Transport
Roads & Maritime
Services

NSW GOVERNMENT

Appendix B4

Soil and Water Management Sub-plan

Albion Park Rail bypass (Stage 2 – Princes Motorway between Yallah and Oak Flats)

April 2020

Document control

Approval and authorisation

Title	Soil and Water Management Sub-plan Albion Park Rail Bypass (Stage 2 – Princes Highway between Yallah and Oak Flats)
Accepted on behalf of Transport for NSW by	Peter Chudleigh
Signed	[redacted]
Dated	5 May 2020

Endorsement

Endorsed by the Environmental Representative	Toby Hobbs
Signed	[redacted]
Dated	11 May 2020

Document status

Revision	Date	Description	Approval
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Glossary/ Abbreviations

Abbreviation	Standard text
ANZECC	Australian and New Zealand Environment Conservation Council
ASM	Acid sulfate material
ASS	Acid sulfate soil
CEMP	Construction Environmental Management Plan
Coastal Management SEPP	*State Environmental Planning Policy (Coastal Management) 2018*
CLMP	Contaminated Land Management Sub-plan
CoA	Conditions of approval (state or federal). State CoA are the NSW Minister for Planning's conditions of approval. Federal CoA are the federal Conditions of Approval under the EPBC Act.
DP&E	NSW Department of Planning and Environment (now known as Department of Planning, Industry and Environment)
DPI	NSW Department of Primary Industries
DPIE	Department of Planning, Industry and Environment (DPIE) - All references to DP&E should be interpreted as DPIE (formerly known as DP&E).
EIS	Environmental Impact Statement
ESCP	Erosion and Sediment Control Plan
EEC	Endangered Ecological Community
EO	Environment Officer
EM	Environment Manager
EPA	NSW Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EWMS	Environmental Work Method Statements
NSW Minister, the	NSW Minister for Planning
Non-compliance	Failure to comply with the requirements of the Project approval or any applicable licence, permit or legal requirements
Non-conformance	Failure to conform to the requirements of Project system documentation including this CEMP or supporting documentation
NTU	Nephelometric Turbidity Unit
OEH	Office of Environment and Heritage - All references to OEH should be interpreted as Department of Planning, Industry and Environment, (DPIE) formerly known as OEH.
PESCP	Progressive erosion and sediment control plan
PIRMP	Pollution Incident Response Management Plan
POEO Act	*Protection of the Environment Operations Act 1997*
Project, the	Albion Park Rail bypass
REMM	Revised Environmental Management Measures
Roads and Maritime	Roads and Maritime Services – All references to Roads and Maritime should be interpreted as Transport for NSW (formerly Roads and Maritime Services)
RUSLE	Revised Universal Soil Loss Equation
Secretary	Secretary of the NSW Department of Planning and Environment
SMZ	Selected Material Zone

Abbreviation	Standard text
SPIR	Submissions and Preferred Infrastructure Report- A report developed to respond to submissions raised during the exhibition of the EIS and assess changes from the EIS
SWMP	Soil and Water Management Sub-plan
SWTC	Scope of Works and Technical Criteria (SWTC)
TfNSW	Transport for NSW
TSS	Total suspended solids
UDLCS	Urban Design and Landscape Character Strategy
UZF	Upper Zone Formation

1 Introduction

1.1 Context

This Soil and Water Management Sub-plan (SWMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Albion Park Rail bypass (Stage 2 – Princes Motorway between Yallah and Oak Flats) (the Project).

This SWMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA), the Albion Park Rail Bypass Environmental Impact Statement (EIS), as amended by the Submissions and Preferred Infrastructure Report (SPIR), including the revised environmental management measures (REMM) listed in the SPIR and all applicable legislation.

1.2 Background and project description

Transport for NSW (formerly Roads and Maritime Services) is extending the M1 Princes Motorway between Yallah and Oak Flats to bypass Albion Park Rail. The motorway completes the 'missing link' for a high standard road between Sydney and Bomaderry. The project is known as the Albion Park Rail bypass.

The Albion Park Rail Bypass EIS assessed the impacts of construction and operation of the Project on soils and water, within Chapters 8, 16 and 17.

As part of EIS development, a detailed hydrology, flooding and groundwater assessment were prepared to address the Environmental Assessment Requirements issued by the then Department of Planning. The assessments were included in the EIS as Technical paper 3 - hydrology and flooding, and Technical paper 11 - groundwater assessment.

The construction of the proposal would use standard procedures and guidelines to mitigate the following potential impacts:

- Soil erosion and sediment transport
- Landslip and mass movement of soils
- Disturbance of acid sulfate soils (ASS) and / or acid sulfate rock
- Disturbance of saline soils
- Disturbance of contaminated soils (if present)
- Settlement of soft soils
- Stormwater runoff
- Negative impacts on water quality.

The project catchment would experience a net reduction in pollutant export of all pollutants assessed compared to the existing condition. The water quality treatment strategy designed for the operational phase would therefore result in a net reduction in stormwater pollutant loadings entering Lake Illawarra.

1.3 Environmental management systems overview

The overall environmental management system for the Project is described in Chapter 3 of the CEMP.

The SWMP is part of Fulton Hogan's environmental management framework for the Project, as described in Chapter 4 of the CEMP. Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS) and Progressive Erosion and Sediment Control Plans (PESCP).

EWMS have been developed and signed off by environment and management representatives prior to associated works and construction personnel will be required to undertake works in accordance with the identified mitigation and management measures.

Used together, the CEMP, strategies, procedures, EWMS and PESCP form management guides that clearly identify required environmental management actions for reference by Fulton Hogan personnel and contractors.

The review and document control processes for this Plan are described in Section 1.6 of the CEMP.

1.4 Consultation for preparation of this SWMP

This SWMP (including the construction water quality monitoring program for surface water and groundwater) has been developed in consultation with the Environment Protection Agency (EPA), Department of Primary Industries (DPI) for Water (DPI Water), DPI Fisheries (DPI Fisheries) and relevant Councils (including Wollongong City Council and Shellharbour City Council). A summary of the key issues raised is provided below and it is noted that there were no outstanding issues.

Key observations raised by the EPA generally related to the project boundary; minimisation of the area of the site that is able to generate suspended material when water runs over it; inspection frequency; measurement of rainfall; and the use of Nephelometric Turbidity Unit (NTU) in place of Total suspended solids (TSS) to provide instantaneous in-field readings. The SWMP was revised in response to these observations and reissued to the EPA. It was acknowledged that Fulton Hogan had consulted with the EPA on the SWMP.

DPI Water recommended that groundwater should only be discharged for dewatering when the pH is between 6.5 and 8.5. Fulton Hogan confirmed that all dewatering/ discharge (including of groundwater) will be addressed in a dewatering Environmental Work Method Statement (EWMS), which will be prepared in early 2019, prior to dewatering activities on site. DPI Water accepted this approach.

DPI Fisheries commented on the monitoring of sediment controls and the dewatering EWMS. Fulton Hogan amended the SWMP inspection/ monitoring text and advised that a dewatering EWMS will be prepared in early 2019, prior to dewatering activities on site. DPI Fisheries advised their comments had been adequately addressed.

Wollongong City Council advised it had no comments.

Shellharbour City Council had one comment related to the responsibility for ongoing maintenance of temporary sediment basins. Fulton Hogan advised that all temporary sediment basins will be decommissioned at the end of the project, so there will be no ongoing maintenance of temporary basins beyond that time. Shellharbour City Council confirmed it had no further comment.

A summary of consultation undertaken during preparation of this Plan, including copies of all correspondence, is provided in Appendix A5 of the CEMP.

2 Purpose and objectives

2.1 Purpose

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

2.2 Objectives

The key objective of the SWMP (including the construction water quality monitoring program for surface water and groundwater) is to ensure all CoA, revised environmental management measures (REMM) and licence/permit requirements relevant to soil and water including water quality are described, scheduled and assigned responsibility as outlined in:

- The EIS
- Conditions of Approval granted to the project on 30/1/2018
- The environment protection licence (EPL)
- Roads and Maritime specifications G36, G38 and G40.

2.3 Targets

The following targets have been established for the management of soil and water impacts during the project:

- Ensure full compliance with the relevant legislative requirements, CoA and REMM
- Meet EPL water quality discharge parameters for all planned basin discharges (i.e. those within design capacity)
- Manage downstream water quality impacts attributable to the project (i.e. maintain water waterway health by avoiding the introduction of nutrients, sediment and chemicals outside of that permitted by the EPL and/or ANZECC guidelines)
- Ensure training on best practice soil and water management is provided to all construction personnel through site inductions.

2.4 Environmental performance outcomes

Table 2-1 identifies the construction-related environmental performance outcomes identified in the EIS as amended by the SPIR and how these will be achieved.

Table 2-1 Environmental performance outcomes

EIS reference	Environmental performance outcome	How achieved
Section 16.3.1 p501	Erosion and sediment controls during construction would be implemented in accordance with Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004)	Chapter 6 mitigation measure ID SWMM3
Section 16.5 p510, SW02	The construction surface water quality monitoring program would address the requirements of the project environment protection licence	Appendix B Construction water quality monitoring program
Section 16.3.1 p502	The project would minimise the impact associated with the disturbance of acid sulfate soils.	Chapter 6 mitigation measure ID SWMM87
Section 16.3.2, p505	The construction would maintain flow within watercourses crossed by the project during construction.	Chapter 6 mitigation measure ID SWMM40, SWMM41. FFMP Chapter 6 mitigation measure ID SWMM19.

EIS reference	Environmental performance outcome	How achieved
Section 16.5 SW02, p510	The project would prevent/ minimise pollution of waterways from refuelling of vehicles and other equipment and accidental spills.	Chapter 6 mitigation measure ID SWMM74-SWMM81
Section 17.5 SW02, p528	Construction water quality discharge would comply with the requirements of an environment protection licence for the project	Section 7.4 Chapter 6 mitigation measure ID SWMM60, SWMM61.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

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

3.1.2 Guidelines and standards

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

- Acid Sulfate Soil Manual (ASSMAC 1998)
- Acid Sulfate Soil and Rock – Victorian EPA Publication 655.1 – July 2009
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC and ARMCANZ 2000)
- Department of Environment and Conservation (DEC): Bunding & Spill Management. Insert to the Environment Protection Manual for Authorised Officers - Technical section "Bu" November 1997
- Managing Urban Stormwater: Soils and Construction. Landcom, (4th Edition) March 2004 (reprinted 2006) (the “Blue Book”). Volume 1 and Volume 2
- Volume 2A Installation of Services (DECCW 2008)
- Volume 2C Unsealed Roads (DECCW 2008)
- Volume 2D Main Roads Construction (DECCW 2008)
- DIPNR Roads and Salinity Guideline, 2003
- DLWC, 1998. Constructed Wetlands Manual.
- Fairfull, S. and Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla, 16 pp
- NSW Fisheries, November 2003. Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings (Ref: NSWF – 1181)
- Roads and Maritime Dewatering Guideline
- RTA’s Code of Practice for Water Management – Road Development and Management (1999)
- Approved Methods for the Sampling and Analysis of Water Pollutants in NSW – March 2004
- Guidelines for the Management of Acid Sulphate materials: Acid Sulphate Soils, Acid Sulphate Rock and Monosulphidic Black Ooze (RTA 2005)
- Roads and Maritime Environment Direction Management of Tannins from Vegetation Mulch
- Stockpile Site Management Guideline, Roads and Maritime 2011
- Roads and Maritime Guideline for Construction Water Quality Monitoring
- EPA publication “Approved Methods for the Sampling and Analysis of Water Pollutants in NSW.”
- Environmental Best Management Practice Guideline for Concreting Contractors, DEC, 2004.

3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed in Table 3-1 below and are from the State approval. There are no relevant federal CoA. 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 SWMP

<table>
<tr><th>CoA No.</th><th>Condition requirements</th><th>Document reference</th></tr>
<tr><td>C4</td><td>The following CEMP sub-plans must be prepared in consultation with the relevant government agencies identified for each CEMP sub-plan and be consistent with the CEMP referred to in Condition C1.

Table 3: CEMP Sub-plan Consultation Requirements
<table><tr><th></th><th>Required CEMP Sub-plan</th><th>Relevant government agencies to be consulted for each CEMP Sub-plan</th></tr><tr><td>a)</td><td>Traffic and transport</td><td>Relevant Council(s)</td></tr><tr><td>b)</td><td>Noise and vibration</td><td>EPA</td></tr><tr><td>c)</td><td>Fauna and Flora</td><td>OEH and DPI Fisheries</td></tr><tr><td>d)</td><td>Soil and water</td><td>EPA and DPI Water and Fisheries</td></tr><tr><td>e)</td><td>Heritage</td><td>OEH, Relevant Council(s), Registered Aboriginal Parties</td></tr><tr><td>f)</td><td>Flooding and Hydrology</td><td>OEH and Relevant Council(s)</td></tr></table></td><td>Section 1.4</td></tr>
<tr><td>C5
(a)</td><td>The CEMP sub-plans must state how:
The environmental performance outcomes identified in the EIS as amended by the SPIR as modified by these conditions will be achieved</td><td>Section 2.4.</td></tr>
<tr><td>(b)</td><td>the mitigation measures identified in the EIS as amended by the SPIR as modified by these conditions will be implemented;</td><td>Through the implementation of this SWMP (in particular refer to Section 3.3).</td></tr>
<tr><td>(c)</td><td>the relevant terms of this approval will be complied with (in particular Part E of this approval);</td><td>Through the implementation of this SWMP (in particular refer to Part E condition cross references below).</td></tr>
<tr><td>(d)</td><td>the identification of the relevant environmental specific training and induction processes for construction personnel; and</td><td>Section 7.2</td></tr>
<tr><td>(e)</td><td>issues requiring management during construction, as identified through ongoing environmental risk analysis, will be managed.</td><td>Chapter 5 second paragraph
Chapter 6</td></tr>
<tr><td>C6</td><td>The CEMP sub-plans must be developed in consultation with relevant government agencies identified in Table 3 of Condition C4 of this approval. Where an agency(ies) request(s) is not included, the Proponent must provide the Secretary justification as to why. Details of all information requested by an agency to be included in a CEMP sub-plan as a result of consultation, including copies of all correspondence from those agencies, must be provided with the relevant CEMP sub-plan.</td><td>Section 1.4</td></tr>
<tr><td>C7</td><td>Any of the CEMP sub-plans may be submitted to the Secretary for approval along with, or subsequent to, the submission of the CEMP but in any event, no later than one (1) month before commencement of construction.</td><td>CEMP (main section) Section 1.4</td></tr>
<tr><td>C8</td><td>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 SSI is being staged, construction of that stage is not to commence until the relevant CEMP and sub-plans have been approved by the Secretary, unless otherwise agreed by the Secretary.</td><td>CEMP (main section) Section 1.4</td></tr>
</table>

<table>
<tr><th>CoA No.</th><th>Condition requirements</th><th>Document reference</th></tr>
<tr><td>C9</td><td>The following Construction Monitoring Programs must be prepared in consultation with the relevant government agencies identified for each Construction Monitoring Program to compare actual performance of construction of the SSI against performance predicted performance:
Table 4: Construction Monitoring Program Consultation Requirements
<table><tr><th></th><th>Required Construction Monitoring Programs</th><th>Relevant government agencies to be consulted for each Construction Monitoring Program</th></tr><tr><td>a)</td><td>Air Quality</td><td>EPA</td></tr><tr><td>b)</td><td>Groundwater</td><td>DPI Water</td></tr><tr><td>c)</td><td>Surface Water</td><td>EPA and DPI Fisheries</td></tr><tr><td>d)</td><td>Noise</td><td>EPA</td></tr></table></td><td>Section 1.4
In accordance with CoA C16, the groundwater and surface water monitoring program requirements have been incorporated into this SWMP. See below.</td></tr>
<tr><td rowspan="9">C10</td><td>Each construction monitoring program must provide:
(a) details of baseline data available</td><td>Appendix B Construction water quality monitoring program – item 1.</td></tr>
<tr><td>(b) details of baseline data to be obtained and when</td><td>Appendix B Construction water quality monitoring program - item 1.</td></tr>
<tr><td>(c) details of all monitoring of the project to be undertaken;</td><td>Appendix B Construction water quality monitoring program - item 2.</td></tr>
<tr><td>(d) the parameters of the project to be monitored;</td><td>Appendix B Construction water quality monitoring program – item 3.</td></tr>
<tr><td>(e) the frequency of monitoring to be undertaken;</td><td>Appendix B Construction water quality monitoring program – Table B-1.</td></tr>
<tr><td>(f) the location of monitoring;</td><td>Appendix B Construction water quality monitoring program - item 2 and Figure B-1.</td></tr>
<tr><td>(g) the reporting of monitoring results;</td><td>Appendix B Construction water quality monitoring program – item 6
Section 7.8</td></tr>
<tr><td>(h) procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory; and</td><td>Appendix B Construction water quality monitoring program – item 5
Section 7.5</td></tr>
<tr><td>(i) any consultation to be undertaken in relation to the monitoring programs.</td><td>Section 1.4</td></tr>
<tr><td>C11</td><td>The Construction Monitoring Programs must be developed in consultation with relevant government agencies as identified in Condition C9 of this approval and must include, to the written satisfaction of the Secretary, information requested by an agency to be included in a Construction Monitoring Programs during such consultation. Details of all information requested by an agency including copies of all correspondence from those agencies, must be provided with the relevant Construction Monitoring Program.</td><td>Section 1.4</td></tr>
</table>

CoA No.	Condition requirements	Document reference
C12	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 the commencement of construction or within another timeframe agreed with the Secretary.	As permitted by CoA C16, the groundwater and surface water Construction Monitoring Programs have been incorporated into this SWMP. The Construction Monitoring Programs are therefore, endorsed by the ER by virtue of the endorsement of this SWMP on page 1.
C16	Where a relevant CEMP Sub-plan exists, the relevant Construction Monitoring Program may be incorporated into that CEMP Sub-plan.	The groundwater and surface water Construction Monitoring Programs have been incorporated into this SWMP.
PART E – SOILS		
E56	Erosion and sediment controls must be installed and appropriately maintained to minimise water pollution. When implementing such controls, any relevant guidance in the *Managing Urban Stormwater* series must be considered.	Chapter 6 mitigation measure ID SWMM3, SWMM7, SWMM20.
PART E – WATER		
E88	Strategies for the management of ASS during works must be implemented.	Chapter 6 mitigation measure ID SWMM87
E89	Where available and practicable, and of appropriate chemical and biological quality, stormwater, recycled water or other water sources shall be used in preference to potable water for the delivery of the SSI, including dust control.	Chapter 6 mitigation measure ID SWMM68
E90	Drainage feature crossings (permanent and temporary watercourse crossings and stream diversions) and drainage swales and depressions must be undertaken in accordance with relevant guidelines and designed by a suitably qualified and experienced person in consultation with DPI Fisheries and the EPA.	Chapter 6 mitigation measure ID SWMM3, SWMM4, SWMM5
E91	The realignment of Frazers Creek must be undertaken in consultation with and meet the reasonable requirements of DPI Fisheries.	Chapter 6 mitigation measure ID SWMM4 FFMP Chapter 6 mitigation measure ID FFMM17 Community Communication Strategy

3.3 Revised environmental management measures

Relevant REMM from the EIS as amended by the SPIR are listed in Table 3-2 below. This includes a cross reference as to where the measure is addressed in this Plan or other Project management documents.

Table 3-2 Revised environmental management measures relevant to this SWMP

ID No.	Revised environmental management measure	Document reference
SW01	Industry standard erosion and sediment controls will be designed and implemented in accordance with the following specifications and guidelines: • Managing Urban Stormwater: Soils and Construction (Landcom, 2004) • Roads and Maritime's Erosion and Sedimentation Management Procedure (PN143) • Roads and Maritime's Soil and Water Management Specification (G38) • The NSW Office of Water's guidelines for Controlled Activities. • Volume 2D Main Road Construction published (DECC, 2008). These controls will be established before the start of construction and maintained in effective working order for the duration of the construction period until the site is restored.	Section 3.1.2 Chapter 6 mitigation measure ID SWMM3 Chapter 6 mitigation measure ID SWMM2, SWMM6.
SW02	The CEMP will include a construction soil and water quality management plan to manage potential impacts on soils and receiving watercourses, to include, but not be limited to:	This SWMP
	• Objectives and targets for soil and water quality management	Sections 2.2, 2.3
	• Information on the relevant statutory and other requirements relating to soils and water quality, including any permits or licences required for the project	Chapter 3 Section 7.4
	• Details of any consultation requirements under the Plan	Section 1.4
	• An overview of the existing environment and potential impacts related to the construction works.	Chapters 4, 5
	Measures to manage impacts of the project including in relation to:	Chapters 6
	• Soils, erosion and sedimentation	Chapter 6 mitigation measure ID SWMM1 - SWMM68.
	• Stockpile management	Chapter 6 mitigation measure ID SWMM3, SWMM5, SWMM23, SWMM25, SWMM28, SWMM59, SWMM67.
	• Spoil and fill management	Chapter 6 mitigation measure ID SWMM3, SWMM5, SWMM6, SWMM7.
	• Surface water quality	Chapter 6 mitigation measure ID SWMM60 - SWMM68.
	• Groundwater levels	Section 7.3

ID No.	Revised environmental management measure	Document reference
	• Discharges from sedimentation basins, ASS treatment areas and groundwater de-watering	Chapter 6 mitigation measure ID SWMM60, SWMM87.
	• Acid sulfate soils and contaminated lands	Acid sulfate soils: Chapter 6 mitigation measure ID SWMM87 Contaminated lands: Chapter 6 mitigation measure ID SWMM85
	• Significant weather events (such as heavy rainfall or flooding)	Chapter 6 mitigation measure ID SWMM66
	• Re-fuelling of vehicles and other equipment and accidental spills	Chapter 6 mitigation measure ID SWMM74-SWMM81
	• Unexpected finds such as asbestos or contaminated fill	Unexpected Contaminated Land and Asbestos Finds Procedure (CoA E60) – to be completed separately to this SWMP
	A surface water quality monitoring program that as a minimum addresses the requirements of the project environment protection licence	Chapter 6 mitigation measure ID SWMM64
	Auditing and reporting requirements	Sections 7.7, 7.8.
	Site inductions and training for construction personnel in the implementation of the Plan	Section 7.2
	The strategy will be prepared in accordance with the relevant industry standard guidelines and procedures.	Section 3.1
SW03	The size, location and number of temporary sedimentation basins to treat site runoff during construction will be confirmed during detailed design. The design process will consider the site constraints (such as topography and ecology), land take, and proximity to receiving waters and / or sensitive receiving waters. They will be designed in accordance with Managing Urban Stormwater: Soils and Construction (Landcom, 2004).	Chapter 6 mitigation measure ID SWMM1-SWMM3
SW04	An emergency spill response procedure will be prepared to minimise the impact of any accidental spills, and include details on the requirements for managing spills, disposing of any contaminated waste, and reporting of any such incidents.	Incident and Emergency Response Plan (IERP) Appendix B WEMP Table 5-2 for disposal of spill kit materials CEMP (main section) Section 3.6 for incident reporting

ID No.	Revised environmental management measure	Document reference
SW05	Areas of potential environmental concern with respect to contamination are identified in this environmental impact statement. The risks posed by work in these areas will be evaluated and managed through a Phase 2 Assessment including: • A review of historical information • Targeted sampling and analysis of samples at the areas of potential environmental concern in accordance with the National Environmental Protection (Assessment of Site Contamination) Measure (2013). In the event the Phase 2 Assessment identifies any areas of contamination that are to be impacted by the project, the CEMP will include a strategy to manage these areas, prepared in accordance with the Guidelines for the Management of Contamination (Roads and Maritime, 2013e).	Contaminated Land Management Sub-plan (CLMP)
GW01	Groundwater monitoring will be undertaken adjacent to groundwater dependent ecosystems in close proximity to the project to identify the potential impacts of dewatering or depressurisation of groundwater as a result of the project. The decision to cease groundwater monitoring in the operational phase, following construction, will be confirmed in consultation with a suitably qualified independent expert.	Appendix B Construction water quality monitoring program Annexure B1 Baseline water quality monitoring program (by RMS)

4 Existing Environment

The soil and water quality environment within the work footprint and its environs is described below. This information is a summary of chapter 16 (soils and surface water quality) and chapter 17 (groundwater) of the EIS.

4.1 Topography and soil characteristics

4.1.1 Topography

Topography within the project area generally consists of undulating hills in the north and south, separated by lower lying coastal floodplain (EIS, p488).

The northern-most part of the project area (near Penrose) is on a broad spur made up of the consolidated rock materials of the Berry Formation (siltstone, shales and sandstones). This spur separates the lower lying Quaternary era alluvial and swamp deposits at Koonawarra to the north, and Duck Creek to the south. Relief in the northern portion of the project area averages 3.5 per cent between Penrose in the north, and Duck Creek in the south. Mount Brown, a regionally significant topographical feature (100 metres Australian height datum (AHD)) is situated one kilometre north-east of the project area at Penrose (EIS, p488).

The topography of the project area gently rises in a northerly direction from about nine metres AHD at its crossing of the Duck Creek floodplain near Yallah to about 30 metres AHD in the vicinity of Haywards Bay. The project area then traverses the Macquarie Rivulet and Frazers Creek floodplains at a relatively consistent elevation of less than six metres AHD through to Tongarra Road. From Tongarra Road through to the southern extent of the project area at Oak Flats, the project area is characterised by gently undulating hills of the Berry Formation. This portion of the project area has a local relief of 20 metres and slopes in the order of five per cent (EIS, p488).

4.1.2 Geology

Published geological information contained within the Wollongong-Port Hacking 1:250 000 Geological Series Sheet (Stroud et al, 1985) indicates the project area traverses two principal geological landscapes – the Permian era Berry Formation and Quaternary era alluvial and swamp deposits. The former geological landscape is present in the northern and southern parts of the project area (principally north of Duck Creek and south of Tongarra Road). Quaternary era alluvium and swamp deposits are largely situated within the central part of the project area, mirroring the floodplains of the present day Duck Creek, Macquarie Rivulet and Frazers Creek (EIS, p488). The geological units present within the project area are shown in Figure 4-1.

The Berry Formation is locally comprised of red brown and grey volcanic sandstones north of Duck Creek and mid grey to grey siltstone and fine sandstone to the south of Duck Creek (Troedson and Hashimoto, 2013). Quaternary era alluvium associated with the Duck Creek floodplain is locally described as Holocene floodplain deposits, comprised of silts, fluvial sand and clay (Troedson and Hashimoto, 2013). Further south, near Macquarie Rivulet and Frazers Creek, the Quaternary era alluvial deposits form a complex of related units, including floodplain deposits (silt, fluvial sand, clay), levee deposits (fluvial sand, silt and clay) and alluvial paleo channel filling units (organic mud, peat, clay, silt, fluvial sand) (EIS, p488).

The Albion Park Rail Bypass Factual Geotechnical Report, Stages 1, 2 and 3 (Golder Associates, 2015) describes the geological conditions that were encountered in the course of the preliminary geotechnical investigation. In the northern portion of the project area, the cut face adjacent to the northbound lanes of the Princes Highway is comprised of sandstone of the Berry Formation. Moving south, at the level of the Princes Highway, the bedrock occurs at shallow depths and comprises siltstones of the Berry Formation with a thin veneer of silty residual soils. This ground profile is reasonably consistent in the project area between the Princes Highway and the South Coast Rail Line, across the old golf course and through the cut down towards the Macquarie Rivulet. The depth to bedrock is relatively shallow and outcropping siltstone can be seen in the small cutting on the eastern side of the rail line (EIS, p489).

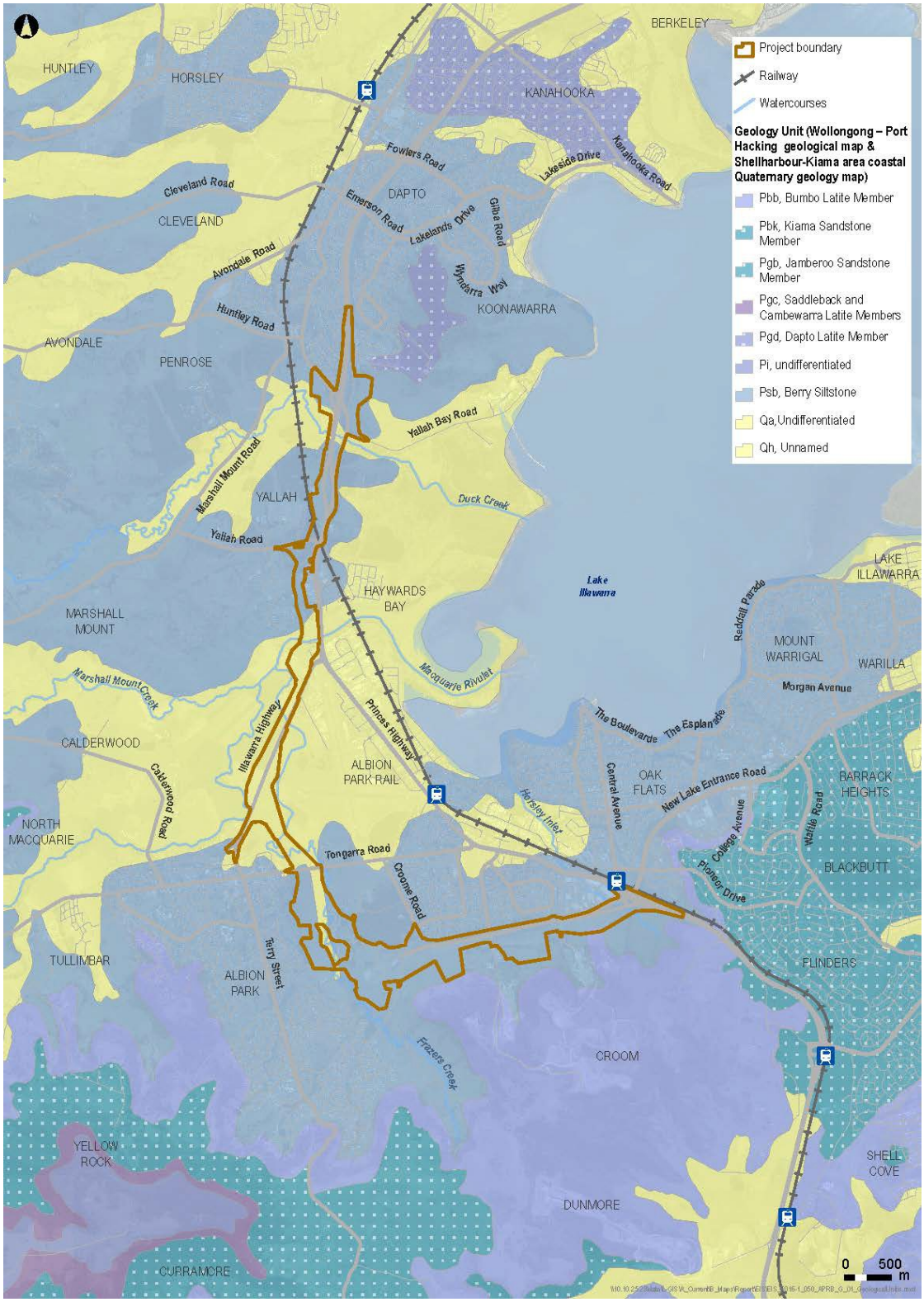

Figure 4-1 Geological units (EIS, p491)[1]

[1] It is noted that the project boundary in the SPIR (not the EIS) is the approved project boundary for the overall approved State Significant Infrastructure (SSI 6878). However, the Project forms Stage 2 of SSI 6878 only. Stage 2 comprises the extension of the Princes Motorway between Yallah and Oak Flats and all associated works including bridges, interchanges and local road changes or upgrades (excluding Stage 3 – Yallah Interchange; and any work as part of Stage 1 - Croom Regional Sporting Complex reconfiguration). For additional details refer to the Albion Park Rail bypass Staging Report (Roads and Maritime, March 2018).

In the area south of the Yallah cut, the bedrock level drops off steeply on the northern bank of the Macquarie Rivulet and then rises rapidly on the southern bank, indicating the extent of the remnant channel of the river. Here the deep alluvial soils are potentially compressible (EIS, p489).

The central part of the project area comprises a relatively flat and poorly drained floodplain fed by the Macquarie Rivulet and Frazers Creek. On the southern bank of the Macquarie Rivulet, there is a thin cover of alluvial soil overlying shallow siltstone bedrock. The depth to bedrock rapidly drops off southwards. Further south the surficial soils comprise interbedded varieties of Holocene Age and Pleistocene Age soils. Through the floodplain the depth to bedrock varies between nine metres and 20.5 metres. The covering soils contain zones of soft clays that appear to be coincident with the Pleistocene Age soils (EIS, p488).

As the project route heads south beyond Tongarra Road, the soft alluvial soils are not present, giving way generally to more granular alluvial deposits on approach to the Croom Regional Sporting Complex. Beneath the existing cricket pitch at the Croom Regional Sporting Complex, the depth to bedrock reduces rapidly from around 11 metres to 1.1 metres with a thin veneer of silty clayey residual soils and alluvial soils. While the bedrock mainly comprises siltstone and sandstone, an area of basalt was observed close to the cricket pitch (EIS, p489).

In the region of the existing East West Link, the siltstone bedrock is exposed in the cut faces. Shallow bedrock is typically present for the majority of the East West Link. The higher ground to the south is mainly underlain by latites with some meta-siltstone lenses, with rock head being encountered between one metre and 2.5 metres below existing ground level (EIS, p488).

4.1.3 Soil landscapes

Four soil landscapes, as defined by Hazelton (1992) occur within project area: the Albion Park, Fairy Meadow, Shellharbour and Bombo soil landscapes. The Albion Park and Fairy Meadow soil landscapes are the most common, while the Shellharbour and Bombo soil landscapes are present in a smaller extent to the far north and south of the project area respectively (EIS, p490).

The Albion Park soil landscape is an erosional landscape typified by short steep upper slopes and gentle foot slopes. This soil landscape follows the Berry Geological Formation, and is primarily located in the northern and south-eastern parts of the project area (EIS, p490).

The Fairy Meadow soil landscape is a swamp landscape. It occurs in the project area as a series of broad alluvial plains bisected by Duck Creek, Macquarie Rivulet and Frazers Creek. This soil landscape occurs in the central portion of the study area on unconsolidated Quaternary era deposits. ASS and soft soils within the project area occur principally within the Fairy Meadow soil landscape (EIS, p490).

The erosional Bombo soil landscape follows the distribution of the Bombo Latite. In the project area it takes the form of rolling low hills with benched slopes (EIS, p490).

The erosional Shellharbour soil landscape is characterised by rolling low hills with long side- slopes and broad drainage plains on Budgong Sandstone (EIS, p490).

The geotechnical investigation for the environmental impact statement (Golder Associates, 2015) found a thin veneer of residual soil cover in the north of the project area, over shallow siltstone bedrock. In the central part of the project area, south of Macquarie Rivulet, bedrock was reported at depths of between nine and 20 metres below ground level, overlain by soft clays consistent with the Fairy Meadow soil landscape. Shallow soils were encountered south of the Fairy Meadow soil landscape near the Croom Regional Sporting Complex. Soil landscapes within the project area are shown in Figure 4-2 (EIS, p490).

Figure 4-2 Soil Landscapes (EIS, p492)[2]

[2] It is noted that the project boundary in the SPIR (not the EIS) is the approved project boundary for the overall approved State Significant Infrastructure (SSI 6878). However, the Project forms Stage 2 of SSI 6878 only. Stage 2 comprises the extension of the Princes Motorway between Yallah and Oak Flats and all associated works including bridges, interchanges and local road changes or upgrades (excluding Stage 3 – Yallah Interchange; and any work as part of Stage 1 - Croom Regional Sporting Complex reconfiguration). For additional details refer to the Albion Park Rail bypass Staging Report (Roads and Maritime, March 2018).

4.1.4 Acid sulfate soils

The NSW Coastal Acid Sulfate Soils Risk Mapping Series (Department of Land and Water Conservation, 1995) groups land with ASS risk in one of five classes on the basis of the potential impacts that may result from different types of work. In the context of soil disturbance, Class 1 represents the highest risk and Class 5 the lowest risk. The project area includes soils mapped under all five risk classes, as follows (EIS, p493):

- North of Macquarie Rivulet is mapped as Class 5. Soil disturbance would occur in this part of the project area, associated with cuttings to a maximum of eight metres below ground level
- The area around Macquarie Rivulet, Frazers Creek and the associated floodplains is mapped as a complex of Classes 1, 2, 3 and 5. Soil disturbance in this area would be limited to piling for the installation of bridge supports and shallow topsoil stripping from beneath embankments
- The area from the Macquarie Rivulet – Frazers Creek confluence south to Tongarra Road is mapped as Class 4. Shallow soils in this area would be removed in preparation of the construction of elevated soil embankments
- The area between Tongarra Road and the south-eastern extent of the project area at Oak Flats is mapped as Class 5. Elevated embankments are proposed in this area and relatively limited soil would be removed.

As part of the geotechnical investigation for the project, 20 soil samples were collected from boreholes mostly in the central portion of the project area. Laboratory analysis indicated 14 of the 20 samples were found to meet the criteria for the potential to generate acid from exposed soils. The samples that exceeded the trigger levels were collected from boreholes at a range of depths and were located principally on the Macquarie Rivulet and Frazers Creek floodplains, and from the banks of Macquarie Rivulet south to Tongarra Road. A sample from a borehole adjacent to the TransGrid Central Region Dapto Office near the Princes Highway was reported at a concentration that exceeded the trigger level (EIS, p493).

Borehole logs from the project's geotechnical investigation (Golder Associates, 2015) show that pyrite (an indicator for acid sulfate rock) was widely observed within the rock materials in the project area at depths ranging from six through to 20 metres below ground. Analysis of a sample collected from a borehole near Yallah Road indicated acid sulfate rock potential. It is considered likely that there are other areas of acid sulfate rock in the project area, and these would be identified via additional geotechnical investigation during detailed design (EIS, p493).

4.1.5 Soft soils

Soft soils are consistently distributed through the central portion of the site associated with the Fairy Meadow soil landscape, a Quaternary era landscape typified by alluvial and swamp deposits. The thickness of soft soils in the project area ranges from a few metres up to 10 metres across the central domain (Golder Associates, 2015).

4.1.6 Salinity

The Fairy Meadow soil landscape, which occurs within the central part of the project area, is reported to exhibit salinity (Hazelton, 1992). Furthermore, a soil salinity investigation carried out for the nearby West Dapto future growth area (MG Planning, 2006) identified saline soils to the immediate north of the project area, in the suburb of Horsley and near Avondale Road in Penrose. Higher levels of soil salinity are expected in the area due to the estuarine nature of adjacent watercourses.

4.1.7 Contaminated land

According to Chapter 16 of the EIS, there are not any known sites of contamination within the project area that have been regulated under the *Contaminated Land Management Act 1997* (NSW) (EIS, p494).

Based on the background review, and site inspection, a number of potentially contaminating land uses have been identified within the project area. The subject sites are designated as areas of

potential environmental concern for the purposes of this assessment. These areas of potential environmental concern are (Figure 4-3):

- The area adjacent to and within the South Coast Rail Line where it crosses the project. This area includes all of the rail corridor
- Commercial buildings on Yallah Road
- Commercial buildings adjacent to the intersection of the Illawarra and Princes Highways
- Dairy located west of the proposed motorway alignment, near the Illawarra Highway
- A heavy vehicle parking area south of the Durgadin Drive/ East West Link intersection, associated with a quarry.

In addition to the specific areas of potential environmental concern, the local topography and existing infrastructure in the project area (including the Princes Highway and Illawarra Highway) suggests roads and roadside levee banks have commonly been built using fill. Fill has been used in parts of the Croom Regional Sporting Complex to level the playing fields (EIS, p494).

Where the origin of imported fill cannot be reliably identified, the material has the potential to include contaminants. Filled parts of the site are therefore considered to represent areas of potential environmental concern until such time as the composition or source of the fill materials can be determined as suitable for the proposed land use (EIS, p494).

Potential contaminants of concern are commonly grouped according to industry type. The potential contaminants of concern with potential to occur in the project area (and their industry type) include (EIS, p494):

- Hydrocarbons, arsenic, phenolics (creosote), heavy metals, nitrates and ammonia (railway yards)
- Hydrocarbons, metals, solvents (scrap yards)
- Fertilizer, insecticides, fungicides, herbicides (agricultural and horticultural activities)
- Hydrocarbons, metals, solvents, acids/alkalis, refrigerants, antifreeze (engine works).

Filling materials that have been used in the project area have the potential to include some or all of these potential contaminants of concern, along with asbestos (EIS, p494).

The preliminary contamination assessment has identified some areas of potential environmental concern which require further assessment. Consistent with the Guideline for the Management of Contamination (Roads and Maritime, 2013e) and the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended 2013, this further assessment would include intrusive investigations, sampling and laboratory analysis. The design of the intrusive investigations would be in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* and the *Contaminated Sites: Sampling Design Guidelines* (Environment Protection Authority, 1995). The further assessment would be documented in a detailed site investigation prepared in accordance with the NSW Environment Protection Authority Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (Office of Environment and Heritage, 2011b) (EIS, p494).

Should the detailed site investigation confirm the presence of contaminants in excess of the relevant guideline values, and conclude that remediation or management measures are required to make the site suitable for the proposed use, a remedial action plan would be developed. The plan would document the approach to remediation and detail the requirements to validate that the site was suitable for the proposed use (EIS, p494).

Subsequent to the EIS, the Hyder Cardno Joint Venture (HCJV) (employed by Roads and Maritime) identified seven locations which were further investigated within the Albion Park Rail bypass footprint. Environmental Site Assessments (ESAs) for those locations presented advice on the subsurface conditions of the sites relative to their intended land use as a road corridor and provided soil management options when required. Refer to the Contaminated Land Management Sub-plan (CLMP) for additional details as required.

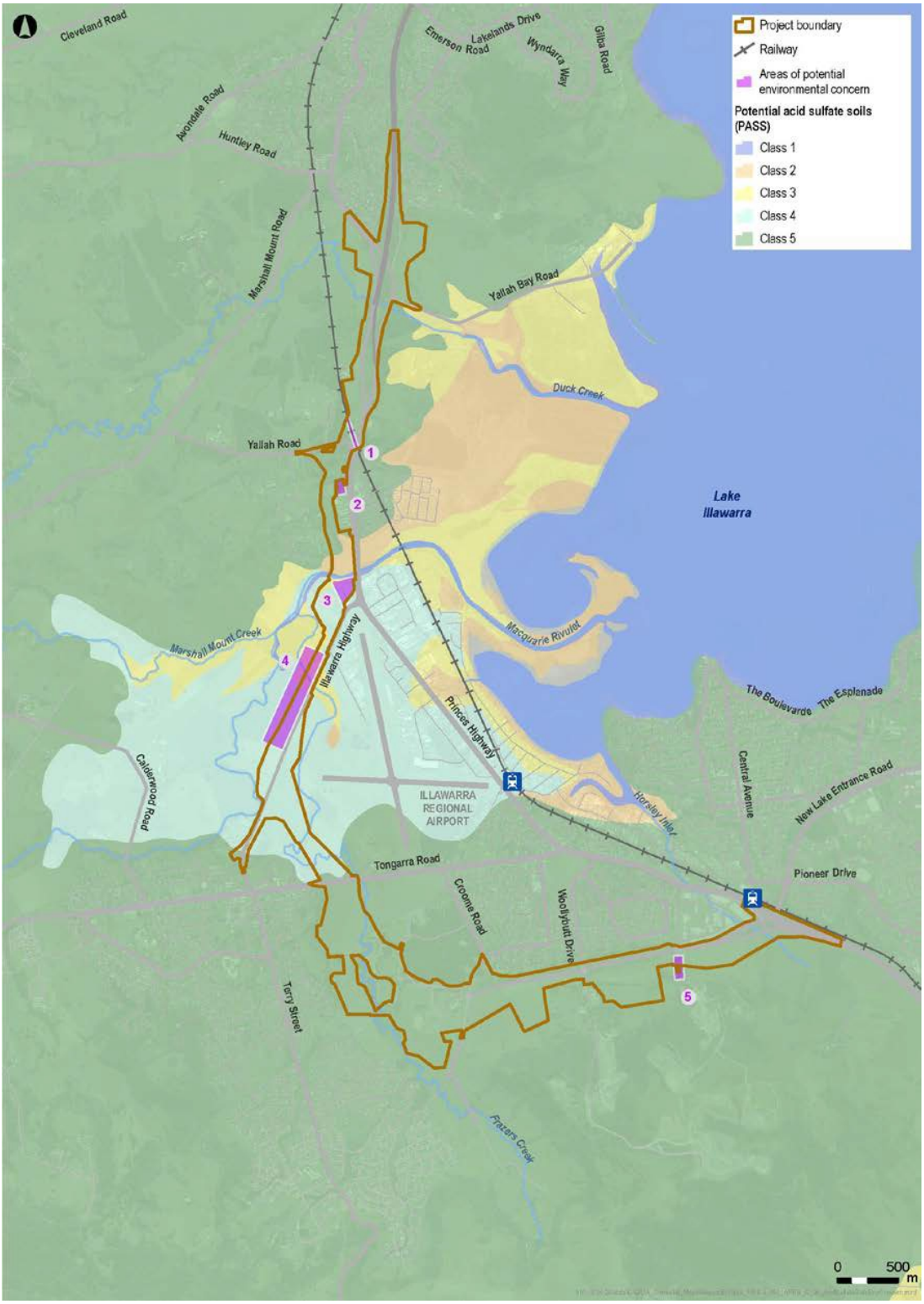

Figure 4-3 Areas of potential environment concern and potential ASS (EIS, p496)[3]

[3] It is noted that the project boundary in the SPIR (not the EIS) is the approved project boundary for the overall approved State Significant Infrastructure (SSI 6878). However, the Project forms Stage 2 of SSI 6878 only. Stage 2 comprises the extension of the Princes Motorway between Yallah and Oak Flats and all associated works including bridges, interchanges and local road changes or upgrades (excluding Stage 3 – Yallah Interchange; and any work as part of Stage 1 - Croom Regional Sporting Complex reconfiguration). For additional details refer to the Albion Park Rail bypass Staging Report (Roads and Maritime, March 2018).

4.2 Surface water

4.2.1 Receiving waters and sensitive receiving environments

The project area drains to three main watercourses, all of which are tributaries of Lake Illawarra:

- Duck Creek
- Macquarie Rivulet, which is fed by Marshall Mount Creek and Frazers Creek
- Horsley Creek.

These watercourses are characterised by largely rural landscapes which are predominantly cleared for rural purposes such as grazing. As these watercourses reach Lake Illawarra they are flow through townships located adjacent to the shoreline, where they are influenced by directed stormwater from urban areas. Some commercial and industrial facilities are also located in the catchment for these watercourses. Large scale land development in West Dapto and Calderwood in the upstream of the catchments also has the potential to result in impacts to these watercourses both from existing works (e.g. via erosion and sedimentation related to construction works) and into the future (e.g. due to changes to stormwater quality from these new urban areas) (EIS, p497).

These watercourses, and Lake Illawarra, comprise the receiving waters for the project, and have the potential to be impacted by the project during its construction and/or operation.

These receiving waters comprise a range of sensitive riparian and aquatic ecosystems that support a diverse range of flora and fauna. They may have high conservation value, be highly valued by the community, support human uses (such as fishing or aquaculture), or be susceptible to water pollution. These sensitive ecosystems are referred to as sensitive receiving environments (EIS, p497).

Sensitive receiving environments for the project area are mapped in Figure 4-4. Those that have potential to be indirectly impacted by the project via water quality impacts are located within and downstream of the project area and include (EIS, p497):

- The aquatic and riparian ecosystems of Duck Creek, Macquarie Rivulet and Horsley Creek. The Macquarie Rivulet and Horsley Creek also comprise of key fish habitat
- Freshwater wetlands and saltmarsh threatened ecological communities
- State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP). The Coastal Management SEPP commenced on 3 April 2018. It aims to promote an integrated and coordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the *Coastal Management Act 2016*. The Coastal Management SEPP consolidates and consequently repeals SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection)
- Groundwater dependent ecosystems
- Lake Illawarra, which is a Nationally Important Wetland (NSW081), a key fish habitat, and a popular place for recreational fishing and swimming.
- Seagrass beds located in Lake Illawarra.

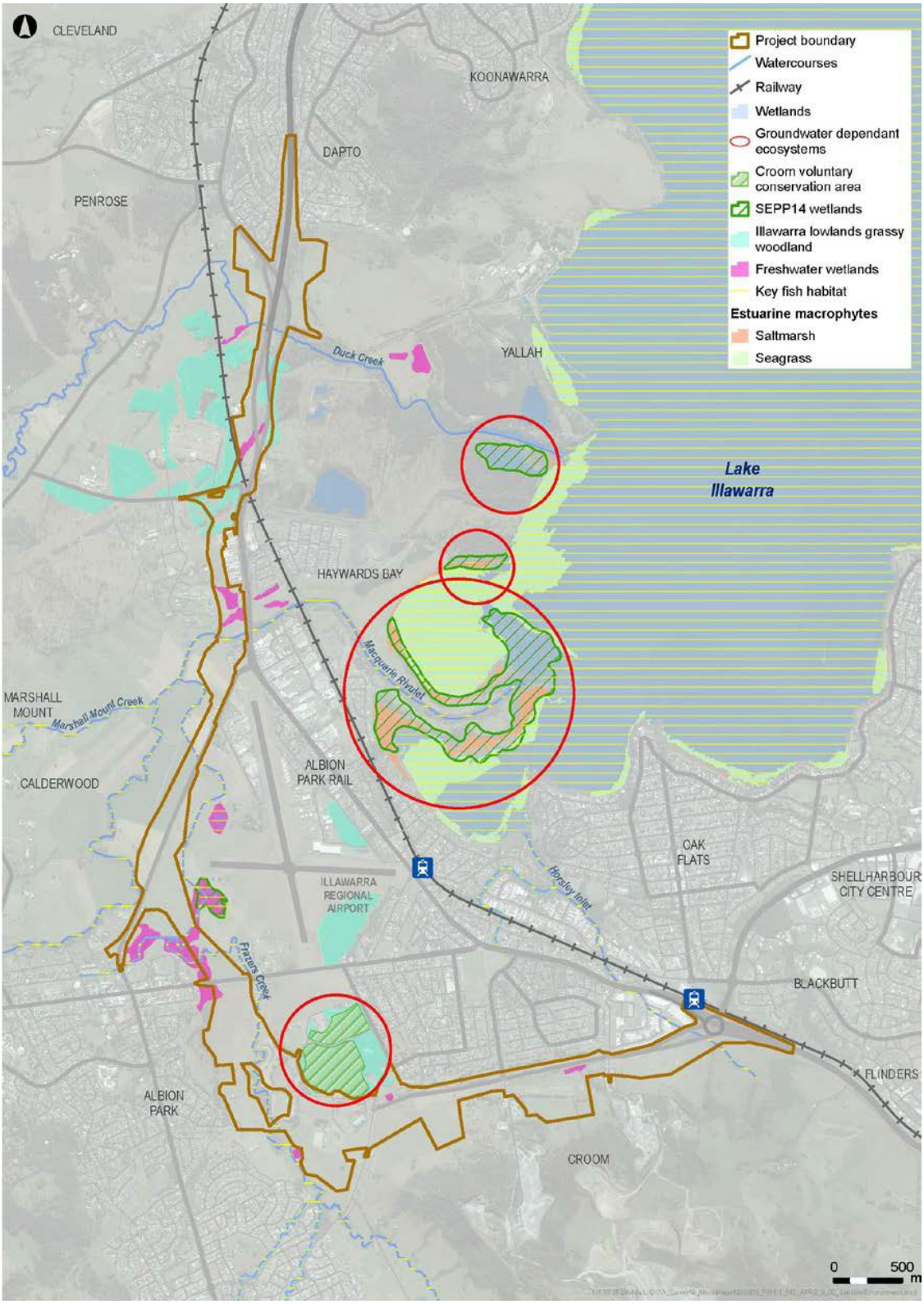

Figure 4-4 Sensitive receiving environments (EIS, p498)[4]

[4] It is noted that the project boundary in the SPIR (not the EIS) is the approved project boundary for the overall approved State Significant Infrastructure (SSI 6878). However, the Project forms Stage 2 of SSI 6878 only. Stage 2 comprises the extension of the Princes Motorway between Yallah and Oak Flats and all associated works including bridges, interchanges and local road changes or upgrades (excluding Stage 3 – Yallah Interchange; and any work as part of Stage 1 - Croom Regional Sporting Complex reconfiguration). For additional details refer to the Albion Park Rail bypass Staging Report (Roads and Maritime, March 2018).

4.2.2 Surface water quality

The most recently published State of the Environment Report by Shellharbour City Council is for 2010–2011 (Shellharbour City Council, 2011). It presents water quality data for the lower reaches of both Horsley Creek and the Macquarie Rivulet, which is summarised in Table 4-1. Values shown in red text represent exceedances of the trigger levels for aquatic ecosystem health guidelines, with the exception of the dissolved oxygen concentration for lower Horsley Creek, which is below the desirable range for estuaries. The Australian and New Zealand Environment and Conservation Council (2000) Guideline values for fresh and marine water quality are (EIS, p499):

- Chlorophyll a: Four micrograms per litre
- Total nitrogen: 0.3 milligrams per litre
- Total phosphorus: 0.03 milligrams per litre
- Dissolved oxygen 80-110 per cent.

The State of the Catchment 2010 Riverine Ecosystems report for the Southern Rivers Region (NSW Government, 2010a) states that the Macquarie Rivulet had numerous exceedances of the guidelines for concentrations of total nitrogen and total phosphorous during the reporting period, and that turbidity levels were high. This is generally consistent with the results presented in the State of the Environment Report (Shellharbour City Council, 2011).

This data indicates that both the Macquarie Rivulet and Horsley Creek are subject to an existing level of impact from the road network and other activities in the catchment. It is noted that the existing road network has limited provision for treating stormwater runoff from the road surface. This is likely contributing to some of the observed water quality issues, along with other land uses in the catchment, including the railway, urban development, agriculture and sporting fields (EIS, p499).

Table 4-1 Existing water quality - Horsley Creek and Macquarie Rivulet (EIS, p500)

Watercourse	Chlorophyll-a (µg/L)		Total Nitrogen (mg/L)		Total phosphorous (mg/L)		Dissolved oxygen (%)	
	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011	2009-2010	2010-2011
Lower Horsley Creek	5.4	6.6	0.41	0.7	0.07	0.31	Not available	70.6
Lower Macquarie Rivulet	1.05	1.3	0.74	0.5	0.11	0.08	Not available	85.8

There was no publicly available water quality data for Duck Creek to enable a similar assessment of existing water quality. The environmental impact statement assumes that the water quality would be subject to a similar level of impact as the Macquarie Rivulet and Horsley Creek.

4.3 Groundwater

This chapter is summarised from Chapter 17 of the EIS.

4.3.1 Groundwater characteristics

The project area is located within the Sydney Basin South Groundwater Source, which is bounded by the Illawarra Range to the north, the Turpentine Range to the south and east, and the geological boundary of the Goulburn Fractured Rock to the west. The groundwater source has a total area of just over 3000 square kilometres. Bores accessing the groundwater source are mainly limited to the northern half of its extent, with National Parks covering much of the southern part (NSW Office of Water, 2011a). The relatively high rainfall and considerable topographical relief suggest that the groundwater contours can be expected to follow the topography. Groundwater discharge is therefore most likely to occur in the low lying coastal area. The study area and project location are mapped in Figure 4-5, which also shows the distribution of bores (EIS, p517).

