APPENDIX B4

Construction Soil and Water Quality Management Plan

Woolgoolga to Halfway Creek

Pacific Highway Upgrade

MAY 2015

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Glossary / Abbreviations

ASS	Acid Sulfate Soils
CEMP	Construction Environmental Management Plan
CLMP	Contaminated Land Management Plan
CHCC	Coffs Harbour City Council
CVA	Clarence Valley Council
CoA	Condition of Approval
DECC	Former Department of Environment and Climate Change (NSW) now NSW Office of Environment and Heritage.
DP&E	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries (Fishing and Aquaculture)
EEC	Endangered Ecological Community
EIS	Woolgoolga to Ballina Pacific Highway Upgrade Environmental Impact Statement (December, 2012)
ERSED	Erosion and Sediment Control Plan
EPA	NSW Environment Protection Authority
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPL	NSW Environment Protection Licence under the *Protection of the Environment Operations Act 1997*.
ESCP	Erosion & Sediment Control Plan
EWMS	Environmental Work Method Statements
FM Act	*NSW Fisheries Management Act 1994*
FFMP	Flora and Fauna Management Plan
Minister, the	NSW Minister for Planning
NOW	NSW Office of Water
OHLY	OHL York Joint Venture
PASS	Potential Acid Sulfate Soils
PIRMP	Pollution Incident Response Management Plan
PoEO Act	*NSW Protection of the Environment Operations Act 1997*
RMS, Roads and Maritime Services	NSW Roads and Maritime
RUSLE	Revised Universal Soil Loss Equitation
Secretary	Secretary of the Department of Planning and Environment
SPIR	Woolgoolga to Ballina Pacific Highway Upgrade Submissions Preferred Infrastructure Report (November, 2013)
SWMP	Soil and Water Management Plan
the Project	Woolgoolga to Halfway Creek Project
W2HC	Woolgoolga to Halfway Creek

1 Introduction

1.1 Context

This Construction Soil and Water Management Plan (SWMP or Plan) forms part of the Construction Environmental Management Plan (CEMP) for the upgrade of the Pacific Highway between Woolgoolga and Halfway Creek (the Project).

This SWMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA) and the mitigation measures listed in the Pacific Highway Upgrade Woolgoolga to Ballina Environmental Impact Statement (EIS), Submissions / Preferred Infrastructure Report (SPIR) and all applicable legislation.

There is one tie in project to the Woolgoolga to Halfway Creek project limits, namely Sapphire to Woolgoolga project. This tie in project has been approved separately by the Minister of Planning. Relevant conditions of approval for this project has been referenced in the CEMP and plans as appropriate, specifically the Arrawarra Rest Area.

1.2 Background

The Pacific Highway Upgrade Woolgoolga to Ballina EIS (RMS 2012) assessed the impacts of construction and operation of the Project on soils and water, within Chapters 8 and 9.

As part of EIS development, detailed groundwater and water quality assessments were prepared to address the Environmental Assessment Requirements issued by the Department of Planning and Environment. These assessments were included in the EIS as Working Paper: Water Quality, Working Paper: Hydrology and Flooding and Working Paper: Groundwater.

The EIS identified the potential for direct and indirect impacts on water quality but concluded that, with implementation of appropriate impact mitigation measures, there would be no significant impacts to waterways crossed by the project, or to high risk areas or sensitive receiving environments downstream of the project.

Additional management measures were provided within the *Woolgoolga to Ballina Submissions / Preferred Infrastructure Report November 2013*, with applicable management measures from that report included as part of this SWMP.

1.3 Environmental management systems overview

The overall Environmental Management System for the Project is described in the Construction Environmental Management Plan (CEMP).

The SWMP is part of the OHL York Joint Venture (OHLY) environmental management framework for the Project, as described in Section 4.1 of the CEMP. In accordance with CoA D25 (c), this Plan has been developed in consultation with EPA, DPI (Fisheries NSW), NOW and the Coffs Harbour City Council (CHCC) and Clarence Valley Council (CVA).

Management measures identified in this Plan will be incorporated into site or activity specific Environmental Work Method Statements (EWMS) and Erosion and Sediment Control Plans (ESCP).

EWMS will be 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 safeguards. For high risk activities, such as construction of working platforms in waterways, EWMS will be provided to EPA and DPI Fisheries Conservation and Aquaculture for input prior to sign off (refer to Section 4.1.3 of the CEMP).

ERSED plans are designed for use as a practical guide and may be produced in conjunction with Environmental Work Method Statement (EWMS) to provide more detailed site-specific environmental mitigation measures. ESCP will be developed by the environment team in consultation with construction personnel and the Project Soil Conservationist, and modified as required when:

- Site conditions evolve.
- Flow paths change.
- Construction activities that affected the characteristics of ground conditions change.

Used together, the CEMP, strategies, procedures, EWMS and ERSED management guides that clearly identify required environmental management actions for reference by OHLY personnel and sub-contractors.

The review and document control processes for this Plan are described in Sections 9 and 10 of the CEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this Plan is to describe how construction impacts on soil and water will be minimised and managed.

2.2 Objectives

The key objective of the SWMP is to ensure that impacts on water quality are minimised and within the scope permitted by the planning approval. To achieve this objective, OHLY aim to undertake the following:

- Ensure best management practice controls and procedures are implemented during construction activities to avoid or minimise erosion/sedimentation impacts and potential impacts to water quality in rivers, creeks and groundwater along the Project corridor.
- Ensure appropriate measures are implemented to address the relevant CoA outlined in Table 3.1 and the safeguards detailed in the EIS and Submission / Preferred Infrastructure Report (SPIR).
- Ensure appropriate measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

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 and CoA.
- Meet environmental protection licence water quality discharge parameters for all planned basin discharges (ie those within design capacity).
- Manage downstream water quality impacts attributable to the project, especially no water quality impacts to the Solitary Islands Marine Park (ie maintain water waterway health by avoiding the introduction of nutrients, sediment and chemicals outside of that permitted by the environmental protection licence and/or ANZECC.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to soil and water management includes:

- *Environmental Planning and Assessment Act 1979* (EP&A Act).
- Environmental Planning and Assessment Regulation 2000.
- *Protection of the Environment Operations Act 1997*.
- *Water Management Act 2000.*
- *Fisheries Management Act 1994.*
- *Commonwealth Environment Protection and Biodiversity Conservation Act 1999.*
- *Water Act 1912*.

Relevant provisions of the above legislation are explained in the register of legal and other requirements 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 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.
- 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).
- RMS Dewatering Guideline.
- RMS Pacific Highway Practice Note for Dewatering.
- 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).
- RMS Environment Direction Management of Tannins from Vegetation Mulch.
- Stockpile Site Management Guideline, RMS 2011.
- Environmental Best Management Practice Guideline for Concreting Contractors, DEC, 2004.
- Australian Standard AS1940 (The Storage and Handling of Flammable and Combustible Liquids).
- RMS QA Specifications G36 Environment Protection and G38 Clearing and Grubbing

3.2 Minister's Conditions of Approval

The CoA relevant to this Plan are listed Table 3-1. 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

CoA No.	Condition Requirements	Document Reference
B34	**Construction Soil and Water Management** Soil and water management measures consistent with *Managing Urban Stormwater - Soils and Construction Vols 1 and 2, 4th Edition* (Landcom, 2004) and *Managing Urban Stormwater Soil and Construction Vols 2A and 2D Main Road Construction* (Department of Environment and Climate Change, 2008) shall be employed during the construction of the SSI to minimise soil erosion and the discharge of sediment and other pollutants to land and/or waters.	This plan
B35	Where available, and of appropriate chemical and biological quality, stormwater, recycled water or other water sources shall be used in preference to potable water for construction activities, including concrete mixing and dust control.	This plan WEMP
B36	All surface water and groundwater shall be adequately treated as far as is practicable, prior to entering the stormwater system to protect the receiving water source quality.	This plan ERSED Plan EWMS
B37	Prior to the commencement of site preparation and excavation activities, or as otherwise agreed by the Secretary, in areas identified as having a moderate to high risk of contamination, a site audit shall be carried out by a suitably accredited contaminated site auditor. A **Site Audit Report** is to be prepared by the site auditor detailing the outcomes of Phase 2 contamination investigations within these areas. The Site Audit Report shall detail, where relevant, whether the land is suitable (for the intended land use) or can be made suitable through remediation. Where the investigations identify that the site is suitable for	CLMP & Site Audit

CoA No.	Condition Requirements	Document Reference
	the intended operations and that there is no need for a specific remediation strategy, measures to identify, handle and manage potential contaminated soils, materials and groundwater shall be identified in the Site Audit Report and incorporated into the Construction Environmental Management Plan. Where the investigations identify that the site is suitable for the intended operations and that a remediation strategy is required, the Site Audit Report shall include a remediation strategy for addressing the site contamination, and how the environmental and human health risks will be managed during the disturbance, remediation and/or removal of contaminated soil or groundwater, and be incorporated into the Construction Environmental Management Plan. Where remediation is required, a **Site Audit Statement(s)** shall be prepared verifying that the site has been remediated to a standard consistent with the intended land use. *Note* *Terms used in this condition have the same meaning as in the Contaminated Land Management Act 1997.*	
B38	**Watercourse crossings** Watercourse crossings shall be designed in consultation with the DPI (Fisheries NSW), EPA, NOW and DoE, and where feasible and reasonable, be consistent with the *Guidelines for Controlled Activities Watercourse Crossings* (Department of Water and Energy, February 2008*)*, *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003), *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW Fisheries, February 2004*),* and *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI Fisheries, 2013). Where multiple cell culverts are proposed for crossings of fish habitat streams, at least one cell shall be provided for fish passage, with an invert or bed level that mimics watercourse flows.	This plan. Project workshops
B39	All crossings of known Giant Barred Frog habitat or waterways with the confirmed presence of the species shall be designed and constructed with bridges. Should the Applicant construct a crossing structure other than a bridge, the Applicant shall demonstrate maintained connectivity for the Giant Barred Frog upstream and downstream of that crossing for a monitoring period of three consecutive years, or such other period agreed by the Secretary in consultation with the EPA. Demonstration of maintained habitat connectivity shall: (a) be based on baseline data that confirms the presence, nature and distribution of Giant	This plan FFMP

CoA No.	Condition Requirements	Document Reference
	Barred Frog population using a survey methodology that has been endorsed by the EPA, and detailed in the Mitigation Framework required in condition D1, and an assessment of the connectivity of the crossing site prior to commencement; or, if adequate baseline data is not provided to the satisfaction of the Secretary, be based on the assumption of occurrence of a population on either side of the crossing site; and (b) be based on evidence that the Giant Barred Frog has remained present upstream and downstream of the crossing site for the monitoring period, with periodic monitoring to occur at least biannually. Should the results of any instance of periodic monitoring record an absence of the Giant Barred Frog, the Applicant shall be required to demonstrate that this change is not as a result of the SSI within one month of the completion of that instance of periodic monitoring, to the satisfaction of the Secretary. Should the Secretary not be satisfied that the change is not a result of the SSI, the SSI will be deemed as the cause of the impact and the Applicant shall offset the loss of the habitat in accordance with this approval.	
D12	The Applicant shall prepare and implement a **Water Quality Monitoring Program**, to monitor the construction and operation impacts of the SSI on surface and groundwater quality and resources and wetlands, prior to construction. The Program shall be prepared in consultation with the EPA, DPI (Fisheries), NOW and DoE to the satisfaction of the Secretary, and shall include but not necessarily be limited to: (a) identification of surface and groundwater quality monitoring locations (including watercourses, waterbodies and SEPP14 wetlands) which are representative of the potential extent of impacts from the SSI; (b) the results of any groundwater modelling undertaken; (c) identification of works and activities during (d) development and presentation of parameters and standards against which any changes to water quality will be assessed, having regard to the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000* (Australian and New Zealand Environment Conservation Council, 2000) or relevant baseline data;	Appendix A

CoA No.	Condition Requirements	Document Reference
	(e) representative background monitoring of surface and groundwater quality parameters for a minimum of twelve months (considering seasonality) prior to the commencement of construction, to establish baseline water conditions, unless otherwise agreed by the Secretary; (f) a minimum monitoring period of three years following the completion of construction or until the affected waterways and/or groundwater resources are certified by an independent expert as being rehabilitated to an acceptable condition. The monitoring shall also confirm the establishment of operational water control measures (such as sedimentation basins and vegetation swales); (g) contingency and ameliorative measures in the event that adverse impacts to water quality are identified; and (h) reporting of the monitoring results to Department of Planning and Environment, EPA, DPI (Fisheries), NOW and DoE .	
D13	The Applicant shall prepare and implement a **Hydrological Mitigation Report** for properties where flooding and/or hydrological impacts are predicted to exceed the relevant flood management objective in the documents listed in condition A2 as a result of the SSI. The Report shall be prepared by a suitably qualified expert and be based on detailed surveys (e.g. floor levels) and associated assessment of potentially flood affected properties in the Corindi, Clarence and Richmond river floodplains. The Report shall: (a) identify properties in those areas likely to have an increased/exacerbated impact and detail the predicted impact; The types of impacts to be considered include all those examined in the EIS including but not limited to changes in flood levels and velocities, alteration to drainage, reduction in flood evacuation access or capability, impacts on infrastructure, impacts on stock and agriculture, and impacts to the environment; (b) identify mitigation measures to be implemented to address these impacts; (c) identify measures to be implemented to minimise scour and dissipate energy at locations where flood velocities are predicted to increase as a result of the SSI and cause localised soil erosion and/or pasture damage; (d) be developed in consultation with the relevant council, NSW State Emergency Service and	Appendix K

CoA No.	Condition Requirements	Document Reference
	directly-affected landowners; (e) identify operational and maintenance responsibilities for items (a) to (c) inclusive; and (f) refer to the assessments described in conditions B31 and B32. The report may be submitted in stages to suit the staged construction of the SSI. Construction shall not commence within those areas likely to have altered flood conditions until such time as works identified in the hydrological mitigation report have been completed, unless otherwise agreed by the Secretary.	
D14	Based on the mitigation measures identified in condition D13 the Applicant shall prepare and implement a final schedule of feasible and reasonable flood mitigation measures proposed at each directly-affected property in consultation with the landowner. The schedule shall be provided to the relevant landowner(s) prior to the implementation/construction of the mitigation works, unless otherwise agreed by the Secretary. A copy of each schedule of flood mitigation measures shall be provided to the Department of Planning and Environment and the relevant council prior to the implementation/construction of the mitigation measures on the property.	Appendix L
D15	The Applicant shall employ a suitably qualified and experienced independent hydrological expert, whose appointment has been endorsed by the Secretary, to deal with all hydrological matters and assist landowners in negotiating feasible and reasonable mitigation measures.	This plan RMS
D16	The Applicant shall provide feasible and reasonable assistance to the relevant council and/or NSW State Emergency Service, to prepare any new or necessary update(s) to the relevant plans and documents in relation to flooding, to reflect changes in flooding levels, flows and characteristics as a result of the SSI.	This plan Communication Action Plan CEMP
D26 (c)	a **Construction Soil and Water Quality Management Plan** to manage surface and groundwater impacts during construction of the SSI. The Plan shall be developed in consultation with the EPA, DPI (Fisheries), NOW, DoE and the relevant council and include, but not necessarily be limited to: (i) details of construction activities and their locations, which have the potential to impact on water courses, storage facilities, stormwater flows, and groundwater; (ii) surface water and ground water impact	This plan Section 5.1 Appendix A

CoA No.	Condition Requirements		Document Reference
		assessment criteria consistent with Australian and New Zealand Environment Conservation Council (ANZECC) guidelines	
	(iii)	management measures to be used to minimise surface and groundwater impacts, including details of how spoil and fill material required by the SSI will be sourced, handled, stockpiled, reused and managed; erosion and sediment control measures; salinity control measures and the consideration of flood events;	Table 6-1
	(iv)	a **Groundwater and Soil Salinity report** should geotechnical investigations determine the presence, extent and severity of soil salinity within the SSI boundary, The report shall detail the outcomes of geotechnical investigations and identify and mitigate impacts to groundwater resources;	Appendix J
	(v)	an **Acid Sulfate Soils contingency plan**, consistent with the *Acid Sulfate Soils Manual*, to deal with the unexpected discovery of actual or potential acid sulfate soils, including procedures for the investigation, handling, treatment and management of such soils and water seepage;	Appendix C
	(vi)	a **tannin leachate management protocol** to manage the stockpiling of mulch and use of cleared vegetation and mulch filters for erosion and sediment control;	Appendix D
	(vii)	management measures for contaminated material and a contingency plan to be implemented in the case of unanticipated discovery of contaminated material during construction;	CEMP Appendix B8 Contaminated Land Management Plan
	(viii)	a description of how the effectiveness of these actions and measures would be monitored during the proposed works, clearly indicating how often this monitoring would be undertaken, the locations where monitoring would take place, how the results of the monitoring would be recorded and reported, and, if any exceedance of the criteria is detected how any non-compliance can be rectified; and	Section 8 Table 6-1
	(ix)	mechanisms for the monitoring, review and amendment of this plan.	Section 8

4 Existing environment

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

The key reference documents are Chapters 8 and 9 of the EIS, Working Paper: Water Quality, Working Paper: Hydrology and Flooding and Working Paper: Groundwater.

