASM, proof of performance (POP) and ongoing validation sampling must be undertaken in accordance with the details specified in the Proof of Performance section.

If validation testing indicates acidity of treated materials is too high, additional neutralising agent will be added to the treated materials and mixed using a centrifugal/mixing bucket excavator (refer to Figure 7). If validation testing indicates alkalinity of treatment materials is too high, additional untreated PASS materials will be added to the treated materials and mixed using a centrifugal/mixing bucket excavator. Following additional mixing, validation testing will be undertaken again via the rates prescribed in Table 9.

No mixing of stockpiles from the same or different treatment options is permitted to occur during the POP testing stage until test results are validated as compliant.

Figure 7 Centrifugal/mixing bucket attachment used to mix ASM and neutralising agent in-situ

Ex situ treatment

If using a centrifugal/mixing bucket method for ex-situ treatment of ASM on a treatment pad, the following must be followed:

- Generate a stockpile of ASM with a minimum volume of 150m3, and a maximum volume of 380m3 and label batch;
- Calculate the appropriate liming rate based on the greatest adjacent net acidity concentration of the treatment batch as per the waste classification report;
- Mix agricultural lime with the stockpile using the centrifugal/mixing attachment (see Figure 7 above) to generate a treated stockpile;
- Collect samples from the treated stockpile for chromium reducible sulfur suite testing as per Section 8.3; and
- Store the ASM at the premises until test results are compliant.

If a future RRO is obtained for the treated ASM, POP and ongoing validation sampling must be undertaken.

If validation testing indicates acidity of treated materials is too high, additional neutralising agent will be added to the treatment pad stockpile and mixed using a centrifugal/mixing bucket excavator. If validation testing indicates alkalinity of treatment materials is too high, additional untreated PASS materials will be added to the treatment pad stockpile and mixed using a centrifugal/mixing bucket excavator. Following additional mixing, validation testing will be undertaken again in accordance with Table 10. No mixing of stockpiles from the same or different treatment options is permitted to occur during the POP testing stage.

Pugmill treatment method

Due to the significant volume of saturated materials excavated from the site, materials will be mixed using a pugmill and paddle mixer (Figure 8). The process undertaken for treatment using a pugmill summarised below:

- Materials will be excavated using machine excavator (>20 tonne);
- Materials will then be transported to the treatment area using 15 tonne bogey trucks;

- Once arriving to the pugmill treatment pad, ASM will be stockpiled and transferred to the pugmill hopper using an excavator;
- Following confirmation of volume and highest net acidity concentration of soil batch, neutralising agent will be added to the pugmill as per the prescribed rates;
- ASM and neutralising agent will be mixed in the pugmill as per Figure 10 below;
- Following processing of the ASM and neutralising agent in the pugmill, the materials will be transferred to the treatment pad;
- A maximum of 300m^3 will be processed per day;
- samples will be collected from the treated stockpile for CRS analysis as per Section 8.3.1.

If a future RRO is obtained for the treated ASM, POP and ongoing validation sampling must be undertaken in accordance with Table 11. Ongoing validation following POP will be undertaken in accordance with the details contained within any future RRO.

