

PROJECT

**SITE BASED MANAGEMENT
PLAN INCORPORATING GOLF
COURSE MANAGEMENT PLAN
KINGS FOREST STAGE 1
PROJECT APPLICATION
KINGS FOREST
NEW SOUTH WALES**

PREPARED FOR
PROJECT 28 PTY LTD

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SYNOPSIS This report constitutes a Site Based Management Plan (SBMP) for the entirety of the Kings Forest Stage 1 Project Application, including the golf course within precincts 12 and 13. This report addresses Environmental Assessment Requirements specified by the Director General of the NSW Department of Planning (DGRs) in relation to the proposed Kings Forest development. It has been prepared to plan a control strategy for any environmental impacts of development within and adjacent to the ecological buffers associated with the SEPP 14 wetlands and environmental protection zones that are adjacent to the site. The SBMP identifies the likely environmental impacts associated with the proposal and describes integrated strategies for the management of these constraints for the pre-bulk earthworks, bulk earthworks, landform stabilisation phase, civil construction, on maintenance and operational life of the project. The implementation of the SBMP provisions will help to ensure work is conducted in an environmentally responsible manner.

REVISION HISTORY

REVISION #	DATE	EDITION BY	APPROVED BY
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SUMMARY

Project 28 Pty Ltd commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare a Site Based Management Plan (SBMP) in support of the Kings Forest Stage 1 Project Application at Kings Forest, Cudgen, New South Wales.

This Site Based Management Plan (SBMP) addresses the environmental issues relating to development of the site, including the golf course within precincts 12 and 13. Preparation of the SBMP involved a review of the amended Director General's Requirements (DGRs), Approved Concept Plan Conditions, the Preferred Project Report for the Concept Plan and a review of existing and revised environmental reports. The SBMP identifies and describes strategies for the management of site constraints and their likely impacts during the pre-bulk earthworks, bulk earthworks, landform stabilisation phase, civil construction, on-maintenance and operational phases of the project. In addition, given that these constraints may potentially be conflicting, the SBMP also acts as a tool for the integration and implementation of the management strategies in accordance with the proposed construction sequencing.

It is anticipated that the implementation of the SBMP provisions will:

- ensure bulk earthworks and civil construction are managed in an environmentally responsible manner and will facilitate the detection of potential or emerging changes in site conditions to allow for construction methods to be adjusted accordingly;
- facilitate the ongoing management of the site to minimise its potential impacts to the ecological zones that surround it; and
- facilitate the ongoing management of the golf course within precincts 12 and 13 to minimise its potential impacts and ensure the golf course acts as an appropriate buffer between the urban development of the site and the ecological zones that surround it.

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12301-05-040-A	Cut and fill plan

GLOSSARY

TERM	MEANING
AGS	Above ground surface
ASSMAC	Acid Sulfate Soils Management Advisory Committee Manual 1998
DGR	Director General requirement
EPA	Environmental Protection Agency
mAHD	Metres Australian Height Datum
NATA	National association of testing authorities
pH	The degree of acidity or alkalinity measured on a scale of 1 to 14, with 7 as neutral. From 1 to 7 is acidic; from 7 to 14 is alkaline.
SBMP	Site based management plan
SEPP	State environmental planning policy

1 Introduction

1.1 Background

Project 28 Pty Ltd commissioned Gilbert & Sutherland Pty Ltd (G&S) to provide a Site Based Management Plan (SBMP), incorporating a golf course management plan, in support of the Kings Forest Stage 1 Project Application.

The concept plan for the proposed Kings Forest Development was approved by the New South Wales Minister for Planning on 22 December 2010 and the Director General of the Department of Planning issued a series of Environmental Assessment Requirements (DGRs) for the site on 23 December 2010.

1.2 Scope of report

This report is a Site Based Management Plan for the Kings Forest Stage 1 Project Application, and incorporates a Golf Course Management Plan.

This SBMP included a review of, and has been prepared in accordance with:

- The latest Master Plan (dated December 2010)
- Planning Minister's Concept Approval conditions (dated 22 December 2010)
- The Amended Director General's Environmental Assessment Requirements (DGRs) for Project Application No. 08_0194, dated December 23, 2010 (see Attachment 3).

The following guidelines were used to develop the SBMP:

- International Erosion Control Association 2008 Best Practice Erosion & Sediment Control (IECA).
- Tweed Shire Council Development Control Plan – Section A5 Subdivision manual – Development construction specifications.
- Acid Sulfate Soils Manual 1998 (ASSMAC).

The SBMP acts as a tool for the integration and implementation of the management strategies proposed in the following reports prepared to satisfy the DGRs listed in Attachment 3:

- Erosion and Sediment Control Management Plan (Gilbert & Sutherland, April 2011).
- Acid Sulfate Soils Management Plan, (Gilbert & Sutherland, June 2011).
- Integrated Water Cycle Management Plan (Gilbert & Sutherland, June 2011).
- Stormwater Management Plan (Gilbert & Sutherland, June 2011).
- Overall Water Management Plan (Gilbert & Sutherland, June 2011).
- Groundwater Assessment and Management Plan (Gilbert & Sutherland, June 2011).
- Review of Environmental Management Plan (ePar 2009).
- Vegetation Management Plan (James Warren & Associates 2011, 'JWA').
- Threatened Species Management Plan (JWA 2011).
- Feral Animal Management Plan (JWA 2011).
- Weed Management Plan (JWA 2011).
- Koala Plan of Management (JWA 2011).

