

# Appendix B5

## Soil and Surface Water Management Sub-plan

M4-M5 Link Mainline Tunnels

April 2020

**WestConnex** M4-M5 Link Tunnels

---



THIS PAGE LEFT INTENTIONALLY BLANK

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Context	1
1.2	Project background	1
1.3	Scope of the Sub-plan	1
1.4	Implementation of the Sub-plan	1
1.5	Environmental management systems overview	1
<b>2</b>	<b>Purpose and objectives</b>	<b>2</b>
2.1	Purpose	2
2.2	Objectives	2
2.3	Environmental performance outcomes and targets	2
<b>3</b>	<b>Environmental requirements</b>	<b>4</b>
3.1	Relevant legislation and guidelines	4
3.2	Minister's Conditions of Approval	5
3.3	Revised Environmental Management Measures	12
3.4	Consultation	12
<b>4</b>	<b>Existing Environment</b>	<b>13</b>
4.1	Topography and soil characteristics	13
4.2	Surface water	15
4.3	Rainfall	18
4.4	Rainfall erosivity factor	18
4.5	Flooding	18
<b>5</b>	<b>Environmental aspects and impacts</b>	<b>20</b>
5.1	Construction activities	20
5.2	Impacts	20
<b>6</b>	<b>Environmental control measures</b>	<b>28</b>
<b>7</b>	<b>Compliance management</b>	<b>41</b>
7.1	Roles and responsibilities	41
7.2	Training	41
7.3	Monitoring and inspection	41
7.4	Licences and permits	42
7.5	Weather monitoring	42
7.6	Auditing	43
7.7	Reporting	43
<b>8</b>	<b>Review and improvement</b>	<b>44</b>
8.1	Continuous improvement	44

8.2 SSWMP update and amendment.....	44
<b>9 References.....</b>	<b>45</b>

**Tables**

Table 2-1 KPIs for soil and surface water management .....	3
Table 3-1 Conditions of Approval relevant to the SSWMP .....	6
Table 4-1 Soil landscape characteristics and erosion potential (from the M4-M5 Link EIS ) .....	13
Table 4-2 Sub-catchments relevant to the Project.....	15
Table 4-3 Summary description of key waterways within the Project area (from the M4-M5 Link EIS).....	15
Table 4-4 Baseline water quality conditions in the Project area.....	17
Table 4-5 Summary of rainfall records from Sydney Airport (BoM station ID: 66037) (BoM 2018). .....	18
Table 5-1 Summary of potential construction surface water quality impacts (from the M4-M5 Link EIS).....	23
Table 5-2 Potential flooding impacts during construction (from the M4-M5 Link EIS) .....	25
Table 6-1 Soil and Water management and mitigation measures .....	29
Table 7-1 Reporting requirements.....	43

**Appendices**

Appendix A – Other Conditions of Approval and Revised Environmental Mitigation Measures relevant to this Plan

Appendix B – Contaminated Land Management Plan

Appendix C – Surface Water Quality Monitoring Program

## Document control

### Approval and authorisation

<b>Title</b>	M4-M5 Link Mainline Tunnels Soil and Surface Water Management Sub-plan
<b>Document No/Ref</b>	M4M5-LSBJ-PRW-EN-MP01-PLN-0005-09
<b>Document Path</b>	

### Document status

Revision	Date	Description
01	17 September 2018	For DPE Review
02	23 October 2018	For DPE approval
03	1 November 2018	For DPE approval
04	4 February 2019	Minor updates
05	27 February 2019	Minor updates – For ER Approval
06	1 May 2019	Minor update – For ER Approval
07	4 September 2019	Minor update – For WestConnex Transurban review
08	25 September 2019	Minor update – For ER Approval
09	17 April 2020	Minor update to Appendix C – For ER Approval

### Internal Review

Name	Position	Date	Signed/Authorised

**Note:**

From Revision D Document Number has changed from M4M5-LSBJ-PRW-GEN-EV01-PLN-0006 (previous revisions) to M4M5-LSBJ-PRW-EN-MP01-PLN-0005.

## Glossary/ Abbreviations

Abbreviations	Expanded text
ARI	Average Recurrence Interval (floods)
Blue Book	Managing Urban Stormwater: Soils and Construction (the “Blue Book”). Volume 1 and Volume 2. (Landcom 2004)
BoM	Bureau of Meteorology
BTEXN	Benzene, toluene, ethylbenzene, xylene, and naphthalene
CEMP	Construction Environmental Management Plan
CLM Act	<i>Contaminated Land Management Act 1997 (NSW)</i>
CLMP	Contaminated Land Management Plan
CoA	Conditions of Approval
DoI Water	Department of Industry – Water (formally DPI Water)
DPE	Department of Planning and Environment
DPIE	Department of Planning, Industry and Environment
DPI	NSW Department of Primary Industries
EC	Electrical Conductivity
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plans
EWMS	Environmental Work Method Statements
GMP	Groundwater Management Sub-plan
GWMP	Groundwater Monitoring Program
mAHD	elevation in metres with respect to the Australian Height Datum
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
KPI	Key Performance Indicator
LSBJV	Lendlease Samsung Bouygues Joint Venture

Abbreviations	Expanded text
OEH	Office of Environment and Heritage
PIRMP	Pollution Incident Response Management Plan
PMF	Probable Maximum Flood
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
REMM	Revised Environmental Management Measures
Roads and Maritime	Roads and Maritime Services
RUSLE	Revised Universal Soil Loss Equation
SEMP	Site Establishment Management Plan
SMC	Sydney Motorway Corporation
SPIR	Submissions and Preferred Infrastructure Report
SSWMP	Soil and Surface Water Management Plan
SWQMP	Surface Water Quality Monitoring Program
TDS	Total Dissolved Solids
WTP	Water Treatment Plant

# 1 Introduction

## 1.1 Context

This Soil and Surface Water Management Sub-plan (SSWMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for M4-M5 Link Mainline Tunnels (the Project). This Plan also includes the Surface Water Quality Monitoring Program prepared for the Project.

This SSWMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR), the WestConnex M4-M5 Link Mainline Tunnel Modification report (September 2018) and all applicable guidance and legislation.

## 1.2 Project background

An EIS (AECOM 2017) assessed the impacts of construction and operation of the Project on soil and surface water, within Chapter 15.

The EIS identified the potential for minor impacts on surface water during construction typically associated with contamination. However, it concluded any potential impacts could be managed by the standard mitigation and management measures that are described in this SSWMP. The potential minor impacts on surface water during construction are discussed in Section 5.

Please refer to Section 1.3 of the CEMP for Project description.

## 1.3 Scope of the Sub-plan

The scope of this Plan is to describe how LSBJV propose to manage and protect surface water during construction of the Project. Operational management measures do not fall within the scope of this Plan and therefore are not included within the processes contained within this Plan.

## 1.4 Implementation of the Sub-plan

The CEMP Sub-plans must be endorsed by the Environmental Representative (ER) and then submitted to the Secretary for approval no later than one (1) month prior to the commencement of the construction activities to which they apply.

Any of the CEMP Sub-plans may be submitted to the Secretary along with, or subsequent to, the submission of the CEMP.

Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the Secretary. The CEMP and CEMP Sub-plans, as approved by the Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. Where the CSSI is being staged, construction of that stage is not to commence until the relevant CEMP and CEMP sub-plans have been endorsed by the ER and approved by the Secretary.

## 1.5 Environmental management systems overview

The environmental management system overview is described in Section 1.5 of the CEMP.



## **2 Purpose and objectives**

### **2.1 Purpose**

The purpose of this Plan is to describe how LSBJV proposes to manage and protect surface water during construction of the Project. This Plan should be read in conjunction with the CEMP.

### **2.2 Objectives**

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

- The EIS prepared for WestConnex M4-M5 Link
- The SPIR prepared for WestConnex M4-M5 Link
- The Modification report for WestConnex M4-M5 Link Mainline Tunnel (September 2018)
- The CoA granted to the Project on 17 April 2018 and as modified on 25 February 2019
- The Roads and Maritime Services (Roads and Maritime) specifications G36 and G38
- The Project's Environment Protection Licence (EPL)
- All relevant legislation and other requirements described in Section 3.1 of this Plan.

### **2.3 Environmental performance outcomes and targets**

The targets presented in Table 2-1 have been established for the management of soil and surface water during construction of the Project. The Project has also established key performance indicators (KPIs) for these targets. These have been derived from the following sources:

- EIS Appendix A
- Conditions of Approval granted to the project on 17 April 2018 and as modified on 25 February 2019
- The Project's EPL.

**Table 2-1 KPIs for soil and surface water management**

Target / KPI number	Target	KPI	Records	Source
1	Soil and surface water management during the construction phase of the Project performed in accordance with this SSWMP	Compliance with SSWMP	Site Inspection Records Other Project records	CoA
2	Soil and surface water management during the construction phase of the Project performed in accordance the principles and requirements in the 'Blue Book' (Landcom 2004)	Compliance with the 'Blue Book' (Landcom 2004)	Erosion and Sediment Control Plans (ESCP) Site Inspection Records	EIS Appendix A CoA
3	Effectively treat water to meet water quality discharge criteria	Compliance with the GMP discharge criteria	WTP discharge records	EIS Appendix A
4	Manage acid sulfate soils in accordance with good practice management	Compliance with the SSWMP	Site Inspection Records	EIS Appendix A
5	Manage contamination to protect environmental values and human health	Compliance with the SSWMP	Site Inspection Records	EIS Appendix A
6	Potential surface water quality impacts mitigated by measures applied during the construction phase of the project	Downstream surface water quality within the baseline range	Water quality monitoring results Construction Compliance Reports	EIS Appendix A
5	Surface water monitoring during the construction phase of the project performed in accordance with the Surface Water Quality Monitoring Program (SWQMP)	Compliance with SWQMP	Water quality monitoring results Construction Compliance Reports	EPL

## 3 Environmental requirements

### 3.1 Relevant legislation and guidelines

#### 3.1.1 Legislation

All legislation relevant to this SSWMP is described 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 Soils Management Advisory Committee (ASSMAC): Acid Sulfate Soil Manual (ASSMAC 1998)
- Australian and New Zealand Environment and Conservation Council and Volume 2A Installation of Services (DECCW 2008a) Volume 2C Unsealed Roads (DECCW 2008b) Agriculture and Resource Management Council of Australia and New Zealand (ANZECC): National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (ANZECC 2000)
- Department of Environment and Conservation (DEC):
  - Guidelines for the Site Auditor Scheme, Second Edition (DEC 2006)
  - Guidelines for the Assessment and Management of Groundwater Contamination (DEC 2007)
  - Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers, November 1997 (DEC 1997)
  - Environmental Best Management Practice Guideline for Concreting Contractors (DEC 2004)
- Department of Environment Climate Change and Water (DECCW): Volume 2D Main Roads Construction (DECCW 2008)
- Environment Protection Authority (EPA):
  - Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA 2004)
  - Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze (RTA 2005)
  - Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA 2015)
- Landcom: Managing Urban Stormwater, Soils and Construction (the Blue Book), 4th Edition, Volume 1 and Volume 2 (Landcom 2004)
- National Environment Protection Council (NEPC): National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) (NEPC 2013)
- Fisheries: Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries 2003)
- Roads and Maritime Services:
  - Dewatering Guideline (Roads and Maritime 2011)
  - Management of Groundwater Contamination (DEC 2007)

- Roads and Maritime Environment Direction Management of Tannins from Vegetation Mulch (Roads and Maritime 2012)
- Roads and Maritime Stockpile Site Management Guideline (Roads and Maritime 2011)
- Roads & Traffic Authority (RTA): Code of Practice for Water Management – Road Development and Management (RTA 1999)
- Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries (Fairfull, S. and Witheridge, G. 2003).

### **3.2 Minister's Conditions of Approval**

The CoA relevant to this Plan are listed in Table 3-1 below. A cross reference is also included to indicate where the condition is addressed in this Plan or other Project management documents.

**Table 3-1 Conditions of Approval relevant to the SSWMP**

CoA No.	Condition Requirements	Document Reference	How addressed
C4(e)	<p>The following CEMP Sub-plans must be prepared in consultation with the relevant authorities identified for each CEMP Sub-plan and be consistent with the CEMP referred to in the EIS.</p> <p>(e) Soil and surface water: DPI Water; OEH; EPA; Sydney Water; and relevant council(s)</p>	Section 3.4	<p>This Soil and Surface Water Management Sub-plan has been prepared in accordance with this condition and describes how LSBJV propose to manage soil and surface water during construction of the Project. This Plan was provided to DoI Water / Natural Resources Access Regulator (NRAR) (formerly DPI Water), Office of Environment and Heritage (OEH), Environment Protection Authority (EPA), Sydney Water and City of Sydney Council and Inner West Council for consultation.</p>
C5	The CEMP Sub-plans must state how:		
	(a) the environmental performance outcomes identified in the EIS and SPIR as modified by these conditions will be achieved;	Section 2.3 Table 2-1	This plan was prepared in accordance with the environmental performance outcomes identified in the EIS and SPIR and is evidenced primarily in Section 2.3 and Table 2-1.
	(b) the mitigation measures identified in the EIS and SPIR as modified by these conditions will be implemented;	Section 6 Table 6-1	The implementation of soil and surface water management and mitigation measures identified in the EIS and SPIR are listed in Table 6-1.

CoA No.	Condition Requirements	Document Reference	How addressed
	(c) the relevant terms of this approval will be complied with; and	Section 3.2 Table 3-1	Details regarding how LSBJV propose to comply with the relevant terms of approval are listed in this Table and in Appendix A.
	(d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.	Section 5.2 Table 6-1 Environmental Risk Assessment Workshop (Section 3.2.1 of CEMP)	Soil and surface water management issues requiring management during construction of the Project have been identified through the EIS, SPIR and Environmental Risk Assessment Workshop. These issues including cumulative impacts have been detailed in Section 5.2 of this plan and Appendix A2 of the CEMP. Environmental risk analysis will be ongoing and regularly reviewed in accordance with Section 3.9 to Section 3.13 of the CEMP to ensure effective management of soil and surface water. Mitigation and management measures for these issues are listed in Table 6-1, Appendix A and Appendix A2 of the CEMP.
C6	The CEMP Sub-plans must be endorsed by the ER and then submitted to the Secretary for approval no later than one (1) month prior to the commencement of the construction activities to which they apply.	Refer to Section 2.2 of the CEMP	This Soil and Surface Water Management Sub-plan will be endorsed by the ER.  The Soil and Surface Water Management Sub-plan will be submitted to DPIE for approval no later than one month prior to the commencement of construction activities.
C7	Any of the CEMP Sub-plans may be submitted to the Secretary along with, or subsequent to, the submission of the CEMP.	Refer to Section 2.2 of the CEMP	This Soil and Surface Water Management Sub-plan has been submitted for approval to DPIE prior to the final submission of the CEMP for DPIE approval.

CoA No.	Condition Requirements	Document Reference	How addressed
C8	Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the Secretary. The CEMP and CEMP Sub-plans, as approved by the Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. Where the CSSI is being staged, construction of that stage is not to commence until the relevant CEMP and CEMP sub-plans have been endorsed by the ER and approved by the Secretary.	Refer to Section 2.2 of the CEMP	Construction will not commence until the CEMP and all CEMP Sub-plans have been approved by DPIE. The CEMP and CEMP Sub-plans will be implemented for the duration of construction.
C9(a)	The following Construction Monitoring Programs must be prepared in consultation with the relevant authorities identified for each Construction Monitoring Program to compare actual performance of construction of the CSSI against predicted performance.  (a) Surface Water Monitoring Program: DPI Water, Sydney Water and relevant council(s)	Section 2.3 of the SWQMP (Appendix C)	The Surface Water Quality Monitoring Program has been prepared in accordance with this condition and describes how LSBJV propose to monitor surface water quality during construction of the Project. The monitoring program was provided to DoI Water / NRAR (formerly DPI Water), Sydney Water and City of Sydney Council and Inner West Council for consultation.
C10	Each Construction Monitoring Program must provide: (a) details of baseline data available; (b) details of baseline data to be obtained and when;	Section 3.1 of the SWQMP (Appendix C)	Details of the surface water baseline data available, as well as data to be obtained and when, during development of the Surface Water Quality Monitoring Program are presented in Section 3.1 of the Surface Water Quality Monitoring Program.

CoA No.	Condition Requirements	Document Reference	How addressed
	(c) details of all monitoring of the project to be undertaken; (d) the parameters of the project to be monitored; (e) the frequency of monitoring to be undertaken; (f) the location of monitoring;	Section 3.2 of the SWQMP (Appendix C)	The details of monitoring to be undertaken by the Project, the parameters to be monitored, the frequency of monitoring and the identification of monitoring locations are described in Section 3.2 of the Surface Water Quality Monitoring Program.
	(g) the reporting of monitoring and analysis results against relevant criteria; (h) details of the methods that will be used to analyse the monitoring data;	Section 3.2.3 of the SWQMP (Appendix C)	Section 3.2.3 of the Surface Water Quality Monitoring Program details the reporting of monitoring and analysis against relevant criteria as well as the methods that will be used to analyse the monitoring data.
	(i) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and	Section 5.3 of the SWQMP (Appendix C)	Procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory are presented in Section 5.3 of the Surface Water Quality Monitoring Program.
	(j) any consultation to be undertaken in relation to the monitoring programs.	Section 2.3 of the SWQMP (Appendix C)	Section 2.3 of the Surface Water Quality Monitoring Program details the consultation undertaken during the development of the monitoring program and also the ongoing consultation identified during construction.



CoA No.	Condition Requirements	Document Reference	How addressed
C13	The Construction Monitoring Programs must be developed in consultation with the relevant authorities as identified in Condition C9.	Section 2.3 of the SWQMP (Appendix C)	The Surface Water Quality Monitoring Program has been prepared in accordance with this condition and describes how LSBJV propose to monitor surface water quality during construction of the Project. The monitoring program was provided to DoI Water / NRAR (formerly DPI Water), Sydney Water and City of Sydney Council and Inner West Council for consultation.
C14	The Construction Monitoring Programs must be endorsed by the ER and then submitted to the Secretary for approval at least one (1) month prior to commencement of construction.	Section 1.3 of the SWQMP (Appendix C)	<p>The Surface Water Quality Monitoring Program (Revision 02) will be endorsed by the ER.</p> <p>The Surface Water Quality Monitoring Program will be submitted to DPIE as part of the Soil and Surface Water Management Plan, for approval no later than one month prior to the commencement of construction activities.</p>
C15	Construction must not commence until the Secretary has approved all of the required Construction Monitoring Programs relevant to that activity and all the necessary baseline data for the required monitoring programs has been collected, to which the CEMP relates.	Section 1.3 of the SWQMP (Appendix C)	Construction will not commence until the CEMP and Sub-plans, including relevant construction monitoring programs have been approved by DPIE, as detailed in Section 1.3 of the Surface Water Quality Monitoring Program.

CoA No.	Condition Requirements	Document Reference	How addressed
C16	The Construction Monitoring Programs, as approved by the Secretary, 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 Secretary, whichever is the greater.	Section 1.3 of the SWQMP (Appendix C)	The Surface Water Quality Monitoring Program will be implemented for the duration of construction as detailed in Section 1.3 of the Surface Water Quality Monitoring Program.
C17	The results of the Construction Monitoring Programs must be submitted to the Secretary, and relevant regulatory authorities, for information in the form of a Construction Monitoring Report at the frequency identified in the relevant Construction Monitoring Program.	Section 5.5 of the SWQMP (Appendix C)	Section 5.5 of the Surface Water Quality Monitoring Program details the reporting requirements and the frequency required for this reporting.

Please refer to Appendix A for all other CoA relevant to the development of this Plan.

### **3.3 Revised Environmental Management Measures**

Refer to Appendix A for all REMMs relevant to the development of this Plan.

### **3.4 Consultation**

This plan was provided to DoI Water (formally DPI Water), NSW Office of Environment and Heritage (OEH), EPA, Sydney Water, City of Sydney Council, and Inner West Council in accordance with CoA C4(e). Refer to Section 2 of the CEMP for consultation requirements relating to the CEMP and all Sub-plans.

Ongoing consultation with relevant councils and other stakeholders, including any unique local receivers, may be undertaken for particular issues pertaining to the Project's impact on soil and surface water. Community feedback and complaints relating to soil and surface water will be dealt with in accordance with the Community Communication Strategy and Complaints Management System.

## 4 Existing Environment

The following sections summarise what is known about factors influencing soils and surface water within and adjacent to the Project corridor.

The key reference document is Chapter 15, Soil and Water Quality, of the EIS (AECOM 2017).

### 4.1 Topography and soil characteristics

#### 4.1.1 Topography

The topography of the Project footprint is relatively flat and low lying, ranging from sea level (adjacent to Sydney Harbour at Iron Cove and the Alexandra Canal) up to approximately 30 m Australian Height Datum (AHD) at Leichardt.

#### 4.1.2 Soil landscapes

The Project alignment transects a highly urbanised environment that consists of established industrial, commercial, recreational and residential areas. The alignment extends from the M4 East at Haberfield, following a route through Leichardt, Annandale, Stanmore, Camperdown, Enmore, and Newtown, emerging at the St Peters interchange.

The Soil Landscapes of the Sydney 1:100,000 Sheet 9130 (DCLM 1989) indicates that the Project alignment is underlain by three soil landscapes. Characteristics of the soil landscapes, as well as their potential for erosion, are summarised in Table 4-1.

**Table 4-1 Soil landscape characteristics and erosion potential (from the M4-M5 Link EIS )**

Soil landscape	Occurrence / characteristics	Erosion potential
Residual Blacktown	Occurs in the St Peters through Newtown, Enmore, and Stanmore areas Poorly drained	No appreciable erosion occurs on this landscape as most of the surface is covered by buildings, structures, roads etc. Low erosion potential (undisturbed). Medium to high erosion potential when disturbed.
Erosional Gymea	Occurs in the Haberfield and Leichardt areas Localised steep slopes High soil erosion hazard	The soil is generally stabilised by urban infrastructure across the Project area, despite the majority of remnant vegetation having been removed. Low erosion potential (undisturbed). Medium to high erosion potential when disturbed.

Soil landscape	Occurrence / characteristics	Erosion potential
Disturbed Terrain	<p>Occurs in the Alexandria and Haberfield areas (associated with low laying areas around Iron Cove Creek, Hawthorne Canal, and Alexandra Canal)</p> <p>Terrain extensively disturbed by human activity, including complete disturbance, removal or burial of soil</p> <p>Variable relief and slopes</p>	<p>Erosion hazard varies according to site characteristics including slope, aspect and exposure. The ground surface within the Project area is generally stabilised by urban infrastructure.</p> <p>Low to medium erosion potential (undisturbed).</p> <p>Medium to high erosion potential when disturbed.</p>

### 4.1.3 Soil salinity

Saline soils form part of the natural landscape of the Sydney Harbour and Parramatta River catchment, particularly within or adjacent to estuarine environments where the natural salt content of tidal waterways is transported to adjacent soils. This may occur adjacent to tidal waterways within the Project area around the concrete lined canals (Hawthorne Canal and Alexandra Canal).

The risk of salinity can be increased by clearing vegetation, irrigation, or other activities that can lead to a rise in the local groundwater level. The Project alignment does not affect land known to be naturally saline, based on a review of the Salinity Potential in Western Sydney Map (NSW Department of Infrastructure, Planning and Natural Resources 2002, in AECOM 2017).

### 4.1.4 Acid sulfate soils

Acid sulfate soils are naturally occurring soils that contain iron sulfides which, when exposed to the air, can oxidise to form sulfuric acid and can pose a risk to the environment if not appropriately managed. Potential acid sulfate soils are generally waterlogged soils, rich in pyrite that have not been oxidised.

Disturbance of acid sulfate soils and/or potential acid sulfate soils can result in adverse impacts on surface and groundwater quality, flora and fauna, and degradation of habitats.

The Campbell Road civil and tunnel site, St Peters, is identified as the only location within the Project footprint containing acid sulfate soils (or potential acid sulfate soils) (AECOM 2017).

## 4.2 Surface water

### 4.2.1 Catchments and waterways

#### Catchments

Table 4-2 outlines the sub-catchments which form part of the larger Sydney Harbour and Parramatta River, and Cooks River catchments as relevant to the Project.

**Table 4-2 Sub-catchments relevant to the Project**

Catchment	Sub-catchment	Project components
Sydney Harbour and Parramatta River catchment	Dobroyd Canal (Iron Cove Creek)	Wattle Street interchange and associated construction ancillary facilities and Water Treatment Plant (WTP) at Haberfield
	Johnstons Creek	Pymont Bridge Road tunnel site and WTP
Cooks River catchment	Alexandra Canal	St Peters interchange and Campbell Road civil and tunnel site, and WTP

#### Waterways

The majority of the Project footprint is located within the Sydney Harbour and Parramatta River catchment. The southern portion of the alignment is located within the Cooks River catchment, which discharges into Botany Bay at Mascot.

Key waterways within the Sydney Harbour and Parramatta River, and Cooks River catchments, and the parts of the Project relevant to those waterways are outlined in Table 4-3.

**Table 4-3 Summary description of key waterways within the Project area (from the M4-M5 Link EIS)**

Waterway	Description	Project components
Dobroyd Canal (Iron Cove Creek)	Dobroyd Canal drains parts of the inner western suburbs of Ashfield, Burwood, Haberfield, Croydon, Drummoyne and Canterbury and discharges into Iron Cove. The creek is a 1 <sup>st</sup> order stream and is mapped as Key Fish Habitat downstream of Ramsay Street, Haberfield.	Dobroyd Canal is the proposed discharge location for a Project construction WTP. The canal runs parallel to the Wattle Street interchange and the proposed tunnel portal of the Project.
Johnstons Creek	The Johnstons Creek catchment is located within the suburbs of Glebe, Annandale, Petersham and Newtown. The catchment is heavily urbanised and comprises a total area of around 4.6 km <sup>2</sup> . The creek is a 1 <sup>st</sup> order stream at the discharge location.	The mainline tunnel traverses beneath Johnstons Creek adjacent to Bridge Road at Stanmore, south of Parramatta Road. The Pymont Bridge Road tunnel site is located within the Johnstons Creek catchment. Johnstons Creek is the proposed discharge location for a Project construction WTP.

Waterway	Description	Project components
Alexandra Canal	The Alexandra Canal catchment (including Sheas Creek) comprises an area of around 23 km <sup>2</sup> and receives runoff from Alexandria, Rosebery, Erskineville, Beaconsfield, Zetland, Waterloo, Redfern, Newtown, Eveleigh, Surry Hills, and Moore Park. Near the St Peters interchange, Alexandra Canal is a 2 <sup>nd</sup> order stream.	The St Peters interchange (including underground connections to the interchange and ventilation facility) is located in the catchment of Alexandra Canal. The Campbell Road civil and tunnel site and proposed Project construction WTP is located within the Alexandra Canal catchment. A proposed operational WTP will also be located within this site.

#### 4.2.2 Geomorphology

The catchments and waterways within the Project area are highly urbanised, disturbed environments. The waterways are all artificial, hard-lined (e.g. concrete channel, piped channel, brick channel, underground concrete channel) stormwater channels, with the exception of Alexandra Canal, which has an unlined base and hard-lined banks.

The geomorphic characteristics of the watercourses reflect their urban and anthropogenic nature.

#### 4.2.3 Surface water quality

Surface water quality in the study area is influenced by several factors including:

- Current and former polluting land uses within the catchments
- Stormwater and sewage overflows and leachate from contaminated and/or reclaimed land
- Urbanisation of the catchments and subsequent reduction in permeable area, increasing run-off and pollutant loads entering waterways
- Illegal dumping.

A review of water quality data, undertaken for the EIS (AECOM 2017), is summarised in Table 4-4 (including samples collected as part of the baseline monitoring program), to determine the water quality of waterways in the Project area.

The baseline surface water quality sampling program included the following analytes:

- Physico-chemical (field) parameters (pH, temperature, electrical conductivity (EC), oxidation / reduction potential, dissolved oxygen, total dissolved solids (TDS) and turbidity)
- Benzene, toluene, ethylbenzene, xylene, and naphthalene (BTEXN)
- Dissolved metals (arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc)
- Nutrients (nitrite as N, nitrate as N, total N, Total phosphorus (P), reactive P, and ammonia)
- Total recoverable hydrocarbons (TRHs)
- Total petroleum hydrocarbons (TPHs).

**Table 4-4 Baseline water quality conditions in the Project area**

Waterway	Description of water quality
Dobroyd Canal (Iron Cove Creek)	<p>Elevated concentrations of heavy metals (copper, chromium, lead, nickel, and zinc) and nutrients (phosphorus, nitrogen, and nitrate) were recorded in tidal and non-tidal zones</p> <p>The pH was outside guideline levels and the turbidity exceeded guideline<sup>1</sup> levels on some occasions</p> <p>High EC indicates brackish, tidally influenced conditions</p> <p>TRHs were detected</p>
Hawthorne Canal	<p>Elevated concentrations of heavy metals (chromium, copper, lead and zinc) and nutrients (phosphorus, nitrogen and nitrate)</p> <p>On some occasions, pH was outside guideline<sup>1</sup> levels and turbidity exceeds guideline<sup>1</sup> levels</p>
Johnstons Creek	<p>Elevated concentrations of heavy metals (cadmium, copper, chromium, lead, nickel, and zinc), nitrogen, phosphorous and nitrate</p> <p>On some occasions, pH was outside guideline<sup>1</sup> levels and turbidity exceeded guideline<sup>1</sup> levels</p> <p>EC indicates brackish, tidally influenced conditions</p> <p>TRHs were detected</p>
Alexandra Canal	<p>Elevated pH, concentrations of metals (copper, lead, chromium, nickel, manganese, and zinc) and nutrients (nitrogen, nitrate and phosphorus) and turbidity</p> <p>The pH was outside guideline<sup>1</sup> levels on occasions</p>

<sup>1</sup> ANZECC (2000)

Baseline water quality monitoring results are presented in the SWQMP (Appendix C).

#### 4.2.4 Sensitive receiving environments

A sensitive receiving environment is an environment that has high conservation or community value, or that supports ecosystem or human uses of water, and that is particularly sensitive to pollution or degradation of water quality.

The receiving surface water environments associated with the Project are characterised as highly urbanised, degraded, and are typically concrete lined storm channels. The environments do not support ecosystems sensitive to proposed Project activities (AECOM 2017). Human uses for the watercourses are limited.



### 4.3 Rainfall

The historical records from the Bureau of Meteorology (BoM) at Sydney Airport (Station ID 66037) have been selected to reflect the potential rainfall due to its proximity to the overall site, and extent of available data (1929 to present).

A summary of the rainfall records from BoM station 66037 is provided in Table 4-2. Rainfall is typically higher during summer and autumn. Winter and spring are typically drier periods.