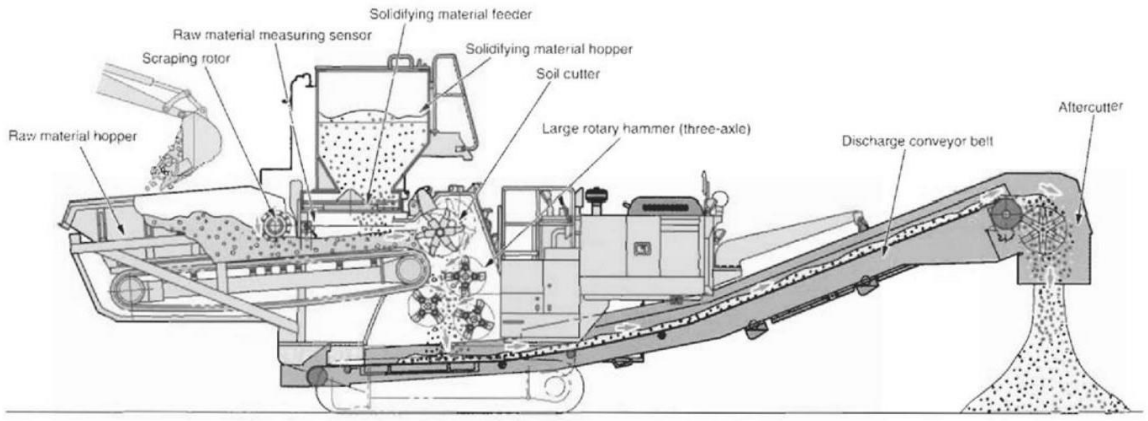

Figure 8 Pugmill and paddle mixer diagram

Proof of Performance

To demonstrate treated PASS materials are suitable for re-use at an approved receiving site, the following POP measures must be undertaken. POP is required to confirm each batch is successfully neutralised and can be transported off-site under an RRO. Prior to POP testing, the material will be batched appropriately. The material will be limed using ag lime to achieve an acceptance criterion detailed in Table 8 below.

A separate POP test is to be carried out for In-Situ method (Table 9), Treatment Pad method (Table 10) and for Pugmill method (Table 11). Samples will be collected from varying depths beneath the ground or stockpile surface to allow representative sampling.

Table 8 Proof of Performance acceptance criteria

Chemicals and other attributes	Average concentration (mg/kg 'dry weight' unless otherwise specified)	Absolute maximum concentration (mg/kg 'dry weight' unless otherwise specified)
1. pH[1]	6.5 to 10	6 to 11
2. Net acidity[2]	NA	0 mol H+/tonne
3. pHox (field)	6.5 to 9	6 to 10

Note:

[1] pH means pHKCL.

[2] Net acidity means potential sulfidic acidity + Actual acidity + Retained acidity – (post treatment acid neutralising capacity – initial acid neutralising capacity). It does not include natural acid neutralising capacity.

Table 9 In situ mixing method sample requirement

Volume of batch in-situ (m3)	In-situ samples	Volume of excavated batch	Secondary stockpile batch samples	Number of consecutive batches
150m^3 – 380m^3	3	150 m^3 – 200 m^3	6	6
		>200 m^3	12	

Note 1: Minimum of 1 blind duplicate sample required from each batch sampled

Table 10 Stockpile treatment pad sample requirement

Volume of batch (m^3)	Ex-situ stockpile	Number of consecutive batches
150m^3 – 380m^3	6	6

Note 1: Minimum of 1 blind duplicate sample required from each batch sampled

Table 11 Pugmill method sample requirement

Volume of batch (m^3)	Ex-situ stockpile	Number of consecutive batches
150m^3 – 380m^3	6	6

Material will be segregated until test results are validated as compliant with the acceptance criteria detailed above. Following successful treatment/neutralisation, batches can be beneficially reused under the RRO and RRE. In the event that a batch is not successfully neutralised, additional treatment of the batch will be required and the retreated material sampled in accordance with the proof of performance test requirements. Neutralisation Monitoring and Record Keeping required during proof of performance includes:

- Unique Batch number / Date / Time;
- Material description;
- Liming rate; and
- Laboratory verification reports and results.

Ongoing Validation testing after POP

Subject to complying with POP testing requirements, validation testing must be followed. All material is to be stored until results are validated as compliant with the maximum average concentration or other value listed in the RRO.

Treated stockpiles from the in-situ centrifugal/mixing bucket attachment method, the ex-situ centrifugal/mixing bucket method, and the ex-situ treatment using the pugmill mixing method must not be mixed until test results are compliant.

In-situ treatment using the centrifugal/mixing bucket attachment method

- Each batch must have a maximum volume of 380m3 and be confirmed using 3DGPS and/or on-site surveyors.
- Collect 3 representative samples from the in-situ treated stockpile for chromium reducible sulfur suite testing.