The SBMP also addresses the following December 2010 DGRs specific to the golf course:

10.1 'Further details are to be provided on how threatened Wallum frog species habitat is to be re- created, managed, monitored and reported on within the golf course. Adaptive management procedures are to be provided detailing how monitoring and reporting will feed back to corrective actions to optimise habitat for the two Wallum frog species.'

Management provisions for the two Wallum frog species are provided in sections 6 to 11 for the bulk earthworks phase, landform stabilisation phase, civil construction, on-maintenance and operational phases for the entirety of the site, including the golf course.

The management tables in sections 6 to 11 were developed with reference to the reports listed above, in particular the 'Threatened Species Management Plan' (JWA 2011).

Each management table in sections 6 to 11 includes provisions for monitoring, auditing and

reporting, with the outcomes of these activities being revised on an annual basis.

Habitat restoration works are described in Section 2.1. These works are further detailed in the Groundwater Assessment and Management Plan (Gilbert & Sutherland, June 2011) and the Threatened Species Management Plan.

10.2 'The Golf Course Management Plan is to demonstrate consistency with the Koala Plan of Management and the Threatened Species Management Plan.'

This Site Based Management Plan, which incorporates a Golf Course Management Plan, has been amended to incorporate the management provisions and recommendations within the Koala Plan of Management ('KPOM', JWA 2011) and the Threatened Species Management Plan ('TSMP', JWA 2011).

This Site Based Management Plan also addresses the following conditions of the 22 December, 2010 Concept Approval:

Schedule 3 Statement of Commitments

5.2 Golf Course management

'The proponent will implement the actions in the Golf Course Management Plan and submit an addendum to the plan...and adopt the recommendations of the E-Par report and relevant elements of the management plans...'

This report is divided into sections outlining:

- The proposed development works.
- The physical characteristics of the site.
- The management guidelines for the potential impacts during the pre-bulk earthworks, bulk earthworks, landform stabilisation phase, civil construction, on-maintenance and operational phases (it is these management sections that form the SBMP).

This report, prepared by qualified Gilbert & Sutherland staff, is based on a review of the project documentation to ascertain the potential environmental impacts of the construction works proposed to be undertaken for Stage 1 of the development.

2 Proposed development

2.1 Stage 1 Project Application

The approved Kings Forest Concept Plan proposes the creation of a residential community inclusive of associated educational, social, commercial, sporting and recreational amenities. The development is to be completed in stages.

The Kings Forest Stage 1 Project Application seeks approval for a rural retail development in Precinct 1, residential development in Precinct 5 and bulk earthworks within the balance of the site. A Precinct Plan prepared by MPS Architects is provided in Attachment 2.

The proposed development would include:

- Subdivision to create new lots/land parcels for future development.
- Construction of the entrance road to the site and associated works for the intersection with Tweed Coast Road, as well as a new connecting road to the Tweed Shire Council's former waste tip.
- Subdivision and associated infrastructure works for the first stage of urban development (Precinct 5).
- Bulk earthworks and planting for the future golf course.
- A rural retail development (commercial site) on the developable land east of Tweed Coast Road.
- Bulk earthworks as required in all precincts.

The revised Master Plan by MPS Architects is included in the reference drawings for this report (Attachment 2). The Stage 1 Project Application Master Plan is shown on Drawing No. 10468.6.1 (Attachment 1). The proximity of the Stage 1 Project Application Master Plan to sensitive environmental receptors is shown on Drawing No. 10468.6.2 (Attachment 1).

Given that the present application is for Stage 1 of the Master Plan, detailed road and allotment layouts have not been completed for the whole of the project. However preliminary bulk earthworks design, site grading and drainage design have been prepared.

In precincts 12 and 13, the golf course site forms part of the environmental controls and protections of the Kings Forest Stage 1 Project Application. The golf course is to act as a buffer between the urban development and the SEPP 14 wetlands and Environmental Protection zones. The area associated with the golf course development may be described as lots 76, 272, 323 of DP755701 and portion 96, Parish of Cudgen, County of Rous.

The preparation of the SBMP for the proposed works is required to ensure the operation of the golf course as an effective buffer between the proposed urban development of the remainder of the site and the ecological zones adjacent to the development site.

The intent of the golf course is to be a substitute for a 50m vegetated buffer between the proposed urban development of precincts 12 and 13 and the SEPP14 wetlands adjacent to it and the mapped environmental protection zones adjacent to and within the urban area.

A cut and fill plan (Mortons Urban Solutions Drawing No. 12301-05-040-A, Attachment 2), shows existing surface levels within precincts 4, 5, 12 and 13 will be lowered by approximately 1m to allow for the construction of residential and commercial allotments and the golf course. Some areas in precincts 12 and 13 will be lowered by approximately 2.5m to facilitate construction of stormwater treatment measures. The material removed from precincts 4, 5, 12 and 13 will be used as fill to create a development platform in the western area of the Kings Forest site.

Average groundwater levels in precincts 12 and 13 range from 3.2 to 4.4m Australian Height Datum (AHD) on the central Pleistocene sand ridge and <2.0mAHD near the southern boundary. Average groundwater levels in the vicinity of Blacks Creek range from 1.3mAHD in the east to 0.4mAHD in the west.

Groundwater impacts associated with the proposal are detailed in the Groundwater Assessment and Management Plan.¹

¹ Gilbert & Sutherland (June 2011) Groundwater Assessment and Management Plan, Kings Forest Stage 1 Project Application, Kings Forest, New South Wales.