**Table 4-5 Summary of rainfall records from Sydney Airport (BoM station ID: 66037) (BoM 2018)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly rainfall (mm)	94.6	111.4	117.0	107.8	96.0	124.6	69.6	76.8	59.7	69.7	80.4	73.6	1083.4
Lowest monthly rainfall (mm)	5.4	2.5	6.4	8.0	2.9	2.5	0.0	0.2	0.2	0.0	5.7	4.8	522.9
Highest monthly rainfall (mm)	400.4	596.9	393.0	476.2	421.7	465.9	253.7	396.6	249.4	271.3	396.1	359.2	2025.2

### 4.4 Rainfall erosivity factor

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

For the purpose of designing sediment basins and managing erosion the Rainfall Erosivity Factor erosion index (EI) of 3000 EI has been selected, based on the Rainfall Erosivity maps in the Blue Book. Specific R values for specific sites will be listed in the site-specific ESCPs.

The risk of rainfall erosion will slightly higher during summer months; therefore erosion control will need to be closely planned and managed during the months of December through March, as reflected by the monthly rainfall records in Table 4-5.

### 4.5 Flooding

#### 4.5.1 Existing flood behaviour

The Project area is predominantly highly urbanised with small pockets of open space that are frequently located along some of the watercourses. Development within the Project area is typically well established with a high proportion of residential and commercial land use.

Flood conditions are discussed in detail in Technical Appendix Q of the EIS (AECOM 2017) and summarised here. Flooding in the Project area has increased since the onset of urbanisation, as a consequence of:

- Development occurring prior to the installation of road drainage systems in the 1900s
- Development occurring in overland flowpaths or in localised topographic depressions and encroaching into floodplains, reducing storage capacity

- Culverting and channelisation of watercourses increasing the speed of water travelling through the system
- Increases in the area of impermeable land resulting in increased runoff during rainfall events.

This means that the watercourse flow rates and water levels respond more quickly to rainfall events, due to reduced storage and infiltration capability within the catchments (AECOM 2017).

The EIS (AECOM 2017) found that the local stormwater drainage systems that control runoff within the Project footprint are of limited capacity. As a result, the Project corridor is presently impacted by both main stream flooding and overland flows.

### **Wattle Street interchange**

The Wattle Street interchange (M4 East project) is located in the catchment of Dobroyd Canal. The western section of the interchange is not affected by creek flooding, only by localised stormwater runoff. Mitigation measures, such as local piped drainage systems, an on-site detention basin and an overland flowpath have been implemented in the M4 East project design to capture local runoff upstream and connect into the new interchange drainage system. Excess flows in events greater than the 100 year average recurrence interval (ARI) up to the probable maximum flood (PMF) will be diverted around the western tunnel portal towards Parramatta Road. The eastern end of the interchange is affected by flooding from Dobroyd Canal. The road crest for the eastern tunnel portal has been located above the PMF level to prevent flooding of the tunnel portals. The tunnel ventilation facility at the Wattle Street interchange (Parramatta Road ventilation facility) is also protected from flooding in events up to the PMF.

### **Pymont Bridge Road**

The Pymont Bridge Road tunnel site is located near the top of the Johnstons Creek catchment. There is only a small catchment draining to the site but the dense existing building development means that all runoff is channelled along Bignell Lane. Water ponds at the low point on Bignell Lane, where the local drainage system connects to the road drainage system on Pymont Bridge Road, before draining towards Johnstons Creek. The Leichhardt Flood Study identified flood depths generally between 0.1 m and 0.2 m along Bignell Lane in the 100 year ARI event and up to 1 m at the low point on Bignell Lane. Given the small catchment size, the relatively high flood depths are a result of the confined overland flowpath.

During construction, some stormwater systems will be replaced, which would assist to overcome concentrated overland flows paths and would also reduce the potential to displace water and impact surrounding properties. With appropriate site drainage to manage runoff at the Pymont Bridge Road tunnel site, the risk of flooding to the site from overland flow is considered to be low. Measures would include a combination of temporary piped drainage, open drains and swales, overland flow paths and sedimentation and erosion control measures.

### **St Peters interchange**

The St Peters interchange (New M5 project) is located in the catchment of Alexandra Canal. The interchange is generally not affected by flooding from Alexandra Canal and only the area around the intersection of Campbell Road and Burrows Road is flood affected in events up to the 100 year ARI. Critical infrastructure such as the motorway operations complexes is generally located above PMF level, including the tunnel ventilation facility at the interchange.

### **Northcote Street site**

The Northcote Street site is located in the catchment of Dobroyd Canal. The site is located outside of the PMF flood extent for both mainstream flooding and overland flowpath. It is therefore not anticipated that the site would experience flooding impacts during construction.

## 5 Environmental aspects and impacts

### 5.1 Construction activities

Key construction activities that could result in adverse impacts to soils and surface water include:

- Vegetation clearing and topsoil stripping
- Bulk earthworks
- Construction and use of site accesses
- Culvert and drainage works
- Material stockpiling including the treatment of acid sulfate soil and rock
- Concrete batch plant operation (subject to further Environmental Assessment and Approvals)
- Paving activities
- Water use / extraction
- WTP establishment and operation
- Operations in the compounds including fuel and chemical storage, refuelling and chemical handling.

### 5.2 Impacts

#### 5.2.1 Overview

The potential for impacts on soil and water by the Project are limited and will be dependent on the nature, extent and magnitude of construction activities and their interaction with the natural environment. Potential impacts attributable to construction, discussed in detail below, include:

- Changes in surface water quality from:
  - Spills and incidents
  - Discharges of tunnel waste water
  - Mobilisation of sediments and pollutants during surface works
- Impacts to soils
  - Erosion and sedimentation
  - Soil salinity
  - Acid sulfate soils
- Scour and changes to channel geomorphology
- Flooding
  - Inundation of excavated tunnels
  - Damage to facilities, infrastructure, equipment, stockpiles and downstream sensitive areas
  - Increased risk of flooding of adjacent areas due to temporary loss of floodplain storage or impacts on the conveyance of floodwaters.

Some impacts on soil and water attributable to the Project are anticipated. Relevant aspects and the potential for related impacts have been considered in a risk assessment in Appendix A2 of the CEMP.

Section 6 provides a suite of mitigation measures that will be implemented to avoid or minimise those impacts.

## **5.2.2 Soils**

### **Erosion and sedimentation**

The majority of the Project construction is underground and therefore the main Project works will not impact the surface water environment. Although minimal, associated above ground construction activities have the potential to result in erosion and sediment migration. Surface disturbance and vegetation removal exposes soils and may weaken surface soil structure leading to erosion sedimentation and soil slippage within and around waterways and slopes in the Project area, particularly during periods of high wind or rainfall (AECOM 2017). Areas of high erosion potential are at a higher risk of being subject to erosion and sedimentation. These areas are identified in Section 4.1.2.

Uncompacted or unconsolidated materials (such as excavated and stockpiled soils) have the potential to migrate from construction areas during rain (through surface water run-off) causing downstream sedimentation. Sedimentation in natural waterways can result in reduced water quality as well as smothering of vegetation and clogging of channels, impacting the natural flow paths of the waterway.

During construction, soil erosion will be managed in accordance with the 'Blue Book' (Landcom 2004). Erosion and sediment control will be focussed on areas of surface disturbance (i.e. surface road works, construction ancillary facility sites, and areas of excavation and vegetation removal).

Site-specific ESCPs will be prepared and be progressively updated as construction progresses for each work location associated with or in the vicinity of waterways and culverts that will be modified as part of the project. The ESCPs will be developed in consultation with the Project's soil conservationists where required.

### **Soil salinity**

Construction of the Project has the potential to contribute to soil salinity through soil compaction at areas of surface disturbance, such as the construction of ancillary facility sites, which can restrict groundwater flow and result in a concentrate of salt in one area (AECOM 2017). As outlined in Section 4.1.3), soil salinity is not considered a significant concern within the minimal above-ground Project footprint.

### **Acid sulfate soils**

Soil testing will be conducted in the Campbell Road civil and tunnel site, St Peters (identified in Section 4.1.4 as an area containing acid sulfate soils (or potential acid sulfate soils)) prior to disturbance, to confirm the presence of the soils.

If acid sulfate soils are identified, they will be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC 1998). The manual includes procedures for the investigation, handling, treatment and management of such soils. This procedure has been outlined in the Unexpected Contaminated Lands Find Procedure included in Appendix B of this Plan.

## **5.2.3 Surface water quality**

### **Spills and incidents**

Vehicle or plant and equipment leakages or a vehicle crash may cause spills of oils, lubricants, hydraulic fluids and chemicals during the construction of the Project. If there are spills or leakages within the Project footprint, they would have the potential to pollute downstream waterways via the stormwater network.

The risks to surface water as a result of such incidents would be managed through construction management procedures in accordance with the CEMP and in accordance with the measures outlined in Section 6. With the implementation of these measures, the risk of water quality impacts would be low.

### **Discharge of tunnel wastewater**

Results of baseline groundwater monitoring carried out for the Project (detailed in the GWMP) have been compared to ANZECC (2000) guideline levels (marine and recreational protection levels) to assess the likely water quality of tunnel inflows. Tunnel wastewater, if discharged untreated or poorly treated, has the potential to impact the receiving waterways. There is also potential for reduction in visual amenity and impacts on aquatic species as a result of heavy metal or other toxicants (AECOM 2017).

During construction, groundwater collected in the tunnel will be tested and treated at construction WTPs prior to reuse, or discharge to receiving waterways (Dobroyd Canal (Iron Cove Creek), Johnstons Creek, and Alexandra Canal). The discharge criteria for the WTPs are included in the GMP along with details of water quality testing of the discharge from the WTP.

### **Mobilisation of sediments and pollutants during surface works**

The majority of the Project construction is underground and therefore the main Project works will have minimal impact on the surface water environment. Minor surface construction activities that may disturb soils and other materials have the potential to impact water quality if not effectively managed.

Table 5-1 summarises the potential water quality impacts during construction of the Project. The contaminants of concern as a result of the construction are increased turbidity from soil disturbance, and increased pH due to the use of concrete and its products. Management and mitigation measures to prevent the identified potential impacts are provided in Section 6. These potential impacts are regularly encountered on major construction Projects, are well understood, and management measures are well developed and consistently applied to minimise impact during construction (AECOM 2017).

Routine surface water quality monitoring and analysis for appropriate physico-chemical parameters will occur at specific downstream locations during construction (refer Table 4-5 of Appendix C).

**Table 5-1 Summary of potential construction surface water quality impacts (from the M4-M5 Link EIS)**

Location (Civil and tunnel sites and adjacent footprints)	Construction activities/incidents	Potentially affected waterways	Potential impacts
<p>Wattle Street civil and tunnel site (C1a), Haberfield</p> <p>Haberfield civil site (C2b), Haberfield</p> <p>Northcote civil and tunnel site (C3a), Haberfield</p> <p>Parramatta Road East civil site (C3b), Haberfield</p> <p>Parramatta Road West civil site (C1b), Haberfield</p> <p>Pymont Bridge Road tunnel site (C9), Camperdown / Annandale</p> <p>Campbell Road civil and tunnel site (C10), St Peters</p>	<p>Vegetation clearance and topsoil stripping</p> <p>Demolition works and relocation of utilities</p> <p>Establishment of construction ancillary facilities, access and utility supply</p> <p>Bulk earthworks, excavations, tunnelling, and paving activities</p> <p>Concrete batch plant operation (subject to further Environmental Assessment and Approvals)</p> <p>Material stockpiling including construction materials, demolition materials, and the treatment of acid sulfate soil and rock Stockpiling of spoil,</p> <p>Construction and use of site accesses</p> <p>Accidental spills of chemicals/fuel stored on site with pollutants mobilised into waterways</p> <p>Plant and equipment leaks and breakages</p> <p>Operation of construction phase WTPs</p> <p>Culvert and drainage works</p> <p>Water use, extraction, and WTP construction and operation</p>	<p>Dobroyd Canal (Iron Cove Creek)</p> <p>Johnstons Creek</p> <p>Alexandra Canal</p>	<p>Decrease in water quality in surrounding water bodies including potential impacts of a failure of the WTP to adequately treat water prior to discharge</p> <p>Erosion and mobilisation of exposed soils, open cuts and stockpiles by stormwater runoff and wind leading to sedimentation of waterways</p> <p>Exposure of acid sulfate soils or contaminated soils which, if mobilised via stormwater runoff, could acidify or pollute waterways</p> <p>Dust, litter, and pollutants associated with building materials and demolition waste mobilised by wind and stormwater runoff into waterways</p> <p>Leakage/spills of hydrocarbons or other chemicals from machinery with pollutants conveyed by stormwater runoff into waterways</p> <p>Increased alkalinity (i.e. increased pH) due to transport of chemicals used in treatment and curing of concrete and concrete dust to waterways by stormwater or wind</p> <p>Vehicles transferring soil to adjacent roads and stormwater runoff conveying soil and pollutants into waterways</p>

#### **5.2.4 Scour and channel geomorphology**

There is potential for sediment to be scoured and mobilised where stormwater or wastewater (from WTPs) is discharged to receiving waterways due to increased discharge flow rates and volumes at Dobroyd Canal (Iron Cove Creek), Johnstons Creek, and Alexandra Canal. This could increase turbidity and lead to mobilisation of contaminants that are bound to sediments.

Given the highly urbanised, artificial characteristics of the majority of watercourses, changes to channel geomorphology as a result of discharge to the waterways are considered to be unlikely (AECOM 2017).

#### **5.2.5 Flooding**

The likelihood of flooding and a summary of the potential impacts of construction sites and associated construction activities on flood risk is provided in Table 5-2.

**Table 5-2 Potential flooding impacts during construction (from the M4-M5 Link EIS)**

Construction facility	Existing flood risk (source, mechanisms)	Potential impacts
<p>Wattle Street civil and tunnel site (C1a) (part of M4 East project footprint):</p> <ul style="list-style-type: none"> <li>• Dive structure into the mainline tunnel</li> <li>• Buildings, parking, laydown area</li> </ul>	<p>Dobroyd Canal catchment</p> <p>Western side of the site inundated the PMF result in overland flow</p> <p>M4 East project has mitigated flood risk from overland flow, channelling PMF flow towards Parramatta Road junction and away from the dive structure</p>	<p>None anticipated – mitigation measures provided by the preceding construction of the M4 East project means that the risk of flooding to the Project from a PMF is considered to be low. As the design surface layout or levels of the interchange will not change as a consequence of the Project, the impact of the development is considered to be negligible and no additional mitigation measures are necessary at this location.</p>
<p>Haberfield civil site (C2b) (part of M4 East project footprint):</p> <ul style="list-style-type: none"> <li>• Mechanical and electrical fitout of M4 East ventilation facility</li> <li>• Office, storage and laydown area, substation, parking</li> <li>• Stockpiling underground</li> </ul>	<p>Dobroyd Canal catchment</p> <p>Outside of PMF flood extent for mainstream flooding and overland flowpath</p>	<p>None anticipated – area outside of PMF flood extent.</p>
<p>Northcote Street civil and tunnel site (C3a) (part of M4 East project footprint):</p> <ul style="list-style-type: none"> <li>• Parking, laydown area</li> </ul>	<p>Dobroyd Canal catchment</p> <p>Outside of PMF flood extent for mainstream flooding and overland flowpath</p>	<p>None anticipated – area outside of PMF flood extent.</p>



Construction facility	Existing flood risk (source, mechanisms)	Potential impacts
Parramatta Road East (C3b) and West (C1a) civil sites <ul style="list-style-type: none"> <li>• Laydown area</li> </ul>	Dobroyd Canal catchment Outside of 100 year ARI flood extent for mainstream flooding  Overland flow paths along Parramatta Road	None anticipated – area just on the fringe of PMF flood extent. No overland flowpaths through the site. No topographic changes proposed for Parramatta Road therefore overland flow paths will be maintained.
Pyrmont Bridge Road tunnel site (C9): <ul style="list-style-type: none"> <li>• Temporary access tunnel for construction</li> <li>• Buildings and laydown area, workshop, parking, acoustic shed and spoil handling area, temporary substation</li> </ul>	Johnsons Creek catchment  Overland flow in 10 year ARI event, depths of over 1m limited to Bignell Lane	Potential displacement of water by bunding of ramps to prevent floodwater ingress, as well as presence of temporary noise walls, buildings/hoardings, acoustic shed, offices and other structures.  During construction, the existing buildings on the site will be demolished and replaced with facilities of a smaller footprint, which would allow for less concentrated overland flowpaths and would also reduce the potential to displace water and impact surrounding properties.

Construction facility	Existing flood risk (source, mechanisms)	Potential impacts
<p>Campbell Road civil and tunnel site (C10) (part of New M5 project footprint):</p> <ul style="list-style-type: none"> <li>• Dive structure into the mainline tunnel</li> <li>• Buildings and laydown area, parking, acoustic shed and spoil, handling area</li> </ul>	<p>Alexandra Canal</p> <p>Outside of 20 year ARI and PMF flood extent associated with mainstream flooding</p>	<p>The New M5 project is providing the construction site platform within the St Peters interchange, including designing to protect the construction site from flooding.</p> <p>No impacts anticipated on the basis that the New M5 project is assessing impacts and providing mitigation, such as a temporary stormwater drainage strategy to divert flows around and away from stockpile sites and other vulnerable infrastructure.</p> <p>The design of the New M5 project is providing enabling works for the Project construction site within the St Peters interchange, including provision of flood mitigation measures. For the St Peters interchange, the mitigation measures provided by the preceding construction of the New M5 project means that the risk of flooding to the Project from a PMF is considered to be low (AECOM 2017). Therefore, the impact of the Project on flood risk is considered to be negligible and no additional mitigation measures are necessary for the Project at this location.</p>

## 6 Environmental control measures

Specific measures and requirements to meet the objectives of this SSWMP (refer Section 2.2) and to address impacts on soil and water are outlined in Table 6-1. Based on the mitigation and management measures, it is considered that potential soils and surface water impacts that may arise as a result of the construction of the Project can be effectively managed.

**Table 6-1 Soil and Water management and mitigation measures**

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
<b>General</b>					
SSWMM1	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.	Construction	Environment and Sustainability Manager	<i>Protection of the Environment Operations Act 1997</i> (POEO Act)	PIRMP
SSWMM2	Environmental incidents that do not trigger SSWMM1 will be managed and reported in accordance with the Project CEMP.	Construction	Environment and Sustainability Manager	CEMP	Environmental incident report
SSWMM3	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.	Construction	Environment and Sustainability Manager	POEO Act	Construction compliance reports
SSWMM4	All activities taking place in, on or under waterfront land, as defined in the <i>Water Management Act 2000</i> will be conducted in accordance with the DoI Water's Guidelines for Controlled Activities.	Construction	Environment and Sustainability Manager	<i>Water Management Act 2000</i>	Site inspection reports and other site work records
SSWMM5	ESCPs will be prepared for all work sites associated with or in the vicinity of waterways and culverts that will be modified as part of the Project in accordance with the 'Blue Book' (Landcom 2004). ESCPs will be implemented in advance of site	Pre-construction	Environment and Sustainability Manager	G38 REMM SW03 CoA E190	ESCPs

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
	disturbance and will be updated as required as the work progresses and the sites change.				
SSWMM6	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, and targeted training.	Pre-construction and during construction	Environment and Sustainability Manager	G36/G38	Training reports
SSWMM7	Environmental Work Method Statements (EWMS) will be prepared and implemented to manage soil and water impacts prior to commencing high risk activities.	Construction	Environment and Sustainability Manager	This Plan G36/G38	EWMS
<b>Tunnel inflows</b>					
SSWMM8	WTP for tunnel water discharge will be designed so that the water will be of suitable quality for discharge to the receiving environment in compliance with the discharge criteria (see Groundwater Management Plan (GMP)), the Project EPL, the POEO Act and if applicable, LSBJV's trade waste licence.	Pre-construction and during construction	Environment and Sustainability Manager	REMM SW10 GMP	Water Monitoring reports
<b>Erosion and sediment control</b>					
SSWMM9	All erosion and sediment controls will be installed in accordance with best-practice guidelines such as the Blue Book.	Construction	Environment and Sustainability Manager	REMM SW03 CoA E180 G38	Site inspection report and ESCPs

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM10	A soil conservation specialist will be engaged to provide advice regarding erosion and sediment control.	Construction	Environment and Sustainability Manager	REMM SW04 G38	Specialist reports and ESCP reviews
SSWMM11	Works will be designed and programmed to minimise the extent and duration of disturbance to vegetation.	Pre-construction and during construction	Area Manager	G38	Site inspection report and other site work records
SSWMM12	The extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion.	Construction	Environment and Sustainability Manager	REMM SW05	Site inspection report and ESCPs
SSWMM13	Disturbed ground and exposed soils will be temporarily stabilised during periods of site inactivity to minimise the potential for erosion.	Construction	Area Manager	REMM SW06	Site inspection report and ESCPs
SSWMM14	Disturbed ground and exposed soils will be permanently stabilised and proposed landscaped areas suitably profiled and vegetated as soon as possible following disturbance to minimise the potential erosion.	Post-construction	Area Manager	REMM SW07	Site inspection report and ESCPs
SSWMM15	Erosion and sediment control structures shall remain installed, inspected and maintained until sufficient stabilisation is achieved.	Construction	Environment and Sustainability Manager	G38	ESCPs

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM16	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	G38	Site inspection report
SSWMM17	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	G38	Site inspection report
SSWMM18	Where flocculation is necessary to settle suspended sediments in excavations, calcium sulfate (gypsum) will be utilised unless the use of alternative chemicals is accepted in consultation with Roads and Maritime.	Construction	Area Manager	G38	Site inspection report
<b>Drainage and waterways</b>					
SSWMM19	Where temporary and permanent watercourse crossings (including temporary work platforms and coffer dams) are required they will be designed in consultation with DPI (Fisheries) and DoI Water.	Construction	Environment and Sustainability Manager	G36	Consultation records
SSWMM20	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: <ul style="list-style-type: none"> <li>• Rock lining.</li> <li>• Concrete lining.</li> <li>• Jute-mesh lining.</li> </ul>	Construction	Design Manager	G36/G38	Site inspection report

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
	<ul style="list-style-type: none"> <li>• Jute-matt lining.</li> <li>• Geo-fabric lining</li> <li>• Hydro mulch.</li> <li>• Revegetation.</li> <li>• Appropriate grade selection.</li> <li>• Appropriately sized drains.</li> </ul> <p>If required energy dissipaters shall also be installed at the base of permanent and temporary drainage outlets. Scour protection and energy dissipaters will be integrated where feasible into current banks to minimise impacts.</p>				
<b>Contamination and acid sulfate soils</b>					
SSWMM21	<p>Soil testing will be conducted in the Campbell Road civil and tunnel site, St Peters. If acid sulfate soils are identified, they will be managed in accordance with the Acid Sulfate Soil Manual (ASSMAC 1998).</p> <p>Management strategies will include:</p> <ul style="list-style-type: none"> <li>• Avoid land where acid sulfate soils occur</li> <li>• Avoid disturbing acid sulfate soils if present on land</li> <li>• Undertake shallow soil disturbance so as not to disturb acid sulfate soil</li> <li>• Cover acid sulfate soils with clean fill material so as not to disturb them</li> <li>• Set aside acid sulfate soil areas and do not disturb them</li> </ul>	Construction	Environment and Sustainability Manager	REMM SW11	Site inspection report



ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM22	<p>Potentially contaminated areas directly affected by the Project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the Contaminated Land Management Act 1997 (NSW) (CLM Act).</p> <p>This includes where required further investigations in areas of potential contamination identified in the Project footprint that will be impacted by the works. If contamination posing a risk to human or ecological receptors is identified, RAPs and SAS will be prepared.</p> <p>Prepare a Soil Contamination Report for higher risk sites where soil is disturbed.</p>	Pre-construction / Construction	Environment and Sustainability Manager	CoA E181 CoA E182 REMM CM01 G36 CI 4.2.2 G36 CI 4.2.2 G36 CI 4.2.4 LLE713 CS 2 (internal document) Section 5 of CLMP	Contamination Reports
SSWMM23	<p>Suitable areas will be identified to allow for contingency management of unexpected waste materials, including contaminated materials. Suitable areas will be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage.</p>	Construction	Environment and Sustainability Manager	REMM RW9	ESCPs
SSWMM24	<p>The discovery of previously unidentified contaminated material will be managed in accordance with the Project Unexpected Contaminated Land and Asbestos Finds Procedure (refer to Appendix A of the CLMP), as outlined in the Guideline for the Management of Contamination (Roads and Maritime 2013) and detailed in the CEMP.</p>	Construction	Environment and Sustainability Manager	REMM RW10 CLMP Appendix A	Site inspection report
<b>Soil stockpiles</b>					

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM25	Spoil stockpiles will be managed to reduce potential impacts associated with dust generation, erosion and sedimentation.	Construction	Environment and Sustainability Manager	REMM RW11 G38	ESCPs
SSWMM26	Stockpiles of soil material will be sited within the Project boundary in low-hazard areas outside of riparian 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	REMM RW11 G38	ESCPs
SSWMM27	Dust suppression will be undertaken on stockpiles as required.	Construction	Environment and Sustainability Manager	REMM RW11 G38	Site inspection report
SSWMM28	Weeds will be managed in accordance with the Weed Management Protocol located in the Flora and Fauna Management Plan.	Construction	Environment and Sustainability Manager	REMM RW11 G38	Site inspection report
SSWMM29	Stockpiles outside of acoustic sheds for greater than five days will be stabilised by compaction as soon as practicable then either: <ul style="list-style-type: none"> <li>• Sprayed with suitable tackifier</li> <li>• Covered with anchored fabrics</li> <li>• Seeded with sterile grass (topsoil only)</li> </ul>	Construction	Environment and Sustainability Manager	REMM RW11 G38 EPL O5.8	Site inspection report

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM30	Weed-free topsoils will be used for rehabilitation purposes wherever possible.	Construction	Environment and Sustainability Manager	REMM RW11 G38	Site inspection report
SSWMM31	Stockpiles of mulch which could result in tannin runoff will be constructed outside of riparian areas and will be earth-bunded (300 mm high).	Construction	Environment and Sustainability Manager	REMM RW11 G38	Site inspection report
<b>Asbestos</b>					
SSWMM32	An Asbestos Management Plan has been prepared (refer to CLMP Appendix B) in accordance with relevant legislation, regulations and codes of practice.	Pre-construction	Safety Manager	REMM CM02 CLMP Appendix B	Asbestos Management Plan (in CLMP Appendix B)
SSWMM33	An asbestos survey will be undertaken of buildings to be demolished in accordance with the Asbestos Management Plan. The survey will be conducted by a suitably qualified person.	Pre-construction	Safety Manager	REMM RW13	Asbestos Management Plan (in CLMP Appendix B)
SSWMM34	Asbestos handling and management will be undertaken in accordance with the Asbestos Management Plan that has been prepared in accordance with relevant legislation, regulations and codes of practice. Adjacent communities will be provided with advance notification about potential hazards.	Construction	Safety Manager	REMM RW14	Asbestos Management Plan (in CLMP Appendix B)

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
					Site inspection report
<b>Chemicals, Fuels, Hazardous Materials and Concrete Use</b>					
SSWMM35	<p>Storage of dangerous goods and hazardous materials will occur in accordance with suppliers' instructions and relevant Australian Standards and legislation including the:</p> <ul style="list-style-type: none"> <li>• Work Health and Safety Act 2011 (NSW)</li> <li>• Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW 2005)</li> <li>• Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (EPA 1997).</li> </ul> <p>Incompatible chemicals will be stored separately in accordance with manufactures specifications and compatibility chart.</p>	Construction	Area Manager	REMM HR1	Site inspection report
SSWMM36	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	REMM HR2	Site inspection report
SSWMM37	Hazardous substances will be stored onsite in lockable containers or on a bund within a secure area, in their original receptacles.	Construction	Area Manager	REMM HR2	Site inspection report

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM38	All hazardous substances will be clearly labelled and will have Safety Data Sheets affixed or available nearby.	Construction	Safety Manager	REMM HR2	Site inspection report
SSWMM39	An up-to-date register of hazardous substances will be kept onsite at all times.	Construction	Safety Manager	REMM HR2	Site inspection report
SSWMM40	Any concrete washout areas will be adequately sized, regularly maintained, and located in designated 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	REMM HR3	Site inspection report
SSWMM41	Hazardous substances will only be used onsite as required, in accordance with the manufacturer/supplier instructions. The use hazardous substances inside tunnels will be minimised as much as possible.	Construction	Environment and Sustainability Manager	REMM HR2	Site inspection report
SSWMM42	Concrete wash out areas - where necessary, will be adequately sized, regularly maintained and located in a position where wastewater will not enter any drainage lines or waterways.	Construction	Area Manager	Good practice	Site inspection report
<b>Spills prevention and incidents</b>					
SSWMM43	The use of any hazardous substance that could result in a spill will be undertaken away from drainage or stormwater lines and, wherever possible, within defined bunds.	Construction	Area Manager	REMM HR3	Site inspection report

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM44	Any refuelling undertaken on site shall be undertaken in designated areas only, outside of riparian areas and well away from stormwater system inlets.	Construction	Area Manager	REMM HR3 G36	Site inspection report
SSWMM45	Spills or leakages will be immediately contained and absorbed. Minor spills will be cleaned up and reported using the Roads and Maritime Incident Reporting Procedure.	Construction	Area Manager	REMM HR3	Incident report
SSWMM46	In the event that a major spill triggers the PIRMP, the PIRMP will be implemented immediately.	Construction	Environment and Sustainability Manager	POEO Act REMM HR3	Incident report
SSWMM47	Spill containment kits will be placed at locations with a high concentration of plant or machinery.	Construction	Environment and Sustainability Manager	REMM HR3	Incident report
<b>Flooding</b>					
SSWMM48	Runoff generated from Project construction facilities and discharges from water treatment facilities will be managed to mitigate risk of overloading the receiving drainage system.	Construction	Area Manager	REMM FD13	Site inspection report
SSWMM49	Entry points to the stormwater system used by, or immediately downgradient from, the Project sites will be inspected regularly for blockages and cleaned as required to maintain performance.	Construction	Environment and Sustainability Manager	REMM FD14	Site inspection report

ID	Measure/Requirement	When to implement	Responsibility	Reference	Evidence
SSWMM50	Appropriate site drainage to manage runoff at the Pymont Bridge Road tunnel site. Measures would include a combination of temporary piped drainage, open drains and swales, overland flowpaths, and sedimentation and erosion control measures.	Construction	Environment and Sustainability Manager	EIS – Technical Appendix Q	Site inspection report and ESCPS
<b>Monitoring</b>					
SSWMM51	Rainfall forecasts will be monitored daily and the site managed to avoid erosion and sedimentation, and to minimise the impact of heavy rainfall and flood events.	Construction	Environment and Sustainability Manager	G38	Site inspection report
SSWMM52	A surface water quality monitoring program will be implemented to monitor potential surface water quality impacts due to the Project.	Construction	Environment and Sustainability Manager	CoA C10 REMM SW02 Appendix C	Water monitoring report
<b>Records</b>					
SSWMM53	Records of monitoring and dewatering activities will be maintained.	Construction	Environment and Sustainability Manager	G38 SWQMP (Appendix C) GWMP	De-watering records

## 7 Compliance management

### 7.1 Roles and responsibilities

The LSBJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 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 on site will undergo site induction training relating to soil and water management issues. The induction training will address elements related to soil and water management including:

- Existence and requirements of this Plan
- Existence and requirements of the PIRMP
- Relevant legislation
- Roles and responsibilities for soil and surface water management
- The location and identification of acid sulfate soil or contamination
- Water quality management and protection measures
- Procedure to be implemented in the event of an unexpected discovery of contaminated land.