4.1 Topography and soil characteristics

The topography throughout the project is variable but can be broadly categorised as either 'lowland' or 'elevated'. Lowland areas are predominately associated with the Clarence and Richmond river floodplains and occur within sections 4 to 5 and 8 to 11 where elevations are less than about 15 meters AHD. Elevated areas are mainly confined to the southern and central parts of the project boundary, occurring in sections 1 to 3 and 6 to 7, and rise to a maximum elevation of about 135 meters AHD on the Coast Range and foot slopes of the Pillar and Richmond ranges.

The project generally traverses the geological sequence of the Clarence-Morton Basin, an extensive Mesozoic age sedimentary basin extending from southern Queensland to the NSW North Coast and comprising sedimentary rocks about 2.5 to four kilometers thick. Both the northern and southern extents of the project extend beyond the sedimentary basin, with the underlying Palaeozoic basement rocks of the New England Fold Belt outcropping at Woolgoolga and Ballina.

The Jurassic age Walloon Coal Measures outcrop generally parallel to the coastline in elevated and steeper terrain areas of north-eastern NSW and are known to result in slope instability in some areas. Sections 1, 4, 6 and 7 of the project traverse Walloon Coal Measures and may therefore have elevated levels of slope instability.

The most common soil landscapes within the project boundary are the erosional, transferal and alluvial types. Soils within these landscapes are generally highly erodible and have low bearing strength. Soft soils occur between the Dirty Creek Range and Halfway Creek and in low-lying areas, including the Clarence and Richmond River floodplains.

Topography and soils for each project section are also outlined in Table 4-1.

Table 4-1 Topography and soils

Topography	Soil type	Soil characteristics
Elevated	Swamp and alluvial landscapes at lower elevations (ie <10m) and transferral landscapes at higher elevations near Dirty Creek.	Highly erodible and prone to water erosion in lower elevations. Reported presence of erodible siltstone seams around Dirty Creek Range.

Potential acid sulfate soils contain iron sulfides (pyrites), which may oxidise when exposed to air, resulting in the soil acidification and dissolved acid and metal discharge into nearby surface water bodies via surface water runoff and groundwater flows. Soil acidification and dissolved acid runoff can result in detrimental impacts on the health of land and aquatic plants and animals. The acid sulfate soil analyses in the EIS indicated that both actual and potential acid sulfate soils are present, including broad areas of high risk acid sulfate soils and some areas of low risk acid sulfate soils (see Appendix A5 of the CEMP). Since the acid neutralising capacity of the soils is insufficient to neutralise the total potential acidity present in the soils, appropriate acid sulfate soil management practices will be required. This is addressed further in Chapter 6

Contamination

Information on contamination as presented in the EIS was obtained from preliminary site contamination studies carried out for previous project development phases and a follow-up assessment of contamination carried out in 2012. The previous studies were carried out between 2005 and 2010 and involved identifying potential contamination based on past and present land uses, using a combination of aerial photographs, historical records and visual site inspections. Limited sampling and laboratory testing of surface soils was carried out at a selection of locations where contamination was considered to have the potential to occur.

The follow-up assessment of contamination carried out in 2012 involved a review of the results of previous studies and existing contamination databases, and a site inspection of accessible areas of interest to verify locations of potential contamination. An assessment of contamination risks was carried out, taking into consideration the proximity of potentially contaminated areas to the project boundary, the likelihood of exposure of contamination during project construction, and the potential consequences of disturbance and exposure of contaminants.

There have been 9 potentially contaminated sites identified in or near the project of the alignment:

Table 4-2 EIS Areas of potential environmental concern within or near the project boundary

Section	Number of sites	Relevant Requirement	Potential Contaminants
1	**9**	Former sawmill, possible banana plantation, Blueberry Exchange, quarry, stockpile, cattle dip site, former orchards and water storage tank.	Heavy metals, pesticides, hydrocarbons, arsenic, PCBs, asbestos.

Subsequent to the EIS, a Phase 2 assessment has been completed. The results indicate that the only sites which may be affected by contamination are the petrol stations, and that the contamination (by hydrocarbons) is moderate.

These locations are illustrated on the projects sensitive area mapping (refer Appendix A5 of the CEMP). Additional details are provided in the CEMP Appendix B8 Contaminated Land Management Plan.

The EIS required that soil contamination would be addressed through further studies prior to construction with appropriate mitigation and management measures identified. Appropriate mitigation measures in relation to contamination are included in Section 6.

4.2 Surface water

The project intercepts eight waterways including freshwater systems and estuarine systems and some of the receiving waters drain to or support sensitive aquatic and riparian environments including key fish habitats and wetlands listed under SEPP 14.

The high risk sensitive environments that may result in the most significant impacts from changes to water quality is the Solitary Islands Marine Park which is outlined in Table 4-3 and are shown on the sensitive area maps attached at Appendix A5 of the CEMP.

Existing water quality monitoring data for waterways within each section was reviewed as part of the EIS. The existing water quality data indicate that the majority of the waterways potentially impacted by the project have a history of water quality problems, with conditions commonly found to be below the standard required for protection of aquatic ecosystems. The occurrence of poor water quality can be attributed to a number of factors, including modification of channel structure, macrophyte and weed growth, soil erosion, acid sulphate soils and nutrient enrichment as a result of runoff from agricultural land.

The pre-construction water quality data will be used to evaluate broader water quality trends throughout and following construction of the project. The water quality monitoring program to be implemented during and following construction is provided as Appendix A.

A broad qualitative evaluation of water quality from the EIS is provided in Table 4-3.

Table 4-3 Watercourses, wetlands and water quality

Waterways	Summary of water quality
• Arrawarra Gully • Corindi River • Cassons Creek • Blackadder Gully • Redbank Creek • Dirty Creek • Dundoo Creek • Halfway Creek	Samples taken in 2007 from Arrawarra Creek, Corindi River, Blackadder Gully, Cassons Creek and Redbank Creek indicated that, with the exception of Corindi River, water quality does not meet the relevant ANZECC/ ARMCANZ guidelines (RTA, 2008b). Issues include low pH, possibly caused by acid sulfate soils and low dissolved oxygen. Redbank Creek and Blackadder Gully were found to have high turbidity, which can be attributed to the presence of stock in the water at the time of sampling. Previous studies of the Corindi River have found that some areas have low dissolved oxygen levels and are impacted by agricultural land uses and bank erosion. Other studies of the estuarine section of Corindi River have found that water quality meets the relevant ANZECC/ ARMCANZ guidelines.

4.3 Groundwater

Alluvial deposits occur throughout the area within the project boundary, laid down by the numerous rivers emanating from the Great Dividing Range.

Recharge to the coastal sediments is generally considered to be via direct infiltration of rainfall and floodwaters, though the impermeable nature of the surface clays in many areas means that localised recharge is probably the dominant recharge mechanism.

Groundwater levels within the lowland areas of the project boundary are typically within three metres of the surface. Following periods of heavy rainfall, the groundwater levels in lowland and floodplain areas are often at the existing ground surface. The water-bearing units in these areas are generally associated with alluvial aquifers on low-lying, alluvial deposits.

In elevated areas underlain by bedrock, groundwater levels are typically more than eight metres below the surface and locally over 45 metres below the surface on the summit of the

Coast Range. The water-bearing units in these areas are generally deep within the rock formations (that is, greater than 10 to 15 metres below the surface).

Of nearly 10,000 bores investigated as part of the Woolgoolga to Ballina EIS:

- Less than three per cent of bores have an allocation for irrigation and an additional one per cent is licensed to extract groundwater for commercial ventures. Combined, this accounts for an entitlement of 30 gigalitres per year, though only an estimated 8.5 gigalitres was used in 2010–11.
- Eighty-five percent of registered bores are licensed for stock and domestic use, with an annual entitlement of generally one to three megalitres per year each (but up to 14 megalitres per year in one case).
- Ten per cent of bores are rated as 'lapsed' or 'cancelled' and the remainder are monitoring or test bores with no water use requirements.

Under normal climatic conditions, groundwater is a minor water source, with surface water supplies sufficient for most operations. However, during periods of drought, as occurred between 2000 and 2007, groundwater becomes an increasingly important water source.

4.4 Rainfall

The rainfall records from Halfway Creek (Pacific Highway) has been selected to reflect the potential rainfall conditions across the Project site due to its location within the overall site, and extent of available data (from 1968 to present). A summary of the rainfall records from the Bureau of Meteorology is provided in Table 4-4.

Table 4-4 Summary of rainfall records

Summary of rainfall record from 1968 to present													
	Summer / Autumn						Winter / Spring						
	Dec	Jan	Feb	Mar	Apr	Ma	Jun	July	Aug	Sep	Oct	Nov	Year
Mean rainfall (mm)	129.8	157.8	164	155.6	112.7	95.8	93.7	48.7	40.2	40.8	68.0	107.2	1214.3
Mean rain days	*13.1*	*14.0*	*15.9*	*12.3*	*12.5*	*12.9*	*9.9*	*7.8*	*9.2*	*8.7*	*12.8*	*13.9*	*116.9*

Rainfall is typically higher during summer and autumn. Winter and spring are typically drier periods during the year.

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 Equitation 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.

4.6 Flooding

The project is located in the Northern Rivers catchment area. The catchment is subject to frequent and extensive flooding, which can be caused by one or a combination of:

- Rainfall in the upper catchment
- Rainfall in the local catchment
- Large ocean tides.

The project would also cross several smaller watercourses and their floodplains, including the Corindi River and Halfway Creek. The watercourses crossed by the project are described in Table 8-3 of the EIS.

Flooding is generally concentrated on and around the coastal floodplains and inundation in these areas can extend over a number of weeks. This can result in damage to buildings and roads, loss or stranding of livestock, loss of crops and blocked access. Flooding also occurs in some upper catchment waterways where fast flows and rapid changes to creek levels can eventuate.

Hydrological and hydraulic models were used to simulate flows and flood behavior for all mapped watercourses and associated floodplains crossed by the project (refer to Section 8.2). Over 15 different models were used, with the model type depending upon the size and characteristics of the waterway being examined.

The level of the existing highway is below the 20 year ARI flood event level in many locations. This means that the highway can be inundated by floodwaters during a 20 year ARI flood event.

Details of flood investigation areas and flood events assessed (two year, five year, 20 year, 50 year 100 year and 200 year ARI events) are included in Table 8-2 of the EIS, and more broadly in Chapter 8 of the EIS. The impacts associated with flood events in between these events or smaller than the two or five year ARI flood events can be generally estimated by interpolation or extrapolation of these results.

Chapter 8.3 of the EIS includes an assessment of construction impacts in relation to hydrology and flooding.

Conditions of approval relating to the Hydrological Mitigation Report (CoA D13, CoA D14, CoA D15, CoA D16), hydrological expert and changes to flood modeling are included in Table 3.1.

5 Environmental aspects and impacts

5.1 Construction activities

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

- Vegetation clearing and topsoil stripping.
- Mulching of vegetation
- Bulk earthworks.
- Site access including temporary waterway crossings.
- Culvert and drainage works.
- Bridge construction.
- Material stockpiles including the treatment of acid sulphate soil and rock.
- Batch plant operation.
- Paving activities.
- Water use / extraction.
- Compounds operation including fuel and chemical storage, refuelling and chemical handling.
- Noxious weed treatment including herbicide spraying.

Refer also to the Aspects and Impacts Register included in Appendix A2 of the CEMP.

5.2 Potential 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 attributable to construction might include:

- Exposure of soils during vegetation clearing and earthworks, creating the potential for off-site transport of eroded sediments and pollutants.
- Sensitive area damage from inappropriate stockpiling activities.
- Production of tannins from mulch during clearing.
- Disturbance of acid sulphate soils, creating the potential for oxidation of these soils and subsequent generation of acidic run-off.
- Alteration of surface and subsurface flows that could cause disturbances to hydrology and hydraulics.
- Intercepting with cuts perched water tables or layers of relatively low permeability soil/rock that support surrounding ecosystems and groundwater sensitive areas.
- A reduction in groundwater levels and flows, and off-site discharge of water containing sediment from dewatering activities.
- Interception and interference with an aquifer that could obstruct groundwater flow and limit groundwater availability.

- Contamination of soils, and surface and groundwater from accidental spills or oil leaks. This might include grease or fuel from machinery and vehicles, construction sites or compounds, or spills of other chemicals that may be used during the course of construction.
- Disturbance of unidentified contaminated land eg former cattle tick dip sites, or other pesticide/chemical concentrations in soil from historical land use practices, and subsequent generation of contaminated runoff.

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 Section 3.4 and 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 control measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS, supplementary assessments, Conditions of Approval and RMS documents, and from recent experience on similar road projects. Specific measures and requirements to address impacts on soil and water are outlined in Table 6-1.