Acid sulfate soils are present along Blacks Creek, which forms the northern border of precincts 12 and 13.² There are also sensitive environmental receptors (SEPP14 wetlands) adjacent the eastern boundary and the northern boundary.

Any groundwater requiring dewatering will be pumped to lined temporary sediment ponds, tested and treated (if necessary) then directed to a series of groundwater recharge trenches. This process is described in detail in the Groundwater Assessment and Management Plan.

Sediment and erosion controls will be installed in accordance with the site's Erosion and Sediment Control Plan³ and the relevant tables in the SBMP.

The final layout and development of the golf course is described in a separate report by GNP Golf Design Pty Ltd.⁴ The development strategy is to have the golf course surround the proposed urban development and the internal environmental protection zones, thus providing an effective buffer separating the different land uses.

Some objectives of the ecological buffers are to:

- Separate other land uses from the ecologically significant areas.
- Minimise the impact of nutrients, sediment and other pollutants on ecologically sensitive areas.
- Minimise groundwater impacts of adjacent land development and protect groundwater dependent ecosystems.
- Enhance the regeneration of ecological areas.
- Slow the ingress of environmental weeds and other pest species into areas of ecological significance.
- Improve the scenic amenity of the interface between ecological zones and other land uses.
- Separate the fauna of the ecological significant areas and other land uses.
- Separate urban uses from biting arthropods of the ecological zone.

² Gilbert & Sutherland (June 2011) Acid Sulfate Soil Assessment and Management Plan, Kings Forest Stage 1 Project Application, Kings Forest, New South Wales.

³ Erosion & Sediment Control Management Plan, Kings Forest Stage 1 Project Application, Kings Forest, New South Wales – Prepared for Project 28 Pty Ltd. April, 2011.

⁴ GNP Golf Design Pty Ltd, June 2007, 'Kings Forest, Kingscliffe NSW, Cudgen Paddock Golf Course Grading Plan'.

This Site Based Management Plan is specifically designed to ensure that the buffer capacity is maintained and enhanced.

The golf course will act as a passive vegetated buffer between the urban areas and sensitive ecological receptors. The passive buffer is outlined in the SEPP10 gazettal of the Kings Forest development area. The substitution for the buffer occurs in only part of the buffer zone. However the golf course, in using this part of the buffer, adds significant additional usable land to the separation of urban use from ecologically sensitive areas such as the SEPP 14 wetlands and Environmental protection zones around and within the broader development area of the site. The additional land represents a general increase in buffer width from 50 to 100m and up to 300m in some locations.

The use of the regulatory 50m buffer has several significant deficiencies, namely:

- The passive vegetative buffer represents a continuing maintenance impost on local government such as weed control, fire management, and biting arthropods management.
- A passive separation of land uses without any active environmental management devices and program may give no environmental protection at all to the surrounding areas.
- There is no active access management program that will provide security to the ecologically sensitive areas.

The proposal is to develop the buffer and the significant additional land into an active recreation area (golf course). The golf course development plan includes:

- fairways
- tees and greens
- short and long roughs
- bio-retention and filter basins
- ecological regeneration zones
- open space
- forest regeneration.

All the components of the golf course contribute to the buffer capacity of the land to separate urban land use from the surrounding ecological zones.

Fairways, tees and greens provide open space that function as fire control areas, corridors for larger wildlife and a space separation for the urban community from some of the biting insects. The short and long roughs act as a filter for suspended material and nutrients and a chemical sink for any contaminants that may flow through them.

Bio-retention basins, to be constructed throughout the golf course, will act as sediment, nutrient and chemical renovators (and sinks) for the entire urban development adjacent to the golf course. The bio-retention basins are described in detail in the Integrated Water Cycle Management Plan and the Stormwater Management Plan.

The basins will occupy some 8.2ha and provide three times the minimum protective capacity that is required for urban development in the area. The basins form an integral part of the ecological regeneration program for the site. In addition to environmental protection, they will also provide habitat for many plants and animals.

The ecological regeneration zones will provide wetland habitat that will augment the existing wetlands and adjacent ecosystems. Associated with these areas will be forest regeneration that will provide habitat and food supplies for the larger wildlife (such as Koala).

The advantages of the proposed golf course buffer is the 'balm' for all the disadvantages of the passive vegetative area namely:

- The site will be actively managed to maintain its ecological integrity.

- The management will be paid for by the users of the course and not the local government authority.
- The designed water treatment works will actively control the flow of water and contaminants that may gain ingress to the SEPP14 wetlands.
- Active regeneration of the ecology of the site will be undertaken.
- Access and security of the ecological zone will be actively managed.
- Monitoring of the golf course and ecological zones will ensure the environmental safety of the area.

The outcome for the proposed golf course buffer will be an actively managed biological screen between the urban land users and the adjacent sensitive ecological areas.

The identified potential impacts associated with bulk earthworks are readily anticipated and manageable. Bulk earthworks will be controlled by the management plans listed in Section 1.2, the provisions of which are included in this report.

3 Site description

3.1 Site location

The site may be described as lots 76, 272, 323 & 326 of DP755701, Lot 6 DP 875446, Lot 2 DP 819015, Lot 1 DP 706497, Lot 40 DP 7482, Lot 37A DP 13727, Lot 38A DP 13727, Lot 38B DP 13727, Lot 1 DP 129737, Lot 1 DP 781633 and Lot 7 DP 875447, Parish of Cudgen, County of Rous.

The site is shown on Drawing No. 10468.6.1 (Attachment 1).