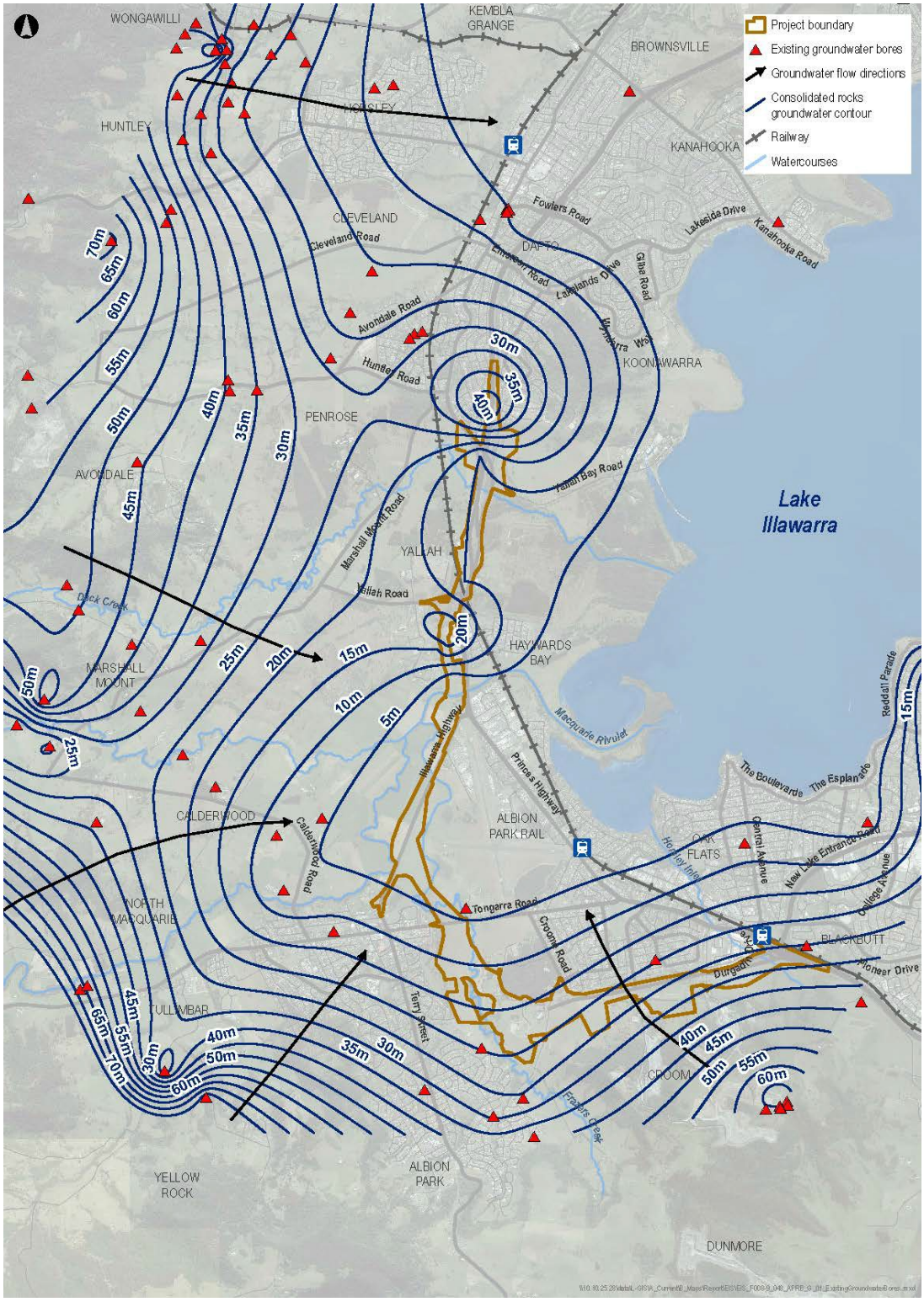

Figure 4-5 Groundwater assessment study area showing existing groundwater bores (EIS, p518)[5]

[5] It is noted that the project boundary in the SPIR (not the EIS) is the approved project boundary for the overall approved State Significant Infrastructure (SSI 6878). However, the Project forms Stage 2 of SSI 6878 only. Stage 2 comprises the extension of the Princes Motorway between Yallah and Oak Flats and all associated works including bridges, interchanges and local road changes or upgrades (excluding Stage 3 – Yallah Interchange; and any work as part of Stage 1 - Croom Regional Sporting Complex reconfiguration). For additional details refer to the Albion Park Rail bypass Staging Report (Roads and Maritime, March 2018).

4.3.2 Groundwater use

The EIS (p519) identified that there are 104 bores located in the groundwater study area, of which a total of 66 are used for water supply. None of the bores used for water supply are located within the project boundary; and most are located further to the west and north-west of the project area.

The licences for water supply bores indicate that they are typically used for watering stock, domestic use and monitoring groundwater. A total of 36 bores used for monitoring are located on five properties, appear to be associated with industrial activity on the subject sites (EIS, p519).

Of the 66 licenced producing bores, 28 are targeting the consolidated rock formation and only two bores are targeting alluvium formations. This reflects the bore yield and groundwater characteristics described in Section 17.2.1 of the EIS, namely that better groundwater resources are found in the fractured rock units of the consolidated formation.

A total of nine bores are used for recreational, industrial and irrigation purposes. Those bores are licenced and have a defined water allocation. Groundwater allocations range from one to 19 megalitres per year (or equivalent share units). The larger groundwater allocation is for recreation purpose with 19 megalitres per year (or equivalent share units) of groundwater allocation.

It is noted that this information is based on a review of the groundwater licences, and does not necessarily reflect the current and ongoing use of the bores (EIS, p519).

4.3.3 Groundwater quality

Based on the fact that the data collation and review in relation to contaminated soils did not identify any known sites of contamination (refer Section 16.2.1 of the EIS), it is considered that there is a low likelihood of encountering contaminated groundwater (EIS, p519).

4.3.4 Groundwater dependent ecosystems

Within the Greater Metropolitan Region for the Sydney Basin South groundwater source, the Macquarie Rivulet estuary wetland is the only defined groundwater dependent ecosystem of high significance near the project (EIS, p520). It is located 1.3 kilometres east of the project and adjacent to Lake Illawarra. The groundwater levels would be close to the surface near Lake Illawarra, and would contribute to the groundwater dependent of the Coastal Management SEPP in this location (EIS, p520).

Other freshwater wetlands (such as the Freshwater Wetlands endangered ecological community) may be only partly sustained by groundwater, relying primarily on surface water flows. A Coastal Management SEPP on Frazers Creek, located directly east of the project, supports low-level vegetation and freshwater fauna, and is potentially partially supported by groundwater. Based on a review of the information presented in Technical Paper 4- Biodiversity Assessment Report, it is not considered to be a high-value groundwater dependent ecosystem (EIS, p520).

It is expected that only deep rooted freshwater wetland communities are expected to be reliant on groundwater. This would include the Illawarra Lowland Grassy Woodland endangered ecological community, which is thought to be partially reliant on groundwater. One Illawarra Lowland Grassy Woodland community located close to the project in Croom Reserve is identified as having a high priority for conservation due to its status as an endangered ecological community that forms part of the Voluntary Conservation Area (see Chapter 9 of the EIS). This community is therefore considered to be a groundwater dependent ecosystem.

The groundwater dependent ecosystems are mapped in Figure 4-6.

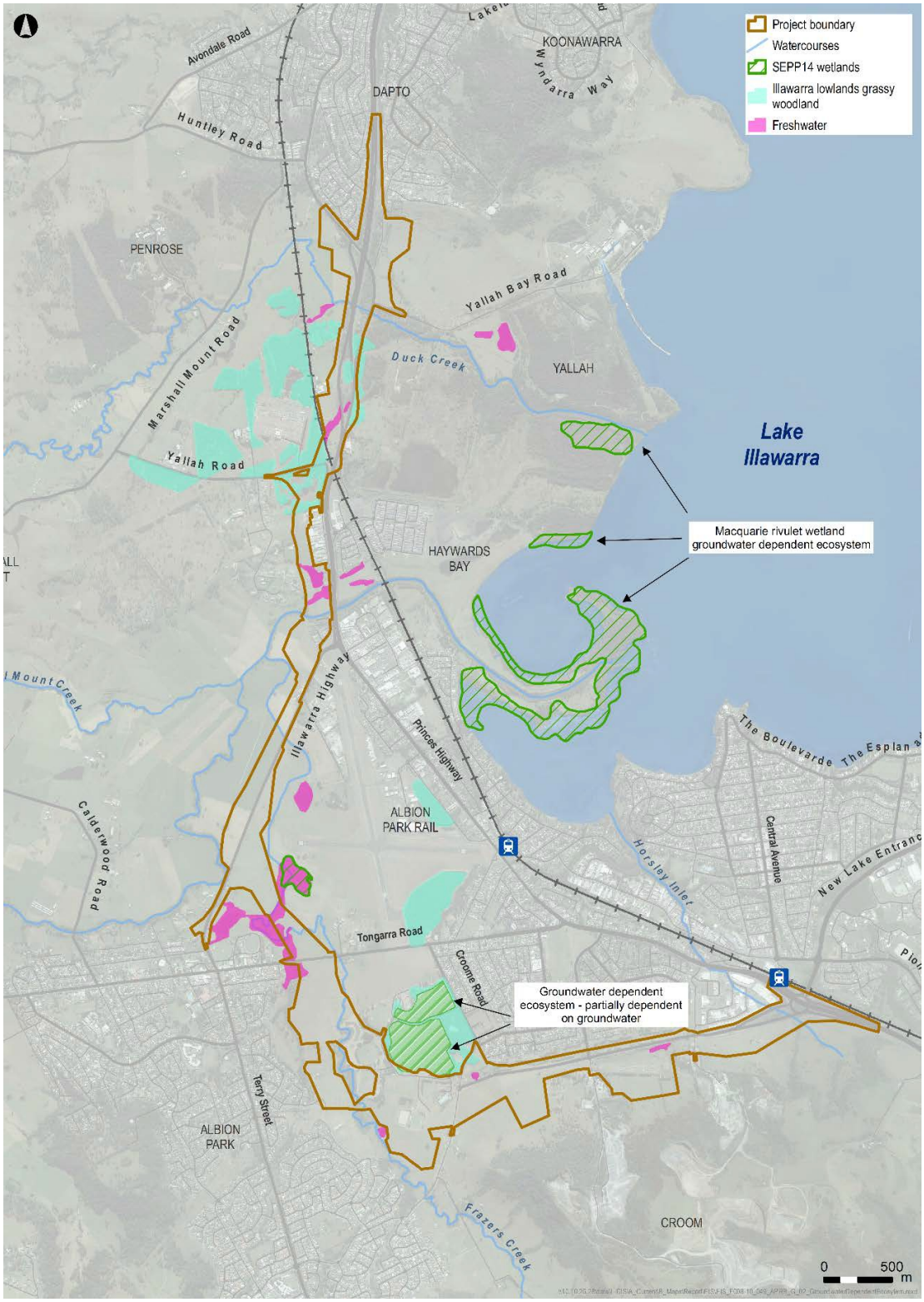

Figure 4-6 Groundwater dependent ecosystems and wetlands (EIS, p521)[6]

[6] It is noted that the project boundary in the SPIR (not the EIS) is the approved project boundary for the overall approved State Significant Infrastructure (SSI 6878). However, the Project forms Stage 2 of SSI 6878 only. Stage 2 comprises the extension of the Princes Motorway between Yallah and Oak Flats and all associated works including bridges, interchanges and local road changes or upgrades (excluding Stage 3 – Yallah Interchange; and any work as part of Stage 1 - Croom Regional Sporting Complex reconfiguration). For additional details refer to the Albion Park Rail bypass Staging Report (Roads and Maritime, March 2018).

4.4 Rainfall

The rainfall records from Albion Park have been selected to reflect the potential rainfall conditions across the project site due to its proximity to the overall site, and extent of available data (from 1888 to present). A summary of the rainfall records from the Bureau of Meteorology is provided in

Table 4-2 Summary of rainfall records

Summary of rainfall record from 1892 to present													
	Summer / Autumn						Winter / Spring						
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	Year
Mean rainfall (mm)	78.6	103.3	125.3	132.0	100.2	91.5	107.4	69.0	67.2	59.6	76.4	84.3	1095.8
Mean rain days	7.3	8.0	8.2	8.6	7.0	6.9	7.0	5.7	5.8	6.3	6.9	7.7	85.3

Source: Bureau of Meteorology Website, Accessed 27 April 2020

4.5 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. The rainfall erosivity factor forms part of the soil loss calculations made during development of the erosion and sediment control plan contained in Appendix A.

5 Environmental aspects and impacts

The key construction activities and the associated potential sources of soil and water impacts are identified through a risk management approach. The consequence and likelihood of each activity's impact on the environment has been assessed to prioritise its significance. The results of this risk assessment are included in Appendix A2 of the CEMP.

Ongoing environmental risk analysis during construction will be undertaken through regular monitoring, inspections and auditing as described in Chapter 7.

5.1 Construction activities

Key aspects of the project that could result in adverse impacts to soils, sediments and water (Chapters 16.3.1 and 16.3.2 in the EIS) are presented in Table 5-1.

Table 5-1 Potential construction activities and associated environmental issues

Environmental Issue	Construction activity
Soil erosion and sediment transport	• The excavation and transport of soils • The construction of subgrade, embankments and culverts • The temporary stockpiling of material.
Landslip	• Cuttings to achieve required road grades • Construction of embankment • Localised excavations, typically for drainage structures.
ASS and acid sulfate rock	• Dewatering activities designed to lower the groundwater table • Drainage work to temporarily and permanently manage surface water flows • Excavation of ASS/ acid sulfate rock and stockpiling of untreated materials, particularly deep soil strata and those situated below the groundwater table • Piling activities, particularly the installation of solid piles that displace ASS • Reuse of ASS and acid sulfate rock within permanent embankments and for landscape rehabilitation • Excavation of sediments around creek crossings • Exposure of in-situ soils and rock to the atmosphere in trenches, excavations and cuttings.
Settlement of soft soils	• Excavation and replacement of unsuitable soft materials • Construction of raised embankments • Soil consolidation • Ground improvement measures such as wick drainage.
Salinity and acidity	• Vegetation clearing • Earthworks.
Water quality	• Stockpiling of vegetation • Vegetation clearing and the exposure of soils • Earthworks or dewatering • Disturbance of contaminated materials • Use of vehicles, plant and machinery on site • Work activities • Construction of adjusted Frazers Creek • Activities at ancillary sites • Generation of waste and spoil • Installation of working platforms in waterways (Macquarie Rivulet, Frazers Creek, Duck Creek).

5.2 Impacts

The potential for impacts on soil and water 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 the natural environment. Potential impacts on soil and water as a result of the project are presented in Table 5-2.

Table 5-2 Potential impacts on soil and water

Environmental Issue	Action/Impact
Soil erosion and sediment transport	• Increased risk of soil erosion • Transportation of soils and sediments via stormwater runoff and wind to nearby waterways and sensitive receiving environments • Adverse impacts on the health of ecosystems by smothering benthic habitats • Increasing turbidity in the water column • Decreasing light penetration • Introducing sediment bound nutrients, trace materials and other toxicants.
Landslip	• Rise to risk of landslips and mass material movement
ASS and acid sulfate rock	• Exposure of ASS that were previously submerged below the groundwater table • Soil and groundwater acidification in ASS landscapes • Modification of groundwater levels in ASS landscapes pose a risk of disturbing ASS by exposing them to oxygen, which can increase the potential for sulfide oxidation and consequent acid generation.
Contaminated land	• Lateral migration of contaminants into the environment via stormwater runoff and vertical infiltration of contaminants into previously unaffected soils and groundwater • Increased risks of exposure for human receptors (workers, and members of the public) via the pathways of skin contact, ingestion and inhalation of volatile or airborne contaminants due to increased proximity to the contaminated materials.
Settlement of soft soils	• Soft soils underneath engineered embankments are expected to settle during the construction phase of the project with a typical consolidation time of three to six months following the application of treatments such as wick drainage • A total settlement of about 1350 millimetres is expected for soft soils • Reduction of water content within shallow soils • Minor changes to shallow groundwater levels • Localised reductions in soil permeability and moisture levels.
Salinity and acidity	• Deeper saline soils being brought to the surface • Risk to vegetation growth • Risk of erosion • Salt export to surface water bodies.
Water quality	• Tannin leachates from stockpiled vegetation, which could enter watercourses, resulting in increased acidity, reduced water clarity and light penetration, and increased biological oxygen demand • Soil erosion by the action of wind or stormwater, and transport into waterways, leading to increased turbidity, sedimentation, and potentially the introduction of nutrients and any other pollutants associated with the sediments. • There is an increased risk where vegetation clearing and / or earthworks are proposed adjacent to or within a watercourse (such as for bridge works or culverts). These activities could result in bank instability • Exposure of potential or actual ASS in some parts of the project area could result in the mobilisation of acidic runoff into watercourses. This would result in increased acidity of surface water and / or groundwater. This work could cause the mobilisation of heavy metals into the environment • The mobilisation of contaminants into surface water and / or groundwater, negatively impacting aquatic ecosystems • Potential for an accidental spill or leak of fuel, oil, greases or other chemicals, which could pollute surface water and / or groundwater • Potential for stagnation of waters, which could lead to water quality issues such as stratification, changes in nutrient cycling and decreased oxygen concentrations. Where flow modification leads to exposure of potential or actual ASS, this could lead to acid generation, with resultant negative impacts on surface water and groundwater

Environmental Issue	Action/Impact
	• Adjusting Frazers Creek north of the existing Croom Regional Sporting Complex could result in soil erosion and sediment transport into waterways, leading to increased turbidity, sedimentation, and potentially the introduction of nutrients and any other pollutants associated with the sediments • Activities at ancillary sites could adversely impact surface water and groundwater.
Impacts on sensitive receiving environments	• Short-term, localised losses of terrestrial and aquatic species • Short-term to medium-term declines in aquatic and riparian habitat condition • Short-term localised impacts on the suitability of waterways for recreation • Minor effects on the quality of water for usage by humans and / or livestock.

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 at Appendix A2 of the CEMP. Chapter 6 provides a suite of mitigation measures that will be implemented to avoid or minimise those impacts.

6 Environmental mitigation measures

Specific mitigation measures to address impacts on soil and water are outlined in Table 6-1.

Table 6-1 Soil and water mitigation measures

ID	Mitigation measure	Responsibility
SWMM1	Engage a soil conservationist selected from the Roads and Maritime' Registered Category of 'Soil Conservation Consultancy Services', to review erosion and sediment control plans where required.	Environmental Manager
SWMM2	Install erosion and sediment controls in all construction areas where soil disturbance is going to occur, prior to soil disturbance occurring.	Environmental Manager Project Engineers Foreman
SWMM3	Design, install and maintain all erosion and sediment controls in accordance with the Erosion and sediment control plan (ESCP) included in Appendix A of this plan. The ESCP has been prepared in accordance with the Blue Book (Landcom, 2004 and DECC, 2008) and includes relevant standard drawings and details from these texts.	Environmental Manager Project Engineers Foreman
SWMM4	Consult with the required, plus optional additional agencies as relevant. For example, ensure permanent and temporary watercourse crossings and stream diversions, drainage swales and depressions are undertaken in consultation with DPI Fisheries and the EPA. Ensure Frazers Creek adjustment is designed and constructed in consultation with DPI Fisheries and DPI Water.	Environmental Manager
SWMM5	In addition to the overarching primary ESCP (refer to Appendix A) prepare Progressive Erosion and Sediment Control Plans (PESCPs) prior to commencing each stage or parcel of work where there is a risk of erosion and sediment loss.	Environmental Manager Project Engineers
SWMM6	Implement appropriate erosion and sediment control measures for each particular section of works in accordance with the PESCP, prior to the commencement of any clearing, stripping or earthworks.	Project Engineers Foreman
SWMM7	Install certain structures and controls (i.e. sediment basins, pipes and culverts) early (i.e. prior to clearing and stripping) to promote successful erosion and sediment control during construction (principally, during clearing, stripping and earthworks).	Project Engineers Foreman
SWMM8	Update PESCPs as required and as the works progress and the site changes.	Environmental Manager
SWMM9	Establish clearing limits and work boundaries that are well defined using barrier tape (or equivalent) prior to any construction, clearing or stripping works commencing. Exclusion zones and fencing or other means to demarcate vegetation to be retained in close proximity to the works need to be in accordance with the Roads and Maritime Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011)	Environmental Manager Project Engineers Foreman
SWMM10	Minimise the extent of clearing and retain as much groundcover as possible.	Project Engineers Foreman
SWMM11	Clearly mark all vegetation that is to be retained. Exclusion zones and fencing or other means to demarcate vegetation to be retained in close proximity to the works need to be in accordance with the Roads and Maritime Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RTA, 2011).	Environmental Manager Project Engineers Foreman
SWMM12	Clear land progressively and clear the areas associated with the current section/stage of works only.	Project Engineers Foreman
SWMM13	Initially clear and grub leaving the soil surface in a reasonably rough condition with some surface vegetative cover.	Project Engineers Foreman
SWMM14	Maximise the separation of 'clean' (offsite) run-on water from 'dirty' (onsite) (e.g. turbid) construction area runoff as much as possible.	Environmental Manager Project Engineers

ID	Mitigation measure	Responsibility
		Foreman
SWMM15	Construct drainage structures early in the project including: • Sediment basins and traps • Catch drains, and • Culverts/ pipes and associated inlet and outlet protection (eg. dissipaters).	Project Engineers Foreman
SWMM16	Maximise the diversion of turbid construction runoff into sediment basins.	Project Engineers Foreman
SWMM17	Control runoff during the construction of embankments (e.g. fill shaping and the construction of temporary dykes and batter drains).	Project Engineers Foreman
SWMM18	Divert clean water runoff into pits and the stormwater drainage system as soon as practical to reduce surface flow lengths.	Project Engineers Foreman
SWMM19	Divert offsite run-on water around the works site as much as possible. Use permanent cut-off drains to achieve this as much as possible.	Project Engineers Foreman
SWMM20	Maintain slope lengths at appropriate lengths (refer to the standard drawings in the Primary ESCP) to reduce water velocity and minimise erosion. Use catch drains to collect and divert runoff from the slopes.	Project Engineers Foreman
SWMM21	Use geotextile linings or other surface protection methods to provide temporary surface protection in areas where appropriate (e.g. batter drains, culvert construction).	Project Engineers Foreman
SWMM22	Use check dams within diversion drains where required to reduce water velocity and minimise erosion within the drains.	Project Engineers Foreman
SWMM23	Locate stockpiles in accordance with the *Stockpile Management Protocol* included in Appendix E of this SWMP.	Project Engineers Foreman
SWMM24	Progressively stabilise exposed ground surfaces using temporary methods such as soil binders, cover crop species or other appropriate practices.	Project Engineers Foreman
SWMM25	Stabilise stockpiles and batters progressively using temporary methods such as geotextile fabric, stabilised mulch, soil binders (e.g. Gluon polymer emulsion) or cover crop species. Use Rye Corn during the months of April to August or Japanese Millet during the months of September to March as required by R178.	Project Engineers Foreman
SWMM26	Immediately commence stabilisation of waterways, including their beds and banks, after the completion of any works within these areas. All stabilised areas to mimic a naturalised creek system and the disturbed areas to be planted with native species in accordance with the Landscape Design Drawings.	Project Engineers Foreman
SWMM27	Control dust using methods such as water trucks, temporary stabilisation methods, soil binders, compaction, progressive revegetation techniques or other appropriate practices.	Project Engineers Foreman
SWMM28	Use temporary ground covers such as soil stabilisers (e.g. Gluon polymer emulsion), hydroseed or hydromulch as much as possible to stabilise batters, stockpiles and large surface areas.	Project Engineers Foreman
SWMM29	Construct sediment control measures as close to the potential source of sediment as possible.	Environmental Manager Project Engineers Foreman
SWMM30	Ensure sediment basin management of turbid water immediately after rain as required with one or a combination of: • Flocculation with gypsum (or approved alternative flocculate), and	Environmental Manager Project Engineers

ID	Mitigation measure	Responsibility
	• Pump-out for construction purposes or dust control.	Foreman
SWMM31	Do not release water from sediment basins prior to achieving acceptable water-quality standards (refer to mitigation measure ID SWMM60 for water quality criteria).	Environmental Manager Project Engineers Foreman
SWMM32	Control the tracking of mud and soil material onto local roads using shakers, rubble pads or washdown areas.	Foreman
SWMM33	Provide sediment fencing or equivalent downslope of disturbed areas that can't be directed into a designated sediment basin, trap or bund unless completely impractical (e.g. works within watercourses). Implement alternative controls (i.e. silt curtains and enhanced erosion controls) in these locations.	Environmental Manager Project Engineers Foreman
SWMM34	Use mulch bunds, earth bunds or straw bales as alternatives to sediment fencing where appropriate. However, do not use mulch in concentrated flow areas or where it has the potential to result in tannin leachate into waterways. Refer to Appendix F *Roads and Maritime Environmental Direction: Management of Tannins from Vegetation Mulch*.	Environmental Manager Project Engineers Foreman
SWMM35	Treat water accumulating within any excavation, trap or low point on site that cannot be re-used in construction or dust suppression, as per the requirements for sediment basins before discharge from site. Refer to mitigation measure ID SWMM60 for water quality criteria.	Environmental Manager Project Engineers Foreman
SWMM36	Install sediment controls around stormwater inlet pits where appropriate and where they won't cause or exacerbate flooding. Consider traffic management and safety if installing such devices on live traffic roads.	Environmental Manager Project Engineers Foreman
SWMM37	Remove sediment controls only after works are complete and 70 per cent stabilisation of disturbed surfaces is achieved.	Environmental Manager Project Engineers Foreman
SWMM38	Test sediment basins and, if required, treat, prior to discharge within 5 days of a rainfall event that causes runoff (refer to mitigation measure ID SWMM60 for water quality criteria). Alternatively, pump sediment basins out for construction or dust control purposes to ensure the required capacities remain available for future rainfall.	Environmental Manager Project Engineers Foreman
SWMM39	Carry out dust suppression whenever necessary to minimise sediments becoming air borne due to wind erosion.	Foreman
SWMM40	Design, construct and maintain temporary waterway crossings in accordance with the requirements of the Blue Book and in consultation with Fulton Hogan's Soil Conservationist where necessary.	Environmental Manager
SWMM41	Undertake all works in and around waterways in accordance with a Works in/around Waterways EWMS. This EWMS will undergo agency review and comment.	Environmental Manager Project Engineers Foreman
SWMM42	Complete any vegetation clearing and removal of topsoil near the waterways in accordance with a Clearing and Grubbing EWMS.	Environmental Manager Project Engineers Foreman
SWMM43	Minimise removal of native riparian vegetation, where practical	Environmental Manager Foreman

ID	Mitigation measure	Responsibility
SWMM44	Undertake permanent replanting/revegetation with local native species in accordance with the Landscape Design Drawings, as soon as practicable. The Vegetation Management Plan will be included in the Landscape Design Drawings.	Project Engineers Foreman
SWMM45	Design all sediment basins in accordance with the requirements of Roads and Maritime Specifications G36 and G38 and in accordance with the Blue Book (Landcom, 2004 and DECC, 2008).	Environmental Manager Project Engineers Foreman
SWMM46	Provide suitable access into sediment basin locations to allow for safe removal of sediment and maintenance operations.	Environmental Manager Project Engineers Foreman
SWMM47	Inspect all sedimentation basins at least weekly and following any rainfall event causing runoff.	Environmental Manager Project Engineers Foreman
SWMM48	Immediately schedule de-silting and water treatment if sediment accumulates to a level above 30 per cent of the sediment storage zone marker.	Environmental Manager Project Engineers Foreman
SWMM49	Apply flocculant to settle sediments within 24 hours of the conclusion of the last rainfall event causing runoff.	Environmental Manager Project Engineers Foreman
SWMM50	Include the following items on sediment basins: • A spillway constructed and stabilised to the 100-year ARI event • A marker peg (or equivalent) showing the boundary between the Sediment (Storage) and Water (Settling) zones of the basin • A sediment basin ID • Lined inlets to minimise scour, and • Measures to minimise the safety risk for site workers.	Environmental Manager Project Engineers Foreman
SWMM51	Adequately compact and stabilise sediment basin walls with appropriate protective ground cover. Provide freeboard of at least 600mm from the spillway invert to the top of any earth wall.	Environmental Manager Project Engineers Foreman
SWMM52	Source water for compaction and dust suppression preferentially from sediment basins.	Environmental Manager Project Engineers Foreman
SWMM53	Treat water in sediment basins and discharge within 5 day of a rainfall event that causes runoff. Refer to mitigation measure ID SWMM60 for water quality criteria.	Environmental Manager Project Engineers Foreman
SWMM54	Undertake all dewatering on site in accordance with the Blue Book and Roads and Maritime guideline titled Environmental Management of Construction Site Dewatering. Prepare and implement a Dewatering EWMS to ensure that the waters being discharged meet the water quality criteria specified under mitigation measure ID SWMM60.	Environmental Manager Project Engineers Foreman

ID	Mitigation measure	Responsibility
SWMM55	Issue a Dewatering Permit prior to any dewatering on site.	Environmental Manager Project Engineers Foreman
SWMM56	Where using cover crop species to progressively revegetate disturbed areas, use Rye Corn during the months of April to August or Japanese Millet during the months of September to March.	Project Engineers Foreman
SWMM57	Commence stabilisation of waterways, including their beds and banks, immediately after the completion of any works within these areas.	Project Engineers Foreman
SWMM58	Control dust through progressive revegetation techniques and by watering unsealed areas.	Project Engineers Foreman
SWMM59	Use temporary ground covers such as soil stabilisers (e.g. Gluon polymer emulsion), hydroseed or hydromulch as much as possible to stabilise batters, stockpiles and large surface areas.	Project Engineers Foreman
SWMM60	Do not release water from any discharge points (e.g. from sediment basins) until the following water quality criteria are met (unless an EPL specifies otherwise): • pH 6.5-8.5 • Total suspended solids (TSS) ≤ 50mg/L • No visible oil and grease Promptly distribute the results of water quality monitoring to relevant project staff for action and further investigate any exceedances. Where a discharge occurs solely as a result of rainfall exceeding the five day 85th percentile rainfall depth value of 41.9mm, the abovementioned pH and TSS criteria do not apply. Multiple High Efficiency Sediment (HES) Basins will be trialled across the project in consultation with the EPA and TfNSW. HES basins treat sediment laden runoff and reduce the volume of sediment leaving a site, thus protecting downstream environments from excessive sedimentation and water quality degradation during the rainfall.	Environmental Manager
SWMM61	A relationship has been developed between NTU and TSS for water quality in sediment basins. This relationship has determined that 31 NTU is the equivalent of 50 mg/L TSS. A method to enable the ongoing verification of the relationship between NTU and TSS has been developed and is being implemented. 10% of discharge samples are sent for laboratory analysis to maintain quality assurance. A copy of the statistical correlation assessment methodology and results has been provided to the EPA. The updated EPL has been provided to TfNSW (formerly Roads and Maritime) for approval of NTU in place of TSS.	Environmental Manager
SWMM62	If water is to be re-used for dust suppression or construction purposes, the above criteria do not apply providing water does not leave the site (either directly or indirectly via runoff).	Environmental Manager
SWMM63	Provide and maintain access to the sediment basins to permit: • Clear identification of each sediment basin and discharge point • Easy collection of samples • Collection of representative samples of water discharged from the sediment basin(s), and • Access to the sampling point(s) at all times by an authorised officer of the EPA.	Environmental Manager
SWMM64	Complete water quality monitoring in accordance with the *Construction Water Quality Monitoring Program* contained at Appendix B.	Environmental Manager

ID	Mitigation measure	Responsibility
SWMM65	Record and retain the results of any monitoring: • In a legible form, or in a form that can readily be reduced to a legible form • For at least four years after the monitoring or recording event to which they relate took place, and • So that they can be produced in a legible form to any authorised officer of the EPA who asks to see them.	Environmental Manager
SWMM66	Check weather forecasts daily and implement the *Heavy Rainfall Event Procedure* (included in Appendix D of this plan) where required.	Environmental Manager
SWMM67	Manage vegetation stockpiles to minimise the impact of tannins leaching into the surrounding environment in accordance with *Roads and Maritime Environmental Direction: Management of Tannins from Vegetation Mulch* included in Appendix F of this SWMP.	Environmental Manager Project Engineers Foreman
SWMM68	Where available and practicable, and of appropriate chemical and biological quality, use stormwater, recycled water or other water sources where feasible and reasonable, in preference to potable water for construction activities, including concrete mixing and dust control.	Environmental Manager Project Engineers Foreman
SWMM69	Wash concrete mixers, pumps, concrete tools and other equipment at specially designated washout areas that are constructed in a manner that will prevent storm water surface run-off from being contaminated.	Environmental Manager Foreman
SWMM70	Locate washout areas within an area that is not subject to natural surface storm water run-off and away from drainage lines. Post signs to advise workers of their locations.	Environmental Manager Foreman
SWMM71	Construct the washout areas with an impermeable type material capable of retaining any contaminated water and concrete residue.	Environmental Manager Foreman
SWMM72	Monitor the washout areas to ensure that they are not getting over full and that the washing activity is not contaminating the surrounding area.	Environmental Manager Foreman
SWMM73	As part of the project induction program, advise all personnel performing concreting or saw cutting activities of the concrete washout areas and their obligations to: • Clean their plant, tools and equipment within the designated area • Maintain the area in a clean condition, and • Ensure that contaminated water associated with their activities is appropriately controlled and prevented from reaching natural storm water surface drainage areas.	Environmental Manager
SWMM74	Properly maintain and regularly check spray sealing and asphalt paving plant, equipment and associated tools to minimise the risk of spills.	Foreman
SWMM75	Promptly contain and collect any spills of fuel or bitumen materials using spill kits. Maintain spill kits and fire extinguishers at all times in the spray trucks, tankers and associated plant.	Foreman
SWMM76	Promptly report all spills to the Environmental Manager.	Environmental Manager Foreman
SWMM77	Allocate designated equipment washdown and cleaning areas for major asphalt works with appropriate environmental controls in place (e.g. bunds) to prevent washout water from reaching the receiving environment.	Foreman

ID	Mitigation measure	Responsibility
SWMM78	Do not locate storage areas within 50 metres of any aquatic habitat, natural surface drainage areas, storm drainage systems, poorly drained or flood prone areas, or any area with a slope steeper than 10 per cent.	Project Engineers Foreman
SWMM79	Keep liquid chemicals and fuels in bunded storage areas or sheds that have the capacity to contain spills from leaky containers or from an incident involving a decanting activity. Ensure the bunded capacity is at least 120 per cent of the total capacity of all containers stored inside the bunded area or shed.	Foreman
SWMM80	Designated bunded plant refuelling areas, plant service/maintenance areas and concrete/plant wash down areas will be placed at least five metres from native vegetation and at least 50 metres from the following: -a natural surface drainage area, and -a built drainage structure such as a storm water pipe or box culvert.	Foreman
SWMM81	During site induction, advise all personnel of the following: -The location of bunded storage areas, liquid absorbent materials and other spill containment materials and kits. -Storage of large quantities of fuel for construction plant is not permitted. Licensed fuel trucks carrying emergency fuel spill kits must be used to service plant and equipment. -All drums and decanted containers must be labelled and stored within bunded areas whenever they are not in use. Whenever practical, all unattended drums/containers must be returned to the bunded storage area.	Environmental Manager
SWMM82	Provisional mitigation measure: Locate temporary batching plants (in the unlikely event they are required) in accordance with the Ancillary Facilities Management Plan required under CoA A17.	Environmental Manager
SWMM83	Provisional mitigation measure: Establish and operate concrete batching plants (in the unlikely event they are required) in accordance with a site specific environment work method statement (EWMS) for Concrete batching.	Environmental Manager Project Engineers Foreman
SWMM84	Portable toilet block systems will be regularly serviced. All effluent facilities will be positioned with consideration of vicinity of water courses, sensitive flora/fauna habitats and residents.	Environmental Manager Project Engineers Foreman
SWMM85	In the event that unexpected contamination is identified implement the Unexpected Contaminated Land and Asbestos Finds Procedure (under CoA E60).	Environmental Manager
SWMM86	Undertake all remediation works in consultation with the EPA and in accordance with the CLMP.	Environmental Manager
SWMM87	Should the presence of ASS or potential ASS (PASS) be confirmed, follow the Acid Sulfate Soil Management Procedure included in Appendix C of this SWMP. An EWMS will be developed and implemented for ASS and rock treatment and potential or actual acid sulfate soil areas.	Environmental Manager Project Engineers Foreman

7 Compliance management

7.1 Roles and responsibilities

The Fulton Hogan Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Chapter 6 of this Plan. The responsibilities of the Soil Conservationist are detailed below.

7.1.1 Soil Conservationist

The environmental responsibilities of the Soil Conservationist are to:

- Prepare the primary ESCP for the project
- Review progressive erosion and sediment control plans as required
- Provide advice on erosion and sediment control measures as required.
- Conduct regular inspections as required.

7.2 Training

All employees, sub-contractors and utility staff working on site will undergo site induction training relating to soil and water management issues, including:

- Existence and requirements of this SWMP
- Existence of sensitive area plans
- Existence of erosion and sediment control plans (primary and progressive)
- Relevant legislation
- Roles and responsibilities for soil and water management
- The location of ASS or PASS
- 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:

- ERSED control installation methodology
- Sediment basin construction
- Sediment basin operation
- Sediment basin maintenance
- Working near or in drainage lines and creeks
- Emergency response measures in high rainfall events
- Preparedness for high rainfall events
- Lessons learnt from incidents and other event e.g. high rainfall/flooding
- Mulch and tannin management
- Spill response
- Stockpile location criteria
- Identification of potentially contaminated spoil and fill material
- Trigger levels.

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

7.3 Monitoring and inspections

Regular monitoring and inspections will be undertaken during construction. Monitoring and inspections will include, but not be limited to:

- Up and downstream of the project alignment water quality monitoring at nominated locations
- Groundwater monitoring, both level and quality at nominated locations
- Monitoring of groundwater dependent endangered ecological communities to evaluate health and vitality
- Construction sediment basin water quality prior to discharge
- All erosion and sediment control measures on the project must be inspected and works undertaken to repair and/or maintain these controls:
    - weekly during standard construction hours outlined in CoA E36 and the EPL
    - daily during periods of rainfall, and
    - within 24 hours of cessation of a rainfall event causing runoff to occur on or from the project.
- Inspections to monitor and maintain erosion and sediment controls when rain or showers are forecasted to be 'heavy' or 'violent' in accordance with the Heavy Rainfall Event Procedure (included in Appendix D of this plan). The procedure outlines how to monitor rainfall forecasts and prepare site to minimise impacts as much as practicable.

The type, timing, frequency and trigger levels are detailed in the Construction Water Quality Monitoring Program attached at Appendix B. It is the responsibility of the Environmental Manager to ensure that the construction water quality monitoring program is implemented.

Additional requirements and responsibilities in relation to inspections and monitoring are documented in Section 3.7.1 and Section 3.7.2 of the CEMP.

7.4 Licences and permits

EPL 21139 has been issued by NSW EPA for the project. The EPL prescribes water quality parameters to be measured and associated discharge criteria. The EPL also details the monitoring and analytical requirements by reference to authority publications such as the Approved Methods for Sampling and Analysis of Water Pollutants in NSW, 2004 (EPA, 2004). All construction work will be undertaken in accordance with the EPL for the duration of the project.

Any other relevant licenses or permits will be obtained during construction as required.

7.5 Non-conformances

Non-conformances will be dealt with and documented in accordance with Section 3.8 of the CEMP. Also refer to Appendix B for the procedures to identify and implement additional mitigation measures where results of monitoring have exceeded the EPL criteria and/or trigger levels.

7.6 Weather monitoring

Rainfall at the premises will be measured and recorded in millimetres per 24-hour period at the same time each day.

Automatic rainfall intensity/ weather devices have been installed at two locations in the northern and southern sections on the project.

7.7 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 3.7.3 of the CEMP.

7.8 Reporting

Reporting requirements and responsibilities (including for the Construction Monitoring Report) are documented in Section 3.7.5 of the CEMP. Also refer to Table B-1 of the construction water quality monitoring program at Appendix B.

8 Review and improvement

8.1 Continuous improvement

Continuous improvement of this SWMP 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 SWMP update and amendment

The processes described in Section 3.7 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

Any revisions to this SWMP will be in accordance with the process outlined in Section 1.6 of the CEMP and as required, be provided to Roads and Maritime, ER and other relevant stakeholders for review and comment and forwarded to the Secretary of NSW Department of Planning and Environment (DP&E) for approval.

A copy of the updated SWMP and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure (refer to Section 1.5 of the CEMP).

Appendix A Primary Erosion and Sediment Control Plans and Standard Blue Book Drawings

ALBION PARK RAIL BYPASS – PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAKS FLATS INTERCHANGE

PRIMARY EROSION AND SEDIMENT CONTROL PLANS

FINAL

DRAWING SCHEDUE

DRAWING NUMBER	DRAWING TITLE
17000301_P02_ESCP0000	PRIMARY ESCP – COVER SHEET, LOCALITY PLAN AND DRAWING SCHEDULE
17000301_P02_ESCP0001	PRIMARY ESCP – GENERAL NOTES – SHEET 1 OF 2
17000301_P02_ESCP0002	PRIMARY ESCP – GENERAL NOTES – SHEET 2 OF 2
17000301_P02_ESCP0003	PRIMARY ESCP – SEDIMENT BASIN SIZING TABLE
17000301_P02_ESCP0004	PRIMARY ESCP – PHOTO EXAMPLES
17000301_P02_ESCP0005	PRIMARY ESCP – BLUE BOOK STANDARD DRAWINGS
17000301_P02_ESCP0006	PRIMARY ESCP – IECA STANDARD DRAWINGS
17000301_P02_ESCP0007	PRIMARY ESCP – IECA STANDARD DRAWINGS
17000301_P02_ESCP0008	PRIMARY ESCP – TYPICAL DETAILS AND PHOTO EXAMPLES
17000301_P02_ESCP0101	EROSION AND SEDIMENT CONTROL – ESCP0001
17000301_P02_ESCP0102	EROSION AND SEDIMENT CONTROL – ESCP0002
17000301_P02_ESCP0103	EROSION AND SEDIMENT CONTROL – ESCP0003
17000301_P02_ESCP0104	EROSION AND SEDIMENT CONTROL – ESCP0004
17000301_P02_ESCP0105	EROSION AND SEDIMENT CONTROL – ESCP0005
17000301_P02_ESCP0106	EROSION AND SEDIMENT CONTROL – ESCP0006
17000301_P02_ESCP0107	EROSION AND SEDIMENT CONTROL – ESCP0007
17000301_P02_ESCP0108	EROSION AND SEDIMENT CONTROL – ESCP0008
17000301_P02_ESCP0109	EROSION AND SEDIMENT CONTROL – ESCP0009
17000301_P02_ESCP0110	EROSION AND SEDIMENT CONTROL – ESCP0010
17000301_P02_ESCP0111	EROSION AND SEDIMENT CONTROL – ESCP0011
17000301_P02_ESCP0112	EROSION AND SEDIMENT CONTROL – ESCP0012
17000301_P02_ESCP0113	EROSION AND SEDIMENT CONTROL – ESCP0013
17000301_P02_ESCP0114	EROSION AND SEDIMENT CONTROL – ESCP0014
17000301_P02_ESCP0115	EROSION AND SEDIMENT CONTROL – ESCP0015
17000301_P02_ESCP0116	EROSION AND SEDIMENT CONTROL – ESCP0016
17000301_P02_ESCP0117	EROSION AND SEDIMENT CONTROL – ESCP0017
17000301_P02_ESCP0118	EROSION AND SEDIMENT CONTROL – ESCP0018
17000301_P02_ESCP0119	EROSION AND SEDIMENT CONTROL – ESCP0019
17000301_P02_ESCP0120	EROSION AND SEDIMENT CONTROL – ESCP0020
17000301_P02_ESCP0121	EROSION AND SEDIMENT CONTROL – ESCP0021
17000301_P02_ESCP0131	EROSION AND SEDIMENT CONTROL – ESCP0031
17000301_P02_ESCP0141	EROSION AND SEDIMENT CONTROL – ESCP0041
17000301_P02_ESCP0151	EROSION AND SEDIMENT CONTROL – ESCP0051
17000301_P02_ESCP0161	EROSION AND SEDIMENT CONTROL – ESCP0061
17000301_P02_ESCP0171	EROSION AND SEDIMENT CONTROL – ESCP0071
17000301_P02_ESCP0181	EROSION AND SEDIMENT CONTROL – ESCP0081
17000301_P02_ESCPAS04	EROSION AND SEDIMENT CONTROL PLAN – ANCILLARY FACILITY AREA AS04
17000301_P02_ESCPAS06	EROSION AND SEDIMENT CONTROL PLAN – ANCILLARY FACILITY AREA AS06
17000301_P02_ESCPAS08	EROSION AND SEDIMENT CONTROL PLAN – ANCILLARY FACILITY AREA AS08
17000301_P02_ESCPAS09	EROSION AND SEDIMENT CONTROL PLAN – ANCILLARY FACILITY AREA AS09
17000301_P02_ESCPAS11	EROSION AND SEDIMENT CONTROL PLAN – ANCILLARY FACILITY AREA AS11
17000301_P02_ESCPAS13	EROSION AND SEDIMENT CONTROL PLAN – ANCILLARY FACILITY AREA AS13

LOCALITY PLAN
N.T.S.

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	FINAL – ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT ISSUE – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	N.A.

FINAL

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY ESCP COVER SHEET, LOCALITY PLAN AND DRAWING SCHEDULE

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0000	00

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GENERAL REQUIREMENTS

EROSION AND SEDIMENT CONTROL DESIGN

The details shown on this drawing are Primary stage erosion and sediment control requirements only. Only major primary controls are shown (e.g. sediment basins, critical sediment traps, major diversion drains and high risk areas requiring a high focus on stabilisation). All minor controls and progressive controls will need to be detailed on Progressive Erosion and Sediment Control Plans. These Construction Stage Progressive Erosion and Sediment Control Plans (PESCPs) will need to be developed prior to construction.

This ESCP has been prepared based on a desktop analysis of the road design and existing site conditions. All areas must be ground truthed/inspected prior to construction of the erosion and sediment controls to ensure all controls are suitable for the current site conditions and proposed works.

This Erosion and Sediment Control Plan (ESCP) has been prepared in accordance with Blue Book Volume 1 (Landcom, 2004) and Volume 2D – Main Road Construction (DECC,2008) and project approval conditions.

An erosion hazard assessment has been completed for all areas within the proposed work zone. The predicted soil loss across all site areas has been determined in accordance with the following:

$$A = R \times K \times LS \times C \times P$$

Where

- A = Annual soil loss due to erosion (t/ha/yr)
- R = Rainfall erosivity factor
- K = Soil erodibility factor
- LS = Topographic factor derived from slope length (SL) and slope gradient (S)
- C = Cover and management factor
- P = Erosion control practice factor

The following values have been used:

- R : 4850
- K : 0.05 (Assumed K-factor for various soil landscapes across the site)
- SL : Up to 80m MAX.
- S : Varies from 1 – 30% (excluding batters and embankments where slopes are generally up to 50%)
- LS : Varies from 0.19 to 11.60
- C : 1.0 (Construction stage – i.e. no soil surface protection or ground cover applied)
- P : 1.3 (for general construction areas)

Based on the above data, the potential soil loss varies from 61 to 3656 t/ha/yr

Under Blue Book standards, sediment basins are required if the soil loss is > 200 t/yr for any catchment. Therefore, sediment basins are required for many catchments within this project. Sediment basin locations are shown on the accompanying SEEC drawings.

STAGING AND ACCESS REQUIREMENTS

- Before commencement of works in any area, a Progressive ESCP is to be prepared and approved for use.
- As much as possible, erosion and sediment control measures are to be installed prior to ground disturbance. These will be detailed on the Progressive ESCPs.
- Barrier fencing, tape, flagging, sediment fence or similar will be installed to define no-go zones and to minimise the extent of disturbance as much as possible to only that required for safe and efficient construction.
- The soil erosion hazard on the site will be kept as low as practicable by minimising land disturbance. Some ways of doing this are outlined in Table 2.

SITE ENTRY AND EXIT POINTS

- Establish stabilised site access points anywhere where construction vehicles enter or exit a work area from a sealed public road. Refer to Standard Drawing SD 6-14 from Landcom (2004). Alternatively existing sealed surfaces can be used as long as sediment tracking is alternatively managed (e.g. wheel-wash systems, hosing down tires or street sweeping where necessary).
- Ensure that all vehicles entering and leaving work areas from a sealed public road pass over a stable access point to minimise bogginess in these areas and to minimise mud tracking onto public roads.
- Refer to the notes on Site Inspection, Monitoring and Maintenance regarding street sweeping.
- The use of wheel-wash systems will be considered where standard construction exits are deemed ineffective or there is a significant risk of mud tracking onto sealed public roads.

SOIL STRIPPING AND STOCKPILING

- Ideally, strip topsoil when it is moist, not too wet or too dry.
- Stockpile areas are to be established within approved locations and as specified by the site manager. Refer to Ancillary Facility ESCPs and to Progressive ESCPs for details.
- Wherever possible, stockpiles are to be established and maintained in accordance with Standard Drawing SD 4-1 (Landcom, 2004).
- Sediment fencing is to be installed around the lower edge of stockpiles as per Standard Drawing SD 4-1, unless the stockpile is adjacent to a suitable alternative sediment control.
- Stockpiles are not to be positioned within 5m of possible concentrated water flow (includes road gutters and table drains) unless that flow directs water to a sediment basin.
- Stockpiles are to be sited at least 50m from a Class 1 or Class 2 fish habitat waterway or a waterway used for human consumption.
- Stockpiles sites are to be located above the 100yr ARI flood level where possible, but may be located above the 20yr ARI flood level if essential (use rock bridging or bunds to achieve this).
- Wherever possible, site stockpiles on gently-sloped lands.
- As much as is feasible, mulched vegetation, topsoil and subsoil (if applicable) are to be stockpiled separately.
- Inactive stockpile faces are to be provided with at least 60% cover (i.e. RUSLE C-factor of 0.1) within 10 days of formation. Stabilisation measures on stockpiles must be employed as per the requirements set out in Table 1.
- Stockpiles of topsoil or mulch should be constructed to no more than 2 meters in height wherever possible (note this only applies to topsoil and mulch).
- Stockpiles should be formed to be no steeper than 2:1 (H:V).

DRAINAGE MANAGEMENT

- Offsite (clean) water drains or bunds and/or temporary pipes (Refer to Photo 1 on ESCP0004) will be installed as early as possible to divert offsite flows away or around or through the work areas. Refer to the accompanying ESCP drawings for locations. Details are to be provided on the Progressive ESCPs prior to commencing construction each area/stage of works.
- Onsite (dirty) water will be conveyed to sediment control structures such as basins and sediment traps using diversion channels, bunds and/or temporary pipes. The accompanying ESCPs show major dirty water diversion locations. Additional locations and details are to be provided on the Progressive ESCPs prior to commencing construction each area/stage of works.
- Wherever possible, place gypsum (e.g. floc-blocks or permeable bags of agricultural gypsum) in dirty water diversions or at the inlets into the sediment control devices to help pre-load water with coagulant prior to it reaching the sediment controls. This will greatly aid the quick settlement of sediment and reduce off-site impacts.

DUST SUPPRESSION

- Dust suppression using water carts is to be carried out whenever necessary to minimise sediments becoming air borne due to wind erosion.
- The water for dust suppression can be sourced from the sediment basins or traps. However, an alternative water source must be identified prior to starting construction works for periods when the sediment basins/traps are dry. Wherever possible, non-potable water sources will be used for dust suppression.
- Biodegradable soil stabilisers (e.g. Vital Stonewall or Gluon 240) can be used for dust suppression to help reduce the use of water (if desired).

STABILISATION AND REHABILITATION

- Undertake progressive stabilisation of disturbed ground surfaces as they are completed rather than at the end of the works program (Refer to Table 1 for ground cover and timing requirements and to Photo 2 for an example).
- Final stabilisation is to achieve the C-factors (ground cover) detailed in Table 1.
- Areas to be revegetated are to be topsoiled first. Refer to Standard Drawing SD 4-2 for instructions regarding topsoil replacement.
- Appropriate seedbed preparation should be carried out when revegetating lands (See Standard Drawing SD 7-1).
- Diversion drains and table drains are to be stabilised as detailed in Table 1, using products or materials able to withstand concentrated flows (e.g. jute matting, geotextile fabric, rock, TRM etc).
- Refer to the Soil Stripping and Stockpiling notes for stabilisation requirements on stockpiles. Also refer to Table 1 and Standard Drawing SD 4-1.
- Sediment basin and culvert outlets are to be stabilised in accordance with Table 1 and energy dissipaters are to be provided as per Standard Drawing SD 5-8.
- As surfaces are stabilised and permanent drainage measures are installed, temporary water management structures (e.g. diversion drains) and sediment controls can be removed.
- Wherever possible, re-use cleared/mulched vegetation for either temporary or permanent stabilisation of disturbed areas.
- Re-vegetating or stabilising is to be undertaken progressively as works are completed in each section.
- Prior to forecast heavy rainfall, forecast high winds or site shutdown (e.g. Christmas/New Year), Priority areas will be 'locked down' as much as is feasible and practical using temporary ground covers such as rock (rip-rap), biodegradable matting, geotextile matting, hydromulch, soil binders or similar. Priority locations are shown on the accompanying drawings and all other areas are to be detailed on the Progressive ESCPs. Refer to Photo 5 for an example of temporary stabilisation.

GENERAL REQUIREMENTS NOTES CONTINUE ON THE FOLLOWING PAGE

TABLE 1 MAXIMUM ACCEPTABLE C-FACTORS AT NOMINATED TIMES

LANDS	MAXIMUM C-FACTOR	REMARKS
Soil Class 6 lands, all lands below the 2yr ARI flood level, all lands within potentially acid sulfate soil areas and all lands within 50m of a watercourse not draining to a sediment basin.	0.05 (i.e. 70% cover)	Applies after ten working days from completion of formation.
Waterways and other areas subjected to concentrated flows (e.g. table drains), post construction and during operation	0.05 (i.e. 70% cover)	Applies after ten working days from completion of formation and before they are allowed to carry any concentrated flows. Flows will be limited to those shown in Table 5.2 of Landcom (2004). Foot and vehicular traffic will be prohibited in these areas
Stockpiles and batters, post formation	0.10 (i.e. 60% cover)	Applies after ten working days from completion of formation. Maximum C-factor of 0.10 equals 60% ground cover
All lands, including waterways and stockpiles during construction and operation	0.15 (i.e. 50% cover)	Applies after 20 working days of inactivity, even though works might continue later. Maximum C-factor of 0.15 equals 50% ground cover
All lands post construction	0.05 (i.e. 70% cover)	Applies after 60 working days of completion of works. Maximum C-factor of 0.05 equals 70% ground cover

TABLE 2 LIMITATIONS TO ACCESS DURING CONSTRUCTION

LAND USE	LIMITATION	REMARKS
Construction areas	Limited to 5 (preferably 2) metres from the edge of any essential construction activity as shown on the engineering plans	All site workers should clearly recognise these areas that, where appropriate, are identified with barrier fencing (upslope) and sediment fencing (downslope) or similar materials.
Access areas	Limited to a maximum width of 5 metres	The site manager will determine and mark the location of these zones on site. They can vary in position so as to best conserve existing vegetation and protect downstream areas while being considerate of the needs of efficient works activities. All site workers will clearly recognise these boundaries
Remaining lands, including revegetation areas	Entry prohibited except for essential management works	Thinning of growth might be necessary, for example, for fire reduction or weed removal

Tables 1 and 2 from Landcom (2004)

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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DRAWING STATUS

DESIGN BY	A.T.
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FINAL APPROVAL	A.M.
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PROJECT TITLE: ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY ESCP
GENERAL NOTES
SHEET 1 OF 2

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
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GENERAL REQUIREMENTS CONTINUED

SEDIMENT BASINS

- Sediment basin locations are shown on the accompanying drawings and sizing details are provided within the table on Sheet ESCP0003.
- If sediment basin volumes cannot be achieved in the locations shown, some options for alternative management include (but are not limited to):
  - Establish additional multiple small sediment sumps, traps and/or check dams within that catchment;
  - Increased use of erosion controls such as slope breaks or temporary ground covers (e.g. soil binders).
- All disturbed areas that do not drain to a sediment basin will be managed with alternative sediment controls such as sediment fences, linear swale infiltration type basins, pocket basins (i.e. sediment sumps), mulch bunds or similar – refer to the notes on Other Sediment Controls.
- If so desired, dirty water accumulating in boxed out sections can be pumped or carted to a sediment basin providing adequate capacity is available and the basin won't overflow as a result. Note that the 5-day maintenance requirement for basins to be emptied still applies (see below).
- Within 5 calendar days of the conclusion of any rainfall event of 5mm or more (i.e. enough to cause runoff), the sediment basins are to be empty, ready for the next rainfall event. This might include testing water, treating (e.g. flocculating), de-watering and de-silting basins. If rainfall occurs again within 5 days of the previous rain event, the 5-day requirement re-sets.
- Dirty water accumulating in sediment basins can be used onsite for dust suppression or construction purposes. If this occurs it does not need to be treated first. Note that the 5-day maintenance requirement for basins to be emptied still applies.
- The design rainfall event for the sediment basins is 41.9mm. It is assumed that the basins might overflow in an event of more than 41.9mm over any 5-day period.
- The sediment basins are to include outlets (weir overflow/spillway) sized to have a capacity to pass the 100 year peak flow. Outlets are to be onto stable lands or into a waterway.
- Water quality must be checked prior to any controlled release from sediment basins. Refer to the De-watering notes below.
- Additional volume can be provided in sediment basins for storing water if so desired (i.e. they can be made bigger than is required by this ESCP).
- As much as is feasible, gypsum should be included in sediment basin walls and inlets to promote sediment settling.
- A marker peg (or similar) is to be included in every basin showing the top level of the Sediment Storage volume.
- Sediment basins are to be de-silted whenever sediment accumulates to more than 60% of the Sediment Storage Volume. Sediment removed from the basin can be taken to a stockpile area, buried onsite or used as general fill. Ensure sediment removed from basins is not placed where it could wash, blow or fall offsite.
- Sediment basins are to achieve at least 3:1 length:width from their inlet(s) to their spillway. If this is not achieved through the natural shape of the basin, a baffle is to be included.
- As much as possible sediment basins within flood-prone areas are to be built up so that the inlet and outlet points are above the 2yr ARI flood level and to minimise excavating into the ground surface. However, during the initial soil stripping and earthworks stage the basin inlet levels may need to be temporarily lowered to enable dirty water flows to drain into the basins. This will essentially temporarily reduce the basin volumes and therefore, alternative sediment traps, filtration outlets and stabilisation of disturbed surfaces prior to heavy rainfall will be required during this initial period. Each sediment basin will need to be assessed individually prior to construction to achieve the best possible outcome.
- To assist with the point above and to minimise disturbance on floodplains, dirty water can be pooled up in long, near-level drains rather than building dedicated sediment basins (i.e. use "linear swale-type basins"). Use large check dams to establish these linear basins if required.
- For sediment basins established in flood-prone areas, adequate armouring will be required around their bases to minimise the risk of scour in the event of inundation.