Table 6-1 Soil and water management and mitigation measures

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
GENERAL					
SW1	Training will be provided to all project personnel, including relevant sub-contractors on sound erosion and sediment control practices and the requirements from this plan through inductions, toolboxes and targeted training.		Pre-construction / Construction	Construction Manager / Environment Manager	G38/G36, Good practice
SW2	A Project Soil Conservationist will be engaged during detailed design to develop an erosion and sedimentation management report to inform the soils and water management plan and will be regularly consulted throughout construction to provide advice on erosion and sediment control design, installation and maintenance.		Pre-construction / Construction	Environment Manager	G38, Good practice, Submissions / PIR (SSW5)
SW3	An environmental protection scheduled activity licence will be obtained for the Project. All relevant conditions relating to soil and water management will be implemented as required by the licence.		Construction / Post construction	Construction Manager	POEO Act 1997
PROCEDURES AND PLANS					
SW4	Erosion and Sediment Control Plans (ESCPs) will be prepared and implemented in advance of construction, including earthworks, stockpiling and clearing. ESCPs and will be updated as required.		Pre-construction / Construction	Environment Officer / Foreman	Managing Urban Stormwater: Soils and Construction Volume 1 and Volume 2D, EIS (SSW4)
SW5	The following EWMS will be prepared and implemented to manage soil and water impacts. EWMS for activities identified as having high environmental risk will undergo a period of consultation with EPA, the Office of Water, and DPI Fisheries Conservation and Aquaculture. Those marked with an asterisk below are those likely to be subject to consultation: • Activities that impact on environmentally sensitive areas* • Working platforms in or adjacent to waterways* • Sediment basin construction and maintenance* • Concreting activities		Construction	Superintendent / Environment Manager	G36 and G40

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	• Batch plant operation* • Management of Acid Sulfate Materials* • Dewatering* • Managing tannin leachate* • Vegetation clearing and grubbing* • Topsoil stripping*				
SW6	All ASS or PASS disturbed during the construction process will be managed in accordance with RMS Acid Sulfate Soil Management Procedure (incorporating an Acid Sulfate Soils contingency plan as required under CoA D26(c)v) attached at Appendix C. The requirements will be incorporated into the EWMS for "Management of Acid Sulfate Materials" referred to in SW2.		Pre-construction / Construction	Superintendent / Environment Manager	Submissions / PIR (SSW25) CoA D26(c) v
SW7	The requirements of the spoil and fill management procedure attached at Appendix B will be implemented throughout construction. The plan includes, among other detail, the types of material expected to be encountered during construction, and how excavated material will be handled, transported, stockpiled, reused and disposed.		Construction	Superintendent / Foreman	CoA D25(d)ix
SW8	Dewatering will be undertaken and managed in accordance with the Pacific Highway Projects Dewatering Guidelines attached at Appendix G. A specific EWMS for dewatering will be prepared and will consider and/or incorporate the following detail: • Areas of the site that will require dewatering. • Dewatering methods that will minimise potential environmental impacts. • Opportunities for reuse. • The limitations for any proposed reuse methods. • Discharge locations and adequate energy dissipation. • Water quality criteria for discharge and/or reuse. • Treatment techniques required to meet the water quality		Construction	Superintendent / Environment Manager	G38 (Section3.5)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	criteria. • Water sampling and testing requirements.				
SOIL EROSION AND SEDIMENTATION CONTROL					
SW9	Appropriate erosion and sediment controls, following the guidelines of the 'Blue Books' (Landcom, 2004 and DECC, 2008), will be established before the start of construction and maintained in effective working order for the duration of the construction period until site stabilisation. Specific controls will include: • Sediment fences and filters to intercept and filter small volumes of non-concentrated construction runoff • Rock check dams across swales and diversion channels to reduce the velocity of flow, thereby reducing erosion of the channel bed and trapping sediment • Level spreaders to convert erosive, concentrated flow into sheet flow • Diversion drains that collect construction runoff and direct it away from unstable and/or exposed soil to treatment facilities • Diversion drains to collect clean runoff from upstream of the construction area and divert it around or through the site without it mixing with construction runoff • Lining of channels and other concentrated flow paths • Sedimentation basins to capture sediment and associated pollutants in construction runoff (see further details below) Specific measures and procedures for works within waterways, such as the use of silt barriers and temporary creek diversions, in accordance with RMS' Technical Guideline – Temporary Stormwater Drainage for Main Road Construction (RMS, 2011).		Construction	Superintendent / Foreman / Environment Manager	CoA B34 Submissions / PIR (SSW26) / EPL/ POEO Act
SW10	Erosion and sediment control plans will be developed in line with current Roads and Maritime specifications and as detailed in the Working paper – Water quality.		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW4)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW11	Sedimentation basins and water quality ponds will be sized and located in accordance with the principles identified in the Working paper – Water quality.		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW6)
SW12	Exposed areas will be progressively rehabilitated. Methods will include permanent revegetation, or temporary protection with spray mulching or cover crops.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW7)
SW13	Any necessary approvals will be obtained in accordance with Roads and Maritime specification G36 for permanent and temporary waterway crossings.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW8)
SW14	All work potentially affecting wetlands will be undertaken in consideration of the requirements outlined in the NSW Wetlands Management Policy 2010.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW9)
SW15	Sensitive receiving environments will be reconsidered during detailed design to include any threatened ecological communities and non- aquatic species and their habitats that may be affected by the project. Appropriate management measures will be implemented, if required.		Pre-construction	Environment Manager / Design Manager	EIS (SSW34)
SW16	The design and construction of works within riparian corridors and within the minimum required distance from waterways will be undertaken in accordance with NSW Office of Water guidelines for working within riparian corridors.		Pre-construction / Construction	Superintendent / Foreman / Environment Manager	EIS (SSW36)
SW17	Flow discharge points will be designed with erosion controls to slow the flow velocities.		Pre-construction	Design Manager	EIS (SSW37)
SW18	In steep areas, the length between sediment fences and other physical controls will be decreased to reduce soil erosion.		Construction	Superintendent / Foreman	EIS (SSW38)
SW19	Construction sequencing and temporary diversions of water will be developed and designed to consider the impact of change on flow regimes and to minimise these changes throughout construction.		Pre-construction / Construction	Superintendent / Foreman	EIS (SSW39)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW20	Works will be programmed to minimise the extent and duration of disturbance to vegetation. This will include leaving clearing (undertaken by manual means) and initial earthworks in intermittent and permanent watercourses until subsequent works are about to commence.		Pre-construction / Construction	Superintendent / Foreman	G38
SW21	Wastewater or "dirty" water generated during the construction process will, wherever possible, be collected, treated and disposed of by appropriate means, including the installation of sediment barriers downslope of all disturbed areas. In areas where it is not possible to direct dirty water to sediment basins, other sediment controls will be implemented in accordance with "Blue book" best practice.		Construction	Superintendent / Foreman	G38 / EPL / POEO Act
SW22	Clean and dirty water runoff will be adequately separated to avoid mixing where possible through the use of diversions, clean water drains, and the early installation of permanent drainage infrastructure.		Construction	Superintendent / Foreman	G38
SW23	Active work areas will be stabilised at the end of each day's work and/or just prior to inclement weather, by means such as grading or smooth drum rolling to create a smooth surface and by installing of temporary "catch" drains to prevent / minimise transport of sediment.		Construction	Superintendent / Foreman	G38
SW24	Catch drains; contour and diversion drains across exposed areas will be installed immediately following clearing, and re-established and maintained during topsoil removal and earthwork operations.		Construction	Superintendent / Foreman	G38
SW25	Hardstand material (coarse aggregate), rumble grids or similar will be provided at exit points from construction areas onto public roads to minimise the tracking of soil and particulates onto public roads.		Pre-construction / Construction	Superintendent / Foreman	G38
SW26	Vehicle movements from site will be minimised during wet weather if the tracking of mud may become an issue.		Pre-construction / Construction	Superintendent / Foreman	Good practice
SW27	Loose rock, soil, debris etc will be removed from public road surfaces (including sweeping of the road). Spills will be cleaned up immediately.		Pre-construction / Construction	Superintendent / Foreman	G38

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW28	All required sediment basins and associated drainage will be installed and commissioned prior to the commencement of clearing and grubbing works in that catchment that could cause sediment to leave site. (Except where clearing is required for basin installation).		Construction	Superintendent / Foreman	Good practice
SW29	Sediment basins will be operated and maintained in accordance with the Sediment Basin Management and Discharge Procedure and Water Quality Monitoring Program contained in Appendix G and Appendix A, respectively. Basins will not be discharged until all monitoring and water quality criteria has been verified and documented.		Construction	Superintendent / Foreman	Good practice
SW30	Works within waterways will consider the need to maintain fish passage, in consultation with the Department of Primary Industries (Fisheries).		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW27)
SW31	Flow discharge points will be designed with erosion controls to manage the flow velocities.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW28)
DESIGN OF CUT AND FILL BATTERS					
SW32	Batter slope gradients will be designed to minimise erosion of select topsoil.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW1)
SW33	Where feasible, bench cuttings will be diverted onto contours and surface flow drainage paths designed to spread flow at the source in preference to concentrating the flow and treating it further downstream.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW2)
CONSTRUCTION SEDIMENT BASINS					
SW34	Where appropriate, construction phase sedimentations basins will be designed so they could be retained and used as permanent operational water quality ponds, where required for operational purposes.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW29)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW35	Sizing of sedimentation basins that drain into the Solitary Islands Marine Park will be reviewed to consider the use of 90th percentile sedimentation basins.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW30)
SW36	Sedimentation basins will be inspected at regular intervals and following significant rainfall events to assess available water storage capacity, water quality, structural integrity and debris levels.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW31)
SW37	Where appropriate, an approved flocculent will be applied to sedimentation basins as early as possible so that early mixing of flocculants occurs. Water quality will be tested prior to discharge in accordance with any licence requirements as defined in the RMS dewatering practice note.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW32)
SW38	Where sediment has built up in a basin to a point where the total sediment storage zone has reached capacity, sediment will be removed and appropriately disposed of.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW33)
SW39	Water from sedimentation basins will be used for construction purposes, such as dust suppression, where feasible.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW34)
SW40	When sedimentation basins require pumping out rather than discharge via a flow outlet, a float will be attached to the suction hose or the hose will be located inside a bucket to prevent sediment from the basin floor from being discharged.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW35)
SW41	Records will be kept of water quality monitoring and erosion and sediment control inspections, including details of rain events, use of flocculants, discharge, sediment removal and dewatering activities.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW36)
ANCILLARY FACILITY AND STOCKPILE MANAGEMENT					
SW42	Stockpiles and ancillary facilities will be located to minimise erosion and in accordance with the criteria outlined in Appendix A3 of the CEMP and Appendix I of this plan.		Pre-construction / Construction	Superintendent / Foreman / Environment Manager	CoA D21, CoA D25(d)ix, G38, Submissions / PIR (SSW11 – SSW13)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW43	Measures to be implemented to minimise impacts to surface and ground water quality include: • Bunded storage facilities for chemicals and clay lined where located on land where groundwater is within two metres of the ground surface • Bunded areas for refuelling and washdown • Locating storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface, otherwise the areas are to be lined if they are located over a shallow groundwater source less than two metres deep. Providing bunded storage facilities for chemicals; these bunded areas will be lined with clay where located on land where groundwater is within two metres of the ground surface • Providing bunded areas for refuelling and washdown • Locating storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface; otherwise, the areas will be lined if located over a shallow groundwater source less than two metres deep.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW37)
SW44	At ancillary facilities, management of runoff and spills will include: • Restricting vehicle movements to designated pathways where feasible. • Paving areas that will be exposed for extended periods, such as car parks and main access roads, where reasonable and feasible. • Diverting off-site runoff around sites where required. • Locating chemical or other hazardous material storage areas away from areas of known near-surface groundwater supplies, in areas where the water table is more than five metres below the surface; otherwise, areas be lined if they are to be located over a shallow groundwater source less than two metres deep.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW38)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW45	Soil and water management at borrow source sites will be in line with Volume 2E of the Blue Book which covers water management of mines and quarries.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW39)
SW46	Topsoil, earthworks and other excess spoil material will be stockpiled and managed in accordance with Roads and Maritime Stockpile Management Guidelines (Roads and Maritime, 2011a), Spoil and Fill Management Procedure (Appendix B) and the "Management of Surplus Material" in Section 3.9 of the Submissions / Preferred Infrastructure Report.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW10)
SW47	Where reasonable and feasible, stockpiles will: • Not require removal of areas of native vegetation. • Be located outside of known areas of weed infestation. • Be located such that waterways and drainage lines are not directly or indirectly impacted.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW11)
SW48	Where practicable, stockpiles will be located away from areas subject to concentrated overland flow.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW12)
SW49	Topsoil will be stockpiled separately and inspected for noxious weed seedlings at six monthly intervals and controlled with herbicide as required. Refer to Stockpile Management Protocol (Appendix H)		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW13)
SW50	All construction stockpiles will comply with the requirements of the *Protection of the Environment Operations Act 1997* and NSW Waste Avoidance and Resource Recovery Strategy 2007 for any waste activities that involve the generation, storage and/or disposal of waste and also consider the NSW Resource Recovery Exemptions as applying the storage of stockpiled material.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW14)
SW51	Stockpiles containing potential acid sulfate soils will be lined, bunded and covered in accordance with relevant guidelines.		Construction	Environment Manager / Superintendent /	Submissions / PIR (SSW15)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
				Foreman	
SW52	Management of tannin leaching from vegetation mulch will be in accordance with Roads and Maritime' Environmental Direction – Management of Tannins from Vegetation Mulch (Roads and Maritime, 2012).		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW16)
DRAINAGE AND WATERWAY					
SW53	The EWMS for working platforms in or adjacent to waterways will detail how the works are to be undertaken to reduce erosion and minimise impacts on water quality and riparian fauna and flora. Considerations will include: • Ensuring that where possible earth and/or rock platforms for driving piles are constructed to minimise impacts on the direct water channel. • Keeping vegetation clearing to a minimum. • Constructing rock platforms for driving piles / girder erection only where necessary. • Selecting the optimum rock size for platforms/ haul roads to account for all issues including safety and environment. • Using larger rock size and grades on the lower side of the works to assist in reducing failure risks. • Addressing stormwater overflow design and pipe capacity. • Enclosing platforms in geotextile fabric and appropriate erosion and sediment controls before clearance commences. The EWMS will be prepared in consultation with EPA and DPI (Fisheries Conservation and Aquaculture).		Pre-construction / Construction	Environment Manager / Superintendent	G36, Good practice
SW54	Watercourse crossings shall be designed in consultation with the DPI (Fisheries NSW), EPA, NOW and DoE, and where feasible and reasonable, be consistent with the *Guidelines for Controlled Activities Watercourse Crossings* (Department of Water and Energy, February 2008), *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003), *Policy and*		Construction	Environment Manager / Superintendent / Engineers	CoA B38 G36, PIR(B21)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	Guidelines for Fish Friendly Waterway Crossings (NSW Fisheries, February 2004), and *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI Fisheries, 2013). Where multiple cell culverts are proposed for crossings of fish habitat streams, at least one cell shall be provided for fish passage, with an invert or bed level that mimics watercourse flows. Where temporary crossings are required, these will be designed, constructed and maintained in accordance with *Managing Urban Stormwater Soils and Construction* Volumes 2A and 2D *Main Road Construction* (DECC 2008) and section 5.3.4 of the guideline *Managing Urban Stormwater 4th edition Volume 1 Soils and Construction* and subject to the preparation of an EWMS identified in SW2 and SW31. Temporary crossings will: • Be 'fish friendly' with a lower section of the temporary crossing provided to act as an emergency spillway. • Be used for the shortest time required to complete their designed operational function. • Use material that will not result in fine sediment material entering the waterway. • Where rock crossings are used, the rock will be of suitable size to prevent / reduce the likelihood of the material being washed away in a storm or flood event, with large sized rock on the lower side of crossings where water velocity increases. • Waterflow is to be maintained at all times in watercourses.				
SW55	Scour protection will be installed at the base of permanent and temporary drainage outlets, and will be integrated where feasible into current banks to minimise impacts.		Construction	Environment Manager / Superintendent / Foreman	G36, G38
SW56	Drainage works will be stabilised against erosion by appropriate selection of channel dimensions, slope and lining, and the inclusion, if necessary, of drop structures and energy dissipaters.		Construction	Environment Manager / Superintendent / Foreman	Good practice