3.2 Catchment description

The catchments surrounding the site are of low relief. In the south-western portions of the site there are low hills of maximum height approximately 70m AHD. The runoff flows in a north-easterly direction with a portion flowing south-east towards Cudgen Lake.

The flow on the low-lying pan that occupies the majority of the site is generally to the north. Flow from the remainder of the site (approximately 30%) is generally to the south towards Cudgen Lake. However, the flow paths are imprecise and all waters flow through a large wetland before gaining ingress to the lake.

3.3 Vegetation

The site has been subject to extensive clearing and historically used for pine plantations. Areas associated with the low-lying plain are mainly under introduced pasture. However there are scattered stands of broad-leaved paperbark (*Melaleuca quinquenervia*) with some Swamp mahogany (*Eucalyptus robusta*) and Swamp banksia (*Banksia robur*).

The low ridges adjacent to the plain contain some of the species associated with open forests on the Neranleigh-Fernvale geological strata such as blackbutt (*Eucalyptus pilularis*) Sydney blue gum (*E. saligna*), grey gum (*E. punctata*) and forest she-oak (*Allocasuarina torulosa*).

3.4 Geology, landform and soils

The ridges in the south-western portion of the site are based on the Neranleigh-Fernvale beds. They are mainly phyllitic siltstones and shales with some argillite, greywackes and greenstone.⁵

The height of the ridge is approximately 70m AHD with slopes ranging from 5 to 25%. The soils are stoney Tenosols on the ridge lines with brown and yellow Kurosols on the slopes.

The plain adjacent to the ridges are mainly Pleistocene marine and Aeolian sand deposits. The elevation of these sand sheets and dunes is 1-5m AHD with the slopes varying from 0.1 to 1%. The dominant soils in this area are Podosols, which are deep sandy soils with the development of indurated sands at depth, and Hydrosols associated with the areas exhibiting high water tables. The soils, when above the water table, are free draining.

Some Organosols are present in the central areas of the proposed golf course site.

3.5 Groundwater

The groundwater levels associated with the sand plain varies from within 1m to 3m of the soil surface. The ground waters and the groundwater windows formed by the drains and depressions on the site are acidic in nature.

Groundwater pH is a special consideration for the site as some of the natural fauna (e.g. Wallum frog) are adapted to and/or require acid conditions for survival. This has significant impact on the monitoring and ecological performance criteria for the golf course management plan. For instance, the pH criteria for indicators of environmental health will be within the acid range rather than the conventional 6.5 to 8.0 pH units.

The environmental conditions specific to this site will underpin the site based management plan for the golf course development and operations.

⁵ Mc Elroy C.T. 1962 The geology of the Clarence – Morton basin Mem. Geol. Surv. NSW 9.

4 Site Based Management Plan

4.1 Aims and objectives

This Site Based Management Plan (SBMP) provides a framework to ensure that any impacts of the on-site activities are managed, treated, monitored, reported and, if necessary, mitigated.

The SBMP aims to achieve the following:

- Provide evidence of practical and achievable plans for the management of site activities.
- To ensure that legislative and environmental requirements are complied with by producing an integrated planning framework for comprehensive monitoring and control of operational impacts. Specific commitments on strategies and design standards to be employed are also given.
- A framework for regulatory authorities and the proponent to confirm compliance with policies and conditions.
- Evidence to the community that the operation is being managed in an environmentally acceptable manner.

The objectives of this SBMP are to ensure the following:

- All reasonable and practical measures are taken to prevent and/or minimise the likelihood of environmental harm being caused.
- On-site activities occur without adverse environmental impact or causing nuisance to nearby sensitive receptors.
- Operation of the golf course within precincts 12 and 13 will provide an effective buffer separating the urban development from SEPP 14 wetlands and environmental protection zones that are adjacent to the site.

4.2 Scope of this document

This document constitutes an overarching SBMP for the activities involved with the development works to be undertaken for the Stage 1 Project Application for the Kings Forest development area. As such, it is the intent of the document to address the environmental issues that may arise onsite with regard to the proposed activities involved in completing the bulk earthworks and civil works, on-maintenance and operations of the site.

Although addressing the issues, it is not within the scope of this document to detail the full extent of each issue, but rather to link and integrate the range of management issues governing each individual aspect. The reports specific to the development of the SBMP include:

- Soil Survey and Acid Sulfate Assessment Kings Forest Estate, Cudgen (Gilbert & Sutherland, June 1998).
- Kings Forest Stage 1 Project Application and associated documentation.
- Erosion and Sediment Control Management Plan (Gilbert & Sutherland, April 2011).
- Acid Sulfate Soils Assessment and Management Plan (Gilbert & Sutherland, June 2011).
- Integrated Water Cycle Management Plan (Gilbert & Sutherland, June 2011).
- Groundwater Assessment and Management Plan (Gilbert & Sutherland, June 2011).
- Review of Environmental Management Plan (ePar 2009).
- Vegetation Management Plan (James Warren & Associates 2011, 'JWA').
- Threatened Species Management Plan (JWA 2011).
- Feral Animal Management Plan (JWA 2011).

- Weed Management Plan (JWA 2011).
- Koala Plan of Management (JWA 2011).

4.3 Implementation

The SBMP requires the Proponent to mitigate the potential environmental impacts associated with the construction of the development works during the baseline data collection phase, bulk earthworks, landform stabilisation phase, civil construction, on-maintenance and operational phases.

4.4 SBMP structure

This SBMP acknowledges the environmental impacts associated with the construction and operations of the proposed development and details strategies to mitigate them. Each control strategy is based upon proven environmental management methods and is presented as a commitment.