Ex-situ treatment using the centrifugal/mixing bucket attachment method

- Each batch must have a maximum volume of 380m3 and be confirmed using 3DGPS and/or on-site surveyors.
- Collect 3 representative samples from the ex-situ treated stockpile for chromium reducible sulfur suite testing.

Ex-situ treatment using the Pugmill mixing method

- Generate a stockpile of WestConnex Stage 3B ASSM with a maximum volume of 380m3.
- Collect 3 representative samples from the treated stockpile for the chromium reducible sulfur suite.

Appendix D – Spill Management Procedure

SPILL MANAGEMENT PROCEDURE

MANAGEMENT AND RESPONSIBILITY

INITIAL ASSESSMENT OF SITUATION
Site Supervisor to be notified of the spill immediately, regardless of the type of material and quantity.

← All Project Personnel On-site

Is there any danger to you or others in attempting to control the spill? REFER TO SDS

← All Project Personnel On-site

N → **ASSESSMENT OF SITUATION**
- Quantity of the substance spilt
- What is the type of substance? Refer to SDS.
- What is the potential safety impact on personnel, the environment and the surrounding resident/business?
- What is the best method of clean up? Refer to SDS.

Can the spill be contained on-site?

Y → **SAFETY**
PPE must be worn, in accordance with the SDS, during all phases of spill control/ clean up
- Gloves – chemical resistant
- Covered footwear
- Face mask where required
- Consider the need to prepare a specific SWMS for a major spill

SPILL MANAGEMENT
- Stop the source of the spill/ leak if it is safe to do so
- Protect drains/ waterways channels or other pathways for environmental release.
- Locate spill kit if required. Spill kits are located:
  - » In Site Supervisor's utes and CGU site trucks
  - » Site locations as shown on SEPs
- Use absorbent materials from spill kit (i.e. booms, pads, pillows, granules etc.), sand bagging or silt sausages, and any handy physical barrier.
- For waterway spills employ appropriate applications, e.g. floating booms and absorbents

SPILL CLEAN UP
- Place used spill kit materials in the waste bag found within spill kit and dispose in the landfill bin.
- Spilled liquid waste to be placed into a labelled sealed container. The container is to comply with Australian/ New Zealand Standards.

N → **EMERGENCY RESPONSE**
Review SDS emergency strategy before triggering notifications

Is the spill hazardous or not manageable with available on-site resources?

Y → Evacuate area and cordon off
Refer to the **Emergency Response Plan**

N → **Phone 000**
HAZMAT
NSW Fire Brigade
Evacuate area and cordon off
Refer to Emergency Response Plan

← Site Supervisor

- **Site Supervisor** to notify **Environment Coordinator/Project Environment Manager**.
- If spill has potential to cause environmental harm, **Project Environment Manager** is to advise the **Approvals, Environment and Sustainability Manager** who will contact EPA.
- Incident Report to be completed by the **Environment and/or Safety Team**

REPLACEMENT OF SPILL KIT
- Site Supervisor to replace all spill equipment that was used immediately after the event.
- Spill kits will be inspected periodically by the Environment Coordinator and/or Site Supervisor to ensure on going serviceability.

SPILL CLEAN UP/SPILL KIT APPLICATION

MATERIAL	APPLICATION
Booms	Deploy booms first to contain spill. Floating booms (hydrophobic) to be used for spills in waterways to minimise spreading. Consider the need to install floating booms before starting works if there is potential for contamination of waterways
Granules/ Particulate	If the booms alone cannot absorb the spill/ leak, then use absorbent granules to soak up spilled liquid. Absorbent granules are best for small spills/ leaks.
Pads and Pillows	Thin absorbent mats place over spills. Cushion shaped products containing absorbent fibres, used directly under a leak or drip.
Drain Covers	Covers placed over stormwater inlets to block drains and stop spills entering stormwater drains.
Sorbents	Sorbents are materials that soak up the spill. Once the absorbent material has been applied to the spill material, the mixture is recovered with the aid of nets, rakes, forks or pike poles.
Manual Recovery	Manual recovery is another common method especially for areas with a high concentration of oil.
Vacuum Truck	Used to remove liquid and sludge wastes.