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW57	Culverts and permanent stream protection measures will be installed as early as possible in the construction program to facilitate transverse drainage during the early stages of construction.		Construction	Environment Manager / Superintendent / Foreman	Good practice
MANAGEMENT OF GROUNDWATER INTERSECTION					
SW58	Further assessment involving geotechnical boreholes, monitoring boreholes and water quality testing at cutting sites will be undertaken at Type A cutting sites to monitor impacts on local groundwater reserves.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW41)
SW59	Where groundwater is released, recharge of the water table is the preferred option of managing groundwater. This will be facilitated by collecting groundwater in grassed swales for infiltration back to the groundwater source. Where possible, these swales will divert the groundwater around the construction area so that the groundwater does not further mix with construction runoff.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW42)
SW60	If recharging is not possible or suitable, then discharging groundwater will be collected via the sedimentation basins before discharge into natural waterways. If discharging to downstream groundwater, then the potential effects of mounding will be mitigated.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW43)
SW61	Dewatering of excavations will be undertaken in line with Roads and Maritime' Technical Guideline – Environmental Management of Construction Site Dewatering (Roads and Maritime, 2011c), and in accordance with any licence conditions.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW44)
GROUNDWATER					
SW62	The proposed management strategy to address potential impacts at type A cuttings includes: • Pre-works investigations ─ geotechnical investigations to determine groundwater condition (quality parameters: electrical conductivity, groundwater depth, geological information), presence of actual or potential acid sulfate soils, presence or potential of salinisation, establishing groundwater monitoring sites, and gathering of other		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW46)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	pertinent information. • Assessment – including the EIS assessment, the pre-works investigations carried out, groundwater modelling of cuts and predictions made from those results. • Monitoring – to assess whether the investigation and its predictions are accurate and to instigate early intervention in the unlikely case/s that the actual outcomes deviate from predictions. Monitoring start before construction, and continue during construction. Monitoring also continue into the operation phase of the project. • Mitigation – implement environmental and engineering management measures where predictions and/or modelling and monitoring suggest that these are required to minimise impacts on groundwater.				
SW63	The monitoring of locations in the vicinity of type B cuttings and major embankments will commence before construction to identify the need to implement any mitigation measure.		Pre-construction, construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW47)
SW64	If required to manage groundwater impacts at type A and type B cuttings and major embankments, the following engineering mitigation measures will be considered: • Engineering measures that transfer the seepage water downstream. Standard practice will be to collect the seepage from the cut face in the drainage system for the highway, which will be diverted into water quality basins before being released back into the creek or natural drainage system at some point downstream. • Engineering impact mitigation measures that transfer the seepage water (where present) into the groundwater ecosystem immediately downslope of the cutting or embankments.		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW48)
SW65	Major embankments will be designed to enable distributed flow of surface waters.		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW49)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
SW66	Measures to manage high-risk groundwater impact areas will continue to be considered through the detailed design process. In identified areas, the design of water quality controls will be reviewed and the need for additional controls may be identified.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW50)
SW67	Where reasonable and feasible, sites used for batch plants, refuelling and chemical storage will be managed so that no groundwater intrusion occurs.		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW51)
SW68	Implement mitigation measures contained in the Groundwater Management Strategy attached at Appendix E.		Pre-construction / Construction	Superintendent / Environment Manager	
WATER QUALITY AND USE					
SW69	All permanent water quality basins will incorporate measures to contain accidental fuel and chemical spills resulting from vehicle accidents on the highway. Basins will be designed to accommodate a spill volume of up to 40,000 litres.		Operation	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW59)
SW70	For water quality treatment in floodplains and other locations with minimal changes in gradient, grassed swales will be considered during detailed design.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW60)
SW71	Appropriate scour protection for drainage measures will be determined during detailed design.		Operation	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW61)
SW72	Except as may be expressly provided by an EPL, the contractor shall comply with section 120 of the Protection of the Environment Operations Act 1997. Water will be used during construction for a number of purposes, including, but not limited to: • Concrete and asphalt batching. • Dust control. • Washing of plant and equipment.		Construction	Environment Manager / Superintendent / Foreman	CoA B30, Good practice / EPL / POEO Act

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	• Drinking water. • Amenities. • Landscaping and re-vegetation. Prior to and during construction, water needs will be identified and water sources assessed to determine the most appropriate water source(s). When determining the most appropriate water source(s), the use of non-potable water sources will be considered in preference to potable water where appropriate. The water sources likely to be considered for construction include: • Creeks. • Groundwater. • Farm dams. • Sediment basins. • Rainwater collection. • Potable water. • Effluent reuse where available and meeting suitable standards. Appropriate licences and/or permits will be sought for each water source as required.				
SW73	Where available, and of appropriate chemical and biological quality, storm water, recycled water or other water sources shall be used in preference to potable water for construction activities, including concrete mixing and dust control.		Construction		CoA B35
SW74	All surface water and groundwater shall be adequately treated as far as is practicable, prior to entering the stormwater system to protect the receiving water source quality.		Construction		CoA B36
MATERIAL STORAGE AND MANAGEMENT					
SW75	Concrete pumping or concreting activities will be undertaken in accordance with Environmental Best Management Practice Guideline for Concreting Contractors 2002 to prevent and/or		Construction	Superintendent / Foreman	G38

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	minimise spillages.				
SW76	Designated impervious bunded facilities will be provided for washout of concrete trucks and cleaning and/or maintenance of other vehicles, plant or equipment. These facilities will be located at least 40 metres away from natural and built drainage lines.		Construction	Superintendent / Foreman	G38
SW77	An EWMS for managing tannin leachate (tannin leachate management protocol) will be prepared in accordance with the RMS Environmental Direction for the Management of Tannins from Vegetation Mulch attached at Appendix D. The requirements include detail on: • Planning and staging vegetation processing activities. • Stockpile location and management to minimise the production and release of tannins. • Monitoring the stockpiles for the production of tannins. • Response to tannin production.		Construction	Environment Manager / Foreman	RMS Environmental Direction for the Management of Tannins from Vegetation Mulch CoA D26(c)vi
SW78	Where refuelling on site is required, the following management practices will be implemented: • Refuelling will be undertaken on level ground and at least 20 metres from drainage lines, waterways and/or environmentally sensitive areas. • Refuelling will be undertaken within the designated refuelling areas with appropriate bunding and/or absorbent material. • Refuelling will not be undertaken on or in the vicinity vegetated areas (even roadside grasses). • Refuelling will be attended at all times. • Spill kits will be readily available and personnel trained in their use. A spill kit will be kept on the refuelling truck at all times. Hand tools will be refuelled within lined trays of site vehicles wherever possible.		Construction	Foreman	Good practice
SW79	Physical controls to address the potential risks associated		Construction	Environment Manager /	Submissions / PIR

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	with the use and storage of chemicals on site will include: • Use of appropriately bunded storage facilities for chemicals and fuels. • Use of appropriately bunded areas for refuelling and washdown. • Availability of effective spill kits at all construction sites.			Superintendent / Foreman	(SSW37)
CONTAMINATION					
SW80	A Stage 1 Preliminary Site Investigation will be conducted to verify past and present potentially contaminating activities, potential contaminants of concern and the need for further investigation. This will include a review of past highway crashes and spills and the associated contamination risks.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (SSW17)
SW81	If necessary, a Stage 2 Detailed Site Investigation will be undertaken to: • Provide information on the type, nature, extent and concentrations of contamination present, and the corresponding risks to human health and the environment. • Examine pathways of contaminant dispersal and exposure, the potential for off-site impacts and the management requirements and options.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (SSW18)
SW82	If required, a Stage 3 Remedial Action Plan will be produced, detailing the remediation goals, environmental safeguards, and any necessary approval and licence requirements in accordance with NSW Office of Environment and Heritage guidelines.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (SSW19)
SW83	Where further assessment indicates that further action is not required, Roads and Maritime' Contaminated Land Management Guideline (RTA, 2005a) will be applied to address any contamination issues and prevent any associated adverse impacts.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (SSW20)
SW84	A hazardous materials buildings assessment will be carried out before the demolition of any structures or buildings to identify the issues of concern and the management		Construction	Environment Manager / Superintendent /	Submissions / PIR (SSW21)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	requirements. This is required under Clause 1.6 of Australian Standard AS 2601 – 2001 The Demolition of Structures.			Foreman	
SW85	An emergency spill response plan will be developed and incorporated into the soils and water management plan. This plan will detail measures for the prevention, containment and clean-up of accidental spills of fuels and chemicals.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW22)
SW86	The storage, handling and use of the chemicals and fuels will be in accordance with the Work Health and Safety Act 2000 and Workcover's Storage and Handling of Dangerous Goods Code of Practice (WorkCover, 2005).		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW23)
ACID SULFATE SOILS					
SW87	All ASS or PASS disturbed during the construction process will be managed in accordance with RMS Acid Sulfate Soil Management Procedure attached at Appendix C. Specific controls to be implemented will include: • Capping of exposed surfaces with clean fill to prevent oxidation. • Placing excavated acid sulfate soils separately in a lined, bunded and covered area. • Neutralising acid sulfate soils for reuse (where appropriate) by using additives such as lime. • Disposing of acid sulfate soils where necessary in accordance with the relevant guidelines set out in DECC (2008). The requirements will be incorporated into the EWMS for "Management of Acid Sulfate Materials" referred to in SW6.		Construction	Foreman / Superintendent / Environment Manager	EIS (SSW31, SSW32)
SW88	Strategies to remove / reduce risks associated with acid sulfate soils will be identified.		Pre-construction and Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW24)
SW89	An acid sulfate soils management plan will be implemented in accordance with Guidelines for the Management of Acid Sulfate Materials (Roads and Maritime 2005) and Waste Classification Guidelines Part 4: Acid Sulfate Soils (DECC		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (SSW25)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	2008), where there is a probability of encountering acid sulfate soils during construction.				
REHABILITATION AND LANDSCAPING					
SW90	Disturbed areas will be progressively stabilised during the construction phase eg with a cover crop, hydromulch, hydroseeding, topsoil and/or mulch. Wherever possible, permanent landscaping and revegetation works will take place progressively in accordance with the Urban Design and Landscape Plan.		Construction	Superintendent / Foreman	G38, EIS (SSW7)
MONITORING					
SW91	Surface water quality monitoring will be undertaken in accordance with Roads and Maritime' Guideline for Construction Water quality Monitoring (RTA, 2003), and as per the framework outlined in the Working paper – Water quality.		Pre-construction	Superintendent / Foreman / Environmental Manager / Environment Officer	Submissions / PIR (SSW62)
SW92	Groundwater monitoring will be undertaken in accordance with the framework outlined in the Working paper – Groundwater (Section 5.2).		Construction	Superintendent / Foreman / Environmental Manager / Environment Officer	Submissions / PIR (SSW63)
SW93	Rainfall forecasts will be monitored daily and the site managed to avoid erosion and sedimentation, and to minimise the impact of heavy rainfall and flood events.		Construction	Superintendent / Foreman / Environmental Manager / Environment Officer	G38
SW94	Erosion and sediment controls will be inspected at least daily (with maintenance and/or modifications made as necessary). Inspections and/or maintenance during wet-weather maybe increased where necessary.		Construction	Foreman	Good practice
SW95	A project soil conservation specialist will inspect the work areas, typically on a fortnightly basis, or as required where high-risk activities are proposed, or where sensitive areas		Pre-construction / Construction	Soil Conservation Specialist	Good practice / EPL / POEO Act

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	have the potential to be affected eg SEPP 14 wetland, heritage sites.			Environment Manager	
SW96	Monitoring of sediment basin water quality will be undertaken in accordance with EPL requirements. See Sediment Basin Management and Discharge Procedure in Appendix G.		Construction	Environment Officer	Appendix G
RECORDS					
SW97	Records of dewatering activities will be maintained. Details will include: i. A copy of the work method statement(s). ii. Date, time and estimated volume released at each discharge location. iii. Water quality test results for each discharge. iv. The personnel approving the dewatering activities. v. Evidence of discharge monitoring, or risk assessment and mitigation measures used to eliminate the risks of pollution.		Construction	Environment Manager	G36
HYDROLOGY AND FLOODING					
HF1	Any permanent fencing at culvert and bridge crossings will consider the potential for blockage and be designed and operated to maintain the existing flood regime.		Pre-construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (HF4)
HF2	Detailed design for permanent road fencing will consider hydrology and flooding impacts.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF5)
HF3	Waterway diversions will be designed in consultation with Office of Environment and Heritage, NSW Office of Water and Department of Primary Industries (Fisheries) so that the final diversion mimics, where feasible and reasonable, the characteristics of the waterway that is being diverted. Characteristics include flow regime, flow velocity, base material, vegetation and habitat for aquatic fauna.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (HF7)
HF4	Revegetation of waterway diversions and surrounding areas		Construction	Environment	Submissions / PIR

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	will be undertaken in accordance with the following principles: • Diversions will be stabilised prior to the diversion receiving flows, in conjunction with the establishment of other scour and erosion control measures. • Diversions will establish appropriate vegetation communities along the channel bed and banks, using endemic native species.			Manager / Superintendent / Foreman	(HF8)
HF5	Batter stability will be assessed and sufficient room provided on both sides of the diversion to allow access for maintenance and to meet batter stability requirements.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF10)
HF6	Farm dams located within or partially within the project boundary will be acquired as part of the acquisition process in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF11)
HF7	Potential impacts to farm dams located downstream of the project that are fed by catchments upstream, and that have a diversion of rainfall as a result of the project, will be considered during the relevant property acquisition process.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF12)
HF8	Detailed design will consider flood access and evacuation for affected landowners including changes in stock access routes.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF13)
HF9	The level of flood immunity of Eggins Drive into Corindi will be built at a 100 year ARI as agreed with Coffs Harbour City Council.		Construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (HF14)
HF10	Appropriate span lengths of bridges will be specified during detailed design that considers the susceptibility of individual watercourse crossings to debris blockage.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF18)
HF11	All work within 40 metres of a permanent watercourse, crossed by the project, will be undertaken in accordance with the NSW Office of Water 'Guidelines for Controlled Actions'		Construction	Environment Manager / Superintendent /	Submissions / PIR (HF19)

ID	Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
	and industry best practice including maintaining where feasible and reasonable the geomorphic integrity and natural hydrological flow regime.			Foreman	
HF12	The need for design modifications to address changes in flood behaviour as a result of climate change will be considered in accordance with Roads and Maritime' Climate Change Plan (Roads and Maritime, 2012).		Pre-construction and operation	Environment Manager / Superintendent / Foreman	Submissions / PIR (HF21)
HF13	Recommendations made in Table 8-8 of Working paper – Hydrology and flooding to minimise the flood impacts of ancillary facilities will be considered in the final location and layout of ancillary facilities.		Pre-construction	Construction Manager / Environment Manager	Submissions / PIR (HF22)
HF14	Consultation with affected landowners will be undertaken during detailed design and construction regarding flooding impacts on properties, residences and other structures.		Pre-construction and construction	Environment Manager / Superintendent / Foreman	Submissions / PIR (HF30)
HF15	The contractor shall employ a suitably qualified and experienced independent hydrological expert, whose appointment has been endorsed by the Sectary, to deal with all hydrological matters and assist in negotiating feasible and reasonable mitigation measures.		Pre-construction and construction	Environment Manager /	CoA D15
HF16	The contractor shall provide feasible and reasonable assistance to the relevant council and/or NSW State Emergency Service, to prepare any new or necessary update(s) to the relevant plans and documents in relation to flooding, to reflect changes in flooding levels, flows and characteristics as a result of the SSI.		Environment Manager	Environment Manager	CoA D16

7 Compliance management

7.1 Roles and responsibilities

The OHLY Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Section 6 of this Plan.

7.2 Training

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

- Existence and requirements of this sub-plan.
- 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 / Pollution Incident Response Management Plan (PIRMP).
- Preparedness for high rainfall events.
- Lessons learnt from incidents and other event eg high rainfall/flooding.
- Mulch and tannin management.
- Spill response.
- Stockpile location criteria.
- Identification of potentially contaminated spoil and fill material.

Further details regarding staff induction and training are outlined in Section 5 of the CEMP.

7.3 Monitoring and inspection

Regular monitoring and inspections will be undertaken in the lead up to, during and following 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.
- Weekly and post rainfall inspections to evaluate the effectiveness of erosion and sediment controls measures in accordance with Section 8.1.1 of the CEMP.
- All monitoring will be carried out in accordance with AS 5667.1 1987.

The type, timing, frequency, assessment criteria and associated reporting requirements are detailed in the Water Quality Monitoring Program (required as per CoA D12) attached at Appendix A.

Additional requirements and responsibilities in relation to inspections are documented in Section 8.2 of the CEMP.

7.4 Licenses and permits

An Environmental Protection Licence (EPL) will be obtained for the scheduled activity “road construction”. The EPL typically prescribes water quality parameters to be measured and associated discharge criteria. They also detail the monitoring and analytical requirements by reference to authority publications eg Approved Methods for Sampling and Analysis of Water Pollutants in NSW, 2004.