The SBMP is based on a series of tables for the baseline data collection phase, bulk earthworks, landform stabilisation phase, civil construction, on-maintenance and operational phases of the development. The person responsible for the implementation of the measures detailed is written on the table itself. The tables then detail the issue, the performance criteria, the implementation strategy, monitoring, auditing, reporting, failure identification and the corrective action. The detachable pages within each section detail the provisions of the SBMP. The format is presented below for reference purposes.

Title

Applies to	The relevant construction stages to which the issue detailed on this page applies.
Person responsible	This is the person(s) who has accepted the responsibility of implementing the SBMP provisions detailed on this page.

Issue	The issue with which the table deals.
Operational policy	The operational policy or management objective that applies to the element.
Performance criteria	Performance criteria (outcomes) for each element of the operation.
Implementation strategy	The strategies or tasks (to nominated operational design standards) that will be implemented to achieve the performance criteria.
Monitoring	The monitoring requirements which will measure actual performance (i.e. specified limits to pre-selected indicators of change).

Auditing	The auditing requirements, which will verify implementation of, agreed construction and operation phase environmental management strategies and compliance with agreed performance criteria.
Reporting	Content, timing and responsibility for reporting and auditing of monitoring results.
Identification of incident or failure	The circumstances under which the agreed performance criteria are unlikely to be met and environmental harm is likely to result.
Corrective action	The action to be implemented in case a performance requirement is not reached and the company(s) responsible for action.

Commitment

What the management has committed the company to.

An objective of the tabular format is to allow for change and allow the SBMP to be a working document. If items need altering, changes may be made to the individual tables after appropriate consultation with the statutory authorities.

4.5 General commitments

Commitment 1

The development shall proceed in accordance with the construction staging detailed in any approved engineering drawings. The Proponents undertake to comply with the environmental implementation strategy as contained within the approved final SBMP at all times throughout the baseline data collection phase, bulk earthworks, site stabilisation phase, civil construction, on-maintenance and operational phases.

Commitment 2

The Proponents undertake to fulfil all commitments made in the approved SBMP and to carry out their activities on the project site in accordance with relevant current statutory requirements and approved amendments.

Commitment 3

The principal golf course management operating the golf course within precincts 12 and 13 shall comply with the environmental implementation strategy as contained within the approved SBMP during the operational phase.

4.6 Definitions

In this SBMP these terms have the following meanings;

- SBMP means the approved Site Based Management Plan and includes any amendments that may be approved from time to time.
- Development means the development of the site in accordance with the Kings Forest Stage 1 Project Application.

- TSC means Tweed Shire Council.
- ASSMAC means the Acid Sulfate Soils Management Advisory Committee.
- Proponent means the person undertaking the construction of the proposed Kings Forest Stage 1 and includes the person nominated by the Proponent as having the responsibility for implementing the provisions of the SBMP.
- DECCW means the Department of Environment, Climate Change and Water.

4.7 Contact details

The following persons are responsible for the implementation of the management measures described in the individual tables of the SBMP.

Contractor's Site Manager

The name and address of the Contractor and its representative will be notified to TSC by the Consulting Engineer prior to the commencement of each contract/stage of the project.

Consulting Engineer

Unless advised otherwise the Consulting Engineer is:

Company: TBA

Address:

Contact Details:

Phone:

Facsimile:

5 Baseline data collection phase

5.1 Intent

This part of the SBMP specifies those matters which must be complied with by the Proponent during the baseline data collection phase, being the period prior to bulk earthworks when baseline monitoring is being undertaken.

5.2 Background water quality monitoring

Applies to	Baseline data collection phase
Person responsible	Nominated Environmental Consultant

Issue	Establishing appropriate discharge criteria for the construction phase. To determine the existing water quality conditions at the site (levels and quality) and examine any seasonal variations that may result from increased precipitation. This would serve as 'baseline' data and allow comparison with level and quality results recovered during the bulk earthworks and civil construction phase of works at the site.
Operational policy	To determine existing water quality parameters for the proposed Kings Forest Stage 1 area, prior to construction.
Performance criteria	The performance criteria shall be set by background monitoring of pre-construction water quality conditions. The following parameters shall be monitored for a minimum of eight (8) rounds of monitoring: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L^{-1}); • total nitrogen and nitrate, nitrite and ammonium (mg L^{-1}); • total and soluble phosphorus (mg L^{-1}); • total and soluble iron and filtered aluminium; • oil and grease (visual inspection); • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate;

	• chloride; • sulfate; and • colour. Laboratory analysis for total acidity (titratable) should also be undertaken on a monthly basis by a NATA accredited laboratory to determine the total potential acidity hazard that may be associated with groundwater at the site.
Implementation strategy	Surface water quality and groundwater level and quality monitoring on a monthly basis from established monitoring locations prior to commencement of bulk earthworks. Following the completion of background monitoring, a water quality report, including results and interpretation would be prepared and submitted to TSC for review.
Monitoring	Background monitoring shall be conducted by a qualified Environmental Scientist for the parameters listed above to allow the interpretation of data for statistical analysis and groundwater modelling purposes.
Auditing	The consultant will audit the results and submit a background groundwater quality report to TSC prior to the commencement of construction works.
Reporting	A background report to TSC including raw data, a results summary and a discussion comparing results with ANZECC guidelines.
Identification of incident or failure	Failure to collect adequate rounds of data prior to commencement of bulk earthworks.
Corrective action	• Cease works until data is available. • Increase frequency of monitoring until sufficient data is available.