Transportation of dangerous goods and hazardous substances

Where Subcontractors and supplies are required to transport dangerous goods and hazard substances to the Project, they must do so in accordance with the National Transport Commission Australian Code for the Transport of Dangerous Goods by Road and Rail Code (Ed 7.7 2020), Dangerous Goods (Road and Rail Transportation) Regulation 2014 and Dangerous Goods (Road and Rail Transportation) Act 2008.

EMERGENCY CONTACTS

SUPERINTENDENT

PROJECT ENVIRONMENT MANAGER

ENVIRONMENT COORDINATORS

LEAD SAFETY MANAGER

SENIOR STAKEHOLDER AND COMMUNITY MANAGER


Oil Spill Boom


General Spill Kit


Chemical Lay Down Pad

Use granular absorbents

Project: M6S1 Approved By: MMalcolm	Revision: 01 Date:14/09/2021 Printed copies are uncontrolled

Appendix E – Water Reuse and Discharge Management Procedure

WATER REUSE AND DISCHARGE MANAGEMENT PROCEDURE

MANAGEMENT AND RESPONSIBILITY

TRAINING

Relevant personnel are to receive Project/Site Inductions and ongoing training via Toolbox Talks.

Site Supervisor
Project Environment Manager
Environmental Advisor

MEASURES TO REDUCE THE VOLUME OF WATER IN EXCAVATIONS/CONCRETE WASH-OUTS

Divert surface runoff around excavations/ concrete wash-outs using cut-off drains, temporary pipe drains, earth mounds etc.

Site Supervisor
Project Engineers
Environmental Advisor

IDENTIFY POTENTIAL SOURCES OF CONTAMINANTS

Potential sources of contaminants must be identified (i.e. PASS, groundwater, hydrocarbons etc.). Limit opportunity for further contamination. Determine if further sampling, testing and treatment is required prior to discharge.

KEY CONTAMINATION AREAS

Refer to site contamination report – Bicentennial Park, MOC3, C2, C6, ATC and roadworks

Site Supervisor
Project Engineers
Environmental Advisor

INTERNAL HOLD POINT: PERMIT TO DEWATER

DISCHARGE OFF THE PREMISES REQUIRES A **PERMIT TO DEWATER**

TESTING AND, WHERE NECESSARY, TREATMENT OF ALL WATER MUST BE UNDERTAKEN PRIOR TO DISCHARGE FROM THE PREMISES. THIS MAY OCCUR WITHIN EXCAVATION OR SEDIMENT BASIN.

PRIOR TO ANY WATER DISCHARGE FROM THE PREMISES CONTACT THE ENVIRONMENTAL ADVISOR OR OR DELEGATED AUTHORITY WHO WILL SIGN OFF THE HOLDPOINT ONCE WATER IS SUITABLE FOR DISCHARGE.

- Appropriate scour protection of the offsite discharge location must be in place to ensure that erosion does not occur. Note: No works to be undertaken off the premise without approval from the Project Environment Manager.
- Record all details of discharge on the Permit to Dewater.

WATER REUSE WITHIN THE PREMISES

INTERNAL HOLD POINT

PRIOR TO WATER REUSE ON THE PREMISES CONTACT THE ENVIRONMENTAL ADVISOR WHO WILL SIGN OFF THE HOLDPOINT CONFIRMING CRITERIA HAS BEEN MET

ALL OTHER ONSITE REUSE

Record details of the discharge on the Permit to Dewater.

NOTE: *a permit is not required to:*

- Transfer water to water treatment plants
- Transfer water between sumps/ fish tanks in tunnels/excavations
- Reuse treated water from water treatment plants i.e. water carts, street sweepers etc.
- Use rainwater from rainwater tanks

THERE IS TO BE NO WASHING DOWN OF HARD SURFACES THAT LEAD TO STORMWATER DRAINS THAT TRANSFER STORMWATER DIRECTLY OFF-SITE

PERSON RESPONSIBLE FOR ACTION

Site Supervisor
Environmental Advisor

PERSON RESPONSIBLE FOR RELEASE

Environmental Advisor

MONITORING

Use of calibrated water monitoring equipment, collection of grab samples for laboratory analysis and/or visual assessments will be undertaken for all water reuse and discharge.