DE-WATERING

- Any active discharge of water from the project (i.e. where water is moved offsite via direct action such as pumping rather than flowing off the project as a result of heavy rainfall) is to achieve:
  - 50mg/L or less TSS (Total Suspended Sediment); and
  - pH 6.5 to 8.5; and
  - <10mg/L oil and grease and no visible trace.
- Treatment of water in sediment basins can be done with gypsum at a rate of approximately 30 kg gypsum per 100 m3 of dirty water . Alternative flocculating agents can be used if agreed by RMS and allowed under the project EPL. Refer to manufacturer's guidelines for dosage details. Batch dosing of sediment basins should ensure that flocculating agents are mixed evenly over the entire basin surface.
- Note that water accumulating in any sort of excavation or sump on the project should be managed in accordance with these de-watering requirements.
- If the water is going to be used within the construction site for dust-suppression or construction purposes and will drain back into the sediment capture system it does not require treatment.

OTHER SEDIMENT CONTROLS

- The positioning of other sediment controls such as Check Dams, Mulch Bunds, Sediment Fences, Straw Bale Filters, Rock Filter Dams (Refer to Photo 3 for an example) and U-Shaped Sediment Traps is to be determined on Progressive ESCPs.
- Where sediment fencing is used, install it in accordance with Standard Drawing SD 6-8 (Landcom, 2004).
- Sediment fences are to be firmly trenched into the ground for their entire length.
- Wherever space permits, sediment fences will include small 'returns' at maximum 20m intervals (see Standard Drawing 6-8) to minimise the risk of water flowing along them rather than through them.
- Where Rock Filter Dams are used install them in accordance with Standard Drawings RFD-01&02 (IECA, 2008).
- Where mulch filter berms are used, ensure they are placed along the contour, away from areas of concentrated flow, away from waterways and are to have a lined spillway/overflow at their low point. Also refer to Standard Drawing MB-01 (IECA, 2008). If required, provide additional bunding to limit the potential for tannin leachate from entering waterways.
- Where straw bale filters are used, install them in accordance with Standard Drawing SD 6-7 (Landcom, 2004).
- Check dams can be formed with sandbags, gravel socks, rock or similar and can be placed in drains to slow flows and assist with sediment capture. Refer to Standard Drawing SD 5-4.

SITE INSPECTION, MONITORING AND MAINTENANCE

- Prior to forecast rainfall of 5mm or more over 24 hours, the following will occur:
  - The site environment manager (or their representative) is to inspect (and record the condition of, and any action required) the condition of all erosion and sediment controls;
  - Slope breaks will be pushed up or cut in across large, exposed areas to slow down flows and minimise erosion. The spacing and locations of these slope breaks is to be determined on Progressive ESCPs but is to be in accordance with the following:
    - Up to 80m for slopes <10%;
    - Up to 40m for slopes >10% but less than 15%;
    - Up to 20m for slopes >15% but less than 30%;
    - Up to 10m for slopes >30%.
  - Windrows are to formed around the outer edge of fill batters with regular batter chutes also installed. Refer to Photo 4 for a typical batter chute. Locations are details are to be provided on Progressive ESCPs.
- Prior to forecast rainfall of 20mm or more over 24 hours, forecast high winds or site shutdown (e.g. Christmas/New Year) the following will occur:
  - Temporary ground covers are to be employed over Priority areas as shown on the accompanying ESCPs and as detailed in the Progressive ESCPs. Also refer to the Stabilisation and Rehabilitation notes.
- Regular site inspections are to be conducted by the site environment manager (or their representative:
  - At least weekly during normal construction hours; and
  - Prior to forecast rainfall (see above); and
  - Daily during rain events (if safe to do so); and
  - Within 24 hours of the cessation of a rain event that causes runoff.
- Additional erosion and sediment controls will be installed as necessary to ensure satisfactory outcomes in keeping with the EPL conditions and best-practice Blue Book guidelines.
- Progressive ESCPs will be updated and/or prepared as required.
- Sediment or rocks tracked from the site will be removed from public roads as soon as possible (e.g. with street sweepers).
- After rainfall, sediment accumulated in trapping devices (e.g. basin, sediment fence) will be removed to a secure location where it can't wash or blow offsite (preferably to an active stockpile).
- Weather conditions will be monitored onsite and daily rainfall will be recorded.
- Safe storage areas for wastes, fuels, excess concrete and other potential contaminants are to be delineated by the site manager. Refer to the SWMP for further details.
- Adequate supplies of flocculant (and flocculating equipment) are to be maintained, based on the number of sediment basins present at that time.
- Batter chutes (see Photo 4 for a typical batter chute example) are to be provided down batters (where necessary) to minimise the risk of scour. The locations for these are to be detailed on Progressive ESCPs.

WORKS AROUND WATERWAYS

- Where access/haul roads cross floodplains, these are to be formed using clean rock with geotextile underlay (or equivalent) to provide a trafficable surface with minimal risk of erosion even when inundated.
- Minimise the extent of disturbance in waterways and on floodplains. When working on floodplains, consider using ground mats instead of clearing vegetation and stripping topsoil.
- Exposed fill batters around waterways and in flood prone areas are to be stabilised (locked down with soil stabilisers or covered with fabric/matting) as required to minimise the risk of erosion.
- Permanent stabilisation and rehabilitation of fill batters is to occur progressively as they are completed.
- As fills are raised, they are to be windrowed whenever rain of 5mm in 24hrs (or more) is likely, with regular batter chutes also installed. Refer to the notes on Site Inspection, Monitoring and Maintenance and to Photo 4 for a typical example.
- Ideally, construct culverts and clean water diversions as early in the works program as possible.
- As much as possible sediment basins within flood-prone areas are to be built up so that the inlet and outlet points are above the 2yr ARI flood level and to avoid excavating into the ground surface. However, during the initial soil stripping and earthworks stage the basin inlet levels may need to be temporarily lowered to enable dirty water flows to drain into the basins. This will temporarily reduce the basin volumes and therefore, alternative sediment traps, filtration outlets and stabilisation of disturbed surfaces prior to heavy rainfall will be required during this initial period. Each sediment basin will need to be assessed individually prior to each stage of construction to achieve the best possible outcome.
- To assist with the point above and to minimise disturbance on floodplains, dirty water can be pooled up in long, near-level drains rather than building dedicated sediment basins (i.e. use "linear swale-type basins"). Use large check dams to establish these linear basins if required.
- For sediment basins established in flood-prone areas, adequate armouring will be required around their bases to minimise the risk of scour in the event of inundation.
- Piling platforms are to be formed with clean rock in accordance with engineering detail. The running surface of piling platforms is to be stabilised with aggregate, gravel, DGB and a heavy duty trafficable soil stabiliser or similar. Refer to ESCP0008 for typical piling platform details and photos.
- Silt curtains are to be provided around works that encroach into waterways where feasible. Silt curtains are to be provided from bank back to the same bank (i.e. they should not cross the waterway to the opposite bank). Refer to the manufacturers requirements for other installation details and to Standard Drawings FSC-01-03 (IECA, 2008). Major locations are shown on the accompanying ESCPs. Other locations and details are to be provided on Progressive ESCPs.
- As much as possible, works within watercourses are to be scheduled for late winter or spring months when rainfall is historically lower.
- The duration of works in waterways is to be minimised as much as possible.

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DRAWING STATUS

DESIGN BY	A.T.
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FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	N.A.

FINAL

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY ESCP GENERAL NOTES SHEET 2 OF 2

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
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SEDIMENT BASIN SIZING TABLE

BASIN ID	16400W	16800W	17100W	17420W	17600E	17800W	18300E	18520E	18800W	19500W	19700W	20000E	20300E	20400E	20650E	20700W	20720E	21000W	21000E	21050E	21100W	21300E	21320W	21500W
CHAINAGE	16400	16800	17100	17420	17600	17800	18300	18520	18800	19500	19700	20000	20300	20400	20650	20700	20720	21000	21000	21050	21100	21300	21320	21500
Catchment area TOTAL (ha)	2.04	1.92	3.7	1.1	3.4	2.65	2.98	1.6	2.16	3.92	4.32	3.4	1.22	1.27	3.5	0.53	0.72	0.3	2.3	1	1.2	1.1	1	1.95
Catchment area DISTURBED (ha)	2.04	1.92	3	1.1	3.4	2.65	2.98	1.6	2.16	3.32	4.32	3.4	1.22	1.27	3.5	0.53	0.72	0.3	2.3	1	1.2	1.1	1	1.95
x-day, y-percentile rainfall event (mm)	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9
Rainfall erosivity (R-factor)	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850
Soil erodibility (K-factor)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Slope length (m)	80	10	20	80	20	80	15	80	80	80	20	20	10	10	15	15	20	6	10	15	15	15	15	15
Slope gradient (%)	4	30	50	10	50	7	50	10	3	5	4.5	4.5	30	50	30	50	4.5	50	50	50	50	50	50	50
LS-Factor	0.91	2.23	5.89	2.81	5.89	1.76	4.64	2.81	0.65	1.19	0.49	0.49	2.23	3.33	3.07	4.64	0.49	2.18	3.33	4.64	4.64	4.64	4.64	4.64
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Ground cover (C-factor)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cv (Volumetric runoff coefficient)	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Soil loss (t/ha/yr)	288	702	1855	885	1855	554	1464	885	205	374	154	154	702	1048	968	1464	154	688	1048	1464	1464	1464	1464	1464
Sediment basin storage (soil) volume (m3)	75	173	714	125	809	188	559	182	57	159	85	67	110	171	434	99	14	26	309	188	225	206	188	366
Sediment basin settling (water) volume (m3)	590	555	1070	318	983	766	862	463	624	1133	1249	983	353	367	1012	153	208	87	665	289	347	318	289	564
Sediment basin total volume (m3)	665	728	1784	443	1792	954	1421	645	681	1292	1334	1050	463	538	1446	252	222	113	974	477	572	524	477	930
Catchment Soil Loss (t/yr)	587	1347	5566	973	6309	1469	4363	1416	443	1242	663	522	856	1331	3389	776	111	206	2411	1464	1757	1610	1464	2855
Is a basin required	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES

BASIN ID	21550E	21800E	21950E	21950W	22250E	22200W	22850E	22900W	23150W	23200E	23200W	23800W	23850E	24300E	24400E	24650W	24800E	25450W	25500W	AS4-1	AS8-1	AS8-2	AS13-1	
CHAINAGE	21550	21800	21950	21950	22150	22200	22850	22900	23150	23200	23200	23800	23850	24300	24400	24650	24800	25450	25500	NA	NA	NA	NA	
Catchment area TOTAL (ha)	3.2	1.5	0.89	0.63	5.3	2.95	1.69	1.13	4.5	5.4	4	2.49	2.4	4.44	5.26	3	3.98	5.77	4.3	1.45	4.95	1.4	7.64	
Catchment area DISTURBED (ha)	3.2	1.5	0.89	0.63	5.3	2.95	1.69	1.13	4.5	5.4	4	2.49	2.4	3.2	4.5	3	3.98	4	4.3	1.45	4.95	1.4	7.64	
x-day, y-percentile rainfall event (mm)	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	41.9	
Rainfall erosivity (R-factor)	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	4850	
Soil erodibility (K-factor)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	
Slope length (m)	15	20	80	10	20	80	80	80	80	80	80	80	80	80	80	40	80	40	80	80	80	80	80	
Slope gradient (%)	50	10	4.5	50	5	4	5	7.5	8	4	7	7	7	6	4	15	15	20	5	7	4	5	12	
LS-Factor	4.64	1.09	1.05	3.33	0.54	0.91	1.19	1.90	2.05	0.91	1.76	1.76	1.76	1.47	0.91	3.05	5.06	4.32	1.19	1.76	0.91	1.19	3.7	
Erosion control practice (P-factor)	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	
Ground cover (C-factor)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
Cv (Volumetric runoff coefficient)	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	
Soil loss (t/ha/yr)	1464	344	331	1048	169	288	374	600	647	288	554	554	554	463	288	961	1596	1362	374	554	288	374	1167	
Sediment basin storage (soil) volume (m3)	601	66	38	85	115	109	81	87	373	199	284	177	171	190	166	370	814	698	206	103	183	67	1143	
Sediment basin settling (water) volume (m3)	925	434	257	182	1532	853	489	327	1301	1561	1156	720	694	1284	1521	867	1151	1668	1243	419	1431	405	2209	
Sediment basin total volume (m3)	1526	500	295	267	1647	962	570	414	1674	1760	1440	897	865	1474	1687	1237	1965	2366	1449	522	1614	472	3352	
Catchment Soil Loss (t/yr)	4685	515	294	660	897	849	632	678	2911	1554	2218	1380	1331	1483	1295	2882	6352	5448	1609	804	1425	524	8917	
Is a basin required	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	FINAL – ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT ISSUE – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	N.A.

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PROJECT TITLE
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE
PRIMARY ESCP
SEDIMENT BASIN SIZING TABLE

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0003	00

Plot Date: Monday, January 14, 2019 1:09:16 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP000_REV 00.dwg

PHOTO 1 - EXAMPLE OF TEMPORARY PIPED CLEAN WATER DIVERSION INSTALLED PRIOR TO RAINFALL

PHOTO 2 - PROGRESSIVE STABILISATION OF BATTERS AS WORKS PROGRESS

PHOTO 3 - EXAMPLE OF ROCK FILTER DAM AND SUMP

PHOTO 4 - EXAMPLE OF BATTER CHUTE

PHOTO 5 - TEMPORARY STABILISATION OF BATTERS WITH POLYMER

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	FINAL – ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT ISSUE – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
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SCALE: (on A3 Original)	NTS

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PROJECT TITLE
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
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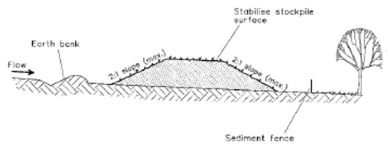
DRAWING TITLE
PRIMARY ESCP
PHOTO EXAMPLES

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0004	00

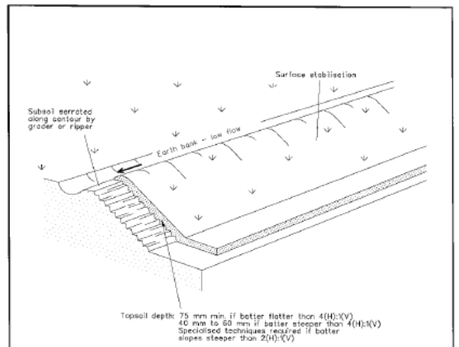
Plot Date: Monday, January 14, 2019 1:09:21 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP000_REV 00.dwg



Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

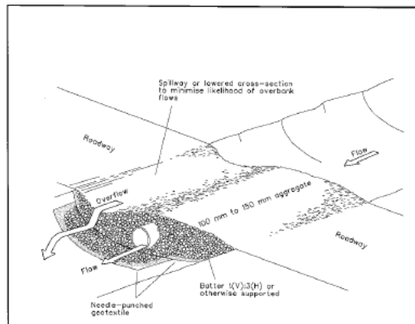
STOCKPILES SD 4-1



Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

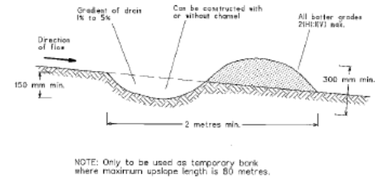
REPLACING TOPSOIL SD 4-2



Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

TEMPORARY WATERWAY CROSSING SD 5-1

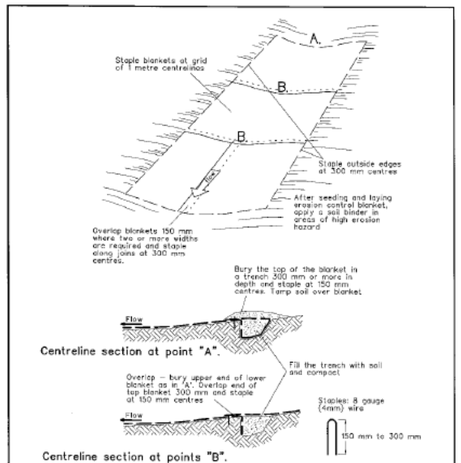


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

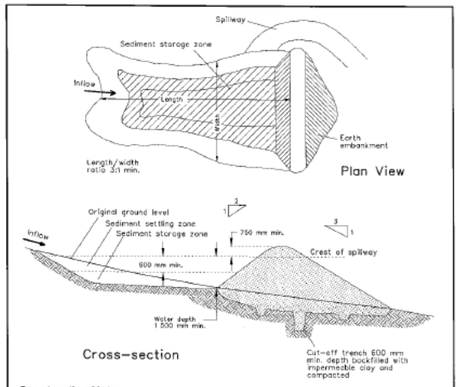
EARTH BANK (LOW FLOW) SD 5-5



Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

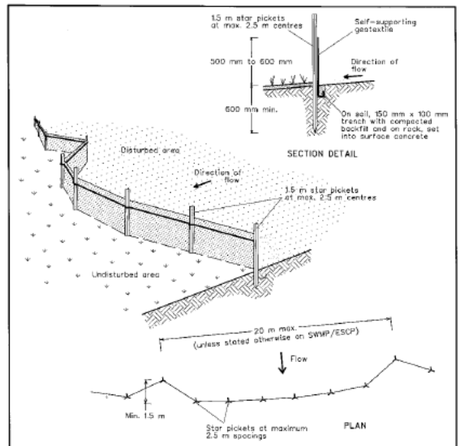
RECP : CONCENTRATED FLOW SD 5-7



Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

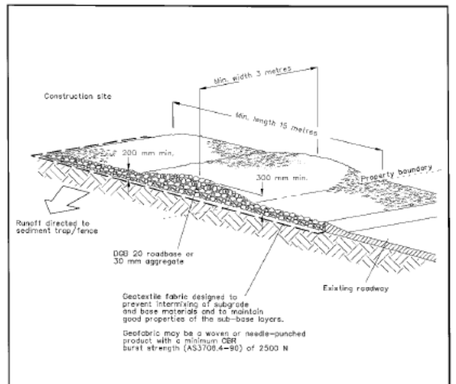
EARTH BASIN - WET SD 6-4
(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

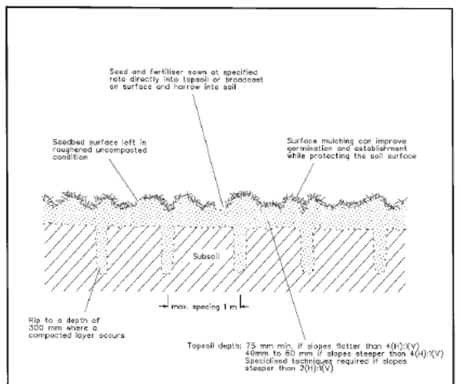
SEDIMENT FENCE SD 6-8



Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS SD 6-14



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION SD 7-1

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	FINAL – ISSUE FOR CONSTRUCTION USE
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DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	N.A.

FINAL

North

CLIENT: Fulton Hogan

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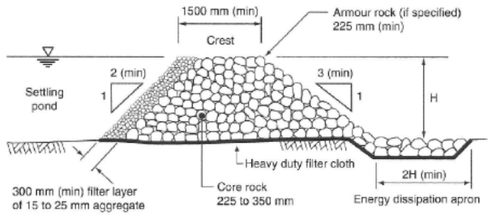
PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

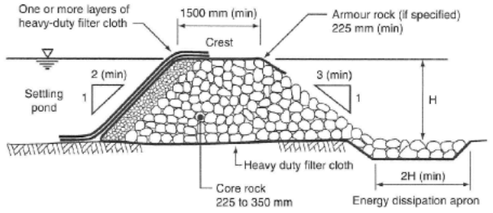
DRAWING TITLE: PRIMARY ESCP BLUE BOOK STANDARD DRAWINGS

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0005	00

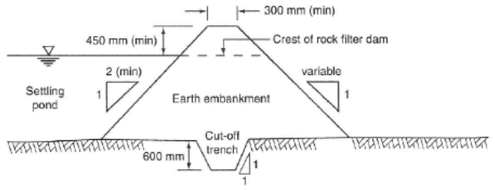
Plot Date: Monday, January 14, 2019 1:09:27 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP000_REV 00.dwg



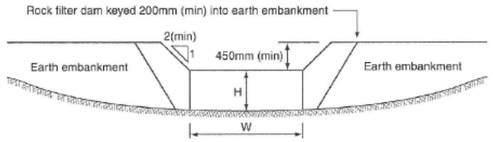
(a) Rock filter dam with aggregate filter



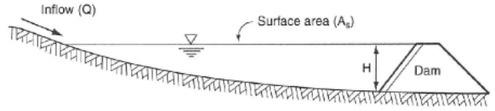
(b) Rock filter dam with geotextile and aggregate filter



(c) Typical cross-section of constructed earth abutment



(d) Typical profile of rock filter dam crest when integrated into an earth embankment



(e) Settling pond

Drawn:	Date:		
GMW	Feb-10	Rock Filter Dam	RFD-01

Catchments & Creeks Pty Ltd

MATERIALS

PRIMARY CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm, OR GREATER THAN 350mm.

ARMOUR ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm.

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE FOUNDATION AREA OF THE ROCK FILTER DAM OF WOODY VEGETATION AND ORGANIC MATTER. DELAY CLEARING THE UP-SLOPE POND AREA UNTIL THE DAM IS FORMED AND IS ABLE TO ACT AS A SUITABLE SEDIMENT TRAP. OTHERWISE AN ALTERNATIVE TEMPORARY DOWNSTREAM SEDIMENT TRAP MAY BE REQUIRED DURING CONSTRUCTION OF THE ROCK FILTER DAM.

3. IF SPECIFIED ON THE PLANS, EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE-LINE OF THE DAM AND EARTH ABUTMENTS (IF ANY).

4. COVER THE FOUNDATION AREA AND CUT-OFF TRENCH WITH HEAVY-DUTY FILTER FABRIC BEFORE BACKFILLING WITH THE CORE ROCK. OVERLAP ADJOINING FABRIC SHEETS A MINIMUM OF 600mm.

5. CONSTRUCT THE ASSOCIATED EARTH ABUTMENT (IF ANY). ALL CUT AND FILL SLOPES SHOULD BE 2:1(H:V) OR FLATTER. THE DOWNSTREAM FACE OF EARTH ABUTMENTS SHOULD BE 3:1(H:V) OR FLATTER. EARTH ABUTMENTS SHOULD BE CONSTRUCTED OF WELL-COMPACTED, EROSION RESISTANT SOIL THAT IS FREE OF VEGETATION AND ROOTS. OVERFILL EARTH ABUTMENTS 150mm TO ALLOW FOR SETTLEMENT.

6. PLACE THE CORE ROCK FOR THE ROCK FILTER DAM. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.

7. ENSURE THE ROCK IS MACHINE PLACED WITH THE SMALLER ROCKS WORKED INTO THE VOIDS OF THE LARGER ROCKS.

8. IF SPECIFIED, CONSTRUCT THE SPILLWAY SECTION USING THE SPECIFIED ARMOUR ROCK. THE SPILLWAY SHOULD HAVE A MINIMUM PROFILE DEPTH OF 300mm. THE SPILLWAY WEIR CREST MUST BE LEVEL ACROSS ITS FULL WIDTH. THE MAXIMUM LONGITUDINAL SLOPE OF THE ROCK SPILLWAY SHOULD BE 3:1(H:V). THE MINIMUM THICKNESS OF ARMOUR ROCK PROTECTION SHOULD BE 500mm, OR TWICE THE NOMINAL ROCK SIZE, WHICHEVER IS THE GREATER.

9. ENSURE THE SPILLWAY OUTLET SECTION EXTENDS DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REACHED, OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER. THE EDGES OF THE SPILLWAY SHOULD BE LEFT FLUSH WITH THE SURROUNDING GROUND.

10. INSTALL THE SPECIFIED FILTER (AGGREGATE AND/OR FILTER CLOTH) ON THE UPSTREAM FACE OF THE ROCK FILTER DAM.

11. IF FILTER CLOTH IS USED, THEN:
(i) EXTEND THE FABRIC OVER THE CREST OF THE ROCK FILTER DAM INTO THE SPILLWAY CHUTE.
(ii) CONSIDER THE PLACEMENT OF SEVERAL LAYERS OF OVERLAPPING FABRIC, THUS ALLOWING EACH LAYER TO BE REMOVED INDIVIDUALLY ONCE THE FABRIC BECOMES BLOCKED WITH SEDIMENT.

12. CLEAR THE SETTLING POND AREA OF WOODY VEGETATION AND ORGANIC MATTER TO THE DIMENSIONS SPECIFIED WITHIN THE PLANS.

13. WHERE NECESSARY, EXCAVATE THE UPSTREAM SETTLING POND AND/OR SEDIMENT STORAGE PIT IN ACCORDANCE WITH THE APPROVED PLANS. EXCAVATED PITS TYPICALLY HAVE SIDE SLOPES OF 2:1(H:V) OR FLATTER UNLESS STEEPER SLOPES ARE KNOWN TO BE STABLE.

14. STABILISE ANY ASSOCIATED EARTH EMBANKMENTS IMMEDIATELY AFTER CONSTRUCTION THROUGH APPROPRIATE COMPACTION, VEGETATION AND/OR EROSION CONTROL MATTING.

15. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

16. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. CHECK ALL ROCK FILTER DAMS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT ALL ROCK AND EARTH EMBANKMENTS FOR UNDERCUTTING OR UNDESIRABLE SEEPAGE FLOWS.

3. IDEALLY, ROCK FILTER DAMS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAYBE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.

4. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.

5. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.

6. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.

7. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE SPILLWAY.

8. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.

9. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE SETTLING POND PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED TO MINIMISE THE EROSION HAZARD.

Drawn:	Date:		
GMW	Apr-10	Rock Filter Dam	RFD-02

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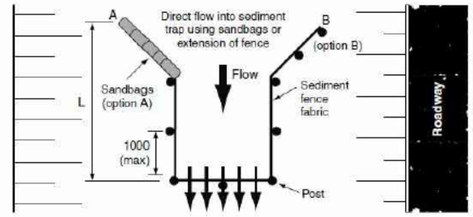
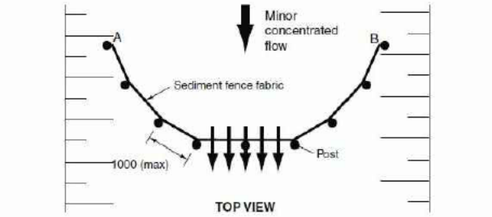
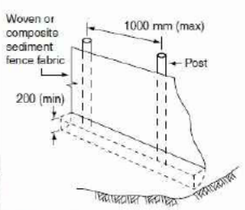


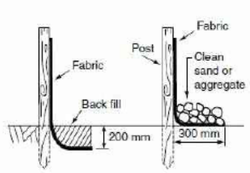
(a) Type AU 'narrow' sediment trap



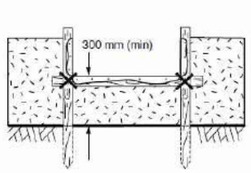
(b) Type BU 'wide' sediment trap



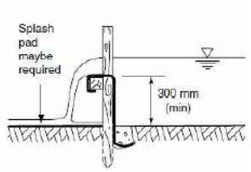
(c) Spacing of support posts



(d) Trenching of fabric



(e) Spill-through weir



(f) Sectional view of weir

Drawn:	Date:		
GMW	Apr-10	U-Shaped Sediment Trap	UST-01

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MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140g/m². ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: (IF USED) WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm² (MIN) HARDWOOD, 2500mm² (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. INSTALL THE FABRIC IN A U-SHAPE, EXTENDING THE WING WALLS EITHER UP THE SIDE SLOPES AND/OR UP THE CHANNEL INVERT (AS DIRECTED) TO A POINT WHERE THE GROUND LEVEL IS AT LEAST 100mm HIGHER THAN THE CREST OF THE SPILL-THROUGH WEIR.

3. ENSURE THAT THE EXPECTED CHANNEL FLOW WILL ENTER THE SEDIMENT TRAP EITHER BY EXTENDING THE WING WALLS UP THE BANK SLOPE, OR CONSTRUCTING SANDBAG FLOW DIVERSION BANKS.

4. UNLESS DIRECTED BY THE SITE SUPERVISOR, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE ALIGNMENT OF THE SPILL-THROUGH WEIR AND WING WALLS.

5. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 1m.

6. CONSTRUCT THE SEDIMENT TRAP FROM A CONTINUOUS ROLL OF FABRIC.

7. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS/STAKES USING 25mm STAPLES OR TIE WIRE AT MAXIMUM 150mm SPACING WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.

8. INSTALL A SPILL-THOUGH WEIR AT THE LOWEST POINT IN THE FENCE. THE WEIR MUST BE AT LEAST 300mm ABOVE ADJACENT GROUND LEVEL, AND BELOW THE LOWEST GROUND LEVEL AT THE ENDS OF THE WING WALLS.

9. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE ADJACENT SUPPORT POSTS. CUT THE FABRIC DOWN THE SIDE OF THE POSTS AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

10. IF DIRECTED, INSTALL A SUITABLE SPLASH PAD IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION DOWNSTREAM OF THE SEDIMENT TRAP.

11. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

MAINTENANCE

1. INSPECT THE SEDIMENT TRAP AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. IF THE FABRIC IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS/STAKES.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 150mm.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS SIX MONTHS.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT TRAP ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE SEDIMENT TRAP MUST BE REMOVED.

2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

Drawn:	Date:		
GMW	Apr-10	U-Shaped Sediment Trap	UST-02

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	FINAL – ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT ISSUE – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	N.A.

FINAL

North

CLIENT: Fulton Hogan

SEEC
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Suites 7 & 8, 68-70 Station Street
Bowral NSW 2576.
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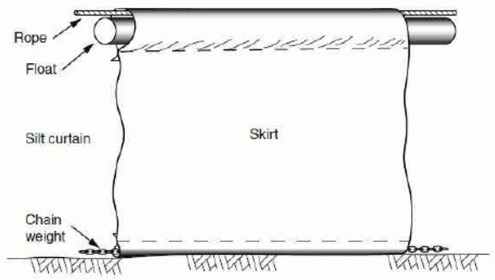
WWW.SEEC.COM.AU

PROJECT TITLE: ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

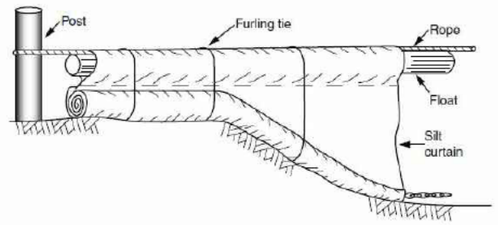
DRAWING TITLE: PRIMARY ESCP
IECA STANDARD DRAWINGS

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0006	00

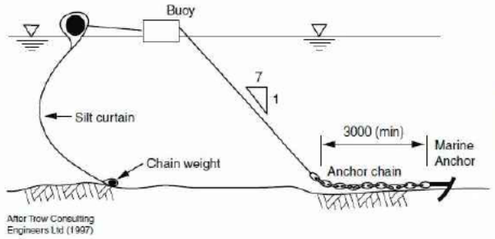
Plot Date: Monday, January 14, 2019 1:09:31 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP000_REV 00.dwg



(a) Components of a floating silt curtain

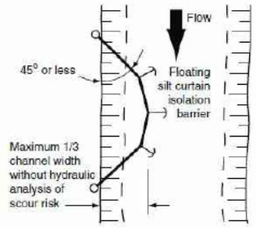


(b) Typical land anchorage system

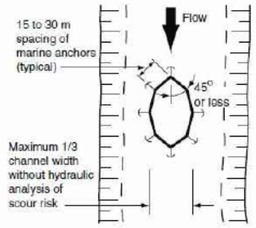


After Trow Consulting Engineers Ltd (1997)

(c) Typical marine anchorage system



(d) Typical installation of floating silt curtain



(e) Typical installation of floating silt curtain

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Feb-10	Floating Silt Curtain	FSC-01

MATERIALS

SILT CURTAIN FABRIC: MANUFACTURED FROM A WOVEN GEOTEXTILE, CANVAS/TARP MATERIAL, OR A COMMERCIALLY AVAILABLE SILT CURTAIN SUCH AS NYLON REINFORCED POLYVINYL CHLORIDE (PVC) OR EQUIVALENT.

BALLAST CHAIN: 10 TO 13mm GALVANISED CHAIN WITH MINIMUM 1.9 TO 3.3kg/m WEIGHT.

LAND ANCHOR: MINIMUM 100mm DIAMETER TIMBER POST (OR EQUIVALENT).

MARINE ANCHOR: MINIMUM 5kg LIGHTWEIGHT (DANFORTH) TYPE ANCHOR WITH 10 TO 13mm NYLON TIE ROPE AND MINIMUM 3m LENGTH OF 8mm GALVANISED CONNECTING CHAIN.

INSTALLATION

1. PRIOR TO COMMENCING ANY WORKS, OBTAIN ALL NECESSARY APPROVALS AND PERMITS REQUIRED TO CONDUCT THE NECESSARY WORKS INCLUDING PERMITS FOR THE DISTURBANCE OF RIPARIAN AND AQUATIC VEGETATION, AND THE CONSTRUCTION OF ALL PERMANENT OR TEMPORARY INSTREAM BARRIERS AND INSTREAM SEDIMENT CONTROL MEASURES.

2. PRIOR TO THE INSTALLATION, CHECK WEATHER REPORTS FOR A SUITABLE WINDLESS, CALM DAY. DO NOT PROCEED WITH THE INSTALLATION UNLESS SAFE TO DO SO.

3. REFER TO APPROVED PLANS FOR LOCATION AND DIMENSIONAL DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

4. CLEAR THE IMMEDIATE LAUNCHING AREA OF ROCK AND DEBRIS. AVOID DISTURBING GROUNDCOVER VEGETATION.

5. LAYOUT A PLASTIC LAUNCHING PAD (SPILLWAY) AT RIGHT ANGLES TO THE WATERCOURSE BANK AND PEG OR ANCHOR IT DOWN. THIS IS TO PROTECT THE CURTAIN AND REDUCE FRICTION WHEN LAUNCHING.

6. UNFOLD THE CURTAIN IN AN OPEN AREA PRIOR TO ITS INSTALLATION. ENSURE THE BARRIER IS FABRICATED WITH SUFFICIENT DIMENSIONS TO BE IN GOOD CONTACT WITH THE BOTTOM OF THE CHANNEL. THE DEPTH OF THE BARRIER SHOULD BE APPROXIMATELY 10% GREATER THAN THE WATER DEPTH TO ENSURE IT RESTS ON THE BED.

7. IDEALLY, THE LENGTH OF THE BARRIER IS 10 TO 20% LONGER THAN THE MEASURED LENGTH OF THE PROPOSED ENCLOSURE.

8. UNFOLD THE FIRST CURTAIN PANEL ON THE SLIPWAY.

9. INSERT THE FLOATS BOTH ENDS FOR EASE OF INSTALLATION.

10. PULL THROUGH THE STEEL CHAIN IN THE BOTTOM SLEEVE USING THE DRAW CORD.

11. PULL THROUGH THE ROPE USING THE DRAW CORD.

12. PRIOR TO DEPLOYING THE BARRIER, GATHER UP THE CURTAIN AND TIE THE CURTAIN WITH LIGHTWEIGHT STRAPS OR ROPE EVERY 1 TO 1.5m. THE AIM OF THIS IS TO ENABLE THE CURTAIN TO BE SET IN PLACE IN THE WATER EASILY WITHOUT THE CURTAIN BEING DRAGGED ALONG THE CHANNEL BED.

13. SET THE UPSTREAM BANK ANCHOR POINT AND TIE OFF ONE END OF THE BARRIER, ENSURING NO WATER WILL BE ABLE TO FLOW INTO THE UPSTREAM END.

14. DEPLOY THE BARRIER FROM THE END OF A BOAT. FASTEN THE FREE END OF THE BARRIER TO THE DOWNSTREAM ANCHOR POINT, THEN ANCHOR THE BARRIER AT INTERMEDIATE POINTS.

15. TAPER THE ENDS OF THE BARRIER TO THE SHAPE OF THE SHORELINE, OTHERWISE TIE THE ENDS OF THE BARRIER WITH FURLING STRAPS SO THE DEPTH OF THE BARRIER CAN BE ADJUSTED TO THE SHAPE OF THE BANK.

16. AFTER THE BARRIER HAS BEEN ANCHORED, CHECK TO SEE THAT THE SKIRT IS NOT TWISTED AROUND THE FLOTATION UNITS. WHEN THE BARRIER IS PROPERLY DEPLOYED, CUT THE TIE ROPES AND LET THE BALLAST WEIGHTS SINK TO THE BED.

17. ENSURE THE SKIRT (AT MAXIMUM WATER LEVEL) IS FREE OF LARGE PLEATS THAT MAY COLLECT SEDIMENT CAUSING THE BARRIER TO BE PULLED UNDER THE WATER SURFACE.

MAINTENANCE

1. INSPECT THE SILT CURTAIN DAILY FOR DAMAGE.

2. ENSURE THE TOP OF THE BARRIER REMAINS ABOVE THE WATER SURFACE, AND THE CURTAIN IS FREE OF TEARS OR GAPS.

3. ENSURE THE BARRIER REMAINS IN THE SPECIFIED LOCATION.

4. CHECK FOR TURBIDITY LEAKS.

5. CHECK ALL ANCHOR POINTS.

6. REPAIR OR REPLACE ANY TORN SEGMENTS.

7. CHECK FOR SEDIMENT BUILD-UP ON THE BOTTOM OF THE SKIRT THAT MAY BEGIN TO PULL THE CURTAIN UNDER THE WATER.

8. DISPOSE OF ANY EXCESSIVE SEDIMENT OR DEBRIS DEPOSITS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

9. REPAIR ANY PLACES IN THE ISOLATION BARRIER THAT HAVE WEAKENED OR THAT HAVE BEEN SUBJECTED TO DAMAGE FROM INFLOWS OR OVERTOPPING WATER.

REMOVAL

1. THE SILT CURTAIN SHOULD BE REMOVED AS SOON AS POSSIBLE AFTER IT IS NO LONGER NEEDED.

2. IF EXCESSIVE SEDIMENT OR DEBRIS HAS COLLECTED AROUND THE BARRIER, THEN REMOVE SUCH MATERIAL BEFORE THE BARRIER IS REMOVED AND DISPOSE OF SUCH MATERIAL PROPERLY.

3. ENSURE THE CHANNEL WATER CONTAINED WITHIN THE ENCLOSURE HAS ACHIEVED A SUITABLE WATER QUALITY BEFORE REMOVING THE SILT CURTAIN.

4. ENSURE THE RELEASE OF SEDIMENT AND THE DAMAGE TO THE CHANNEL'S BED AND BANKS IS MINIMISED DURING REMOVAL OF THE SILT CURTAIN.

5. IF IT IS NOT FEASIBLE TO WAIT FOR ADEQUATE SETTLEMENT OF SUSPENDED SEDIMENTS, THEN WHERE PRACTICABLE, PUMP THE SEDIMENT-LADEN WATER TO AN OFF-STREAM DE-WATERING SEDIMENT CONTROL SYSTEM FOR TREATMENT. THIS TREATMENT AREA SHOULD IDEALLY BE LOCATED AT LEAST 50m FROM THE CHANNEL.

6. REMOVE ALL CONSTRUCTION MATERIALS, EXCESSIVE SEDIMENT DEPOSITS AND DEBRIS AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. RESTORE THE WATERCOURSE CHANNEL TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILISE AND/OR REVEGETATE ALL DISTURBED AREAS.

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Feb-10	Floating Silt Curtain	FSC-02

MATERIALS

SILT CURTAIN FABRIC: MANUFACTURED FROM A WOVEN GEOTEXTILE, CANVAS/TARP MATERIAL, OR A COMMERCIALLY AVAILABLE SILT CURTAIN SUCH AS NYLON REINFORCED POLYVINYL CHLORIDE (PVC) OR EQUIVALENT.

BALLAST CHAIN: 10 TO 13mm GALVANISED CHAIN WITH MINIMUM 1.9 TO 3.3kg/m WEIGHT.

LAND ANCHOR: MINIMUM 100mm DIAMETER TIMBER POST (OR EQUIVALENT).

MARINE ANCHOR: MINIMUM 5kg LIGHTWEIGHT (DANFORTH) TYPE ANCHOR WITH 10 TO 13mm NYLON TIE ROPE AND MINIMUM 3m LENGTH OF 8mm GALVANISED CONNECTING CHAIN.

ALTERNATIVE LAND-BASED INSTALLATION PROCEDURE

1. UNFOLD THE FIRST CURTAIN PANEL ON THE SLIPWAY.

2. INSERT THE FLOATS BOTH ENDS FOR EASE OF INSTALLATION.

3. PULL THROUGH THE STEEL CHAIN IN THE BOTTOM SLEEVE USING THE DRAW CORD.

4. PULL THROUGH THE ROPE USING THE DRAW CORD.

5. PRIOR TO DEPLOYING THE BARRIER, GATHER UP THE CURTAIN AND TIE THE CURTAIN WITH LIGHTWEIGHT STRAPS OR ROPE EVERY 1 TO 1.5m. THE AIM OF THIS IS TO ENABLE THE CURTAIN TO BE SET IN PLACE IN THE WATER EASILY WITHOUT THE WEIGHTS BEING DRAGGED ALONG THE BOTTOM.

6. SET THE UPSTREAM BANK ANCHOR POINT AND TIE OFF ONE END OF THE BARRIER, ENSURING NO WATER WILL BE ABLE TO FLOW INTO THE UPSTREAM END.

7. INSTALL AN EXTRA LENGTH OF ROPE OR CABLE IN THE FINAL CURTAIN POSITION IN THE WATER.

8. TIE THE END OF THE CURTAIN ROPE TO THE EXTRA LENGTH ALREADY IN POSITION AND PULL THE CURTAIN INTO THE WATER STOPPING WHEN THE END OF THE FIRST SECTION OF CURTAIN IS STILL ON THE BANK.

9. UNFOLD THE SECOND SECTION OF CURTAIN ON THE SLIPWAY MAKING SURE THE CURTAIN IS CORRECTLY ORIENTATED WITH THE FIRST SECTION OF CURTAIN

10. INSERT THE FLOATS, CHAIN AND ROPE AS BEFORE.

11. USING THE DRAW CORD FROM THE FIRST SECTION, TIE UP THE ENDS USING THE EYELETS ALREADY IN THE CURTAIN.

12. GATHER UP THE CURTAIN AND TIE TOGETHER WITH TWINE OR THIN ROPE.

13. LAUNCH AS BEFORE.

14. CONTINUE UNTIL THE ENTIRE CURTAIN IS INSTALLED.

15. ANCHOR WELL TO SHORE ANCHORS.

16. USING A SUITABLE BOAT, MOVE ALONG THE CURTAIN AND CUT THE TIES HOLDING THE CHAIN AND CURTAIN AND ALLOW THE WEIGHTED END TO SINK.

17. ENSURE THE SKIRT (AT MAXIMUM WATER LEVEL) IS FREE OF LARGE PLEATS THAT MAY COLLECT SEDIMENT CAUSING THE BARRIER TO BE PULLED UNDER THE WATER SURFACE.

MAINTENANCE

1. INSPECT THE SILT CURTAIN DAILY FOR DAMAGE.

2. ENSURE THE TOP OF THE BARRIER REMAINS ABOVE THE WATER SURFACE, AND THE CURTAIN IS FREE OF TEARS OR GAPS.

3. ENSURE THE BARRIER REMAINS IN THE SPECIFIED LOCATION.

4. CHECK FOR TURBIDITY LEAKS.

5. CHECK ALL ANCHOR POINTS.

6. REPAIR OR REPLACE ANY TORN SEGMENTS.

7. CHECK FOR SEDIMENT BUILD-UP ON THE BOTTOM OF THE SKIRT THAT MAY BEGIN TO PULL THE CURTAIN UNDER THE WATER.

8. DISPOSE OF ANY EXCESSIVE SEDIMENT OR DEBRIS DEPOSITS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

9. REPAIR ANY PLACES IN THE ISOLATION BARRIER THAT HAVE WEAKENED OR THAT HAVE BEEN SUBJECTED TO DAMAGE FROM INFLOWS OR OVERTOPPING WATER.

REMOVAL

1. THE SILT CURTAIN SHOULD BE REMOVED AS SOON AS POSSIBLE AFTER IT IS NO LONGER NEEDED.

2. IF EXCESSIVE SEDIMENT OR DEBRIS HAS COLLECTED AROUND THE BARRIER, THEN REMOVE SUCH MATERIAL BEFORE THE BARRIER IS REMOVED AND DISPOSE OF SUCH MATERIAL PROPERLY.

3. ENSURE THE CHANNEL WATER CONTAINED WITHIN THE ENCLOSURE HAS ACHIEVED A SUITABLE WATER QUALITY BEFORE REMOVING THE SILT CURTAIN.

4. ENSURE THE RELEASE OF SEDIMENT AND THE DAMAGE TO THE CHANNEL'S BED AND BANKS IS MINIMISED DURING REMOVAL OF THE SILT CURTAIN.

5. IF IT IS NOT FEASIBLE TO WAIT FOR ADEQUATE SETTLEMENT OF SUSPENDED SEDIMENTS, THEN WHERE PRACTICABLE, PUMP THE SEDIMENT-LADEN WATER TO AN OFF-STREAM DE-WATERING SEDIMENT CONTROL SYSTEM FOR TREATMENT. THIS TREATMENT AREA SHOULD IDEALLY BE LOCATED AT LEAST 50m FROM THE CHANNEL.

6. REMOVE ALL CONSTRUCTION MATERIALS, EXCESSIVE SEDIMENT DEPOSITS AND DEBRIS AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. RESTORE THE WATERCOURSE CHANNEL TO ITS ORIGINAL CROSS-SECTION, AND SMOOTH AND APPROPRIATELY STABILISE AND/OR REVEGETATE ALL DISTURBED AREAS.

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Feb-10	Floating Silt Curtain (alt)	FSC-03

MATERIALS

(i) MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(ii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m.

(iii) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A MULCH FILTER BERM, TO THE MAXIMUM DEGREE PRACTICAL, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

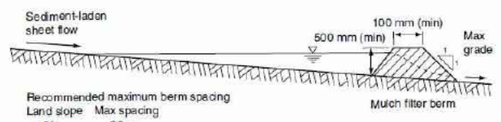
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	30 m
5%	25 m
10%	15 m
20%	8 m

Figure 1 - Typical placement of mulch filter berm

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Apr-10	Mulch Filter Berms	MB-01

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DRAWING STATUS	
DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	N.A.

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY ESCP IECA STANDARD DRAWINGS

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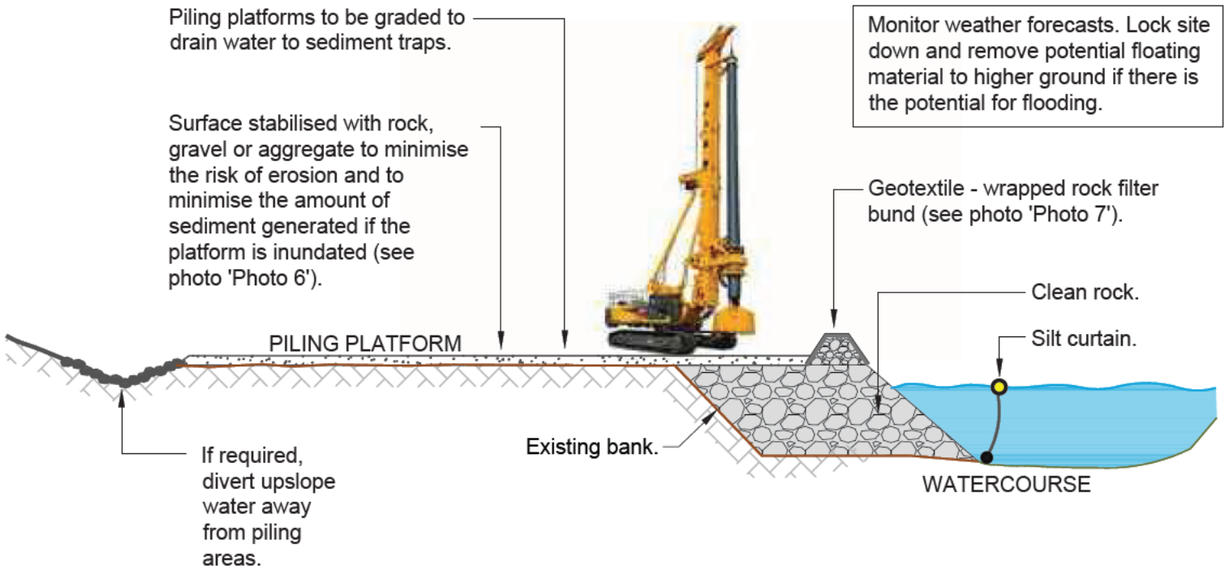
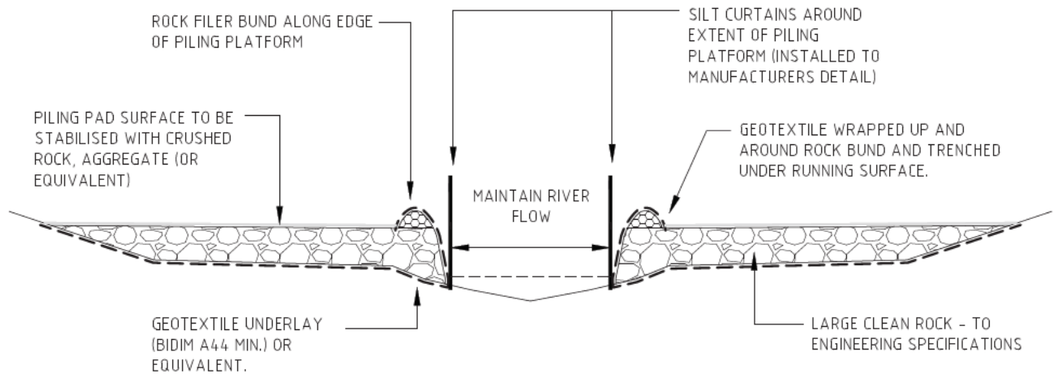
PILING PLATFORM IN/NEAR WATERCOURSE - TYPICAL DETAIL



PILING PAD CONSTRUCTION WORKS TO BE CARRIED OUT IN A FORECAST PERIOD OF NO RAINFALL AND LOW FLOW. ENSURE ALL EXPOSED SOIL SURFACES WITHIN 20m OF THE TOP BANK OF WATERWAY ARE STABILISED/COVERED PRIOR TO RAINFALL AND SITE CLOSURE EACH DAY. USE GEOTEXTILE, ROCK, AGGREGATE OR EQUIVALENT TO ACHIEVE THIS.



PILING PAD CONTROL MEASURES

PHOTO 6 - EXAMPLE OF A PILING PLATFORM STABILISED SURFACE

PHOTO 7 - EXAMPLE OF A PILING PLATFORM WITH ROCK FILTER BUND

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY ESCP TYPICAL DETAILS AND PHOTO EXAMPLES

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
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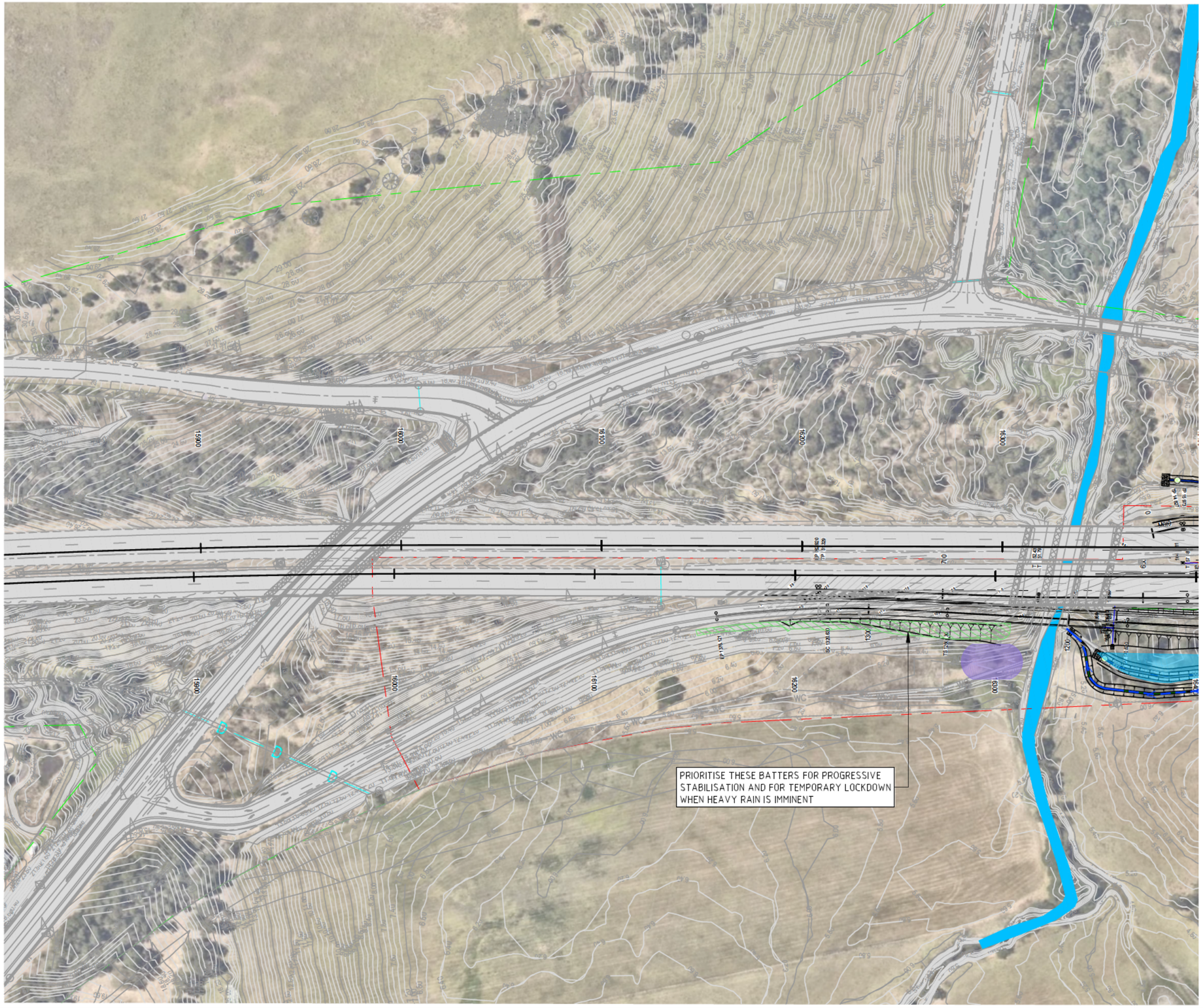

LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
- SEDIMENT TRAP - FOOTPRINTS SHOWN ARE INDICATIVE ONLY
- SEDIMENT BASIN (SB) – FOOTPRINTS SHOWN ARE INDICATIVE ONLY
- OVERFLOW DIRECTED INTO STORMWATER SYSTEM – LOCATION TO BE CONFIRMED ONSITE
- PRIORITISE THESE BATTERS FOR PROGRESSIVE STABILISATION AND FOR TEMPORARY LOCKDOWN WHEN HEAVY RAIN IS IMMINENT
- WRAPPED ROCK BUND
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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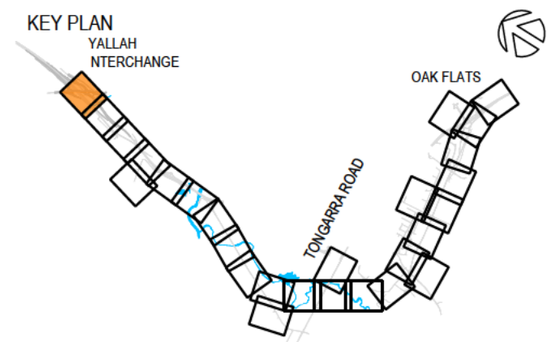
REFER TO DRAWINGS 17000301_P02_ESCP0000-0008 FOR GENERAL REQUIREMENTS, SEDIMENT BASIN SIZING REQUIREMENTS AND TYPICAL DETAILS AND PHOTOS.