Any other relevant licenses or permits will be obtained in the lead up to and during construction as required. Refer to CEMP – Section 3.3 Approvals, permits & Licences.

7.5 Weather monitoring

Rainfall at the premises will be measured and recorded in millimetres per 24-hour period at the same time each day from the time that the site office associated with the activities is established. Automatic rainfall intensity/ weather devices will be installed on the project, likely to be at the major compounds. The data collected from the automatic weather stations shall;

- Provide a more detailed early understanding of potential rainfall and other adverse weather impacts
- Provide a proactive and early inspection and maintenance regime response to erosion and sedimentation and the effects of other adverse climatic conditions before pollution occurs
- Trigger weather alarms and messages to relevant site personnel to take action where appropriate
- Assess and validate the performance of installed erosion and sediment control measures against the design performance criteria, and
- Provide compliance data for statutory monitoring on-site.

The stations shall record rainfall, temperature, relative humidity, wind speed, wind direction and bathometric pressure. The rain gauge within each mobile automatic weather station shall be of the tipping bucket type. The stations shall have a battery or voltage meter and shall target 98% reliability. Manual rain gauges will also be used across the project to assist with assessment of rainfall data accuracy. The weather stations shall conform to relevant standards for the location of such devices and shall be fully protected and secured.

Data from the automatic weather stations shall be accessible via SMS alarms or queries to a mobile phone and downloadable to a desktop console logger or laptop computer. SMS queries and alarms shall be sent to RMS Representatives as necessary. All data shall be accessible at all times by the RMS representative(s). The mobile automatic weather stations shall download data to the internet and allow live views of weather data by authorised users, which shall include RMS Representative(s), and the Environmental Representative. The mobile automatic weather stations shall also be compatible with and communicate live data to RMS's online weather station page.

In accordance with normal standard construction practices weather forecasts shall be used to guide work activities undertaken on-site. Forecasts shall be checked at the start of each day and prior to undertaking new work activities that may be affected by rainfall or adverse weather. Where weather forecasts predict conditions that may pose an environmental risk, site environmental controls shall be inspected and secured to reduce erosion and sediment control impacts. Contingency planning to prevent spills shall also involve monitoring for predicted flood events and the removal of fuels and chemicals from flood prone areas.

7.6 Auditing

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

Audit requirements are detailed in Section 8.3 of the CEMP.

7.7 Reporting

Reporting requirements and responsibilities are documented in the Water Quality Monitoring Program, and Chapter 7 and Section 8.3 of the CEMP. Similarly, the Groundwater and Soil Salinity Reporting requirements will also be addressed.

8 Review and improvement

8.1 Continuous improvement

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

The continuous improvement process will be designed to:

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

8.2 SWMP update and amendment

The processes described in Section 8 and Section 9 of the CEMP may result in the need to update or revise this Plan. This will occur as needed.

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

A copy of the updated plan and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.

Appendix A
Water Quality Monitoring Program

Appendix B
Spoil and Fill Management Procedure

Spoil & Fill Management Procedure

Distribution

There are no restrictions on the distribution/circulation of this Procedure within the Project.

Purpose

This document details the OHLY procedure for Spoil and Fill Management.

Induction/Training

Personnel involved in Spoil and Fill management will be trained in the requirements of this Procedure during the Project induction and/or regular toolbox talks.

Scope

This Procedure is applicable to all activities conducted by personnel on the Project that involve Spoil and Fill management.

Excavated Natural Material (ENM) is covered by resource recovery exemption and must undergo testing in accordance with the ENM exemption should off-site disposal (to landfill or off-site landholder) be proposed. The landfill facility must be appropriately licenced to receive ENM to be disposed. Disposal of ENM off-site to a private or publically owned site requires that the landholder be issued a written statement of compliance to the ENM exemptions and a Section 143 Notice and where necessary it is confirmed that the landowner has an appropriate development approval from the relevant planning authority (Council), as required by the *Protection of Environment Operations of Act 1997*. Excavated Public Road Material (EPRM) shall not be applied on private land. An Environment Protection Licence (EPL) is not required for either situation.

Similarly, EPRM materials require testing to ensure that they are in compliance with the relevant resource recovery exemption if to be used outside of a road corridor (for road construction and maintenance) or if there is evidence of potential past contamination. If disposal is proposed, the landfill facility must be appropriately licenced to receive the EPRM. Disposal of EPRM off-site to a private or publically owned site requires the landholder be issued with a written statement of compliance to the waste exemptions and a Section 143 Notice. An Environment Protection Licence (EPL) is not required for either situation.

Topsoil can be reused on-site during revegetation/rehabilitation works.

1. - Disposal from site

This will be undertaken in accordance with the waste and energy management plan and the aforementioned methodology for each type of exempt material.

2. – Spoil and Fill Storage

Stockpiles will be established in the locations identified in Figure 2 of the SWMP and at Roads and Maritime Stockpile site three to the north of the site adjacent to the Pacific Highway. The stockpiles will be managed in accordance with the Stockpile Management Protocol (*Appendix H*) and the Primary Erosion and Sediment Control Plan. Where possible, fill to be used for construction will be placed in the location it is required to prevent double handling.

3. – Spoil and Fill Transportation

Where possible, transportation will be undertaken within the project corridor. The staging of the project has been developed such that movements of material excavated on the project will not utilise the existing Pacific Highway. In instances where haulage of cut material is required by public road, exit from and entry to the Project will be via specific project access points, using designated haul routes, as detailed in the Project Traffic Management Plan.

4. – Record Keeping

Section 143 certificates are required for any material to be disposed of outside the Project boundary and landfill disposal tickets for material disposed of to landfill will be completed/obtained by engineers and/or the site foreman.

Records of any laboratory analysis required to determine compliance with waste exceptions will also be retained.

Procedure

1. – Classification of Spoil.

a) Virgin excavated natural material (VENM)

VENM will be encountered in areas that have not in any way been impacted by development or industry (e.g. natural clay road embankments).

During the Project, VENM will be confirmed as clean through visual observation of landform, understanding of past land uses and based on findings from the geotechnical reports.

b) Topsoil

Topsoil assessed as clean, and fertile will be stockpiled for reuse on site during rehabilitation works. Stockpiles will be no greater than 2m in height, where possible, and have batters with a maximum slope of 2:1. Stockpiles will be regularly assessed for weed invasion.

Topsoil will be sampled and tested by a National Association of Testing Authorities (NATA) accredited laboratory prior to reuse. Soil requiring treatment will be dosed with the appropriate ameliorants prior to placement.

c) Clean fill material

Fill material will be encountered in areas typically associated with previously developed lands (e.g. road embankments of the existing highway) and may include:

- Excavated Natural Material (ENM);
- recovered aggregates;
- reclaimed asphalt pavement; and
- Excavated public road material (EPRM).

d) Potentially contaminated material

Potentially contaminated material may be identified during the course of the Project and will be handled in accordance with the "Unexpected Discovery of Contaminated Land Procedure", which is contained in the Appendix A of the Contaminated Land Management Plan (CEMP Appendix B8).

2. Reuse on-site

The Project can reuse any material on-site that has been classified as VENM or Clean Fill Material as outlined below, however all industrial material must be disposed off-site in accordance with legal disposal requirements.

No sampling or testing is required if the material is being re-used within a road corridor, unless there is evidence that potentially contaminating activities previously took place on the excavation site (e.g. former service station site, cattle tick dip site, asbestos has been dumped on the site). An Environment Protection Licence (EPL) is not required if the material is to be reused within the road corridor for construction and maintenance of roads.

Appendix C
Acid Sulfate Soil Management Procedure

Acid Sulphate Soil Chance Find Procedure

1 Distribution

There are no restrictions on the distribution/circulation of this Procedure within the Woolgoolga to Halfway Creek Project.

2 Purpose

This procedure details the actions to be taken when actual Acid Sulphate Soils (ASS) or Potential Acid Sulfate Soils (PASS) are unexpectedly encountered during excavation / construction activities.

3 Induction / Training

Where required, JV personnel need to be inducted on the identification of ASS/PASS including this procedure during the project induction, site inductions and regular toolbox talks.

4 Scope

This procedure is applicable to all activities conducted by JV personnel that have the potential to uncover/disturb ASS/PASS.

Figure 1 - Acid Sulphate Soils Chance Find Flow Chart summarises the steps required to effectively manage a chance find discovery of ASS/PASS.

5 Procedure

1. Unexpected Disturbance of ASS / PASS

If on-site personnel suspect that ASS or PASS has been unexpectedly disturbed, stop work in the immediate vicinity, notify the Environment Officer (EO) and recommence work in an alternate area where possible. The EO is responsible for testing of ASS/PASS.

ASS Characteristics:

Any of the following characteristics may indicate the presence of ASS:

- Soil pH of <4
- 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
- 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)

Examples of ASS material;

Photo 1 – Temporary treatment area **Photo 2 – Testing for acid sulfate soil**

The EO will undertake testing to determine the acidity (field pH test) and potential for acidity (field 30% peroxide test). The procedure for conducting the 30% field peroxide test and indicators of positive results are included at the end of this procedure.

If it is shown conclusively that the material is not ASS or PASS, construction can proceed as normal. If results are positive or inconclusive proceed to Step 2.

2. Positive or Inconclusive Test for ASS / PASS

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. In this event all disturbed undetermined material must be stockpiled and bunded in accordance with document **Treatment of ASS Procedure.**

If the net acidity results confirm the presence of ASS/PASS, the material will be treated in accordance with the above procedure with appropriate liming rates based on Chromium Suite analysis results.

3. Personal Protective Equipment (PPE)

Prior to any PASS / ASS treatment, appropriate personal protective equipment (PPE) is to be worn as per the MSDS (e.g. for Lime)

This may include:

Eye goggles;

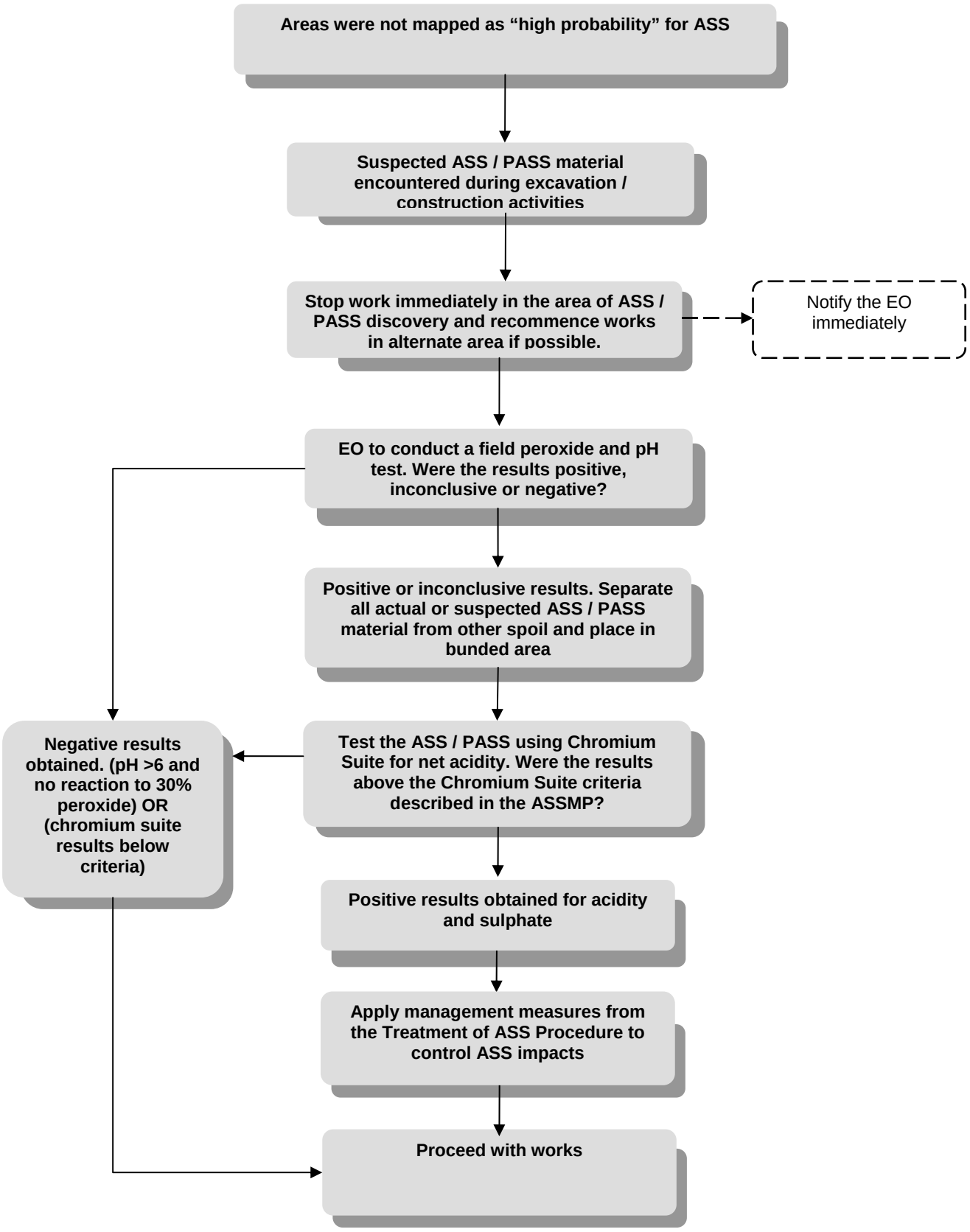
Hard hat;

Face mask;

Rubber boots, gloves; and

Appropriate clothing (e.g. long sleeved pants and shirts)

Figure 1 - Acid Sulphate Soils Chance Find Flow Chart



Field pH and the 30% Peroxide Test

ASSMAC Assessment Guidelines

1 Field pH Test

The field pH (pHF) of actual ASS tends to be ≤ 4 while the field pH of PASS tends to be neutral. Field pH provides a useful quick indication of the likely presence and severity of "actual" acid sulphate soils. The field pH is a qualitative method only that cannot be used as a substitute for laboratory analysis in the identification of acid sulphate soils for assessment purposes.

Field pH readings should be taken at regular intervals down the soil profile. It is recommended this test be done every 0.25m down the profile but at least every 0.5m interval or horizon whichever is the lesser until 1 below excavation.

pH Indications:

- pH readings of pH ≤4, indicates that actual acid sulphate soil are present with the sulphides having been oxidised in the past, resulting in acid soil (and soil pore water) conditions.
- pH values >4 and <5.5 are acid and may be the result of some previous or limited oxidation of sulphides, but is not a definite confirmation of actual ASS. Substantial exchangeable / soluble aluminium and hydrogen ions usually exist at these pH values. Other factors such as excessive fertiliser use, organic acids or strong leaching can cause pH >4 - <5.5. Field pH alone cannot indicate potential ASS as they may be neutral to slightly alkaline when unoxidised, laboratory testing required.

In order to test for potential acid sulphate soils that contain unoxidised sulphides, peroxide is used to rapidly oxidise the iron sulphides (usually pyrite), resulting in the production of acid with a corresponding drop in pH.

Notes on pH equipment
Preferably a battery powered, field pH meter with a robust, spear point, double reference pH electrode should be used. The probe can be inserted directly into soft wet soils or soil mixed up into a paste with deionised water. Care must be exercised not to scratch the electrode on sandy or gravely soils. The probe should be standardised prior to use and regularly during use against standard solutions according to the manufacturer's instructions. Alternatively, an approximate 1:5 ratio of soil:deionised water suspension can be made up in small tubes, hand shaken and pH of the solution measured. pH test strips can be used to give an approximate value (pH +/- 0.25). Raupach soil pH test kits should be used with caution as they can give erroneous results. Both these latter methods are based on mixed indicator solutions that give a pH dependant colour and are subject to interferences.