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

- Erosion and sediment control installation methodology and maintenance
- WTP management
- Dewatering
- Emergency response measures in high rainfall events
- Preparedness for high rainfall events
- Lessons learnt from incidents and other event (e.g. high rainfall/flooding).

Further details regarding staff induction and training are outlined in Section 3.5 of the CEMP.

### 7.3 Monitoring and inspection

#### 7.3.1 Monitoring

The SWQMP (Appendix C) provides detailed inspection criteria including:

- Surface water quality monitoring locations
- Parameters/analytes to be monitored
- Type and frequency of monitoring
- Monitoring methodology.

#### 7.3.2 Inspections

Regular monitoring and inspections will be undertaken and will include, but not be limited to:



- Weekly inspections at active, exposed work sites to evaluate the effectiveness of erosion and sediment controls measures in accordance with Section 3.9.1 of the CEMP
- Rainfall inspections will be conducted after receiving >25 mm over a 24 hour period at active exposed work sites to evaluate the effectiveness of erosion and sediment controls measures in accordance with Section 3.9.1 of the CEMP
- Inspections will be undertaken of erosion and sediment controls prior to any shut down of greater than 48 hours
- Pre-work inspection will be conducted prior to ground disturbing activities to ensure appropriate controls are installed or are planned to be installed in accordance with the ESCP
- Construction discharge water (including tunnel inflows) will be tested, treated, reused or discharged, recorded and reported to meet the requirements of the Project EPL, and if applicable, LSBJV's trade waste licence.
- Surface and groundwater monitoring will be conducted, recorded and reported in accordance with the project EPL. The location and frequency of monitoring will be in accordance with the SWQMP (Appendix B) and GWMP.

LSBJV's Environmental Management System internal documents relevant to this SSWMP are:

- LLE701A - Environmental Work Method Statement (internal document)
- LLE702: Figure 1 - Potential Critical Incident Notification (internal document)
- LLE702A - Environmental Incident Report (internal document)
- LLE702B - Environmental Incident Investigation (internal document)
- LLE703A - Environmental Inspection Checklist (internal document)
- LLE703B - Environmental Observation Report (internal document)
- LLE703C - Environmental Improvement Notice (internal document)
- LLE705A - Sediment Basin Discharge Permit (internal document)
- LLE705B - Dewatering Permit (internal document).

Additional requirements and responsibilities in relation to inspections are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

## 7.4 Licences and permits

The Project construction activities will be regulated by an EPL issued by the EPA and the SWQMP (refer Appendix C).

The EPL typically prescribes water quality parameters to be measured and associated discharge criteria for the licensed discharge points. They also detail the monitoring and analytical EPL requirements by reference to authority publications (e.g. Approved Methods for Sampling and Analysis of Water Pollutants in NSW (EPA 2004)). The likely EPL criteria for WTP discharge is listed in the GMP.

Other relevant licences or permits will be obtained in the lead up to and during construction as required.

## 7.5 Weather monitoring

Weather (rainfall, temperature, wind speed/direction) will be monitored during the construction phase via Bureau of Meteorology weather stations located at Sydney Airport, Canterbury Racecourse and Sydney Observatory Hill. Where adverse weather warnings are provided, the

environmental team will alert relevant Project staff, enabling them to prepare the site for inclement weather.

## 7.6 Auditing

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

Audit requirements are detailed in Section 3.9.3 of the CEMP.

## 7.7 Reporting

Reporting requirements associated with the Plan for the construction phase of the Project are presented in Table 7-1.

**Table 7-1 Reporting requirements**

Schedule (during construction)	Requirements	Recipient (relevant authority)
Water Quality Monitoring Report (every six months)	Data summary reports presenting tabulated surface water monitoring data collected during the six month period. Surface water quality results will be presented and performance criteria exceedances will be highlighted. Applicable management responses will be documented.	DPIE DoI Water Sydney Water EPA
EPL Monitoring Reports and Annual Returns	EPL monitoring reports will be prepared in accordance with the requirements of the EPL.  An EPL Annual Return will be prepared in respect of each EPL reporting period (typically 12 months).	EPA

## 8 Review and improvement

### 8.1 Continuous improvement

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

The continuous improvement process will be designed to:

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

### 8.2 SSWMP update and amendment

The processes described in Section 3.9 to Section 3.13 of the CEMP may result in the need to update or revise this Plan.

Any revisions to the SSWMP will be in accordance with the process outlined in Section 1.5 of the CEMP.

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 3.11.2 of the CEMP.

## 9 References

Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC), 2000. National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1.

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

Bureau of Meteorology (BoM), 2018. Climate data from Sydney Airport (station ID: 66037), accessed July 2018.

Department of Environment and Conservation (DEC), 1998. Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu".

DEC, 2004. Environmental Best Management Practice Guideline for Concreting Contractors.

DEC, 2006. Guidelines for the Site Auditor Scheme (Second Edition) (NSW Department of Environment and Conservation).

DEC, 2007. Guidelines for the Assessment and Management of Groundwater Contamination.

Department of Environment Climate Change and Water (DECCW), 2008. Volume 2D Main Roads Construction.

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

Environment Protection Authority (EPA), 2004. Approved Methods for the Sampling and Analysis of Water Pollutants in NSW.

EPA, 2015. Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997.

Fairfull, S. and Witheridge, G., 2003. Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries.

Infrastructure Sustainability Council of Australia (ISCA), 2016. IS technical manual (Version 1.2). Sydney, NSW Infrastructure Sustainability Council Pty Ltd

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

National Environment Protection Council (NEPC), 1999. National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) 2013.

NSW Fisheries, 2003. *Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings* (Ref: NSWF – 1181).

Roads and Maritime Services (Roads and Maritime), 2011. Road and Maritime Dewatering Guideline.

Roads and Maritime, 2014. Roads and Maritime Management of Wastes on Roads and Maritime Services Land.

Roads and Maritime, 2011. Roads and Maritime Stockpile Site Management Guideline.

Roads and Maritime, 2012. Roads and Maritime Environment Direction Management of Tannins from Vegetation Mulch.

Roads and Traffic Authority (RTA), 1999. RTA's Code of Practice for Water Management – Road Development and Management.

# Appendix A – Other Conditions of Approval and Revised Environmental Mitigation Measures relevant to this Plan

Other relevant Conditions of Approval relevant to the development of this Plan.

CoA No.	Condition Requirements	Document Reference
E180	All reasonably practicable erosion and sediment controls must be installed and appropriately maintained to minimise any water pollution. When implementing such controls, any relevant guidance in the Managing Urban Stormwater series must be considered.	Table 6-1 SSWMM9

Revised Environmental Mitigation Measures relevant to the development of this Plan.

Outcome	Ref #	Commitment	Timing	SSWMP Reference
<b>Water quality</b>				
Management and monitoring of potential surface water quality impacts during construction in accordance with this Plan.	REMM SW01	A Construction Soil and Water Management Plan (CSWMP) will be prepared for the project. The plan will include the measures that will be implemented to manage and monitor potential surface water quality impacts during construction. The CSWMP will be developed in accordance with the principles and requirements in Managing Urban Stormwater – Soils and Construction, Volume 1 (Landcom 2004) and Volume 2D (NSW Department of Environment, Climate Change and Water 2008), commonly referred to as the 'Blue Book'.	Pre-construction	This Plan Table 6-1

Outcome	Ref #	Commitment	Timing	SSWMP Reference
Surface water quality monitoring program developed and implemented to monitor potential surface water quality impacts due to the project	REMM SW02	A program to monitor potential surface water quality impacts due to the project will be developed and included in the CSWMP. The program will include the water quality monitoring parameters and the monitoring locations identified in Annexure E of Appendix Q (Technical working paper: Surface water and flooding) to the EIS where appropriate. The monitoring program will commence prior to any ground disturbance to establish appropriate baseline conditions and 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 (or as otherwise required by any project conditions of approval). Further details to be included in the program are outlined in Appendix Q (Technical working paper: Surface water and flooding) of the EIS.	Pre-construction	Table 6-1 SSWMM52 SWQMP (Appendix C) Section 4.2 of the SWQMP (Appendix C)
Soil erosion and consequent sediment pollution to lands and waterways is controlled	REMM SW03	Erosion and Sediment Control Plans (ESCPs) will be prepared for all work sites in accordance with the Blue Book. ESCPs will be implemented in advance of site disturbance and will be updated as required as the work progresses and the sites change.	Pre-construction	Table 6-1 SSWMM5 Table 6-1 SSWMM9

Outcome	Ref #	Commitment	Timing	SSWMP Reference
Achieve stabilisation with suitable cover that protects the ground surface from erosive forces	REMM SW04	A soil conservation specialist will be engaged for the duration of construction to provide advice regarding erosion and sediment control.	Construction	Table 6-1 SSWMM10
Mitigate potential for sediment pollution to downslope lands and waterways	REMM SW05	The extent of ground disturbance and exposed soil will be minimised to the greatest extent practicable to minimise the potential for erosion.	Construction	Table 6-1 SSWMM12
	REMM SW06	Disturbed ground and exposed soils will be temporarily stabilised prior to extended periods of site inactivity to minimise the potential for erosion.	Construction	Table 6-1 SSWMM13
	REMM SW07	Disturbed ground and exposed soils will be permanently stabilised and proposed landscaped areas will be suitably profiled and vegetated as soon as possible following disturbance to minimise the potential erosion.	Construction	Table 6-1 SSWMM14
Excess water from the project will be of suitable quality for discharge to the receiving environment.	REMMs SW10	<p>Temporary construction water treatment plants will be designed and managed so that treated water will be of suitable quality for discharge to the receiving environment.</p> <p>An ANZECC (2000) species protection level of 90 per cent is considered appropriate for adoption as discharge</p>	Pre-construction	Table 6-1 SSWMM8 Section 3.4.2 of the SWQMP (Appendix C)



Outcome	Ref #	Commitment	Timing	SSWMP Reference
		criteria for toxicants where practical and feasible. The discharge criteria for the treatment facilities will be included in the SWMP.		
Mitigate the potential for soils disturbance to expose acid sulphate soils and/or exacerbate this problem	REMM SW11	Procedures, prepared in accordance with the requirements of the Acid Sulfate Soil Manual (ASSMAC1998), will be included in the CSWMP and implemented in the event that acid sulfate soils, rocks or monosulfidic black oozes are encountered during construction of the project	Construction	Section 5.2.2, Table 6-1 SSWMM21
Compliance with the Blue Book	REMM B4	Site-specific Erosion and Sediment Control Plans (ESCPs) will be prepared for each work location associated with or in the vicinity of waterways and culverts that will be modified as part of the project. The ESCPs will contain measures to stabilise all surfaces disturbed as a result of the project as soon as possible following the disturbance to prevent erosion and to minimise sedimentation in adjacent aquatic environments.	Pre-construction Construction	Section 5.2.2
Air quality				
Dust reduction	REMM AQ25	Controls such as wheel washing systems and rumble grids will be	Construction	Section 6, Table 6-1

Outcome	Ref #	Commitment	Timing	SSWMP Reference
		installed at all site exits to minimise deposition of loose material on sealed surfaces outside project sites to reduce potential dust generation.		
Contamination				
Potentially contaminated areas directly affected by the Project will be investigated and managed in accordance with the CLM Act	REMM CM01	<p>Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the Contaminated Land Management Act 1997 (NSW) (CLM Act).</p> <p>This includes further investigations in areas of potential contamination identified in the project footprint. If contamination posing a risk to human or ecological receptors is identified, a Remediation Action Plan will be prepared.</p>	Construction	Table 6-1 SSWMM22 Contaminated Land Management Plan (CLMP) (Appendix B)
Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan	REMM CM02	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan (or similar) prepared in accordance with relevant legislation, regulations and codes of practice as described in Chapter 23 (Resource use and waste	Construction	Table 6-1 SSWMM32 CLMP (Appendix B)

Outcome	Ref #	Commitment	Timing	SSWMP Reference
		minimisation) of the EIS (AECOM 2017).		
Compliant Waste Management	REMM RW9	Suitable areas will be identified to allow for contingency management of unexpected waste materials, including contaminated materials. Suitable areas will be required to be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage.	Pre-construction	Table 6-1 SSWMM23
Compliant Contamination Management	REMM RW10	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (RMS 2013) and detailed in the CEMP.	Construction	Table 6-1 SSWMM24 Unexpected finds procedure (in CLMP - Appendix B)
Dust reduction	REMM RW11	Spoil stockpiles will be provided with appropriate environmental controls and managed to reduce potential impacts associated with dust generation, erosion and sedimentation.	Construction	Table 6-1 SSWMM25 Table 6-1 SSWMM26 Table 6-1 SSWMM27 Table 6-1 SSWMM28 Table 6-1 SSWMM29 Table 6-1 SSWMM30 Table 6-1 SSWMM31

Outcome	Ref #	Commitment	Timing	SSWMP Reference
Health and safety of workforce and community	REMM RW13	An asbestos survey will be undertaken of buildings to be demolished as part of the project in accordance with an Asbestos Management Plan as part of the Work Health and Safety Plan. The survey will be conducted by a suitably qualified person.	Construction	Table 6-1 SSWMM33 Unexpected Finds Procedure (in CLMP - Appendix B)
Health and safety of workforce and community	REMM R14	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan (or similar) prepared in accordance with relevant legislation, regulations and codes of practice as described in Chapter 23 (Resource use and waste minimisation) of the EIS. Adjacent communities will be provided with advance notification about potential hazards.	Construction	Table 6-1 SSWMM34
<b>Hazards and Risks</b>				
Storage of dangerous goods and hazardous materials will be conducted in a safe manner in accordance with industry standards.	REMM HR1	Storage of dangerous goods and hazardous materials will occur in accordance with suppliers' instructions and relevant Australian Standards and legislation including the: <ul style="list-style-type: none"> <li>Work Health and Safety Act 2011 (NSW)</li> </ul>	Construction	Table 6-1 SSWMM35

Outcome	Ref #	Commitment	Timing	SSWMP Reference
		<ul style="list-style-type: none"> <li>Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW 2005)</li> <li>Environment Protection Manual for Authorised Officers: Bunding and Spill Management, technical bulletin (NSW EPA 1997).</li> </ul> <p>Storage methods may include bulk storage tanks, chemical storage cabinets/ containers or impervious bunds.</p>		
	REMM HR2	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.	Pre-construction	<p>Table 6-1 SSWMM36</p> <p>Table 6-1 SSWMM37</p> <p>Table 6-1 SSWMM38</p> <p>Table 6-1 SSWMM39</p> <p>Table 6-1 SSWMM41</p>
	REMM HR3	Management measures to reduce the potential for spills, reduce potential spill volumes and prevent any contamination will be developed and implemented for activities such as vehicle refuelling, servicing, maintenance and washdown, where there is a potential for spills and contamination.	Construction	<p>Table 6-1 SSWMM40</p> <p>Table 6-1 SSWMM43</p> <p>Table 6-1 SSWMM44</p> <p>Table 6-1 SSWMM45</p> <p>Table 6-1 SSWMM46</p> <p>Table 6-1 SSWMM47</p>

Outcome	Ref #	Commitment	Timing	SSWMP Reference
<b>Flooding and drainage</b>				
Runoff will be managed in accordance with industry standards.	REMM FD02	<p>Hydrologic and hydraulic assessments will be carried out for all temporary project components (including ancillary facilities) and permanent design features that have the potential to affect flood levels in the vicinity of the project.</p> <p>The results of the assessment will inform the preparation of the Flood Mitigation Strategy as well as the design development of temporary and permanent works.</p>	Pre-construction	Section 6, Table 6-1
	REMM FD13	Runoff generated from project construction and operational facilities and discharges from water treatment facilities will be managed to mitigate risk of overloading the receiving drainage system.	Construction	Table 6-1 SSWMM48
	REMM FD14	Entry points to the stormwater used by or immediately downgradient from the project sites will be inspected regularly for blockages and cleaned as required to maintain performance.	Construction	Table 6-1 SSWMM49

# Appendix B – Contaminated Land Management Plan

# Appendix B

## Contaminated Land Management Sub-plan

M4-M5 Link Mainline Tunnels

October 2018



THIS PAGE LEFT INTENTIONALLY BLANK

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Context	1
1.2	Purpose	1
1.3	Objectives	1
1.4	Targets	1
<b>2</b>	<b>Environmental Requirements</b>	<b>3</b>
2.1	Relevant legislation and guidelines	3
2.2	Minister's Conditions of Approval	5
2.3	Revised Environmental Management Measures	6
<b>3</b>	<b>Existing Environment</b>	<b>10</b>
3.1	Previous investigations	10
3.2	Further investigations	19
<b>4</b>	<b>Environmental aspects and impacts</b>	<b>20</b>
4.1	Construction activities	20
4.2	Impacts	20
<b>5</b>	<b>Management Process</b>	<b>22</b>
5.1	Phase 1 Environmental Site Assessment	22
5.2	Phase 2 Sampling, Analytical and Quality Plan	22
5.3	Phase 2 Environmental Site Assessment	22
5.4	Remediation Action Plan	23
5.5	Remediation Validation Report	23
5.6	Long-term Site Environmental Management Plan	24
5.7	Site Audit Report and Site Audit Statements	25
<b>6</b>	<b>Environmental control measures</b>	<b>26</b>
<b>7</b>	<b>Compliance management</b>	<b>33</b>
7.1	Roles and responsibilities	33
7.2	Training	33
7.3	Monitoring and inspections	33
7.4	Auditing	34
7.5	Reporting	34
<b>8</b>	<b>Review and improvement</b>	<b>35</b>
8.1	Continuous improvement	35
8.2	CLMP update and amendment	35

**Appendix**

Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure

Appendix B Asbestos Management Plan

**Tables**

Table 2-1 Conditions of Approval relevant to the CLMP ..... 5

Table 2-2 Revised environmental management measures relevant to this CLMP ..... 6

Table 3-1 Existing contamination on Project surface sites with information sourced from the EIS (Appendix R)..... 11

Table 4-1 Risk assessment for potential construction impacts from the EIS Chapter 16 (Contamination) ..... 21

Table 6-1 Contaminated Land management and mitigation measures ..... 27

Table 7-1 Inspection and monitoring requirements relevant to contamination management.... 34

# Document control

## Approval and authorisation

<b>Title</b>	M4-M5 Link Mainline Tunnels Contaminated Land Management Plan
<b>Document No/Ref</b>	M4M5-LSBJ-PRW-EN-MP01-PLN-0021-01
<b>Document Path</b>	

**Note:**

Revision 01 Document Number has changed from M4M5-LSBJ-PRW-EN-MP01-PLN-0021-D (previous revisions) to M4M5-LSBJ-PRW-EN-MP01-PLN-0021-01.

# Abbreviations/Glossary

Abbreviations	Expanded text
ACM	Asbestos Containing Materials
AMP	Asbestos Management Plan
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASS	Acid Sulfate Soil
ASSMAC	Acid Sulfate Soils Management Advisory Committee
BTEXN	Benzene Toluene Ethylbenzene Xylenes and Naphthalene
CEMP	Construction Environmental Management Plan
CLM Act	<i>Contaminated Land Management Act 1997</i>
CLMP	Contaminated Land Management Plan
CoA	Conditions of Approval
CoC	Contaminants of Concern
CSSI	Critical State Significant Infrastructure
DEC	Department of Environment and Conservation
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
EPL	Environment Protection Licence
ESA	Environmental Site Assessment
EWMS	Environmental Work Method Statements
HIL	Health Investigation Level

Abbreviations	Expanded text
LSBJV	Lendlease Samsung Bouygues Joint Venture
LTSEMP	Long-term Site Environmental Management Plan
NEPM	<i>National Environmental Protection (Assessment of Site Contamination) Measure 1999</i>
OEH	Office of Environment and Heritage
OCP	Organochlorine Pesticide
OPP	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soil
PCB	Polychlorinated Biphenyls
PIRMP	Pollution Incident Response Management Plan
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Project, the	WestConnex M4-M5 Link Mainline Tunnels
RAP	Remediation Action Plan
REMMs	Revised Environmental Management Measures
Roads and Maritime	Roads and Maritime Services
RMS	Roads and Maritime Services
RVR	Remediation Validation Report
SAR	Site Audit Report
SAS	Site Audit Statement
SEMP	Site Environmental Management Sub-plan
SSWMP	Soil and Surface Water Management Sub-plan
TRH	Total Recoverable Hydrocarbons

<b>Abbreviations</b>	<b>Expanded text</b>
UPSS	Underground Petroleum Storage System
UST	Underground Storage Tanks
VOC	Volatile Organic Compounds
WMP	Waste Management Sub-plan
WTP	Water Treatment Plants

# 1 Introduction

## 1.1 Context

This Contaminated Land Management Plan (CLMP or Plan) forms part of the Soil and Surface Water Management Plan (SSWMP) prepared for the Construction Environmental Management Plan (CEMP) for the M4-M5 Link Mainline Tunnels (the Project).

This CLMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the Revised Environmental Management Measures (REMM) listed in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR) and all applicable guidance and legislation.

## 1.2 Purpose

The purpose of this CLMP is to describe how LSBJV propose to manage contaminated land during construction of the Project. This CLMP aims to establish a set of best practice procedures for the identification and management of contaminated land and materials if encountered during works undertaken for the Project. This CLMP will form an Appendix of the SSWMP.

This plan has been prepared to address the requirements of G36 CI 4.2.2 which requires the inclusion in the CEMP of a Contaminated Land Management Sub-plan, which must comply with the Contaminated Land Management Act 1997 (NSW), Roads and Maritime publication "Contaminated Land Management Guideline", Roads and Maritime "Environmental Incident Classification and Reporting Procedure", and Environmental Protection Authority (EPA) guidelines on contaminated land management.

## 1.3 Objectives

The key objective of the CLMP is to ensure all CoA, REMM and licence/permit requirements relevant to contaminated land are described, scheduled and assigned responsibility as outlined in:

- The EIS prepared for WestConnex M4-M5 Link
- The SPIR prepared for WestConnex M4-M5 Link
- Conditions of Approval granted to the Project on 17 April 2018
- Roads and Maritime Services (Roads and Maritime) specifications G36, G38 and G40
- The Project's Environment Protection Licence (EPL)
- All relevant legislation and other requirements described in Section 2.1 of this Plan.

## 1.4 Targets

The following targets have been established for the management of contaminated land during the Project:

- Ensure full compliance with the relevant legislative requirements
- Ensure that potentially contaminated sites are identified, assessed and managed in accordance with relevant requirements, legislation and guidelines
- Ensure appropriate controls and procedures are implemented during construction activities to avoid or minimise potential adverse impacts to human health and the environment from contaminated materials within the Project footprint



- Ensure Asbestos handling and management is undertaken in accordance with an Asbestos Management Plan and Unexpected Contaminated Land and Asbestos Finds Procedure
- Minimise contaminated material disturbance and ensure that mobilisation of contamination off the Project site does not occur as a result of construction activities
- Manage any unexpected contaminated material or asbestos finds unearthed during construction in accordance with the Unexpected Contaminated Land and Asbestos Finds Procedure
- Ensure Project staff are informed via toolbox talks and the Project induction to enable the identification of potentially contaminated land.

## 2 Environmental Requirements

### 2.1 Relevant legislation and guidelines

#### 2.1.1 Legislation

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

#### 2.1.2 Additional approvals, licences, permits and requirements

Refer to Appendix A1 of the CEMP.

#### 2.1.3 Guidelines and standards

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

- Acid Sulfate Soils Assessment Guidelines, Acid Sulfate Soils Management Advisory Committee ((ASSMAC) 1998)
- Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme (3<sup>rd</sup> edition) (NSW Environment Protection Authority (EPA) 2017)
- Contaminated Sites: Sampling Design Guidelines NSW (EPA 1995)
- Department of Urban Affairs and Planning and Environment Protection Authority Planning Guidelines SEPP 55 – Remediation of Land (1998)
- Environmental Guidelines: Solid Waste Landfills Second Edition (NSW EPA 2016)
- Environmental Incident Classification and Reporting Procedure (Roads & Maritime Services 2017)
- Environmental Procedure Management of Wastes on Roads and Maritime Services Land (Roads and Maritime Services 2014)
- Guideline for the Management of Contamination (Roads and Maritime Services 2013)
- Guidelines for Consultants Reporting on Contaminated Sites (NSW Office of Environment and Heritage (OEH) 2011)
- Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (NSW EPA 2012)
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (NSW EPA 2015)
- Guidelines for the Site Auditor Scheme (Second Edition) (NSW Department of Environment and Conservation (DEC) 2006)
- Guidelines for the Assessment and Management of Groundwater Contamination (DEC 2007)
- LLE603B Safety – Area Inspection (internal document)
- LLE607 Asbestos (internal document)
- LLE703A Environmental Inspection Checklist (internal document)
- LLE713 Contaminated Sites Procedure (internal document)
- National Environment Protection (Assessment of Site Contamination) Measure (NEPM), (National Environment Protection Council 1999)
- NSW Office of Environment and Heritage (2011) Guidelines for Consultants Reporting on Contamination Sites

- National Water Quality Management Strategy, Paper No. 4, Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000)
- Roads and Maritime QA Specification G36 – Environmental Protection
- State Environmental Planning Policy 55 – Remediation of Land (NSW Department of Planning, 2014)
- Stockpile Site Management Guideline (RMS 2011)
- Waste Classification Guidelines – Part 1: Classification of waste (NSW EPA 2014).

## 2.2 Minister's Conditions of Approval

The CoA relevant to this plan are listed in Table 2-1 below. A cross reference is also included to indicate where the condition is addressed in this plan or other Project management documents.

**Table 2-1 Conditions of Approval relevant to the CLMP**

CoA No.	Condition Requirements	Document Reference
E181	A Site Contamination Report, documenting the outcomes of Phase 1 and Phase 2 contamination assessments of land upon which the CSSI is to be carried out, that is suspected, or known to be, contaminated must be prepared by a suitably qualified and experienced person in accordance with guidelines made or approved under the Contaminated Land Management Act 1997 (NSW).	Site Contamination Report Section 5.3 Section 5.7 Table 6-1 C2 Section 7.5
E182	If a Site Contamination Report prepared under Condition E181 finds such land contains contamination, a site audit is required to determine the suitability of a site for a specified use. If a site audit is required, a Site Audit Statement and Site Audit Report must be prepared by a NSW EPA Accredited Site Auditor. Contaminated land must not be used for the purpose approved under the terms of this approval until a Site Audit Statement is obtained that declares the land is suitable for that purpose and any conditions on the Site Audit Statement have been complied with.	Site Audit Report Section 5.3 Section 5.7 Table 6-1 C2 Section 7.5
E184	An Unexpected Contaminated Land and Asbestos Finds Procedure must be prepared and must be followed should unexpected contaminated land or asbestos be excavated or otherwise discovered during construction.	Table 6-1 C7 Appendix A – Unexpected Contaminated Lands and Asbestos Finds Procedure
E185	The Unexpected Contaminated Land and Asbestos Finds Procedure must be implemented throughout construction.	Table 6-1 C7 Appendix A – Unexpected Contaminated Lands and Asbestos Finds Procedure

## 2.3 Revised Environmental Management Measures

The relevant REMM are listed in Table 2-2 below. 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 2-2 Revised environmental management measures relevant to this CLMP**

Outcome	Ref #	Commitment	Timing	CLMP Reference
Impacts on site workers and/or local community through disturbance and mobilisation of contaminated material	CM01	Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the Contaminated Land Management Act 1997 (NSW) (CLM Act). This includes further investigations in areas of potential contamination identified in the project footprint where disturbance is required. If contamination posing a risk to human or ecological receptors is identified, a Remediation Action Plan will be prepared.	Construction	Section 5 Table 6-1 C2 Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure Site Contamination Report Site Audit Report
	CM02	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan (or similar) prepared in accordance with relevant legislation, regulations and codes of practice) as described in Chapter 23 (Resource use and waste minimisation) of the EIS.	Construction	Table 6-1 C3 Asbestos Management Plan (AMP) from the Work Health and Safety Plan Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure Appendix B Asbestos Management Plan

Outcome	Ref #	Commitment	Timing	CLMP Reference
	CM03	A hazardous materials assessment will be carried out prior to and during the demolition of buildings. Demolition works will be undertaken in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the Work Health and Safety Regulation 2011 (NSW).	Prior to Construction (Pre-demolition)	Table 6-1 C4 AMP Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure Appendix B Asbestos Management Plan
	CM04	The Construction Waste Management Plan for the project, prepared as described in Chapter 23 (Resource use and waste minimisation) of the EIS, will include procedures for handling and storing potentially contaminated substances.	Construction	Table 6-1 C5 Section 7.3 Section 5.2.3, Table 5-5 and Table 7-1 W21 of the Waste Management Sub-plan (WMP)
	CM05	Stockpile management procedures will be implemented to control dust, odour and cross contamination.	Construction	Table 6-1 C6

Outcome	Ref #	Commitment	Timing	CLMP Reference
	CM06	<p>The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime 2013) and detailed in the CEMP. The procedure will include:</p> <ul style="list-style-type: none"> <li>• Cease work in the vicinity</li> <li>• Initial assessment by an appropriately qualified environmental consultant</li> <li>• Further assessment and management of contamination, if confirmed, in accordance with section 105 of the CLM Act.</li> </ul>	Construction	<p>Table 6-1 C7 Section 7.2 Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure</p>
Impacts on soil and water quality through incorrect handling of hazardous or contaminated material	CM07	A Construction Soil and Water Management Plan will be prepared for the project including procedures to minimise the interaction of stormwater with contaminated land, including acid sulfate soils, and manage potentially contaminated stormwater runoff, as described in Chapter 15 (Soil and water quality) of the EIS.	Construction	<p>Table 6-1 C8 SSWMP WMP Pollution Incident Response Management Plan (PIRMP)</p>
	CM08	Measures identified in Chapter 25 (Hazard and risk) of the EIS will be implemented to appropriately store contaminated materials and materials with the potential to cause contamination and reduce the potential for environmental contamination due to spills and leaks.	Construction	<p>Table 6-1 C9 WMP PIRMP</p>

Outcome	Ref #	Commitment	Timing	CLMP Reference
Waste Generation and Disposal	RW9	Suitable areas will be identified to allow for contingency management of unexpected waste materials, including contaminated materials. Suitable areas will be required to be hardstand or lined areas that are appropriately stabilised and bunded, with sufficient area for stockpile storage. These areas will be inspected regularly to ensure effective contamination management.	Construction	Table 6-1 C6 Section 7.3 Site Environmental Management Plan (SEMP) WMP
Exposure to unexpected contaminated land	RW10	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime 2013) and detailed in the CEMP.	Construction	Table 6-1 C7 Section 7.2 Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure
Spills and leaks from the storage and transport of dangerous goods and hazardous substances during construction	HR3	Management measures to reduce the potential for spills, reduce potential spill volumes and prevent any contamination will be developed and implemented for activities such as vehicle refuelling, servicing, maintenance and washdown, where there is a potential for spills and contamination.	Construction	Table 6-1 C10 PIRMP WMP
Impacts on water quality from disturbance of acid sulfate soils	SW11	Procedures, prepared in accordance with the requirements of the Acid Sulfate Soil Manual (Acid Sulfate Soil Management Advisory Committee 1998), will be included in the SSWMP and implemented in the event that acid sulfate soils, rocks or monosulfidic black oozes are encountered during construction of the project.	Prior to construction	Table 6-1 C1 SSWMP Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure



## 3 Existing Environment

This section describes the existing environment of the Project, specific to contaminated land. It also summaries previous contaminated land investigations undertaken to date and outlines further investigation required.