Commitment

The Proponent will undertake background water quality monitoring to ascertain existing conditions at the site prior to bulk earthworks commencing.

6 Management of potential impacts – bulk earthworks phase

6.1 Intent

This part of the SBMP specifies those matters which must be complied with by the Proponent during the bulk earthworks phase, being the period during which cut and fill works are being undertaken. The obligations in this section of the SBMP must be complied with by the Proponent until each precinct is at final grade and stabilised.

6.2 Threatened species - Wallum Froglet

Applies to:	Species: Wallum Froglet (<i>Crinia signifera</i>) Bulk earthworks phase - disturbed mixed grassland and regenerating heathland
Person responsible:	Contractor's site manager, all personnel, ecologist.

Issue	Protection of habitat. Provision of habitat from construction of artificial wetland areas – constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats. Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Wallum Froglet habitat in accordance with the 'Threatened Species Management Plan' (JWA 2011)
Performance criteria	- Minimise impacts on Wallum Froglet habitat. - Colonisation of constructed wetlands by Wallum Froglet. - Maintenance of water quality (pH, nutrient levels) within constructed and naturally occurring habitat. pH should be 4.2 – 6.7 in accordance with the 'Threatened Species Management Plan' (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in 'Habitat and Movements of the Wallum Froglet <i>Crinia tinnula</i> at the Southern Part of its Range'. ⁶ A similar pH range of 4.2 to 7.2 is identified in 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. ⁷ - Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Wallum Froglet). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.

⁶ White, A. W. & Pyke, G. H., 2006, 'Habitat and Movements of the Wallum Froglet *Crinia tinnula* at the Southern Part of its Range'. Unpublished paper submitted to Journal of Herpetology.

⁷ Ehmann, H. 1997 (ed), 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

Implementation strategy	• Design of constructed wetlands (liaison with relevant personnel). • Construction of wetlands. • Landscaping /revegetation works. • Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Wallum Froglet activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a weekly basis; and • frog monitoring on a monthly basis with an emphasis on monitoring in breeding season (June – August).
Reporting	Standard monitoring pro-formas to be filled in accordingly including results of any water quality testing. Results of monitoring to be collated and presented as report to Council, and other relevant authorities.
Identification of incident or failure	• Physical failure of constructed wetlands (e.g. breach). • Inappropriate pH levels. • Records of high nutrient input. • Absence or decline of Wallum Froglet.
Corrective action	Apply remedial measures to correct issues of water quality and habitat suitability.

Commitment

The contractor will commit to monitoring Wallum Froglet populations to ensure that constructed wetlands are appropriately constructed and maintained.

6.3 Threatened species - Olongburra frog

Applies to:	Species: Olongburra Frog (<i>Litoria olongburensis</i>) Bulk earthworks phase
Person responsible:	Contractor site manager, all personnel, ecologist.

Issue	Protection and restoration of habitat - disturbed mixed grassland and regenerating heathland. Protection and restoration of previously 2 constructed dams which currently occur in precincts 12 and 13, one of which requires repair. Provision of habitat from construction of artificial wetland areas – constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats. Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Olongburra Frog habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	• Minimise impacts on Olongburra Frog habitat. • Colonisation of constructed wetlands by Olongburra Frog. • Maintenance of water quality (pH, nutrient levels). • Maintenance of aquatic vegetation and dense reedland. • Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Olongburra Frog). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	• Design of constructed wetlands (liaison with relevant personnel). • Construction of habitat areas. • Landscaping /revegetation works. • Re-evaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Olongburra Frog activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a weekly basis; and • frog monitoring on a monthly basis with an emphasis on monitoring in breeding season (June – August).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any testing. Results of monitoring to be collated and presented as report to, Council and other relevant statutory authorities.

Identification of incident or failure	• Physical failure of constructed wetlands (e.g. breach). • Inappropriate pH levels. • Records of high nutrient input. • Absence or decline of Olongburra Frogs.
Corrective action	Apply remedial measures to correct issues of water quality and habitat suitability.

Commitment

The contractor will commit to monitoring Olongburra Frog populations to ensure that constructed wetlands are appropriately constructed and maintained.

6.4 Threatened species - Bush stone-curlew

Applies to:	Species: Bush Stone-curlew (<i>Burhinus grallarius</i>) Bulk earthworks phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, All personnel, ecologist.

Issue	Protection and restoration of habitat (Scribbly Gum woodland and regrowth heath in the south eastern margins of precincts 12 and 13). Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of vegetation and golf course management.
Operational policy	Protection and improvement of Bush Stone-curlew habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	Minimise impacts on Bush Stone-curlew habitat. Survival of planted trees to ensure additional habitat creation.
Implementation strategy	- Identifying area to be set aside for habitat protection. - Surveying & fencing area to exclude vehicle access. - Signage installed stating 'Habitat Area – Keep Out'. - Weed control & planting of additional Scribbly Gum to increase suitability of habitat. - Placement of woody debris to augment habitat requirements. - Retain existing vegetation where possible. - Reevaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: - ensure no works take place within habitat area; - ensure fencing and signage are maintained; - assess growth of planted trees & monitor weed invasion; and - survey for presence of Bush Stone-curlew.
Auditing	Periodic monitoring inspections of planted trees to be completed at stated intervals (e.g. every 3 months) in addition to weed assessment & control (if required). Bush Stone-curlew surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring planted trees and weed control works to be filled in by landscape maintenance staff/bush regenerators. Survey pro-formas to be completed by ecologist and presented as report to client and TSC and any other relevant statutory authorities.
Identification of	Contractors working within identified habitat area.

incident or failure	• Accidental removal of trees. • Poor survival of planted trees. • Removal of fencing or signage. • Weed invasion. • Absence or decline of Bush Stone-curlew population.
Corrective action	Educate contractors so that works (e.g. vegetation clearing) are not undertaken in habitat areas. Replacement of any dead trees with new stock as soon as detected. Responsibility for corrective actions rests with construction management, contractors and landscape staff or bush regenerators.