KEY PLAN



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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0101	00

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PRIORITISE THESE BATTERS FOR PROGRESSIVE STABILISATION AND FOR TEMPORARY LOCKDOWN WHEN HEAVY RAIN IS IMMINENT

BASIN IS REQUIRED HERE BUT SPACE IS RESTRICTED SO INSTALL AS A LINEAR TRAP AS LARGE AS POSSIBLE WITHIN THE SWALE DRAIN AND FOCUS ON INCREASED EROSION CONTROL THROUGH THIS CATCHMENT. ALSO PROVIDE TEMPORARY DIVERSIONS ACROSS THE WORKS TO DIRECT AS MUCH OF THE RUNOFF AS POSSIBLE INTO SB 16800W.

PERMANENT DRAINAGE USED TO DIRECT RUNOFF FROM THE WORK AREA IN-BETWEEN THE EXISTING NORTH AND SOUTHBOUND LANES INTO BASIN.

(B)

SB 16800W

(A)

SB 16400W

THIS BASIN TO BE CONSTRUCTED AS A LINEAR BASIN PARTIALLY WITHIN THE PERMANENT CHANNEL LOCATION.
SEVERAL TIERS (STEP DOWNS) MAY BE REQUIRED WITHIN THE BASIN TO ACHIEVE THE VOLUME. IF THE BASIN VOLUME CANNOT BE ACHIEVED BATTERS WITHIN THE CATCHMENT ARE TO BE PRIORITISED FOR PROGRESSIVE STABILISATION AND FOR TEMPORARY LOCKDOWN WHEN RAIN IS IMMINENT.

INSTALL TEMPORARY PIPE FOR DIRTY WATER DIVERSION

THIS BASIN CAN BE CONSTRUCTED AS A LINEAR BASIN WITHIN THE PERMANENT CHANNEL LOCATION IF DESIRED.
SEVERAL TIERS (STEP DOWNS) MAY BE REQUIRED WITHIN THE BASIN TO ACHIEVE THE VOLUME. HOWEVER, TO ACHIEVE THE VOLUME THE BASIN MAY NEED TO EXTEND OUTSIDE OF THE PERMANENT CHANNEL LOCATION.

CULVERT EXTENSION COMPLETED AS EARLY WORKS. PROVIDE A BREAK AT (A) AND (B) SO THAT WATER CAN BE DISCHARGED FROM MEDIAN AND/OR BASIN SB 16800W

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- HERITAGE SITE

0 10 20 30 40 50m

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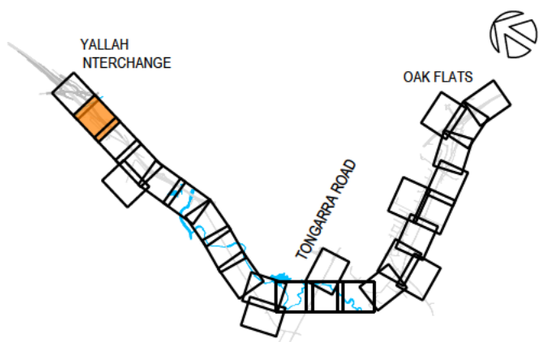

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DRAWING STATUS

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DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

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PROJECT TITLE

ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE

PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
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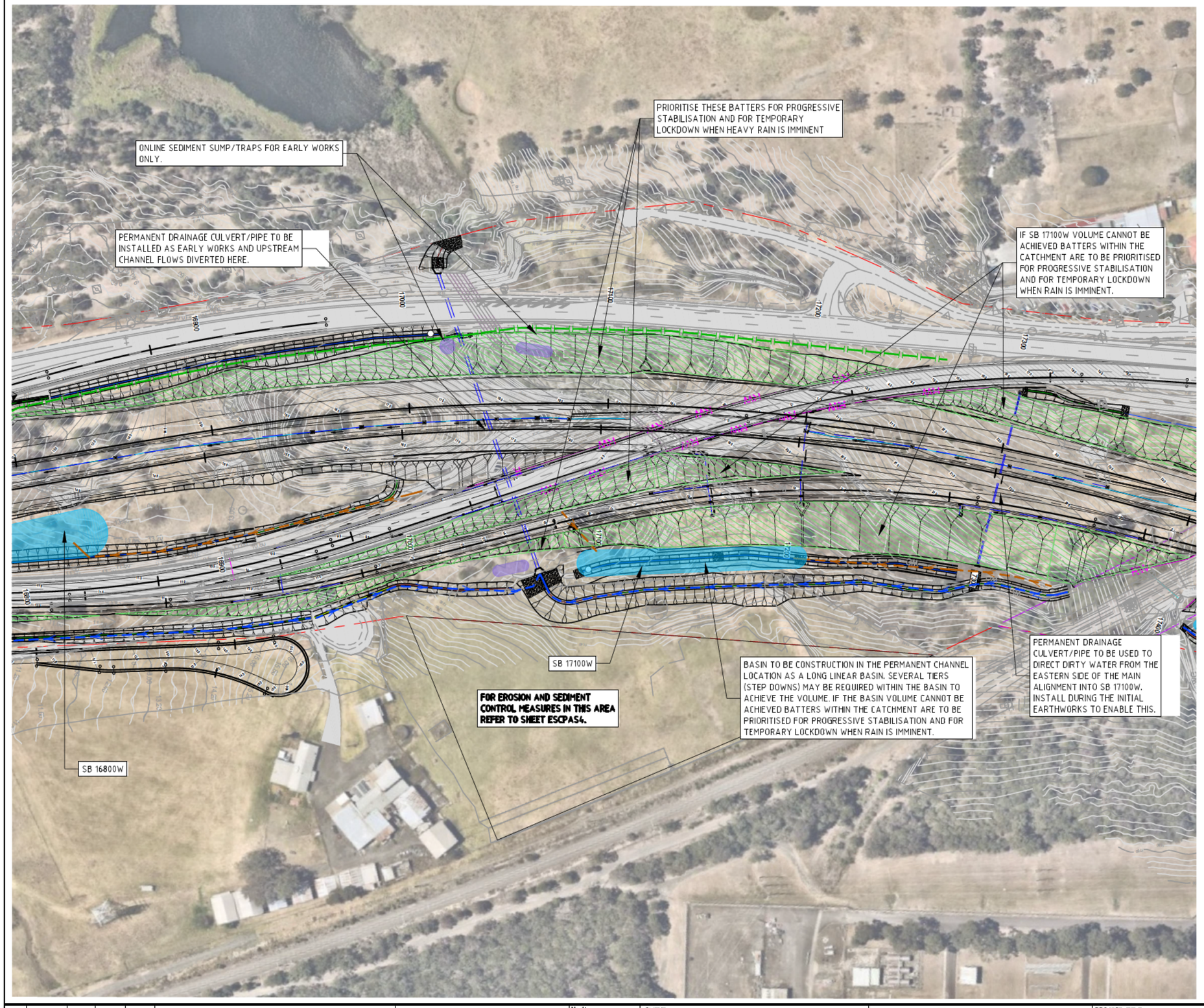

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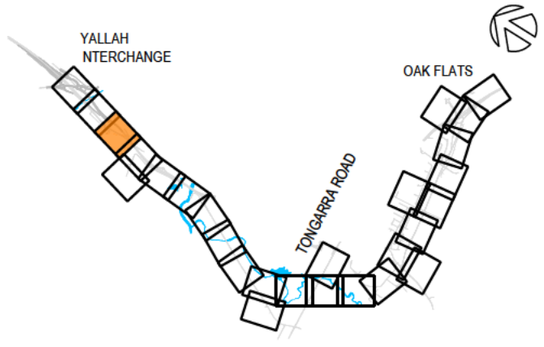

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

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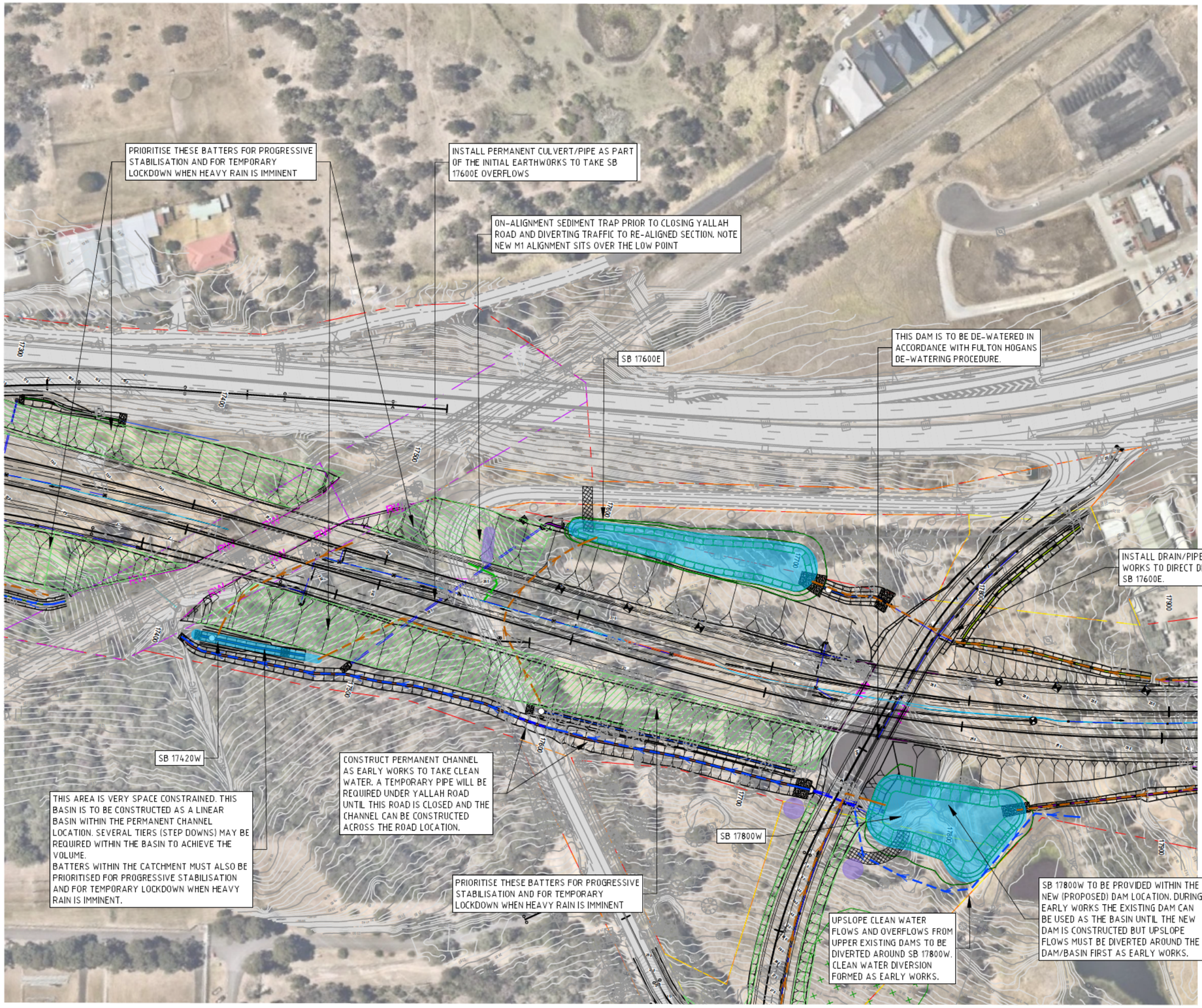

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0 10 20 30 40 50m

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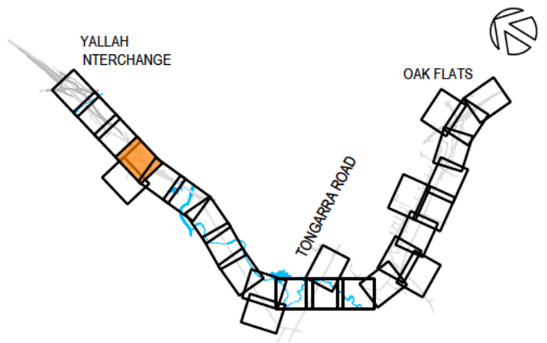

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DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

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0 10 20 30 40 50m

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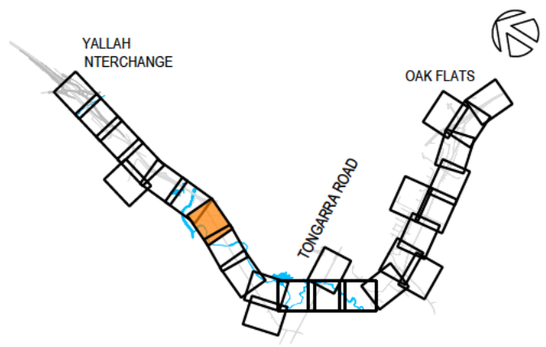

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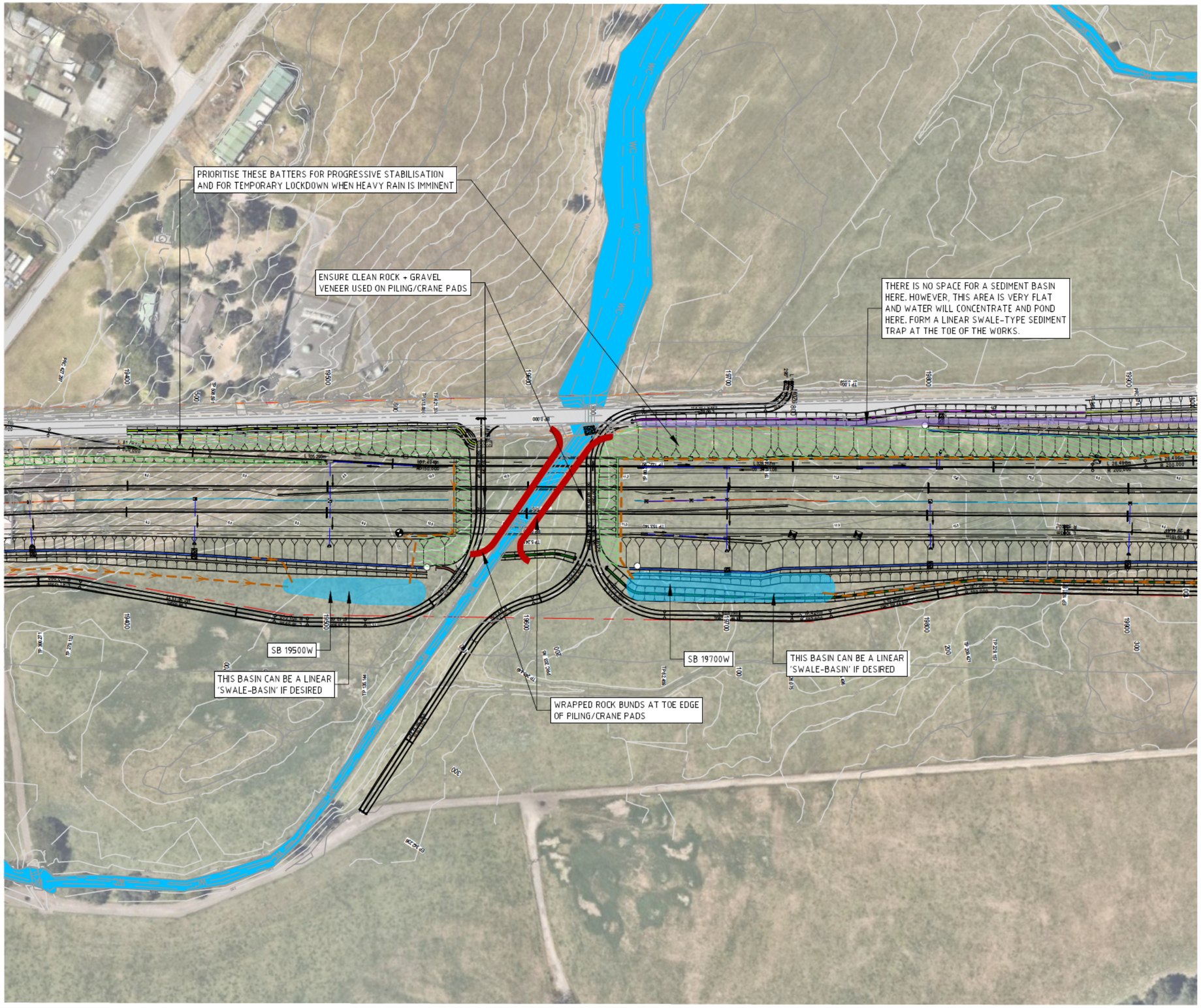

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0 10 20 30 40 50m
Scales: 1:2000 (A3 SHEET)

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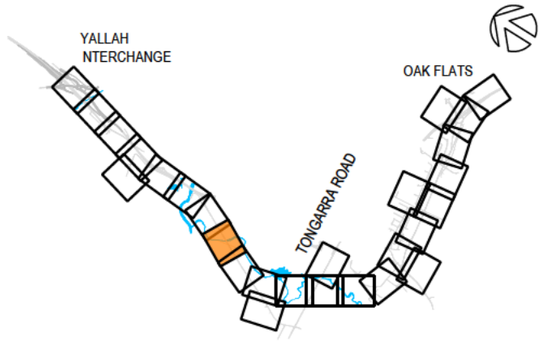
REFER TO DRAWINGS 17000301_P02_ESCP0000-0008 FOR GENERAL REQUIREMENTS, SEDIMENT BASIN SIZING REQUIREMENTS AND TYPICAL DETAILS AND PHOTOS.



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00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

North

CLIENT: Fulton Hogan

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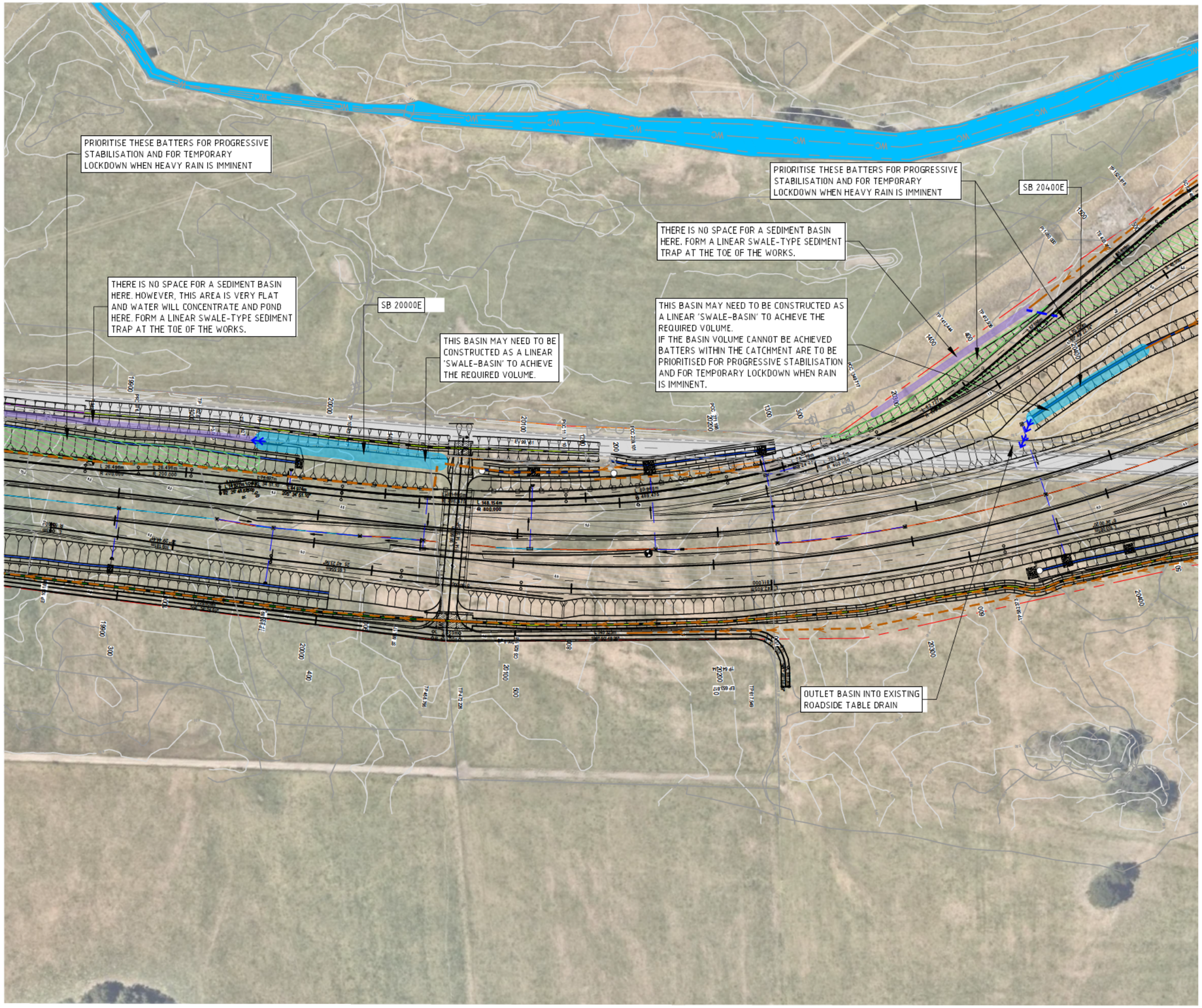
PROJECT TITLE
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE
PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0108	00

Plot Date: Monday, January 14, 2019 11:34:32 AM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
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- WRAPPED ROCK BUND
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

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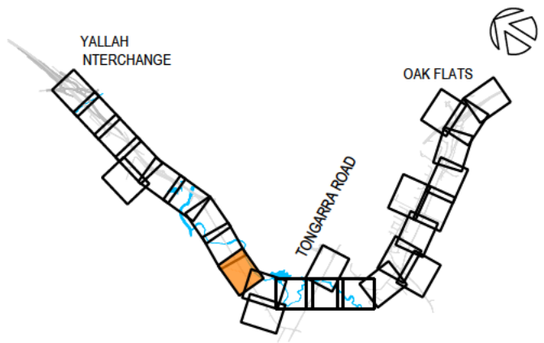

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DRAWING STATUS

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DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0109	00

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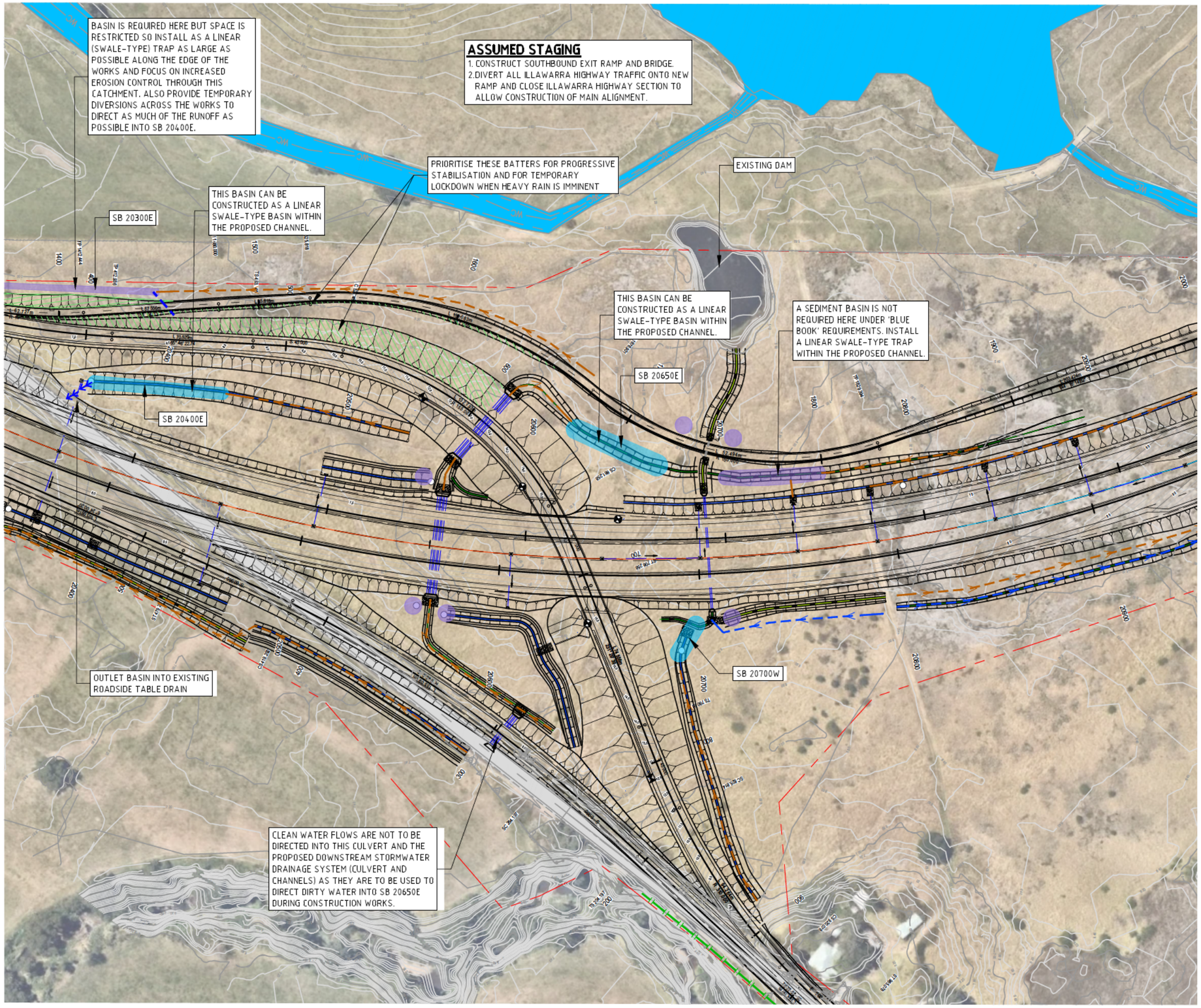

LEGEND:

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0 10 20 30 40 50m

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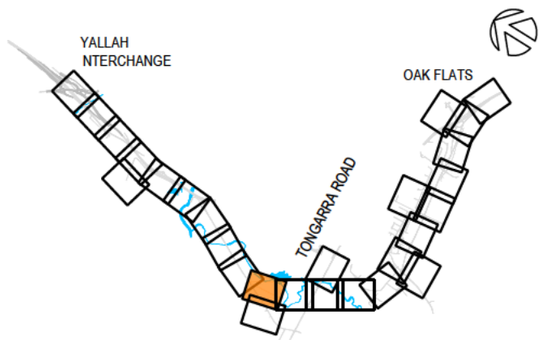

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DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0110	00

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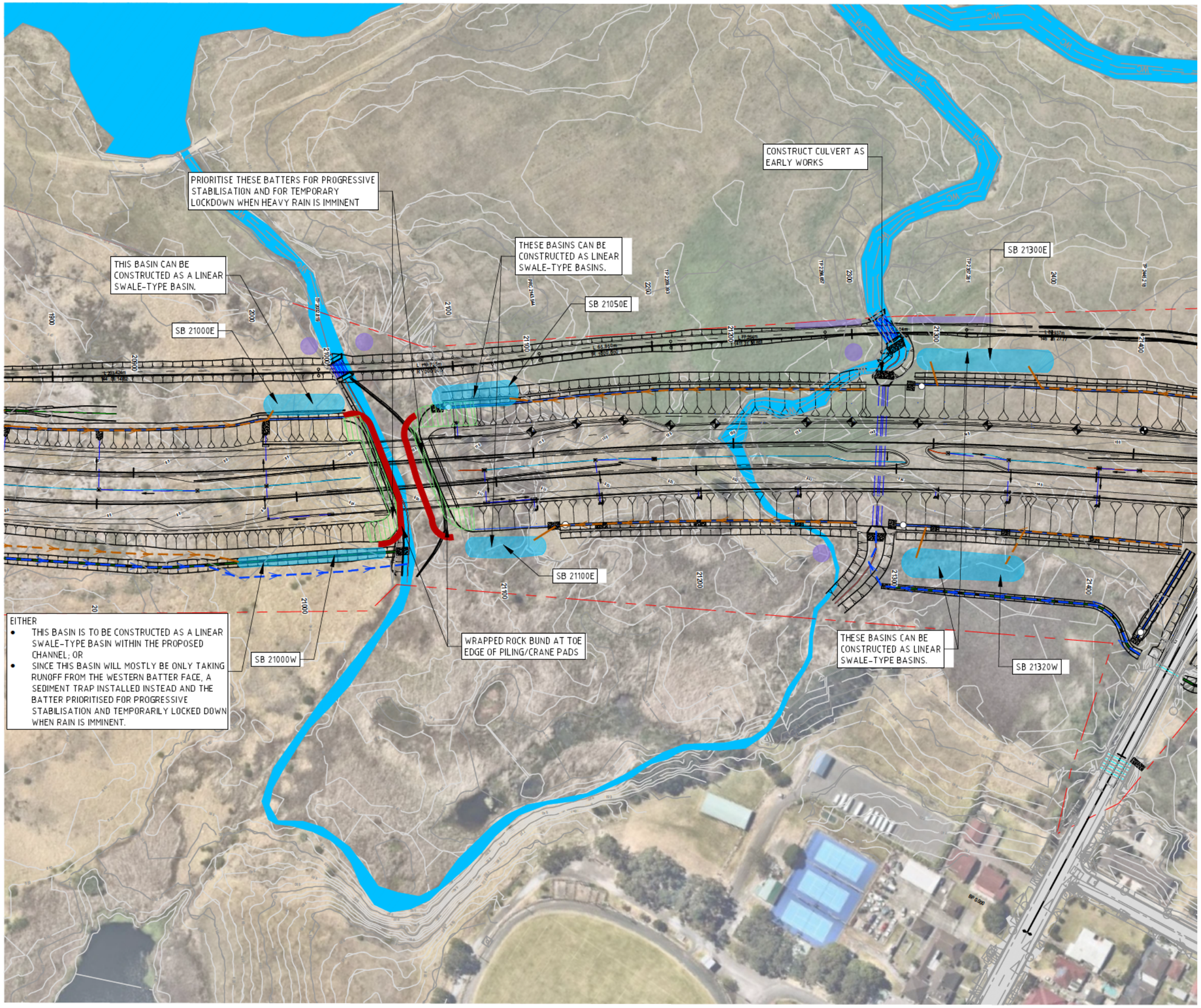

LEGEND:

- PROJECT BOUNDARY
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0 10 20 30 40 50m

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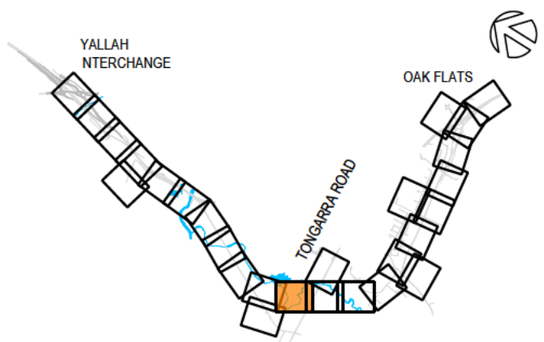

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DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
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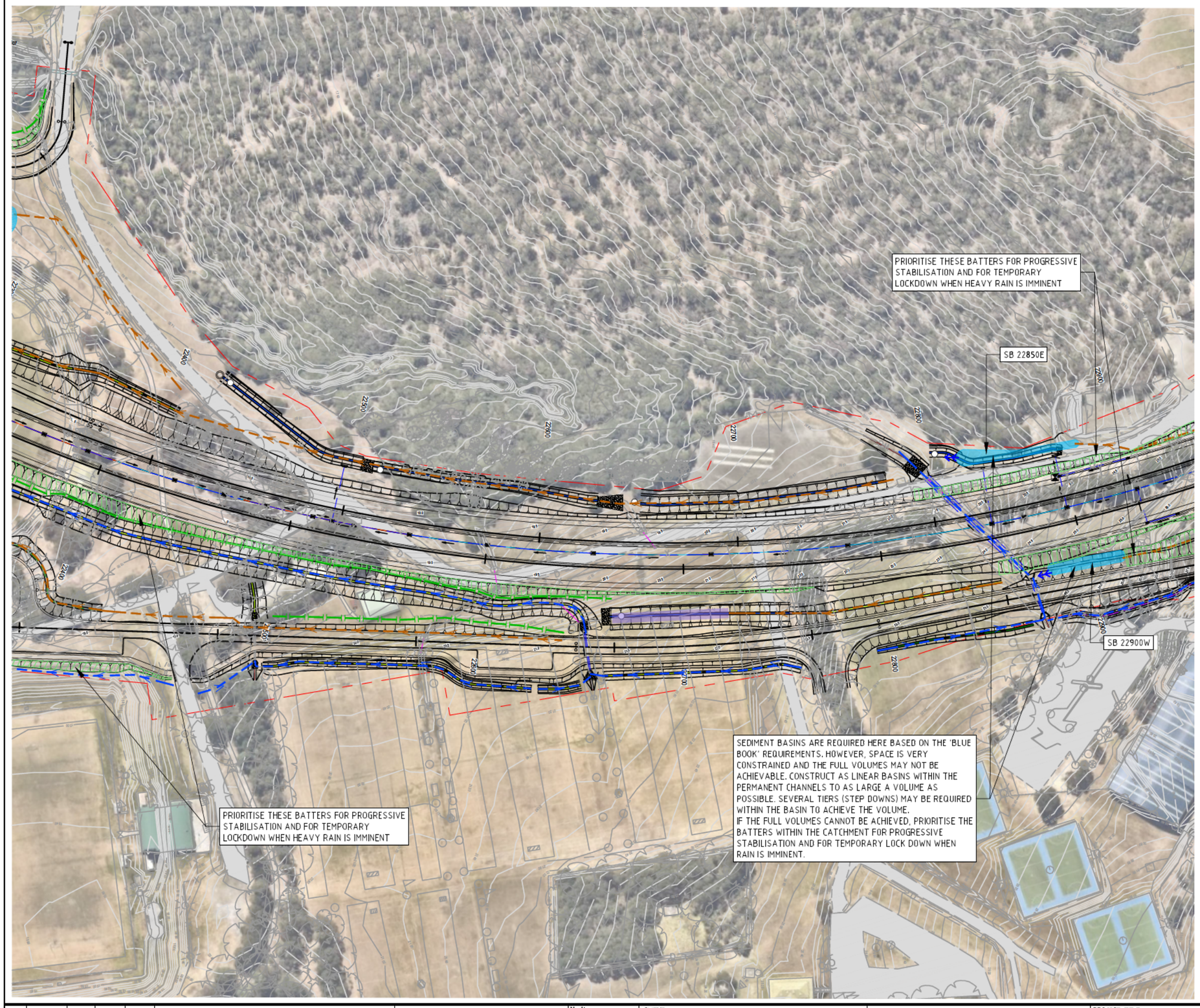

LEGEND:

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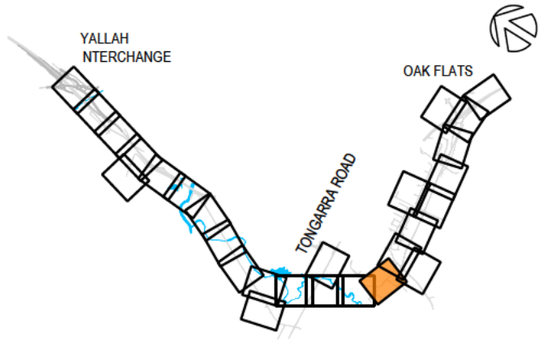

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A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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CLIENT: Fulton Hogan

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PROJECT TITLE:
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE:
PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0114	00

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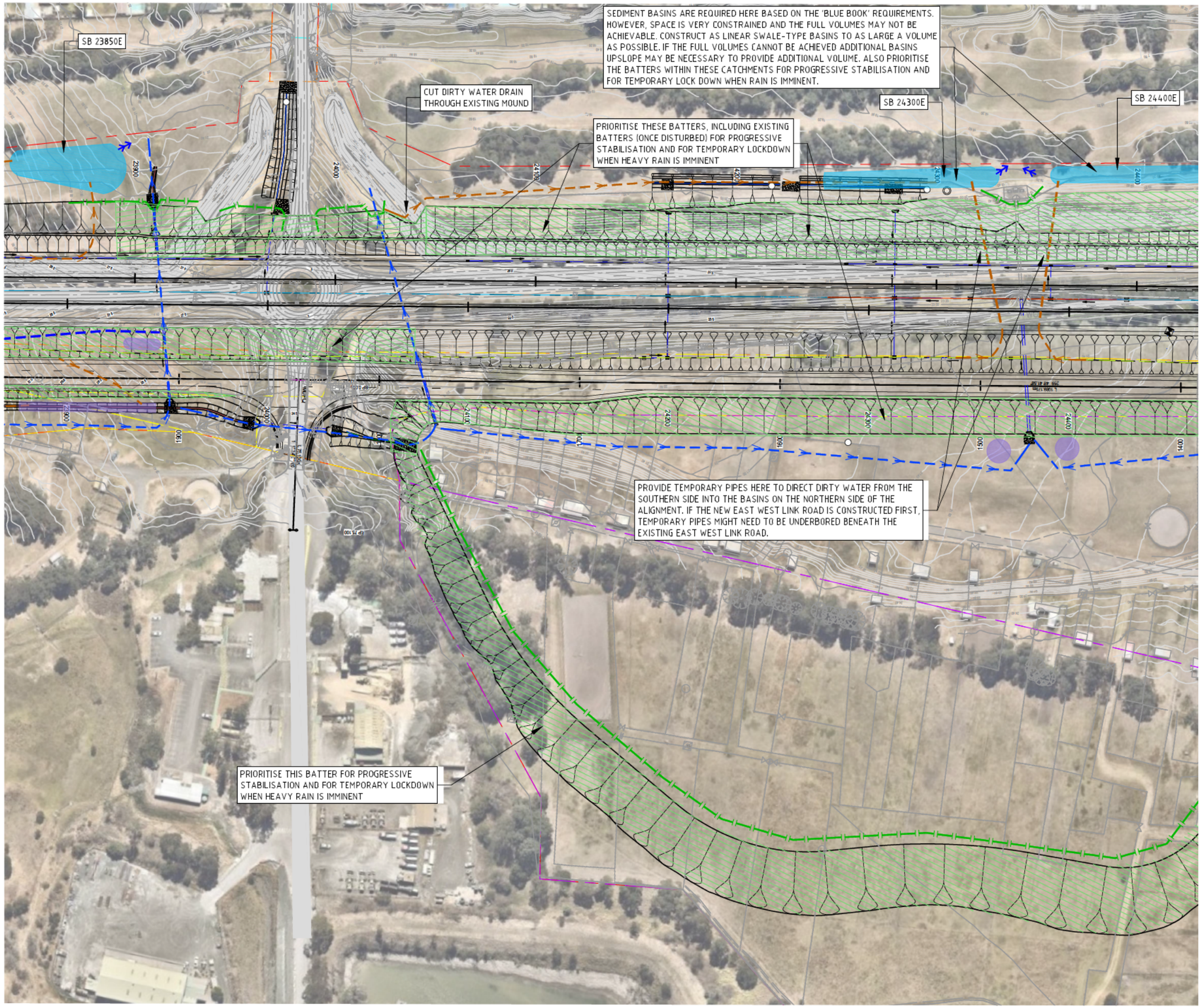

LEGEND:

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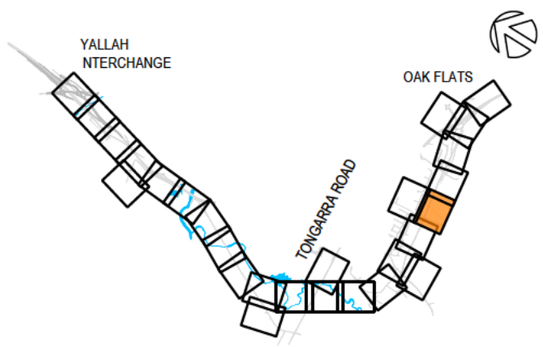

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DRAWING STATUS

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DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0117	00

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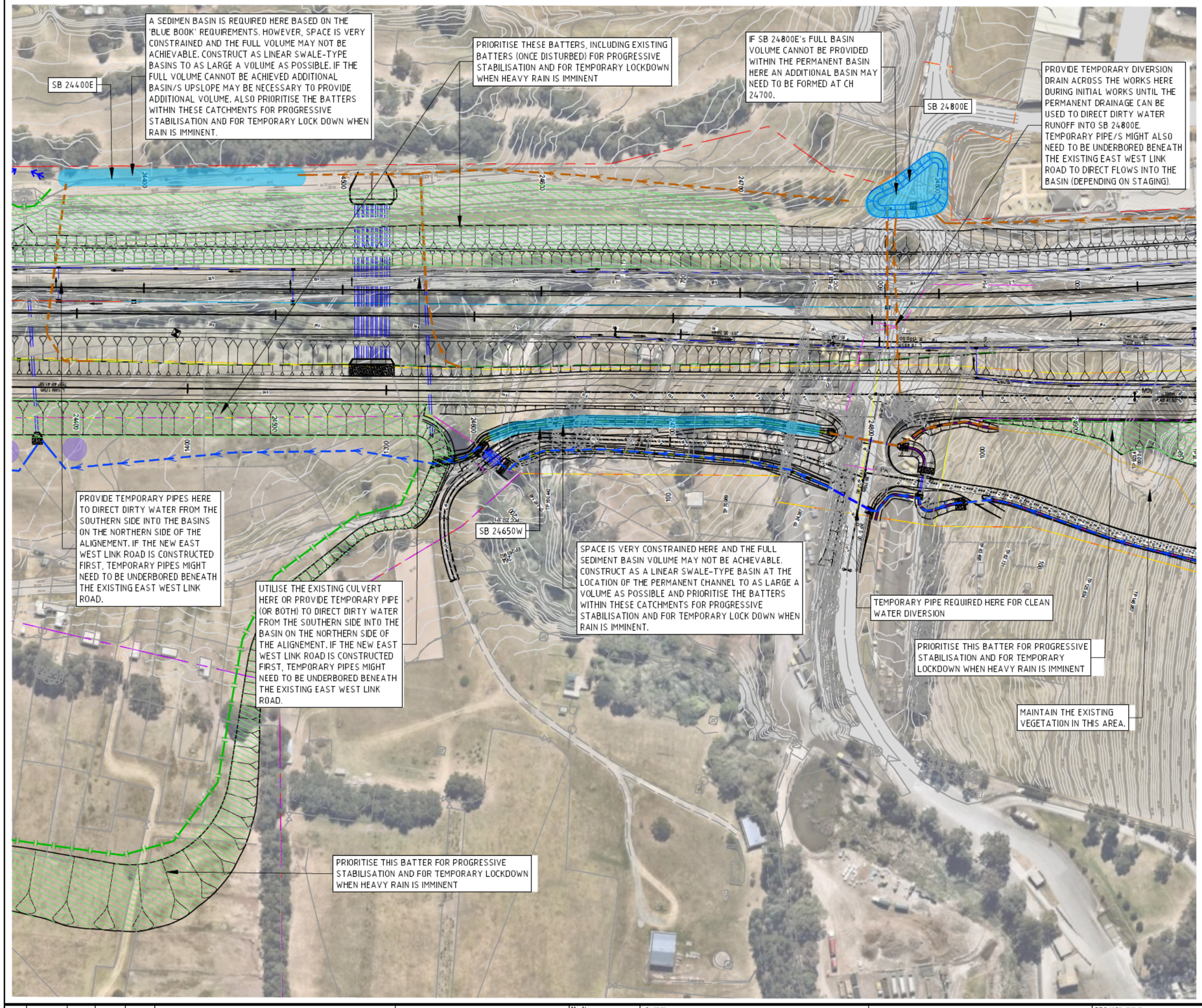

LEGEND:

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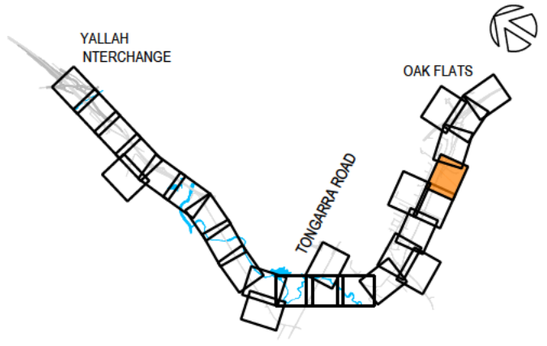

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0118	00

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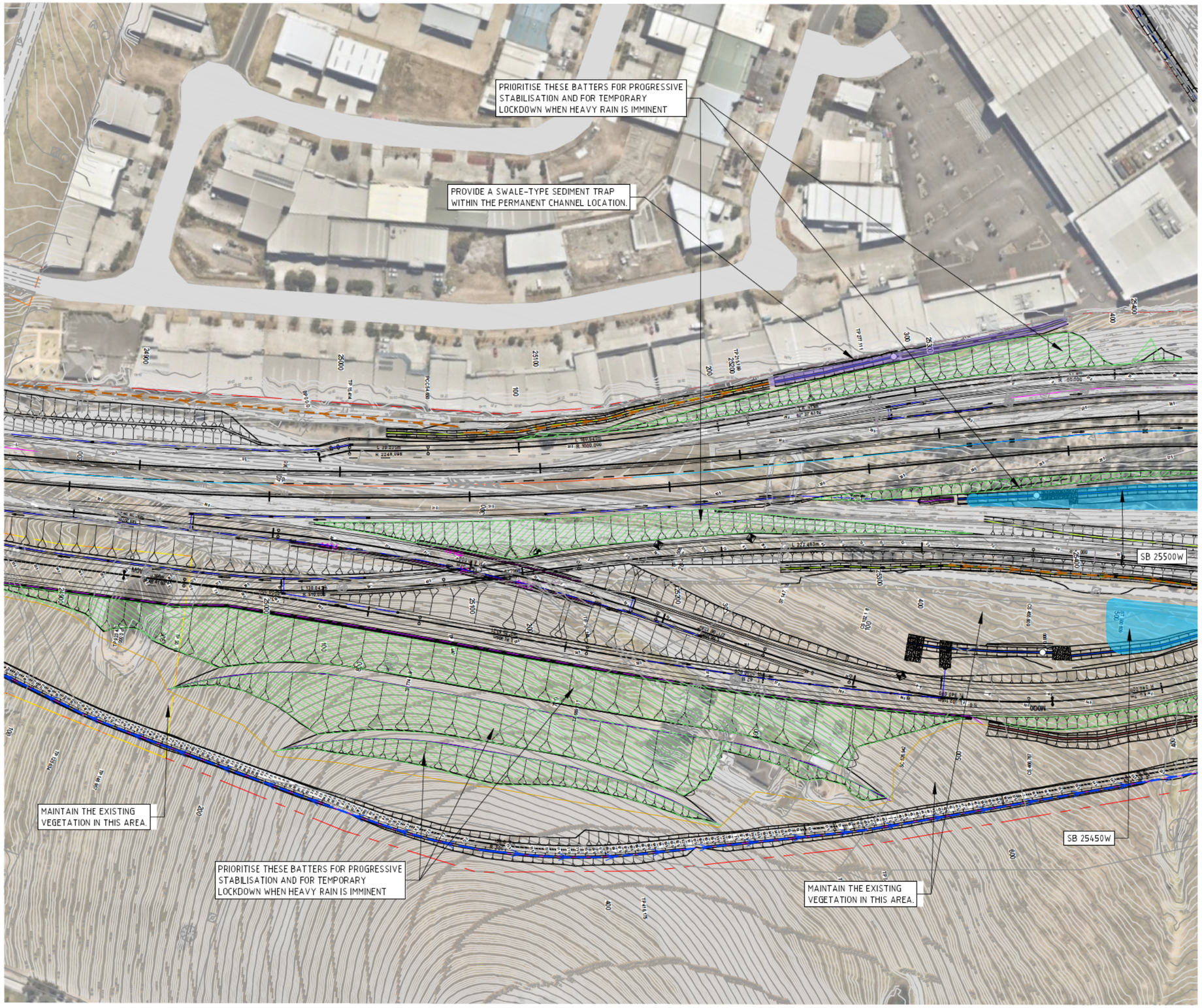

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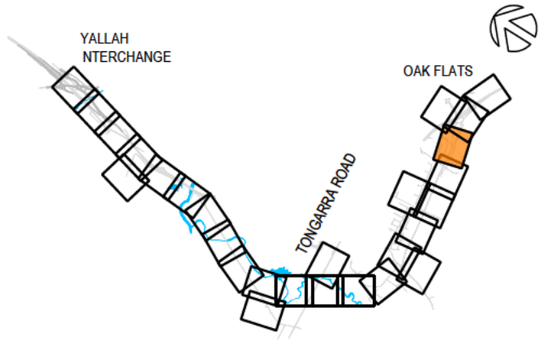

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

North

CLIENT: Fulton Hogan

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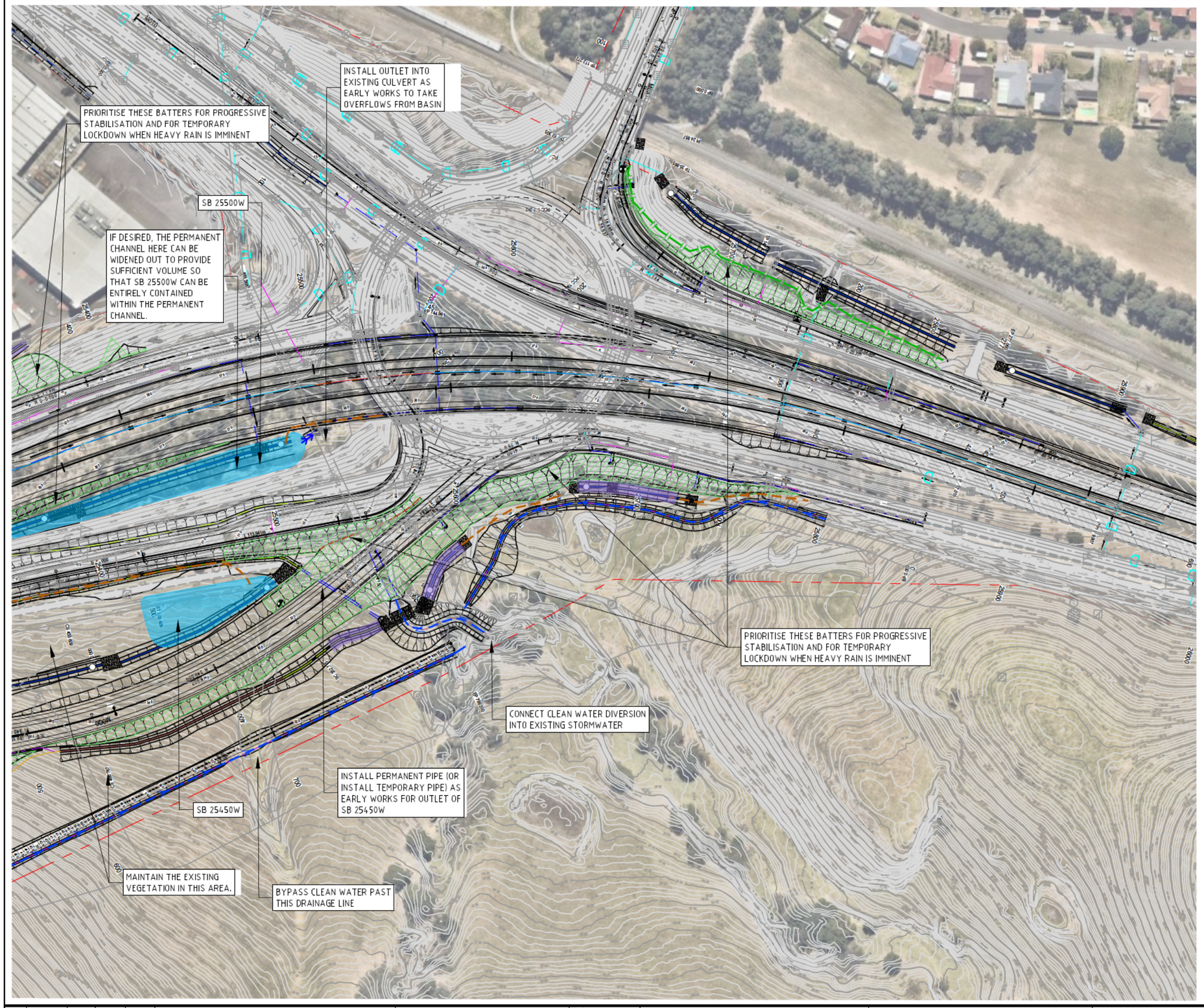
WWW.SEEC.COM.AU

PROJECT TITLE:
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE:
PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0119	00

Plot Date: Monday, January 14, 2019 12:12:14 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
- SEDIMENT TRAP - FOOTPRINTS SHOWN ARE INDICATIVE ONLY
- SEDIMENT BASIN (SB) - FOOTPRINTS SHOWN ARE INDICATIVE ONLY
- OVERFLOW DIRECTED INTO STORMWATER SYSTEM - LOCATION TO BE CONFIRMED ONSITE
- PRIORITISE THESE BATTERS FOR PROGRESSIVE STABILISATION AND FOR TEMPORARY LOCKDOWN WHEN HEAVY RAIN IS IMMINENT
- WRAPPED ROCK BUND
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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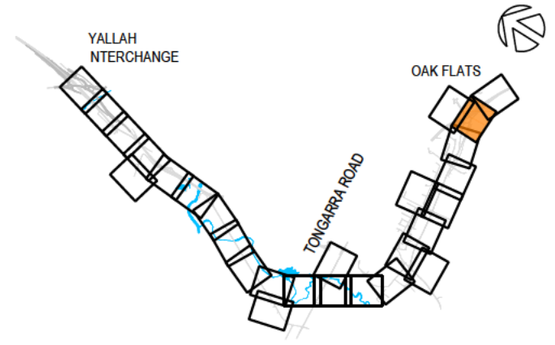
REFER TO DRAWINGS 17000301_P02_ESCP0000-0008 FOR GENERAL REQUIREMENTS, SEDIMENT BASIN SIZING REQUIREMENTS AND TYPICAL DETAILS AND PHOTOS.



REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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CLIENT: Fulton Hogan

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0120	00

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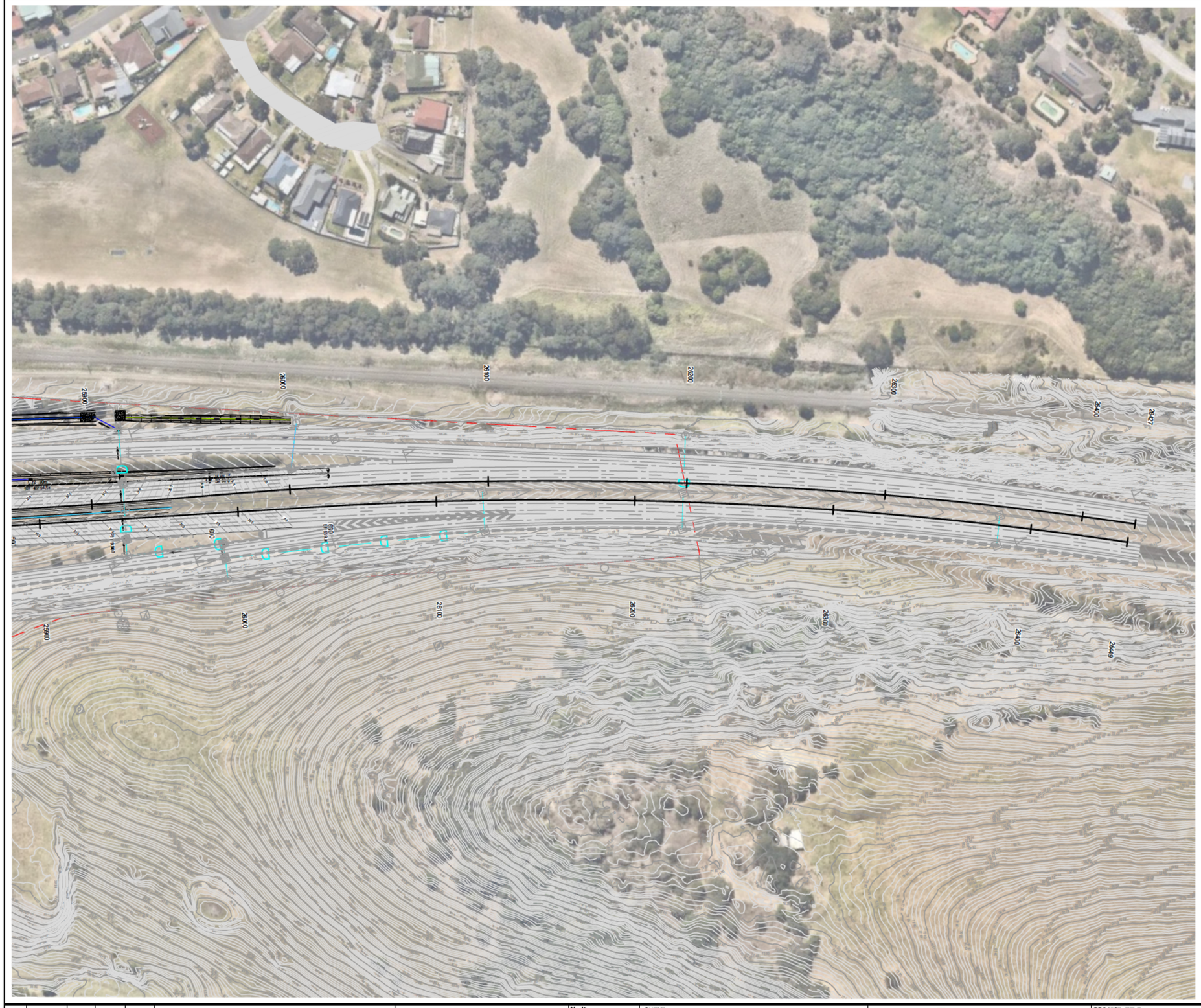

LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
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- WRAPPED ROCK BUND
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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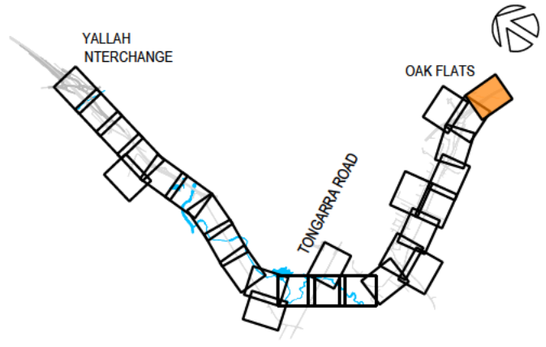

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A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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CLIENT: Fulton Hogan

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0121	00

Plot Date: Monday, January 14, 2019 12:19:07 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg

LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
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- WRAPPED ROCK BUND
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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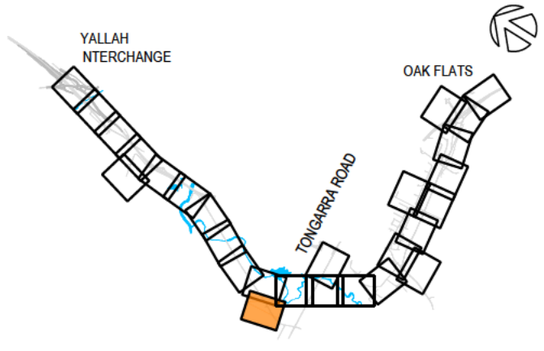

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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CLIENT

Fulton Hogan

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PROJECT TITLE

ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE

PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0141	00

Plot Date: Monday, January 14, 2019 12:25:16 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg

LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
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- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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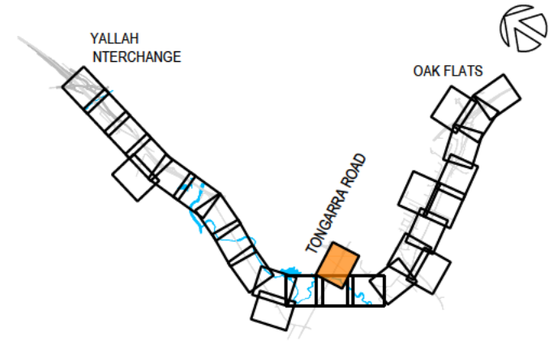

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A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

North

CLIENT

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PROJECT TITLE

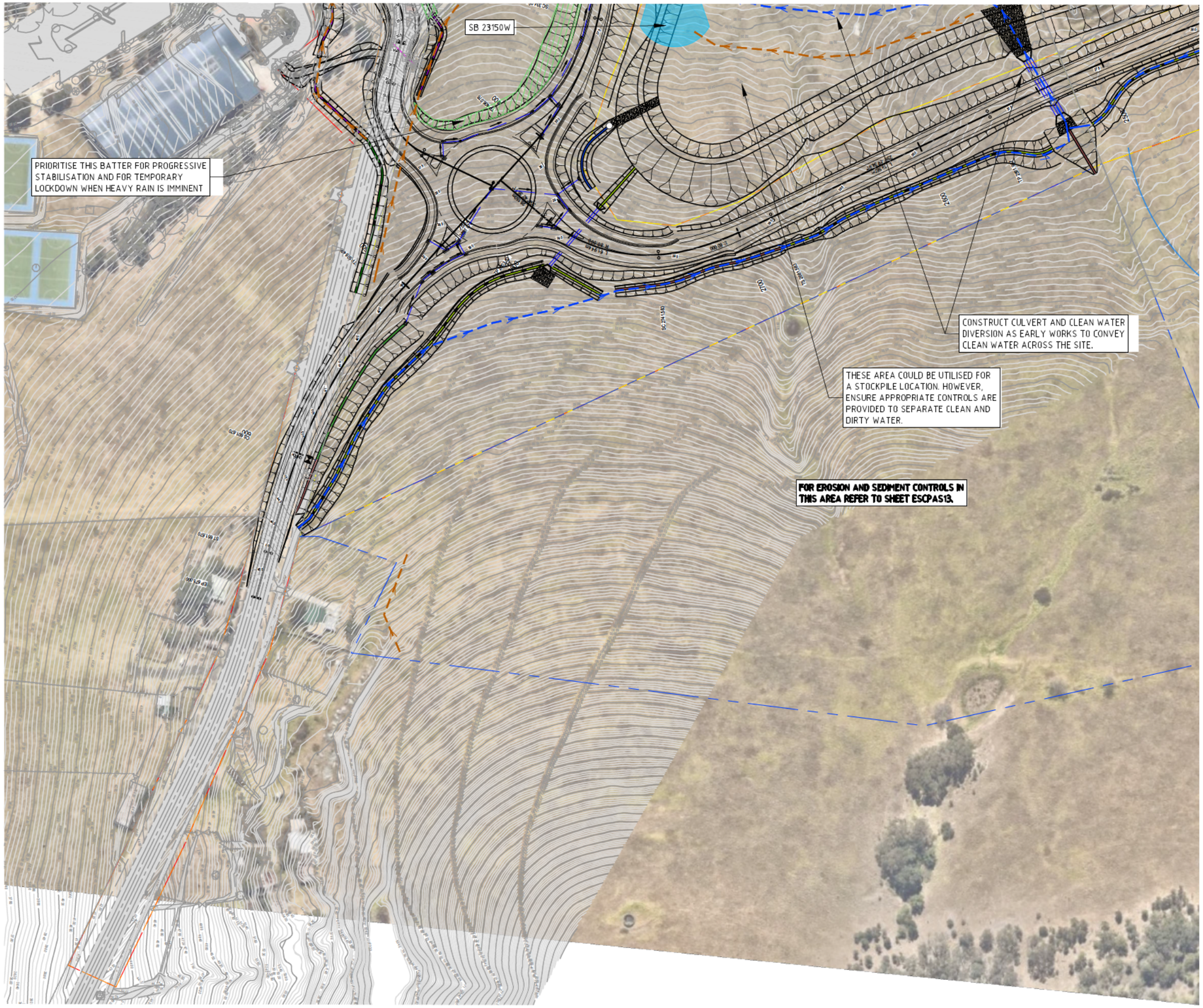
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE

PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0151	00

Plot Date: Monday, January 14, 2019 12:28:53 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
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- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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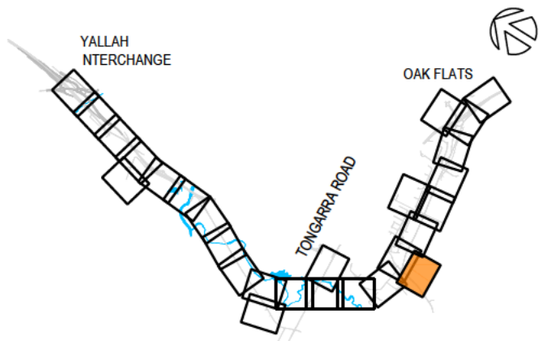

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A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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CLIENT: Fulton Hogan

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0161	00

Plot Date: Monday, January 14, 2019 12:32:21 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg

LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
- SEDIMENT TRAP - FOOTPRINTS SHOWN ARE INDICATIVE ONLY
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- WRAPPED ROCK BUND
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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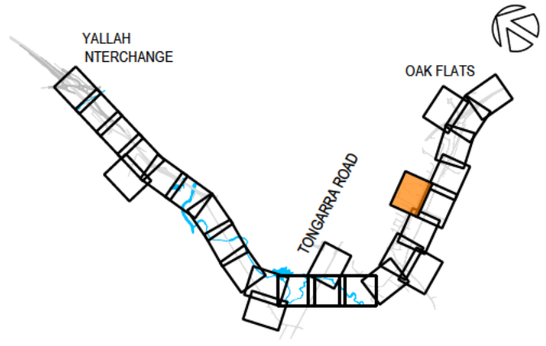

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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CLIENT: Fulton Hogan

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0171	00

Plot Date: Monday, January 14, 2019 12:35:22 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg

LEGEND:

- PROJECT BOUNDARY
- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- CLEAN WATER TEMPORARY PIPE
- DIRTY WATER TEMPORARY PIPE
- SEDIMENT FENCE (SD 6-8) OR SIMILAR
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- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SILT CURTAIN
- HERITAGE SITE

0 10 20 30 40 50m

Scale: 1:2000 (A3 SHEET)

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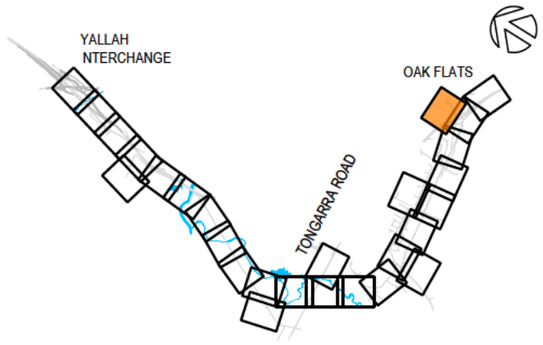

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
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DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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PROJECT TITLE

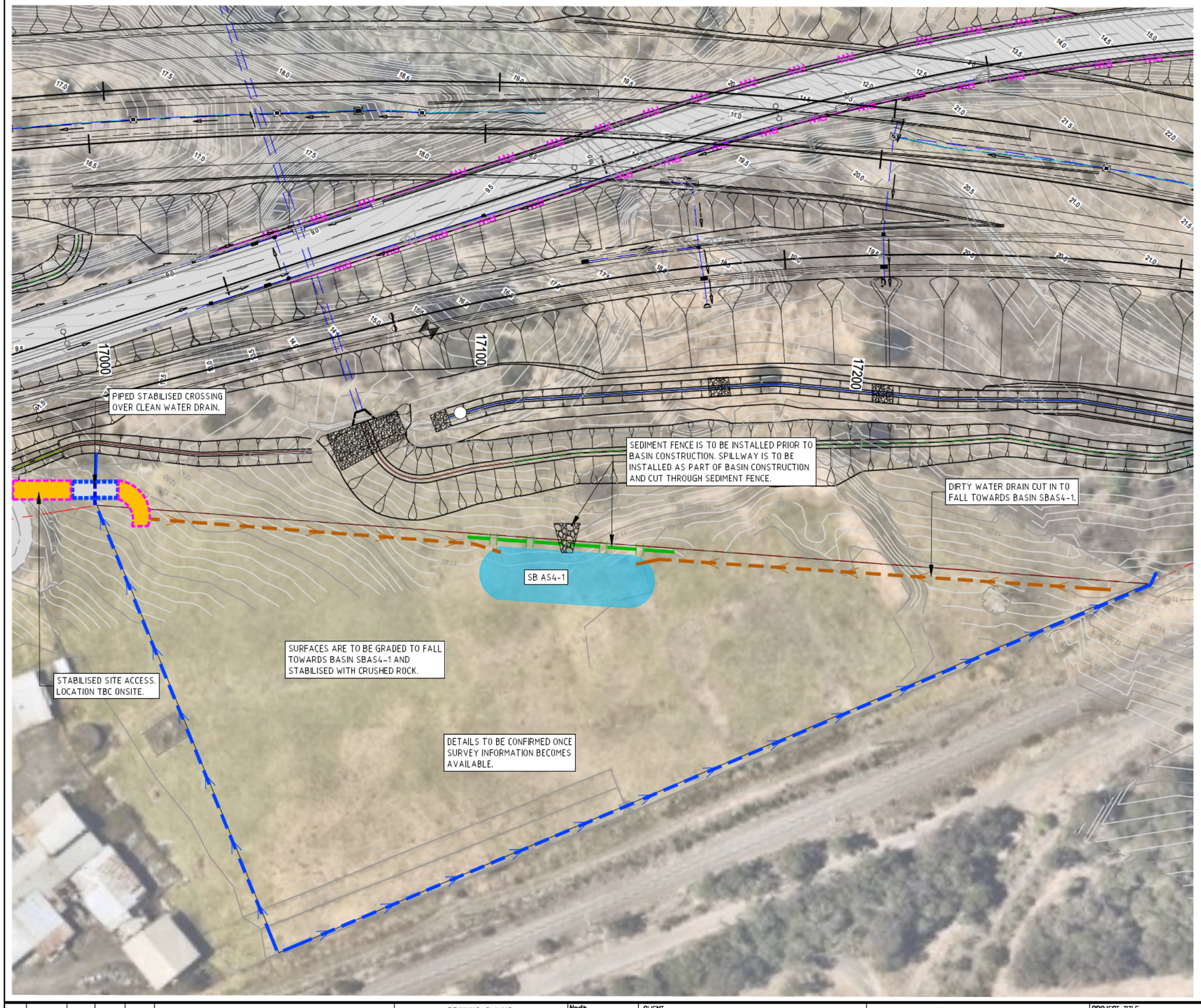
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE

PRIMARY EROSION AND SEDIMENT CONTROL PLAN

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCP0181	00

Plot Date: Monday, January 14, 2019 12:38:25 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- SEDIMENT FENCE (SD 6-8)
- SEDIMENT BASIN (SB) - SEE PLAN FOR SEDIMENT BASIN DETAILS AND SIZING REQUIREMENTS
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
- CLEAN WATER FLOW DIRECTION
- DIRTY WATER FLOW DIRECTION
- SITE COMPOUND AND PARKING AREA
- LAYDOWN/STORAGE AREA
- STOCKPILE AREA (SD 4-1)
- COALWASH STOCKPILE AREA (SD 4-1) /FUTURE CRUSHING SITE
- ACCESS TRACK
- HERITAGE ARTIFACTS SITE
- STABILISED CROSSING (SD 5-1)
- DISSIPATER OULET/INLET (GEOTEXTILE + ROCK Ø200min. OR CONCRETE)

0 5 10 15 20 25m
Scale: 1:1000 (A3 SHEET)

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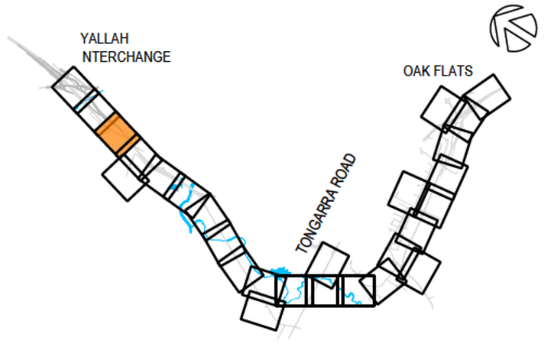
REFER TO DRAWINGS 17000301_P02_ESCP0000-0008 FOR GENERAL REQUIREMENTS, SEDIMENT BASIN SIZING REQUIREMENTS AND TYPICAL DETAILS AND PHOTOS.



REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:1000

FINAL

North

CLIENT: Fulton Hogan

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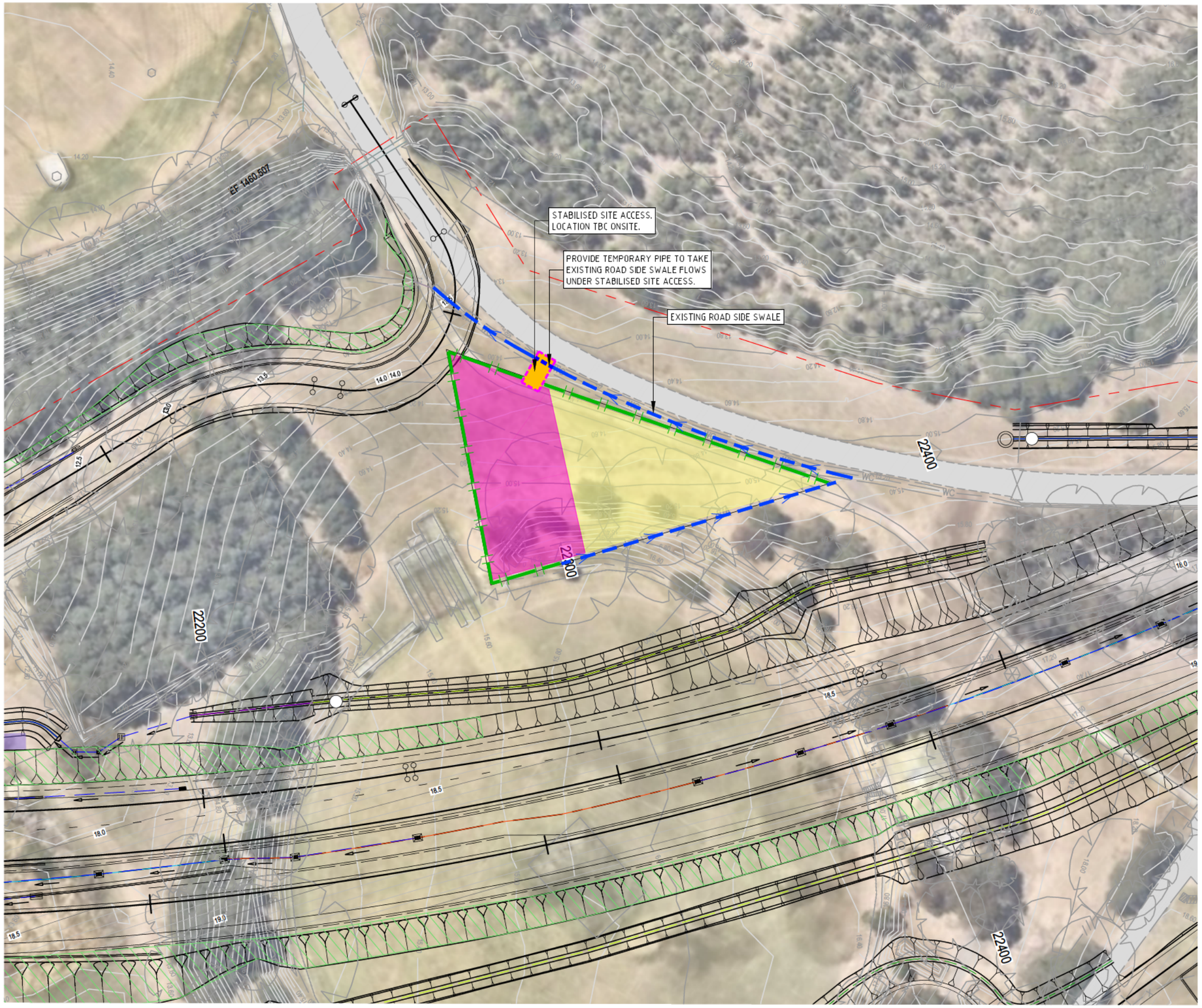
PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN ANCILLARY FACILITY AS4

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCPAS04	00

Plot Date: Monday, January 14, 2019 12:41:27 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- SEDIMENT FENCE (SD 6-8)
- SEDIMENT BASIN (SB) – SEE PLAN FOR SEDIMENT BASIN DETAILS AND SIZING REQUIREMENTS
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- ACCESS TRACK
- HERITAGE ARTIFACTS SITE
- STABILISED CROSSING (SD 5-1)
- DISSIPATER OULET/INLET (GEOTEXTILE + ROCK Ø200min. OR CONCRETE)

0 5 10 15 20 25m
Scale: 1:1000 (A3 SHEET)

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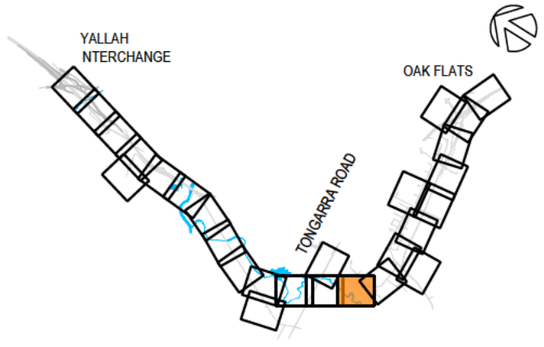
REFER TO DRAWINGS 17000301_P02_ESCP0000-0008 FOR GENERAL REQUIREMENTS, SEDIMENT BASIN SIZING REQUIREMENTS AND TYPICAL DETAILS AND PHOTOS.



REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT – FOR CONSULTATION

DRAWING STATUS

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DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:1000

FINAL

North

CLIENT: Fulton Hogan

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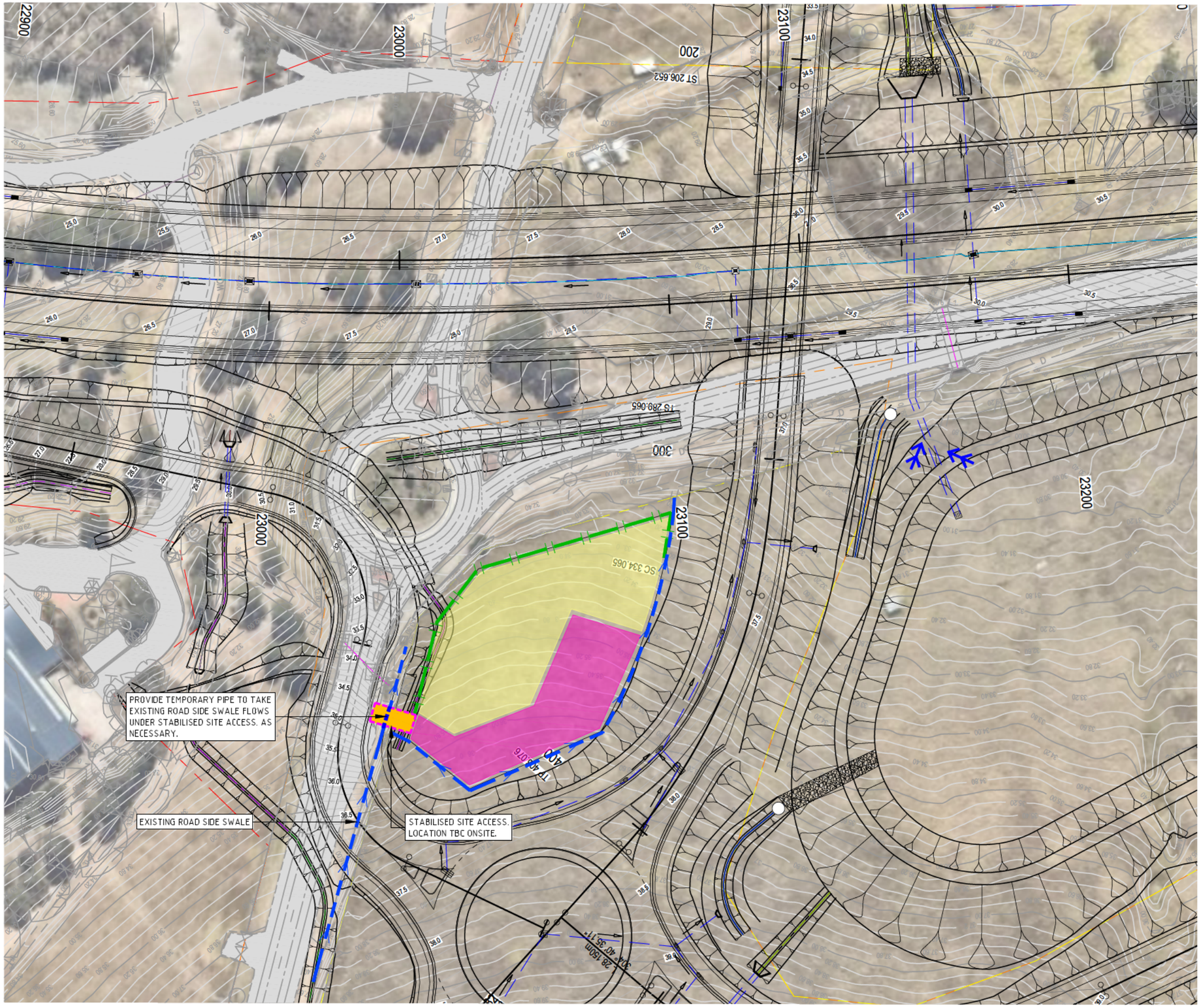
WWW.SEEC.COM.AU

PROJECT TITLE:
ALBION PARK RAIL BYPASS
PRINCES HIGHWAY UPGRADE
FROM DUCK CREEK TO THE
OAK FLATS INTERCHANGE

DRAWING TITLE:
PRIMARY EROSION AND SEDIMENT CONTROL PLAN
ANCILLARY SITE AS09

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCPAS09	00

Plot Date: Monday, January 14, 2019 12:51:39 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- CLEAN WATER DIVERSION
- DIRTY WATER DIVERSION
- SEDIMENT FENCE (SD 6-8)
- SEDIMENT BASIN (SB) - SEE PLAN FOR SEDIMENT BASIN DETAILS AND SIZING REQUIREMENTS
- STABILISED SITE ACCESS (SD 6-14) OR UTILISE EXISTING SEALED SURFACES
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- HERITAGE ARTIFACTS SITE
- STABILISED CROSSING (SD 5-1)
- DISSIPATER OULET/INLET (GEOTEXTILE + ROCK Φ200min. OR CONCRETE)

0 5 10 15 20 25m
Scale: 1:1000 (A3 SHEET)

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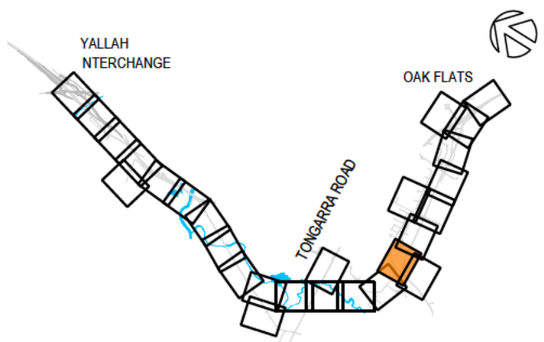
REFER TO DRAWINGS 17000301_P02_ESCP0000-0008 FOR GENERAL REQUIREMENTS, SEDIMENT BASIN SIZING REQUIREMENTS AND TYPICAL DETAILS AND PHOTOS.



REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT - FOR CONSULTATION

DRAWING STATUS	
DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:1000

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CLIENT: Fulton Hogan

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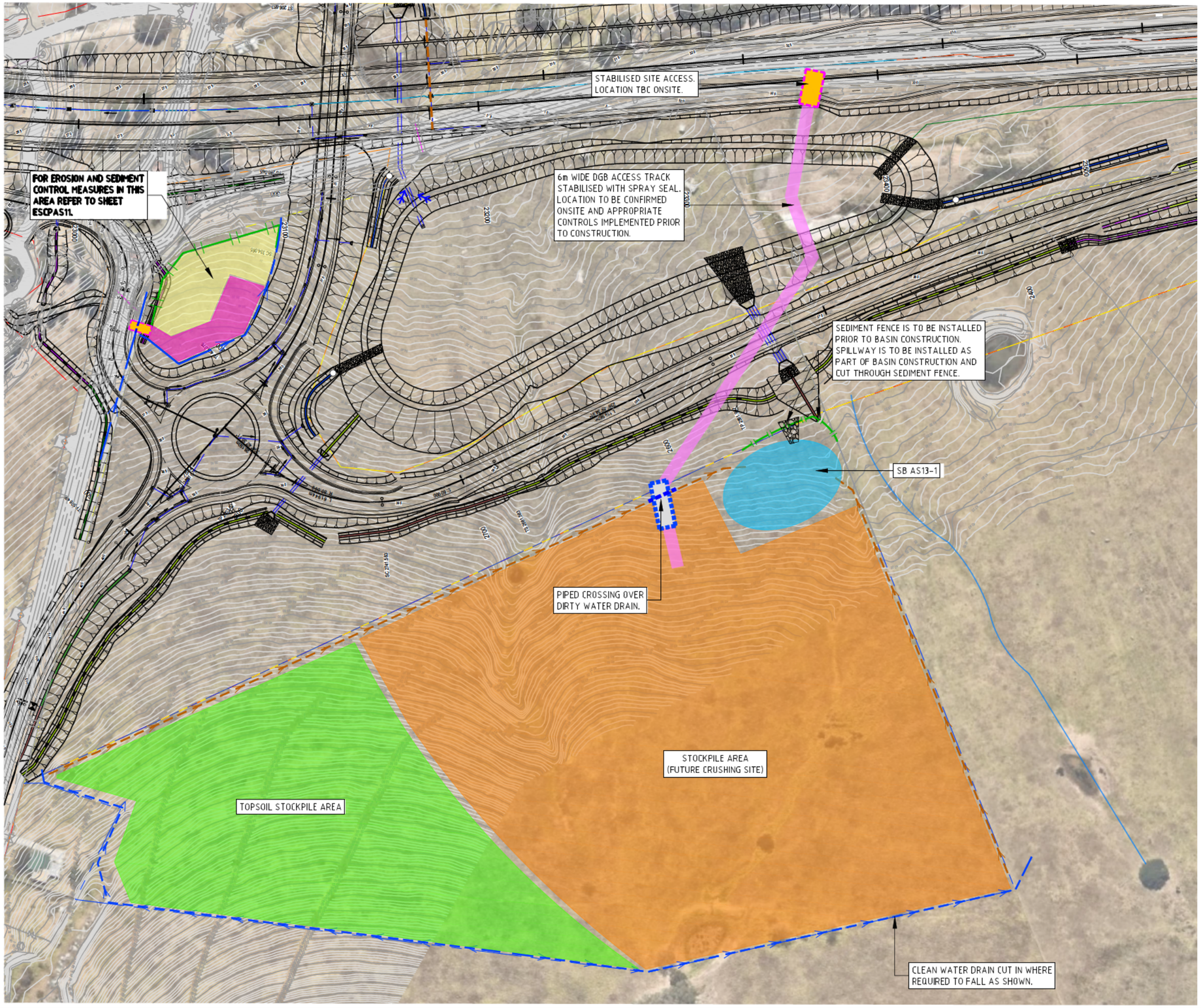
PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN ANCILLARY SITE AS11

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCPAS11	00

Plot Date: Monday, January 14, 2019 12:55:12 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg



LEGEND:

- CLEAN WATER DIVERSION
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- SEDIMENT BASIN (SB) - SEE PLAN FOR SEDIMENT BASIN DETAILS AND SIZING REQUIREMENTS
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- ACCESS TRACK
- HERITAGE HERITAGE SITE
- STABILISED CROSSING (SD 5-1)
- DISSIPATER OULET/INLET (GEOTEXTILE + ROCK Ø200min. OR CONCRETE)

0 10 20 30 40 50m
Scale: 1:2000 (A3 SHEET)

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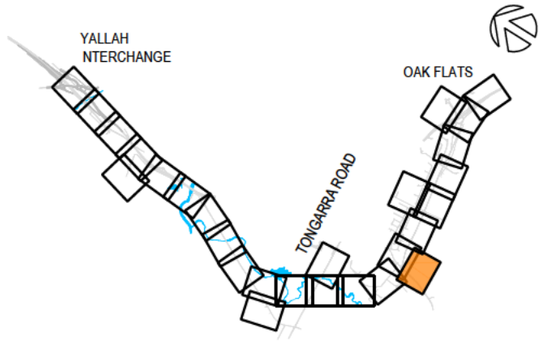

REV	DATE	DES.	DRN.	APP.	REVISION DETAILS
00	14/01/19	A.T.	A.T.	A.M.	ISSUE FOR CONSTRUCTION USE
A	13/12/18	A.T.	A.T.	A.M.	DRAFT - FOR CONSULTATION

DRAWING STATUS

DESIGN BY	A.T.
DRAWN BY	L.O.
FINAL APPROVAL	A.M.
SCALE: (on A3 Original)	1:2000

FINAL

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PROJECT TITLE: ALBION PARK RAIL BYPASS PRINCES HIGHWAY UPGRADE FROM DUCK CREEK TO THE OAK FLATS INTERCHANGE

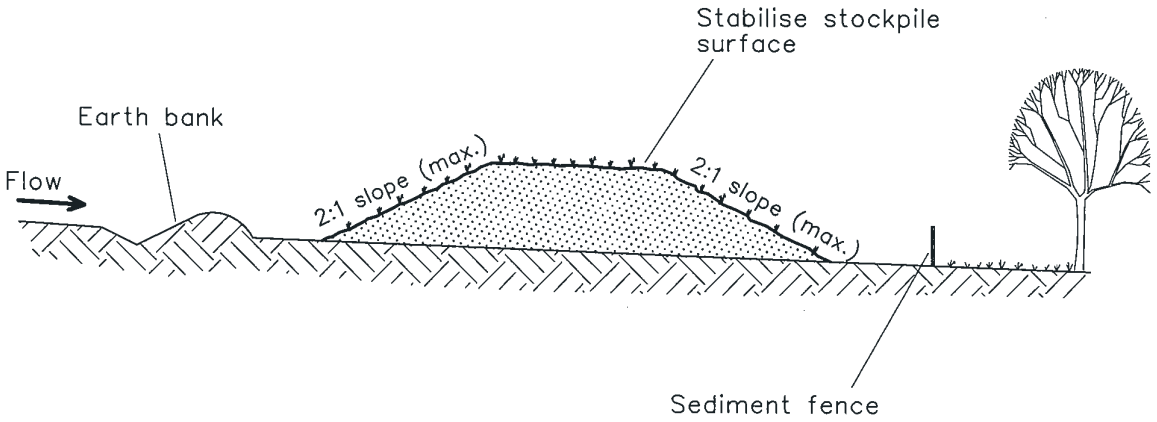
DRAWING TITLE: PRIMARY EROSION AND SEDIMENT CONTROL PLAN ANCILLARY FACILITY AS13

PROJECT NO.	SUB-PR NO.	DRAWING NO.	REV
17000301	P02	ESCPAS13	00

Plot Date: Monday, January 14, 2019 12:58:46 PM CAD File Name: C:\Users\aburnus\Desktop\Jobs\17000301\Z.NEW\DRAWINGS\17000301_P02_ESCP100_REV 00.dwg

BLUE BOOK STANDARD DRAWINGS

STANDARD DRAWINGS

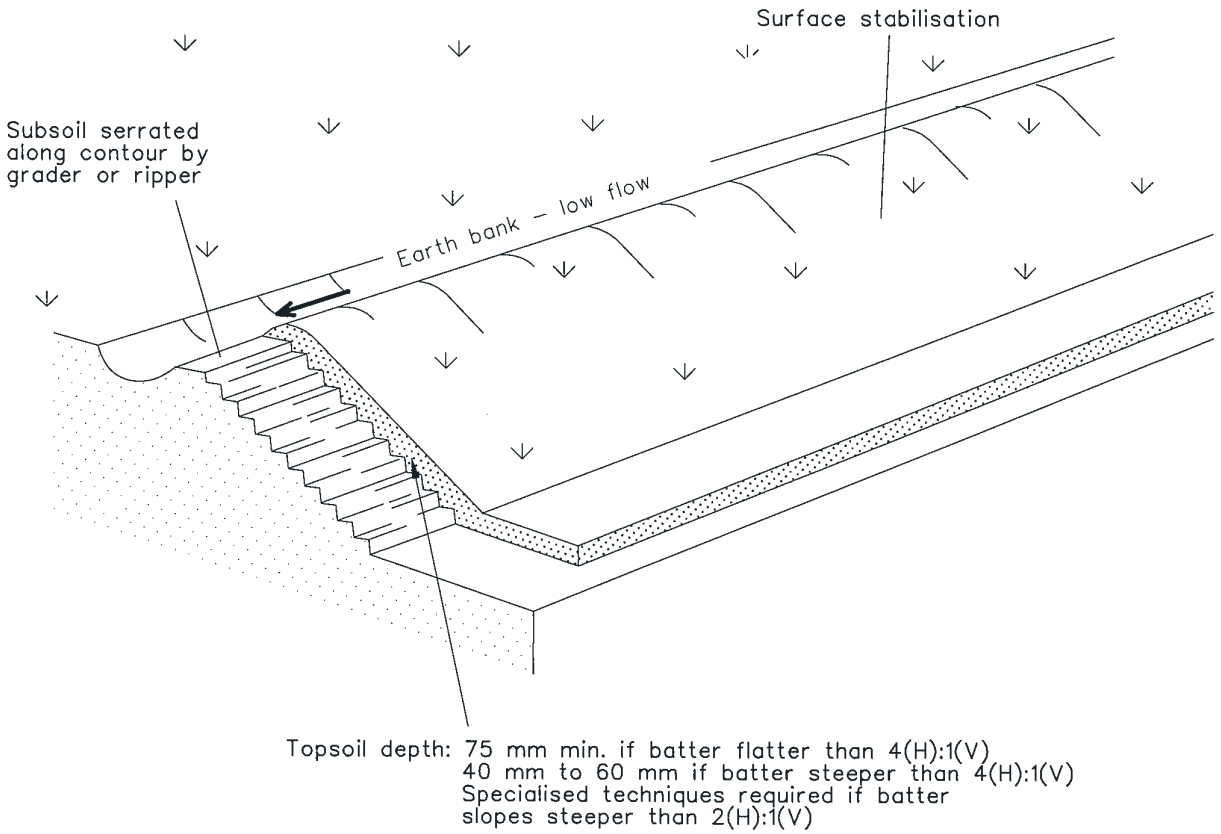


Construction Notes

1. Place stockpiles more than 2 (preferably 5) metres from existing vegetation, concentrated water flow, roads and hazard areas.
2. Construct on the contour as low, flat, elongated mounds.
3. Where there is sufficient area, topsoil stockpiles shall be less than 2 metres in height.
4. Where they are to be in place for more than 10 days, stabilise following the approved ESCP or SWMP to reduce the C-factor to less than 0.10.
5. Construct earth banks (Standard Drawing 5-5) on the upslope side to divert water around stockpiles and sediment fences (Standard Drawing 6-8) 1 to 2 metres downslope.

STOCKPILES

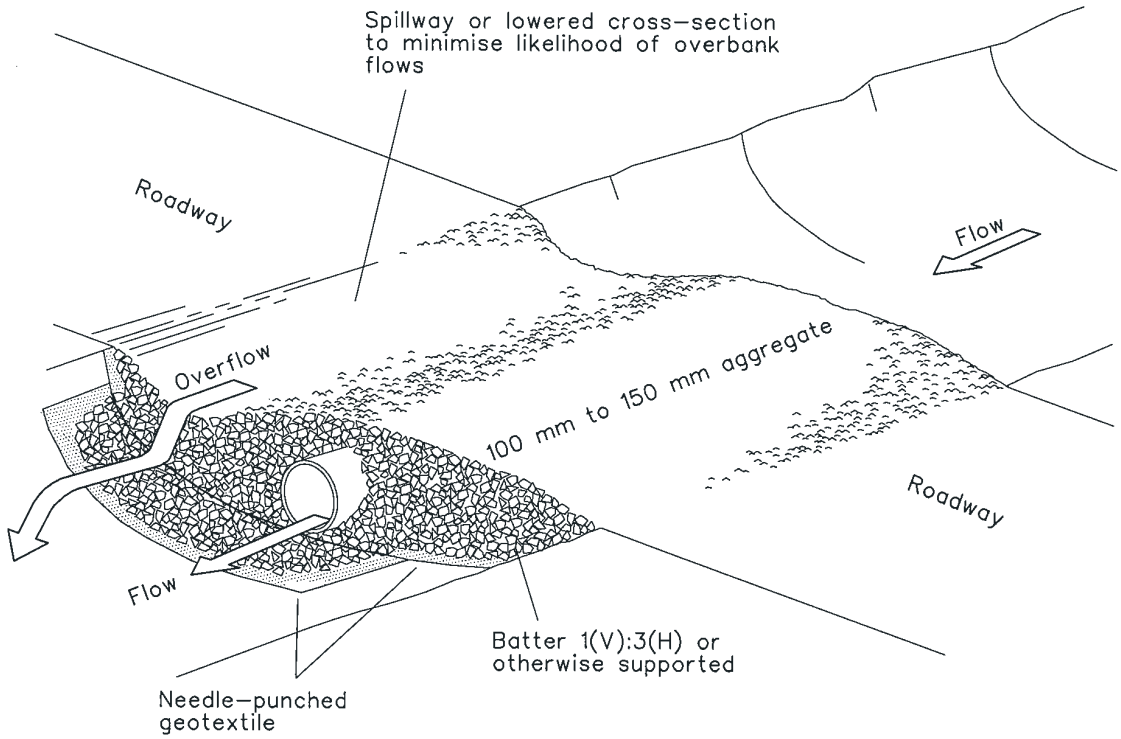
SD 4-1



Construction Notes

1. Scarify the ground surface along the line of the contour to a depth of 50 mm to 100 mm to break up any hardsetting surfaces and to provide a good bond between the respread material and subsoil.
2. Add soil ameliorants as required by the ESCP or SWMP.
3. Rip to a depth of 300 mm if compacted layers occur.
4. Where possible, replace topsoil to a depth of 40 to 60 mm on lands where the slope exceeds 4(H):1(V) and to at least 75 mm on lower gradients.

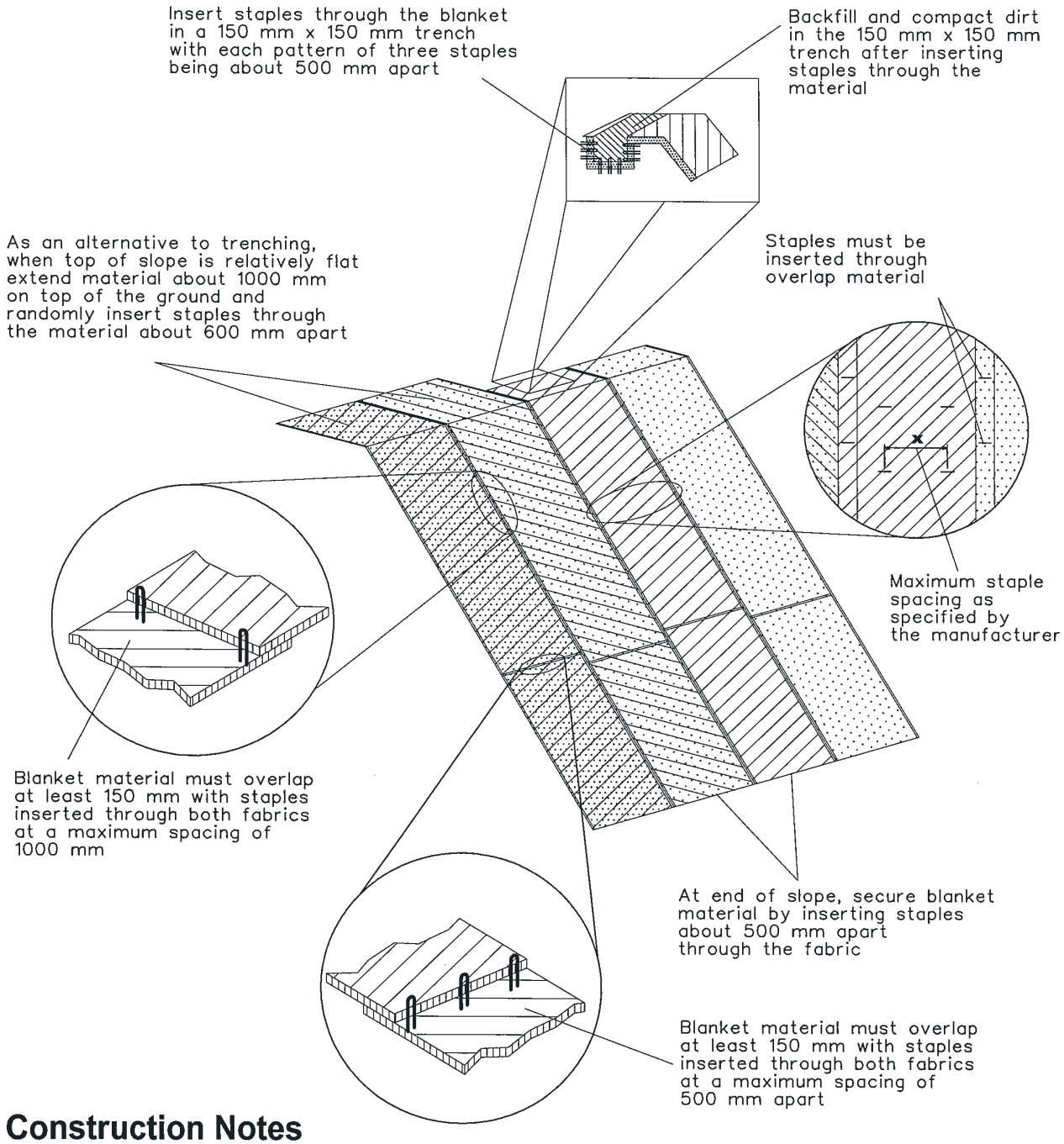
REPLACING TOPSOIL SD 4-2



Construction Notes

1. Prohibit all traffic until the access way is constructed.
2. Strip any topsoil and place a needle-punched textile over the base of the crossing.
3. Place clean, rigid, non polluting aggregate or gravel in the 100 mm to 150 mm size class over the fabric to a minimum depth of 200 mm.
4. Provide a 3-metre wide carriageway with sufficient length of culvert pipe to allow less than a 3(H): 1 (V) slope on side batters.
5. Install a lower section to act as an emergency spillway in greater than design storm events.
6. Ensure that culvert outlets extend beyond the toe of fill embankments.

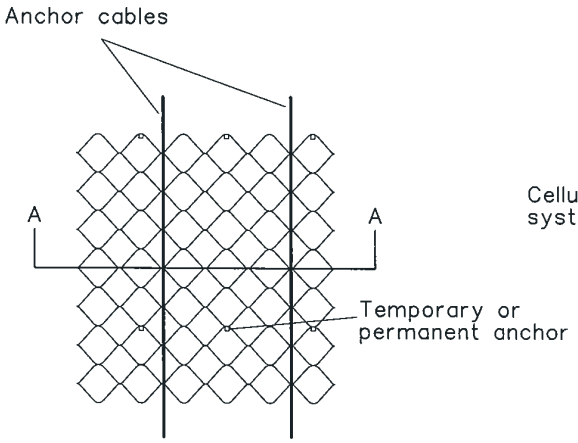
TEMPORARY WATERWAY CROSSING SD 5-1

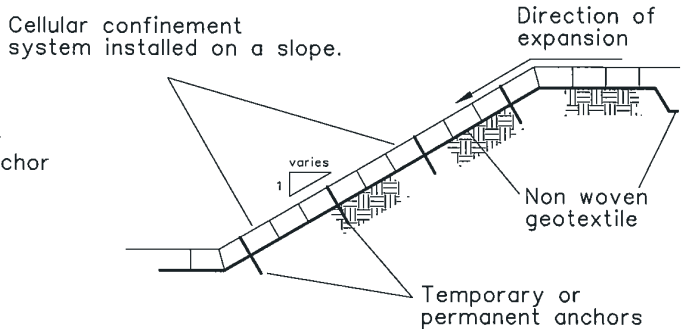


Construction Notes

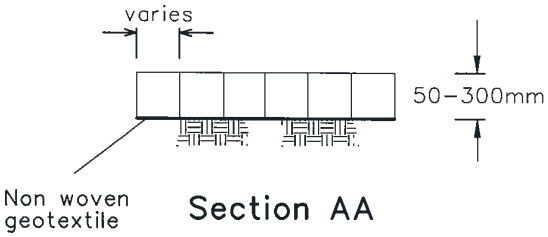
1. Remove any rocks, clods, sticks or grass from the ground surface before laying the matting.
2. Spread topsoil to at least 75 mm depth.
3. Where appropriate, complete fertilising and seeding on a properly prepared seedbed (Standard Drawing 7-1) before laying the matting.
4. Ensure the fabric can be continuously in contact with the soil by grading the surface carefully first.
5. Lay the matting in "shingle-fashion" with the ends of each upstream roll overlapping the next roll downslope.
6. Ensure sufficient staples are used to maintain a good contact between the soil and the matting.

RECP : SHEET FLOW SD 5-2

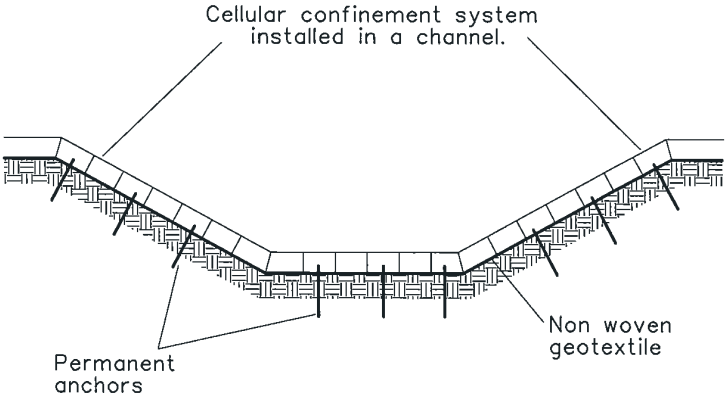




Slope Protection System



Section AA

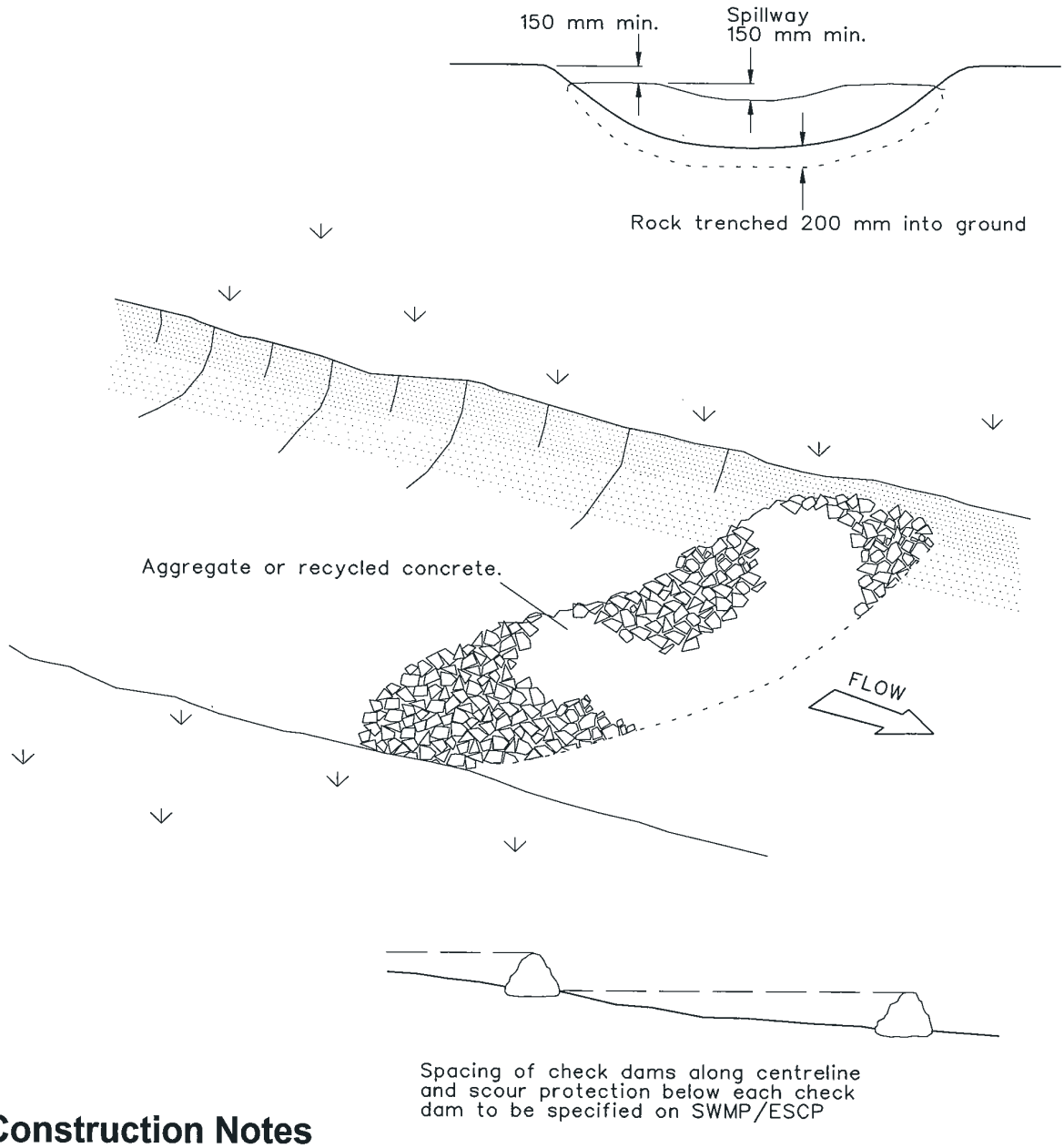


Channel Protection System

Construction Notes

1. Undertake design only with the help of a suitably qualified geotechnical engineer.
2. Anchor systems on steep slopes to prevent sliding or movement under gravitational forces. This might include the use of high tensile, low creep cables made of polyester (not polypropylene), rope or steel wire.
3. Place thick, non woven geotextiles under the cellular confinement system to allow for lateral drainage.
4. Fill the cells with soil, rock or concrete depending on the application.

CELLULAR CONFINEMENT SYSTEMS SD 5-3



Spacing of check dams along centreline and scour protection below each check dam to be specified on SWMP/ESCP

Construction Notes

1. Check dams can be built with various materials, including rocks, logs, sandbags and straw bales. The maintenance program should ensure their integrity is retained, especially where constructed with straw bales. In the case of bales, this might require their replacement each two to four months.

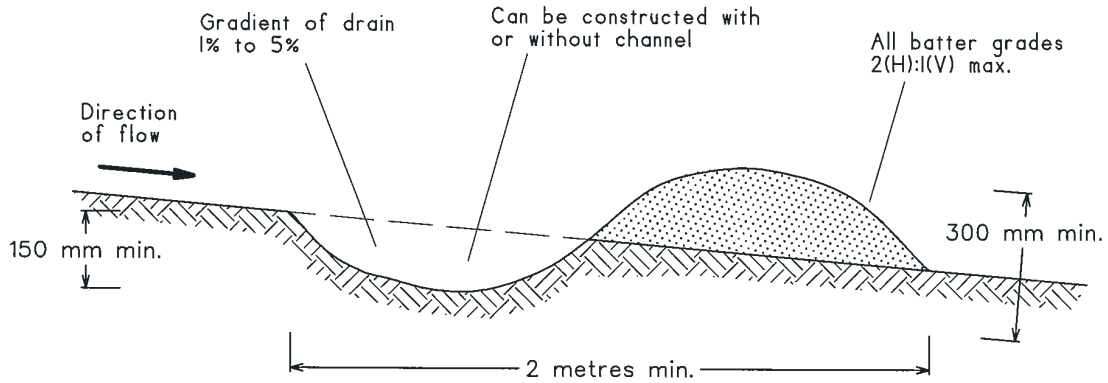
2. Trench the check dam 200 mm into the ground across its whole width. Where rock is used, fill the trenches to at least 100 mm above the ground surface to reduce the risk of undercutting.

3. Normally, their maximum height should not exceed 600 mm above the gully floor. The centre should act as a spillway, being at least 150 mm lower than the outer edges.