### 3.1 Previous investigations

The study area for the contamination assessment has been assessed in two parts:

- An assessment of the surface components of the Project (construction and operational activities)
- An assessment of the Project tunnel alignment to identify potential sources of groundwater contamination.

#### 3.1.1 Surface Component

The historical use, areas of concern and contaminants of concern (CoC) in relation to the Project are summarised below in Table 3-1. For a detailed explanation of existing contamination and previous investigations in relation to the Project refer to the EIS Appendix R - Technical working paper: Contamination (AECOM 2017).

It is noted that the Wattle Street civil and tunnel site (C1a), the Northcote Street civil and tunnel site (C3a) and the Haberfield civil site (C2b) have been recorded as historically containing levels of contamination. However, these sites have been utilised for previous stages of the WestConnex Project and it is understood that contamination issues at these sites have been addressed.

**Table 3-1 Existing contamination on Project surface sites with information sourced from the EIS (Appendix R)**

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
Wattle Street civil and tunnel site (C1a)	Lead, asbestos, metals, Polycyclic Aromatic Hydrocarbons (PAHs) and hydrocarbons	<p>Current land use: as a construction ancillary facility for the M4 East Project. N.B. the site will be demobilised and earthworks carried out by the M4 East contractor to provide finished levels consistent with the original ground surface before being handed over to LSBJV.</p> <p>Previous site use included: low density residential.</p> <p>Surrounding land use: current surrounding land use is characterised by low density residential. Former surrounding land use includes car sales yards, dry cleaner/laundry business and car service centres.</p>	<ul style="list-style-type: none"> <li>Residual contamination arising from the demolition/construction of former buildings</li> <li>ACM fragments and lead paint flakes in soil</li> <li>WestConnex M4 East Project construction ancillary facilities related construction leaks and spills</li> <li>Demolition activities, use of plant and machinery and excavation activities.</li> </ul>	<p>Three limited investigations.</p> <p>On-site:</p> <p>Friable asbestos found 0.2-0.6 metres below ground level, cement fibre asbestos present in former building material, a piece of bonded asbestos at the surface and one minor zinc exceedance in shallow topsoil was reported at one location.</p> <p>Elevated metals including lead in groundwater were reported to exceed the ANZECC guidelines.</p> <p>Off-site:</p> <p>None.</p>
Parramatta Rd West civil site (C1b)	On-site: PAHs, metals, (mainly lead), Total Recoverable Hydrocarbons (TRHs), Benzene Toluene Ethylbenzene Xylenes and	<p>Current land use: for commercial purposes (including a car dealership and associated maintenance facilities).</p> <p>Previous site use included: car servicing, dry cleaner, workshops associated with former car dealerships and mechanics.</p>	<p>Historical and current land uses including car servicing, potential Underground Storage Tanks (USTs), former dry cleaner, workshops associated with former car dealerships and mechanics may have resulted in soil and groundwater contamination. Soil contaminations (PAHs) have also been previously identified to the east of the site (GHD</p>	<p>Two limited previous investigations.</p> <p>On-site:</p> <p>Exceedances of benzo(a)pyrene ASC NEPM (NEPC, 2013) criterion, B(a)P TEQ in exceedances in soil and groundwater detections of metals copper, nickel and zinc in</p>

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
	<p>Naphthalene (BTEXN), PAHs, Volatile Organic Compounds (VOCs), Asbestos, Polychlorinated Biphenyls (PCBs), phenols, Organochlorine Pesticide (OCPs) and Organophosphorus Pesticides (OPP).</p> <p>Former underground petroleum storage system (UPSS) including USTs and pipelines may be present on the site.</p> <p>Off-site: As above.</p>	<p>Surrounding land use: primarily residential and commercial.</p>	<p>2015). If present and not appropriately controlled, there is potential for:</p> <ul style="list-style-type: none"> <li>demolition activities to mobilise contaminants (asbestos containing material (ACM) and lead paint)</li> <li>inhalation and/or ingestion risk to site workers from hazardous building materials and PAHs in excavated soil via dust</li> <li>cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds</li> <li>accidental leaks and spills from the use of the site as a construction ancillary site.</li> </ul>	<p>exceedance of groundwater investigation levels.</p>
Haberfield civil site (C2b)	<p>On-site: Lead, asbestos, metals, PAHs, hydrocarbons, TRH, BTEXN, VOCs, VHCs.</p>	<p>Current land use: as a construction ancillary facility for the M4 East Project.</p> <p>Previous site use included: former residential and commercial properties included a car dealership and dry-</p>	<ul style="list-style-type: none"> <li>Small scale mechanical workshops may have been operational within the property, which may have historically stored and handled oils, fuels and solvents</li> </ul>	<p>One limited previous study.</p> <p>The GHD report concluded that acquired commercial and residential properties may contain hazardous building materials and that further assessment should be</p>

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
	Off-site: None.	cleaning business, demolished as part of the M4 East Project  Surrounding land use: residential and commercial land use including a Bunnings Warehouse and Preschool.	<ul style="list-style-type: none"> <li>ACM fragments and lead paint flakes in soil</li> <li>WestConnex M4 East Project construction ancillary facilities related construction leaks and spills</li> <li>Demolition activities, use of plant and machinery and excavation activities</li> </ul>	completed prior to any demolition works.
Northcote Street civil and tunnel site (C3a)	On-site: TRH, BTEX, PAHs, VOCs, lead, asbestos.  Off-site: None.	Current land use: currently being utilised as a construction ancillary facility for the M4 East Project.  Previous site use included: residential and commercial properties  Surrounding land use: residential and commercial properties including service stations, car repair facilities, car washes and a childcare facility.	<ul style="list-style-type: none"> <li>Residual contamination arising from the demolition/construction of former buildings</li> <li>Possible that the former UPSS including USTs and pipelines may still be in situ. Therefore a medium to high risk of soil and groundwater contamination from historical leaks</li> <li>WestConnex M4 East Project construction ancillary facilities related construction leaks and spills</li> <li>Demolition activities, use of plant and machinery and excavation activities.</li> </ul>	One limited previous study.  On-site:  The GHD report concluded that acquired commercial and residential properties may contain hazardous building materials and recommended that further assessment should be completed prior to any demolition works.  Off-site:  None
Parramatta Road East civil and	On-site: Metals, (mainly lead), TRHs,	Current land use: primarily commercial properties including	Historical and current land uses for car servicing, USTs, former dry cleaner, workshops associated with	Two previous investigations (soil and land contamination investigations).

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
tunnel site (C3b)	<p>BTEXN, PAHs, VOCs,</p> <p>Off-site:</p> <p>As above with asbestos, PCB, Phenols, OCPs and OPPs.</p>	<p>a car dealership and associated maintenance facilities.</p> <p>Previous site use included: residential, commercial and industrial including newsagency and revulsion repairs shop.</p> <p>Surrounding land use: adjacent sites used by various commercial/industrial businesses including Service Stations, mechanical workshops and motor part manufacturer.</p>	<p>former car dealerships and mechanics may have caused soil and groundwater contamination. Isolated soil contamination may be present from demolition or construction of former buildings and use of lead paint which may have resulted in localised areas of ACM and lead paint flakes in surface soil. Soil contaminations (PAHs) have also been previously identified to the east of the site (GHD 2015).</p> <p>Demobilisation activities, use of plant and machinery and excavation activities are proposed which could result in:</p> <ul style="list-style-type: none"> <li>• inhalation and/or ingestion risk to site workers from hazardous building materials (if present) and PAHs in surface soil via dust</li> <li>• cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds</li> <li>• accidental leaks and spills from the use of the site as a construction ancillary site.</li> </ul>	<p>On-site:</p> <p>None that exceeded Health Investigation Level (HIL) (NEPC 2013), no asbestos found and general solid waste classification of soil.</p> <p>Off-site:</p> <p>As above.</p>
Pyrmont Bridge Road	<p>On-site:</p> <p>Metals namely lead, TRH, BTEXN, PAHs,</p>	<p>Current land use: primarily commercial properties.</p> <p>Previous site use included: self-storage facility, golf shop, gym,</p>	<p>There are historical land uses within and surrounding the site which may have caused soil and potentially groundwater contamination. Further</p>	<p>None</p> <p>However up-gradient (within 150 metres) former EPA regulated sites</p>

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
tunnel site (C9)	VOCs, asbestos, cyanide and PCBs  Off-site:  Metals, TRH, BTEXN, PAHs, VOCs, SVOCs, cyanide	tax firm, medical device retailer, offices, tile shop, photo and video shop.  Surrounding land use: up-gradient risks include historical motor garages, petrol stations, dry cleaners, metal platers and manufacturers. Former EPA regulated sites Gee Graphic 27 Church Street, Camperdown and a Shell Coles Express service station, 124–126 Johnston Street.  O’Dea Reserve, Salisbury Lane, Camperdown (340 metres south), a former uncontrolled landfill in a former brick pit, was formerly regulated by the NSW EPA under the CLM Act 1997 for PAH, lead and TPH contamination, which suggests this location has historically been remediated.	intrusive investigations would be required to assess the risk posed during construction.  Potential construction impacts include: <ul style="list-style-type: none"> <li>• Direct contact, inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust</li> <li>• Discharge of contaminated surface water to the stormwater system and ultimately Johnstons Creek, which discharges to Rozelle Bay</li> <li>• Residual contamination from former EPA regulated sites (PAH, lead and TPH contamination).</li> </ul>	that had PAH, lead and TPH contamination.
Campbell Road civil and tunnel site (C10)	On-site:  Landfill gases, leachate, metals, PAHs, SVOCs, VOCs, TRH, BTEXN and asbestos	Current land use: construction site for New M5 Project. Remediation and management of the site is being undertaken as part of the New M5 Project.  Previous site use included: residential, an inert/non-	There is known soil and groundwater contamination and landfill gas and leachate at the site.  During excavation activities, there is potential for the following impacts:	Three previous investigations.  On-site:  Confirmed presence of friable asbestos metals, TRH, CPAHs, PAHs, PCBs, dioxins and asbestos within subsurface soil exceeding

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
	<p>Off-site: Landfill gases, metals, TRH, SVOCs, VOCs.</p>	<p>putrescible' landfill, brick works, industrial use (fishing line and laminated timber veneer factory), commercial (pie shop, production company workshop and transport business).</p> <p>Surrounding land use: poses a risk for migrating contaminants namely from industrial properties, former landfill sites, and a nearby up-gradient former drum reconditioning facility.</p>	<ul style="list-style-type: none"> <li>• Inhalation and/or exposure risk from landfill gases for site workers and surrounding land users</li> <li>• Direct contact, inhalation and ingestion risk to site workers or surrounding human receptors from leachate, landfill refuse and contaminated soil by dust</li> <li>• Discharge of contaminated surface water and groundwater/leachate to Alexandria Canal</li> <li>• Disturbance of actual or potential ASS which could impact local soil and water quality</li> <li>• Potential for leaks or spills from equipment and plant used during construction.</li> </ul>	<p>ASC NEPM (2013) HIL C and HIL D criteria.</p> <p>Characteristic Gas Situation 4 (moderate to high risk) methane levels based on the MWCC (NSW EPA 2012)</p> <p>Landfill gases carbon dioxide and carbon monoxide were detected at high concentrations. Hydrogen sulfide exceeded the adopted site assessment criteria.</p> <p>Concentrations of TRH &gt;C10-C34 fractions, benzene, manganese, nickel, sodium, chloride and TDS exceeded the human health based criteria in groundwater.</p> <p>TRH &gt;C10-C34 fractions and benzene were detected in the leachate and not in the Botany Sands or bedrock aquifer</p> <p>Concentrations of cobalt, cadmium, copper, nickel and zinc exceeded the ecological based assessment criteria in leachate and the bedrock aquifer. Concentrations of metals were highest in the leachate and the bedrock aquifer</p> <p>Concentrations of ammonia exceeded the adopted groundwater ecological based</p>

Site	CoC	Site history	Areas of concern	Previous intrusive investigations
				assessment criteria in leachate and slightly exceeded the criteria in the Botany Sands and bedrock aquifers.



### 3.1.2 Tunnelling Component

During shallow tunnelling activities there is the potential that LSBJV will encounter groundwater that is impacted from contamination from industrial and commercial sources such as petrol stations with dissolved and undissolved petroleum hydrocarbon plumes. The highest risk locations relevant to the Project are considered to be:

- C1a: The Wattle Street entry and exit ramps, which are located in an area historically occupied for residential land use and have the potential for ACM and lead paint to be present in surface soils
- C3b: The temporary access tunnel connecting the mainline tunnel to the Pyrmont Bridge Road tunnel site (C9) passes directly south of a 7-Eleven service station that is presently under assessment by the NSW EPA under section 60 of the CLM Act. The temporary access tunnel could potentially intercept a dissolved or undissolved (i.e. Light Non-Aqueous Phase Liquid) petroleum plume
- C10: The tunnel portal area and temporary access tunnel within the former Alexandria Landfill at the New M5 St Peters Interchange could potentially encounter leachate and landfill gases. If a Site Contamination Report prepared under Condition E181 finds that the land contains contamination, a site audit will be undertaken and a subsequent Site Audit Statement and Site Audit Report will be prepared by a NSW EPA Accredited Site Auditor.

With the exception of the former Alexandria Landfill (assessed as part of the New M5 Project), other sections of the tunnel are at depths greater than 30 metres and therefore the likelihood of encountering plumes with high concentrations of contaminants is low given that deep contamination (greater than 30 metres below ground level) has generally not been identified along the proposed M4-M5 Link tunnel alignment.

However, it is noted that any groundwater extracted is likely to contain concentrations of metals and nutrients above background concentrations and low concentrations of chemical and petroleum hydrocarbon contaminants from the types of sources listed in Table 3-1. Notwithstanding, tunnels would be drained to construction water treatment facilities and processed in accordance with the EPL prior to any discharge to receiving surface water bodies. It is also noted that there is a low risk that dewatering during construction works may cause changes in the migration of plumes by changing groundwater gradients and drawing the contamination towards the tunnel. Groundwater will be monitored in accordance with Groundwater Monitoring Program to ensure early detection of any potential contamination or plume intrusions.

Temporary construction water treatment plants (WTPs) would be located at each construction ancillary facility where tunnelling would occur, and would be designed to treat construction water and groundwater inflows encountered during construction. The level of treatment would consider the characteristics of the water requiring treatment, operational constraints or practicalities and associated environmental impacts. The treatment would be developed in accordance with ANZECC (2000) and with consideration to the relevant NSW Water Quality Objectives.

## 3.2 Further investigations

In accordance with the relevant CoA and REMMs listed in Section 2.2 and Section 2.3 of this Plan, a Site Contamination Report documenting the outcomes of Phase 1 and Phase 2 contamination assessments of land for this Project will be prepared by a suitably qualified and experienced person in accordance with guidelines made or approved under the Contaminated Land Management Act 1997 (NSW). If the Site Contamination Report finds such land contains contamination, a site audit is required to determine the suitability of a site for a specified use. If a site audit is required, a Site Audit Statement and Site Audit Report must be prepared by a NSW EPA Accredited Site Auditor. Contaminated land will not be used for the purpose approved under the terms of this approval until a Site Audit Statement is obtained that declares the land is suitable for that purpose and any conditions on the Site Audit Statement have been complied with.

[This Section will be updated as required following completion of further contamination investigations undertaken for the Project].

## 4 Environmental aspects and impacts

### 4.1 Construction activities

Key aspects of the Project that could result in adverse impacts to human health, soils or water as a result of contamination include:

- Pre-construction activities including utility adjustment, site access provisions, property adjustments
- General earthworks particularly during site establishment
- Removal of redundant utilities
- Establishment of site offices, amenities, laydown areas and temporary infrastructure including temporary noise barriers
- Demolition of existing buildings and structures
- Laydown and storage of materials
- Delivery of materials, plant and equipment
- Tunnelling and associated excavation and stockpiling
- Construction of permanent operational infrastructure
- Demobilisation.

### 4.2 Impacts

The potential for contaminated land disturbance and impacts will depend on a number of factors. Primarily impacts will be dependent on the nature, extent and magnitude of construction activities and their interaction with known and potential contaminated land sources.

If present and not appropriately controlled, there is potential for contamination to impact soil and water during construction. Potential impacts attributable to construction activities might include:

- Demolition activities to mobilise contaminants (asbestos containing material (ACM) and lead paint)
- Inhalation, exposure and/or ingestion risk to site workers and surrounding land users from landfill gases, hazardous building materials and PAHs in excavated soil via dust
- Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds
- Direct contact, inhalation and ingestion risk to site workers from contaminated soil or hazardous building materials via dust
- Discharge of contaminated surface water to the stormwater systems
- Discharge of contaminated surface water and groundwater/leachate to Alexandria Canal
- Direct contact, inhalation and ingestion risk to site workers or surrounding human receptors from leachate, landfill refuse and contaminated soil by dust
- Disturbance of actual or potential ASS which could impact local soil and water quality
- Accidental leaks and spills from the use of the site as a construction ancillary site
- Potential for leaks or spills from equipment and plant used during construction.

Relevant aspects and the potential for related impacts have been considered in a risk assessment at Section 3.2.1 of the CEMP. Chapter 7 provides a suite of mitigation measures that will be implemented to avoid or minimise those impacts.

As stated in Chapter 26 (Cumulative Impacts) of the EIS the construction of the Project is not anticipated to create additional soil or groundwater contamination to that already identified within the Project footprint as a result of historical land use activities. It is likely that construction activities would result in an overall improvement in the condition of the land at Project completion with appropriate management of contaminated materials.

The risk assessment as stated in Chapter 16 (Contamination) of the EIS for the aforementioned impacts for surface works during construction is presented below in Table 4-1.

**Table 4-1 Risk assessment for potential construction impacts from the EIS Chapter 16 (Contamination)**

Area	Likelihood of contamination	Consequence	Risk
Wattle Street civil and tunnel site (C1a)	Very unlikely and limited in extent	Exposure pathway likely to be present	Low
Parramatta Road West civil site (C1b)	Potentially present and widespread	Exposure pathway likely to be present	Medium
Haberfield civil site (C2b)	Very unlikely and limited in extent	Exposure pathway likely to be present	Low
Northcote Street civil and tunnel site (C3a)	Very unlikely and limited in extent	Exposure pathway likely to be present	Low
Parramatta Road East civil site (C3b)	Known to be present	Exposure pathway potentially present	Medium
Pymont Bridge Road tunnel site (C9)	Potentially present and widespread	Exposure pathway likely to be present	Medium
Campbell Road civil and tunnel site (C10)	Known to be present and widespread	Exposure pathway likely to be present	High

## 5 Management Process

The contamination assessment process for the Project and provision of recommendations for subsequent remediation and/or management will be completed with reference to relevant State and National guidance documents, endorsed under section 105 of the CLM Act including:

- Guidelines for the NSW Auditor Scheme (3rd Edition), Department of Environment and Conservation NSW (DEC 2017)
- Guidelines for Consultants Reporting on Contaminated Sites, Office of Environment and Heritage (OEH 2011)
- National Environment Protection (Assessment of Site Contamination) Measure (NEPM) 1999, National Environment Protection Council (NEPC 2013)
- Contaminated Sites: Sampling Design Guidelines (NSW EPA 1995).

### 5.1 Phase 1 Environmental Site Assessment

A site-specific Phase 1 Environmental Site Assessment (ESA) is required to determine whether potential site contamination poses an actual or potential risk to human health and the environment, either on or off the site, to determine if additional intrusive investigations are required. A thorough understanding of the contaminants of concern would be ascertained, including whether potentially contaminated soil is in an area of cut / fill or is likely to be unsuitable for construction purposes.

A number of site specific Phase 1 ESAs have been prepared by Sydney Motorway Corporation (SMC) for surface construction sites.

Any further site-specific Phase 1 ESAs will be prepared and the outcomes will be presented to the LSBJV appointed NSW EPA accredited Site Auditor for review. Where no further action is proposed sign-off by the Site Auditor will be sought prior to commencement of works on land identified as potentially contaminated.

### 5.2 Phase 2 Sampling, Analytical and Quality Plan

Where intrusive investigations are deemed necessary, a Phase 2 Sampling Analysis and Quality Plan (SAQP) would be prepared to assess the nature and extent of potential contamination. A soil and/or groundwater SAQP would be developed to inform the Phase 2 ESA in accordance with the EPA (1995) *Sampling Design Guidelines* or activity specific guidelines.

### 5.3 Phase 2 Environmental Site Assessment

A Phase 2 ESA is required at sites where there has only been a Phase 1 ESA completed and the Phase 1 ESA concluded a Phase 2 investigation is required.

Where a Phase 2 ESA is required, it will be completed to a level which is sufficient to inform remediation and or management approaches appropriate to the existing land use during and post construction. As noted previously, the assessment process outlined in the NEPM will be followed when determining whether sites within the Project footprint are contaminated.

A Phase 2 ESA report will be prepared which includes:

- Identification of the type, extent and concentration of contaminants of concern
- Information on the potential effects of contaminants on public health and the environment
- Off-site impacts on soil, sediment and biota (where applicable)

- The adequacy and completeness of all information available to be used in making decisions on remediation or site management
- An assessment of whether the EPA should be notified under Section 60 of the CLM Act
- Identification of preferred options for remediation and/or site management (i.e. whether the contamination is in an area of cut or fill; preferentially either to be retained in situ, reused within the Project boundary, or disposed off site)
- If removal of the contaminated material from site is a remediation option, analysis of the material and classification under the *Waste Classification Guidelines Part 1: Classifying waste* (NSW EPA, 2014) and specification that the movement of all potentially contaminated material will be tracked and recorded as per the Waste Management Sub-plan.

A Site Contamination Report as required by the CoA E181, documenting the outcomes of Phase 1 and Phase 2 contamination assessments of land upon which the CSSI is to be carried out, that is suspected, or known to be, contaminated must be prepared by a suitably qualified and experienced person in accordance with guidelines made or approved under the Contaminated Land Management Act 1997 (NSW).

If a Site Contamination Report prepared under the CoA E181 finds such land contains contamination, a site audit is required to determine the suitability of a site for a specified use. If a site audit is required, a Site Audit Statement and Site Audit Report must be prepared by a NSW EPA Accredited Site Auditor. Contaminated land must not be used for the purpose approved under the terms of this approval until a Site Audit Statement is obtained that declares the land is suitable for that purpose and any conditions on the Site Audit Statement have been complied with.

If the Phase 2 ESA report concludes that contamination is present the report will be presented to the Site Auditor for review if remediation is required. Where this is the case, the Phase 2 ESA may include a recommendation for the development of a RAP, dependent on the land use type. Where a RAP is not deemed necessary, a Contaminated Land Management Summary (CLMS) may be prepared to outline any management actions that are required as a result of the Phase 2 ESA.

## 5.4 Remediation Action Plan

A RAP would be developed to establish the remediation objectives and detail the strategy for sites identified as requiring remediation to make them suitable for the land use. The RAP will demonstrate how the risks of contamination will be reduced to within acceptable levels and prevent migration within the site as well as off-site. Where required, RAPs for the Project will:

- Set remediation goals that ensure the remediated site will be suitable for the land use and will pose no unacceptable risk to human health or to the environment
- Document requirements to be implemented to reduce risks to workers during remediation
- Outline sampling requirements to validate that the remediation strategy has been successful.

RAPs will be prepared and submitted to the Site Auditor for review prior to commencement of remediation works.

## 5.5 Remediation Validation Report

A remediation validation report (RVR) is required to confirm that the remediation goals specified under the RAP have been achieved. The report will detail:

- descriptions of remedial action undertaken
- the validation results of the remediation action undertaken on the site

- confirmation that all regulatory requirements, where applicable, have been met
- identification of any residual contamination with discussion of any associated risks and an outline of control measures required.

RVRs will be submitted to the Site Auditor for review and approval. Where residual contamination is retained onsite, the RVR may be accompanied by a Long-term Site Environmental Management Plan (LTSEMP) (Section 5.6).

## 5.6 Long-term Site Environmental Management Plan

A LTSEMP may be required to ensure:

- the environment is protected
- site users are not exposed to contamination
- the site is suitable for its intended land use where:
  - complete clean-up of contamination affecting a site is not practicable
  - contaminants are being capped or contained on-site
  - remediation is likely to cause a greater adverse impact than would occur if the site were left undisturbed.

An LTSEMP would ensure activities which could potentially result in exposure of future land users to the residual contaminated soils and/or groundwater beneath the site are precluded or appropriately limited/controlled.

Where required, an LTSEMP would be prepared to succinctly describe the nature and location of contamination at a site. It would state what the objectives of the plan are, how contaminants are to be managed, who would be responsible for the plan's implementation and over what timeframe actions specified in the plan would take place.

In addition, an LTSEMP would document the following:

- Administrative controls
- Program of inspections and maintenance
- Protocols on intrusive site works
- Protocols for on-site use and limitations
- List roles and responsibilities
- Contact details
- Emergency and Incident Response Plan.

The LTSEMP would be reviewed by the Site Auditor. The *Auditor Guidelines* (DEC NSW, 2017) also identify several specific requirements to be addressed in the preparation of the LTSEMP. These include that the implementation of a LTSEMP must not be specified by a Site Auditor as a condition on a Site Audit Statement, nor accepted by the Auditor as a means of managing contamination of a site, unless the following conditions have been met:

- The LTSEMP has been reviewed by the Auditor
- The LTSEMP can reasonably be made to be legally enforceable, for example because compliance with it is a requirement of a Notice under the CLM Act or of development consent conditions issued by the relevant planning authority
- There will be appropriate public notification of any restrictions applying to the land to ensure that potential purchasers or other interested individuals are aware of the restrictions, for example appropriate notations on a planning certificate issued under

Section 149(2) of the *Environmental Planning and Assessment Act 1979* or a covenant registered on the title to the land under Section 88B of the *Conveyancing Act 1919*

- There is no off-site migration of contamination from the site which is the subject of the Site Audit. Where there is off-site migration or its potential, that contamination within the site is managed or monitored so that it does not present an unacceptable risk to either the onsite or offsite environments.

## **5.7 Site Audit Report and Site Audit Statements**

As required under CoA E182: “If a Site Contamination Report prepared under Condition E181 finds such land contains contamination, a site audit is required to determine the suitability of a site for a specified use. If a site audit is required, a Site Audit Statement and Site Audit Report must be prepared by a NSW EPA Accredited Site Auditor. Contaminated land must not be used for the purpose approved under the terms of this approval until a Site Audit Statement is obtained that declares the land is suitable for that purpose and any conditions on the Site Audit Statement have been complied with.”

The Site Audit Statement (SAS) cannot be prepared without completion of the Site Audit Report (SAR), which involves the review and consideration of all the steps and associated documents cited under this CLMP. The outcome of the Site Audit process, for instance, the statement of site suitability on the SAS, cannot be pre-empted and requires all Requirements of the CoA be met.



## 6 Environmental control measures

Specific measures and requirements to meet the objectives of this CLMP by addressing contract specifications, CoA and EMM in relation to impacts on contaminated land are lined in Table 6-1.

**Table 6-1 Contaminated Land management and mitigation measures**

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
C1	Follow procedures listed in the SSWMP and Unexpected Contaminated Lands and Asbestos Finds Procedure in the event that ASS are encountered during construction of the Project.	Unexpected Contaminated Lands and Asbestos Finds Procedure	Prior to Construction / Construction	Environment and Sustainability Manager Superintendent Foreman	REMM SW11	SSWMP Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure
C2	<p>Potentially contaminated areas directly affected by the Project will be further investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the CLM Act.</p> <p>This includes where required further investigations in areas of potential contamination identified in the Project footprint that will be impacted by the works. If contamination posing a risk to human or ecological receptors is identified, RAPs and SAS will be prepared.</p> <p>Prepare a Soil Contamination Report for higher risk sites where soil is disturbed.</p>	N/A	Prior to Construction / Construction	Environment and Sustainability Manager Construction Manager	CoA E181 CoA E182 REMM CM01 G36 CI 4.2.2 G36 CI 4.2.2 G36 CI 4.2.4 LLE713 CS 2 (internal document)	Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure Soil Contamination Report (if applicable) Remedial Action Plan (if applicable) Site Audit Statements (if applicable)

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
C3	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan	Asbestos Management Plan LLE607 (internal document) Unexpected Contaminated Lands and Asbestos Finds Procedure A suitably qualified person in Asbestos Materials Investigation and Removal	Construction	Superintendent Foreman Safety Manager All Project Personnel	REMM CM02 LL GMR 4.10.3 Asbestos Register and Maintenance Plan LLE607 (internal document)	Waste and Spoil Tracking Register LLE603B Safety (internal document) Waste Transport Certificates AMP prepared as a part of the Work Health and Safety Plan Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure Appendix B Asbestos Management Plan

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
C4	A hazardous materials assessment will be carried out prior to and during the demolition of buildings. Demolition works will be undertaken in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the WHS Regulation 2011 (NSW).	A suitably qualified person in Hazardous Materials Investigation	Prior to Construction	Environment and Sustainability Manager Safety Manager Construction Manager	REMM CM03 LL GMR 4.10.1 Hazardous Substance and Hazardous Materials Identification LL GMR 4.10.3 Asbestos Register and Maintenance Plan	Asbestos Survey Report LLE603B Safety – Area Inspection (internal document) AMP prepared as a part of the Work Health and Safety Plan Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure Appendix B Asbestos Management Plan
C5	Procedures in the WMP will be followed to minimise impacts to soil and water from the inappropriate handling and storing potentially contaminated substances.	WMP	Prior to Construction	Environment and Sustainability Manager	REMM CM04	WMP Waste Transport Certificates

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
C6	Stockpile management procedures will be implemented to control dust, odour and cross contamination.	WMP	Construction	Superintendent Foreman All Project Personnel	REMM CM05 REMM RW09	LLE703A Environmental Inspection Checklist (internal document)
C7	The discovery of previously unidentified contaminated or asbestos containing material will be managed in accordance with an Unexpected Contaminated Land and Asbestos Finds Procedure. This procedure will be implemented throughout construction.	Unexpected Contaminated Lands and Asbestos Finds Procedure	Construction	Environment and Sustainability Manager Construction Manager Superintendent Foreman	CoA E184 CoA E185 REMM CM06 REMM RW10 G36 CI 4.2.2 G36 CI 4.2.3	Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure
C8	Follow measures listed in the SSWMP to reduce the possibility of contaminated stormwater runoff and ASS.	SSWMP	Prior to Construction	Environment and Sustainability Manager	REMM CM07	SSWMP LLE703A Environmental Inspection Checklist (internal document)

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
C9	All excavation, movement, treatment, processing or remediation of dangerous goods, contaminated soils or groundwater must be planned and conducted in accordance with the requirements of High Risk Activities with all site remediation activities being conducted in accordance with regulatory requirements including provision for any decontamination and wash/disposal facilities.	N/A	Construction	Superintendent Foreman All Project Personnel	REMM CM08 G36 CI 4.3 LLE713 CS 3 (internal document)	LLE703A Environmental Inspection Checklist (internal document)
C10	Plan and execute construction activities so as to minimise the possibility for spills, reduce potential spill volumes and prevent any contamination for activities such as vehicle refuelling, servicing, maintenance, washdown, where there is a potential for spills and contamination.	N/A	Construction	Environment and Sustainability Manager Construction Manager Superintendent Foreman	REMM HR3 G36 CI 4.3	Plant maintenance records LLE703A Environmental Inspection Checklist (internal document)
C11	Project induction and targeted toolbox talks will include discussion of known sites of contamination and the procedure to follow if potential/unexpected contamination is encountered.	N/A	Prior to Construction / Construction	Environment and Sustainability Manager Construction Manager Superintendent Foreman	Best Practice	Site Induction Records Toolbox Talks

ID	Measure/Requirement	Resources needed	When to implement	Responsibility	Reference	Evidence
C12	Any known contaminated soils or groundwater on the site likely to cause risk to health, safety or the environment must be identified, signposted and segregated from site activities by the erection of physical barriers to prevent unauthorised entry, exposure and/or cross contamination.	N/A	Prior to Construction / Construction	Environment and Sustainability Manager Construction Manager Superintendent Foreman	Best practice LLE713 CS 1 (internal document) LLE713 CS 10 (internal document)	N/A
C13	Ensure that contaminated materials are tracked in accordance with state legislation, including transport of waste interstate.	GPS Tracking	Construction	Environment and Sustainability Manager Construction Manager Superintendent Foreman	Best Practice WMP LLE713 CS 9 (internal document)	Waste Transport Dockets Waste and Spoil Management Tracking Register

## 7 Compliance management

### 7.1 Roles and responsibilities

The LSBJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

### 7.2 Training

All personnel, including employees, contractors and utility staff working on site will undergo site induction training relating to contaminated land management issues. The induction training will address elements related to contaminated land management including:

- Existence and requirements of this Sub-plan including the Unexpected Contaminated Lands and Asbestos Finds Procedure (Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure)
- Existence and requirements of other related management plans and guidelines such as the Asbestos Management Plan and the Waste Management Sub-plan
- Responsibilities pertaining to the management of contamination under the *Contaminated Land Management Act 1997* and the *Protection of the Environment Operations Act 1997*
- Responsibilities under the Guidelines for the Assessment of On-site Containment of Contaminated Soil (ANZECC, 1999) and National Environmental Protection (Assessment of Site Contamination) Amendment Measure 1999 revised 2013 (No. 1) (NEPM, 2013)
- Responsibilities including tracking of waste
- Methods and procedures for the handling of hazardous or contaminated material
- Reporting requirements
- Potential for contaminated material to be present on site and management requirements if such material is identified
- Contaminated land management
- ASS identification and management
- Asbestos management.