Commitment

The contractor will commit to monitoring Bush Stone-curlew populations and ensuring that the habitat area is appropriately protected and maintained.

6.5 Threatened species - Grass owl

Applies to:	Species: Grass Owl (<i>Tyto capensis</i>) Bulk earthworks phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, all personnel, ecologist.

Issue	Protection and restoration of habitat – tall rank grassland and heathland. Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of golf course management.
Operational policy	Protection of Grass Owl habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	- Minimise impacts on Grass Owl habitat. - Maintenance of rank grasslands and heathland vegetation.
Implementation strategy	- Identifying area to be set aside for habitat protection. - Surveying & fencing area to exclude vehicle access. - Signage installed stating 'Habitat Area – Keep Out'. - Weed control (if required). - Retain existing vegetation where possible. - Reevaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: - ensure no works take place within habitat area; - ensure fencing and signage are maintained; - monitor (& control) weed invasion; and - survey for presence of Grass Owl.
Auditing	Periodic weed assessment & control (if required) at 3 month intervals. Grass Owl surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client and TSC and any other relevant statutory authorities.
Identification of incident or failure	- Contractors working within identified habitat area. - Weed invasion. - Removal of fencing or signage. - Absence or decline of Grass Owl population.

Corrective action	Educate contractors so that works (e.g. vegetation clearing) are not undertaken in habitat areas. Replacement of any dead trees with new stock as soon as detected. Responsibility for corrective actions rests with construction management, contractors and landscape staff or bush regenerators.
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Commitment

The contractor will commit to monitoring Grass Owl populations ensuring that identified habitat area is appropriately protected and maintained.

6.6 Threatened species - Koala

Author:	James Warren & Associates Pty Ltd
Applies to:	Species: Koala (<i>Phascolarctos cinereus</i>) Bulk earthworks phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, all personnel, ecologist.

Issue	Protection and restoration of habitat. Predation by feral dogs. Injury/death from vegetation clearing. Injury/death from vehicle strike.
Operational policy	Protection and creation of Koala habitat in accordance with the <i>Koala Plan of Management</i> ('KPoM', JWA 2011).
Performance criteria	- Minimise loss of Koala feed trees as identified in the KPoM. - Planting of additional feed trees in accordance with rehabilitation and maintenance targets prescribed in the KPoM (JWA 2011). - Creation of habitat corridors for movement & foraging.
Implementation strategy	- Identify all areas of Core Koala habitat to be retained and surround with barrier fencing prior to any works commencing. - Inform all contractors that these areas are to be retained. - Contractors are prohibited to bring dogs on to site. - Establish Koala sighting logbook for contractors to fill out while on site. All sightings, including mortalities, to be reported in accordance with KPoM. - Identify potential areas for tree/corridor plantings. - Survey and fence corridor planting areas and erect signage 'Restoration Area – Keep Out'. - Vehicles restricted to a maximum speed of 50kph, only operating in daylight hours. - Planting of preferred Koala food tree species within planting areas identified in the KPoM (JWA 2011). - Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: - monitor fenced areas have not been breached; - monitor health of plantings; and - survey for Koala presence & use of habitat areas.
Auditing	Periodic assessment of plantings & weed assessment & control (if required) within habitat areas at 3 month intervals. Koala surveys to be

	completed on a periodic basis (e.g. every 6 months).
Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client and TSC and any other relevant statutory authorities. A Koala Monitoring Report is to be prepared by a suitably qualified person on an annual basis, from the date of commencement of bulk earthworks, for 5 years or as otherwise determined by the Director-General. Reports to be submitted to DoP, DECCW, TSC and DPI Fisheries.
Identification of incident or failure	• Contractors working within identified habitat area. • Removal of any marked Koala feed trees. • Weed invasion & decline in planting health. • Death of planted trees. • Absence or decline of Koala population.
Corrective action	Educate staff that no clearing of Koala feed trees occurs, and that works do not occur within fenced Koala habitat areas. Replacement of any dead trees with new stock as soon as detected, and weed control undertaken in restoration areas.

Commitment

The contractor will commit to monitoring Koala populations and liaising with construction management to ensure that identified habitat area is appropriately protected and maintained.