2 Field Peroxide pH Test

To test for the presence of unoxidised sulphides and therefore PASS, the oxidation of the soil with 30% (100 volume) hydrogen peroxide can be performed in the field. The most common method is:

A small sample of soil (approx. 5 g) is placed in a small glass container (e.g. short clear centrifuge tubes, clear tissue culture clusters or sample jar) and a small volume of peroxide is dropped onto the soil (20 mL).

Note: Allow the digested solution to cool after the reaction.

A pH probe will only measure to 60°C.

The reaction should be observed and rated. In some cases, the reaction may be instantaneous; in others, it may take 10 minutes or more. Heating over hot water or in the sun may be necessary to start the reaction on cool days, particularly if the peroxide is cold.

Potentially positive reactions for PASS include one or more of the following:

- change in colour of the soil from grey tones to brown tones
- effervescence
- the release of sulphurous odours
- final pH of <3.5 and preferably < 3
- lowering of soil pH by at least one pH unit

The strength of the reaction is a useful indicator. The peroxide test is most useful and reliable with clays and loams containing low levels of organic matter. It is least useful on coffee rock, sands or gravels, particularly dredged sands with low levels of sulphuric material (e.g. <0.05 % S). With soils containing high organic matter (such as surface soils, peats, mangrove / estuarine muds, and marine clays), care must be exercised when interpreting the reaction as high levels of organic matter and other soil constituents particularly manganese oxides can also cause a reaction.

Note of caution with the use of peroxide

30 % hydrogen peroxide is a strong oxidising agent and should be handled carefully with appropriate eye and skin protection. This test should be only undertaken by trained personnel.

The pH of analytical grade peroxide may be as low as 3 as manufacturers stabilise technical grade peroxide with acid, The peroxide pH should be checked on every new container and regularly before taking to the field and adjusted to 4.5 - 5.5 with a few drops of 0.1M NaOH if necessary. False field pH_{FOX} readings could result if this step is not undertaken.

3 pH After Oxidation

The measurement of the change in the pH_{FOX} following oxidation can give a useful indication of the presence of sulphuric material and can give an early indication of the distribution of sulphide down a core/ profile or across the site. The pH after oxidation test is not a substitute for analytical test results.

If the pH_{FOX} value is at least one unit below field pH_F, it may indicate potential acid sulfate soils. The greater the difference between the two measurements, the more indicative the value is of a potential acid sulfate soils. The lower the final pH_{FOX} value is, the better the indication of a positive result.

- If the pH_{FOX} < 3 and there was a strong reaction to the peroxide, there is a high level of certainty of a potential acid sulfate soils. The more the pH_{FOX} drops below 3, the more positive the presence of sulphides.
- A pH_{FOX} 3-4 is less positive and laboratory analyses are needed to confirm if sulphides are present. Sands particularly may give confusing field test results and must be confirmed by laboratory analysis.
- For pH_{FOX} 4-5 the test is neither positive nor negative. Sulphides may be present either in small quantities and be poorly reactive under quick test field conditions. In some cases, the sample may contain shell / carbonate that neutralises some or all acid produced by oxidation. In other cases, the pH_{FOX} value may be due to the production of organic acids and there may be no sulphides present. In these cases, analysis for sulphur using the POCAS method would be the best to check for the presence of oxidisable sulphides.
- For pH >5 and little or no drop in pH from the field value, little net acid generating ability is indicated. Again, the sulphur trail of the POCAS method should be used to check some samples to confirm the absence of oxidisable sulphides.

Note of caution with testing of soil with high organic content

Note: When selecting soil for testing it is advisable to avoid material high in organic matter as the oxidation of organic matter can lead to the generation of acid. However pH of soils containing organic matter and no pyrite do not generally stay below 4 on extended oxidation. In general positive tests on apparently well drained'' surface soils should always be treated with caution and followed up with laboratory confirmation.

Care is needed with interpretation of the result on highly reactive soils. Some soil minerals other than pyrite react vigorously with peroxide, particularly manganese but may only show small pH changes.

The field peroxide tests can be made more consistent if a fixed volume of soil (using a small scoop) is used, a consistent volume of peroxide is added and left to react for an hour, and the sample is made up to a fixed volume with deionised water before reading. However, such procedures take time in the field and are more suited to a 'field shed' situation. When effervescence (sometimes violent) has ceased, a few additional mL of peroxide should be until the reaction appears complete. If the reaction is violent, it is recommended that added deionised water be added to cool and dilute the reaction. The test may have to be repeated with a small amount of water added to the soil prior to peroxide addition. The pH_{FOX} of the resultant mixture is then measured.

Treatment of Acid Sulphate Soil Procedure

1 Distribution

There are no restrictions on the distribution/circulation of this Procedure within the Woolgoolga to Halfway Creek Project.

2 Purpose

This procedure details the method of testing and treatment for actual Acid Sulphate Soils (ASS) and Potential Acid Sulphate Soils (PASS).

3 Induction / Training

Where required, JV personnel will be inducted on the identification of ASS/PASS along with this procedure during the project induction, site inductions and regular toolbox talks.

4 Scope

This procedure is applicable to all activities conducted by JV personnel that have the potential to uncover/encounter ASS/PASS.

Figure 1 - Treatment of Acid Sulfate Soils Flow Chart summarises the steps required to effectively treat ASS/PASS.

5 Procedure

1. Actual or Potential Acid Sulfate Soils encountered during excavation / construction activities

If ASS/PASS is encountered by chance during excavation / construction activities:

- **STOP ALL WORK** in the immediate / affected area and follow the steps detailed in **Acid Sulphate Soil Chance Find Procedure**.
- Recommence works in alternate area where practicable.

If ASS/PASS is expected during excavation and test results are available to determine treatment rates, then proceed to **Step 4** of this procedure.

Action Criteria for determining if neutralisation treatment of soil is required is provided in Table 5.1.

2. Identification of ASS / PASS

The identification of unexpected ASS/PASS shall be performed as detailed in **Acid Sulphate Soil Chance Find Procedure**.

3. Personnel Protective Equipment (PPE)

Prior to any PASS / ASS management, appropriate personal protective equipment (PPE) is to be worn as per relevant MSDSs (e.g. for Lime). This may include:

Eye goggles and/or face masks;

Hard Hat;

Rubber boots, gloves; and

Appropriate clothing (e.g. long sleeved shirts)

4. ASS / PASS Storage and Handling

Organising the storage and handling of ASS/PASS is the responsibility of the Foreman. If ASS/PASS cannot be immediately transported to the specific treatment area, it may be stockpiled in temporary locations near to the excavation, at least 20 metres from waterways

and drainage lines.

If the material is to be stored for more than 24 hours, a bed of aglime (5kg/m2) must be spread over the storage location and the material removed to the treatment area as soon as practicable. ASS / PASS must be contained in adequately bunded areas and the DECCW contacted to determine the most appropriate management strategy.

All runoff from the interim storage sites greater than 5 days shall be treated in the same way as leachate from ASS treatment areas.

Transport of ASS/PASS material

Will be made via haulage trucks with adequate tailgates to prevent spillage of material onto public or construction access roads.

Haulage routes would be monitored routinely for ASS material and any spills are to be cleaned up appropriately and material returned to the ASS treatment facility as soon as possible.

ASS Treatment Area

ASS / PASS treatment areas will be constructed. An example ASS Treatment Area Layout is provided in Figure 2.

The ASS treatment area may be divided into segregated lots or 'cells' to separate material from different sections of the alignment.

Designated ASS treatment areas will be outlined to construction personnel as part of ongoing tool box talks. During these talks, the Foreman is to stress that the ASS treatment area will be clearly signposted and is for ASS / PASS material only, and that other unsuitable material is to be assessed and treated separately from the ASS treatment area.

5. ASS / PASS Treatment

ASS / PASS treatment will occur within the ASS treatment area, Material which is transported to the 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 Environment Officer (EO).

Aglime will be stored in 'dry areas' such as elevated holding bin or zero permeability bunded stockpiles. A tarpaulin is necessary to cover stockpiles to minimise dust generation and to keep the aglime dry as it is difficult to handle when wet.

Stockpiling of aglime outside the ASS treatment area shall be in accordance with **Stockpile Location Procedure**.

Mixing of Aglime (of alternative) and ASS

Aglime (or alternative) shall be added in appropriate ratio and/or based on results of Chromium Suite testing. Two options are available for the addition of aglime, advice from Environment Manager / Geotechnical Representative / Laboratory shall be sought also:

1. The first option is for when disturbed material is to be placed back into the excavation once finished such as for service relocations. In this instance add the lime over the top of the pre-disturbed soil in the appropriate quantities, providing immediate mixing and treatment;
2. The second, and preferred, option is done post ASS extraction in the ASS treatment area and the following process followed:
    a. 1/3 of the total aglime required for the excavated material (determined from lab

testing) will be placed as a bed over the proposed treatment location.

b. ASS or PASS material is to be placed on top of the lime in a layer no greater than 350mm and allowed to dry sufficiently.

c. When the material is dry (expected 1-2 days in dry weather), another 1/3 of the total lime shall be added to the top and sides of the stockpile and thoroughly mixed, using either small or large mechanical equipment such as a disc plough or rotary hoe attached to a tractor or other suitable equipment.

d. The partially treated stockpile shall then be allowed to dry further if required.

e. The remaining 1/3 of lime shall be added to the top and sides of the stockpile.

f. Thoroughly mix the stockpile using a rotary hoe (either on a tractor or as an excavator attachment). Where an excavator is to be used increase the safety factor to 2-2.5 dependent on the difficulty of mixing lime into the material.

g. Validation testing is required as per Step 6.

h. The treated soil is then considered to be neutral and can be reused as general fill material. The final location of the neutral soil shall then be tracked and recorded in the **Treated ASS Tracking Register**.

Note: the ratios of aglime to be added may be varied on approval by the Environment Manager.

6. Treated ASS / PASS Monitoring

Following mixing and additional drying if required, the treated soil is to be tested by laboratory analysis using the Chromium Suite method to determine if the criteria for sulphur and acid trails have been met (see Action Criteria in table below).

For the initial month of treatment area operation, samples will be taken from each treated stockpile or area to determine if the treatment process is effective. Following initial confirmation of neutralisation, laboratory testing using the Chromium Suite method will be undertaken monthly to ensure continued compliance with neutralisation criteria.

Treated ASS / PASS will be determined to be neutral if results for the acid and/or sulphur trails are below the criteria detailed in the table below. Consideration must be given to the amount of treated soil and the soil texture. If any doubt exists over either factor, the lowest criteria of 0.03% oxidisable sulphur or 18 Mol H+ per tonne shall be used.

If testing shows the criteria are met, and the pH of the soils and leachate pond does not fall below 6.5 no further treatment is required and the material may be reused on site. A record of where this treated material is transported to must be kept via **Treated ASS Tracking Register**.

If these acid and sulphur criteria are not met, further mixing with additional treatment product is required on the relevant material until targets are met. The amount of additional treatment product can be determined from results of the sulphur and acid trails.

When the pH of the leachate pond falls below 6.5 the water must be treated using hydrated lime in the ratio detailed in Table 1.2. The Acid Sulphate Treatment Area (ASTA) must be constructed so that all surface flows are directed to a bunded and impervious ASS leachate pond. The leachate point's discharge point will be defined by the approved erosion and sediment control plan. The capacity of the leachate should be designed as a minimum 85% 5 day annual average rainfall using local data station (Coffs Harbour) to minimise the potential for uncontrolled non-compliant waters during rainfall.

ASS / PASS material will be treated as much as possible. However, 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 Environment Manager / Environment Officers will liaise with a licensed waste facility and coordinate the process.

Table 1.1 - Action Criteria (for determining if neutralisation treatment of soil is required)

TYPE OF MATERIAL		ACTION CRITERIA 1-1000 TONNES DISTURBED		ACTION CRITERIA >1000 TONNES DISTURBED	
Texture	Approx Clay Content %	Equivalent Sulphur % S Oxidisable	Equivalent Acid Mol H+ / tonne TPA	Equivalent Sulphur % S Oxidisable	Equivalent Acid Mol H+ / tonne TPA
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	1	62	0.03	18

Table 1.2 - Leachate Pond Hydrated Lime Treatment Ratios

Quantity of pure neutralising agent required to raise from existing pH to pH 7 for 1 megalitre of low salinity acid water.

Current Water pH	*$[H^+]$ {mol/L}*	*H^+ in 1 Megalitre {mol}*	*Lime to neutralise 1 Megalitre {kg pure $CaCO_3$}*	*Hydr. lime to neutralise 1 Megalitre {kg pure $Ca(OH)_2$}*	*Pure $NaHCO_3$/ 1 Megalitre {kg }*
0.5	.316	316,228	15,824	11,716	26,563
1.0	.1	100,000	5,004	3705	8390
1.5	.032	32,000	1,600	1185	2686
2.0	.01	10,000	500	370	839
2.5	.0032	3,200	160	118	269
3.0	.001	1,000	50	37	84
3.5	.00032	320	16	12	27
4.0	.0001	100	5	4	8.4
4.5	.000032	32	1.6	1.18	2.69
5.0	.00001	10	0.5	0.37	0.84
5.5	.0000032	3.2	0.16	0.12	0.27
6.0	.000001	1	0.05	0.037	0.08
6.5	.00000032	.32	0.016	0.12	0.027