Targeted training in the form of toolbox talks or specific training will also be provided to personnel with a key role in contaminated land management.

Further details regarding staff induction and training are outlined in Section 3.5 of the CEMP.

### 7.3 Monitoring and inspections

Compliance with the requirements of this CLMP, its implementation and effectiveness will be monitored through:

- Regular inspections of worksite and activities
- LSBJV Environmental Inspections which occur weekly (or more depending on works/weather conditions)
- Internal and external audits, including regular audits of appointed Project Contamination Management Contractor(s) and waste disposal facilities



- Compliance Tracking Reviews.

Inspections and monitoring requirements relevant to contamination management for the Project are identified in Table 7-1.

**Table 7-1 Inspection and monitoring requirements relevant to contamination management**

Item	Frequency	Standards	Records	Responsibility
Asbestos survey	As required, prior to demolition	Inspection to be undertaken by a qualified asbestos surveyor	Reporting as per Asbestos Management Plan	Safety Manager
Site Inspections	Weekly	LLE703 (internal document)	Environmental Inspection Checklist (LLE703A) (internal document)	Environment and Sustainability Manager
Visual surveillance	Daily	Storage containers (bins, skips, tanks, etc.) in sufficient numbers to facilitate segregation Correct bin type used Containers clearly sign posted Containers emptied at sufficient frequency	Log book and photos as relevant	Foreman Environment and Sustainability Manager

Additional requirements and responsibilities in relation to monitoring and inspections are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

## 7.4 Auditing

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

Audit requirements are detailed in Section 3.9.3 of the CEMP.

## 7.5 Reporting

Reporting requirements and responsibilities are documented in Section 3.9.5 of the CEMP.

## 8 Review and improvement

### 8.1 Continuous improvement

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

The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Document any changes in procedures resulting from process improvement identified through the following:
  - As a result of any investigations into any exceedances or non-conformances that determine changes to this plan are required to prevent reoccurrences
  - To take into account changes to the Environment or generally accepted environmental management practices, new risks to the Environment, any Hazardous Substances, Contamination or changes in legislation
  - In response to internal or external audits or annual management reviews.
- Make comparisons with objectives and targets
- Meet approval requirements and conditions such as EPL requirements.

### 8.2 CLMP update and amendment

The processes described in Section 3.9 to Section 3.13 of the CEMP may result in the need to update or revise this plan.

Any revisions to the CLMP within the SSWMP will be in accordance with the process outlined in Section 1.5 of the CEMP.

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 3.11.2 of the CEMP.

# Appendix A Unexpected Contaminated Lands and Asbestos Finds Procedure

# Appendix A

## Unexpected Contaminated Land and Asbestos Finds Procedure

M4-M5 Link Mainline Tunnels

October 2018

THIS PAGE LEFT INTENTIONALLY BLANK

## Document control

### Approval and authorisation

<b>Title</b>	M4-M5 Link Mainline Tunnels Contaminated Land Management Plan
<b>Document No/Ref</b>	M4M5-LSBJ-PRW-EN-GE01-PRC-0001-02
<b>Document Path</b>	

Note:

Revision 02 Document Number has changed from M4M5-LSBJ-PRW-GEN-EV01-PRC-0001-E (previous revisions) to M4M5-LSBJ-PRW-EN-GE01-PRC-0001-02.

# Glossary / Abbreviations

Abbreviations	Expanded text
ACM	Asbestos Containing Materials
AMP	Asbestos Management Plan
ASS	Acid Sulfate Soil
CEMP	Construction Environmental Management Plan
Client, the	Sydney Motorway Corporation
CLMP	Contaminated Land Management Plan
CLM Act	<i>Contaminated Land Management Act 1997</i>
CoA	Conditions of Approval
EC	Environmental Coordinator
EM	Environment and Sustainability Manager
EPA	Environmental Protection Agency
ER	Environmental Representative
EWMS	Environmental Work Method Statement
LSBJV	Lendlease Samsung Bouygues Joint Venture
PPE	Personal Protective Equipment
Project, the	The M4-M5 Link Mainline Tunnels
RAP	Remediation Action Plan
REMM	Revised Environmental Management Measures (from the SPIR)
Roads and Maritime	Roads and Maritime Services
SEMP	Site Establishment Management Plan
SM	Safety Manager
SMC	Sydney Motorway Corporation
SS	Site Supervisor
SSWMP	Soil and Surface Water Management Sub-plan
WTP	Water Treatment Plants

# 1 Introduction

This Unexpected Contaminated Land and Asbestos Finds Procedure (the Procedure) forms part of the Contaminated Land Management Plan (CLMP) developed for the construction of the M4-M5 Link Mainline Tunnels (the Project).

This Procedure details the actions to be taken and describes how the Lendlease Samsung Bouygues Joint Venture (LSBJV) will manage unexpected contaminated and asbestos finds discovered during construction activities.

This Procedure has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR) and all applicable guidance and legislation.

This procedure will be reviewed and updated in accordance with the Soil and Surface Water Management Sub-plan (SSWMP) and/or Site Establishment Management Plan (SEMP).

## 2 Purpose

There is the potential for previously unidentified contaminants to be uncovered during construction of the Project. Unexpected finds may include the discovery of hazardous materials, such as asbestos containing materials (ACM), contaminants, or unexpected acid sulfate soils (ASS) in addition to that identified on site.

## 3 Induction / Training

All personnel on site, including employees, contractors and sub-contractors, will be trained and made aware of the requirements of this procedure in accordance with the SSWMP during the Project induction and in toolbox talks where relevant. Key personnel will be trained in the identification and management procedures of unexpected potentially contaminated or asbestos containing materials.

## 4 Scope

This Procedure is applicable to all activities conducted by personnel on the Project that have the potential to uncover/encounter contaminated soil/material. For further details regarding the general management of Contaminated Lands for the Project, refer to the CLMP. For further details regarding the general management of asbestos refer to the Asbestos Management Plan (AMP) prepared as part of the CEMP.

This procedure will be implemented by LSBJV throughout construction.

## 5 Requirements

The CoA, REMM and Roads and Maritime QA Specifications G36 relevant to this procedure are listed in Table 5-1 below. A cross reference is also included to indicate where the requirements are addressed in this procedure or other Project management documents.



**Table 5-1 CoA, REMMs, Roads and Maritime QA Specifications G36 relevant to the Unexpected Contaminated Lands and Asbestos Finds Procedure**

Requirement	Commitment	Timing	Document Reference
CoA			
E184	An Unexpected Contaminated Land and Asbestos Finds Procedure must be prepared and must be followed should unexpected contaminated land or asbestos be excavated or otherwise discovered during construction.	Prior to Construction / Construction	SSWMP CLMP AMP This plan
E185	The Unexpected Contaminated Land and Asbestos Finds Procedure must be implemented throughout construction.	Construction	SSWMP CLMP AMP Section 4
REMMs			
CM06	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime 2013) and detailed in the CEMP. The procedure will include: <ul style="list-style-type: none"> <li>• Cease work in the vicinity</li> <li>• Initial assessment by an appropriately qualified environmental consultant</li> <li>• Further assessment and management of contamination, if confirmed, in accordance with section 105 of the CLM Act.</li> </ul>	Construction	SSWMP CLMP AMP Section 6.1, 6.2, 6.3, 6.4 Section 7
RW10	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime 2013) and detailed in the CEMP.	Construction	SSWMP CLMP AMP Section 6.1, 6.2, 6.3, 6.4 Section 7
Roads and Maritime QA Specifications G36			
Section 4.2.2	Include in your CEMP a Contaminated Land Management Sub-Plan, which must comply	Prior to Construction	SSWMP

Requirement	Commitment	Timing	Document Reference
	<p>with the <i>Contaminated Land Management Act 1997</i> (NSW), Roads and Maritime Services publication “Contaminated Land Management Guideline”, Roads and Maritime Services “Environmental Incident Classification and Reporting Procedure”, and Environmental Protection Authority (EPA) guidelines on contaminated land management.</p> <p>The Contaminated Land Management Sub-Plan must provide for dealing with:</p> <ul style="list-style-type: none"> <li>• areas of known contamination (if applicable)</li> <li>• unexpected contamination finds</li> <li>• any land contamination caused by you.</li> </ul>		<p>CLMP AMP Section 6.1, 6.2, 6.3, 6.4 Section 7</p>
Section 4.2.3	<p>Unexpected contamination find - Promptly notify the Roads and Maritime Services Representative of any suspected or potential contamination exposed during construction activities, and cease all work activities within the vicinity of actual or suspected contaminated land.</p> <p>The Roads and Maritime Services Representative may at its discretion choose to take over the investigation and management of an unexpected contamination find, and directly appoint an EPA accredited contaminated site auditor.</p>	Construction	<p>SSWMP CLMP AMP Section 7</p>
Section 4.2.4	<p>Where the contamination is known or an unexpected contamination find has been identified, a Remediation Action Plan may be provided by the Roads and Maritime Services Representative. If a Remedial Action Plan is not provided by the Roads and Maritime Services Representative, prepare a Remediation Action Plan for remediating the known areas of contamination or an unexpected contamination find, and areas of potential contamination in their immediate vicinity.</p> <p>The Remediation Action Plan must be prepared in accordance with EPA guidelines on contaminated land management, and must include the following:</p>	Construction	<p>SSWMP CLMP AMP Section 6.6 Section 7</p>

Requirement	Commitment	Timing	Document Reference
	<p>(a) testing requirements for any contaminated material prior to its disposal off site</p> <p>(b) validation plan, which must include the area in the immediate vicinity of (both below and adjacent to) the known contamination</p> <p>(c) implications of the validation results on the waste classification for material that may be excavated in the vicinity of the known contamination.</p>		

## 6 Procedure

### 6.1 Potential Asbestos Containing Materials

If unexpected Asbestos Containing Materials (ACM) are found during construction activities, LSBJV will follow the general procedure shown in Figure 6-1.

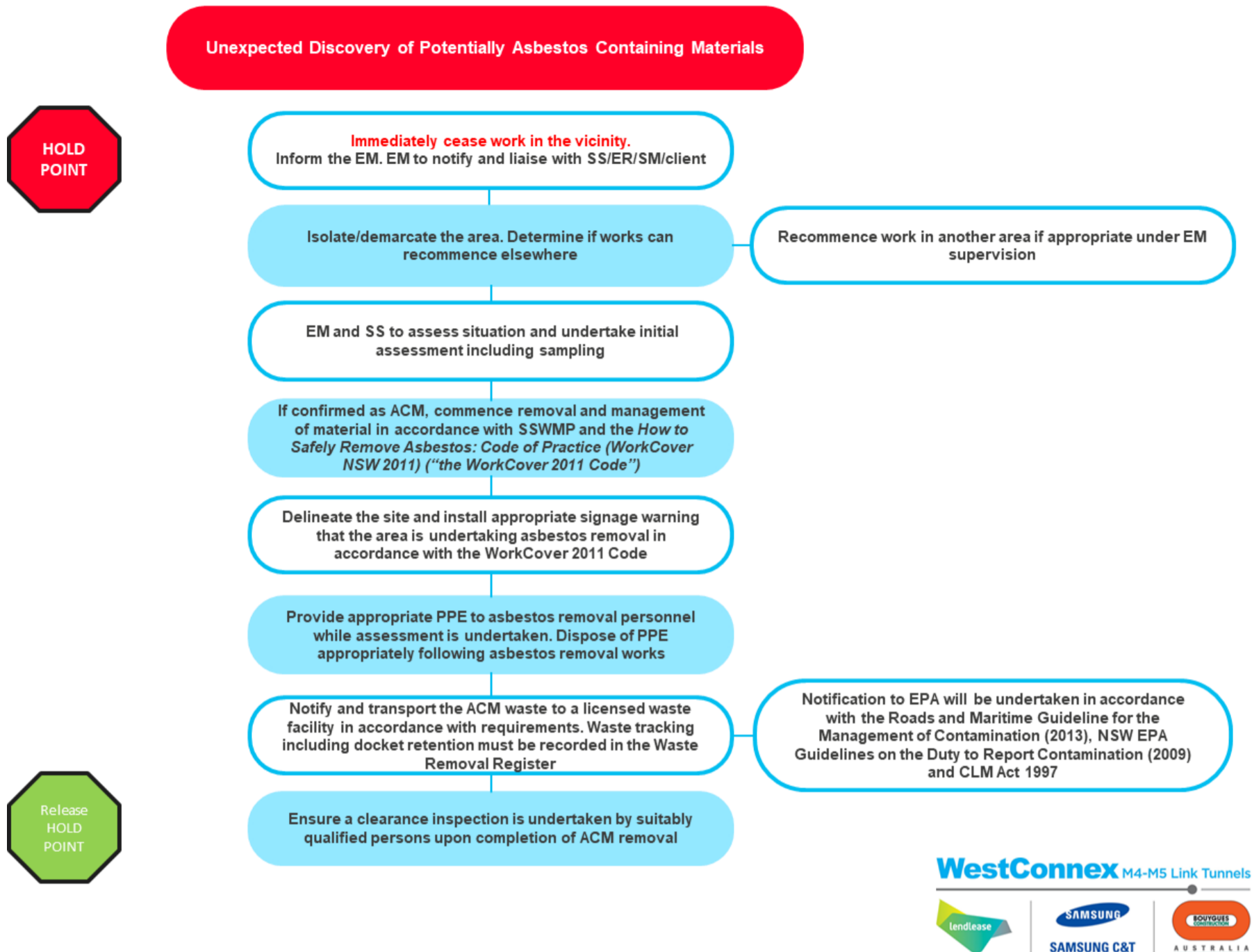


Figure 6-1 Unexpected Asbestos finds flowchart

(EM = Environmental Manager, ER = Environmental Representative, SS = Site Supervisor / Foreman, SM = Safety Manager, client = Sydney Motorway Corporation)

## 6.2 Potential Contamination

If unexpected contamination is found during construction activities, LSBJV will follow the general procedure shown in Figure 6-2.

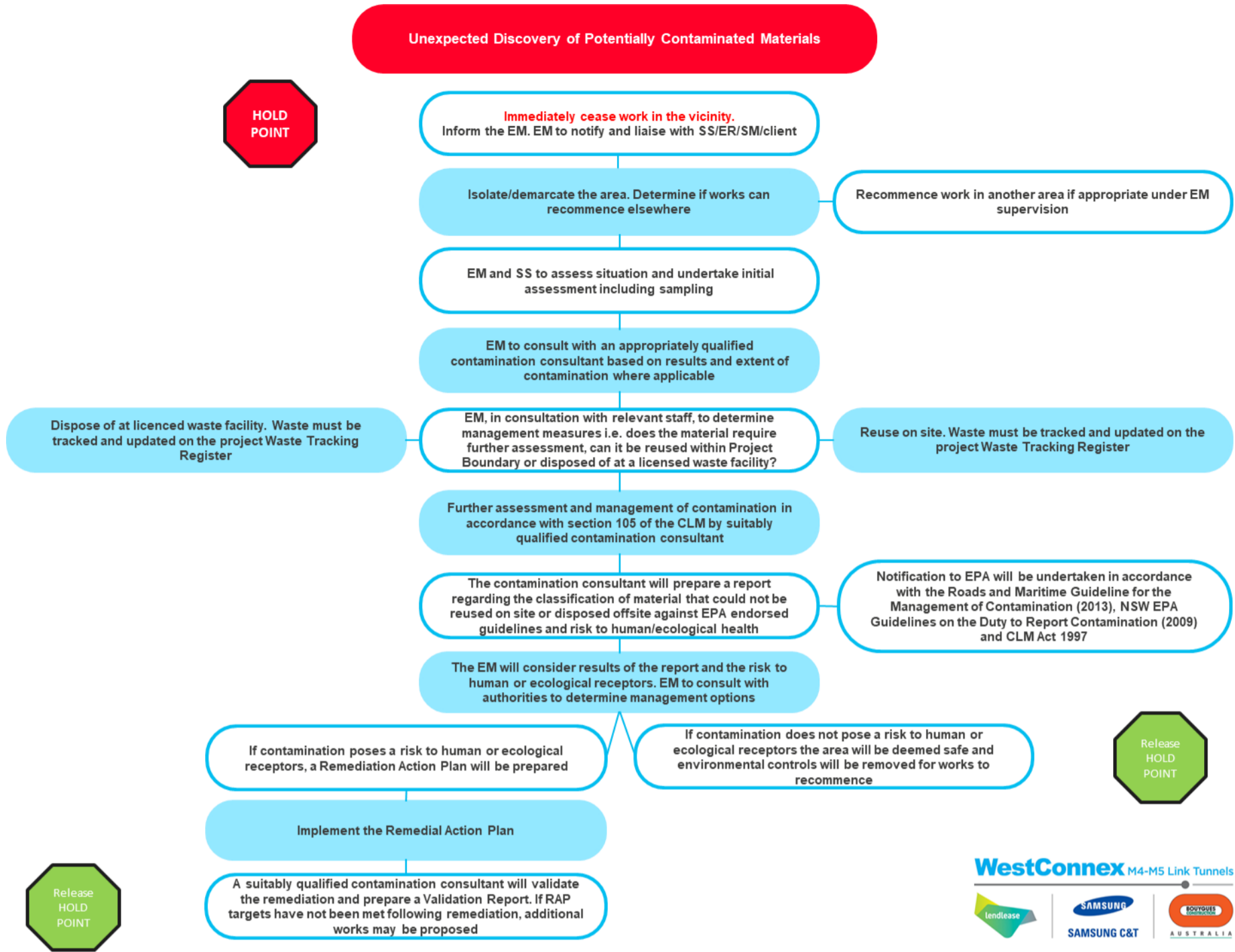


Figure 6-2 Unexpected discovery of Contamination flowchart

(EM = Environmental Manager, ER = Environmental Representative, SS = Site Supervisor / Foreman, SM = Safety Manager, client = Sydney Motorway Corporation)

### 6.3 Potential Acid Sulfate Soils

If unexpected acid sulfate soils are encountered during construction activities, LSBJV will follow the general procedure shown in Figure 6-3.

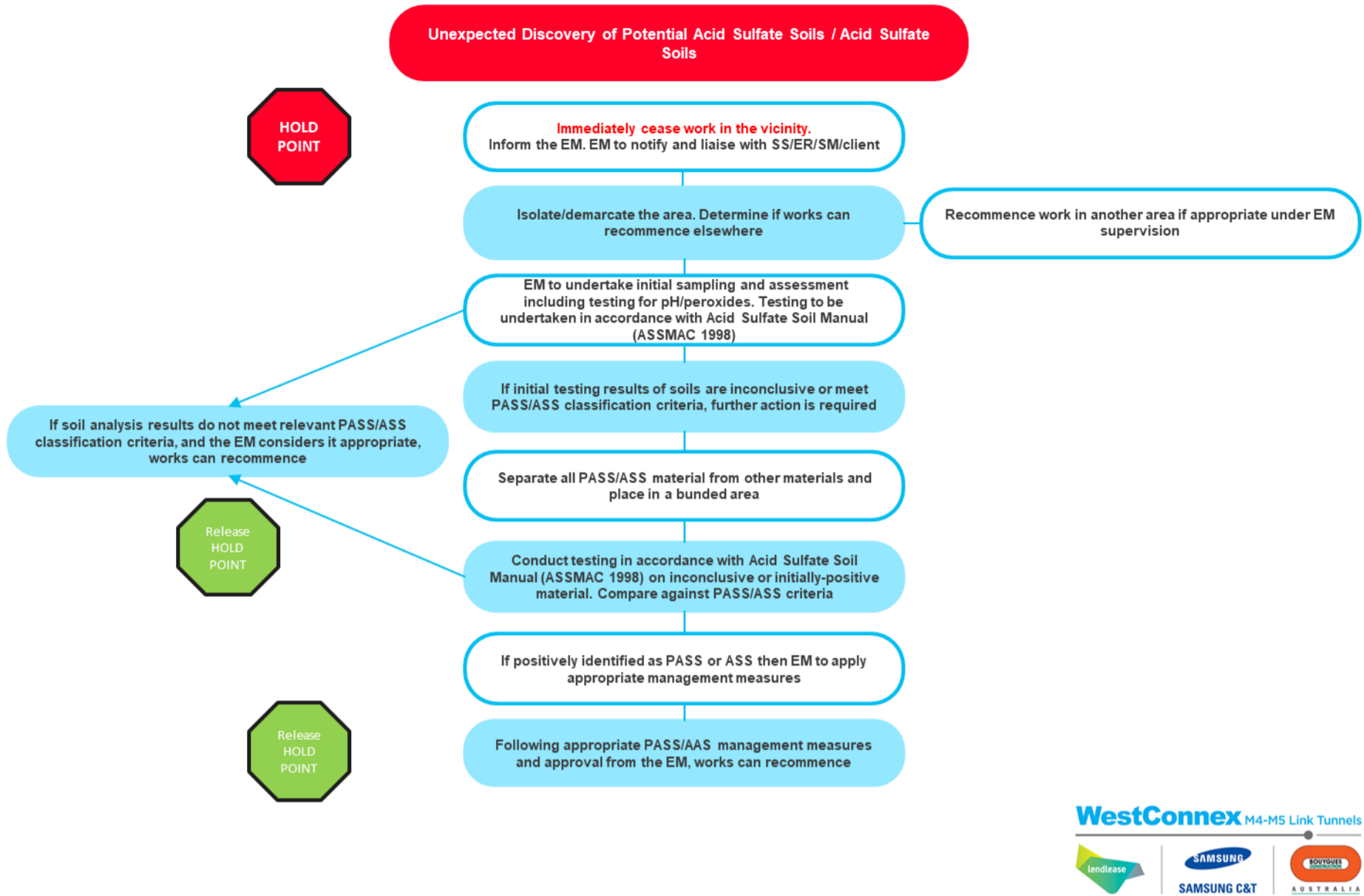


Figure 6-3 Unexpected discovery of Acid Sulfate Soils flowchart

(EM = Environmental Manager, ER = Environmental Representative, SS = Site Supervisor / Foreman, SM = Safety Manager, client = Sydney Motorway Corporation)

## 6.4 Contaminated Groundwater

Construction Water Treatment Plants (WTP) would be used to treat groundwater intercepted by tunnelling works. These WTPs would be designed to treat groundwater in accordance with CoA E186. As such this unexpected find protocol does not include the treatment and management of contaminated groundwater. Refer to the Groundwater Management Plan (GMP) and Groundwater Monitoring Program both prepared as part of the Construction Environmental Management Plan for groundwater treatment and management procedures. Should groundwater be encountered that is contaminated beyond expected parameters identified in the GMP and monitoring program, water treatment or offsite disposal will be evaluated. The following procedure will be followed:

- Groundwater will be inspected and sampled by the Environment Team or Project environmental consultant
- Evaluate the ability of the water treatment plant to treat the water to a quality suitable for disposal. Where the water treatment plant is not able to treat the contaminants present, other options for treatment or disposal will be considered including disposal to an appropriately licensed liquid waste facility.

## 6.5 Personal Protective Equipment (PPE)

Prior to any contamination investigation or management, appropriate personal protective equipment (PPE) is to be worn as per the relevant Material Safety Data Sheet(s). This may include, but not be limited to:

- Eye goggles
- Face mask
- Rubber boots
- Rubber gloves
- Appropriate work clothes (i.e. long sleeve shirt/pants and steel capped boots).

PPE will be utilised in accordance with the Project Safety Management Plan.

## 6.6 Site/Area Contamination Investigation and Remedial Action

In accordance with the relevant CoA, REMMs and guidelines, unexpected contamination will be subjected to an initial assessment when discovered. An LSBJV EM or Environmental Coordinator (EC) will assess the situation and if considered necessary, commission a suitably qualified contamination specialist to undertake a contamination investigation in the area of the find. The material will be classified in accordance with the Waste Classification Guidelines Part 1: Classifying Waste (NSW EPA 2014).

If contamination is confirmed, it will be managed in accordance with this guideline, the Roads and Maritime Guideline for the Management of Contamination (2013), Roads and Maritime Environmental Incident Classification and Reporting Procedure (2017) and guidelines endorsed under Section 105 of the *Contaminated Land Management Act 1997* (NSW) (CLM Act). The EM (in consultation with specialists and the relevant authorities if necessary) will determine the appropriate management measures to be implemented. This may include treatment or offsite disposal. If the material is to be disposed of offsite, ensure the waste facility is appropriately licensed.

If contamination posing a risk to human or ecological receptors is identified as a result of these further investigations, a Remediation Action Plan (RAP) will be prepared.

For activities within the vicinity of actual or suspected contaminated land LSBJV will submit the RAP to the Site Auditor and relevant authorities where required, at least 5 working days prior. The Nominated Authority may request additional information in respect of the submitted documents. In accordance with Roads and Maritime QA Specification G36 and relevant EPA guidelines, the RAP will include the following:

- (a) testing requirements for any contaminated material prior to its disposal off site
- (b) validation plan, which must include the area in the immediate vicinity of (both below and adjacent to) the known contamination
- (c) implications of the validation results on the waste classification for material that may be excavated in the vicinity of the known contamination.

Any changes to the RAP must be agreed to by the Roads and Maritime Representative.

Remedial actions are to be incorporated into specific Environmental Work Method Statements (EWMS) and training provided to site personnel and subcontractors through inductions and toolbox training sessions. Remedial works are to be undertaken in line with the EWMS.



## 7 Notification and Reporting

If LSBJV uncover any suspected or potential contamination exposed during construction activities the LSBJV Environmental Manager will notify Sydney Motorway Corporation (SMC) and Roads and Maritime in accordance with the requirements of Roads and Maritime QA Specification G36.

Records containing details of the unexpected finds will be maintained by LSBJV and stored appropriately.

If material is to be disposed of offsite, material tracking would be undertaken in accordance with the *Protection of the Environment Operations Act 1997* and the measures outlined in Section 5.6 of the Waste Management Sub-plan.

Notification and reporting to authorities such as the EPA will be undertaken in accordance with the Roads and Maritime Guideline for the Management of Contamination (2013), NSW EPA Guidelines on the Duty to Report Contamination (2009) and *CLM Act 1997* where relevant. In the event that suspected contamination is uncovered during delivery of the Project the following would occur:

- Reporting under the “Reportable Event” category in accordance with the Roads and Maritime Environmental Incident Classification and Reporting Procedure (September 2017)
- Where it is deemed that the contamination has been, or could have been caused, or changed by the operations of LSBJV, the EPA would be notified in accordance with Section 60 of the *CLM Act 1997*.

# Appendix B Asbestos Management Plan

# Appendix B

## Asbestos Management Plan

M4-M5 Link Mainline Tunnels

October 2018

THIS PAGE LEFT INTENTIONALLY BLANK

## Document control

### Approval and authorisation

<b>Title</b>	M4-M5 Link Mainline Tunnels Contaminated Land Management Plan
<b>Document No/Ref</b>	M4M5-LSBJ-PRW-EN-GE01-PRC-0009-01
<b>Document Path</b>	

Note:

Revision 01 Document Number has changed from M4M5-LSBJ-PRW-GEN-EV01-PLN-0025-D (previous revisions) to M4M5-LSBJ-PRW-EN-GE01-PRC-0009-01.