4. Space the dams so the toe of the upstream dam is level with the spillway of the next downstream dam.

ROCK CHECK DAM

SD 5-4

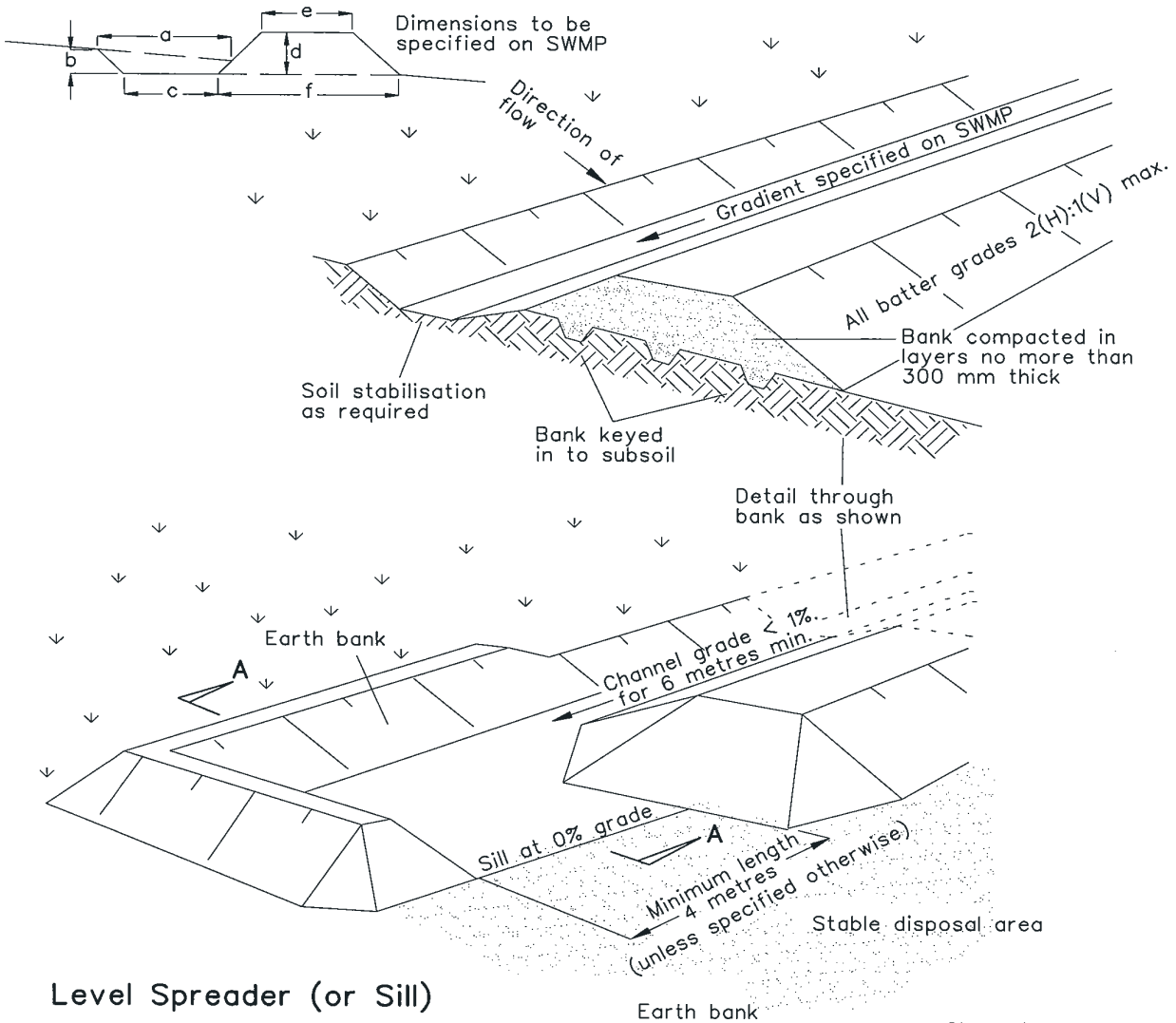


NOTE: Only to be used as temporary bank where maximum upslope length is 80 metres.

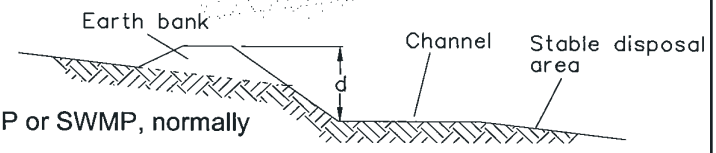
Construction Notes

1. Build with gradients between 1 percent and 5 percent.
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V shaped.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction.

EARTH BANK (LOW FLOW) SD 5-5



Level Spreader (or Sill)

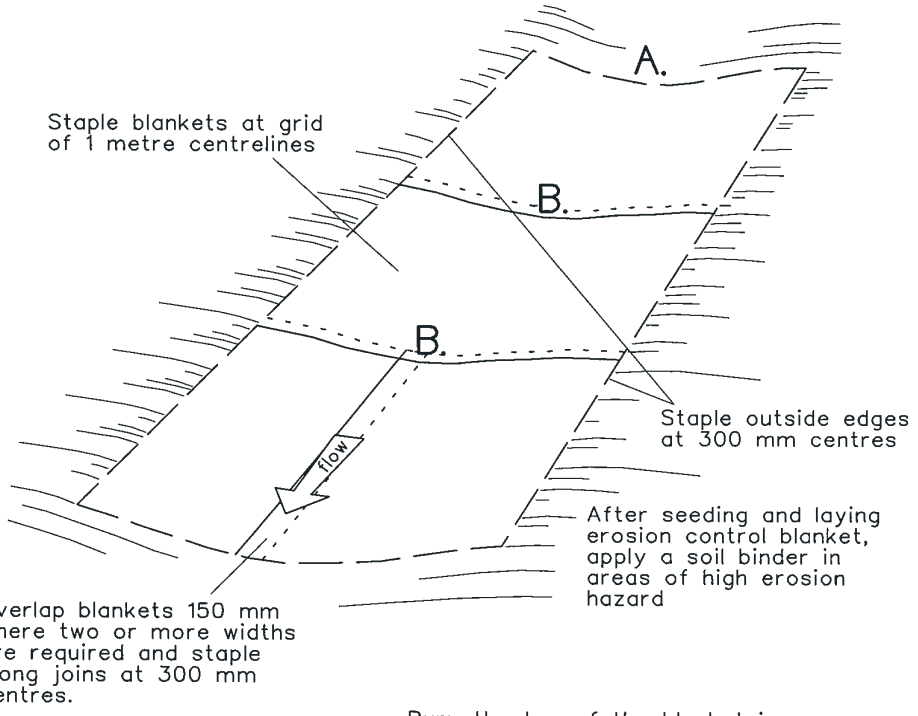


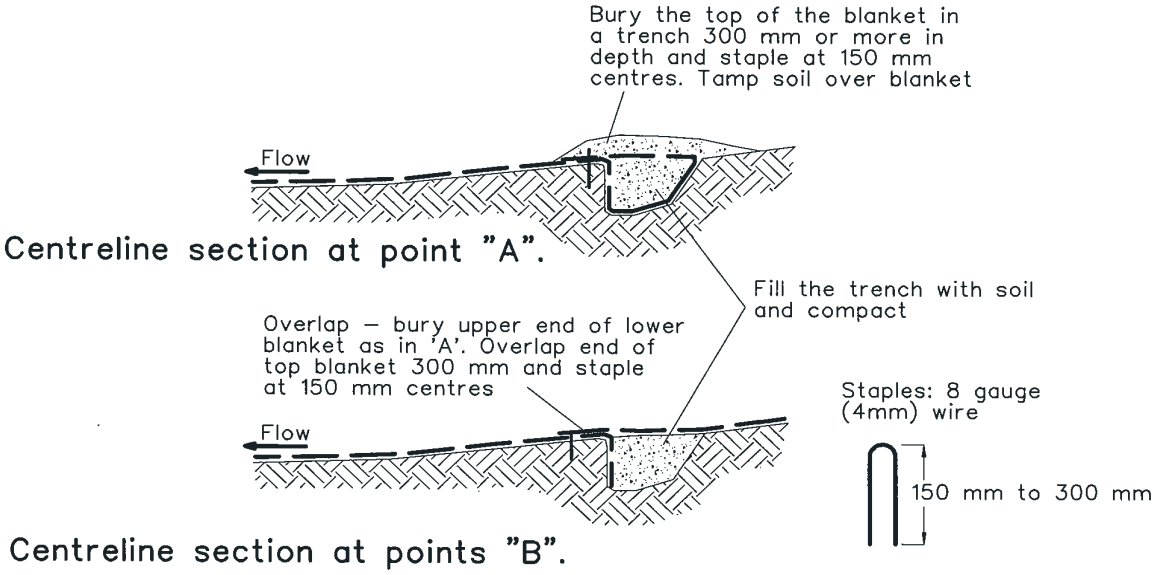
Section AA

Construction Notes

1. Construct at the gradient specified on the ESCP or SWMP, normally between 1 and 5 percent
2. Avoid removing trees and shrubs if possible - work around them.
3. Ensure the structures are free of projections or other irregularities that could impede water flow.
4. Build the drains with circular, parabolic or trapezoidal cross sections, not V-shaped, at the dimensions shown on the SWMP.
5. Ensure the banks are properly compacted to prevent failure.
6. Complete permanent or temporary stabilisation within 10 days of construction following Table 5.2 in Landcom (2004).
7. Where discharging to erodible lands, ensure they outlet through a properly constructed level spreader.
8. Construct the level spreader at the gradient specified on the ESCP or SWMP, normally less than 1 percent or level.
9. Where possible, ensure they discharge waters onto either stabilised or undisturbed disposal sites within the same subcatchment area from which the water originated. Approval might be required to discharge into other subcatchments.

EARTH BANK (HIGH FLOWS) SD 5-6

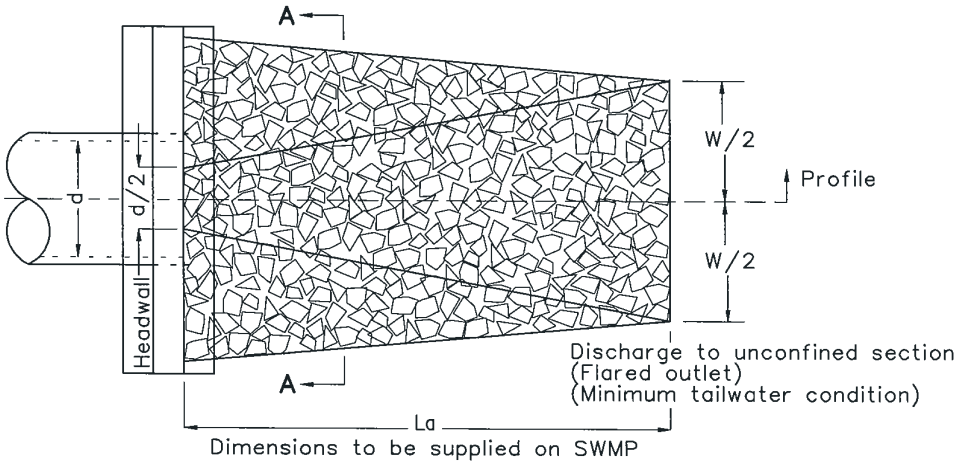




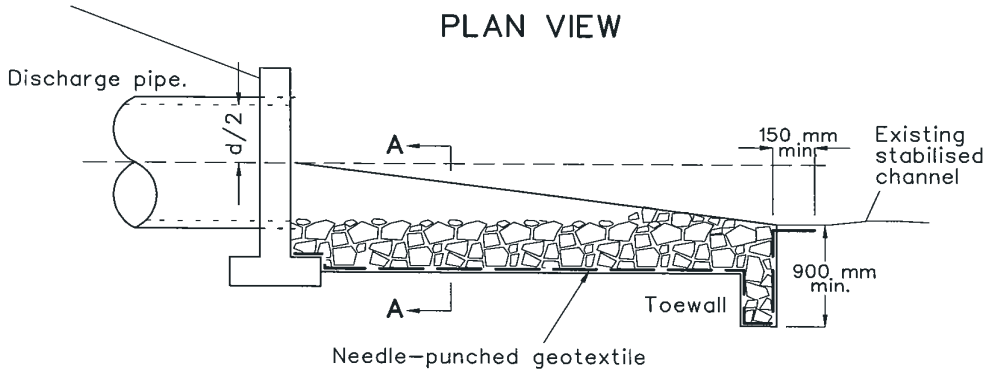
Construction Notes

1. Remove any rocks, clods, sticks or grass from the surface before laying matting
2. Ensure that topsoil is at least 75 mm deep.
3. Complete fertilising and seeding before laying the matting.
4. Ensure fabric will be continuously in contact with the soil by grading the surface carefully first.
5. Lay the fabric in "shingle-fashion", with the end of each upstream roll overlapping those downstream. Ensure each roll is anchored properly at its upslope end (Standard Drawing 5-7b).
6. Ensure that the full width of flow in the channel is covered by the matting up to the design storm event, usually in the 10-year ARI time of concentration storm event.
7. Divert water from the structure until vegetation is stabilised properly.

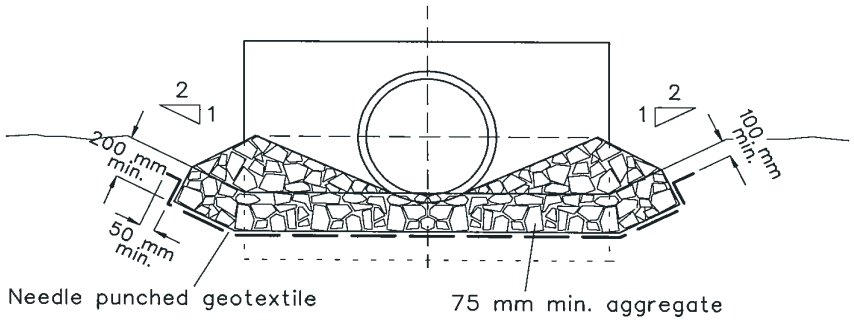
RECP : CONCENTRATED FLOW — SD 5-7



PLAN VIEW



PLAN VIEW

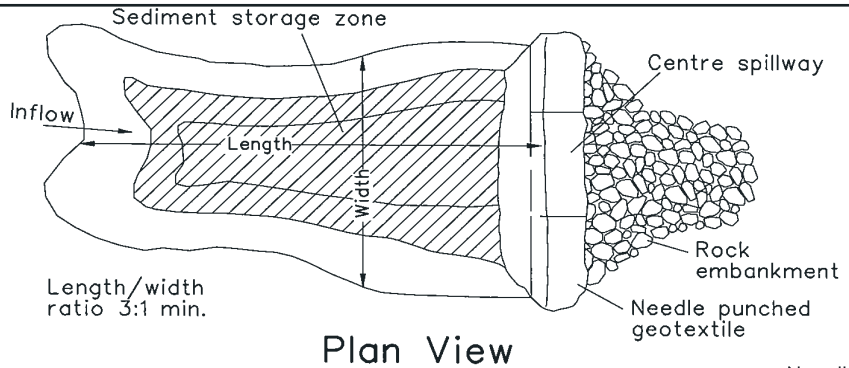


CROSS SECTION AA

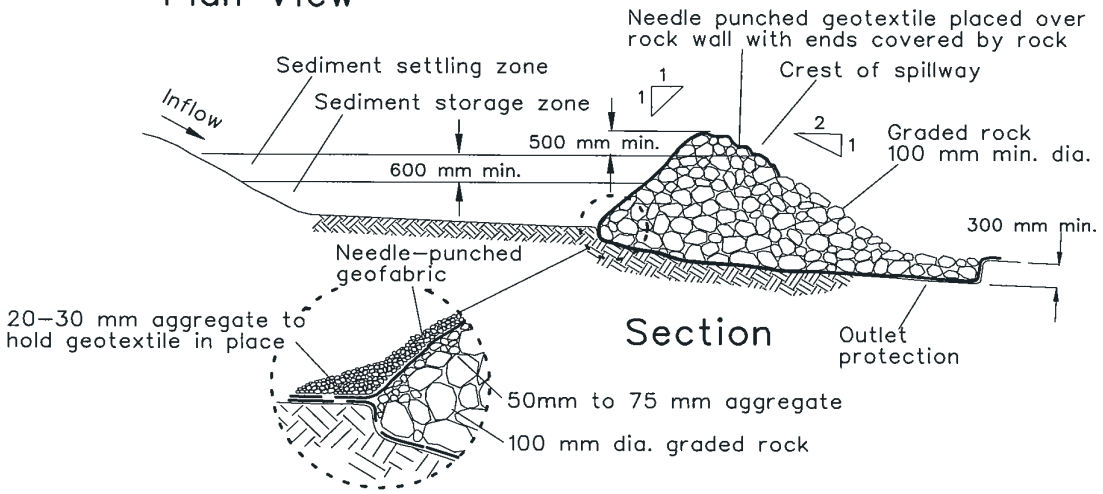
Construction Notes

1. Compact the subgrade fill to the density of the surrounding undisturbed material.
2. Prepare a smooth, even foundation for the structure that will ensure that the needle-punched geotextile does not sustain serious damage when covered with rock.
3. Should any minor damage to the geotextile occur, repair it before spreading any aggregate. For repairs, patch one piece of fabric over the damage, making sure that all joints and patches overlap more than 300 mm.
4. Lay rock following the drawing, according to Table 5.2 of Landcom (2004) and with a minimum diameter of 75 mm.
5. Ensure that any concrete or riprap used for the energy dissipater or the outlet protection conforms to the grading limits specified on the SWMP.

ENERGY DISSIPATER SD 5-8

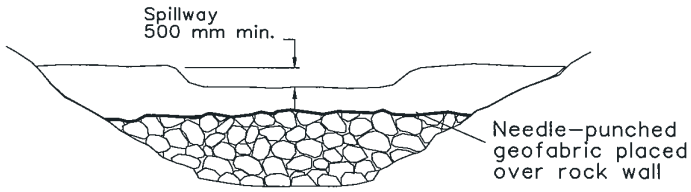


Plan View



Section

NOTE:
Spillway width and depth, wall crest width and downstream outlet protection measures to be specified on SWMP.



Downstream Elevation

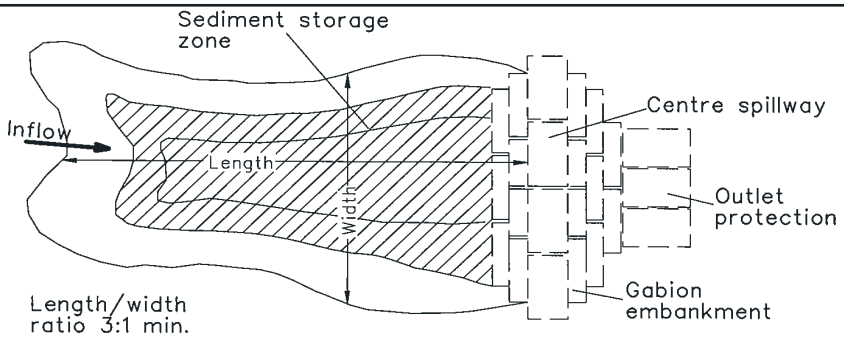
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Excavate to 300 mm depth for base of the dam wall.
3. Line the excavation with a needle-punched geotextile allowing sufficient to line below the wall, and over the upstream rock and the spillway to 500 mm below the spillway exit on the downstream face.
4. Make up the wall profile and outlet protection with100 mm (min.) diameter graded rock. Spread a layer of 50 mm to 75 mm diameter aggregate over the upstream batter for a more even surface, and add 100 mm to 150 mm of 20 mm to 30 mm gravel over the 50 mm to 75 mm diameter aggregate.
5. Lay geotextile over the upstream batter and through the spillway, fixing in place with 100 mm rock.
6. Place a "Full of Sediment" marker to show when less than design capacity occurs and sediment removal is required.
7. Replace the upstream geotextile layer each time sediment is removed

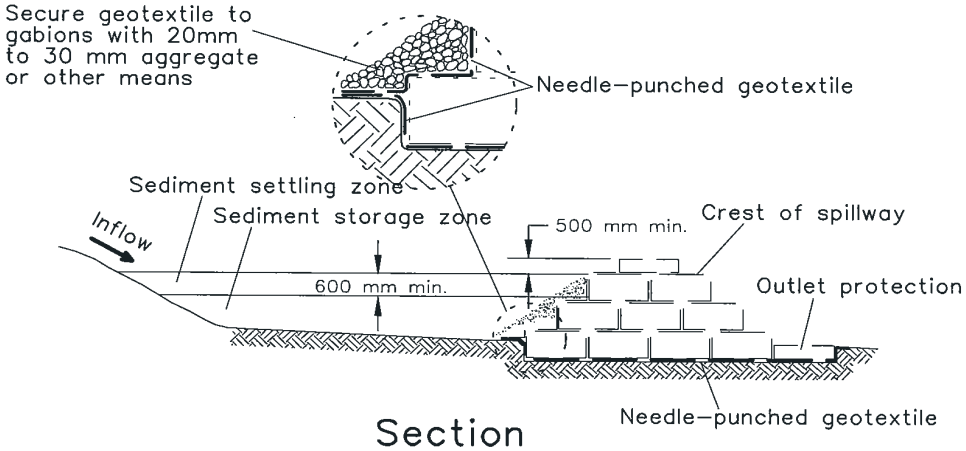
ROCK SEDIMENT BASIN

(APPLIES TO 'TYPE C' SOILS ONLY)

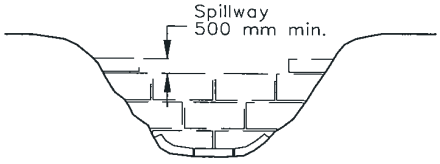
SD 6-1



Plan View



Section



Downstream Elevation

NOTE: Spillway width and depth, wall crest width and downstream outlet protection measures to be specified on SWMP.

Construction Notes

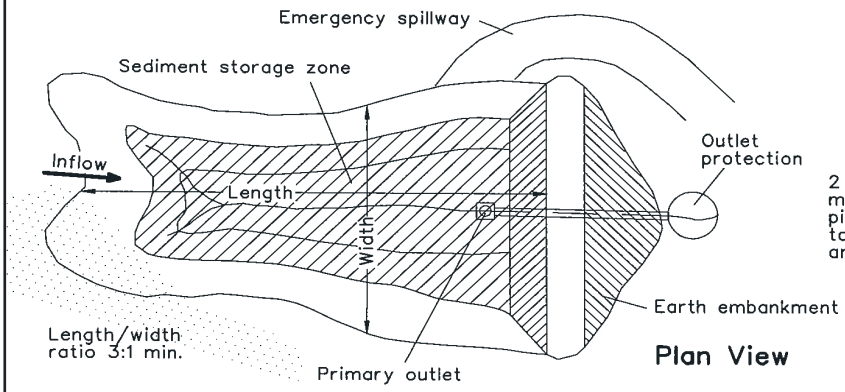
(Applies to Type C soils only)

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Excavate to 300 mm depth for the base of the dam wall and form a level platform for the gabions.
3. Line the excavation with a needle-punched geotextile allowing sufficient to line below the wall, and over the upstream gabions and spillway to 500 mm below the spillway exit on the downstream face.
4. Make up the wall profile and outlet protection with gabion units filled with graded rock as specified on the SWMP.
5. Construct a spillway 500 mm below the crest of the dam and for the width specified on the SWMP.
6. Lap the geotextile over the upstream face and through the spillway and fix it in place with the top row of gabions.
7. Cover the upstream face of the wall with 20 mm to 30 mm gravel and geotextile (Standard Drawing 6-2b)
8. Place a "Full of Sediment' marker to show when less than design capacity occurs and sediment removal is required.
9. Replace the upstream geotextile layer when sediment is removed if a dry basin is required.

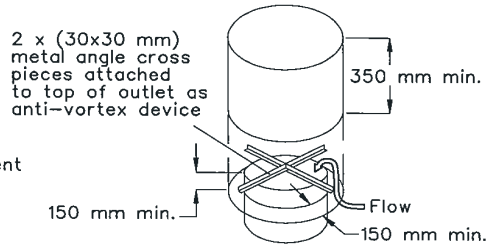
GABION SEDIMENT BASIN

(APPLIES TO 'TYPE C' SOILS ONLY)

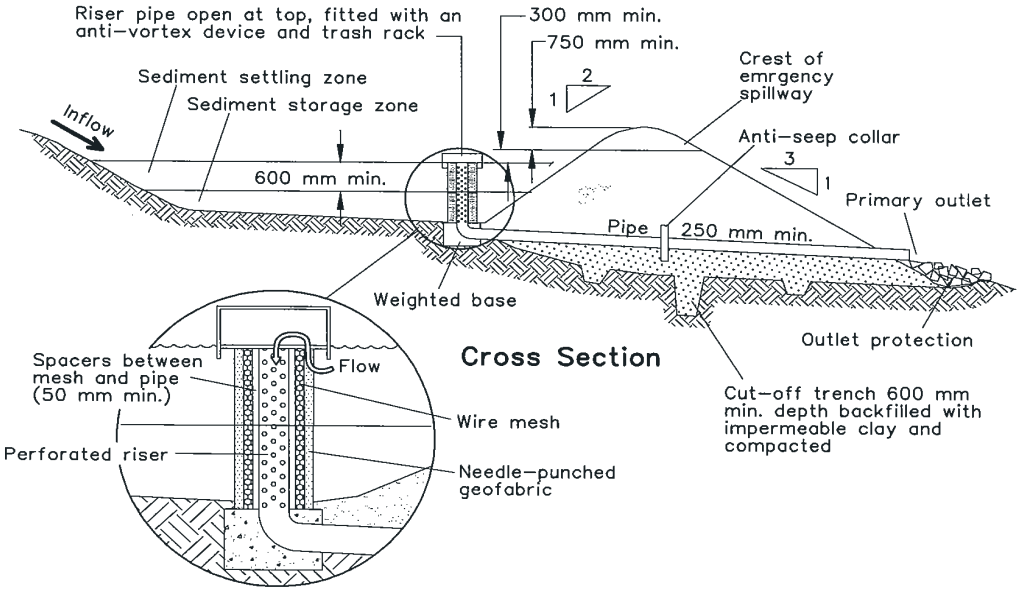
SD 6-2



Plan View



Trash Rack/ Anti-vortex Device



Cross Section

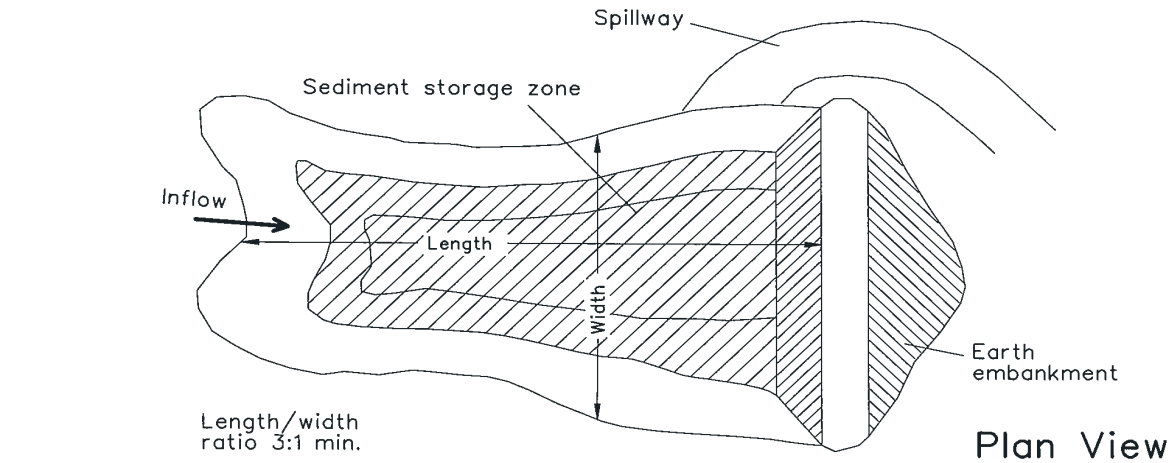
Construction Notes

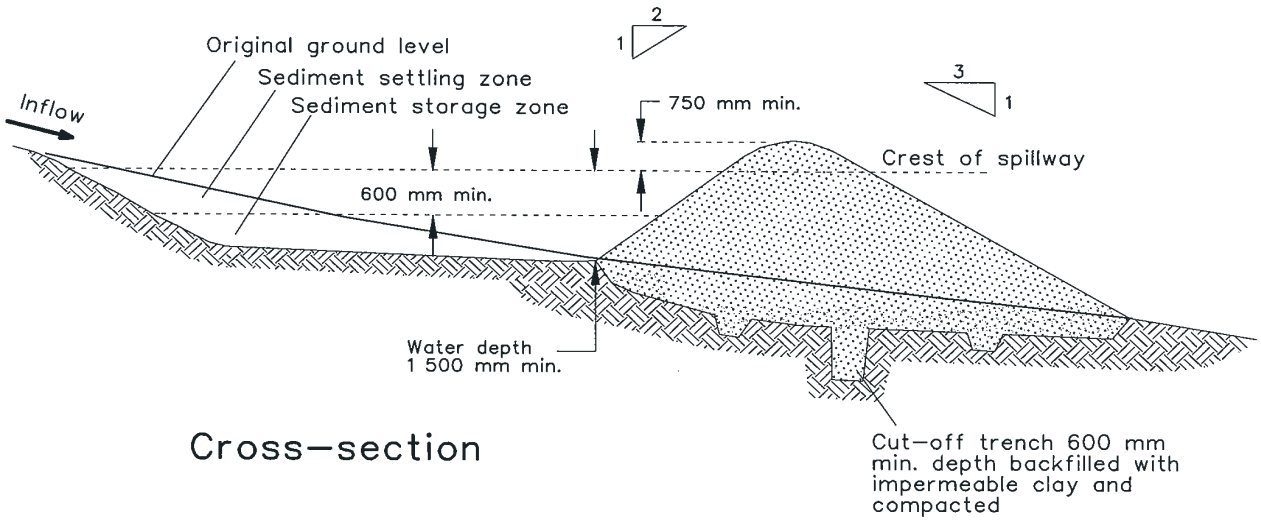
1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Form a cut off trench under the centreline of the embankment 600 mm deep and 1,200 mm wide, extending to a point on the watercourse wall above the riser sill level.
3. Maintain the trench free of water and recompact the materials with equipment as specified In the SWMP to 95 per cent Standard Proctor Density.
4. Select fill according to the SWMP that is free from roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond the compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Install the pipe outlet with seepage collars as specified in the SWMP and Standard Drawing 6-3b.
8. Form batter grades at 2(H):1(V) upstream and 3(H):1(V) downstream or as specified in the SWMP

EARTH BASIN - DRY

(APPLIES TO 'TYPE C' SOILS ONLY)

SD 6-3





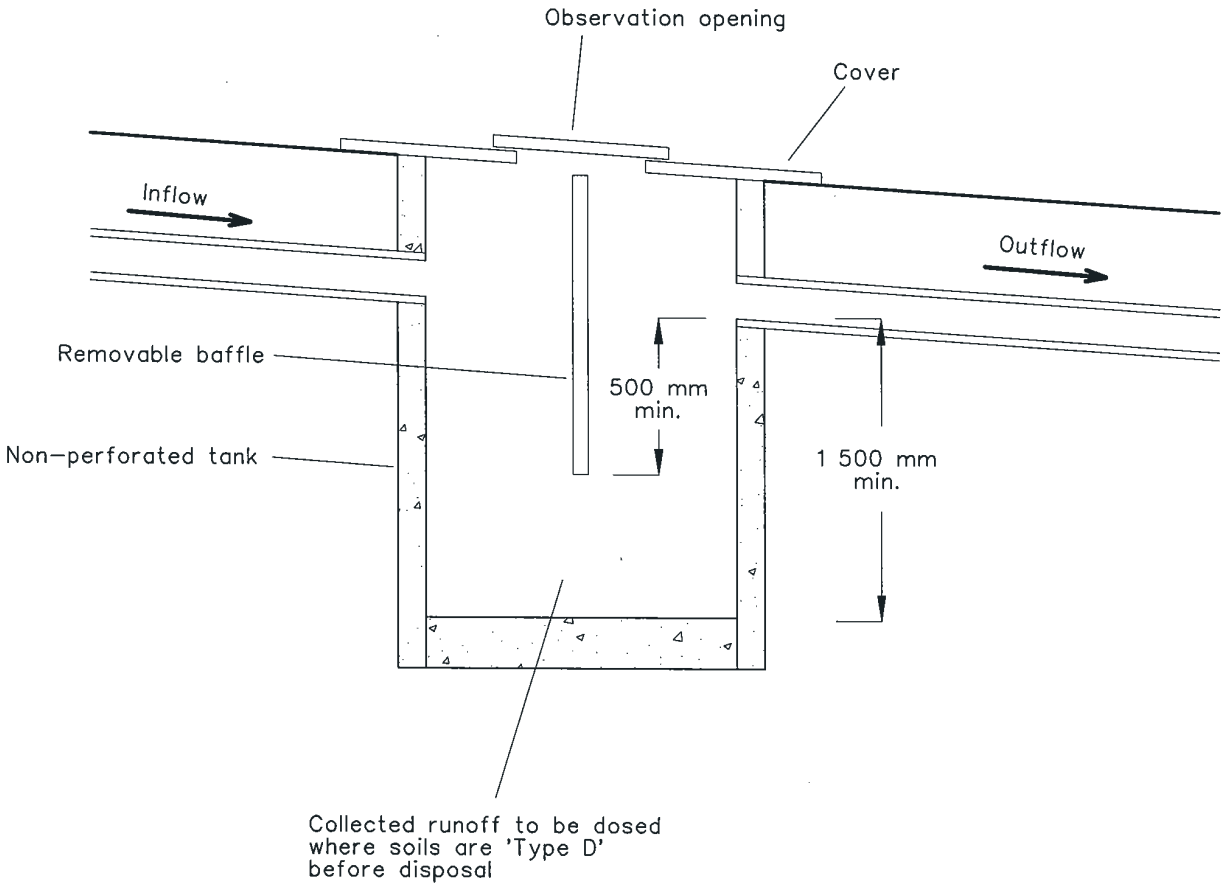
Construction Notes

1. Remove all vegetation and topsoil from under the dam wall and from within the storage area.
2. Construct a cut-off trench 500 mm deep and 1,200 mm wide along the centreline of the embankment extending to a point on the gully wall level with the riser crest.
3. Maintain the trench free of water and recompact the materials with equipment as specified in the SWMP to 95 per cent Standard Proctor Density.
4. Select fill following the SWMP that is free of roots, wood, rock, large stone or foreign material.
5. Prepare the site under the embankment by ripping to at least 100 mm to help bond compacted fill to the existing substrate.
6. Spread the fill in 100 mm to 150 mm layers and compact it at optimum moisture content following the SWMP.
7. Construct the emergency spillway.
8. Rehabilitate the structure following the SWMP.

EARTH BASIN - WET

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

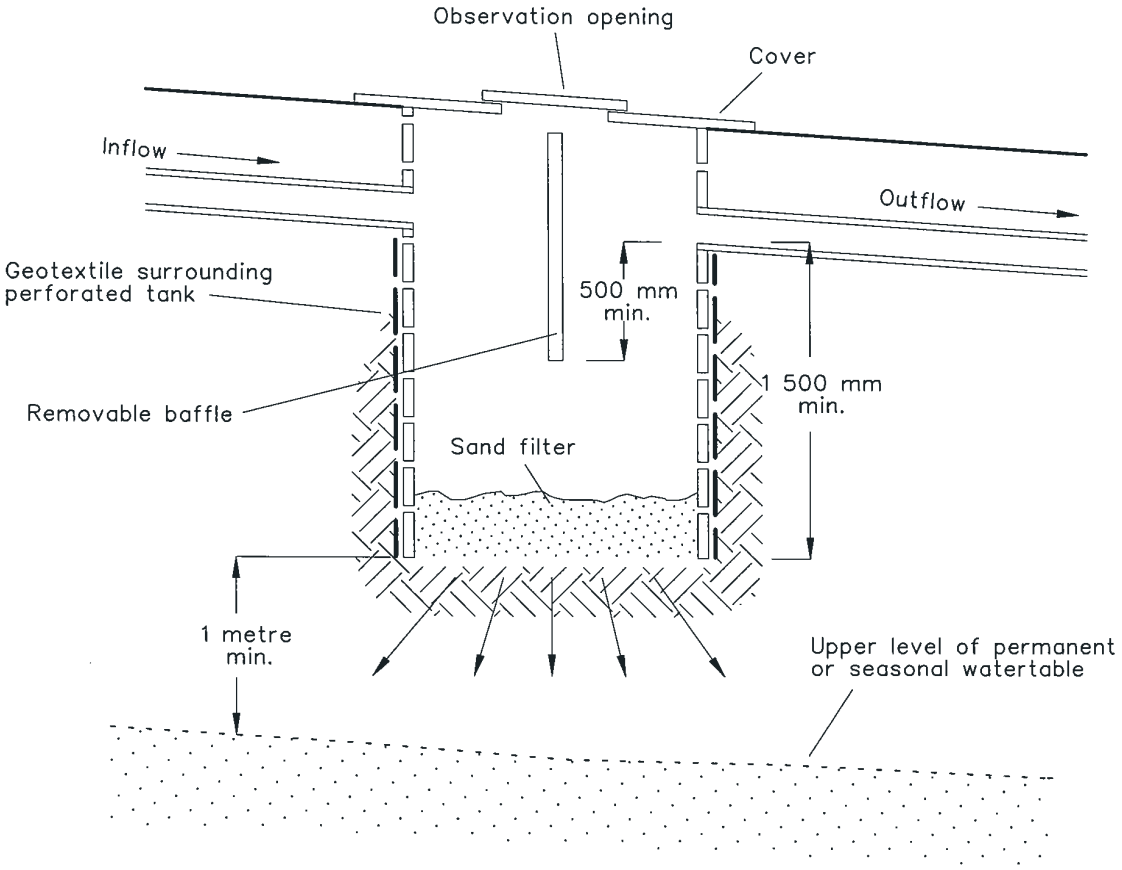
SD 6-4



Construction Notes

1. Join the inlet to the stormwater, taking any suitable steps to remove bulky or coarse material before it can enter the tank.
2. Connect the outlet to a safe disposal area following the SWMP.
3. Install a removable baffle, central to the inflow/outflow and normal to the direction of flow, ensuring that it reaches 500 mm below the invert of the outlet pipe.
4. Install a cover over the pit with an observation port and access cover.

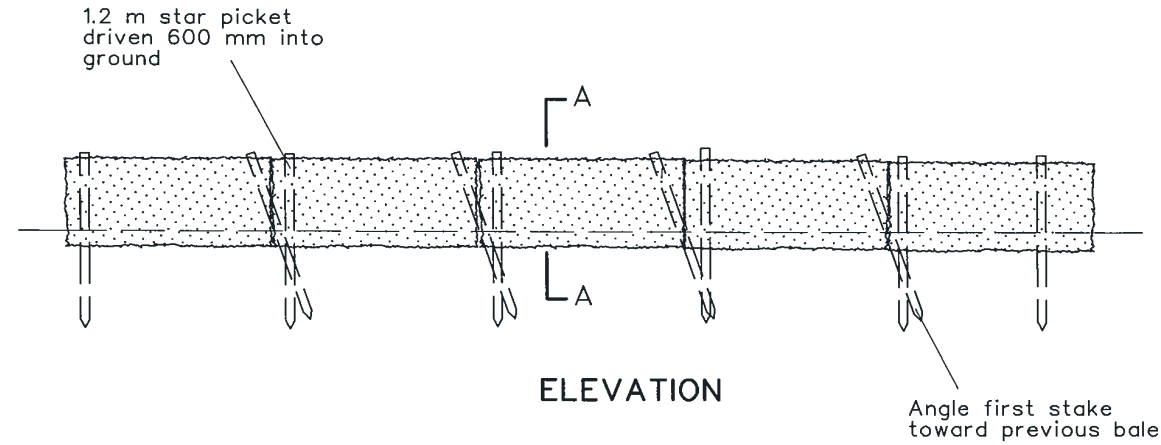
LINED TANK SD 6-5

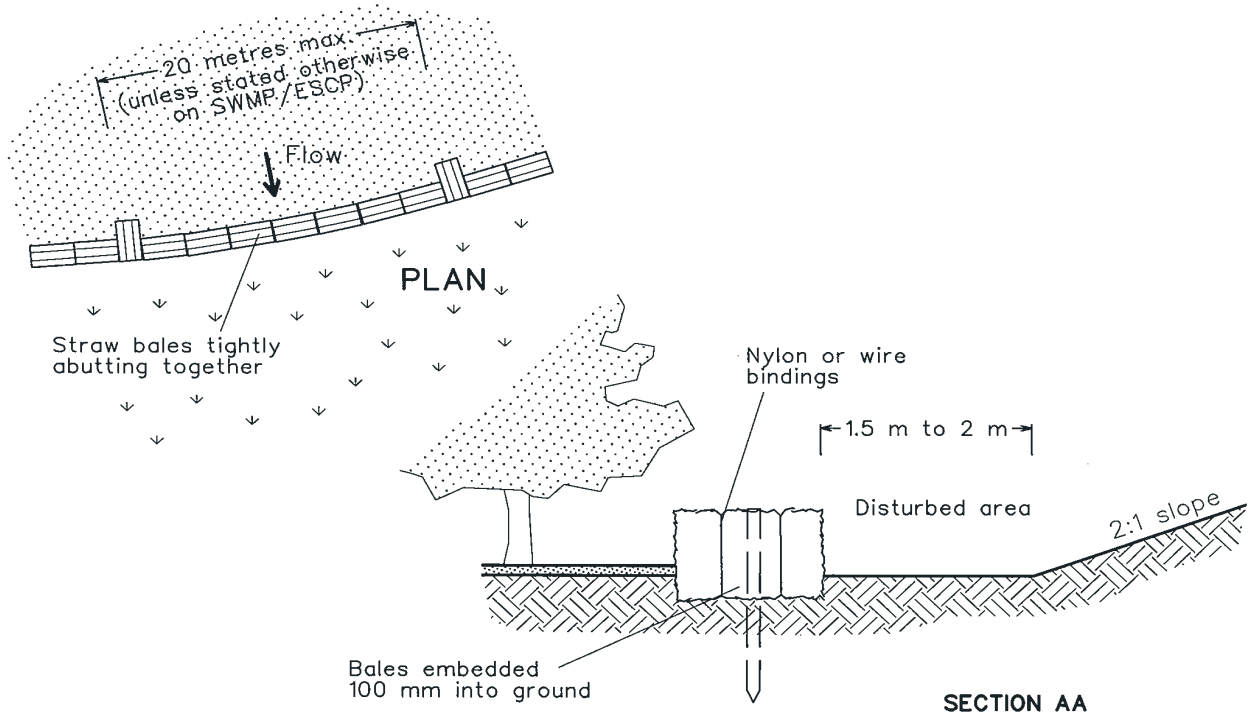


Construction Notes

1. Join the inlet to the polluted supply taking any suitable step to remove bulky material before it can enter the sump.
2. Connect the outlet to a safe disposal area following the ESCP/SWMP.
3. Place a geotextile liner on the outside of the pit.
4. Install a removable baffle, central to the inflow/outflow and normal to the direction of flow, ensuring that it reaches 500 mm below the invert of the outlet pipe.
5. Install a cover over the pit with an observation port and access cover.

INFILTRATION SUMP — SD 6-6

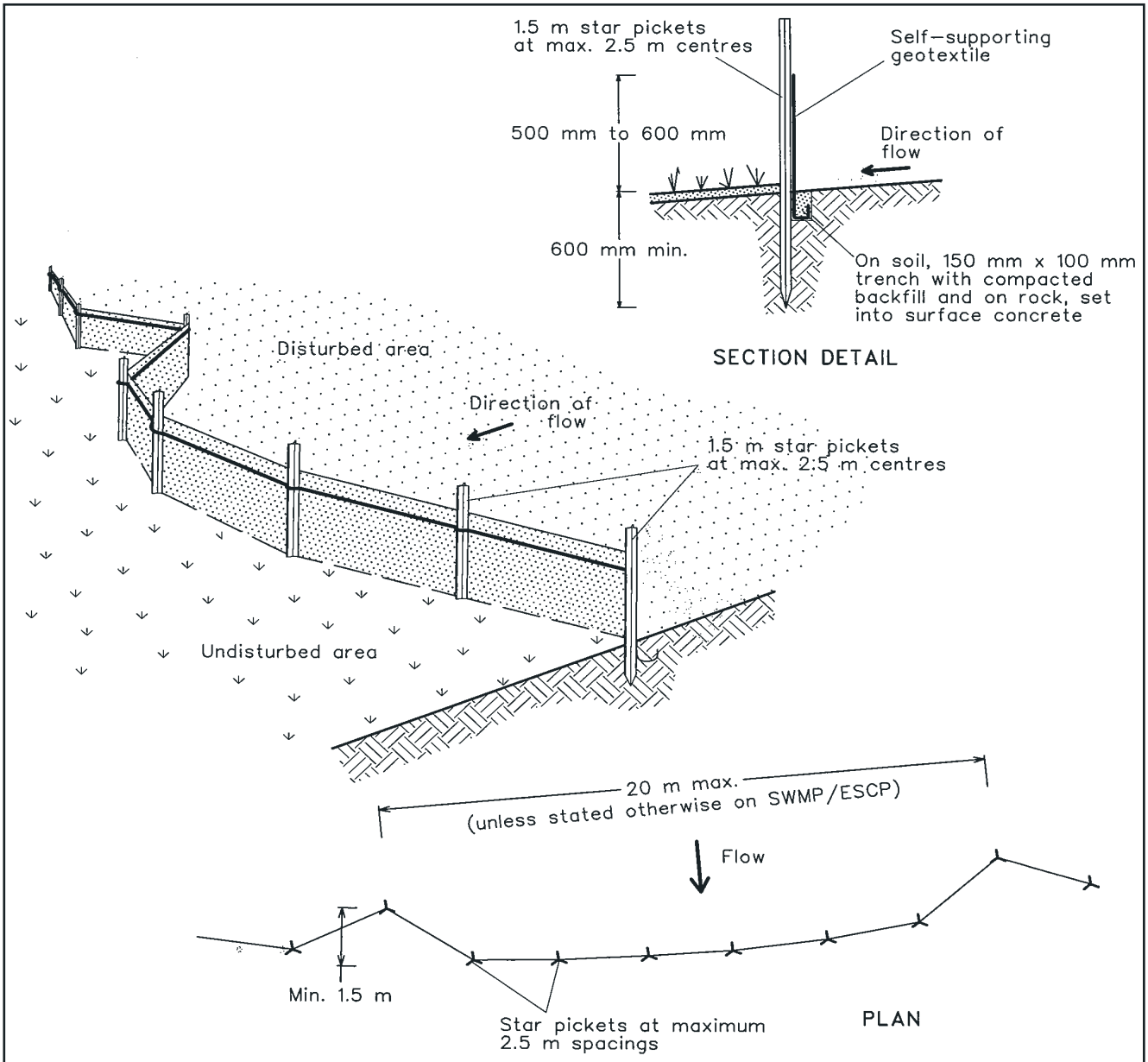




Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

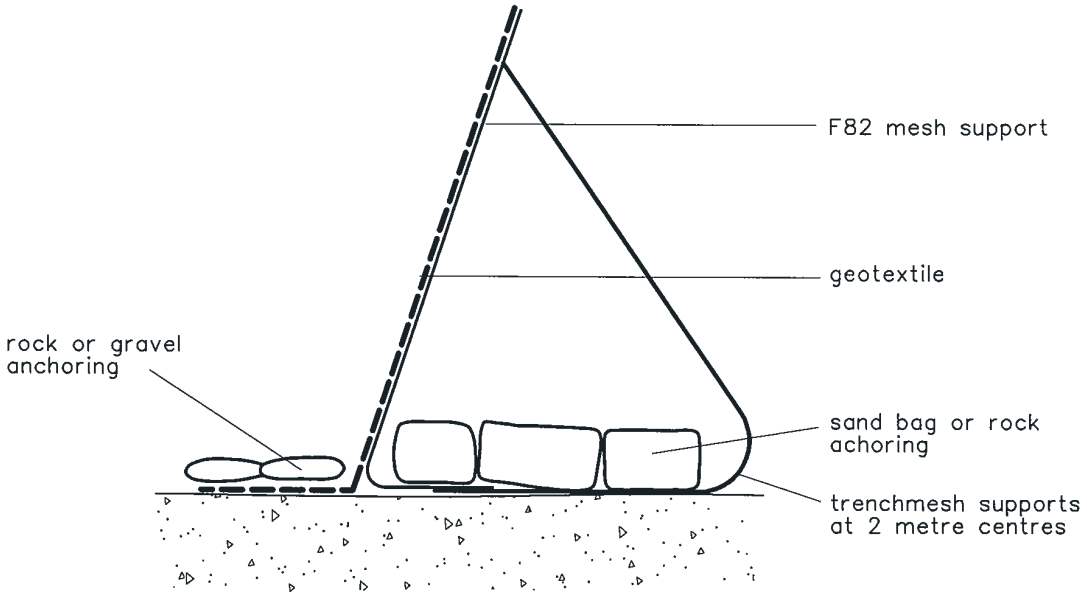
STRAW BALE FILTER SD 6-7



Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

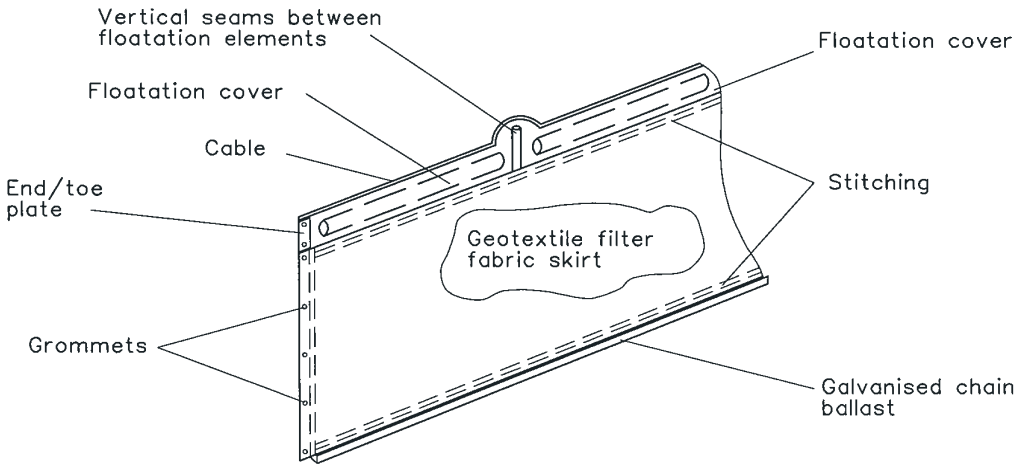
SEDIMENT FENCE — SD 6-8

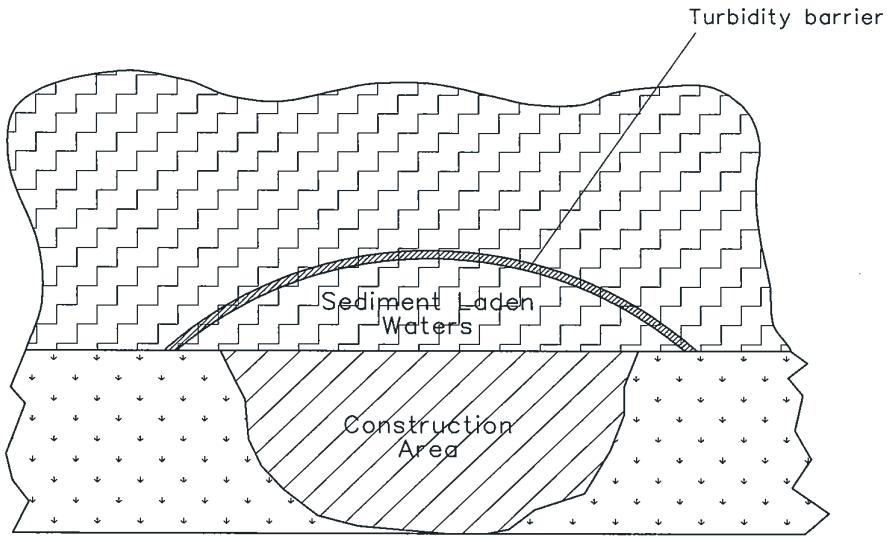


Construction Notes

1. Install this type of sediment fence when use of support posts is not desirable or not possible. Such conditions might apply, for example, where approval is granted from the appropriate authorities to place these fences in highly sensitive estuarine areas.
2. Use bent trench mesh to support the F82 welded mesh facing as shown on the drawing above. Attach the geotextile to the welded mesh facing using UV resistant cable ties.
3. Stabilise the whole structure with sandbag or rock anchoring over the trench mesh and the leading edge of the geotextile. The anchoring should be sufficiently large to ensure stability of the structure in the design storm event, usually the 10 year event.

ALTERNATIVE SEDIMENT FENCE SD 6-9

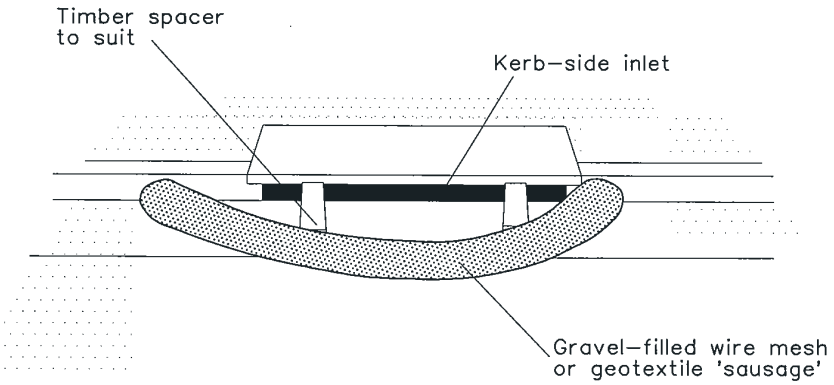


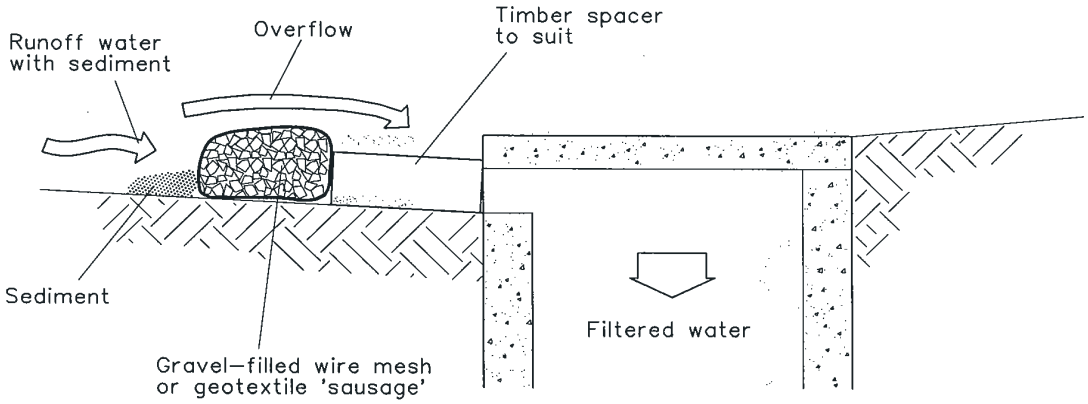


Construction Notes

1. Use turbidity barriers only where high flows are unlikely to remove accumulated sediment and/or move the curtain significantly.
2. Where the barrier is to remain in place for more than one month, ensure the floatation cover is a UV-resistant, durable material.
3. Use only closed cell foam or foam-filled PVC piping as floatation elements. Do not use unfilled pipes.
4. Use only woven or heat-set non woven geotextiles. Needle-punched, non woven geotextiles can become fouled with debris that fray and delaminate them as they move with the waves or currents.
5. Remove captured sediment before the barrier is decommissioned.
6. In tidal areas, ensure the barrier can rise and fall without being moved from its position.