DISCHARGE OFF PREMISE

All water discharge off premise must be in accordance with the Environmental Protection Licence (EPL) 21600.

Environmental Protection Licence

All off premise discharges are to be carried out in accordance with the discharge concentrations included in the Project Environmental Protection Licence (EPL) 21600.

Discharges from WTPs will be in accordance with the EPL. A water discharge impact assessment for each WTP is required to inform discharge criteria.

In the interim, discharge targets for pollutants include:

a) The relevant physical and chemical stressors set out in of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ, 2000);

b) The ANZG (2018) 90 per cent species protection levels for toxicants generally, with the exception of those toxicants known to bioaccumulate, which will be treated to meet the ANZG (2018) 95 per cent species protection levels;

c) less than 0.13ug/L for Perfluorooctane sulphonate (PFOS); and

d) less than 220ug/L for Perfluorooctanoic acid (PFOA).

Note: Liquid waste may be removed from the premise for disposal at a licenced facility.

Further Guidance

Environmental Advisor to complete the Permit to Dewater prior to discharge for all discharges on and off premise.

- Visual inspection and supervision is required for the duration of the discharge. Pump inlet hoses are too be fixed in place to restrict movement and to stop sediment or settled particles being sucked in. Pumps must be monitored at all times while running.
- Environmental Inspection Checklist to be completed following significant rainfall events by the Environmental Advisor and/or Site Supervisor.
- Weekly inspections are to be conducted by the environment team to monitor erosion and sediment controls in active worksites. Weekly inspections will be documented on the Environmental Inspection Checklist.
- Erosion and Sediment Control Plans (ERSED) must be reviewed prior to commencing work if there has been significant rain.

REUSE WITHIN PREMISES

Parameter and Criteria	Identification method
Oil and grease (none visible)	Visual Inspection
No potential for water to leave the premises	Visual Inspection
No surface runoff will be generated from the reuse (reuse includes dust suppression, watering retained vegetation etc.)	Visual Inspection
No potential for water to reach any watercourse	Visual Inspection
Concrete washout water only no visible fines (in addition to criteria above). pH of concrete washout must be assessed and suitable for reuse purpose	Visual Inspection

Safety and Sampling

- Always wear appropriate PPE (refer to SWMS).
- Always ensure personal safety when sampling (refer to SWMS).
- **DO NOT** inhale gases or aerosols formed from sampled material or associated preservatives in sample bottles.
- Maintain high standards of personal hygiene when sampling, **DO NOT** eat or smoke when sampling and ALWAYS wash hands prior to and following sampling.
- **DO NOT** enter sediment basins during sampling.

Treatment of Water

pH Levels

- If pH of water is outside the range 6.5-8.5 it needs to be neutralised. If the water is above 8.5, acid is used to lower the pH. If the water is below 6.5 a base is used to raise the pH.
- To treat water, safety requirements must be followed.

Treatment to Lower pH

- Acid is used to lower pH. As a guide, a dosage rate of approx. 500ml of acid (50% concentration of H_2SO_4) lowers pH of 7000L of water by approx. 1.5 pH.
- Good mixing of the acid in the water is to occur otherwise it is not as effective (acid will generally sink in water column).

Treatment to Raise pH

- Caustic e.g. Builders Lime is used to raise the pH.
- Good mixing of the base in the water is to occur otherwise it is not as effective.

Turbidity

- If turbidity is greater than 50mg/L then it needs to have the sediment settled out.
- Water must be treated using Gypsum, unless another flocculant/s have been approved by TfNSW under ***G38 3.3.2 Using Flocculants or Coagulants Other Than Gypsum***
- When treating in sediment basins or excavations even chemical application across the water surface is to be undertaken to increase effectiveness of sediment drop out. Application rates should be based upon the Blue Book and/or manufacture's specifications. Note that even application over the captured water is essential for effective flocculation.