# Glossary / Abbreviations

Abbreviations	Expanded text
AMP	Asbestos Management Plan
Asbestos	A naturally occurring silicate mineral that is a known carcinogen. Asbestos was used for its heat and corrosion resistant properties, mainly in buildings, ships and vehicles, from the 1950s to the 1980s.
Asbestos Containing Materials (ACM)	Any material containing more than a prescribed amount, (>0.5%) or as defined by local authorities in any form of asbestos. The two groups of ACMs likely to be encountered in the workplace include non-friable asbestos and friable asbestos.
CLMP	Contaminated Land Management Plan
CLM Act	<i>Contaminated Land Management Act 1997</i>
CoA	Conditions of Approval
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority NSW
ER	Environmental Representative
Friable Asbestos	An ACM that may be crumbled, pulverised, or reduced to powder by hand pressure, or as a result of the work process becomes such that it may be crumbled, pulverised, or reduced to powder by hand pressure. Examples of friable ACM could include damaged plaster surfaces or thermal insulation. Note: This includes dust resulting from non-friable ACMs, raking or removal of plaster ceilings containing asbestos.
LSBJV	Lendlease Samsung Bouygues Joint Venture
Non-friable Asbestos	ACM that is not friable. Examples of non-friable asbestos could include flat, corrugated or compressed asbestos cement sheeting (roofing, exterior & interior wall cladding, eaves, fencing) and asbestos cement pipes such as electrical, water, drainage and flue pipes or vinyl floor tiles.
NOHSC	National Occupational Health and Safety Commission
Project, the	The M4-M5 Link Mainline Tunnels
REMM	Revised Environmental Management Measures (from the SPIR)
Roads and Maritime	Roads and Maritime Services
SEMP	Site Establishment Management Plan
SPIR	Submissions and Preferred Infrastructure Report
SSWMP	Soil and Surface Water Management Sub-plan
Suitably Qualified Person	A person who, through training, qualifications, experience or a combination of these, has acquired the knowledge and skills that are needed for them to correctly and safely perform a task.

# 1 Introduction

This Asbestos Management Plan (AMP or Plan) forms part of the Contaminated Land Management Plan (CLMP) developed for the construction of the M4-M5 Link Mainline Tunnels (the Project).

This plan details the actions to be taken and describes how the Lendlease Samsung Bouygues Joint Venture (LSBJV) will manage asbestos or asbestos containing material (ACM) encountered during construction activities.

This plan has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR) and all applicable guidance and legislation.

This procedure will be reviewed and updated in accordance with the Soil and Surface Water Management Sub-plan (SSWMP) and/or Site Establishment Management Plan (SEMP).

## 2 Purpose

The EIS identified that Asbestos Containing Material (ACM) is likely to be present within the Project footprint.

This plan defines the approach to the management of ACM to control potential environmental impacts associated with asbestos that may be discovered in the course of construction of the Project.

## 3 Induction / Training

All relevant on site personnel, including employees, contractors and sub-contractors, will be made aware of the requirements of this plan and trained in the identification of potential ACM during the Project induction and/or regular toolbox talks where relevant.

## 4 Scope

This plan is applicable to all activities conducted by personnel on the Project that have the potential to uncover/encounter asbestos or ACM. For further details regarding the general management of contaminated lands for the project, refer to the CLMP prepared as a part of the SSWMP.

This Plan will be implemented by LSBJV throughout construction.

*Note: The scope of this Plan does not include handling, monitoring and management measures to comply with Work Health and Safety legislation. The management of the discovery, handling and removal of asbestos is the responsibility of the Occupational Hygienist under the direction of the Project Safety Team. Please refer to the Work Health and Safety Plan for guidance on these measures.*

## 5 Requirements

The CoA, REMM and Roads and Maritime QA Specifications G36 relevant to this procedure are listed in Table 5-1 below. A cross reference is also included to indicate where the requirements are addressed in this Plan or other Project management documents.

**Table 5-1 Requirements relevant to the Asbestos Management Plan**

Requirement	Commitment	Timing	Document Reference
CoA			
E184	An Unexpected Contaminated Land and Asbestos Finds Procedure must be prepared and must be followed should unexpected contaminated land or asbestos be excavated or otherwise discovered during construction.	Construction	CLMP Unexpected Contaminated Lands and Asbestos Finds Procedure Section 6.2.1
E185	The Unexpected Contaminated Land and Asbestos Finds Procedure must be implemented throughout construction.	Construction	CLMP Unexpected Contaminated Lands and Asbestos Finds Procedure Section 6.2.1
REMM			
CM02	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan (or similar) prepared in accordance with relevant legislation, regulations and codes of practice) as described in Chapter 23 (Resource use and waste minimisation) of the EIS.	Construction	This Plan Work Health and Safety Plan SSWMP CLMP Unexpected Contaminated Lands and Asbestos Finds Procedure Section 5.1
RW13	An asbestos survey will be undertaken of buildings to be demolished as part of the project in accordance with an Asbestos Management Plan as part of the Work Health and Safety Plan. The survey will be conducted by a suitably qualified person.	Construction	SSWMP CLMP Work Health and Safety Plan Section 6.1.1 Asbestos Survey



Requirement	Commitment	Timing	Document Reference
RW14	Asbestos handling and management will be undertaken in accordance with an Asbestos Management Plan (or similar) prepared in accordance with relevant legislation, regulations and codes of practice as described in Chapter 23 (Resource use and waste minimisation) of the EIS. Adjacent communities will be provided with advance notification about potential hazards.	Construction	This Plan Work Health and Safety Plan SSWMP CLMP Unexpected Contaminated Lands and Asbestos Finds Procedure CCS Section 5.1 Section 9

## 5.1 Legislation, Regulations and Codes of Practice

As directed by RW14, the following legislation, regulations and codes of practice are applicable to the excavation, handling, storage, movement and disposal of ACM as listed within the EIS:

- Work Health and Safety Act 2011 (NSW)
- Code of Practice for the Safe Removal of Asbestos 2nd Edition (National Occupational Health and Safety Commission (NOHSC) 2005a)
- Code of Practice for the Management and Control of Asbestos in Workplaces (NOHSC 2005b)
- Protection of the Environment Operations (Waste) Regulation 2014 (NSW) – clause 42 special requirements relating to asbestos waste
- National Environment Protection (Assessment of Site Contamination) Measure 1999
- AS2601:2001 Demolition of Structures.

## 6 Asbestos Management

### 6.1 Assessment of the work area

The contamination assessment process for the project and provision of recommendations for subsequent remediation and/or management will be completed with reference to relevant State and National guidance documents, endorsed under section 105 of the *Contaminated Lands Management 1997 Act (NSW)* (CLM Act).

Prior to commencing work that requires ground disturbance, a review of Section 4 of the CLMP for areas of known asbestos contamination will occur as part of the Early Works and Ground Disturbance Permit process. These areas must be managed in accordance with the procedures described in CLMP.

### **6.1.1 Asbestos Survey**

In accordance with REMM CM03, a hazardous materials assessment will be carried out prior to and during the demolition of buildings, by an appropriately qualified person, such as an Occupational Hygienist. This assessment will include an assessment of potential asbestos or ACM in accordance with the requirements of REMM RW13. The survey will be undertaken by a suitably qualified person.

Additional requirements and responsibilities in relation to this survey are documented in the Section 8 of the CLMP, and in Section 3.9.1 and Section 3.9.2 of the CEMP.

## **6.2 Management Process**

A Waste Management Register shall be maintained which identifies all waste removed from the site. Further information is contained in Section 8 and Appendix A of the Waste Management Sub-plan.

Asbestos Register shall be maintained as per the protocols detailed in the Project Work Health and Safety Plan.

### **6.2.1 Unexpected Asbestos or ACM Finds**

Asbestos or ACM which has not been previously identified and is uncovered during construction of the Project will be managed in accordance with this plan and the protocols outlined in the Unexpected Contaminated Lands and Asbestos Finds Procedure.

## **6.3 Removal of asbestos or ACM waste**

Removal of asbestos or ACM would be undertaken by suitably qualified persons in accordance with NSW Government Health and Safety protocols and detailed outlined in Section 5 of the Construction Waste Management Sub-plan and the Unexpected Contaminated Lands and Asbestos Finds Procedure.

Transport and disposal undertaken in accordance with the Protection of the Environment Operations (Waste) Regulation 2005 (POEO Waste Regulation) and the Environmental Protection Authority (EPA) Waste Classification Guidelines (2014). All contractors transporting asbestos 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. Tracking would be undertaken in accordance with the *Protection of the Environment Operations Act 1997*.

## **7 Incident management and emergency procedures**

Emergency procedures on site will cover actions to be taken when asbestos is uncovered, catastrophic events occur or air monitoring indicates high levels of airborne asbestos fibre. The emergency procedures contained in the CEMP will be implemented.

Any incident or near miss resulting in an exposure or potential exposure must be reported immediately and the Project Emergency Response Plan followed.

## **8 Responsibilities**

The management of the discovery, handling and removal of asbestos is the responsibility of the specialist consultant with overview by the Safety Team.

The Environmental Team are responsible for the tracking and appropriate disposal of asbestos.

## **9 Notification and Reporting**

The protocol for reporting an unexpected asbestos or ACM find is detailed in Section 7 Unexpected Contaminated Lands and Asbestos Finds Procedure.

Reporting requirements and responsibilities for management of asbestos contamination are documented in Section 3.9.5 of the CEMP and Section 6 of the CLMP.

### **9.1 Community**

In accordance with REMM RW14, if applicable, adjacent communities will be provided with advanced notification regarding potential hazards, such as the uncontrolled migration of contamination offsite. Notification shall occur in accordance with the Community Communication Strategy.

# Appendix C – Surface Water Quality Monitoring Program

# Appendix C

## Surface Water Quality Monitoring Program

M4-M5 Link Mainline Tunnels

April 2020

**WestConnex** M4-M5 Link Tunnels



THIS PAGE LEFT INTENTIONALLY BLANK

# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Context	1
1.2	Scope of the surface water monitoring program	1
<b>2</b>	<b>Purpose and objectives</b>	<b>2</b>
2.1	Purpose	2
2.2	Objectives	2
2.3	Consultation	2
<b>3</b>	<b>Surface water monitoring</b>	<b>3</b>
3.1	Baseline monitoring	3
3.2	Construction monitoring	8
<b>4</b>	<b>Monitoring methodology / Sampling protocol</b>	<b>13</b>
4.1	Sample collection	13
4.2	Field measurements	13
4.3	Recording of field results	13
4.4	Decontamination	13
4.5	Quality Assurance and documentation	13
<b>5</b>	<b>Compliance management</b>	<b>15</b>
5.1	Roles, responsibility, and training	15
5.2	Monitoring and inspection	15
5.3	Data analysis and management response	15
5.4	Auditing	16
5.5	Reporting	16
<b>6</b>	<b>Review and improvement</b>	<b>17</b>
6.1	Continuous improvement	17
6.2	SWQMP update and amendment	17
<b>7</b>	<b>References</b>	<b>18</b>

## Tables

Table 3-1	Baseline surface water monitoring locations	3
Table 3-2	Baseline surface water quality sampling program	6
Table 3-3	Baseline water quality conditions in the Project area	7
Table 3-4	Construction phase surface water monitoring program	9
Table 3-5	Surface water quality monitoring parameters	11
Table 3-6	Water quality performance criteria (applicable to downstream (impact) monitoring locations)	12
Table 5-1	Reporting requirements	16

## Figures

Figure 3.1 Baseline surface water monitoring locations.....	5
Figure 3.2 Construction phase surface water monitoring network .....	10

## Appendices

Appendix A – Baseline surface water monitoring results

Appendix B – Site-specific trigger value review



# Document control

## Approval and authorisation

<b>Title</b>	M4-M5 Link Mainline Tunnels Surface Water Quality Monitoring Program
<b>Document No/Ref</b>	M4M5-LSBJ-PRW-EN-MP01-PLN-0013-07
<b>Document Path</b>	

## Document status

Revision	Date	Description
A	6 July 2018	First draft for LSBJV review
B	13 July 2018	Second draft for LSBJV review
C	17 July 2018	Draft for Agency review
D	3 August 2018	Draft for SMC, RMS and ER review
E	5 September 2018	Draft following SMC, RMS and ER comments
01	17 September 2018	For DPE Review
02	23 October 2018	For DPE Approval
03	1 November 2018	For DPE Approval
04	1 May 2019	Minor updated – For ER approval
05	4 September 2019	Minor update – For WestConnex Transurban review
06	25 September 2019	Minor update – For ER approval
07	17 April 2020	Update following annual SSTV review – For ER approval

# 1 Introduction

## 1.1 Context

This Surface Water Quality Monitoring Program (SWQMP or Program) has been prepared for the construction stage of the M4-M5 Link Mainline Tunnels (the Project). The Program forms Appendix B of the Soil and Surface Water Management Sub-plan (SSWMP).

The SWQMP addresses the requirements of the Minister's Conditions of Approval (CoA), the WestConnex M4-M5 Link Environmental Impact Statement (EIS), the revised environmental management measures (REMM) listed in the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (SPIR) and all applicable guidance and legislation.

## 1.2 Scope of the surface water monitoring program

The scope of this SWQMP is to describe how Lendlease Samsung Bouygues Joint Venture (LSBJV) propose to monitor potential impacts to surface water during construction of the Project. Operational monitoring and operation measures do not fall within the scope of the construction phase and therefore are not included within the processes contained within the SWQMP.

## 2 Purpose and objectives

### 2.1 Purpose

The purpose of the SWQMP is to describe how LSBJV propose to monitor surface water quality during construction of the Project. LSBJV will monitor the extent and nature of potential impacts to surface water quality during construction of the Project.

The SWQMP 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 a comprehensive management regime can be implemented to address those impacts and manage local surface water quality.

This Program provides details of the surface water monitoring network, frequency of monitoring, and test parameters. This SWQMP supplements the SSWMP, which, itself, is an appendix of the Construction Environmental Management Plan (CEMP).

This SWQMP is based on baseline studies developed for the project EIS (AECOM 2017).

### 2.2 Objectives

The key objective of the SWQMP is to ensure all CoA, REMM, and licence/permit requirements relevant to surface water monitoring are described, scheduled, and assigned responsibility as outlined in:

- The EIS prepared for WestConnex M4-M5 Link
- The SPIR prepared for WestConnex M4-M5 Link
- Conditions of Approval granted to the project on 17 April 2018
- Roads and Maritime specifications G36, G38 and G40
- The Project's Environment Protection Licence (EPL)
- All relevant legislation and other requirements described in Section 3 of the SSWMP.

### 2.3 Consultation

This program was provided to DoI Water, Sydney Water, City of Sydney Council, and Inner West Council in accordance with CoA C9(a). Refer to Section 2 of the CEMP for consultation requirements relating to the CEMP and all sub-plans.

Ongoing consultation with relevant councils and other stakeholders, including any unique local receivers, may be undertaken for particular issues pertaining to the Project's impact on surface water quality. Community feedback and complaints relating to surface water quality will be dealt with in accordance with the Community Communication Strategy and Complaints Management System. This SWQMP was provided to DoI Water, Sydney Water, City of Sydney Council, and Inner West Council for review and comment.

## 3 Surface water monitoring

### 3.1 Baseline monitoring

#### 3.1.1 Overview

A baseline surface water monitoring program was implemented in July 2016 to inform the project EIS (AECOM 2017). The program was based on a desktop assessment involving a review of the existing surface water environment across the project area, including:

- Information obtained from geotechnical investigations and assessments carried out as part of the project
- Information and water quality monitoring data from the M4 East EIS and the New M5 EIS relevant to surface water within the project area
- Data relevant to the existing surface water conditions in the study area from sources including the Inner West Council and the City of Sydney Council, WestConnex Transurban, and NSW Government agencies including Sydney Water and Roads and Maritime Services (Roads and Maritime).

The baseline surface water monitoring program was implemented to:

- Evaluate the existing surface water quality at key locations in the project area
- Identify potential pathways of pollutants to surface water receivers
- Monitor and assess the surface water quality in the project area to form a baseline of environmental conditions, to measure the environmental performance of the project during the construction and operation of the project.

#### 3.1.2 Monitoring network

Baseline water quality monitoring locations were located upstream and downstream of the Project alignment and ancillary facilities as shown in Figure 3.1 and listed in Table 3-1.

Monitoring locations were chosen to provide general characterisation of the waterways, and include water quality monitoring locations established for the M4 East and the New M5 projects.

**Table 3-1 Baseline surface water monitoring locations**

Sample ID <sup>1</sup>	Sample location	Ancillary Facility	Waterway
SW03	Smith Park pedestrian bridge, Neilson Lane, Annandale	Pymont Bridge Road	Johnstons Creek (downstream, tidal)
SW04	Adjacent to playground, Chester Street, Annandale (non-tidal, i.e. not influenced by the ocean tides)	Pymont Bridge Road	Johnstons Creek (downstream)
SW05	Hawthorne Canal Reserve, Canal Road, Leichhardt	Darley Road (no longer part of the Project)	Hawthorne Canal (upstream)
SW06	Canal Road (between City West Link and Lilyfield Road) Lilyfield	Darley Road (no longer part of the Project)	Hawthorne Canal (downstream)

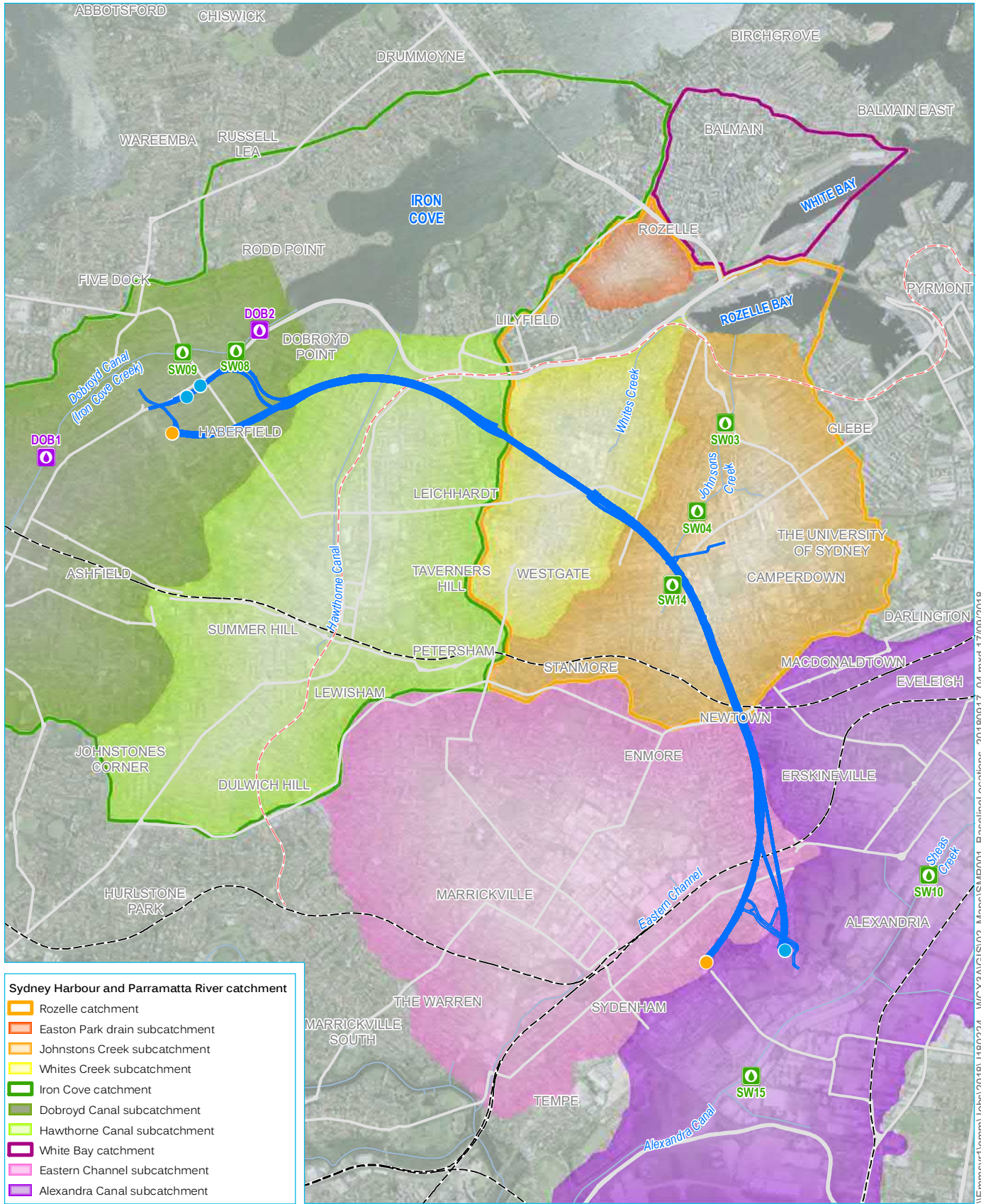
Sample ID <sup>1</sup>	Sample location	Ancillary Facility	Waterway
SW08	Pedestrian bridge between Timbrell Park and Reg Coady Reserve, Dobroyd Parade, Haberfield	Haberfield Sites	Dobroyd Canal (Iron Cove Creek) (downstream)
SW09	West of Ramsay Road bridge at Dobroyd Parade, Haberfield	Haberfield Sites	Dobroyd Canal (Iron Cove Creek) (upstream)
SW10	South side of Huntley Street, Alexandria	Campbell Road	Sheas Creek (upstream)
SW14	Cruikshank Street, Stanmore	Pymont Bridge Road	Johnstons Creek (upstream)
SW15 <sup>2</sup>	Euston Road, Alexandria	Campbell Road	Sheas Creek (Alexandra Canal) (downstream)
DOB1 <sup>3</sup>	Gregory Avenue, Croydon	Haberfield Sites	Dobroyd Canal (upstream)
DOB2 <sup>3</sup>	Henley Marine Road, Five Dock	Haberfield Sites	Dobroyd Canal (Iron Cove Creek) (downstream, tidal)
DSW <sup>3</sup>	Hawthorne Parade, Haberfield	Darley Road (no longer part of the Project)	Hawthorne Canal (upstream)

<sup>1</sup> Sample location ID's retained from EIS for consistency

<sup>2</sup> SW15 is monitoring location SW1 from the New M5 project monitoring network

<sup>3</sup> M4 East surface water monitoring locations





Baseline surface water monitoring locations

Westconnex M4-M5 Link Tunnels  
Surface water monitoring program

Figure 3-1



\\Emmsvr1hemm\Jobs\2018\180224 - WCX3A\GIS\02\_Maps\SWIP001\_BaselineLocations\_20180917\_04.mxd 17/09/2018

### 3.1.3 Surface water quality

The baseline surface water quality sampling program (Table 3-2) included the following analytes:

- Physico-chemical (field) parameters (pH, temperature, electrical conductivity (EC), oxidation / reduction potential, dissolved oxygen, and turbidity)
- Benzene, toluene, ethylbenzene, xylene, and naphthalene (BTEXN)
- Dissolved metals (arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel and zinc)
- Nutrients (nitrite as N, nitrate as N, reactive phosphorus and ammonia)
- Total recoverable hydrocarbons (TRHs)
- Total petroleum hydrocarbons (TPHs).

Summary tables of the baseline water quality data are included in Appendix A. Interpretation of the baseline surface water monitoring data is included in the EIS (AECOM 2017) and summarised in Table 3-3. The results are compared against the ANZECC (2000a) water quality guidelines. It should be noted that these guidelines are not to be used as a mandatory standard, rather they provide a guideline for the environmental values of water resources.

**Table 3-2 Baseline surface water quality sampling program**

Sample ID	Number of samples <sup>1</sup>	Start of baseline monitoring	End of baseline monitoring	Minimum frequency
SW03	30	July 2016	June 2018	monthly
SW04	30	July 2016	June 2018	monthly
SW08	30	July 2016	June 2018	monthly
SW09	31	July 2016	June 2018	monthly
SW10	29	July 2016	May 2018	monthly
SW14	23	December 2016	June 2018	monthly
SW15 <sup>2</sup>	11	August 2015	November 2018	monthly
DOB1 <sup>3</sup>	37	June 2015	May 2016	monthly
DOB2 <sup>3</sup>	37	June 2015	May 2016	monthly

<sup>1</sup> Includes wet weather sampling events

<sup>2</sup> SW15 is monitoring location SW1 from the New M5 project monitoring network

<sup>3</sup> M4 East surface water monitoring locations

**Table 3-3 Baseline water quality conditions in the Project area**

Waterway	Baseline data obtained	Description of water quality
Dobroyd Canal (Iron Cove Creek)	Samples collected at SW08, SW09, DOB1, and DOB2	<p>Elevated concentrations of heavy metals (copper, chromium, lead, nickel and zinc) and nutrients (phosphorus, nitrogen and nitrate) were recorded in tidal and non-tidal zones.</p> <p>The pH was outside guideline levels and the turbidity exceeds guideline<sup>1</sup> levels on some occasions.</p> <p>High electrical conductivity (EC) indicates brackish, tidally influenced conditions</p> <p>Total recoverable hydrocarbons were detected</p>
Johnstons Creek	Samples collected at SW03, SW04 and SW14	<p>Elevated concentrations of heavy metals (cadmium, copper, chromium, lead, nickel and zinc), nitrogen, phosphorous and nitrate</p> <p>On some occasions, pH was outside guideline<sup>1</sup> levels and turbidity exceeds guideline<sup>1</sup> levels</p> <p>EC indicates brackish, tidally influenced conditions</p> <p>Total recoverable hydrocarbons have been detected at SW04</p>
Alexandra Canal	Samples collected at SW10 and SW15	<p>Elevated pH, concentrations of metals (copper, lead, chromium, nickel, manganese and zinc) and nutrients (nitrogen, nitrate and phosphorus) and turbidity</p> <p>The pH was also outside guideline<sup>1</sup> levels on occasions</p>

<sup>1</sup> ANZECC (2000a)



## **3.2 Construction monitoring**

### **3.2.1 Overview**

The mobilisation of sediments and pollutants during the minor above ground surface construction works are identified as a potential impact on surface water within the highly urbanised and disturbed catchments and waterways. A soil conservation consultant will be engaged to provide design input.

Other potential impacts during the construction stage include increased turbidity from soil disturbance, increased pH from the use of concrete products, discharge of poorly treated water, erosion and sediment migration from areas of existing contamination.

Potential impacts will be assessed during the construction stage by routinely monitoring physico-chemical parameters across the monitoring network listed in Table 3-5 and shown in Figure 3.2. It may be necessary to identify alternative monitoring locations if some of the existing monitoring locations are inaccessible during tunnel construction. In addition to this monitoring, monitoring undertaken as part of the WTP operation is detailed in the GMP (Section 6.1).

Variation in physico-chemical parameters provide an indication of a change to overall water quality triggering the assigned performance criteria and further impact assessment.

Groundwater inflows intercepted during tunnelling will be discharged via the Project WTP. Discharged water quality will be monitored as detailed in the Project GMP (in Section 6.1).

### **3.2.2 Rainfall monitoring**

To provide data to assess water quality trends, rainfall will be monitored during the construction phase via a rain gauge (at least one gauge located in each catchment), which will be checked daily at approximately the same time each day or automated using an electronic weather station.

### **3.2.3 Surface water quality monitoring**

#### **Monitoring locations**

Surface water quality monitoring will be carried out during construction at six sites, listed in Table 3-4 and shown in Figure 3.2. The monitoring program will commence prior to any ground disturbance in accordance with REMM SW02. The selection of the monitoring locations has incorporated upstream (control) sites and downstream (impact) sites relevant to the Project alignment and ancillary facilities (including WTP). This type of monitoring allows for the assessment trends in water quality, including natural variations, and will allow sufficient data to enable assessment of any potential impacts measured during construction. Some of the surface water quality monitoring locations were also monitored during the baseline monitoring period that informed the EIS (as discussed in Section 3.1).

Monitoring of discharge from the WTPs is discussed in the GMP (Section 6.1).

**Table 3-4 Construction phase surface water monitoring program**

Sample ID <sup>1</sup>	Sample location	Ancillary Facility	Receiving environment	Analysis suite	Sampling frequency
SW04	Johnstons Creek (downstream)	Pyrmont Bridge Road	Sydney Harbour/ Parramatta River	Physico-chemical parameters <sup>2</sup>	Monthly/Wet weather <sup>3</sup>
SW14	Johnstons Creek (upstream)	Pyrmont Bridge Road	Sydney Harbour/ Parramatta River	Physico-chemical parameters <sup>2</sup>	Monthly/Wet weather <sup>3</sup>
SW09	Dobroyd Canal (Iron Cove Creek) (downstream)	Haberfield Sites	Sydney Harbour/ Parramatta River	Physico-chemical parameters <sup>2</sup>	Monthly/Wet weather <sup>3</sup>
LSB02	Dobroyd Canal (Iron Cove Creek) (upstream)	Haberfield Sites	Sydney Harbour/ Parramatta River	Physico-chemical parameters <sup>2</sup>	Monthly/Wet weather <sup>3</sup>
SW10	Sheas Creek (Alexandra Canal) (upstream)	Campbell Road	Cooks River catchment	Physico-chemical parameters <sup>2</sup>	Monthly/Wet weather <sup>3</sup>
LSB01	Alexandra Canal (downstream)	Campbell Road	Cooks River catchment	Physico-chemical parameters <sup>2</sup>	Monthly/Wet weather <sup>3</sup>

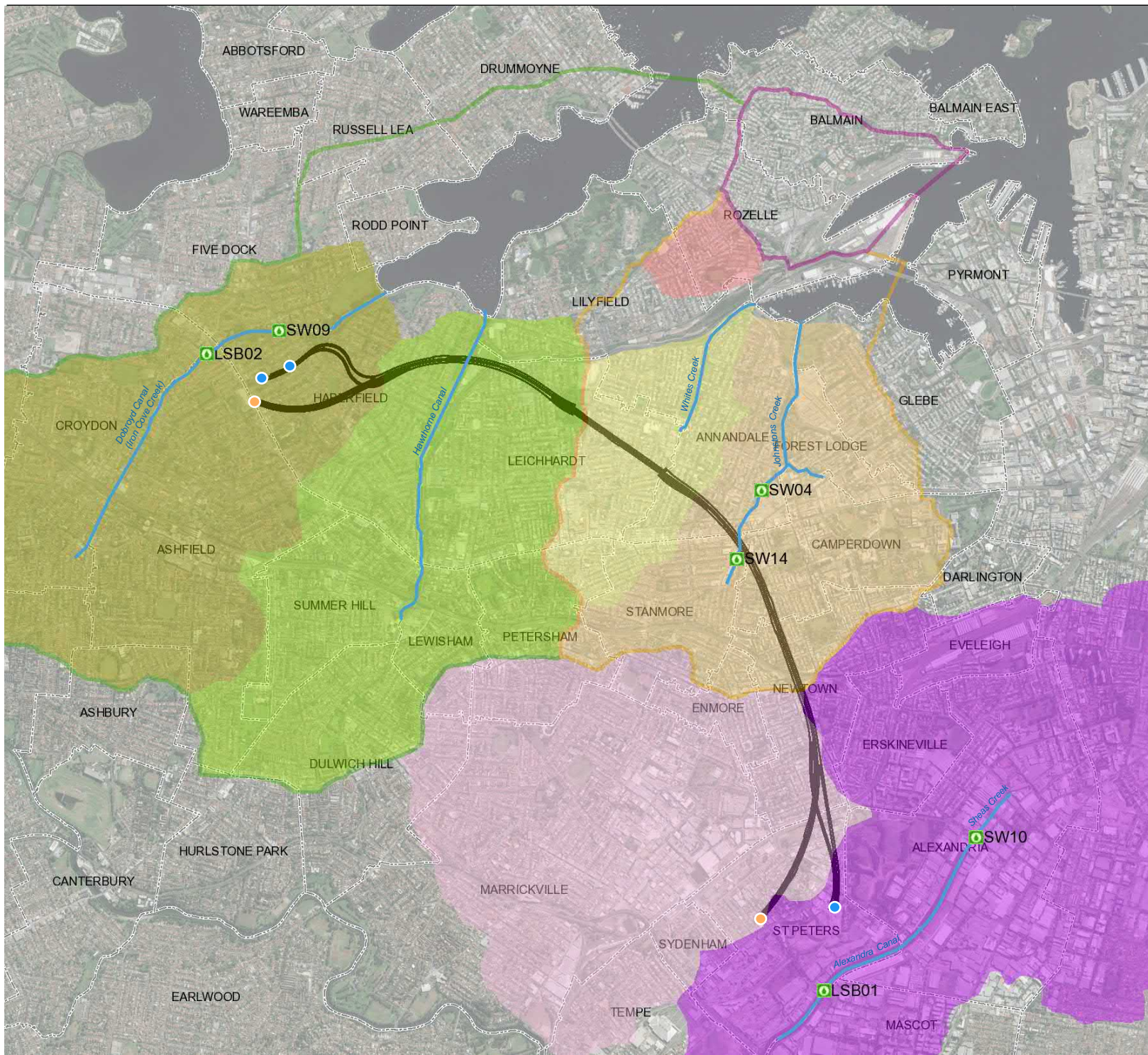
<sup>1</sup> Sample location ID's retained from EIS for consistency

<sup>2</sup> Physico-chemical (field) parameter analysis as detailed in Table 3-5

<sup>3</sup> Quarterly wet weather monitoring (at least once every 3 months following 25 mm of continuous rainfall – see Sampling frequency)



**Figure 3.2: Construction Surface Water Monitoring**



**Key**

**Surface water monitoring points**

M4-M5 Link Tunnels

**Sydney Harbour and Parramatta River catchment**

- Rozelle Catchment
- Iron Cove Catchment
- White Bay Catchment
- Easton Park Drain Subcatchment
- Johnstons Creek Subcatchment
- Whites Creek Subcatchment
- Dobroyd Canal Subcatchment
- Hawthorne Canal Subcatchment
- Eastern Channel Subcatchment
- Alexandria Canal Subcatchment

**Existing features**

Watercourse / drainage line

**Project Features**

- Proposed M4-M5 Link Mainline Tunnel alignment
- Tunnel portal
- Tunnel connection





## Sampling frequency

Water quality sampling will be undertaken at a monthly frequency during the construction phase.