TURBIDITY BARRIER SD 6-10



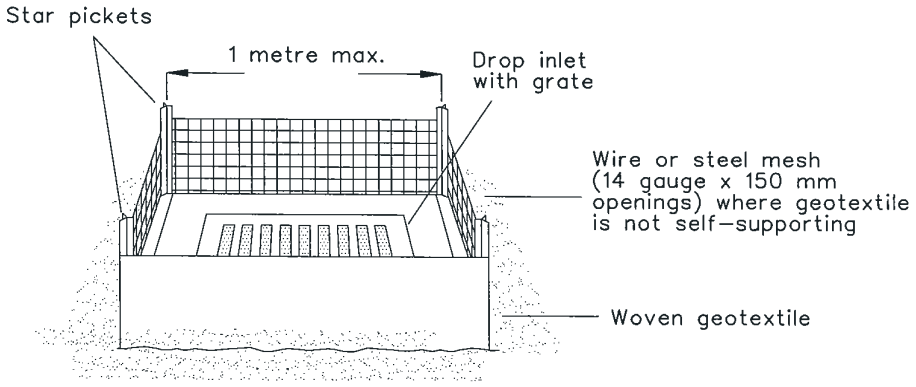


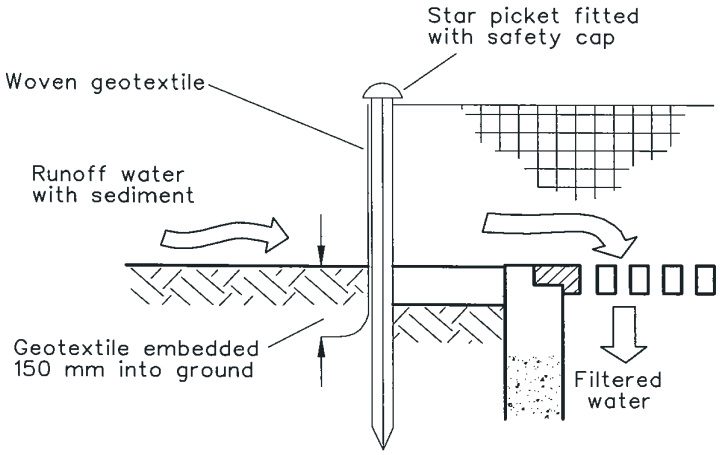
NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

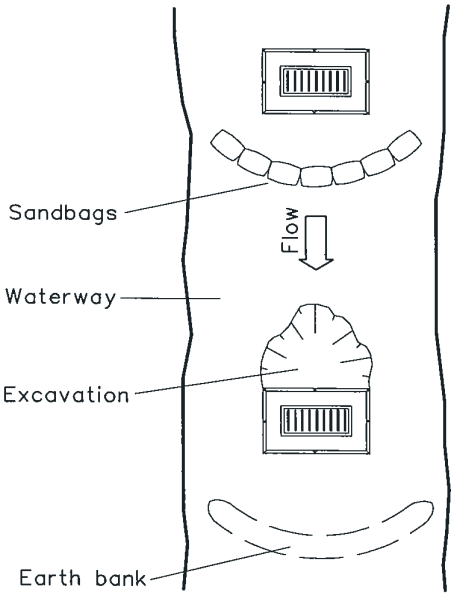
Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

MESH AND GRAVEL INLET FILTER SD 6-11





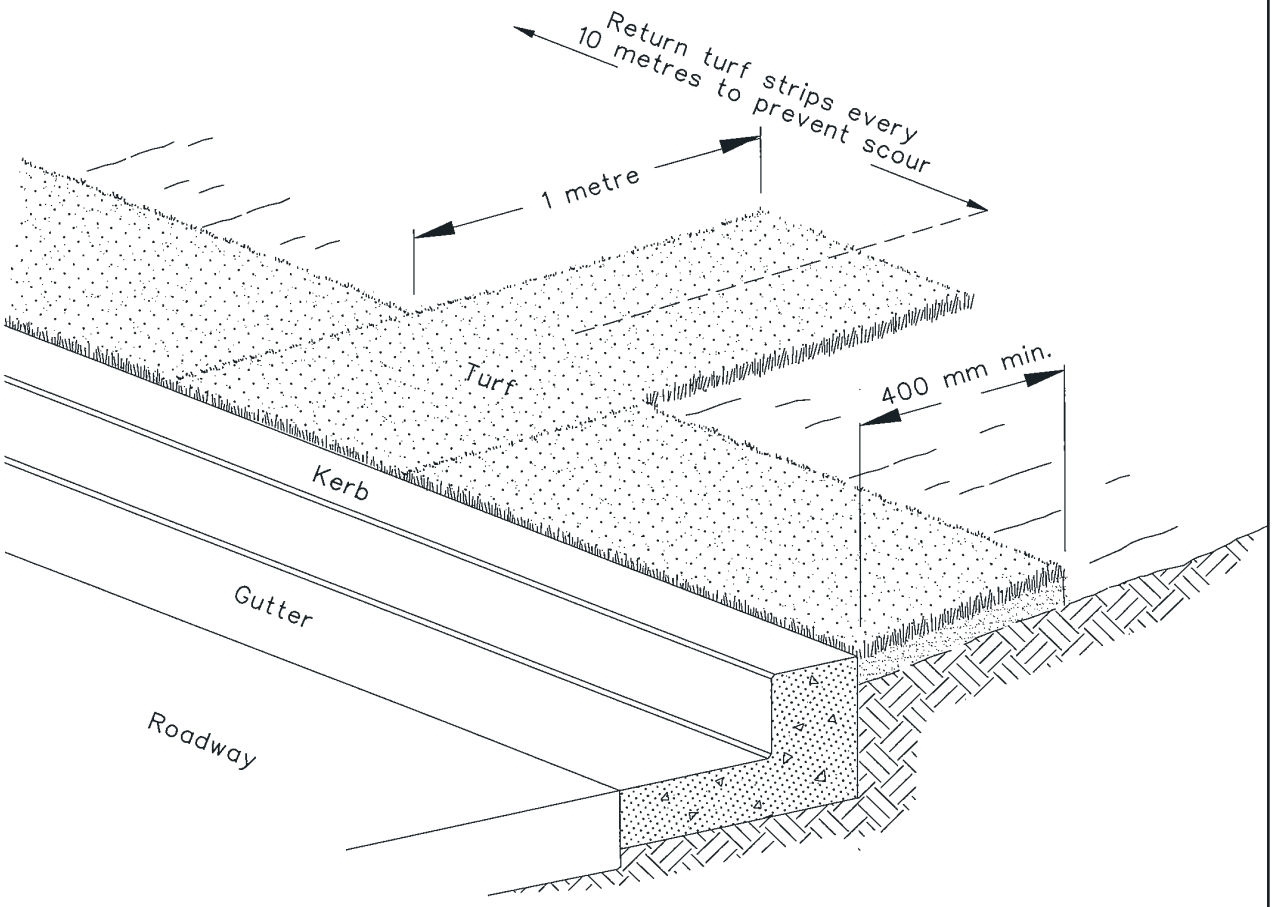


For drop inlets at non–sag points, sandbags, earth bank or excavation used to create artificial sag point

Construction Notes

1. Fabricate a sediment barrier made from geotextile or straw bales.
2. Follow Standard Drawing 6-7 and Standard Drawing 6-8 for installation procedures for the straw bales or geofabric. Reduce the picket spacing to 1 metre centres.
3. In waterways, artificial sag points can be created with sandbags or earth banks as shown in the drawing.
4. Do not cover the inlet with geotextile unless the design is adequate to allow for all waters to bypass it.

GEOTEXTILE INLET FILTER SD 6-12

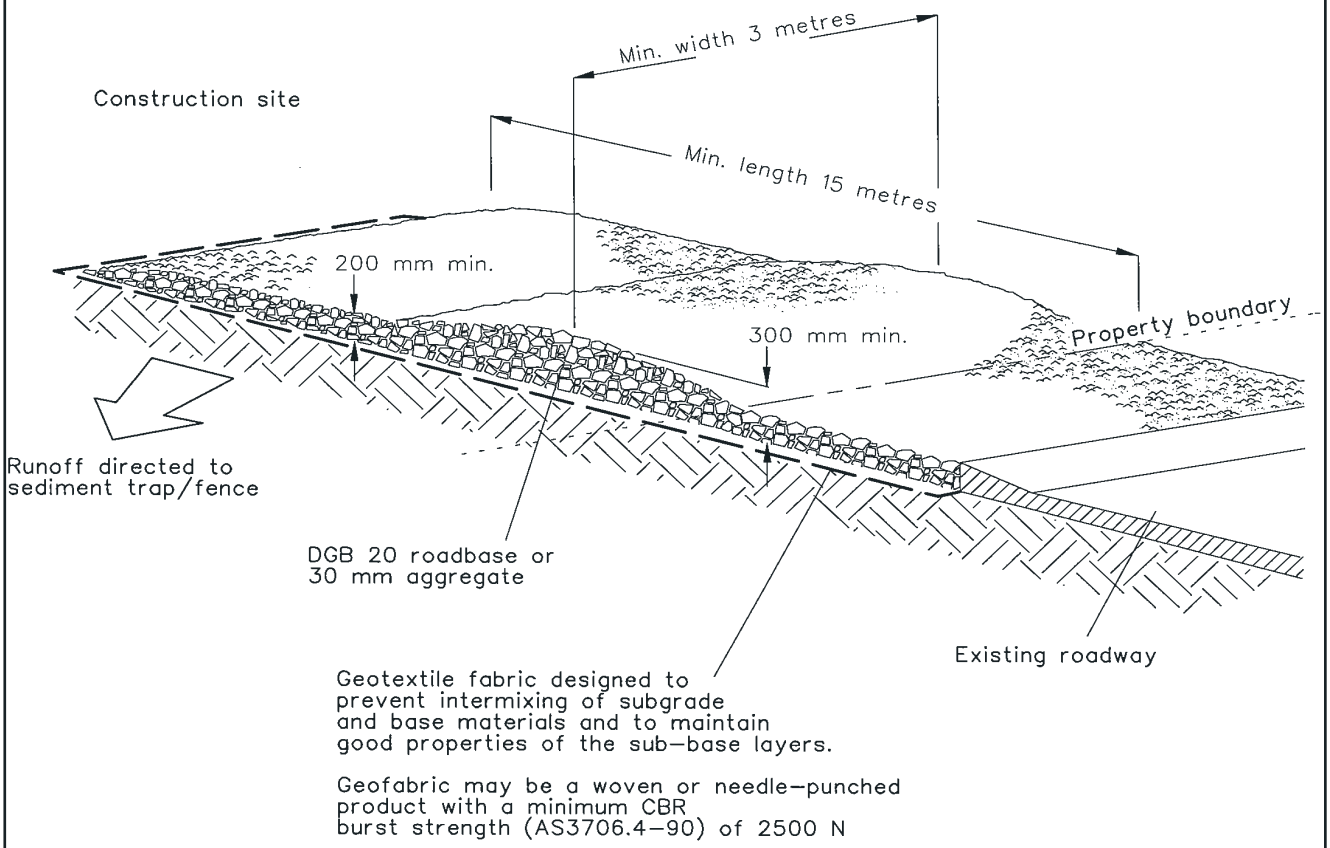


Construction Notes

1. Install a 400-mm minimum wide roll of turf on the footpath next to the kerb and at the same level as the top of the kerb.
2. Lay 1.4 metre long turf strips normal to the kerb every 10 metres.
3. Rehabilitate disturbed soil behind the

KERBSIDE TURF STRIP

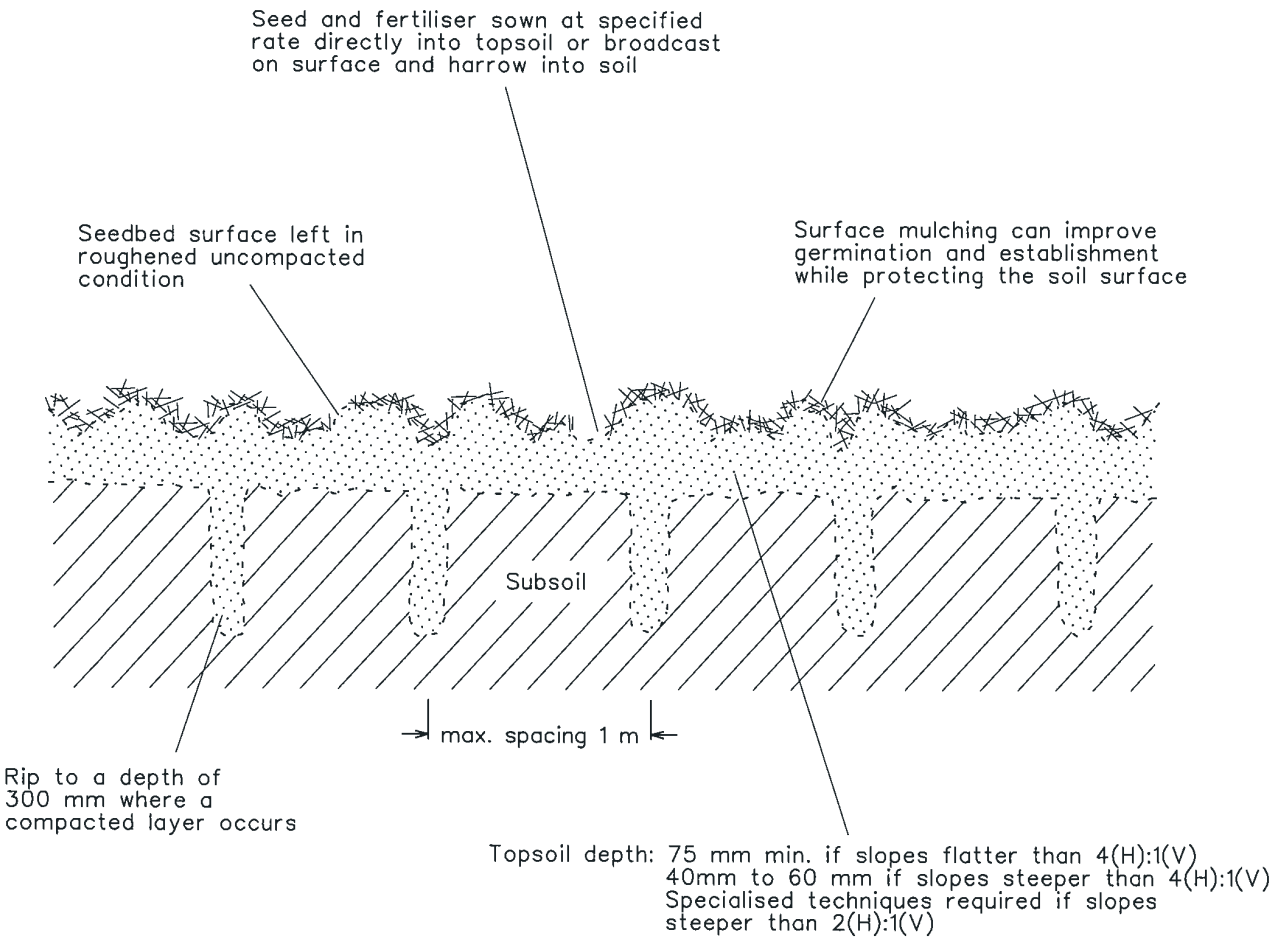
SD 6-13



Construction Notes

1. Strip the topsoil, level the site and compact the subgrade.
2. Cover the area with needle-punched geotextile.
3. Construct a 200-mm thick pad over the geotextile using road base or 30-mm aggregate.
4. Ensure the structure is at least 15 metres long or to building alignment and at least 3 metres wide.
5. Where a sediment fence joins onto the stabilised access, construct a hump in the stabilised access to divert water to the sediment fence

STABILISED SITE ACCESS SD 6-14



Construction Notes

1. Loosen compacted soil before sowing any seed. If necessary, rip the soil to a depth of 300 mm. Avoid rotary hoe cultivation.
2. Work the ground only as much as necessary to achieve the desired tilth and prepare a good seedbed.
3. Avoid cultivation in very wet or very dry conditions.
4. Cultivate on or close to the contour where possible, not up and down the slope.

SEEDBED PREPARATION SD 7-1

Appendix B Construction water quality monitoring program

Construction water quality monitoring program

1. Background

WSP was engaged by Transport for NSW (formerly Roads and Maritime Services) to prepare a baseline water quality monitoring program for the project. Transport for NSW (formerly Roads and Maritime Services) commenced baseline monitoring of surface water quality and groundwater quality in November 2017 at various sites along the project alignment. Transport for NSW (formerly Roads and Maritime Services) will continue to monitor background conditions until commencement of construction. Baseline monitoring data reports (including results) are provided by WSP to Transport for NSW (formerly Roads and Maritime Services) on a monthly basis separate to this SWMP. The reports are available upon request. Upon completion of baseline monitoring, surface water and groundwater results recorded will be incorporated in a baseline monitoring program summary report. This report will include a discussion of observed baseline trends in water quality and groundwater levels (WSP, 2018 p20). Once the baseline monitoring program summary report has been completed, statistical assessment of the data will be undertaken to confirm the trigger levels presented in Table B-1.

It is noted that the baseline monitoring program provides information about general ecosystem health, rather than impacts from road construction activities.

The baseline water quality monitoring program (WSP, 2018) is contained in Annexure B1 and has been considered in the development of this construction water quality monitoring program.

2. Construction monitoring locations

During the construction phase of the project, surface water and groundwater quality will be monitored at the same locations as for the baseline monitoring program with the exception of SW1 as it is not influenced by Stage 2 works. Surface water quality will be monitored at eight locations (i.e. SW2-SW4, SW5A, SW6 to SW9) and groundwater quality will be monitored at six locations (i.e. BH318 and GW1 to GW5). It is noted that WSP (2018, p3-5) gave consideration to the location of groundwater dependent ecosystems when siting the groundwater monitoring wells.

In addition to the eight surface water monitoring locations identified for the baseline program (WSP, 2018), surface water quality will be monitored downstream of the bridge works at Duck Creek (i.e. SW2DS) and upstream of the bridge works at Macquarie Rivulet (i.e. SW3US) following feedback from DPI Fisheries during a consultation meeting on 26 June 2018. As a result, there will now be a total of 10 construction surface water quality monitoring locations for the project.

All construction water quality monitoring locations are shown in Figure B-1 and on the Sensitive Area Plans contained in Appendix A6 of the CEMP.

The precise location (easting and northing) of each water sampling location will be determined once the project team mobilises to site and agrees the location with the various landowners (where relevant). The location of the ground water monitoring points will be chosen to ensure they are clear of permanent and temporary works areas and confirmed on site with survey to ensure they are not destroyed during the project. This is a requirement of Transport for NSW (formerly Roads and Maritime Services) Scope of Works and Technical Criteria (SWTC) Appendix 14 Clause 14.4.2. They will also be assessed with the construction team to ensure they will remain accessible throughout the project.

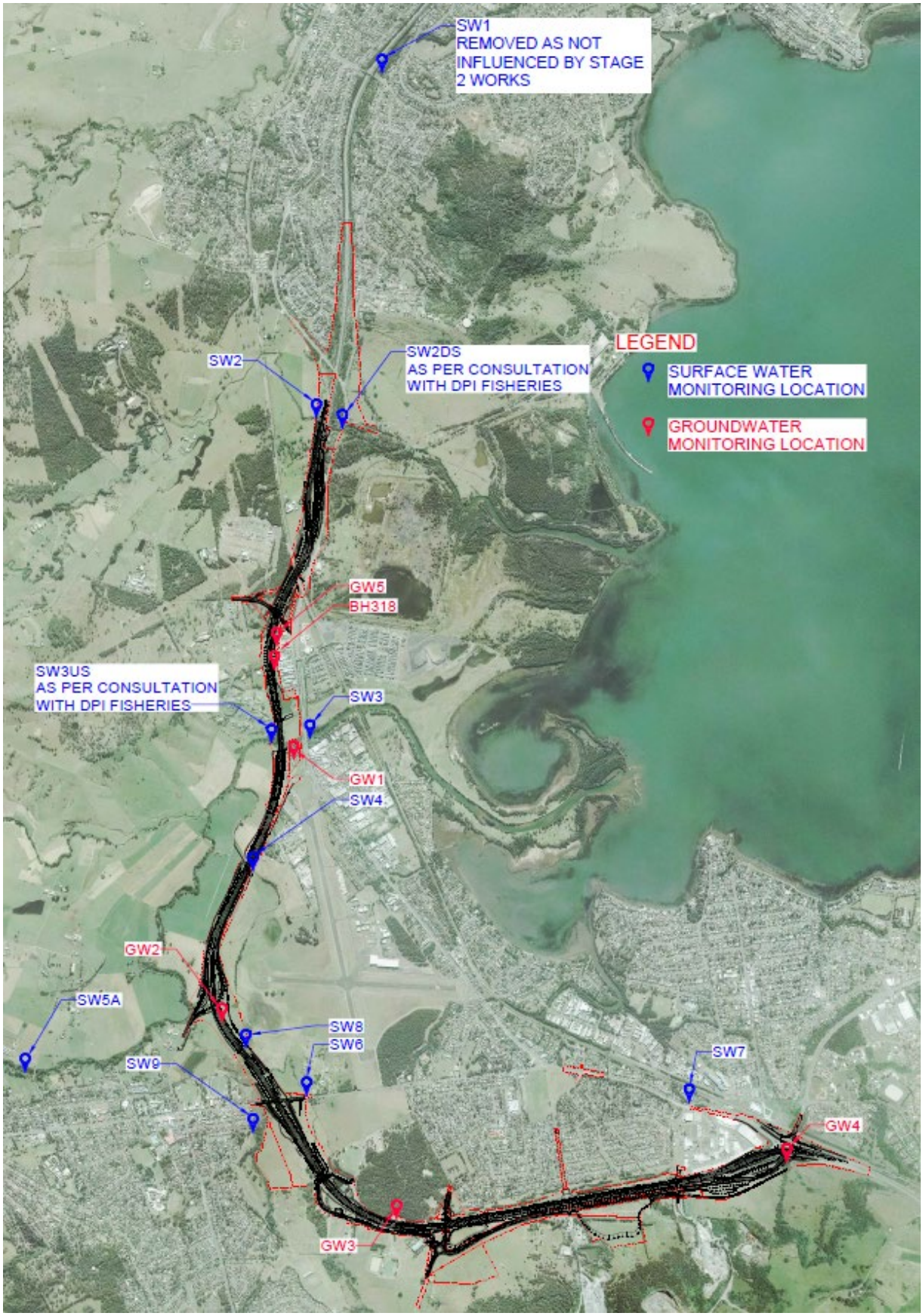


Figure B-1 Construction monitoring network (WSP, 2018) as amended to include two additional surface water monitoring locations (i.e. SW2DS and SW3US)

3. Construction monitoring parameters

The purpose of water quality monitoring during the construction phase is to determine impacts resulting from construction of the project only (i.e. road construction) and not other unrelated sources, such as agricultural operations. The potential impacts from road construction activities will most likely result from erosion and sediment control loss and spills. Nutrients from construction activities are not anticipated. The construction surface water and groundwater parameters are listed below.

In accordance with G38 Clause 2.3, a NATA accredited laboratory will be used for all testing of water quality.

Surface water

Surface water monitoring focuses on the parameters associated with road construction and include:

- Total suspended solids
- pH
- Oil and grease.

Groundwater

Groundwater monitoring focuses on the parameters associated with road construction and include:

- pH
- electrical conductivity
- temperature
- no visible oil and grease
- dissolved metals for GW2 only, which is located in a PASS risk area

Groundwater levels will also be measured at each groundwater monitoring location identified in Figure B-1.

4. Construction monitoring trigger levels

Following consultation with DPI Water, trigger levels have been included in the construction water quality monitoring program. Refer to Table B-1 below. The trigger levels identify when construction impacts are approaching the EPL criteria where relevant.

Monitoring results will be checked against the trigger levels (refer to Table B-1) and EPL criteria (refer to mitigation measure ID SWMM60) to identify any exceedances.

Refer to point 5 below for the procedures to be implemented when a monitoring result is outside of the water quality trigger level and/or EPL criteria.

5. Procedures to identify and implement additional mitigation measures where results of monitoring are unsatisfactory

Implementation of the standard mitigation measures listed in Table 6-1 will ensure surface water and groundwater impacts are minimised during construction. In the event that complaints about surface water and/or groundwater are received or an exceedance of the EPL criteria (refer to mitigation measure ID SWMM60) or trigger levels (refer to Table B-1) has been identified through monitoring, site inspections or audits, Fulton Hogan will implement the following procedure:

- The Environmental Manager will investigate the issue to determine possible causes of the non-conformance (in accordance with Section 7.5) and to develop appropriate mitigation measures on a case-by-case basis.
- Surface water and/or groundwater complaints will be managed in accordance with complaints management process described in Sections 2.3 and 2.4 of the Community Communication Strategy. Where investigation confirmed clear and unambiguous impact resulting from the

construction of the project, the Environmental Manager, in consultation with the project team, will identify additional mitigation measures which may include, but not necessarily be limited to:

- Modification of the construction methods used
- Conduct unscheduled monitoring to further verify exceedance trend, where relevant

It is the responsibility of the Environmental Manager to ensure that the identified contingency measures are implemented.

6. Construction water quality monitoring program

Table B-1 summarises the construction water quality monitoring program for the Project. Information regarding non-conformances and reporting requirements are documented in Section 7.5 and 7.8 respectively of this SWMP.

Table B-1 Construction water quality monitoring program

Monitoring details	Area	Record	Responsibility	Monitoring parameters	Frequency	Trigger Level
SURFACE WATER						
Construction surface water quality at SW4, SW6, SW7, SW8, SW9.	Refer to the surface water monitoring locations identified in Figure B-1	Monthly Report Water quality sampling field record Chain of custody form (for environmental samples)/ Laboratory results	Environment Manager	Total suspended solids	Monthly	2 consecutive exceedances of the monthly average for TSS determined through assessment of the baseline data contained in the baseline monitoring program summary report
				pH	Monthly	Less than 6.6 and greater than 7.9
				Oil and grease	Monthly visual inspection and as required in response to spills on site. Laboratory testing only if sheen is visually present.	Greater than or equal to 9 mg/L
SW5a	Refer to the surface water monitoring locations identified in Figure B-1	Monthly Report Water quality sampling field record Chain of custody form (for environmental samples)/ Laboratory results	Environment Manager	Total suspended solids	Monthly	N/A. Location is an upstream control site and is not influenced by Stage 2 works.
				pH	Monthly	N/A. Location is an upstream control site and is not influenced by Stage 2 works.
				Oil and Grease	Monthly	N/A. Location is an upstream control site and is not influenced by Stage 2 works.
Upstream and downstream of the bridge works at Duck	Refer to the surface water monitoring locations	Monthly Report Water quality sampling field	Environment Manager	Total suspended solids	Monthly	2 consecutive exceedances of the monthly average for TSS determined

Monitoring details	Area	Record	Responsibility	Monitoring parameters	Frequency	Trigger Level
Creek (i.e. SW2, SW2DS) and Macquarie Rivulet (i.e. SW3US, SW3)	identified in Figure B-1	record Chain of custody form (for environmental samples)/ Laboratory results				through assessment of the baseline data contained in the baseline monitoring program summary report
				pH	Monthly	Less than 6.6 and greater than 7.9 Less than 6.9 and greater than 8.4 (Macquarie Rivulet only - estuarine)
				Oil and grease	Monthly visual inspection and as required in response to spills on site. Laboratory testing only if sheen is visually present.	Greater than or equal to 9 mg/L
Sediment basin discharge water quality	Refer to the discharge points specified in the EPL.	Monthly Report Dewatering record Water quality sampling field record Chain of custody form (for environmental samples)/ Laboratory results	Environment Manager	Total suspended solids (or NTU in accordance with the EPL)	Prior to discharge	48 mg/L TSS (or NTU equivalent in accordance with the EPL)
				pH	Prior to discharge	Less than 6.6 and greater than 8.4
				Oil and grease	Prior to discharge	Visible oil and grease
Monitoring Bureau of Meteorology forecast	All	Email Record to staff	Environment Manager/ Administration	Not applicable	Daily	Not applicable
GROUNDWATER						
Groundwater construction water quality monitoring	Refer to the groundwater monitoring locations identified in Figure B-1.	Quarterly Report Dewatering record Water quality sampling field record Chain of custody form (for environmental samples)/	Environment Manager	pH electrical conductivity temperature no visible oil and grease dissolved metals for GW2 only,	Quarterly	2 consecutive exceedances of the quarterly averages determined through assessment of the baseline data contained in the baseline monitoring

Monitoring details	Area	Record	Responsibility	Monitoring parameters	Frequency	Trigger Level
		Laboratory results		which is located in a PASS risk area		program summary report
Groundwater level	Refer to the groundwater monitoring locations identified in Figure B-1.	Quarterly Report	Environment Manager	Groundwater level	Quarterly	2 consecutive exceedances of the quarterly average level determined through assessment of the baseline data contained in the baseline monitoring program summary report

Annexure B1 Baseline water quality monitoring program (by then, Roads and Maritime)

ROADS AND MARITIME SERVICES

BASELINE MONITORING PROGRAM - ALBION PARK RAIL BYPASS

APRIL 2018

Question today
Imagine tomorrow
Create for the future

Baseline monitoring program - Albion Park Rail bypass

Roads and Maritime Services

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REV	DATE	DETAILS
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

	NAME	DATE	SIGNATURE
Prepared by:	Pepijn van Ravesteyn	20/04/18	[redacted]
Reviewed by:	Andrea Madden, Eric Lam	20/04/18	[redacted]
Approved by:	Andrea Madden	20/04/18	[redacted]

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1 INTRODUCTION

1.1 BACKGROUND

The Roads and Maritime Services is planning a 9.8 km extension of the Prices Motorway to a four-lane divided motorway between Yallah and Oak Flats, to bypass the suburb of Albion Park Rail, NSW. Key features of the Albion Park Rail bypass (the project) include the provision of interchanges, multiple bridges to carry the motorway over roads and water courses, and improved pedestrian and cycle connections.

An environmental impact statement was prepared for the project in 2015 and a submissions and preferred infrastructure report was submitted in September 2017. The Department of Planning and Environment provided planning approval for the project in early 2018, with major construction anticipated to commence in early 2019 (Roads and Maritime Services, 2018).

The project area consists of rocky hills and ridges to the north and south, an escarpment to the west and the foreshore of Lake Illawarra to the east. The central section of the project area comprises a low-lying floodplain. Much of the central section of the project area is classified as Class 1 (highest risk) for potential acid sulfate soils (Hyder Cardno Joint Venture, 2015).

1.2 OBJECTIVES

The objectives of the surface water and groundwater monitoring program are to obtain baseline monitoring data, which considers seasonality, prior to the commencement of construction for the project. The baseline data will support the development of surface water and groundwater monitoring programs to be used for impact assessment during project construction and operation.

The primary objectives of this document are to detail the baseline surface water and groundwater monitoring program and water quality sampling protocols that are being adopted.

2 CONSULTATION WITH REGULATORS

A framework baseline monitoring program (WSP, 2017a), which provides the basis of this baseline monitoring program, was prepared and sent to the NSW Environment Protection Authority (EPA) and the Division of Crown Lands & Water (Department of Industry, formerly Department of Primary Industries - Water). This section summaries the consultation.

2.1 NSW ENVIRONMENT PROTECTION AUTHORITY

The framework baseline monitoring program (WSP, 2017a) was sent to the NSW EPA in October 2017. The EPA deemed a meeting was not required. An email was sent by the EPA (Jen Byrne) on 26 October 2017, stating the framework was reviewed, especially in relation to surface water. The EPA stated the framework appears to be comprehensive. The following comments were provided for consideration:

- Continuing to monitor the same sample locations during construction and post-construction.
- The University of Wollongong School of Environmental Science may have some data to supplement the study.
- Publishing the monitoring data on the website of the Roads and Maritime Services.
- Including reference to sampling and analysis methods, such as the approved methods for the sampling and analysis of water pollutants in NSW (EPA, 2004).
- Providing the NSW EPA with any monitoring data collected.

2.2 DEPARTMENT OF INDUSTRY

The framework baseline monitoring program (WSP, 2017a) was sent to the Department of Industry (DI) and a meeting held on 7 December 2017. Richard Green and Janne Grose from DI attended the meeting. The following was recommended:

- The production of a flow net and surveying the new monitoring wells.
- Analysing the groundwater in the vicinity of the main cut, which is near an industrial area, for benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN), polycyclic aromatic hydrocarbons (PAH), total recoverable hydrocarbons (TRH) and oil and grease. Recommended as a one-off event for now.
- Analysing the groundwater in the vicinity of the Fire and Rescue site at Albion Park and the alluvium for per- and polyfluoroalkyl substances (PFAS) and pesticides. An assessment for further monitoring to be made following receipt of the results.

Refer to Section 12 in relation to the additional monitoring undertaken in response to the above recommendations.

The groundwater component of the framework was deemed adequate, with internal DI discussion regarding the surface water required prior to determining the surface water monitoring programs adequacy.

The DI provided a letter on 6 February 2018, stating the following:

- The groundwater monitoring program is adequate.
- The proposed surface water sampling of 48 to 72 hours following a rainfall event should be reduced.
- The program should detail how data from sampling is to be stored, analysed, interpreted and reported on.

Refer to Section 5 for further information regarding the sampling time following a rainfall event. Refer to Sections 8, 9 and 10 for details regarding the storage, analysis, interpretation and reporting.

3 OVERVIEW OF ENVIRONMENTAL IMPACTS

3.1 SURFACE WATER

The following information on surface water and potential impacts was summarised from Hyder Cardno Joint Venture (2015).

The project area drains to three main watercourses, all of which are tributaries of Lake Illawarra: Duck Creek, Macquarie Rivulet (which is fed by Marshall Mount Creek and Frazers Creek), and Horsley Creek (Figure 3.1). These watercourses and Lake Illawarra, comprise the receiving waters for the project, and have the potential to be impacted by the project during construction and operation.

The sensitive receiving environments are shown in Figure 3.1. Those that may potentially be impacted by the project, via water quality impacts, are located within and downstream of the project area and include:

— the ecosystems of Duck Creek, Macquarie Rivulet and Horsley Creek

— freshwater wetlands and saltmarsh threatened ecological communities

— State Environmental Planning Policy (SEPP) 14 (Coastal Wetlands)

— groundwater dependent ecosystems (GDEs)

— Lake Illawarra.

The construction phase impacts on water quality are associated with the following:

— leaching of tannins from stockpiled vegetation

— sediment from vegetation clearing and exposure of soils

— earthworks and dewatering, exposing potential and actual acid sulfate soils

— disturbance of contaminated materials

— use of vehicles, plant and machinery

— adjusting Frazers Creek north of the existing Croom Regional Sporting Complex

— activities at ancillary sites, such as storage of chemicals and stockpiling

— construction activities generating waste.

The above has the potential to negatively impact receiving waters by increasing turbidity and sedimentation, changes in acidity, changed in dissolved oxygen and introduction of pollutants such as nutrients, metals, oils and grease.

3.2 GROUNDWATER

The following information on the groundwater systems and potential impacts was summarised from Roads and Maritime Services (2015).

The hydrogeology of the project area consists of an unconfined, unconsolidated alluvium aquifer (Quaternary age) and a deeper unconfined to semi-confined consolidated rock aquifer (shale, siltstone, sandstone and volcanics (latites and tuffs)) (Permian age). Broadly, the geology is dominated by consolidated rock to the north and south and alluvium in the centre of the study area.

Map: PS106112_GIS_001_A7	Author: David.Naiken		
Date: 1/03/2018	Approved by: P.Van Ravesteyn		

Data source , Department of Finaces, Services and Innovation (2017), Data serived from RMS, Hyder, Cardno (2017), ESRI

0 400 800 m

1:28,000

Coordinate system: GDA 1994 MGA Zone 56

Scale ratio correct when printed at A3

Albion Park Rail Bypass

Figure 3.1
Monitoring Network

Groundwater flow in the alluvium and the consolidated rocks is predominantly from west to east, and south to north in the southern part of the study area.

As stated in Roads and Maritime Services (2015), the aquifers were interpreted to support the Macquarie Rivulet GDE, possibly in conjunction with surface water interaction, located at the estuary of the Macquarie Rivulet on Illawarra Lake. The Macquarie Rivulet GDE has been identified as high priority in the NSW regulation. A SEPP 14 freshwater wetland located on Frazers Creek is directly east of the alignment. Reliance on groundwater is uncertain. Deep rooted vegetation of the Illawarra Lowlands Grassy Woodland Endangered Ecological Community (EEC) would be partially reliant on groundwater, including Croom Reserve, located close to the alignment (Figure 3.1).

The project activities, which include a number of bridges, cut and fill areas and soil treatments, have a potential to impact the groundwater regime. There will be several cuts, with one deep cut (Cut 1), to the south of Yallah Road and north of Macquarie Rivulet (Figure 3.1). The cut is 440 m long, up to 15.2 m high, predominantly in siltstone and a predicted outflow for this cut of 21 m^3/day over the distance of 440 m.

The impact assessment identified some key findings, such as the following:

- The Macquarie Rivulet estuary GDE and SEPP14 wetland on Frazers Creek are not anticipated to be impacted by the project, however there is a level of risk to the wetland and the deep rooted GDEs associated with the Illawarra Lowlands Grassy Woodland EEC at Croom Reserve.
- There is some dewatering required due to road cuts on the northern section of the route, particularly associated with Cut 1. There will be no impact on groundwater users or GDEs.
- Fill and soil treatments may locally alter groundwater flow in the alluvium aquifer, associated with the two largest fill areas of Fill 6 and Fill 7(Figure 3.1). This is through the use of wick drains which drain pore water and cause compaction of the sediments.
- There is a risk of groundwater contamination from spills and runoff water.

4 MONITORING NETWORK

4.1 SURFACE WATER

The surface water monitoring network, along with the rationale for selection, is provided in Table 4.1. The location of the network is shown in Figure 3.1. Safety was taken into consideration in the design of the monitoring network, with sampling sites carefully selected to ensure they can be accessed safely during dry weather events and following rainfall.

Table 4.1 Surface water monitoring network

SITE IDENTIFIER	LOCATION	RATIONALE
SW1	Brooks Creek, north of the project area, near Emerson Road	Flowing to the north, past the northern-most section of the project.
SW2	Duck Creek, near the intersection of the Princes Highway and Yallah Bay Road.	One of the main watercourses in the project area; a tributary of Lake Illawarra.
SW3	Macquarie Rivulet, east of the Princes Motorway (bridge)	One of the main watercourses in the project area; a tributary of Lake Illawarra. Contributes flow to the Macquarie Rivulet GDE.
SW4	Frazers Creek, east of Terry Street (Illawarra Highway), Albion Park Rail	Macquarie Rivulet is fed by Frazers Creek. Location is downstream from freshwater wetlands, including a SEPP 14 wetland. The preferred location for SW4 is at the downstream (western) side of the project boundary, however site access has made this unfeasible. Thus, the upstream location was selected.
SW5	Macquarie Rivulet, on the western edge of the project area, by the Illawarra Highway	One of the main watercourses in the project area; a tributary of Lake Illawarra. Contributes flow to the Macquarie Rivulet GDE. SW5 was to be sampled further upstream as a control site, however property access was not obtained. SW5 was sampled from November 2017 to mid-February 2018. This location was replaced in late February 2018 with SW5A.
SW5A	Macquarie Rivulet, on the western edge of the project area, by the Illawarra Highway	This is a control site (unaffected by the project) and one of the main watercourses in the project area; a tributary of Lake Illawarra. Contributes flow to the Macquarie Rivulet GDE. SW5A replaces SW5, and was sampled from late February 2018.
SW6	Frazers Creek, south of Tongarra Road, Croom	Macquarie Rivulet is fed by Frazers Creek. The location is downstream from Croom Reserve, an Illawarra Lowlands Grassy Woodland EEC and GDE.

SITE IDENTIFIER	LOCATION	RATIONALE
SW7	Horsley Inlet, between Princes Highway and Pioneer Drive, Albion Park Rail. North of the south-eastern edge of the project area.	One of the main watercourses in the project area; a tributary of Lake Illawarra. Flowing to the northwest, through the project area to Lake Illawarra.
SW8	Frazers Creek, just upstream of a SEPP14 (freshwater) wetland, east of Terry Street, Albion Park.	Just upstream of a SEPP14 wetland on Frazers Creek, which feeds Macquarie Rivulet.
SW9	Tributary of Frazers Creek, southeast of O'Gorman Street, Albion Park	Flowing to the north, into the project area. Macquarie Rivulet is fed by Frazers Creek. SW9 may occasionally be affected by backwater from downstream and thus may not always be considered as a control site. The preferred location was further upstream, to ensure this site as a control site, however this is unfeasible as there is no surface flow.

4.2 GROUNDWATER

4.2.1 EXISTING GROUNDWATER MONITORING NETWORK

A groundwater monitoring network was installed by Golder Associates (2017) in late 2014 and early 2015 (Figure 3.1). All existing monitoring wells, except BH301, are likely to be destroyed during construction as they are located on or in close vicinity of the alignment. BH301 is in the northern portion of the project and comprises part of the current monitoring network.

In addition to BH301, monitoring an existing monitoring well near Cut 1 was recommended given the predicted dewatering and drawdown in this area, even though it may be destroyed during construction. This would supplement the data obtained from monitoring well GW5 (Section 4.2.2). Of the existing monitoring wells in the vicinity of the cut (BH312A, BH314, BH317, BH318, GA-BH102 and GA-BH219), BH318 was recommended to comprise part of the current monitoring network given the following:

- it is located further from GW5 than BH312A and GA-BH102, and thus would provide a better spread of data
- it is located on the edge of the cut and thus has a higher potential to survive construction than the monitoring wells located in the centre of the cut (BH314 and GA-BH219)
- it appears to be well constructed (Golder Associates, 2017).

4.2.2 ADDITIONAL GROUNDWATER MONITORING NETWORK

The additional monitoring network, along with the rationale and target formation, is provided in Table 4.2. Along with the rationale listed in the table, main considerations for all sites included locations outside construction activities, so that they can be utilised ongoing during project operations, site access/land ownership, and locations within the project boundary.

The location of the network is shown in Figure 3.1. The five monitoring wells were drilled and developed in November 2017 (WSP, 2018).

Table 4.2 Groundwater monitoring network

SITE IDENTIFIER	LOCATION	RATIONALE	TARGET FORMATION
GW1	West of the Princes Motorway, south of Macquarie Rivulet, Yallah	Obtain baseline groundwater information in the northern portion of the project area. Nearby existing monitoring well, GA-BH211, will be destroyed during construction activities.	Consolidated rock aquifer
GW2	Near the freshwater wetland on Frazers Creek and Fill 7	There is potential impact from compaction of the alluvium at Fill 7, potentially affecting groundwater flow to the SEPP 14 wetland.	Alluvium aquifer
GW3	Croom Reserve	Croom Reserve contains deep rooted vegetation of the Illawarra Lowlands Grassy Woodland EEC which would be partially relying on groundwater. There is a level or risk associated with the project. Nearby existing monitoring well, BH330, will be destroyed during construction activities.	Consolidated rock aquifer
GW4	South of East West Link, Croom	Obtain baseline groundwater information in the southern portion of the project area. Nearby existing monitoring well, BH334, will be destroyed during construction activities.	Consolidated rock aquifer
GW5	Directly east of Cut 1	Cut 1 is the deepest cut with a predicted outflow for this cut of 21 m^3/day over the length of the cut. The existing monitoring network in the vicinity of the cut is expected to be destroyed during construction. Monitoring the baseline conditions and drawdown due to dewatering during construction are required.	Consolidated rock aquifer

5 MONITORING FREQUENCY

The baseline monitoring frequency is outlined below and summarised in Table 5.1:

- Monthly for surface water – dry events.
- Following 15 mm or more of rainfall within 24 hours for surface water – wet weather events. Sampling is to be undertaken within 24 to 48 hours of the wet weather event. For a long rain event (e.g. 1-2 weeks duration), sampling may occur more than once.
- Quarterly for groundwater.

Table 5.1 Monitoring frequency

SAMPLING	2017		2018									
	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
Surface water	X	X	X	X	X	X	X	X	X	X	X	X
Groundwater		X			X			X			X	

The monitoring frequency will be reassessed following 12 months of monitoring. Monitoring will also be required during the construction and operational phases.

Note, rainfall will exceed 15 mm in 24 hours approximately 17 times per year. This is based on the rainfall records from January 2000 to December 2017 from the Bureau of Meteorology (BOM) rainfall station at Albion Park (site number 0680241; refer to Section 7.3).

6 ANALYTICAL SUITE AND METHODS

6.1 ANALYTICAL SUITE

A base analytical suite for surface water is analysed monthly (Type A), with a more extensive analytical suite analysed on a quarterly basis (Type B). The surface water samples collected during the wet weather events are analysed for the Type A parameters. The analytical suite for surface water and groundwater is summarised in Table 6.1.

Table 6.1 Analytical suite

	ANALYSIS	SURFACE WATER – DRY AND WET WEATHER EVENTS TYPE A	SURFACE WATER – QUARTERLY DRY WEATHER EVENTS TYPE B	GROUND-WATER
pH	In the field	X	X	X
Electrical conductivity	In the field	X	X	X
Temperature	In the field	X	X	X
Oxidation-reduction potential	In the field	X	X	X
Dissolved oxygen	In the field	X	X	
Turbidity	Laboratory	X	X	
Total suspended solids	Laboratory	X	X	
Total oils and grease[1]	Visual and olfactory inspection	X	X	X
Total nitrogen	Laboratory	X	X	X
Total phosphorus	Laboratory	X	X	X
Total dissolved solids	Laboratory			X
Total recoverable hydrocarbons	Laboratory		X	
Total metals[2]	Laboratory		X	
Dissolved metals[2]	Laboratory			X[3]
Major cations[4]	Laboratory			X
Major anions[5]	Laboratory			X

(1) Oil and grease is to be analysed by the laboratory only if total oils and grease are visually or olfactorily present.

(2) Total and dissolved metals comprise aluminium, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver and zinc.

(3) Dissolved metal analysis for GW2 only, which is located in a potential acid sulfate soil risk area.

(4) Major cations comprise calcium, sodium, magnesium and potassium.

(5) Major anions comprise chloride, sulphate, alkalinity and bicarbonate.

6.2 LABORATORY METHODS

Laboratory analysis is undertaken by Australian Laboratory Services (ALS). ALS has been accredited by an independent accreditation body acceptable to the NSW Environment Protection Authority (EPA), the National Association of Testing Authorities (NATA).

Laboratory methods used by ALS for the project are compared with the NSW EPA (2004) approved methods for the sampling and analysis of water pollutants. The laboratory methods used by ALS and the EPA-approved methods per analyte are listed in Table 6.2.

Table 6.2 Laboratory methods per analyte

ANALYTE	EPA-APPROVED METHOD	ALS METHOD
Alkalinity (total)	APHA 2320	APHA 2320 B
Aluminium	USEPA 6020	USEPA 6020
Arsenic (As III)	USEPA 6020	USEPA 6020
Bicarbonate	APHA 2320	APHA 2320 B
Cadmium	USEPA 6020	USEPA 6020
Chromium	USEPA 6020	USEPA 6020
Copper	USEPA 6020	USEPA 6020
Iron	USEPA 6020	USEPA 6020
Lead	USEPA 6020	USEPA 6020
Manganese	USEPA 6020	USEPA 6020
Mercury	APHA 3112	APHA 3112 - Hg B
Nickel	USEPA 6020	USEPA 6020
Oil and grease	APHA 5520 D	APHA 5520 D
Silver	USEPA 6020	USEPA 6020
Suspended solids	APHA 2540 D	APHA 2540 D
Total dissolved solids	APHA 2540 C	APHA 2540 C
Total nitrogen	APHA 4500 N-C	APHA 4500-Norg
Total phosphorus	APHA 4500 P F	APHA 4500 P F
TRH (C_6-C_{40})	USEPA 8015B	USEPA 8015A
Turbidity	APHA 2130	APHA 2130 B
Zinc	USEPA 6020	USEPA 6020

The methods used by ALS are generally consistent with the EPA-approved methods. Slight differences may occur when the EPA-approved methods relate to an older version of the American Public Health Association (APHA) Standard Methods for the Examination of Water and Wastewater, such as the 1998 version. ALS informed WSP that the specification of an APHA number without a letter suggests any of the equivalent lettered methods are permissible (refer to alkalinity (total), bicarbonate, mercury, total nitrogen and turbidity). ALS also stated that the letter following the USEPA 8015 method for TRP (C_6-C_{40}) does not denote the actual method for TRH, and thus the ALS method is consistent with the EPA-approved method.

7 MONITORING METHODOLOGY

7.1 EQUIPMENT

7.1.1 GENERAL EQUIPMENT

The following equipment is used for the majority of sampling tasks and is applicable to groundwater and surface water sampling:

- personal protective equipment and other safety equipment as identified in the health, environment and safety plan for the project
- sampling record sheets (Appendix A)
- chain-of-custody (COC) forms (Appendix B)
- multi-parameter water quality instruments and calibration solutions
- appropriate sample containers with the required preservatives as specified by the laboratory
- storage containers for the samples (such as an esky)
- decontamination equipment including clean buckets, phosphate-free detergent such as Decon 90, liquid chlorine and potable water
- nitrile gloves, syringes and water filters for filtering samples (e.g. dissolved metals)
- mobile phone with camera.

7.1.2 SURFACE WATER EQUIPMENT

Surface water samples are collected using a grab sample technique. Samples are collected directly into laboratory-supplied sample containers that do not contain preservatives with the use of a telescopic sampling pole if there is moderate to high surface flow or steep banks. The sampled water is then decanted into the appropriate bottles. The submerged portion of the telescopic sampling pole is cleaned using phosphate-free detergent and potable water, followed by a solution of 200 mg/L of chlorine, which is left on the pole for one minute. The chlorine is then rinsed off with potable water. The use of chlorine is an additional precaution due to the Epizootic Haematopoietic Necrosis (EHN) virus.

7.1.3 GROUNDWATER EQUIPMENT

7.1.3.1 PURGING AND SAMPLING

A range of methods can be used to purge groundwater and collect groundwater quality samples from the monitoring wells. The most appropriate method for each monitoring well is selected based on the depth of the well, the depth to groundwater, and the permeability of the formation at the screened zone. Higher yielding monitoring wells are purged and sampled using a submersible (high-flow) pump. Lower yielding wells or wells with limited purge volume are sampled using a disposable bailer or a grab sampler.

SUBMERSIBLE (HIGH-FLOW) PUMP

A high-flow pump (12-volt Monsoon pump) is deployed in high yielding wells. Typically a minimum of three well volumes are extracted before a water quality sample is collected, however abstracting this volume is not required when field parameters (particularly pH and EC) have stabilised (refer to Section 7.2.4).

7 MONITORING METHODOLOGY

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The following equipment is used for the majority of sampling tasks and is applicable to groundwater and surface water sampling:

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- nitrile gloves, syringes and water filters for filtering samples (e.g. dissolved metals)
- mobile phone with camera.

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7.1.3 GROUNDWATER EQUIPMENT

7.1.3.1 PURGING AND SAMPLING

A range of methods can be used to purge groundwater and collect groundwater quality samples from the monitoring wells. The most appropriate method for each monitoring well is selected based on the depth of the well, the depth to groundwater, and the permeability of the formation at the screened zone. Higher yielding monitoring wells are purged and sampled using a submersible (high-flow) pump. Lower yielding wells or wells with limited purge volume are sampled using a disposable bailer or a grab sampler.

SUBMERSIBLE (HIGH-FLOW) PUMP

A high-flow pump (12-volt Monsoon pump) is deployed in high yielding wells. Typically a minimum of three well volumes are extracted before a water quality sample is collected, however abstracting this volume is not required when field parameters (particularly pH and EC) have stabilised (refer to Section 7.2.4).

BAILING

Disposable bailers with a single stop valve are used to collect samples from shallow wells with limited purge volume and/or low yielding wells. Monitoring wells screened in low yielding aquifers with a slow recovery are bailed dry and samples are collected once the monitoring well has sufficiently recovered to obtain a groundwater sample.

GRAB SAMPLER

A no-purge (passive) grab sampler (e.g. HydraSleeve®) may be used for extremely slowly recovering monitoring wells. The grab sampler will be deployed and retrieved in the well in accordance with the manufacturer's instructions. With this method, groundwater samples are collected directly from the screened zone without having to purge the monitoring well prior to sample collection. It is a single-use (disposable) sampler (HydraSleeve, 2016).

7.1.3.2 GROUNDWATER LEVELS

An electronic groundwater level dipper is used to measure the static groundwater level. Solinst Leveloggers will be deployed to continuously monitor groundwater levels in the current monitoring network. Two barometric loggers will also be installed to correct for atmospheric pressure. Data loggers will be:

- Suspended from the surface using stainless steel cable and swages.
- Suspended below the standing groundwater level. Potential groundwater level variations in the monitoring well and individual logger specifications (different loggers have different pressure thresholds) are considered before the depth at which the logger is to be installed is determined, as the logger must remain below the groundwater level.
- Programmed and then lowered into the monitoring well. Data logging intervals are to be set at six-hourly intervals (00:00, 6:00, 12:00 and 18:00).

7.2 SAMPLING AND MONITORING

Surface water and groundwater monitoring are conducted in general accordance with WSP's standard operating procedure. The procedure outlines the general protocols, procedures and work practices to be applied when collecting surface water and groundwater samples and downloading data loggers.

7.2.1 SURFACE WATER SAMPLING

The surface water sampler is carefully lowered into the surface water body to obtain the samples. The grab sampler is lowered approximately 100-500 mm below the surface of the water body, depending on the depth of water. Disturbing the sediment and surface debris is avoided as much as possible when collecting a sample. Following collection, the surface water sample is decanted into the laboratory supplied sample containers.

The appearance of the surface water body is recorded, such as colour, turbidity, water flow, odour, surface crusts, films or floating material, vegetation and algae. Notes are also made of any other relevant observations such as dead, decaying or distressed vegetation, surface rubbish, and surface sheen. Refer to Section 8.4.1.

Should the sampling location be considered unsafe due to changed conditions, such as following a large rainfall event, then a suitable nearby location will be selected, and any change recorded on the sampling record sheets (Section 8.4.1).

7.2.2 GROUNDWATER LEVELS

Groundwater levels are manually measured by an electronic groundwater level dipper and data loggers will be installed at each monitoring well to automatically measure the groundwater level at a predetermined time interval (refer to Section 7.1.3.2).

Manual groundwater levels are recorded prior to purging or sampling. The groundwater level is measured from the top of casing and is measured to the nearest millimetre. The depth of the monitoring well is also recorded. These levels are recorded on the groundwater sampling record sheets (refer to Section 8.4.1).

The data logger can then be retrieved from the monitoring well for download by pulling up the stainless steel wire attached to the data logger. Data loggers will then be downloaded using appropriate software for storage and data processing. The following diagnostics are performed regularly to ensure data loggers are functioning properly:

- visual inspection and cleaning the data logger if necessary
- inspection of swages and connections to ensure the data logger is secured at the surface
- real time data is checked to ensure water levels recorded by the data logger are accurate before redeploying
- recording data logger battery levels.

7.2.3 GROUNDWATER SAMPLING

Following the measurement of static groundwater levels, typically three well volumes are purged prior to sampling. Less than three well volumes can be removed prior to sampling in the following circumstances:

- A well is purged dry and will not yield sufficient water for further continuous purging. As such, the recovery water is then sampled.
- At least one well volume has been removed and field parameters stabilise, principally pH, EC and temperature. Field parameters are considered to have stabilised when three consecutive sets of the selected field parameters are within 10%.
- No-purge sampling equipment is used (e.g. HydraSleeve or similar) for very low yielding monitoring wells, that may not sufficiently recover overnight.

The purged water colour, turbidity, any odours and other observations are assessed and recorded. Characteristics of how these change as pumping progresses over time are also noted on the groundwater sampling record sheet (refer to Section 8.4.1).

7.2.4 COLLECTION OF FIELD PARAMETERS

The field parameters listed in Section 6.1 are measured using a calibrated water quality meter, which is calibrated daily. Field parameters are measured from samples collected with a laboratory supplied plastic sample collection container for surface water samples. Groundwater samples are measured in the pumped water stream as purging progresses or from a sample collected with a disposable bailer (depending on sampling technique). The readings stabilise before being recorded on the surface water or groundwater sampling data record sheets (refer to Section 8.4.1).

7.2.5 COLLECTION OF SAMPLES FOR LABORATORY ANALYSIS

Surface water and groundwater samples are collected using the methods outlined above and decanted into laboratory-supplied containers. The following procedures are used:

- All fields are completed on the label of the sample container using a xylene free marker.
- Sampling personnel wear a new pair of nitrile disposable gloves for each sample location.
- All bottles are filled and capped as quickly as practicable to reduce exposure of the sample to the atmosphere. Care is taken when handling sample container lids to avoid contact with any surfaces that may compromise the integrity of the sample.
- When collecting samples for volatile analysis, all bottles are filled as far as practicable to minimise the headspace within the container and avoid potential loss of volatiles.
- Where filtering of samples is required to remove fine suspended particles, for example for dissolved metals analysis, disposable disc filters (0.45 µm) are used with disposable syringes. Filtering equipment is not reused between sampling locations.

7.3 METEOROLOGY

The rainfall from the BOM rainfall station located closest to the project is monitored on a daily basis, that is, Albion Park (Wollongong Airport) (site number 068241). Following 15 mm or more of rainfall within 24 hours, sampling is undertaken within 24 to 48 hours after the wet weather event.

8 QUALITY MANAGEMENT

8.1 QUALITY CONTROL

One blind replicate (field duplicate) water sample is collected for every 10 samples during each monitoring round and is collected to provide an indication of the precision (repeatability) of the laboratory's analysis and sampling procedures, as well as the heterogeneity of the sampling material. Duplicate samples are labelled ‘QA#’ with the first QA sample labelled QA1 and the second labelled QA2 etc. in order of collection. When a duplicate sample is taken, a note is made on the sampling record sheet of the parent sample. Duplicate samples are submitted to a NATA accredited laboratory for analysis.

Where appropriate, dedicated sampling equipment is used to eliminate the risk of cross-contamination as much as possible. Examples of such equipment are disposable bailers, HydraSleeves, filters and syringes. For reusable sampling equipment, such as submersible pumps, they are cleaned using phosphate-free detergent and rinsed with potable water between sample locations. The submerged portion of the telescopic sampling pole is cleaned using phosphate-free detergent and chlorine, which is an additional precaution due to the EHN virus. Refer to Section 7 for further information.