Figure 1 - Treatment of Acid Sulfate Soils Flow Chart

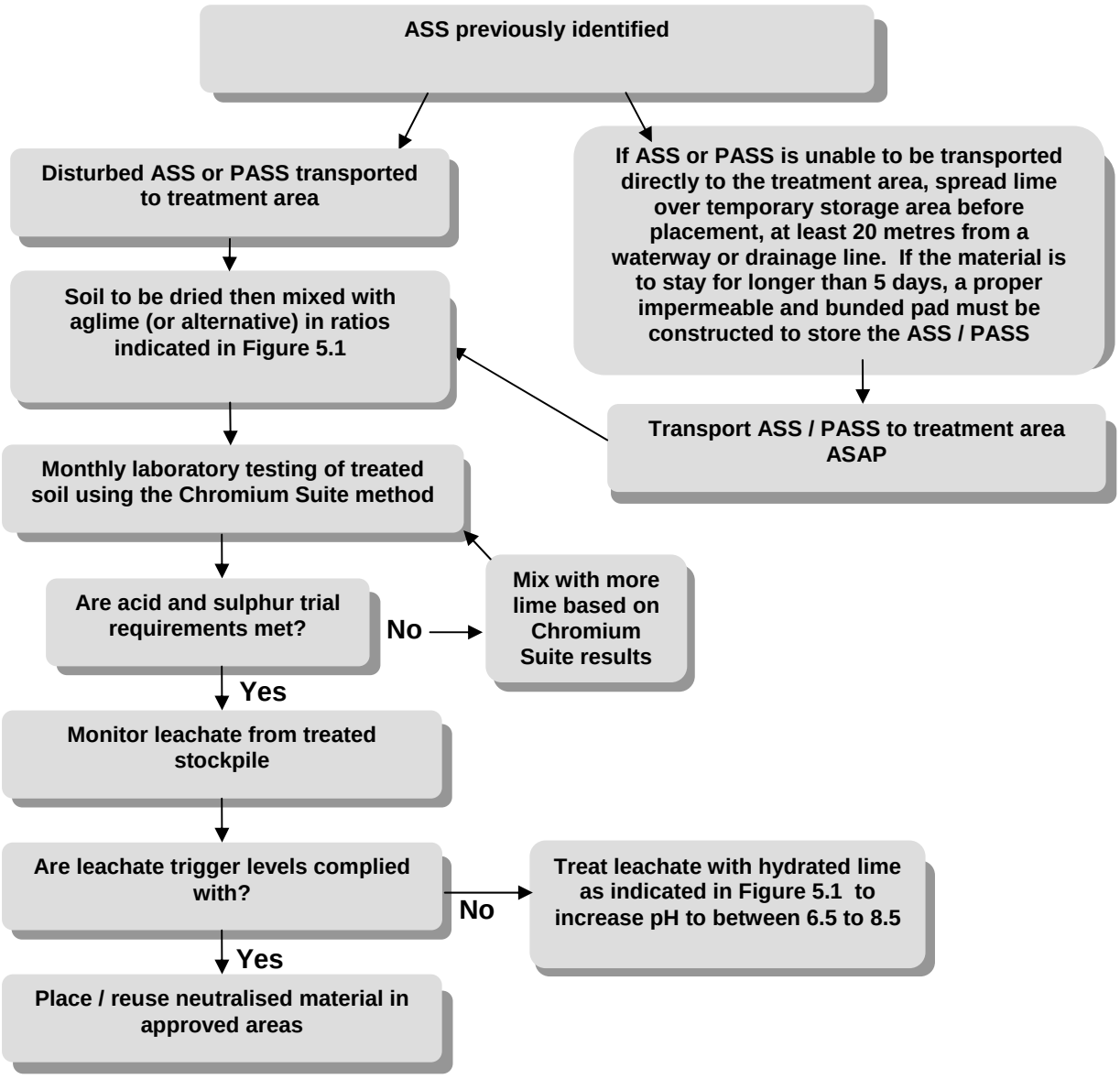
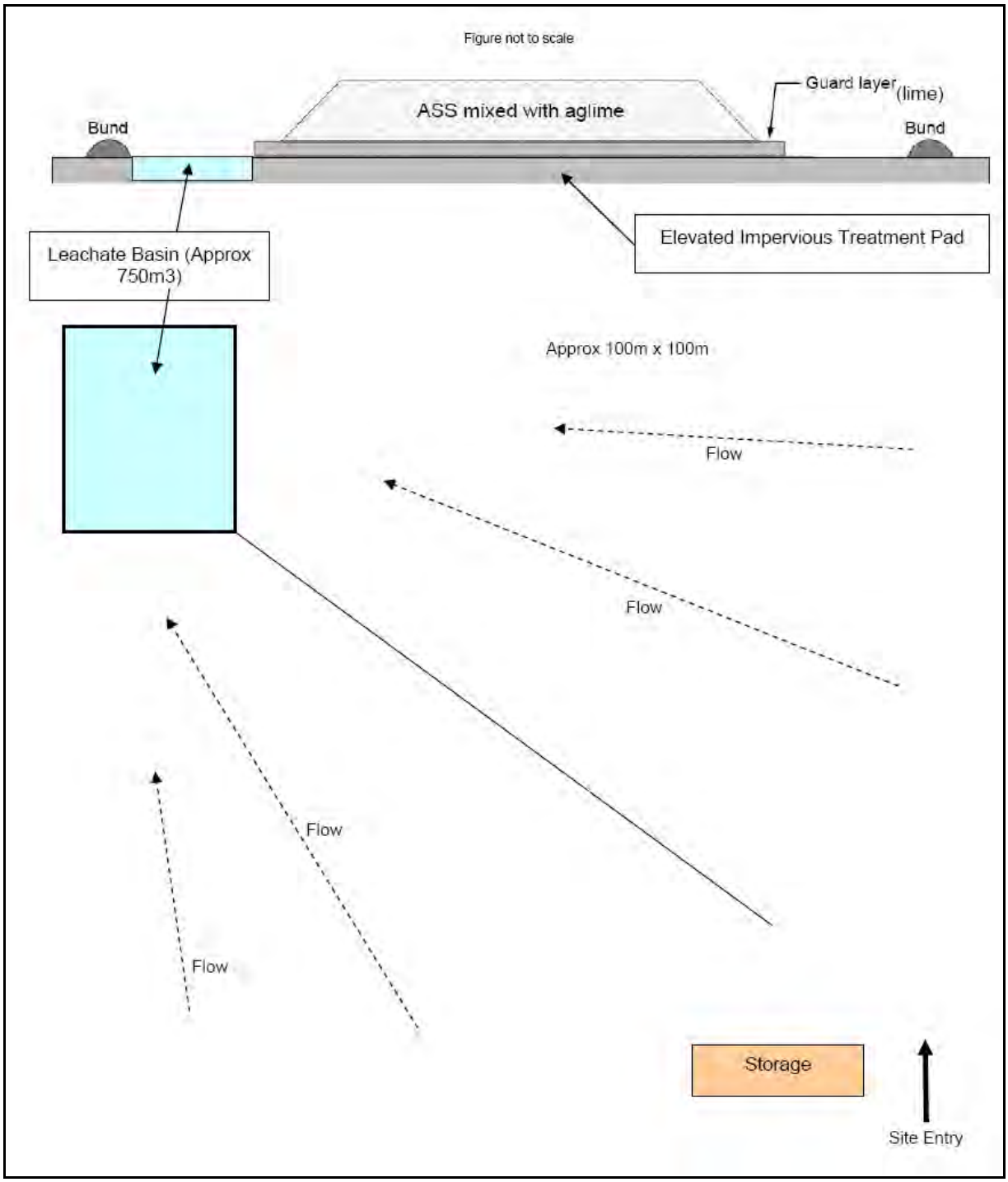


Figure 2 Example ASS Treatment Area Layout



Appendix D
Management of Tannins from Vegetation Mulch

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 up gradient 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

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**
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		
		D Yes		

Appendix E
Groundwater Management Strategy

Appendix F
Pacific Highway Projects Dewatering Practice Note

Appendix G
Sediment Basin Management and Discharge Procedure

Sediment Basin Management and Discharge Procedure

1 Distribution

There are no restrictions on the distribution/circulation of this Procedure within the Woolgoolga to Halfway Creek Project.

2 Purpose

This procedure applies to basin management during the construction phase and details the following –

- the actions to be taken in the construction phase of the project regarding licensed sediment basins including steps to be taken prior to any discharge.
- the actions to be taken for water management in the batch plants, specifically the licensed sediment basins, ASS areas, which includes the leachate pond & the batch plant pH containment ponds (pH ponds).

3 Induction / Training

All relevant JV personnel are to be inducted on the revisions of this procedure. Ongoing training to be facilitated by the Joint Venture's Environmental Team as required.

4 Scope

This procedure will ensure that sediment basins and pH ponds are constructed and managed in accordance with relevant methods and Environmental Protection Licence for the project.

IMPORTANT NOTE: This procedure relates specifically to sediment basins used for capturing surface run-off, dewatering of excavations and capturing batch plant pond water.

Figure 1 - Sediment Basin and Discharge Procedure Flow Chart details the steps required to manage sediment basins.

Figure 2 – Batch Plant pH Pond Management Flow Chart and details the steps required to manage batch plant pH pond water

5 Procedure

1. Record Keeping
Relevant data will be recorded on the **Weekly Environmental Checklist (refer Appendix A9 of the Construction Environmental Management Plan)** and given to the Environmental Manager (EM). All discharges should be recorded on the **Water Release Permit Form by authorised OHLY project personnel.** The final results will also be recorded on **Sediment Basin Discharge Register by the Environmental Coordinator** All test results of the batch plant pH ponds to be recorded on the **pH Register by the Environment Coordinator.**
2. Location and Construction of Sediment Basin/pH Pond
Refer to the SWMP, site Environment Protection Licence (EPL), Erosion Sediment and Control Plans (ESCP) and also relevant Environmental Work Method Statements (EWMS) and relevant Safety Health Work Method Statements (SHWMS) for the location of all sediment basins including the Erosion and Sediment Control Plan.

If a sediment basin is considered necessary in a new location not covered in the CSEWMP, EPL, ESCP or EWMS, then consult and obtain consent of the EM prior to constructing as an updated ESCP will need to be prepared. Any proposed discharge points will also need to be added to the EPL,, therefore basin location should be considered well in advance of actual construction.

If a sediment basin needs to be built quickly and is not included in the EPL, then discharges to the environment from this basin shall not occur until the location has been included in the EPL. In this situation any water in the basin must be pumped to a licensed discharge point for release, or used for dust suppression.

For each sediment basin the location and design detail (volume – length, width & depth) will be outlined in the relevant design drawings. A diagram of a preferred siphon design is provided in Figure 3 of this Procedure. The Soil Conservationist will be consulted when designing new basins to ensure the following criteria are met:

2) All requirements of Volume 2D of *Managing Urban Stormwater, Soils & Construction* (2008b) will be followed;
3) Impervious clay to be used in construction of the embankments;
4) Embankments are to meet required compaction levels – 95% MMD is considered standard; and

Spillways are to be appropriately designed for the minimum design requirement. .

3. Monitoring

Sediment basins, pH ponds and ASS areas shall be inspected at the following times:

5) At least weekly during dry weather and will be recorded on the **Weekly Environmental Checklist.** pH ponds and ASS areas shall be inspected daily (refer Figure 2).
6) Additionally after a storm event (no later than the following working day if the event occurs outside working hours). Inspections will assess the integrity of the basin and the water holding capacity available within the basin. Safe access to the basin/pond is to be maintained at all times.
7) After rainfall events, sediment basin capacity will be checked as per G36 and G38 requirements. Prompt testing of basin water and dewatering (once acceptable water quality has been achieved) will occur to ensure adequate capacity for the next storm event is available. Basin markers will be installed to indicate that adequate sediment storage capacity is available, as well as monitor the volume of runoff into the sediment basin in order to assist in flocculation and time to discharge. Note that the water may be used for construction purposes, such as dust suppression or compaction.
8) Prior to discharge, pH and total suspended solids (TSS) will be measured. To use turbidity (NTU) (EPA approval required) as a field indicator of TSS, laboratory analysis of water samples will, compare TSS and NTU to establish as close a correlation as possible, between the two. The accuracy of this correlation will be checked by sending a water sample for analysis every tenth basin discharge. The pH measurement will be taken by a calibrated pH meter or other. Oil and Grease shall only be tested for if an oily sheen is visible on the surface of the water. Results should meet the criteria as per the EPL prior to discharge.
9) Should the turbidity be outside the EPL requirements, treatment of basin water will be required using gypsum as a flocculant. High pH will require treatment with acid, while low pH will require treatment using ag lime. No discharge is permitted otherwise. To be read in accordance with ASS Procedure (SWMP) for ASS management.
10) Samples should be taken from 30cm below the surface of the water in bottles appropriate for the analytes to be tested.

Water quality management records will be recorded on **Water Release Permit Form** and the final results will be recorded on the **Sediment Basin Discharge Register** and will include details such as time, duration and amount of flocculent used, water quality monitoring details (time, tests undertaken, results) and time of dewatering to satisfy EPL monitoring / recording requirements.

4. Water Quality Criteria for Discharge from Sediment Basins/pH Ponds

Before any water can be discharged from sediment basins to either stormwater or the on-site recharge retention basin(s) it must be tested to ensure it meets the following criteria:

11) pH between 6.5-8.5;
12) TSS <50mg/L (based on field correlation to turbidity', by laboratory test); and
13) No visible oil and grease.

Before any water can be discharged from sediment basins (e.g. to stormwater or on-site recharge retention basins) it must meet the following criteria:

ASS Leachate Ponds / Basins

14) pH between 6.5-8.5;
15) TSS <50mg/L (considered to be equivalent to turbidity <72 NTU);
16) Conductivity < 1500 micro Siemens per centimetre;
17) Dissolved Iron <1 mg/L; and
18) Dissolved Aluminium <0.4 mg/L.

If all the criteria above are met, then the water is suitable for discharge (proceed to **Step 6**). If the criteria are not met, the water will have to be treated (continue to Step 5 onwards).

19) Discharge from ASS leachate ponds / basins can proceed if the in situ testing for pH, turbidity and conductivity confirms that the criteria for these parameters are met. Water samples must still be collected and sent to the laboratory to be tested for dissolved iron and dissolved aluminium. If the laboratory results for dissolved iron and dissolved aluminium exceed the criteria, the EPA must be notified within three working days.

If all the criteria above are met, then the water is suitable for discharge (proceed to **Step 6**). If the criterion is not met, the water will have to be treated (continue to **Step 5** onwards). The spillway has been determined as the water quality test site.

5. Treating Water

Figure 1 and Figure 2 illustrate the Sediment Basin and Discharge Procedure Flow Chart & the Batch Plant pH Pond Management Flow Chart which detail the steps required to manage sediment basins & pH pond water.

pH Levels

20) If the pH of sediment pond water is outside the range 6.5-8.5 it needs to be treated. If the water is above 8.5, acid is used to lower the pH, if the water is below 6.5 a base is used to raise the pH; and
21) To treat water with acid, all safety requirements must be followed as outlined in relevant SDS and SHEWMS. The use of a venturi system or other may be utilised for safe acid application.

Treatment to lower pH

22) Hydrochloric (HCL) or other acid is used to lower pH (refer to Figure 1 and 2). To determine an appropriate acid dosage rate, field titration testing (bucket test) may be required. A method for 'bucket testing' is outlined in the Blue Book Vol 2D, however the initial dosage rate of 0.004% for 32% HCL should be used.

Treatment to raise pH

23) Aglime or Hydrated Lime (refer to Figure 1 and 2).

Total Suspended Solids (TSS)

24) If the turbidity correlation (NTU) for TSS of water is greater that 50 mg/L, the **Flocculation Procedure** should be followed subject to EPA approval.
25) Only environmentally safe flocculants are to be used as approved by the Environmental Manager.. Other flocculants and coagulants such as, 'floc blocks', polyelectrolytes and

other suitable methods may be trialled if approval has been obtained from the EM.

26) Treating water with flocculent will speed up the settling out of suspended solids. Initially, dose gypsum at a rate of 30kg per 100m^3. Additional dosing may be required. Gypsum application methods such as those recommended in the "Blue Book" (*Managing Urban Stormwater, Soils & Construction Vol 1* may be used.

27) Note that for effective flocculation, it is essential to apply the flocculant (gypsum) evenly over the surface of the water as early as possible to give the basin the best opportunity to reach the performance criteria within the required EPL timeframe Some time may be required in waiting for the suspended solids to settle out.

Hydrocarbons

28) If an oily sheen is found on the surface of the water the Environment Coordinator (EC) will use a hydrophobic oil boom to skim off the sheen prior to discharge

29) If a heavy oil layer is found on the surface of the water the Environmental Coordinator or Foreman will have the oily water removed by a licensed liquid waste contractor and disposed of at an appropriately licensed facility.

Metals

30) Consult with the Environmental Coordinator / Environmental Manager for treatment options for heavy metals.

Test water as in **Step 4** once treatment has been undertaken to ensure criteria is met.

6. Discharging Water

Once water has been tested and meets all the criteria it may be discharged to the clean water system by an authorised personnel. Ensure the discharge point will not result in scour or erosion. Where possible water is to be used for construction (e.g.: dust suppression).

If sedimentation basins / ph ponds are to be pumped out rather than discharged through the low flow outlet, a float will be attached to the hose to ensure that sediment on the basin floor is not sucked through the pump. The basin is to be regularly monitored during discharge using syphon system. A diagram of a preferred siphon design is provided in Figure 3 of this Procedure.

Pumps must only be operated by dedicated dewatering crews toolboxed on dewatering procedures. During dewatering **pumps must be supervised at all times** to ensure that sediment is not picked up during discharge and water is discharged through ERSED controls.