Wet weather monitoring will be conducted at a frequency of at least once a quarter (once every 3 months) when a continuous rainfall event of more than 25 mm is received in the local catchment during a 24 hour period as recorded at the Project's rain gauge(s). For safety reasons sampling will not be undertaken during peak storm-flows. Sampling will be completed when flows are reasonably constant and safe.

The monitoring program will continue for the duration of construction (or as otherwise required by any Project CoA).

## Surface water quality parameters

Table 3-5 details the analytes that will be monitored during the construction phase surface water monitoring, at the locations listed in Table 3-4 and shown in Figure 3.2. Discharge criteria for the construction phase WTP are detailed in Section 6.1 of the GMP.

**Table 3-5 Surface water quality monitoring parameters**

Category	Parameters <sup>1</sup>
Physico-chemical parameters (field)	pH Dissolved oxygen (DO) Oxidation/reduction potential (ORP) Turbidity Temperature

<sup>1</sup> Measured in the field using a fully calibrated multi-probe water quality meter(s)

Surface water quality analysis results will be assessed and compared to baseline conditions, rainfall records, upstream monitoring results, and the performance criteria described below.

## Performance criteria

Baseline monitoring shows that some surface water quality parameters exceed the default ANZECC (2000a) water quality trigger values for slightly to moderately disturbed ecosystems. This is not unexpected given the highly urbanised and disturbed Project area and receiving waterways.

Location specific performance criteria (site specific trigger values (SSTV)) have been developed for downstream (impact) surface water monitoring locations (see Table 3-6).

SSTV were initially developed for appropriate parameters using baseline monitoring data and ANZECC (2000a) guideline criteria for slightly to moderately disturbed ecosystems (generally protecting 90% of species) (Table 3-6).

- The 80<sup>th</sup> percentile of baseline data is used as the SSTV for those parameters/locations that exceeded the relevant ANZECC (2000a) guideline criteria. It is noted that exceedances of the ANZECC (2000a) guideline criteria are not unexpected due to the highly disturbed nature of the urban catchment area.
- The relevant ANZECC (2000a) guideline criteria is used as the SSTV for parameters where the 80<sup>th</sup> percentile of baseline data was below the relevant ANZECC (2000a) guideline criteria.

Following 12 months of construction monitoring, SSTV were reviewed and updated to ensure they remained appropriate. This review is presented in Appendix B.

Monitoring results from the downstream (impact) locations that exceed SSTV (see Table 3-6) will be used for comparison with the monitoring results from upstream (control) locations to assess if the elevated parameters are likely attributable from Project activities or from the wider upstream catchment. As such, no performance criteria are developed for upstream monitoring locations.

**Table 3-6 Water quality performance criteria (applicable to downstream (impact) monitoring locations)**

Parameter	Units	ANZECC guidelines <sup>1</sup>	Site Specific Trigger Value		
			SW04	SW09	LSB01
pH	pH	7.0 - 8.5 <sup>2</sup>	7.0 - 8.5	7.0 - 8.5	7.0 - 8.5
Turbidity	NTU	0.5 - 10 <sup>2,3</sup>	107 <sup>4</sup>	42 <sup>4</sup>	24 <sup>4</sup>

<sup>1</sup> ANZECC (2000a) – slightly to moderately disturbed aquatic ecosystems

<sup>2</sup> Guideline value for SE Australian estuaries

<sup>3</sup> ANZECC (2000a) notes that turbidity is not a very useful indicator in estuarine and marine waters

<sup>4</sup> 80<sup>th</sup> percentile of baseline data

The SSTV's provide an easily identifiable indication of a potential change in water quality. A management response would be initiated following any exceedance of the SSTV.

Following an SSTV exceedance, a review will be initiated immediately to determine the significance of the exceedance(s) and possible causes. The review will assess the upstream (control) 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.

If the exceedance is determined to be attributable to Project works and has the potential to cause harm to the environment, the event will be treated as an environmental incident and managed in accordance with the requirements of Section 3.8 and Section 3.10 the CEMP. Corrective and preventative actions will be identified where required and implemented as part of that process. Corrective and preventative actions identified and implemented during the incident management process will be verified for effectiveness and to prevent recurrence of exceedances. Incident notification will be undertaken in accordance with Section 3.8 of the CEMP.

## 4 Monitoring methodology / Sampling protocol

### 4.1 Sample collection

Grab samples will be collected manually from the sampling locations identified in Table 3-4 . The volume of sample collected will be sufficient for the required physico-chemical (field) parameter analysis using a multi-probe water quality meter(s).

### 4.2 Field measurements

Field physico-chemical parameters including pH, DO, ORP, temperature, and turbidity will be measured at each sampling location using a fully calibrated multi-probe water quality meter(s). Other observations including odour and colour 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, location, and sampler details.

### 4.4 Decontamination

Sampling equipment will be cleaned (decontaminated) between each sample. Where a sample site shows evidence of contamination (i.e. there is an algal bloom, or the site smells strongly of hydrocarbons, sewage or something else) 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 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 finally
- Allow to dry.

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

### 4.5 Quality Assurance and documentation

Quality assurance and control protocols during sampling and recording of physico-chemical (field) parameters will be undertaken monthly (each sampling event) in accordance with ANZECC/ARMCANZ (2000b) to ensure the integrity of the dataset.

As part of sampling, quality assurance and control samples during sampling will be undertaken to ensure the integrity of the dataset. These are to include:

- Rinsate blanks (one per sampling event only)
- Blind duplicates (at a rate not less than 20% of total samples)
- Split duplicates (at a rate not less than 20% of total samples).

Samples are to be transported to a NATA-accredited laboratory under documented chain-of-custody protocols.

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 LSBJV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in the SSWMP.

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 3.5 of the CEMP.

### 5.2 Monitoring and inspection

Sections 3.2 and 4 of this SWQMP provide detailed inspection criteria including:

- Surface water monitoring locations
- Parameters/analytes to be monitored
- Type of monitoring
- Frequency of monitoring
- Monitoring methodology.

LSBJV's Environmental Management System internal documents relevant to this SWQMP are:

- LLE701A - Environmental Work Method Statement (internal document)
- LLE702: Figure 1 - Potential Critical Incident Notification (internal document)
- LLE702A - Environmental Incident Report (internal document)
- LLE702B - Environmental Incident Investigation (internal document)
- LLE703A - Environmental Inspection Checklist (internal document)
- LLE703B - Environmental Observation Report (internal document)
- LLE703C - Environmental Improvement Notice (internal document)
- LLE705A - Sediment Basin Discharge Permit (internal document)
- LLE705B - Dewatering Permit (internal document)

Additional requirements and responsibilities in relation to inspections are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

### 5.3 Data analysis and management response

Results from the construction monitoring program will be compared with the SSTVs (for downstream sites) and with previous upstream/downstream results.

Monthly monitoring results for surface water quality (downstream impact sites) will be compared against SSTVs (Table 3-6), and reported in the construction compliance monitoring reports (Section 5.5). If a SSTV is exceeded (see Section 3.2.3), a review will be initiated to determine the significance of the exceedance(s) and possible causes. The review will assess the upstream (control) 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.



If the exceedance is determined to be attributable to Project works and has the potential to cause environmental harm, the event will be treated as an environmental incident and managed in accordance with the requirements 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

During construction, surface water quality data will be collected, tabulated and assessed against baseline conditions and performance criteria.

Reporting requirements associated with the Program for the construction phase of the Project are presented in Table 5-1.

**Table 5-1 Reporting requirements**

Schedule (during construction)	Requirements	Recipient (relevant authority)
Water Monitoring Reports (every six months)	Data summary reports presenting tabulated surface water monitoring data collected during the reporting period. Surface water quality results will be presented and performance criteria exceedances will be highlighted. Applicable management responses will be documented.	EPA, DPIE, DoI Water, Sydney Water

## 6 Review and improvement

### 6.1 Continuous 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. SSTV were reviewed for appropriateness following 12 months of construction monitoring. Findings of this first review and recommended SSTV changes are presented in Appendix B. Alterations to SSTV, monitoring locations, analytical suites, or frequencies will continue to be reviewed following another 12 months of construction monitoring. Changes to this monitoring program will be reported in the Water Monitoring Reports (Section 5.5).

Continuous improvement of this Program will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets (detailed in Section 2.2), and the Project performance outcomes of the EIS for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

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

### 6.2 SWQMP update and amendment

The processes described in Section 3.9 to Section 3.13 of the CEMP may result in the need to update or revise this Program.

Revisions of this Program will be in accordance with the process outlined in Section 1.5 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 – refer to Section 3.11.2 of the CEMP.

## 7 References

- Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998. Acid Sulfate Soil Manual
- AECOM, 2017. WestConnex M4-M5 EIS Technical Working Paper: Surface Water and Flooding, August 2017.
- 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.
- 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 – Baseline surface water monitoring results

Parameter	Units	ANZECC 2000 guideline							Baseline data SW04				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
<b>Physiochemical parameters</b>													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	28	7.79	5.78	9.25	8.30
Temperature	°C	-	-	-	-	-	-	-	28	19	14	25	21
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	28	743	71	6980	722
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	28	295	122	388	350
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	28	8.5	6.1	10.3	9.2
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	24	57	4	254	107
<b>Chemical analytes</b>													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	3	0.005	0.005	0.005	0.005
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	1	14.1	14.1	14.1	14.1
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	1	0.005	0.005	0.005	0.005
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	1	0.005	0.005	0.005	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	14	0.0005	0.0005	0.0005	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	2	0.0005	0.0005	0.0005	0.0005
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	-	-	-	-	-
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	4	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	-	-	-	-	-
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	-	-	-	-	-
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	-	-	-	-	-
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	25	0.000005	0.000005	0.000005	0.000005
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	1	0.00025	0.00025	0.00025	0.00025
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	-	-	-	-	-

Parameter	Units	ANZECC 2000 guideline							Baseline data SW04					
		South-east Australia default triggers				Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection						
Benzene	µg/L	-	-	10	600	950	500	700	30	0.5	0.5	0.5	0.5	
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1	
Toluene	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1	
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1	
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	30	1	1	1	1	
Xylene Total	µg/L	-	-	-	-	-	-	-	30	1	1	1	1	
Naphthalene	µg/L	-	-	-	2.5	16	50	70	30	2.5	2.5	2.5	2.5	
C6-C10	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01	
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01	
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05	
C10-C16	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05	
C16-C34	mg/L	-	-	-	-	-	-	-	24	0.05	0.05	0.05	0.05	
C34-C40	mg/L	-	-	-	-	-	-	-	26	0.05	0.05	0.05	0.05	
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	24	0.05	0.05	0.05	0.05	
C6 - C9	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01	
C10 - C14	mg/L	-	-	-	-	-	-	-	28	0.025	0.025	0.025	0.025	
C15 - C28	mg/L	-	-	-	-	-	-	-	24	0.05	0.05	0.05	0.05	
C29-C36	mg/L	-	-	-	-	-	-	-	24	0.025	0.025	0.025	0.025	
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	24	0.025	0.025	0.025	0.025	

Parameter	Units	ANZECC 2000 guideline							Baseline data SW08				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
<b>Physiochemical parameters</b>													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	27	7.85	5.67	8.81	8.17
Temperature	°C	-	-	-	-	-	-	-	27	21	14	30	25
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	27	33160	83	58650	48183
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	27	343	164	587	401
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	27	8.27	2.73	19.76	11.64
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	24	22.39	1.00	95.70	42.02
<b>Chemical analytes</b>													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Kjeldahl Nitrogen Total	mg/L	-	-	-	-	-	-	-	6	0.25	0.25	0.25	0.25
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	6	0.005	0.005	0.005	0.005
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	6	2.0	0.3	10.7	0.3
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	5	0.005	0.005	0.005	0.005
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	8	0.025	0.025	0.025	0.025
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	8	0.00615	0.005	0.0142	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	27	0.0005111	0.0005	0.0008	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	9	0.0042556	0.0005	0.0343	0.0005
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	7	0.0234286	0.005	0.134	0.005
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	8	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	3	6.2	0.1	18.6	11.2
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	6	0.0311667	0.005	0.162	0.005
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	1	0.204	0.204	0.204	0.204
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	26	2.173E-05	0.000005	0.00044	0.000005
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	8	0.0022188	0.00025	0.016	0.00025
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	7	0.0991429	0.026	0.538	0.026

Parameter	Units	ANZECC 2000 guideline							Baseline data SW08				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
Benzene	µg/L	-	-	10	600	950	500	700	30	0.5	0.5	0.5	0.5
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1
Toluene	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	30	1	1	1	1
Xylene Total	µg/L	-	-	-	-	-	-	-	30	1	1	1	1
Naphthalene	µg/L	-	-	-	2.5	16	50	70	30	2.5	2.5	2.5	2.5
C6-C10	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	30	0.05	0.05	0.05	0.05
C10-C16	mg/L	-	-	-	-	-	-	-	30	0.05	0.05	0.05	0.05
C16-C34	mg/L	-	-	-	-	-	-	-	27	0.05	0.05	0.05	0.05
C34-C40	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	27	0.05	0.05	0.05	0.05
C6 - C9	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
C10 - C14	mg/L	-	-	-	-	-	-	-	30	0.025	0.025	0.025	0.025
C15 - C28	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C29-C36	mg/L	-	-	-	-	-	-	-	27	0.025	0.025	0.025	0.025
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	27	0.025	0.025	0.025	0.025



Parameter	Units	ANZECC 2000 guideline							Baseline data SW09				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
<b>Physiochemical parameters</b>													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	27	8.45	7.43	10.30	9.17
Temperature	°C	-	-	-	-	-	-	-	27	21.3	13.8	31.4	25.5
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	27	16780	147	50206	39961
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	27	341	122	659	390
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	27	10.1	1.7	20.8	13.7
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	24	39	2	271	53
<b>Chemical analytes</b>													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Kjeldahl Nitrogen Total	mg/L	-	-	-	-	-	-	-	3	0.25	0.25	0.25	0.25
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	1	0.005	0.005	0.005	0.005
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	4	3612.5	250	13700	5630
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	4	0.005	0.005	0.005	0.005
Phosphorus	mg/L	0.025	0.03	-	-	-	-	-	3	0.025	0.025	0.025	0.025
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	3	0.005	0.005	0.005	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	28	0.0005	0.0005	0.0005	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	5	0.0005	0.0005	0.0005	0.0005
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	2	0.005	0.005	0.005	0.005
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	10	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	1	0.05	0.05	0.05	0.05
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	2	0.005	0.005	0.005	0.005
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	1	0.005	0.005	0.005	0.005
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	27	0.000005	0.000005	0.000005	0.000005
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	5	0.00025	0.00025	0.00025	0.00025
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	3	0.026	0.026	0.026	0.026

Parameter	Units	ANZECC 2000 guideline							Baseline data SW09				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
Benzene	µg/L	-	-	10	600	950	500	700	31	0.5	0.5	0.5	0.5
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	31	1	1	1	1
Toluene	µg/L	-	-	-	ID	ID	ID	ID	31	1	1	1	1
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	31	1	1	1	1
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	31	1	1	1	1
Xylene Total	µg/L	-	-	-	-	-	-	-	31	1	1	1	1
Naphthalene	µg/L	-	-	-	2.5	16	50	70	31	2.5	2.5	2.5	2.5
C6-C10	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C10-C16	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C16-C34	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C34-C40	mg/L	-	-	-	-	-	-	-	30	0.05	0.05	0.05	0.05
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C6 - C9	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
C10 - C14	mg/L	-	-	-	-	-	-	-	31	0.025	0.025	0.025	0.025
C15 - C28	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C29-C36	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025

Parameter	Units	ANZECC 2000 guideline							Baseline data				
		South-east Australia default triggers			Freshwater		Marine		SW10				
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile
<b>Physiochemical parameters</b>													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	26	7.72	5.78	9.79	8.19
Temperature	°C	-	-	-	-	-	-	-	27	19.7	15.5	24.5	22.1
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	27	684	111	4830	510
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	26	338	249	470	375
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	27	12.4	5.6	65.2	10.2
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	23	19	1	93	25
<b>Chemical analytes</b>													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	-	-	-	-	-
Phosphorous filterable reactive (P)	mg/L	0.02	0.005	-	-	-	-	-	1	0.025	0.025	0.025	0.025
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	2	0.005	0.005	0.005	0.005
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	2	0.025	0.025	0.025	0.025
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	3	0.0042	0.0026	0.005	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	19	0.0005	0.0005	0.0005	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	7	0.0009714	0.0005	0.0038	0.0038
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	1	0.036	0.036	0.036	0.036
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	4	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	1	2.57	2.57	2.57	2.57
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	3	0.0087333	0.005	0.0162	0.0162
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	2	0.0575	0.005	0.11	0.11
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	27	7.778E-06	0.000005	0.00008	0.00008
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	6	0.0008083	0.00025	0.0036	0.0036
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	1	0.134	0.134	0.134	0.134

Parameter	Units	ANZECC 2000 guideline							Baseline data				
		South-east Australia default triggers			Freshwater		Marine		SW10				
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile
Benzene	µg/L	-	-	10	600	950	500	700	29	0.5	0.5	0.5	0.5
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Toluene	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	29	1	1	1	1
Xylene Total	µg/L	-	-	-	-	-	-	-	29	1	1	1	1
Naphthalene	µg/L	-	-	-	2.5	16	50	70	29	2.5	2.5	2.5	2.5
C6-C10	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C10-C16	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C16-C34	mg/L	-	-	-	-	-	-	-	28	0.05	0.05	0.05	0.05
C34-C40	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	26	0.05	0.05	0.05	0.05
C6 - C9	mg/L	-	-	-	-	-	-	-	29	0.01	0.01	0.01	0.01
C10 - C14	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025
C15 - C28	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C29-C36	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	29	0.025	0.025	0.025	0.025

Parameter	Units	ANZECC 2000 guideline							Baseline data					
		South-east Australia default triggers				Freshwater		Marine		SW14				
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection	count	mean	min	max	80th percentile	
<b>Physiochemical parameters</b>														
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	20	8.22	7.43	8.80	8.48	
Temperature	°C	-	-	-	-	-	-	-	21	20.1	15.1	26.0	23.6	
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	21	531	44	996	814	
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	21	334	91	447	365	
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	21	9.2	6.1	10.7	10.0	
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-	
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	18	58.21	3.50	222.70	88.78	
<b>Chemical analytes</b>														
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-	
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	2	0.005	0.005	0.005	0.005	
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-	
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	-	-	-	-	-	
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	-	-	-	-	-	
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	1	0.005	0.005	0.005	0.005	
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	21	0.0005	0.0005	0.0005	0.0005	
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	5	0.0005	0.0005	0.0005	0.0005	
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	-	-	-	-	-	
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	8	0.025	0.025	0.025	0.025	
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	-	-	-	-	-	
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	2	0.005	0.005	0.005	0.005	
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	-	-	-	-	-	
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	20	0.000005	0.000005	0.000005	0.000005	
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	3	0.00025	0.00025	0.00025	0.00025	
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	-	-	-	-	-	

Parameter	Units	ANZECC 2000 guideline							Baseline data SW14					
		South-east Australia default triggers				Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection						
Benzene	µg/L	-	-	10	600	950	500	700	23	0.5	0.5	0.5	0.5	
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	23	1	1	1	1	
Toluene	µg/L	-	-	-	ID	ID	ID	ID	23	1	1	1	1	
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	23	1	1	1	1	
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	23	1	1	1	1	
Xylene Total	µg/L	-	-	-	-	-	-	-	23	1	1	1	1	
Naphthalene	µg/L	-	-	-	2.5	16	50	70	23	2.5	2.5	2.5	2.5	
C6-C10	mg/L	-	-	-	-	-	-	-	23	0.01	0.01	0.01	0.01	
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	23	0.01	0.01	0.01	0.01	
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	22	0.05	0.05	0.05	0.05	
C10-C16	mg/L	-	-	-	-	-	-	-	22	0.05	0.05	0.05	0.05	
C16-C34	mg/L	-	-	-	-	-	-	-	21	0.05	0.05	0.05	0.05	
C34-C40	mg/L	-	-	-	-	-	-	-	23	0.05	0.05	0.05	0.05	
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	19	0.05	0.05	0.05	0.05	
C6 - C9	mg/L	-	-	-	-	-	-	-	23	0.01	0.01	0.01	0.01	
C10 - C14	mg/L	-	-	-	-	-	-	-	23	0.025	0.025	0.025	0.025	
C15 - C28	mg/L	-	-	-	-	-	-	-	21	0.05	0.05	0.05	0.05	
C29-C36	mg/L	-	-	-	-	-	-	-	22	0.025	0.025	0.025	0.025	
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	21	0.025	0.025	0.025	0.025	

Parameter	Units	ANZECC 2000 guideline							Baseline data SW15				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
<b>Physiochemical parameters</b>													
pH	-	6.5-8.5	7.0-8.5	6.5-8.5	-	-	-	-	27	7.46	5.65	7.97	7.89
Temperature	°C	-	-	-	-	-	-	-	27	20.14	15.70	25.10	24.17
Conductivity	µS/cm	125-2,200	-	-	-	-	-	-	27	42066.69	402.90	52314.60	49676.20
Oxidation Reduction Potential	mV	-	-	-	-	-	-	-	27	320.17	28.70	590.00	386.24
Dissolved Oxygen	mg/L	-	-	>6.5	-	-	-	-	27	7.40	0.16	66.20	6.57
Dissolved Oxygen	% sat	85-110	80-110	>80	-	-	-	-	-	-	-	-	-
Turbidity	NTU	6-50	0.5-10	-	-	-	-	-	24	4.93	0.00	18.70	9.02
<b>Chemical analytes</b>													
Ammonia as N	µg/L	20	15	10	320	900	500	910	-	-	-	-	-
Kjeldahl Nitrogen Total	mg/L	-	-	-	-	-	-	-	17	0.25	0.25	0.25	0.25
Nitrite (as N)	mg/L	-	-	-	-	-	-	-	19	0.005	0.005	0.005	0.005
Nitrogen (Total Oxidised)	mg/L	0.04	0.015	10/1	-	-	-	-	-	-	-	-	-
Nitrogen (Total)	mg/L	0.35	0.3	-	-	-	-	-	18	2541.6667	250	41500	250
Reactive Phosphorus as P	mg/L	0.02	0.005	-	-	-	-	-	2	0.005	0.005	0.005	0.005
Phosphorus (Total)	mg/L	0.025	0.03	-	-	-	-	-	16	0.025	0.025	0.025	0.025
Arsenic	mg/L	-	-	0.05	0.001/0.0008	0.024/0.013	ID	ID	11	0.0047545	0.0023	0.005	0.005
Cadmium	mg/L	-	-	0.005	0.00006	0.0002	0.0007	0.0055	23	0.0005	0.0005	0.0005	0.0005
Chromium (III+VI)	mg/L	-	-	0.05	ID/0.00001	ID/0.001	0.008/0.00014	0.027/0.0044	21	0.0005	0.0005	0.0005	0.0005
Copper	mg/L	-	-	1	0.0010	0.0014	0.0003	0.0013	10	0.0047	0.002	0.005	0.005
Ferrous Iron	mg/L	-	-	0.3	ID	ID	ID	ID	13	0.025	0.025	0.025	0.025
Iron	mg/L	-	-	0.3	ID	ID	ID	ID	9	0.0534444	0.05	0.081	0.05
Lead	mg/L	-	-	0.05	0.001	0.0034	0.0022	0.0044	10	0.00463	0.0013	0.005	0.005
Manganese	mg/L	-	-	0.1	1.2	1.9	ID	ID	8	0.00515	0.005	0.0062	0.005
Mercury	mg/L	-	-	0.001	0.00006	0.0006	0.0001	0.0004	28	0.000005	0.000005	0.000005	0.000005
Nickel	mg/L	-	-	0.1	0.008	0.011	0.007	0.07	14	0.000275	0.00025	0.0006	0.00025
Zinc	mg/L	-	-	5	0.0024	0.008	0.007	0.015	7	0.0244286	0.015	0.026	0.026

Parameter	Units	ANZECC 2000 guideline							Baseline data SW15				
		South-east Australia default triggers			Freshwater		Marine		count	mean	min	max	80th percentile
		NSW Lowland Rivers	Estuarine	Recreation	99% Protection	95% Protection	99% Protection	95% Protection					
Benzene	µg/L	-	-	10	600	950	500	700	31	0.5	0.5	0.5	0.5
Ethylbenzene	µg/L	-	-	-	ID	ID	ID	ID	31	1	1	1	1
Toluene	µg/L	-	-	-	ID	ID	ID	ID	30	1	1	1	1
Xylene (m & p)	µg/L	-	-	-	ID	ID	ID	ID	29	1	1	1	1
Xylene (o)	µg/L	-	-	-	200	350	ID	ID	29	1	1	1	1
Xylene Total	µg/L	-	-	-	-	-	-	-	28	1	1	1	1
Naphthalene	µg/L	-	-	-	2.5	16	50	70	31	2.5	2.5	2.5	2.5
C6-C10	mg/L	-	-	-	-	-	-	-	30	0.01	0.01	0.01	0.01
C6-C10 less BTEX (F1)	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
F2-NAPHTHALENE	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C10-C16	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C16-C34	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C34-C40	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C10 - C40 (Sum of total)	mg/L	-	-	-	-	-	-	-	29	0.05	0.05	0.05	0.05
C6 - C9	mg/L	-	-	-	-	-	-	-	31	0.01	0.01	0.01	0.01
C10 - C14	mg/L	-	-	-	-	-	-	-	30	0.025	0.025	0.025	0.025
C15 - C28	mg/L	-	-	-	-	-	-	-	31	0.05	0.05	0.05	0.05
C29-C36	mg/L	-	-	-	-	-	-	-	31	0.025	0.025	0.025	0.025
+C10 - C36 (Sum of total)	mg/L	-	-	-	-	-	-	-	30	0.025	0.025	0.025	0.025



# Appendix B – Site-specific trigger value review

14 April 2020

Grant Sainsbery  
Environment & Sustainability Manager  
Lendlease Samsung Bouygues Joint Venture  
Via email

**Re: M4-M5 Link Mainline Tunnels - surface water monitoring review**

---

Dear Grant,

## 1 Introduction

The WestConnex M4-M5 Link is being constructed in two stages:

- Stage 1 (the project and subject of this document): Mainline tunnels; and
- Stage 2: Rozelle interchange including Iron Cove Link.

WestConnex Transurban has engaged the Lendlease Samsung Bouygues Joint Venture (LSBJV) to design and construct Stage 1 (herein referred to as the project). The project will consist of two parallel tunnels, each approximately 7.5 km long, which link the M4 East tunnel at Haberfield with the New M5 at St Peters.

In accordance with Section 6.1 of the *Surface Water Quality Monitoring Program*, this memo reviews the site-specific trigger values (SSTV) adopted for the project, following 12 months of construction monitoring.

## 2 Management plans and requirements

The Minister for Planning approved the M4-M5 Link under Section 5.19 of the *Environmental Planning and Assessment Act 1979* (EP&A Act 1979) on 17 April 2018. The State significant Infrastructure approval (SSI 16\_7485) incorporated the Minister's Conditions of Approval.

A series of environmental management plans have been prepared to meet the Conditions of Approval, including, the *Soil and Surface Water Management Sub-plan, M4-M5 Link Mainline Tunnels Rev 08* (LSBJV 2019). Appendix C of this report provides the *Surface Water Quality Monitoring Program Rev 06* (SWQMP).

SWQMP Section 3.2.3, 'Surface water quality parameters' lists the following monitoring parameters for ambient surface water:

- pH;
- dissolved oxygen (DO);
- oxidation/reduction potential (ORP);
- turbidity;

- electrical conductivity (EC);
- total dissolved solids (TDS); and
- temperature.

This section of the SWQMP provides the following performance criteria:

**Table 3-6 Water quality performance criteria (applicable to downstream (impact) monitoring locations)**

Parameter	Units	ANZECC guidelines <sup>1</sup>	Site Specific Trigger Value		
			SW04	SW09	LSB01
pH	pH	7.0 - 8.5 <sup>2</sup>	7.0 - 8.5 <sup>5</sup>	7.0 <sup>2</sup> - 8.5 <sup>2</sup>	7.0 - 8.5 <sup>2</sup>
EC	µs/cm <sup>6</sup>	125 – 2,200 <sup>3</sup>	2,200 <sup>3</sup>	48,183 <sup>5</sup>	49,676 <sup>5</sup>
Turbidity	NTU	0.5 - 10 <sup>2,4</sup>	107 <sup>5</sup>	42 <sup>5</sup>	10 <sup>2,4</sup>

<sup>1</sup> ANZECC (2000a) – slightly to moderately disturbed aquatic ecosystems

<sup>2</sup> Guideline value for SE Australian estuaries

<sup>3</sup> Micro-Seimens per centimetre

<sup>4</sup> ANZECC (2000a) notes that turbidity is not a very useful indicator in estuarine and marine waters

<sup>5</sup> 80<sup>th</sup> percentile of baseline data

<sup>6</sup> Rounded to the nearest 1000

These location-specific performance criteria (SSTVs) were developed for downstream (impact) surface water monitoring locations. For the parameters where no trigger values are provided (DO, ORP, TDS and temperature), comparison of downstream and upstream monitoring sites was intended to provide an indication of whether project-related discharges may be impacting ambient water quality.