8.2 QUALITY ASSURANCE

8.2.1 RECORDS

Surface water and groundwater sampling record sheets are completed for each sampling location, providing a record of relevant information at each location. Sampling record sheets for the project are provided at Appendix A. Some of the information contained in these sheets are listed below:

— well number or sampling identification

— date and time

— sampling method

— samplers name

— specific field parameters and their units

— comments, such as colour, odour and turbidity

— purge volume (for groundwater only)

— quality assurance/quality control details

— general environmental/climatic conditions.

8.2.2 CHAIN OF CUSTODY

A COC form is completed following sampling and sent with the samples to the laboratory. The COC is a record of the sampling undertaken and the analysis required. A COC is shown at Appendix B. Some of the information contained within a COC is listed below:

— sample ID

— sample date and time

— analysis required

— sampler and project manager's names and contact details

— date and time the samples were relinquished by the sampler and received by the laboratory

— project number.

8.2.3 SAMPLE STORAGE, TRANSIT AND DELIVERY

The following additional quality measures are undertaken:

— Immediately following sampling, all samples are placed into an esky pre-packed with ice in a bag to prevent leakage or with ice bricks.

— To reduce the potential for breakage, samples are placed upright on the firm base of the esky. Samples are arranged to minimise lateral movement during transport.

— A quality control check is completed of the labels of all samples to be submitted to the laboratory against the sample ID's on the COC.

— The esky containing the samples for transport to the laboratory are sealed.

— All samples (temperature below 6°C) are picked up by a courier or delivered directly to the laboratory as soon as practical with the completed and relinquished COC.

9 ANALYSIS AND INTERPRETATION

Analysis and interpretation of the data collection during this pre-construction period will focus on establishing the baseline conditions. During construction and operation of the project, the baseline results will be used for comparison, to enable any potential impacts to be identified.

The Australian and New Zealand guidelines for fresh and marine water quality (ANZECC/ARMCANZ, 2000) will be used to compare with the baseline water quality results from the surface water and groundwater monitoring. The water quality guidelines for the protection of freshwater aquatic ecosystems are used, with:

- Default trigger values for physical and chemical stressors for south-eastern Australia for slightly disturbed ecosystems. The lowland river trigger values have been adopted for the majority of surface water (see next point) and groundwater.
- Default trigger values for physical and chemical stressors for south-eastern Australia for slightly disturbed ecosystems. The estuarine trigger values for SW3 only, Macquarie Rivulet, have been adopted due to the tidal nature of Macquarie Rivulet at this location.
- Freshwater trigger values for toxicants at a 95% level of protection are also adopted for groundwater and surface water.

The guideline values per analyte are listed in Table 9.1. Guideline values trigger values are not available for temperature, redox, TSS, TDS, calcium, sodium, magnesium, potassium, chloride, sulphate, alkalinity or bicarbonate.

Table 9.1 Guideline values

	UNITS	ANZECC/ARMCANZ (2000) GUIDELINES		
		SURFACE WATER (EXCEPT SW3)	SW3 – MACQUARIE RIVULET	GROUNDWATER
pH	pH units	6.5-8.0[1]	7.0-8.5[2]	6.5-8.0[1]
EC	µS/cm	125–2200[1]	N/A	125–2200[1]
Dissolved oxygen	% saturation	85-110[1]	80-110[2]	N/A
Turbidity	NTU	6-50[1]	0.5-10[2]	N/A
Total nitrogen	mg/L	0.35[1]	0.3[2]	0.35[1]
Total phosphorus	mg/L	0.025[1]	0.03[2]	0.025[1]
Aluminium	mg/L	0.055[3,4]	0.055[3,4]	0.055[3,4]
Arsenic (As III)	mg/L	0.024[3] (As III)	0.024[3] (As III)	0.024[3] (As III)
Cadmium	mg/L	0.0002[3]	0.0002[3]	0.0002[3]
Chromium	mg/L	0.001[3] (Cr VI)	0.001[3] (Cr VI)	0.001[3] (Cr VI)
Copper	mg/L	0.0014[3]	0.0014[3]	0.0014[3]
Iron	mg/L	ID[3]	ID[3]	ID[3]
Lead	mg/L	0.0034[3]	0.0034[3]	0.0034[3]
Manganese	mg/L	1.9[3]	1.9[3]	1.9[3]
Mercury	mg/L	0.0006[3] (inorganic Hg)	0.0006[3] (inorganic Hg)	0.0006[3] (inorganic Hg)

	UNITS	ANZECC/ARMCANZ (2000) GUIDELINES		
		SURFACE WATER (EXCEPT SW3)	SW3 – MACQUARIE RIVULET	GROUNDWATER
Nickel	mg/L	0.011[3]	0.011[3]	0.011[3]
Silver	mg/L	0.00005[3]	0.00005[3]	0.00005[3]
Zinc	mg/L	0.008[3]	0.008[3]	0.008[3]

(1) Default trigger values for physical and chemical stressors for south-eastern Australia for slightly disturbed ecosystems (lowland river).

(2) Default trigger values for physical and chemical stressors for south-eastern Australia for slightly disturbed ecosystems (estuarine).

(3) Freshwater trigger values for toxicants at a 95% level of protection.

(4) pH>6.5, otherwise there is no trigger value at pH <6.5.

ID – Insufficient data to derive a reliable trigger value.

The baseline surface water quality data and groundwater levels will also be assessed in consideration of the weather, particularly rainfall.

10 RECORDING AND REPORTING OF MONITORING RESULTS

10.1 RECORDING RESULTS

The following documents and files are placed on the electronic project folder as soon as possible upon completion of the fieldwork:

- surface water and groundwater sampling record sheets (for templates refer to Appendix A)
- completed COC (for template refer to Appendix B)
- logger data files
- signed health, environment and safety plan for the project.

10.2 REPORTING RESULTS

Surface water and groundwater monitoring results are reported monthly in a brief report. The contents of the report include a summary of the monitoring activities undertaken that month, the monitoring results with values outside the guidelines highlighted, rainfall and temperature data for the month, and calculated relative percentage differences for the duplicate and primary samples.

Upon completion of 12 months of baseline monitoring, surface water and groundwater results recorded during the previous 12 months will be incorporated in a baseline monitoring program summary report. This report will include a discussion of observed baseline trends in water quality and groundwater levels and in relation to rainfall. In addition, recommendations for any alterations to the monitoring program will be included.

11 ROLES AND RESPONSIBILITIES

The role of the project manager is to oversee and manage the project and is the primary contact for the Roads and Maritime Services. In general, the project manager is responsible for project scope, schedule, costs, personnel, safety and quality. The project manager is supported by WSP and the project management processes that are based on industry best practice and externally accredited safety and quality systems.

The project manager is also a technical specialist, allowing for review and assessment of the technical and quality aspects of the project on an ongoing basis. The project manager, a Principal Hydrogeologist, typically undertakes the technical review of tasks and reports, and is also supported by other Principal Hydrogeologists and Principal Hydrologists as required.

The project manager familiarises field personnel with the project scope and requirements, including the analytical suite, holding times, sample security procedures and other project requirements. Safety is an integral part of our day-to-day business, with safety protocols in place for all field activities.

Fieldwork staff are nominated by the project manager. The staff are technically qualified, have undertaken the relevant safety training and are first-aid certified. Before staff use any sampling equipment, they are trained and competent in the use of the equipment, and be familiar with the operation and safe work method statements for the tasks to be performed. Prior to a new field staff member undertaking the monitoring, the new personnel will shadow the current personnel, to ensure they are familiar with the specific requirements of the project, including all site locations and access.

Some of the responsibilities of the fieldwork staff are as follows:

- adhere to the health, environment and safety plan for the project
- follow the sampling protocols outlined within this report
- ensure representative samples are collected, appropriately stored, and transported to the laboratory
- monitor the daily rainfall
- record and save the required information, such as the sampling record sheets
- draft the monthly reports

12 ADDITIONAL ONE-OFF GROUNDWATER SAMPLING

12.1 SAMPLE ORIGINAL MONITORING NETWORK

To allow for the commencement of baseline groundwater monitoring prior to installing the new groundwater monitoring network, 13 existing groundwater monitoring wells were sampled in November 2017 for the quarterly analytical suite, as listed in Section 6.1. Manual groundwater levels were measured and where data loggers were installed, these were downloaded.

The results were included in the November 2017 monthly report (WSP, 2017b).

12.2 SAMPLE THE NETWORK NEAR THE INDUSTRIAL AREA AND MAIN CUT

Consultation with Crown Lands and Water on 7 December 2017 (Section 2) resulted in the one-off sampling of the monitoring wells near the industrial area and main cut, that is GW1, BH312A, BH314, BH317, BH318, GA-BH102 and GA-BH219 (Figure 3.1). The groundwater samples were analysed for BTEXN, TRH, PAH, dissolved metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) and oil and grease.

The results were included in the December 2017 quarterly report (WSP, 2017c).

12.3 SAMPLE THE NETWORK IN AGRICULTURAL AREA AND NEAR THE FIRE & RESCUE SITE

Consultation with Crown Lands and Water on 7 December 2017 (Section 2) resulted in the one-off sampling of the monitoring wells to the east of the Fire & Rescue NSW site at Albion Park, that is GW2, GA-BH239, GA-BH241, BH321A and BH327 (Figure 3.1). The groundwater samples were analysed for per- and poly-fluoroalkyl substances (PFAS) (full suite – 28 analytes), organochlorine pesticides and organophosphorus pesticides (OC/OP pesticides).

The results were included in the December 2017 quarterly report (WSP, 2017c).

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- WSP (2017c). December 2017 Quarterly Baseline Monitoring Data Report – Albion Park Rail Bypass. Prepared for Roads and Maritime Services, letter number PS106112-WAT-LTR-007 RevA, dated 19 January 2018.
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APPENDIX A

SAMPLING RECORD SHEETS

Surface Water Sampling Record Sheet

Job. number: PS106112	**Sampling date:**	**Water quality meter ID:**
Client:	**Sampling method:**	**Calibration date:**

Sample ID.	Time	Temp. (°C)	EC (uS/cm)	TDS (mg/L)	Redox (mV)	DO		pH	Bottles collected:	Comments: Including colour, turbidity, water flow, odour, surface crusts, films or floating material, vegetation, algae, gauge reading and environmental/climatic conditions.
						% sat	mg/L			

Sampler's name:	Signature:	**QA/QC details:**

Version: A	**Reviewer: P van Ravesteyn**	**Date: 27/02/18**	**Approver: Andrea Madden**	**Date: 27/02/18**

Surface Water Sampling Record Sheet

Sample ID.	Time	Temp. (°C)	EC (uS/cm)	TDS (mg/L)	Redox (mV)	DO		pH	Bottles collected:	Comments: Including colour, turbidity, water flow, odour, surface crusts, films or floating material, vegetation, algae, gauge reading and environmental/climatic conditions.
						% sat	mg/L			
Sampler's name:					Signature:				QA/QC details:	

Groundwater Sampling Record Sheet

Job Number: PS106112	**Well Number:**
Property name/owner: **Contact details:**	**Purging Date:** **Sampling Date:**
Depth to groundwater from TOC (m):	PVC Stickup (m):
Well depth from TOC (PVC) (m):	Casing diameter (mm):

Purging Information

Purging method: ○ Micropurge ○ Grundfos ○ 12V pump ○ Bailer ○ Flowing ○ Grab sample	Calculated bore volume (m^3) = $\pi r^2 h$ π = 3.14 r = 0.5 x casing diameter (m) h = well depth – depth to GW (m)
Logger download: ○ YES ○ NO	1 bore volume (L): 3 bore volumes (L):
Start time:	$1m^3$ = 1000L
Finish time:	Purging depth:

Field Results While Purging

Time	Vol (L)	Temp. °C	EC (uS/cm)	TDS (g/L)	DO		pH	Redox (mV)	Colour/odour/ turbidity
					%sat	mg/L			
	CO_2 (mg/L) = mL in syringe x 10 =								

Measurements for pH should be within 0.1 pH units and measurements for conductivity, salinity and dissolved oxygen should be within 10% and temperature within 0.5 °C before the well is sampled.

Sampling Details

Sampling method (*if different from purging* method): ○ Micropurge ○ Grundfos ○ 12V pump ○ Bailer ○ Flowing ○ Grab sample	Bottles collected:
Sampling time:	QA/QC details

Other comments and observations (environmental/climatic conditions):

Sampler's name:	Signature:

Groundwater Sampling Record Sheet

Field Results While Purging (continued)									
Time	Vol (L)	Temp. °C	EC (uS/cm)	TDS (g/L)	DO		pH	Redox (mV)	Colour/odour/ turbidity
					%sat	ppm			

Other comments:

APPENDIX B

CHAIN OF CUSTODY

CHAIN OF CUSTODY

ALS Environmental

ALS Laboratory: please tick →

❑ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

❑BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

❑GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

❑MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

❑MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

❑MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

❑NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4968 9433 E: samples.newcastle@alsglobal.com

❑NOWRA 4/13 Geary Place North Nowra NSW 2541 Ph: 024423 2063 E: nowra@alsglobal.com

❑PERTH 10 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

❑SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

❑TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townesville.environmental@alsglobal.com

❑WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobal.com

CLIENT WSP	**TURNAROUND R** ☐ Standard TAT **(List due date)**	**FOR LABORATORY USE ONLY (Circle)**	
OFFICE L27, 680 George St. Sydney 2001	(Standard TAT may be longer for some ☐ Non Standard or urgent TAT **(List due date)**	Custody Seal Intact?	Yes No N/A
PROJECT	**ALS QUOTE NO.**	Free ice / frozen ice bricks present upon receipt?	Yes No N/A
ORDER NUMBER	**COC SEQUENCE NUMBER (Circle)** COC: 1 2 3 4 5 6 7	Random Sample Temperature on Receipt:	˚C
PROJECT MANAGER **CONTACT PH**	OF: 1 2 3 4 5 6 7	Other comment:	

SAMPLER **SAMPLER MOBILE**	**RELINQUISHED BY**	**RECEIVED BY**	**RELINQUISHED BY**	**RECEIVED BY**
COC emailed to ALS? **EDD FORMAT (or default) .csv**				
Email Reports to:	DATE/TIME:	DATE/T ME:	DATE/T ME:	DATE/T ME:
Email Invoice to:				

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL

ALS USE	SAMPLE DETAILS MATRIX SOLID (S) WATER (W)				ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where **Metals** are required, specify **Total** (unfiltered bottle required) or **Dissolved** (field filtered bottle required).																		Additional Information		
LAB ID	**SAMPLE ID**	**DATE / TIME**	**MATRIX**	**TOTAL CONTAINERS**																			**Sampled by**	**Signature**	**Remarks**
		TOTAL																							

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Pres
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Appendix C Acid Sulfate Soil Management Procedure

Acid Sulfate Soil Management Procedure

1. Purpose

This procedure details the actions to be taken when actual acid sulfate rock (ASR), acid sulfate soils (ASS) or potential acid sulfate Soils (PASS) are encountered during excavation/ construction activities. This procedure is prepared to demonstrate compliance with the following standards and guidelines:

- The Acid Sulfate Soils Manual (1998)
- Acid Sulfate Soils Assessment Guidelines (1998)
- Laboratory Methods Guidelines (2004), and
- EPA Waste Classification Guidelines (2014), Part 4: Acid Sulfate Soils.

2. Scope

This procedure applies to all construction activities undertaken as part of the Project that have the potential to uncover / disturb ASR / ASS / PASS.

3. Induction and training

All site personnel and subcontractors working in areas of high probability ASR / ASS risk will be trained in the relevant parts of this procedure.

4. Procedure

Identification of ASS treatment areas

The design and location of ASR / ASS treatment areas will be marked on PESCPs and any other relevant plans. Potential areas of acid sulfate material are tabulated below. These areas and the type of material will be confirmed via additional geotechnical investigation during the detailed design phase.

Table C-1 Potential areas of acid sulfate material

Area	Approximate Chainage (m)	Construction Activity	ASS probability
Northern and southern banks of the Macquarie Rivulet	18400-18750	Minor excavation and bridge piles	High risk 1-2m
South of Macquarie Rivulet	18750-19500	Minor cuts and excavation for drainage, footings, etc	Low risk above 4m AHD
Norther and southern bank of Frazer Creek	19500-19870	Minor excavation and bridge piles	High risk 2-4m AHD
South of Frazer Creek	19870-21400	Minor excavation for bridge foundations drainage, footings, etc.	Low risk above 4m AHD

Unexpected actual ASR / ASS or PASS encountered during excavation / construction activities

If ASR / ASS / PASS is encountered during excavation/construction activities the Foreman must:

- STOP ALL WORK in the immediate/ affected area and contact the Environmental Officer (EO)
- Recommence works in alternate area where practicable.

The EO is responsible for testing of ASR / ASS / PASS and will undertake testing to determine the acidity (field pH test) and potential for acidity (field 30 per cent peroxide test) of the material encountered.

Any of the following characteristics indicate the presence of ASR / ASS:

- Soil pH of less than four
- A sulphurous smell following soil disturbance
- Pale yellow surface encrustations;
- Excessive iron staining on drain surfaces or stream banks, or iron stained drain water and orange red ochre deposits around water bodies
- Excessive corrosion of concrete and / or steel structures exposed to ground or drainage waters, or rapid corrosion of fresh steel in the soil; and
- Blue-grey, blue-green or grey waterlogged soils which smell of rotten egg gas.

High risk indicators for PASS could include:

- Low position in the landscape
- Soil from beneath the water table
- Heavy textures
- Dark colours; and
- Sulfur odour (rotten egg odour).

Action criteria for management intervention

Table C-2 details the texture based action criteria for management of ASR / ASS disturbance. Where soils containing concentrations at or above the action criteria are disturbed, management of spoil is required.

For the purposes of the Project, both action criteria have been included for reference purposes, ie less than 1,000 tonnes for fine texture soils, and greater than 1,000 tonnes for all soil types. As the project will disturb spoil greater than 1000 tonnes, the action criteria of greater than 1000 tonnes disturbed should be used.

Table C-2 Action criteria based on the ASS analysis for three broad texture categories

Type of material	Clay content	Action criteria 1 to 1000 tonnes disturbed		Action criteria >1000 tonnes disturbed	
Texture range (McDonald et al. (1990)	Approx clay content (%<0.002 mm)	Sulphur trail % S oxidisable e.g. STOS or SPOS	Acid trail mol H+/tonne e.g. TPA or TSA	Sulphur trail % S oxidisable e.g. STOS or SPOS	Acid trail mol H+/tonne e.g. TPA or TSA
Coarse Texture Sands to loamy sands	≤5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5 – 40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≤40	0.1	62	0.03	18

Source: Ahern *et al.* 1998

Neutralisation of excavated acid sulfate materials (ASM) from earthworks

If field tests are positive or inconclusive, laboratory analysis using the Chromium Suite will be required to determine if the material is in fact ASS and/or the required treatment rates based on the net acidity.

Neutralising agents must be incorporated within all ASR / ASS / PASS. All cut batters shall be coated with fine aglime at the rate of five kg/m and the lime coating should be checked and re-limed as necessary on a daily basis during periods of dewatering during construction excavation. The base of all fill areas where treated material is to be placed shall be treated with a neutralising agent forming a guard layer prior to the placement of any fill soils to neutralise downward seepage of acidic

drainage water. This application may need to be increased depending on stockpile height and actual and potential acidity of the ASM developed through detail assessment.

Aglime rates will be as determined through analytical assessment to establish per cent of sulfur present (S%) to determine an indicative level of treatment as specified in Table C-3. Interpretation of analytical data must be conducted by an appropriately qualified and experienced in dealing with ASS/PASS management.

ASS/PASS must be sufficiently dry before neutralising is commenced so that the lime can be thoroughly mixed through the soil. Where moisture levels in soil are high, the soil must be dried by spreading and leaving open to the atmosphere. Drying can be accelerated by regular aeration by turning with an excavator or backhoe. Drying should be carried out on a guard layer and protected from stormwater ingress.

Mixing of ASS/PASS with neutralising agent shall be carried out by spreading the soil in layers of not more than 300mm to 400mm thick using an agricultural spreader and disc plough, rotary hoe or similar. Care shall be taken to ensure that mixing occurs throughout the depth of the layer prior to placement of new material.

Following the successful treatment of the lot (as determined through the validation testing), the material shall be compacted and the next layer of excavated material to be treated shall be placed over the already treated material. This process shall be continued until the required site elevation is achieved.

Even when neutralised, excavated and processed ASR will not be used for upper pavement layers above Upper Zone Formation (UZF), including Selected Material Zone (SMZ) and verge and other layers with the potential to be exposed.

Table C-3 Treatment levels and aglime required to treat total weight of disturbed ASS (Source: Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines 2002)

Disturbed ASS (tonnes) (=m^3×BD) †	Soil Analysis* – Existing Acidity plus Potential Acidity (converted to equivalent S% units)													
	0.03	*0.06*	*0.1*	*0.2*	*0.4*	*0.6*	*0.8*	*1*	*1.5*	*2*	*2.5*	*3*	*4*	*5*
1	0	0	0	0	0	0.03	0.04	0.05	0.1	0.1	0.1	0.1	0.2	0.2
5	0	0	0	0.05	0.1	0.1	0.2	0.2	0.4	0.5	0.6	0.7	0.9	1.2
10	0	0.03	0.05	0.1	0.2	0.3	0.4	0.5	0.7	0.9	1.2	1.4	1.9	2.3
50	0.1	0.1	0.2	0.5	0.9	1.4	1.9	2.3	3.5	4.7	5.9	7.0	9.4	12
100	0.1	0.3	0.5	0.9	1.9	2.8	3.7	4.7	7.0	9.4	12	14	19	23
200	0.3	0.6	0.9	1.9	3.7	5.6	7.5	9.4	14	19	23	28	37	47
250	0.4	0.7	1.2	2.3	4.7	7.0	9.4	12	18	23	29	35	47	59
350	0.5	1.0	1.6	3.3	6.6	10	13	16	25	33	41	49	66	82
500	0.7	1.4	2.3	4.7	9.4	14	19	23	35	47	59	70	94	117
600	0.8	1.7	2.8	5.6	11	17	22	28	42	56	70	84	112	140
750	1.1	2.1	3.5	7.0	14	21	28	35	53	70	88	105	140	176
900	1.3	2.5	4.2	8.4	17	25	34	42	63	84	105	126	168	211
1000	1.4	2.8	4.7	9.4	19	28	37	47	70	94	117	140	187	234
2000	2.8	5.6	9.4	19	37	56	75	94	140	187	234	281	374	468
5000	7.0	14	23	47	94	140	187	234	351	468	585	702	936	1170
10000	14	28	47	94	187	281	374	468	702	936	1170	1404	1872	2340

L	**Low treatment:** (≤0.1 tonnes lime)
M	**Medium treatment:** (>0.1 to 1 tonne lime)
H	**High treatment:** (>1 to 5 tonnes lime)
VH	**Very High treatment:** (>5 to 25 tonnes lime)
XH	**Extra High treatment:** (>25 tonnes lime)

Notes

1. The tonnes (t) of pure fine aglime, CaCO3 required to fully treat the total weight/volume of ASS can be read from the table at the intersection of the weight of disturbed soil [row] with the existing plus potential acidity [column]. Where the exact weight or soil analysis figure does not appear in the heading of the row or column, use the next highest value
2. An approximate soil weight (tonnes) can be obtained from the calculated volume by multiplying volume (cubic m) by bulk density (t/m3). (Use 1.7 if B.D. is not known.) Dense fine sandy soils may have a BD up to 1.7, and hence 100 cubic metres of such soil may weigh up to 170 t. In these calculations, it is necessary to convert to dry soil masses, since analyses are reported on a dry weight basis.
3. Potential acidity can be determined by Chromium Reducible Sulfur (SCR), Peroxide Oxidisable Sulfur (SPOS) and Total Oxidisable Sulfur (STOS). For samples with pH less than 5.5, the existing acidity must also be determined by appropriate laboratory analysis eg. Titratable Actual Acidity (TAA). Soils with retained acidity eg. jarosite or other similar insoluble compounds have a less available acidity and will require more detailed analysis. The amount of treatment required may be reduced if the self-neutralising capacity of the soil is appropriately measured.

Neutralising materials

For management or neutralisation of ASS/PASS soils, medium-fine Aglime will be used. Dolomitic Aglime, or magnesium-blend Aglime, will not be used. In general, a finer grind is better. The Aglime purity should preferably be 90 per cent or better, (that is, neutralising value (NV) greater than 90), unless there is a significant savings to be made by use of less pure Aglime. In the latter case, however, the individual lime dosing rates will need to be increased accordingly. The requirement for greater amounts of Aglime of lower purity should be borne in mind when assessing the supplies of this material, as the cost savings from less pure material may be offset by the need for more, and correspondingly higher total transport costs.

ASS/PASS treatment will occur within an ASS treatment area. Material which is transported to treatment cells must be completely treated and removed from the treatment area before new material is introduced. This will ensure that treated material remains segregated and is not mixed with contaminated material. Aglime or other suitable treatment material will be stored at the treatment area in sufficient quantities to enable the treatment of all ASS/PASS material expected to be treated in the upcoming few weeks/months and will be determined by the expected delivery schedule of treatment material. The management of onsite treatment is the responsibility of the Site Foreman, with assistance from the Environmental Officer (EO).

Aglime is non-corrosive, and requires no special handling – it may be necessary to cover the stockpile with a tarpaulin or cover the stockpile with plastic, to minimise dust generation and prevent wetting, since it is then more difficult to spread. Intermittently, until such time as field testing suggests otherwise, a small quantity of Aglime will be stored on site, in the order of 200 kilograms or so. This will enable the regular treatment of soil and cater for any unexpected occurrences of ‘hotter’ ASS/PASS.

Dolomitic aglime, or magnesium-blend aglime, should not be used as these materials impose environmental risks from overdosing with the potential to damage estuarine ecosystems. A reasonable quantity of calcium hydroxide solution (hydrated lime) shall be kept on site at all times for treatment of acidic waters. The supply shall be stored in a covered and bunded area to prevent accidental release to waters. Neutralising agents must be replenished and or replaced regularly to remain effective against loss by wind or water erosion.

Validation of ameliorated ASR / ASS / PASS

Samples of the treated soil should be taken and laboratory analysed to demonstrate compliance with the performance criteria (ie. verification testing). These performance criteria equate to there being no net acidity in the soil following neutralisation. Soil that has been treated by neutralisation techniques and has not met these criteria must be retreated until the above performance criteria are met.

The objective of ameliorating ASR / ASS / PASS materials is to ensure that there is no chance that net acidity will be produced. Validation testing only occurs when soils have been treated (with a neutralising agent) to prevent any future acidification. If results of the validation testing indicate a failure to comply with the performance criteria, soil may need to be re–treated with an additional application of neutralising agent.

Soils that have been mixed with aglime will be analysed by either the SPOCAS or SCR Suite test methods at a rate of one sample per 250 cublic metre. All validation samples are to be recorded by GPS or survey, clearly marked on a map/sketch or otherwise recorded.

Where large quantities (greater than 1,000 cubic metres) of ameliorated soils are involved and ‘net acidity’ rates are generally low (18 mol H+/t to less than 125 mol H+/t or 0.03 to 0.20 per cent sulfur), a reduced rate of sampling may be appropriate subject to approval. A rate of one sample per 1,000 cubic metre may be suitable for example.

The following performance criteria must be attained for soil that has been treated using neutralisation:

- The neutralising capacity of the treated soil must exceed the existing plus potential acidity of the soil

- Post-neutralisation, the soil pH is to be greater than 5.5
- Excess neutralising agent should remain within the soil until all acid generation reactions are complete and the soil has no further capacity to generate acidity.

If ameliorated ASS is going to be reused on site, due environmental regard for areas of placement should be assessed, documented and approved by the Fulton Hogan Environment Manager (EM). Assessment measures may include:

- Location of proposed placement areas and potential receptors (waterways, sensitive flora and fauna, structures)
- Stability and suitability of materials as select fill (especially clays), and
- Suitability of soil type for plant growth.

In the unlikely event that the treated material is unable to be reused on-site for other purposes, the material will need to be disposed of to an appropriately licensed waste disposal facility. The EM/ EO will liaise with a licensed waste facility and coordinate the process.

Large-scale dewatering or drainage

Earthworks and/or pumping that result in localised drainage or lowering of groundwater and the exposure of sulfidic soils to the ingress of oxygen may generate acidity as a function of soil type(s), sulfide contents, area exposed, and length of time the excavation remains ‘dry’. The scale of the dewatering or drainage should be defined by the size of the cone of depression rather than the size of the void. Activities of this type are high-risk, and should not be undertaken without technical risk assessment by qualified personnel and the formulation of management measures sufficient to reduce risk to levels acceptable by the administering authorities.

Neutralising acid leachate and drain water using lime

The liming rate for treating acid water should be carefully calculated to avoid the possibility of "overshooting" the optimum pH levels of 6.5 to 8.5. This can occur quite easily if more soluble or caustic neutralising agents such as hydrated lime (pH 12) or magnesium hydroxide (pH 12) are used. It should be noted that when neutralising acid water, no safety factor is used. However, monitoring of pH should be carried out regularly during neutralisation procedures.

Agricultural lime (pH 8.2) is the safest neutralising agent. It equilibrates around a pH of 8.2 that is not generally harmful to plants, stock or humans and most aquatic ecology species. The main shortcoming associated with the use of lime is its insolubility in water.

When using alkaline materials, strict protocols must be established for the use, handling and monitoring of these materials. Prior to any ASR / ASS / PASS management, appropriate personal protective equipment (PPE) is to be worn as per relevant SDS (eg for Lime). This may include:

- Eye goggles and/or face masks
- Hard Hat
- Rubber boots, gloves
- Appropriate clothing (e.g. long sleeved shirts).

Calculating the quantity of lime

The current pH is measured with a recently calibrated pH detector. The desired pH is usually between 6.5 and 8.5 with pH 7 is normally targeted. The volume of water can be calculated by assuming one cubic metre of acid water is equivalent to one kilolitre (1000 litre) and 1,000 cubic metre is equivalent to one megalitre (ML).

As a general guide, Table C-4 shows minimum quantities of pure lime, hydrated lime or sodium bicarbonate needed to treat dams or drains of one ML (1,000 cubic metre) capacity.

Table C-4 Quantity of pure neutralising agent required to raise from existing pH to pH 7 for one megalitre of low salinity acid water

Current water pH	[H+] {mol/L}	H+ in 1 Megalitre {mol}	Lime to neutralise 1 Megalitre {kg pure CaCO3}	Hydr. lime to neutralise 1 Megalitre {kg pure Ca(OH)2}	Pure NaHCO3/ 1 Megalitre {kg }
0.5	0.316	316,228	15,824	11,716	26,563
1.0	0.1	100,000	5,004	3705	8390
1.5	0.032	32,000	1,600	1185	2686
2.0	0.01	10,000	500	370	839
2.5	0.0032	3,200	160	118	269
3.0	0.001	1,000	50	37	84
3.5	0.00032	320	16	12	27
4.0	0.0001	100	5	4	8.4
4.5	0.000032	32	1.6	1.18	2.69
5.0	0.00001	10	0.5	0.37	0.84
5.5	0.0000032	3.2	0.16	0.12	0.27
6.0	0.000001	1	0.05	0.037	0.08
6.5	0.00000032	.32	0.016	0.12	0.027

Notes on Table C-3:

- 1 m3 = 1,000 litre = 1 kilolitre = 0.001 megalitre
- Agricultural lime has very low solubility and may take considerable time to even partially react
- Hydrated lime is more soluble than aglime and hence more suited to water treatment. However, as Ca(OH)2 has a high water pH, incremental addition and thorough mixing is needed to prevent overshooting the desired pH. The water pH should be checked regularly after thorough mixing and time for equilibration before further addition of neutralising product
- Weights of lime or hydrated lime are based on theoretical pure material and hence use of such amounts of commercial product will generally result in under treatment
- To more accurately calculate the amount of commercial product required, the weight of lime from the table should be multiplied by a purity factor (100/ Neutralising Value for aglime) or (148/ Neutralising Value for hydrated lime).
- Calculations are based on low salinity water acidified by hydrogen ion, H+ (acid) and do not take into account the considerable buffering capacity or acid producing reactions of some acid salts and soluble species of aluminium and iron. For example, as the pH increases towards 4, the precipitation of soluble ferric ion occurs, liberating more acid:
- $Fe3+ + 3H2O \rightarrow Fe(OH)3 + 3H+$
- If neutralising substantial quantities of ASS leachate, full laboratory analysis of the water will be necessary to adequately estimate the amount of neutralising material required.

Application of lime to water

To increase the efficiency, lime should be mixed into a slurry before adding. A slurry can be prepared in a concrete truck, cement mixer or large vat with an agitator. Methods of application of the slurry include:

- Spraying the slurry over the water with a dispersion pump
- Pumping the slurry into the water body with air sparging (compressed air delivered through pipes) to improve mixing once added to water
- Pouring the slurry out behind a small motorboat and letting the motor mix it in
- Incorporating the slurry into the dredge line (when pumping dredge material)
- Using mobile water treatment equipment such as the 'Neutra- mill' and 'Aqua Fix' to dispense neutralising reagents to large water bodies.

A change in pH will not be instantaneous. The rate of neutralisation will vary with the solubility, fineness of the lime, the application technique and the acidity (pH) of the water. The finer the lime (preferably microfine with the consistency of white dust) and the more agitated the water, the faster the lime will dissolve and become effective. The pH must be carefully monitored even after the desired pH has been reached. If the water has not reached the desired pH within two weeks, more lime may need to be added. Before additional lime is added, the lack of success should be investigated. Issues to consider may include:

- The quality of the lime being used
- The effectiveness of the application technique
- The existence of additional sources of acid leaching into the water body further acidifying the water, and
- The lime has become lumpy and is sitting on the bottom

Neutralisation may be faster if higher rates are used, but is not recommended as it is expensive and resource wasteful. Moreover, over-dosing may result, though this is unlikely to be a concern with agricultural lime.

Appendix D Heavy rainfall event procedure

Heavy Rainfall Event Procedure

Purpose

To detail the actions to be taken in the event of a 'heavy' or 'violent' rainfall forecast as defined by the Australian Government Bureau of Meteorology. The procedure outlines how to monitor rainfall forecasts and prepare site to minimise impacts as much as practicable.

For management measures and procedures to be implemented prior to a flooding event, including timeframes for securing work sites and moving plant and equipment, refer to the Flooding and Hydrology Management Sub-plan (FHMP).

Table D-1 Definition of rain or showers intensity

Category	Description
Light	Up to 2 mm per hour. Individual drops easily identified, puddles form slowly, small streams may flow in gutters.
Moderate	2.2 mm to 6 mm per hour. Rapidly forming puddles, down pipes flowing freely, some spray visible over hard surfaces.
Heavy	6.2 mm to 50mm mm per hour. Falls in sheets, misty spray over hard surfaces, may cause roaring noise on roof.
Violent	Over 50mm per hour. Gutters and downpipes overflowing, spray to height of several centimetres over hard surfaces, may cause roaring noise on roof.

Source: Australian Government Bureau of Meteorology website http://www.bom.gov.au/info/wwords

Induction and training

All Fulton Hogan Superintendents, Foremen and Engineers will be trained in this procedure.

Procedure

1. Monitoring of 'heavy' or 'violent' rain or shower events (through the Australian Government Bureau of Meteorology):
2. On each working day, the Environmental Manager (EM)/ Environment Officer (EO) or delegate will log on to the Australian Government Bureau of Meteorology website http://www.bom.gov.au/weather/nsw review the weather forecast for the next three days and notify the Project team of the same by email. When rain or showers are described as 'heavy' or 'violent', the EM/EO or delegate will highlight that:
    - rain or showers are described as 'heavy' or 'violent' (as applicable)
    - the Heavy Rainfall Event Procedure must be followed.
3. The EM/ EO or delegate will keep a record of all weather forecast emails.
4. The daily weather forecast may be discussed at Prestart Meetings as deemed required by the Fulton Hogan Foreman/ Superintendent.
5. When rain or showers are described as 'heavy' or 'violent' the Fulton Hogan Superintendent will notify the Project team of personnel who will monitor and maintain erosion and sediment controls if required.
6. The Foremen will ensure that there is an adequate supply of erosion and sediment control measures on site.
7. Prior to the 'heavy' or 'violent' rainfall or shower event, the Foremen and the EM/ EO or delegate will inspect erosion and sediment control measures, focusing on the critical areas first. These may include stockpile areas, chemical storage areas and sediment basins.
8. Additional temporary erosion and sediment controls will be installed as required.

Appendix E Stockpile Management Protocol

Stockpile Management Protocol

Purpose

This protocol provides a process for the establishment of *temporary* stockpile areas within the approved project boundary and any approved ancillary facility to ensure that environmental impacts associated with stockpiling are minimised during construction.

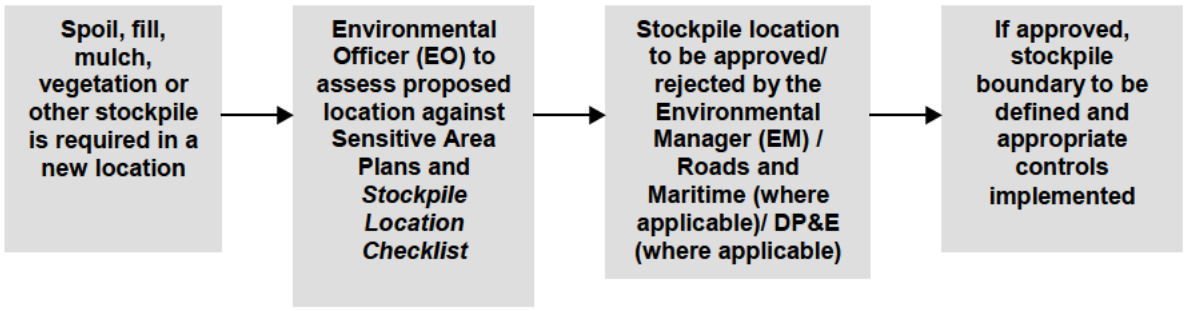
Stockpile sites may typically be required to store material including, but not limited to:

- Excavated materials to be used in fill embankments and other design features
- ASS subject to treatment prior to reuse
- Excavated material unsuitable for reuse in the formation
- Excess concrete, pavement, rock, steel and other material stored for either future use in the Project or prior to removal from site, and
- Topsoil, mulch, excess timber for landscaping and revegetation works.

Scope

This protocol and associated *Stockpile location checklist* describe the environmental criteria/ factors to be considered to ensure stockpiles are located in areas where potential environmental harm is minimised.

To avoid duplication, refer to the relevant Sub-plan e.g. AQMP, WEMP, FFMP, NVMP, HMP and this SWMP for the mitigation measures that will be implemented to avoid/ minimise air quality; waste management; flora and fauna; noise; heritage; and erosion and sediment impacts respectively from stockpiles.



Induction and training

All site personnel and subcontractors will be trained in this procedure.

Procedure

Proposed stockpile information

Prior to requesting the assessment of a stockpile location from the EO, the person requesting the new stockpile location should check approved stockpile locations to ensure current approved stockpile sites cannot be better utilised. Minimise the number of stockpiles sites wherever practicable.

If existing sites cannot be used, the expected quantity of material, expected dimensions required, expected stockpiling timeframes, destination of the stockpiled material, whose land the stockpile will be located on and the type of material to be stockpiled must be detailed. Once this information is known, the EO shall be contacted for an assessment of the proposed stockpile location.

Assessment of stockpile site

The EO shall utilise the **Stockpile Location Checklist** (included in this Protocol, Table E-1) to assess the stockpile location.

Note stockpiles within the approved project boundary are intrinsic to and undifferentiated from the bulk earthworks operations, these stockpiles are assessed in accordance with the section below of this protocol below.

Approval of stockpile site

Stockpiles within the approved project boundary

The EO shall give the completed *Stockpile Location Checklist* (Table E-1) to the EM for review and assessment. Following this review, the EM shall either approve or reject the proposed stockpile location and notify the EO of the decision.

A register of all stockpile sites (Table E-2, included in this Protocol) shall be kept on file by the EO and they shall also ensure that any additional erosion and sediment control measures are included in the relevant progressive erosion and sediment control plan (PESCP).

Preparing stockpile site

If the proposed stockpile site is approved, the boundaries will be agreed between the person proposing the stockpile and the EO (or Roads and Maritime where required). The proposed stockpile site will be marked out and appropriate erosion and sediment controls installed. Stockpile sites will also be signposted to clearly identify and delineate between other stockpiles. The erection of signs will be agreed with the Site Foreman.

Details of stockpile management in regard to erosion and sediment control will be included in the relevant ESCP/ PESCP.

Mulch stockpiles

Locate and manage mulch stockpiles to minimise and manage tannin generation. Refer to Appendix F of this SWMP for **Roads and Maritime Environmental Direction: Management of Tannins from Vegetation Mulch.**

Stockpile location checklist

Proposed Stockpile number:	
Chainage:	
Location sketch is attached? (mandatory)	☐ Yes
Stockpile type and dimensions (HxWxD):	

The location of stockpile sites will be determined following review of the following documents and requirements:

- CEMP and Sub-plans including review of relevant mitigation measures
- Sensitive Area Plans
- Stockpile Management Protocol
- Revised environmental management measure REMM SW02
- Roads and Maritime Specification D&C G36, G38 and G40
- Roads and Maritime Stockpile Site Management Guideline.

Where proposed sites do not comply with the criteria below, provide justification and additional mitigation measures to demonstrate how potential impacts will be managed.

Table E-1 Stockpile location criteria

Criteria		Source of requirement	Does the proposed site meet the criteria?	If proposed site does not meet the criteria, provide justification/ additional mitigation measures to demonstrate how potential impacts will be managed
Vegetation	Site should minimise damage to natural vegetation and trees	G40 cl 5.2		
	Site should be located outside of the 'dripline' of trees	G 40 cl 2.4.1(ii)		
	Site should be located outside of the tree protection zone of trees or native vegetation identified for retention. Refer to AS 4970.	G 38 cl 3.2		
	Site should avoid clearing native *Ficus* and *Eucalyptus* species	SWTC App 14 cl 14.3		
	Site must not result in any clearing of native vegetation beyond that which is otherwise required for the project.	SWTC App 4 cl 4.21		
	Site should be located so that the removal of threatened species, endangered ecological communities (EECs) or roosting habitat for listed threatened fauna species is not required	SWTC App 4 cl 4.21		

Criteria		Source of requirement	Does the proposed site meet the criteria?	If proposed site does not meet the criteria, provide justification/ additional mitigation measures to demonstrate how potential impacts will be managed
Drainage and water quality	Site should be located away from drainage lines and watercourses	G40 cl 5.2		
	Site should be located at least 50 m from a waterway unless an ESCP/PESCP is prepared and implemented so as not to adversely affect water quality in the waterway[1]	SWTC App 4 cl 4.21		
	Site should be located at least five metres from likely areas of concentrated water flows and at least 10 metres from waterways that are classified as Class 1 and Class 2 from the DPI Fisheries guideline "Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings"	G 38 cl 3.2 SWTC App 4 cl 4.21		
	Site should be located on land with a slope less than 10 per cent.	SWTC App 4 cl 4.21		
Dust and noise	Site should be located away from dust sensitive locations	G36 cl 4.4.2(o)		
	Site should be located away from noise sensitive locations	G36 cl 4.6.1(f)		
Access	Site must be positioned with ready access to the road network or direct access to the construction corridor	SWTC App 4 cl 4.21		
	Site must be positioned so that the stockpiled material is access ble at any time	G40 cl 5.2		
Heritage	Site be located in areas of low heritage conservation significance (including areas identified as low Aboriginal Cultural value) so as to not impact upon heritage sites beyond those already impacted by the Project.	SWTC App 4 cl 4.21		
Flooding and hydrology	Where stockpiles are to be located in the floodplain, site located and sized to ensure temporary impacts are not greater than those specified in the design criteria.	REMM HF02 G 38 cl 3.2		

[1]**"Waterway" is defined in SWTC Appendix 4 Clause 4.21(a)(ii) as "any Class 1 or Class 2 fish habitat waterways (as described in the Department of Primary Industries Fisheries guidelines); and waters that are used for the purpose of human consumption."**

Prepared by Environment Officer: ..... Date:.....
Environmental Manager: ..... Date:.....
Approved / Rejected (please circle) by: ..... Date: .....

Table E-2 Approved stockpile location register

Stockpile number/ identifier	Date approved	Location description	Chainage	Issued To	Updated PESCP? (yes/ no/ not required)

Appendix F Roads and Maritime environmental direction: management of tannins from vegetation mulch

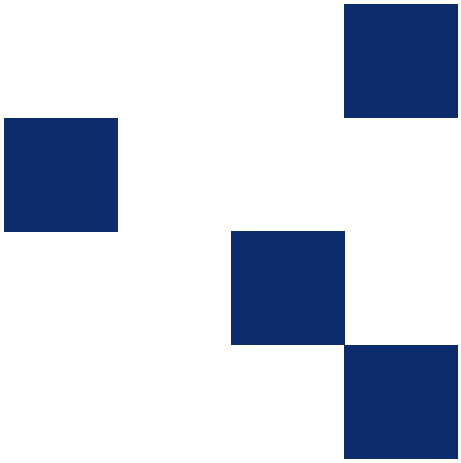
Transport Roads & Maritime Services

NSW GOVERNMENT

ENVIRONMENTAL DIRECTION

Management of Tannins from Vegetation Mulch

JANUARY 2012



ABOUT THIS RELEASE

Environmental Direction number	25
Environmental Direction title	Management of Tannins from Vegetation Mulch
Author	Environment Branch (Environmental Policy)

Issue	Date	Revision description
1	December 2011	Final draft
2	January 2012	Final

CONTENTS

1 PURPOSE

The purpose of this environmental direction is to set RMS's minimum management measures to minimise the generation and discharge of tannins from vegetation mulch on Roads and Maritime Services (RMS) construction projects. Additional background information on tannins and the use of mulch on construction sites is included in section 3 of this direction.

2 MANAGEMENT MEASURES

The primary focus must be to minimise tannin generation on construction sites.

2.1 General mulch management measures

These general mulch management measures are to be followed for all RMS construction projects.

2.1.1 Planning and works staging

The first step in planning and works staging is to identify the amount of mulch to be generated. With this information, a strategy can be prepared to manage mulch on site. Staging of chipping, tub grinding and/or mulching activities should be planned to reduce the volume of mulch to be managed at any one time. The volume of excess mulch can then be assessed and plans made to dispose of this off site.

Other general considerations at the planning and works staging phase are as follows:

- Mulch stockpile sites should be established with appropriate controls in place before the main site clearing activities commence. Limited clearing may be required earlier for establishment of stockpile areas and access.
- Stage the mulching of cleared vegetation to ensure that mulch can be progressively moved to elevated, or otherwise suitable, stockpile locations. It is preferred that mulch should be transferred to a stockpile or reused on the day of mulching.
- Plan to efficiently reuse mulch in progressive works to reduce the time that mulch is concentrated in stockpile locations.
- Excess mulch can be managed by community giveaway. This takes considerable time and mulch needs to be suitably located and managed as this occurs. The conditions for community giveaway of mulch are included as Appendix 3.
- Any other form of bulk offsite mulch disposal (eg to Council parkland or a development site) must be assessed to ensure waste management provisions are adhered to for off site disposal.

2.1.2 Stockpile location and management

- Mulch stockpile sites should be established on elevated ground where possible.
- Stockpile sites with a duration of not more than 1 month should be constructed not less than 20 metres from a watercourse, including floodplains.
- Stockpile sites with a duration of more than 1 month should be constructed not less than 50 metres from a watercourse, including floodplains.
- Mulch stockpiles should be designed and constructed to divert upgradient water to prevent it from entering the stockpile site.

2.1.3 Management measures for the use of mulch on site

- Do not use mulch for surface cover or sedimentation controls in any low lying areas of the site that remain consistently wet. Alternative controls such as geofabric (for surface protection) or sediment fence will be required in these areas.
- Do not spread surface mulch in thicker than 100mm layers. Mixing mulch with topsoil is encouraged for batters to prevent loss of topsoil during initial stabilisation. It should be noted that mulch will generally cause nitrogen draw down which may inhibit plant growth, unless mulch has been composted first.
- Care is to be taken to ensure that excessive mulch is not applied for sedimentation controls such as perimeter bunds or catch dams.

2.1.4 Monitoring and response

- Monitor the site for generation of tannins. Tannin impacts can be readily identified visually as dark coloured ponded water. Site staff should be trained to identify and report potential impacts to the site project management or environment staff.
- Review management practices where required to prevent the generation of tannins in identified problem areas.

2.2 Mulch management methods for high risk sites

2.2.1 High risk sites

High risk sites, where additional management measures may be required, include:

- where large quantities of mulch will be generated and stockpiled.
- where high tannin generating vegetation types are to be mulched (see 3.1).
- where the receiving environment is identified as sensitive (eg Marine Park, threatened aquatic species habitat).
- where tannins have been observed to be generated or discharged from an operating site with standard management controls.

2.2.2 Stockpile management measures for high risk sites

- Mulch stockpiles for high tannin generating vegetation types should incorporate an impermeable bund to capture stockpile leachate or tannin impacted water. Impervious bunds must be a minimum of 300 mm high, preferably higher to capture tannin impacted water. All bunded stockpiles that are in place for a period longer than one month must include a lined discharge point for overflow in extreme rainfall events.
- Stockpiles established on sloping sites must be designed to provide temporary stormwater containment equivalent to a 300 mm minimum height bund on a flat site.
- Tannin impacted water should be pumped out of bunded stockpiles within 5 days of the end of a rainfall event to maintain the storage capacity. This water should be used for on site purposes including dust suppression and landscape watering. These activities must be managed to prevent any pooling or runoff of tannin impacted water.
- Bunded stockpiles must be inspected within 24 hours of cessation of any rainfall event greater than 10mm to ensure tannin impacted water does not overflow.

2.3 Site management procedures

Site management procedures must be prepared for all sites where tannins are identified as a potential issue. Site management procedures should be based on the management measures provided in this Environmental Direction.

3 BACKGROUND

3.1 Tannin generation from vegetation mulch

See Plates 1 – 3 in Appendix 1.

Tannins are naturally occurring plant compounds. Tannin generation from vegetation mulch is likely to be highest from low-lying coastal floodplain areas. The species of vegetation (eg *Melaleuca*) will have a major impact on the likelihood of tannin generation.

Tannin generation is generally highest from mulched vegetation that is stockpiled in areas that are subject to inundation. Placement in wet areas will result in accelerated leaching of tannins into water, concentration of tannins in pooled water, and greater impacts on water quality.

3.2 Tannin impacts on water quality

See Plates 4 – 5 in Appendix 1.

The main concern with the discharge of water that is high in tannins is that it may increase the biological oxygen demand (BOD) of the receiving environment. Increases in BOD may result in a decrease in available dissolved oxygen. A lack of dissolved oxygen is identified as the main cause of about 80 percent of fish kills in NSW rivers and estuaries.

Tannin impacts may result in dark coloured water discharge from construction sites. This impact can be obvious and may raise the concern of the community and other stakeholders including regulatory authorities. Once discharged to the environment, tannins may reduce visibility and light penetration and change the pH of receiving waters. These impacts may affect aquatic ecosystems in receiving environments.

Tannins cannot be readily treated with standard construction site water quality controls. Once water on site is impacted with tannins it is not possible to treat effectively with currently approved flocculants. Minimisation of tannin generation in the first place is the management strategy that must be applied.

3.3 Use of mulch on construction sites

See Plates 10 – 16 in Appendix 2.

The RMS Biodiversity Guidelines provide guidance on the benefits of reusing various sizes of vegetation for different purposes. Mulch is a readily available and cheap source of material for temporary site stabilisation and sedimentation control. The re-use of mulch reduces the need to transport this material off-site and reduces handling and disposal costs for construction contracts.

Unprotected mulch sedimentation controls should not be placed in concentrated flow lines where mulch may be washed away. Mulch may be protected by wrapping it with geofabric or other materials to provide a stable control. All temporary catch dams constructed from mulch must have a stable outlet to minimise the washing away of mulch in high rainfall events, and the possible failure of the control.

4 ADDITIONAL RESOURCES

- RTA Biodiversity Guidelines- Protecting and Managing Biodiversity on RTA Projects, 2011
- Pacific Highway Mulch Protocol 2011

5 APPENDICES

Appendix 1: Plates showing tannin generation & water quality impacts

Plate 1: Melaleuca vegetation community – mulch from this vegetation type will generally produce high amounts of tannins.

Plate 2: Vegetation mulching activity – mulch should be progressively moved into prepared stockpile areas.

Plate 3: Tannin generation from recently felled and partially mulched vegetation in an area subject to localised inundation. Mulched vegetation should be progressively moved to prepared stockpiles to manage tannin impacted water.

Plate 4: Tannin impact in stormwater at the discharge point from a road construction site. The discharge of impacted water may be obvious to community and other stakeholders.

Plate 5: Tannins in a drainage line generated from very thickly applied mulch on the batter above. Note that the sedimentation fence is not effective in treating the tannins.

Appendix 2: Plates showing the use of mulch for erosion & sedimentation controls

Plate 6: Mulched vegetation stockpiled in a low-lying area subject to inundation. This is not an appropriate stockpile location and may increase the generation of tannins from stockpiled mulch.

Plate 7: Mulch being placed as batter erosion control. Mulch should not be applied in layers more than 100 mm thick for surface stabilisation.

Plate 8: Site showing recent application of a mulch/topsoil mix on batters (40% mulch to 60% topsoil). Mulch mixes are used to provide temporary stabilisation to prevent the loss of topsoil from batters in heavy rainfall events. Mulch use is also shown as a mounded sedimentation control to prevent sediment entering the median drain.

Plate 9: A mulch/topsoil mix used to provide temporary batter stabilisation and to assist cover crop establishment.

Plate 10: Successful establishment of cover crops on batters where mulch has been used with topsoil to assist temporary stabilisation.

Plate 11: Geofabric wrapped mulch bunds used for sedimentation control

Plate 12: Mulch used as a bund for a temporary sedimentation catch dam. Mulch is effective as it can provide both containment and filtering of site water. Mulch should not be used as a control in areas of concentrated flow where it may be washed away. Any mulch containment control should have a defined and lined outlet that allows discharge from the control without washing mulch away. Note that this control does not have a defined discharge outlet which should be installed to prevent failure of the control in heavy rainfall events.

Appendix 3: Minimum requirements for community mulch giveaways

The purpose of community mulch giveaways is to provide mulch for residential landscaping purposes.

The activities of a community mulch giveaway are permissible under the *Protection of the Environment Operations (Waste) Regulation 2005 – General Exemption Under Part 6, Clause 51 and 51A* (the Raw Mulch Exemption 2008). However, the activities remain subject to other relevant environmental regulations within the Act and Regulations. The Raw Mulch Exemption 2008 is subject to the following conditions:

- The raw mulch can only be applied to land for the purposes of filtration or as a soil amendment material or used either singularly or in any combination as input material(s) to a composting process.
- The consumer must land apply the raw mulch within a reasonable period of time.

Further information can be found at: www.environment.nsw.gov.au/resources/waste/ex08mulch.pdf

It is the mulch generators responsibility to ensure that the mulch is reused in an environmentally responsible manner.

A safe work method statement (SWMS) must be prepared that identifies potential OHS risks and all prevention and mitigation measures. The SWMS must apply to both the community and site workers involved in the mulch giveaway.

Each member of the community who participates in the mulch giveaway must read and understand a site specific information sheet. A template information sheet is attached as Appendix 4.

The site occupier must maintain written records for each load of mulch that is taken away and to ensure that each community participant understands the conditions of the community mulch giveaway information sheet. A suggested template to record this information is attached as Appendix 5.

Appendix 4: Community mulch giveaway information sheet

The following community mulch giveaway information sheet must be populated with site specific information.

Community Mulch Giveaway
Information Sheet

Details of Mulch Supply	
Site Occupier	<insert name of contractor / alliance etc>
Project Name	<insert project name>
Location	<insert location of mulch stockpile>
Mulch stockpile access directions	<insert adequate directions for community members to find the stockpile location>

Background

- This information sheet supports the non-commercial giveaway of mulch for local residents.
- The product is raw vegetation mulch from <insert project location / name>.

Conditions

- Any one individual may only take a maximum of 5 trailer loads from this project.
- The mulch may only be used for residential landscaping purposes.
- Mulch must not be placed in or immediately adjacent to waterways.
- The raw mulch can only be applied to land for the purposes of filtration or as a soil amendment material or used either singularly or in any combination as input material(s) to a composting process.
- The consumer must apply the raw mulch to land within a reasonable period of time.

Community Safety Requirements

- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>
- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>
- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>
- <add in any safety requirements or mitigation measures from the SWMS that apply to the community>

Appendix 5: Records template for community mulch giveaway

The records in the following suggested template must be kept as a minimum.

Community Mulch Giveaway Record Sheet				
Date	**Car Registration**	**I have read and understand the 'Community Mulch Giveaway Information Sheet'**	**Name**	**Signature**
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		
		❑ Yes		