The **Sediment Basin Discharge Register** will be completed when treated water is discharged from the basin. All test results of the batch plant pH ponds to be recorded on the **pH Register**

7. Maintenance of Sediment Basins/pH Ponds

Maintenance of the sediment basins/pH ponds shall be ongoing for the duration of the Upgrade and shall comprise the following:

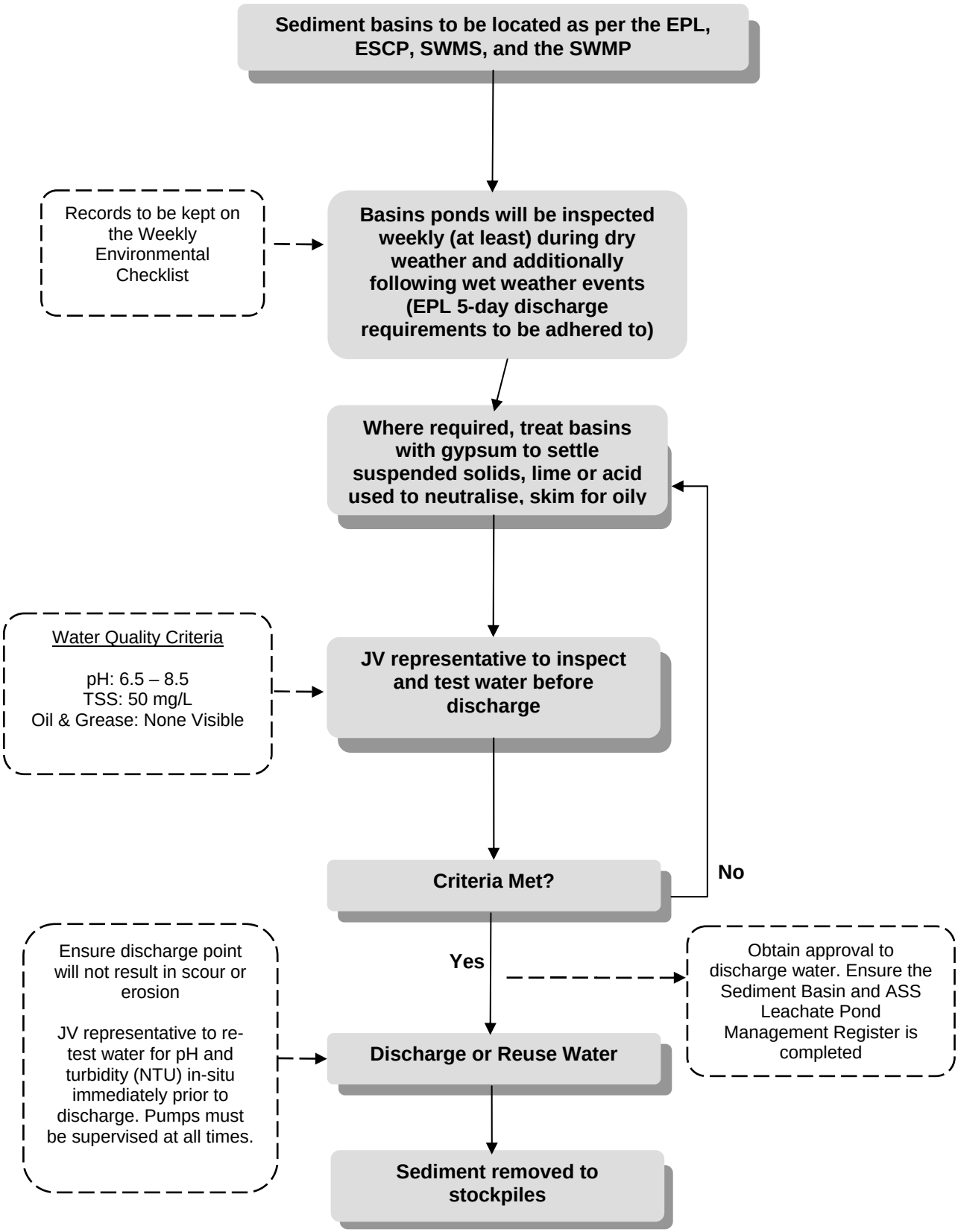
31) A marker will be installed inside the basin to mark the sediment storage capacity limit. Once this marker is reached and/or where there is a large build up of sediment at the basin inlet, sediment will be removed.

32) Sediment that is removed from basins shall be disposed of at locations as approved by the Project Engineer and EC where it will not flow off site without proceeding through appropriate ERSED controls.

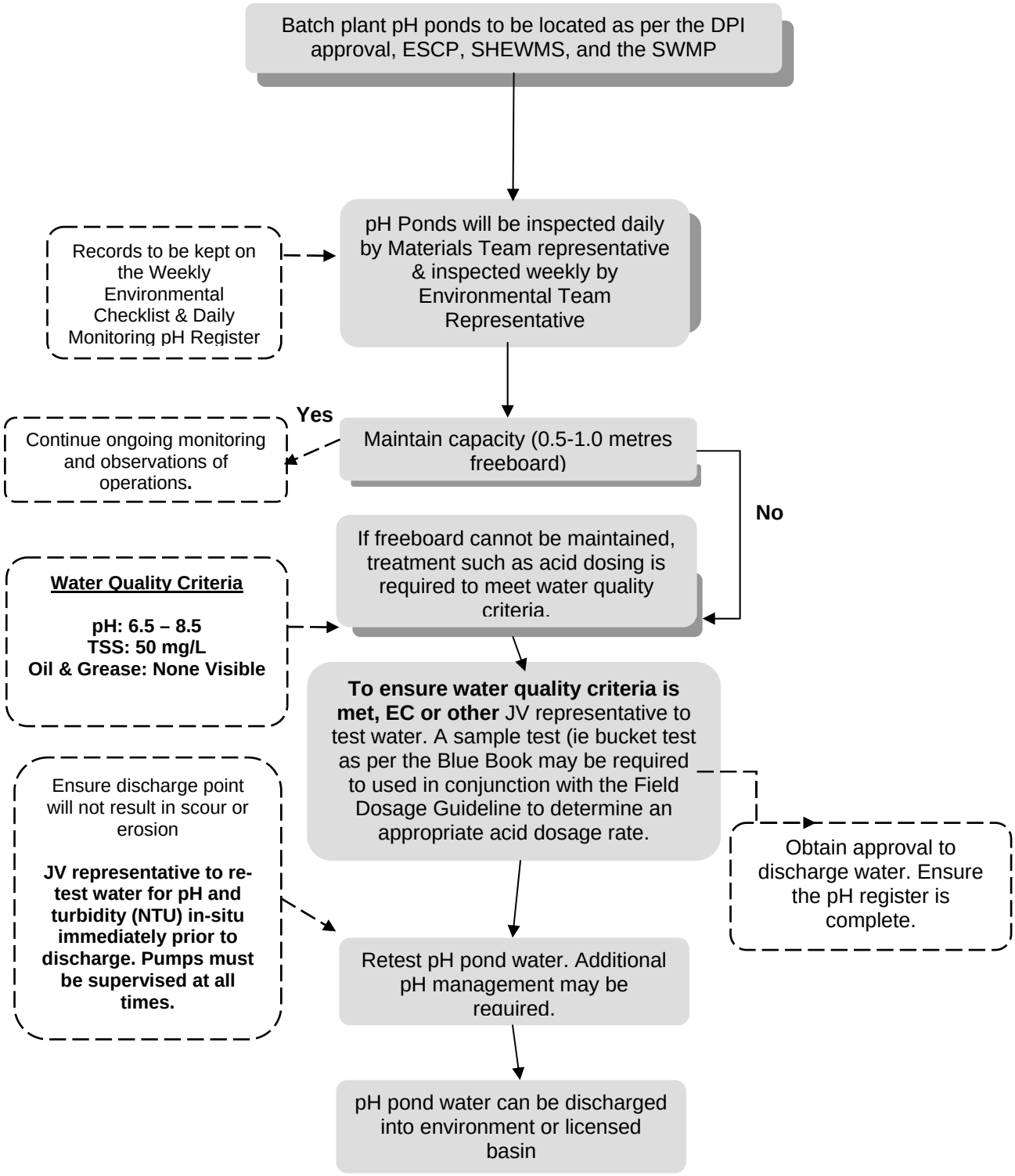
33) Approximately 0.5 to 1 metre freeboard is to be maintained at the batch plant pH ponds. During extended periods of rainfall, where freeboard cannot be maintained, acid dosing will be required to ensure the EPL requirements are met, prior to any discharge from the batch plant pH pond.

34) The results of maintenance inspections shall be recorded on the **Weekly Environmental Checklist**.

Figure 1 - Sediment Basin Management and Discharge Procedure Flow Chart



8.2.1 Figure 2 – Batch Plant pH Pond Management Flow Chart



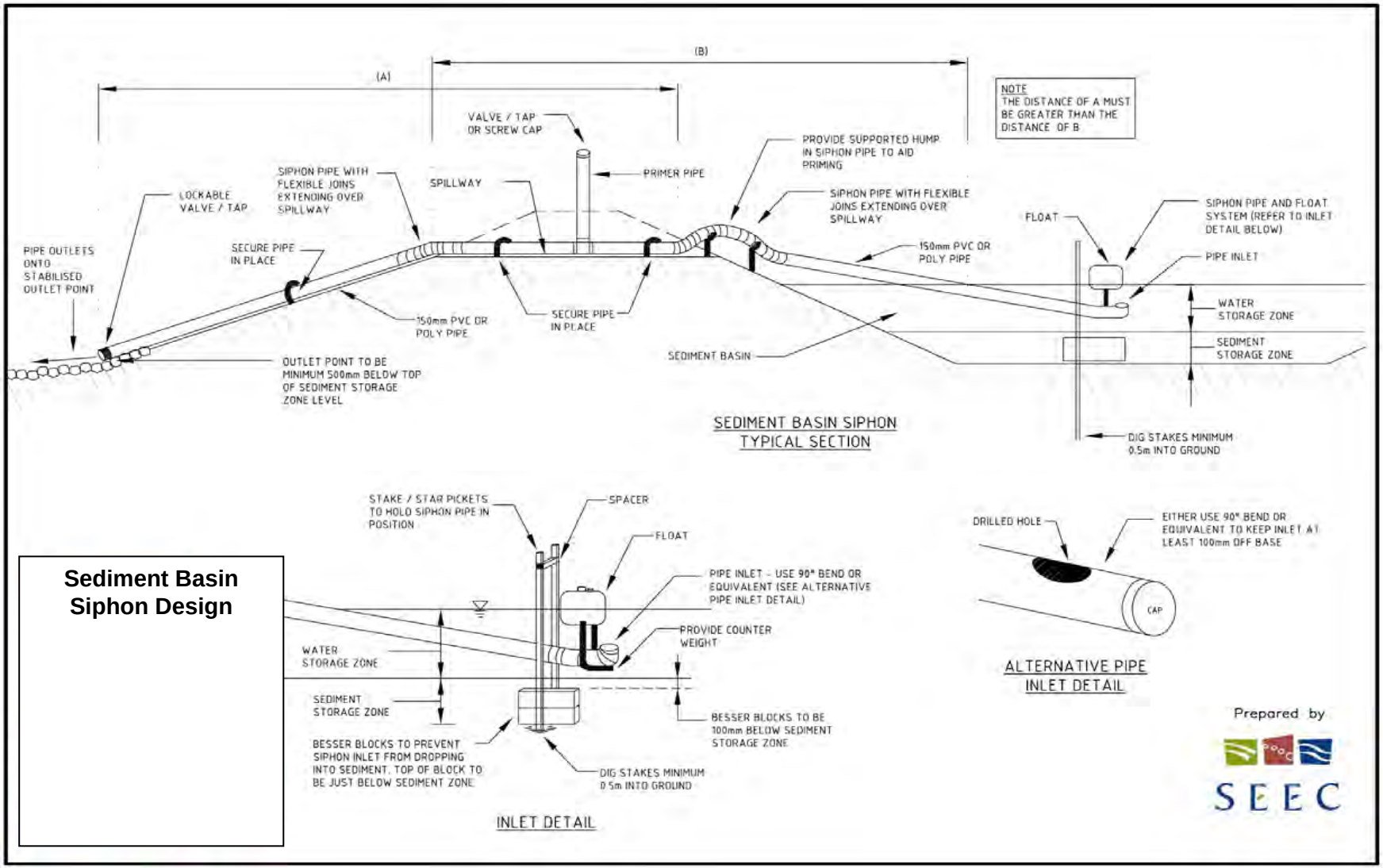


Figure 3 Sediment Basin Siphon Design

Appendix H
Stockpile Management Protocol

Appendix I
Environment Incident & Emergency Spill Response Protocol

Table 1-1 Woolgoolga to Halfway Creek Contacts for Environmental Incidents/Emergencies

Company	Name	Position	Phone Number
OHL York JV	Nicola Fraser	Environment Manager	0400 675 298
	Murray Stuart	Construction Manager	0458309137
	Ian Chaffey	Project Manager	0408 648 757
	Janice Smith	Community Relations Manager	TBA
RMS	Roy Marsh	RMS Representative	0457 886 290
	Lindsay Nash	Project Manager	TBA
	Tim Gooley	Environment Officer	0418 641 383
EPA	Stuart Murphy	Regional Operations Officer	0408 634 153
	Info Line	-	131 555
SMEC	Daniel Saunders	Environmental Representative	TBA
Fisheries	James Sakker	Conservation Manager	0419 185 378
Police, Fire, Ambulance	-	-	000
SES	-	-	132 500

Table 1-2 Environmental Incident / Emergency Response Protocol

This protocol is to be read in conjunction with RMS QA G36 and RMS Incident Management Protocol Guidelines.

Step	Action	Responsibility
1	Incident Occurs – Contact the area Foreman or Construction Manager	All
2	If safe to do so, implement measures to contain incident or prevent any/further environmental harm.	All / Foreman
3	Contact Environment Manager	Foreman
4	Environment Manager to verbally notify RMS Representative or RMS Environment Officer immediately	EM
5a	If the incident is of a routine nature such as a minor spill, follow spill response procedure below (refer Table 3) OR	All / Foreman
5b	If the incident is significant (ie over clearing, large spills, waterway impact, EEC impact, heritage impact, etc). STOP WORKS and wait until the EM or other Senior Manager attends site	All / Foreman
6	Notify regulatory agencies if legally required, including the ER.	RMS / EM
7	Implement further containment or protection strategies as directed by the EM or Senior Manager	All / Foreman
8	Implement RMS environmental incident classification and reporting procedure (Appendix A6 to the CEMP)	EM
9	Implement any additional measures if directed by RMS, ER or agencies	EM / Foreman

10	Undertake incident investigation and reporting as per process detailed in the CEMP	EM
11	Toolbox relevant personnel on incident to ensure similar incidents are prevented in the future	EM / Foreman
12	Update CEMP, EWMSs or relevant procedures if required.	EM /Engineers/Coordinators

Table 1-3 Minor Spill Protocol

Step	Action	Responsibilities	Comments
1	Make the area safe and stop further pollution	Person causing/finding leak	If leak from oil drum, roll drum so that leak area is uppermost. If leak from pipe close valve.
2	Inform Supervisor / Area Superintendent	Person causing/finding leak	Stop human and vehicular traffic & isolate area.
3	Determine the source of the leak or issue	Supervisor / Area Superintendent	For major leaks notify Area Superintendent. If spill has escaped offsite into waterway contact EM immediately.
4	Form barrier around leak/spill to contain leak/spill at source	Forman/Area Superintendent	Use fuel/oil from spill drum into another drum, etc
5	Stop the spreading of the leak.	Foreman / Area Superintendent	Transfer fuel/oil from spill drum into another drum, etc.
6	Put barriers around drains/outlets	Foreman/Area Superintendent	Seal drain gates by putting sand bags, etc around them.
7	Obtain oil spill kit and apply oil absorbent on spill	Foreman/Area Superintendent	Use absorbent' or equivalent.
8	Clean up/remove absorbent material to bin	Foreman/Area Superintendent	Use 'Chem-Oil-A-Way'or equivalent for clean-up of area. Use brush/pan provided in kit.
9	Clean up soft surface by excavating contaminated soil	Foreman/Area Superintendent	Stockpile contaminated material in designated area.
10	Inform Environment Manager and complete incident log form	Foreman/Area Superintendent	Record incident and investigate

This Emergency Response Plan should be read in conjunction with the Project's Pollution Incident Response Management Plan (PIRMP), which is available on the project's environmental records database as required under the Environmental Protection Licence.

Appendix J
Groundwater and Soil Salinity Report

Appendix K
Hydrological Mitigation Report