SWQMP Section 3.2.3, ‘Surface water quality monitoring’, states:

The SSTV’s provide an easily identifiable indication of a potential change in water quality. A management response would be initiated if any of the following occurs:

- A parameter exceeds the SSTV for two consecutive monthly monitoring events
- A parameter exceeds the SSTV for any single monitoring event by more than 30%
- A parameter downstream exceeds the corresponding parameter upstream for any single monitoring event by more than 20%.

### 3 Review objectives

SWQMP Section 6.1 ‘Continuous improvement’ states that:

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. SSTV will be reviewed for appropriateness following 12 months of construction monitoring.

This letter has been prepared to address SWQMP Section 6.1. It considers whether:

- surface water monitoring data from February 2019 to March 2020 indicate that the project is impacting ambient water quality;
- the SSTVs are appropriate for determining if a management response is required; and

- whether the monitoring parameters are appropriate.

Due to the urban setting of the waterways, a perfect ‘before/after and control/impact’ (BACI) sampling design is not available (ie monitoring immediately upstream and downstream of the discharge outlets) as safe and public access immediately adjacent to the outlets is restricted. Monitoring locations as close as possible to the discharge locations were selected. There are multiple non-project discharges that influence water quality in the waterways between the control and impact sites. With the exception of the control site for St Peters water treatment plant (WTP), the monitoring sites are subject to tidal flows so water ‘downstream’ of the monitoring sites may influence the water quality measured at the sites.

## 4 Groundwater quality

Water quality discharged from the WTPs is largely groundwater that has seeped into the tunnel.

The EC of groundwater has been monitored by dataloggers installed in nine bores close to the tunnel alignment in accordance with the *Groundwater Monitoring Program Rev 08* (GWMP) (LSBJV 2019).

The primary purpose of this monitoring is to detect potential intrusion of saline water towards the tunnel. The data are also used to determine the EC of groundwater likely to flow into the tunnel. Water flowing into the tunnel is pumped to one of the project’s WTPs, treated and then reused on site or discharged to stormwater infrastructure.

The EC of groundwater varied between the bores (Figure 4.1). The groundwater EC generally varied between 0.9 mS/cm and 5.4 mS/cm. The minimum EC recorded was 0.73 mS/cm and the maximum EC recorded was 7.9 mS/cm a. For comparison, the EC of seawater is around 50 mS/cm.

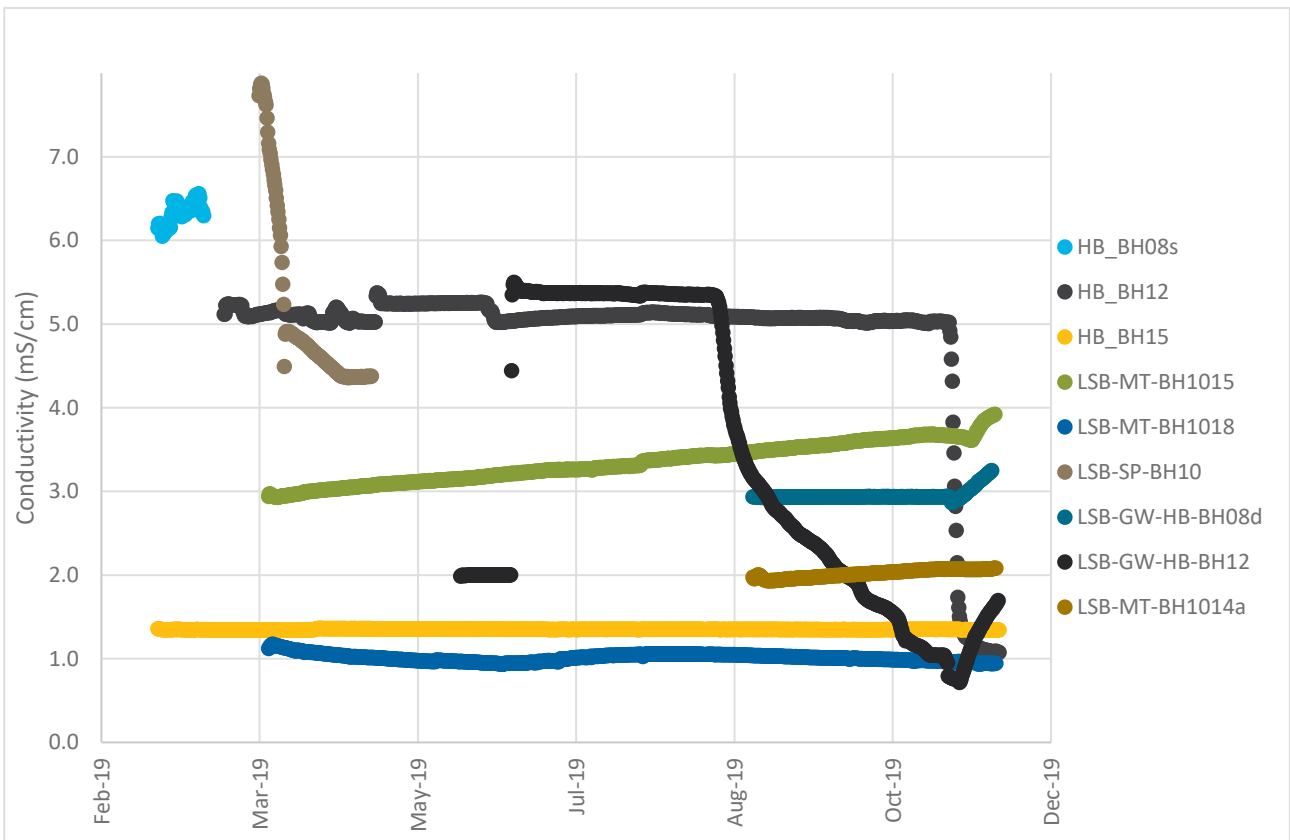


Figure 4.1 Groundwater – electrical conductivity

## 5 Ambient surface water quality monitoring results

Ambient surface water quality monitoring results are provided in Appendix A. These results are reviewed below.

### 5.1 Surface water results review

#### 5.1.1 Haberfield WTP

Details of the Haberfield WTP and the receiving waterbody are provided in Table 5.1.

**Table 5.1** Ambient monitoring sites – Haberfield WTP

Item	Details
Water treatment plant	Northcote Tunnel site/ Wattle Street Tunnel site, Haberfield
EPL Licenced discharge points <sup>1</sup>	5/6
Receiving environment	Dobroyd Canal (aka Iron Cove Creek)
Control (upstream)	LSB02 (formerly SW09) – see Photograph 5.1
Impact (downstream)	SW09 (formerly SW08) – see Photograph 5.2

1. Environment Protection Licence (EPL 21149).



**Photograph 5.1** Dobroyd Canal – Haberfield WTP control monitoring site (LSB02)





**Photograph 5.2 Dobroyd Canal – Haberfield WTP impact monitoring site (SW09)**

Ambient surface water monitoring results for Dobroyd Canal are reviewed in Table 5.2.

**Table 5.2 Surface water results review – Haberfield WTP**

Parameter	SSTV	Comments
pH	7–8.5	The upper pH criterion was exceeded on a number of occasions. However, in all but one case (9/12/19), the exceedance was greater at the control site than impact site. On 9/12/19, the WTP was not discharging.  This indicates that the exceedances were not project-related.
EC	48.183 mS/cm	The EC criterion is very similar to the EC of seawater, about 50 mS/cm, and is well above the EC of groundwater (generally 0.9 to 5.4 mS/cm).  There were no exceedances of the SSTV. The EC at the control and impact sites is indicative of seawater movement within Dobroyd Canal due to tidal flows.  A higher EC is expected at the downstream impact site compared to at the control site, as the tidal influence is greater the downstream impact site. On the majority of monitoring occasions, the EC was >20% higher at the impact site than at the control site. This is listed as a trigger for a management response (see Section 2 above). The higher EC at the impact site is natural and not indicative of potential project impacts, such that a management response was required.
Turbidity	42 NTU	There were some exceedances of the turbidity criterion during wet weather sampling. On each occasion, the turbidity was higher at the control site than at the impact site, indicating that the elevated turbidity at the impact site was unlikely to be project-related.  The lower turbidity at the impact site may also have been influenced by dilution by seawater or flocculation of suspended sediment by seawater reducing the turbidity.  There were no exceedances of the turbidity criterion during routine monitoring except on two occasions (20/1/20 and 5/2/20) at the control site (but not at the impact site).

### 5.1.2 Pyrmont WTP

Details of the Pyrmont WTP and the receiving waterbody are provided in Table 5.3.

**Table 5.3**      **Ambient monitoring sites – Pymont WTP**

Item	Details
Water treatment plant	Pymont Bridge Road, Annandale
Licensed discharge point <sup>1</sup>	3
Receiving environment	Johnstons Creek
Control (upstream)	SW14 – see Photograph 5.3
Impact (downstream)	SW04 – see Photograph 5.4

1. Environment Protection Licence (EPL 21149).



**Photograph 5.3**      **Johnstons Creek –Pymont WTP control monitoring site (SW14)**





**Photograph 5.4** Johnstons Creek –Pymont WTP impact monitoring site (SW04)

Ambient surface water monitoring results for Johnstons Creek are reviewed in Table 5.4.

**Table 5.4** Surface water results review - Pymont

Parameter	SSTV	Comments
pH	7–8.5	No exceedances.
EC	2.2 mS/cm	<p>A comparison of the control and impact sites indicates that the water at both sites was generally fresh and that the EC is generally higher at the impact site but, with one exception (8/1/20), was below the SSTV.</p> <p>On 9 of the 18 sampling occasions, the EC was &gt;20% higher at the impact site than at the control site. This is expected as the tidal influence is expected to be greater at the downstream impact site. On these occasions, the higher EC at the impact site was not indicative of potential project impacts or that a management response was required.</p> <p>Johnstons Creek is a concrete channel at the impact site (see Photograph 5.4). This concrete channel discharges into Rozelle Bay about 1.3 km downstream of the impact site. The concrete channel does not provide any ecological value downstream of the impact site. This is reflected in the EPL, which specifies water quality criteria aimed the protecting the marine environment of Rozelle Bay.</p> <p>Implementation of the EC criterion at the impact site is of little value as it is far below the EC in the receiving environment (about 50 mS/cm) that requires protection (Rozelle Bay).</p>
Turbidity	107 NTU	<p>There were exceedances of the turbidity criterion on five occasions during wet weather sampling (including 4/3/20, which did not meet the rainfall 25 mm trigger). The criterion was exceeded at both the control and impact sites (three occasions) or just at the control site (two occasions). On four of these five occasions, the turbidity was higher at the control site than at the impact site.</p> <p>There were no exceedances during routine monitoring, with the exception of 4/3/20 (see above).</p> <p>The turbidity was &gt;20% higher at the impact site compared to the control site on 7 of the 18 sampling occasions. And conversely, it was &lt;20% higher or lower on 11 of the 18 sampling occasions.</p>



## 5.2 St Peters WTP

Details of the St Peters WTP and the receiving waterbody are provided in Table 5.5.

**Table 5.5 Ambient monitoring sites – St Peters WTP**

Item	Details
Water treatment plant	Campbell Road, St Peters
Licensed discharge points <sup>1</sup>	4
Receiving environment	Alexandra Canal
Control (upstream)	SW10 (Sheas Creek) – See Photograph 5.5 (control site) and Photograph 5.6 (weir between control and impact sites)
Impact (downstream)	LSB01 (formerly SW15) – see Photograph 5.7

1. Environment Protection Licence (EPL 21149).



**Photograph 5.5 Sheas Creek – St Peters WTP control monitoring site (SW10)**



**Photograph 5.6** Weir between Sheas Creek (control site) and Alexandra Canal



**Photograph 5.7** Alexandra Canal – St Peters WTP impact monitoring site (LSB01)

Ambient surface water monitoring results for Sheas Creek/Alexandra Canal are reviewed in Table 5.6.

**Table 5.6**      **Surface water results review – St Peters**

Parameter	SSTV	Comments
pH	7–8.5	There were only two exceedances of the upper pH criterion, both at the control site.
EC	49.676 mS/cm	<p>There was one exceedance of the EC criterion (50.5 mS/cm on 8/1/20). This EC is indicative of undiluted seawater. Any mixing of discharged water (&lt;9.6 mS/cm) and seawater would reduce the EC in the receiving environment.</p> <p>On all occasions, the EC was &gt;20% higher at the impact site than at the control site. This is expected as the control site is above a weir, protecting it from tidal influence, while the impact site is tidal with a ECs reflective of a mix of seawater and freshwater.</p> <p>The control site (upstream of a weir – see photograph 5.6) is clearly a poor control for the impact site.</p>
Turbidity	10 NTU	<p>There were exceedances of the turbidity criterion on all five wet weather sampling occasions (including 4/3/20, which did not meet the rainfall 25 mm trigger). On all but one of these occasions, the turbidity was higher at the impact site than at the control site.</p> <p>On 11 of the 13 routine sample occasions (control and impact), the turbidity was &gt;20% higher at the impact site than at the control site.</p> <p>The control site (upstream of a weir – see photograph 5.6) is a poor control for the impact site.</p>

The current turbidity criterion for Alexandra Canal (10 NTU) is extremely low.

The ANZG (2018) *Guidelines for Fresh & Marine Water Quality* recommend that site-specific guideline values are determined for physical stressors including turbidity. These guidelines refer to the default guideline values (DGVs) for physical stressors including turbidity. The ANZECC (2000) *Guidelines for Fresh & Marine Water Quality* provide the following default DGV for estuarine and marine ecosystems (emphasis added):

0.0–10 NTU: Low turbidity values are normally found in offshore waters. Higher values may be found in estuaries or inshore coastal waters due to wind-induced resuspension or to the input of turbid water from the catchment. Turbidity is not a very useful indicator in estuarine and marine waters. A move towards the measurement of light attenuation in preference to turbidity is recommended.

Given that Alexandra Canal is an estuarine ecosystem, the 10 NTU criterion currently applied is too low and not useful in determining when management measures should be implemented.

The ANZECC (2000) default guideline value for turbidity was specified in the *Surface Water Quality Monitoring Program* because at the time the program was prepared, there was insufficient monitoring data available to LSBJV to derive a SSTV. Since this time, monitoring data from LSB01 (formerly SW15) collected as part of the New M5 Project has been made available to LSBJV. This site is referred to as ‘CDS-SW-02’ in the New M5 monitoring dataset. These data are presented in Appendix B and summarised statistically in Table 5.7.



**Table 5.7 Statistical summary of ambient water quality data – Alexandra Canal (CDS-SW-02/SW15)**

Statistical parameter	Value
<b>Data 2016-2018 (pre-construction)</b>	
n	28
Median	12.6
80th percentile	24.2
<b>All data (2016–2019)</b>	
n	48
Median	12.6
80th percentile	24.2

On the basis of the 80<sup>th</sup>-percentile turbidity value measured at SW15 and CDS-SW-02 (Table 5.7), it is recommended that the turbidity SSTV for LSB01 is updated to 24 NTU. This SSTV has not been exceeded.

### 5.3 Summary

#### Are impacts to water quality indicated?

The impacts to receiving water can be summarised as follows:

- pH: there is no indication that the project is impacting the pH in the receiving water.
- EC:
  - The EC at the Haberfield and St Peters impact sites was highly variable and generally indicative of the mixing of freshwater and seawater in these estuarine environments – the EC in the discharged water would not generally exceed that measured in the groundwater (generally 0.9 to 5.4 mS/cm) and any impacts that discharges have on EC at the impact site would be small compared to natural variation and would have no environmental impact.
  - The EC at the Pymont impact site was generally indicative of freshwater to brackish water. On roughly half of the monitoring occasions it was higher at the control site than at the impact site. This indicates that the variability in EC is most likely to be due to natural variability rather than project impacts.
- Turbidity:
  - Some turbidity values exceeded the SSTVs during wet weather as expected. There is no indication that these were project-related.
  - There were no exceedances of the turbidity SSTVs at Haberfield or Pymont during dry weather sampling.
  - There were multiple exceedances of the turbidity criterion (10 NTU) at St Peters during dry weather sampling. This criterion is not an SSTV. It is based on the ANZECC (2000) default guideline value and is too low for the site. The recommended SSTV for the site, 24 NTU, was not exceeded during dry weather sampling.

## **Are SSTVs appropriate for determining if a management response is required?**

The appropriateness of SSTVs can be summarised as follows:

- The pH criteria are generally in accordance with ANZG (2018)/ANZECC (2000) DGVs and no change is recommended.
- The EC SSTVs for the Haberfield and St Peters sites are indicative of undiluted seawater. The EC of discharges is similar to that of the groundwater and much lower than that of seawater. The effects on EC of mixing of 'natural' freshwater or of mixing discharged water with seawater are indistinguishable. There is little value of measuring EC at the Haberfield and St Peters sites and it is recommended that the requirement for this monitoring is removed.
- The EC SSTV for the Pymont site is lower than the maximum EC recorded in groundwater. However, implementation of the SSTV is of little value as it is far below the EC in the receiving environment (about 50 mS/cm) that requires protection (Rozelle Bay). It is recommended that the requirement for this monitoring is removed.
- The turbidity criteria at all impact sites are of limited value due to the expected natural variability. However, the discharge of turbid water from the WTPs could be seen as a significant issue by the community. It is recommended that turbidity criteria are maintained for these sites, but that the very low criterion for St Peters is amended to 24 NTU.

There is value in monitoring pH and turbidity at the control and impact sites to assist in understanding elevated values at the impact site. However, there is wide natural variability in the values at and between these sites. In these circumstances, it is recommended that the triggers to take management actions listed in SWQMP Section 3.2.3, 'Surface water quality monitoring' (as quoted above) are deleted.

Instead, it is recommended that any exceedance of an SSTV triggers an investigation. If this investigation indicates that a) the exceedance is likely to be as a result of the discharge WTP water and b) that it has the potential to cause harm to the environment, then management actions should be implemented.

## **Are the monitoring parameters appropriate?**

The appropriateness of the monitoring parameters can be summarised as follows:

- It is appropriate to continue to monitor pH and turbidity at all impact and control sites.
- There is little value in monitoring EC at the Haberfield, Pymont or St Peters sites and it is recommended that the parameter is removed from the ambient water quality monitoring suite.

## 6 Closing

The performance and appropriateness of the above will be reviewed following another 12 months of construction monitoring data.

We trust that this review meets your needs. However, please do not hesitate to contact me if you have any questions.

Yours sincerely

A handwritten signature in blue ink, appearing to be 'PT' followed by a long horizontal flourish.

**Dr Philip Towler**

Associate Director

[ptowler@emmconsulting.com.au](mailto:ptowler@emmconsulting.com.au)

Mobile: 0409 702 050

---

Appendix A

# Ambient surface water quality monitoring results

---

Haberfield Dobroyd Canal – Control: LSB02 (formerly SW09) and Impact: SW09 (formerly SW08)

			pH	EC (mS/cm)	Turbidity (NTU)	Notes
SSTV	(SW09)		7 – 8.5	48.183	42	
Mean Baseline Data values	(SW09)		8.45	16.78	39	
<b>Monitoring event</b>						
Dec-18	12/12/2018	Control	8.15	32.1	5.1	
		Impact	7.8	46.4	2.5	
Jan-19	24/01/2019	Control	8.29	35.4	14.4	
		Impact	8.17	39	4.7	
Feb-19	28/02/2019	Control	10.68	0.768	19.1	
		Impact	8.98	28.6	16.5	
Mar 2019*	18/03/2019	Control	8.44	0.535	165.5	Wet weather monitoring
		Impact	8.39	4.48	45.2	
Apr-19	12/04/2019	Control	9.28	0.871	11.8	
		Impact	8.15	32.5	13.1	
May-19	10/05/2019	Control	8.06	42	8.8	
		Impact	8.03	39.3	7.5	
June 2019*	18/06/2019	Control	7.15	7.4	86.1	Wet weather monitoring
		Impact	7.54	12.9	57.4	
Jul-19	10/07/2019	Control	7.95	43.6	9.1	
		Impact	7.5	34.2	19.1	
Aug-19*	9/08/2019	Control	9.4	1.47	9.7	Wet weather monitoring
		Impact	9.13	2.42	12.4	
Aug-19*	30/08/2019	Control	8.43	0.36	318	Wet weather monitoring
		Impact	8.27	1.28	228	
Sep-19	9/09/2019	Control	9.44	0.6	11.4	
		Impact	9.09	5.36	4.7	
Oct-19	9/10/2019	Control	9.12	1.23	29.6	
		Impact	7.42	4.76	9.9	
Nov-19	11/11/2019	Control	9.25	1.28	14.6	
		Impact	8.16	41.2	4.9	
Dec-19	9/12/2019	Control	6	0.73	6	Northcote WTP was not discharging during
		Impact	9.43	5.75	3.7	
Jan-20	8/01/2020	Control	9.12	0.906	2.7	
		Impact	7.86	24.15	13.8	
Jan-20	20/01/2020*	Control	8.9	0.708	47.4	Wet weather monitoring
		Impact	7.43	43.1	3.8	
Feb-20	5/02/2020	Control	8.47	0.692	58.2	
		Impact	7.76	33.2	11	
Mar-20	4/03/2020*	Control	7.76	0.1032	89.2	Monitoring occurred during rainfall (though formal wet
		Impact	7.85	0.375	72	



**PBR Johnstons Creek – Control: SW14 and Impact: SW04**

Parameter			pH	EC (mS/cm)	Turbidity (NTU)	Notes
<b>SSTV</b>	(SW04)		<b>7.0-8.5</b>	<b>2.2</b>	<b>107</b>	
<b>Mean Baseline Data values</b>	(SW04)		<b>7.79</b>	<b>0.743</b>	<b>57</b>	
<b>Monitoring event</b>						
Dec-18	12/12/2018	Control	8.27	0.622	2.7	
		Impact	7.86	0.74	72.1	
Jan-19	24/01/2019	Control	7.91	1.01	8.7	
		Impact	8.05	0.31	14.3	
Feb-19	28/02/2019	Control	8.29	0.679	20	
		Impact	7.98	0.768	16.6	
Mar-19*	18/03/2019	Control	7.6	0.441	277	Wet weather monitoring
		Impact	7.7	0.435	198.7	
Apr-19	12/04/2019	Control	8.07	0.621	17.2	
		Impact	7.79	0.846	17.4	
May-19	10/05/2019	Control	8.21	0.751	9.2	
		Impact	7.8	1	13.9	
Jun-19*	18/06/2019	Control	8.11	0.534	135.4	Wet weather monitoring
		Impact	7.89	0.521	270	
Jul-19	10/07/2019	Control	8.37	0.55	34.4	
		Impact	8.45	0.78	48.3	
Aug-19	9/08/2019	Control	7.76	0.63	9.5	
		Impact	7.62	0.72	8.7	
Aug-19*	30/08/2019	Control	7.79	0.37	416	Wet weather monitoring
		Impact	7.34	0.26	66.9	
Sep-19	9/09/2019	Control	8.39	0.624	14.5	
		Impact	8.41	1.91	11	
Oct-19	9/10/2019	Control	8.38	0.58	42.2	
		Impact	7.8	1.65	9.7	
Nov-19	11/11/2019	Control	8.32	0.684	20.9	
		Impact	8.34	1.461	7.1	
Dec-19	9/12/2019	Control	8.17	1.19	3.2	
		Impact	8.19	1.094	6.9	
Jan-20	8/01/2020	Control	8.05	0.575	2.8	
		Impact	7.99	5.48	4.5	
Jan-20*	20/01/2020*	Control	8.18	0.443	113.1	Wet weather monitoring
		Impact	8.13	0.955	42.4	
Feb-20	5/02/2020	Control	8.17	-	56.9	Control site result error
		Impact	7.8	0.734	35.8	
Mar-20	4/03/2020	Control	7.72	0.2102	345	Monitoring occurred during rainfall (though formal wet wether trigger not reached i.e. <25mm)
		Impact	7.74	0.1861	180.6	

**SPI Sheas Creek / Alexandra Canal – Control: SW10 and Impact: LSB01 (formerly SW15)**

			pH	EC (mS/cm)	Turbidity (NTU)	Notes
SSTV	(LSB01)		7.0 - 8.5	49.676	10	
Mean Baseline Data values	(SW15) <sup>&amp;</sup>		7.46	42.066	4.93	
<b>Monitoring event</b>						
Dec-18	12/12/2018	Control	8.39	0.637	1.8	
		Impact	7.43	39.5	5.1	
Jan-19	24/01/2019	Control	8.11	0.558	5.8	
		Impact	7.5	44.6	5.7	
Feb-19	28/02/2019	Control	8.47	0.696	5.7	
		Impact	7.53	29.1	16.1	
Mar-19*	18/03/2019	Control	7.76	0.469	26.0	Wet weather monitoring
		Impact	7.56	0.912	30.5	
Apr-19	12/04/2019	Control	7.78	0.527	4.3	
		Impact	7.91	33.1	9.6	
May-19	10/05/2019	Control	7.58	0.558	3.8	
		Impact	8.36	34.2	15.5	
Jun-19*	18/06/2019	Control	7.69	0.46	225.0	Wet weather monitoring
		Impact	7.56	2.81	59.6	
Jul-19	10/07/2019	Control	8.26	0.55	3.0	
		Impact	8.79	32.7	25.9	
Aug-19	9/08/2019	Control	8.18	0.74	3.2	
		Impact	7.72	56.9	5.7	
Aug-19*	30/08/2019	Control	7.19	0.25	34.3	Wet weather monitoring
		Impact	8.02	2.21	23.5	
Sep-19	9/09/2019	Control	7.99	0.53	1.5	
		Impact	7.6	42.8	4.3	
Oct-19	9/10/2019	Control	8.65	0.73	3.7	
		Impact	7.2	38.1	4.7	
Nov-19	11/11/2019	Control	9.12	0.84	2.6	
		Impact	7.62	42.1	7.4	
Dec-19	9/12/2019	Control	8.66	0.647	3.7	
		Impact	7.59	49.9	8.0	
Jan-20	8/01/2020	Control	8.67	0.972	3.9	
		Impact	7.49	50.5	6.4	
Jan-20	20/01/2020	Control	9.4	0.517	9.0	Wet weather monitoring
		Impact	7.21	18.28	15.6	
Feb-20	5/02/2020	Control	8.32	0.502	9.5	
		Impact	7.37	18.1	8.6	
Mar-20	4/03/2020	Control	7.66	0.237	17.9	Monitoring occurred during rainfall (though formal wet wether trigger not reached i.e. <25mm)
		Impact	7.22	8.02	33.5	

---

Appendix B

# Alexandra Canal ambient water quality monitoring (CDS-SW-02/SW15)

---

**Alexandra Canal ambient monitoring (CDS-SW-02/SW15)**

Site ID	Date	pH	EC	Turbidity
			mS/cm	NTU
CDS-SW-02	19/08/2016	7.32	4.1	19
CDS-SW-02	28/10/2016	7.47	33.5	24.2
CDS-SW-02	14/11/2016	7.72	46.6	4.2
CDS-SW-02	14/12/2016	6.29	40.9	12.6
CDS-SW-02	25/01/2017	7.83	38.8	12.6
CDS-SW-02	28/02/2017	7.68	12.4	16
CDS-SW-02	17/03/2017	7.07	15.9	0
CDS-SW-02	27/04/2017	6.91	35.5	0
CDS-SW-02	26/05/2017	6.63	3.1	32
CDS-SW-02	27/06/2017	7.05	45.3	2.9
CDS-SW-02	14/07/2017	7.48	37.7	4.8
CDS-SW-02	5/08/2017	7.28	20.5	14.6
CDS-SW-02	21/09/2017	7.6	46.4	0
CDS-SW-02	22/11/2017	7.53	38.4	3.6
CDS-SW-02	21/12/2017	7.8	38.8	36.9
CDS-SW-02	10/01/2018	7.43	10.1	112
CDS-SW-02	14/02/2018	3.33	38.7	16.1
CDS-SW-02	28/03/2018	5.25	36.4	9.2
CDS-SW-02	27/04/2018	7.7	47.2	15.8
CDS-SW-02	29/05/2018	7.36	46.2	17.9
CDS-SW-02	28/06/2018	7.39	25.3	63
CDS-SW-02	26/07/2018	8.05	43.2	7.2
CDS-SW-02	31/08/2018	7.87	29.2	18.6
SW15	19/09/2018	7.41	28.3	38.2
CDS-SW-02	19/09/2018	6.57	36.0	7.1
SW15	5/10/2018	8.13	1.4	504
CDS-SW-02	5/10/2018	5.98	0.2	5.02
SW15	1/11/2018	7.47	28.1	19.7
CDS-SW-02	9/11/2018	8.14	21.4	11.5
CDS-SW-02	7/12/2018	7.9	40.5	8.7
SW15	12/12/2018	7.43	39.5	5.1
CDS-SW-02	21/01/2019	8.01	35.3	10.7
SW15	24/01/2019	7.5	44.6	5.7
CDS-SW-02	7/02/2019	8.04	41.6	13.6
SW15	28/02/2019	7.53	29.1	16.1
CDS-SW-02	12/03/2019	10.79	44.1	8.5
SW15	18/03/2019	7.56	0.9	30.5
SW15	12/04/2019	7.91	33.1	9.6
CDS-SW-02	16/04/2019	7.61	33.0	5.7
CDS-SW-02	8/05/2019	8.3	51.2	21.6
SW15	10/05/2019	8.36	34.2	15.5
SW15	18/06/2019	7.56	2.8	59.6
CDS-SW-02	18/06/2019	7.77	0	55.1
SW15	10/07/2019	8.79	32.7	25.9
CDS-SW-02	15/07/2019	7.79	0	8.9
SW15	9/08/2019	7.72	56.9	5.7
SW15	30/08/2019	8.02	2.2	23.5

**Alexandra Canal ambient monitoring (CDS-SW-02/SW15)**

<b>Site ID</b>	<b>Date</b>	<b>pH</b>	<b>EC</b>	<b>Turbidity</b>
CDS-SW-02	30/08/2019	7.19	0	14.3
SW15	9/09/2019	7.6	42.8	4.3
SW15	9/10/2019	7.2	38.1	4.7
SW15	11/11/2019	7.62	42.1	7.4

<b>Data 2016-2018 (pre-construction)</b>				
Average		7.20	30.0	33.6
Median		7.43	36.0	12.6
80th percentile		7.80	40.9	24.2
<b>All data</b>				
Average		7.49	29.3	27.2
Median		7.56	35.3	12.6
80th percentile		7.91	42.80	24.2