6.7 Erosion controls

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Consulting Engineer

Issue	Erosion controls.
Operational policy	To prevent the displacement of sediment and soil across and offsite during storm events. To manage erosion controls in accordance with the site's <i>Erosion and Sediment Control Plan</i> (ESCP, Gilbert & Sutherland April 2011).
Performance criteria	No visual indication of erosion on stages under construction, including evidence of rilling (an indicator of sheet erosion).
Implementation strategy	Erosion and sediment control devices shall be installed prior to the commencement of work in each stage in accordance with the site's ESCP. No site disturbance shall commence until the appropriate approvals have been obtained. Where possible, the construction program shall be scheduled to minimise the potential for soil loss to occur. Where construction activities cannot be altered, additional controls shall be implemented in the areas of high erosion potential. Runoff and erosion controls shall be installed prior to clearing and include: • Diversion of upslope runoff around cleared and/or disturbed areas in a way that minimises erosion, minimises the upslope catchment and diverts waters to a legal point of discharge. • Sediment control fences or other measures at the downslope perimeter of cleared and/or disturbed areas. • Regular maintenance of all erosion control measures at operational capacity until land is effectively rehabilitated. • Temporary erosion measures are to be employed onsite during construction in accordance with the site's ESCP or where reasonably deemed necessary by TSC from an assessment of slope and soil type. Such measures shall be maintained at, or above, their design capacity. Such measures should be in accordance with the recommendations in Council's 'Code of Practice for Soil and Water Management on Construction Works – Annexure A of Development Design Specification D7 – Stormwater Quality' and "Managing Urban Stormwater: Soils and Construction" March 2004 by Landcom, Australia. On stages where more than 1,000m² are to be disturbed, runoff controls are also to include: • the use of barrier fencing; • the use of exclusion zones; and

	• minimising slope lengths of disturbed, uncontrolled areas. Stripped topsoil shall be separated from subsoil materials and shall only be stripped from the areas designated on the appropriate plans. Stockpiled soil should be stored taking into account the following considerations: • stockpiles are not to be located on public footpaths, nature strips, roads, road shoulders or any other public land; • they will be located at least 2m away from any hazard areas; • they will be protected from upslope surface flows; and • downslope sediment filters will be provided. • Fill batters shall be located to avoid established trees. • Unless otherwise specified, trenches must be backfilled and compacted to 95% standard compaction and capped with topsoil. Excess spoil may be retained onsite provided the stockpile area is prepared by stripping topsoil from beneath the fill site for further use in revegetation. Outside the construction area of Stage 1, existing surface water conditions should be maintained wherever possible. All stockpiles, including preload, should be seeded within a fortnight of final forming with an appropriate mix.
Monitoring	Regular site inspections shall be undertaken to monitor the effectiveness of sediment and erosion controls. A site inspection and monitoring program shall include: • weekly site inspections; • inspections immediately following rainfall events that cause runoff; and • inspections immediately before site closure. Surface water to be monitored at discharge points during rainfall events for suspended solids/turbidity in accordance with Section 6.14.
Auditing	Regular site inspections shall be carried out in accordance with the above monitoring requirements. Additional visual inspections to be carried out weekly and after rainfall events to verify that control measures are in place and properly maintained.
Reporting	Signed site inspection records, original test results, weekly and other result sheets shall be kept on site and made available on request to TSC officers and other relevant statutory authorities.
Identification of incident or failure	• Signs of erosion on site. • Damaged or failed erosion control devices. • Decline in water quality as identified by environmental consultant.

Corrective action	Apply remedial measures to improve sediment and erosion control including the incorporation of additional measures, including but not limited to hay bales, silt fences and flocculation of water quality control ponds. Should additional measures prove unsuccessful, consultation with an environmental consultant and/or construction site erosion and sedimentation control specialist.
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Commitment

The Contractor will ensure best management practices are implemented during bulk earthworks phase to minimise erosion.

6.8 Sediment control

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Consulting Engineer

Issue	Sediment control.												
Operational policy	To prevent the displacement of sediment and soil across and offsite during storm events. To manage sediment controls in accordance with the Erosion and Sediment Control Plan (Gilbert & Sutherland April 2011).												
Performance criteria	Offsite discharges to comply with requirements for suspended sediments, turbidity and litter/gross pollutants as detailed below. <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>Suspended solids</td><td><50mg L⁻¹</td><td>Maximum</td></tr><tr><td>Turbidity</td><td>As developed from background monitoring</td><td>Maximum</td></tr><tr><td>Litter and gross pollutants</td><td>No man made material >5mm in any dimension</td><td>--</td></tr></table>	Water Quality Parameter	Release Criteria	Criteria Type	Suspended solids	<50mg L ⁻¹	Maximum	Turbidity	As developed from background monitoring	Maximum	Litter and gross pollutants	No man made material >5mm in any dimension	--
Water Quality Parameter	Release Criteria	Criteria Type											
Suspended solids	<50mg L ⁻¹	Maximum											
Turbidity	As developed from background monitoring	Maximum											
Litter and gross pollutants	No man made material >5mm in any dimension	--											
Implementation strategy	All sediment control measures and facilities must be installed and stabilised prior to the commencement of construction activities. No site disturbance shall commence until the appropriate approvals have been obtained. Temporary erosion measures (e.g. silt fences) are to be employed onsite during construction where reasonably deemed necessary by TSC from an assessment of slope and soil type. Such measures should be in accordance with the recommendations in Council's 'Code of Practice for Soil and Water Management on Construction Works – Annexure A of Development Design Specification D7 – Stormwater Quality' and "Managing Urban Stormwater: Soils and Construction" March 2004 by Landcom, Australia. Silt fence geotextiles are to be replaced when damaged or permanently blocked. Level markers shall be installed within all sediment ponds. Internal waterbodies or waterways shall be dosed with flocculating agents when required to ensure that discharge water quality meets required limits specified in the above performance criteria. Sediment shall be cleaned out of sediment ponds when accumulated sediment volume reaches 70%. Removed materials must be disposed of												

Monitoring

in a manner that does not cause pollution.

All weather access tracks shall be constructed to all internal water bodies, trash racks and gross pollutant traps.

Where practical, surface waters from undisturbed lands shall be diverted away from construction areas.

Sediment detention basins and clean-water diversion channels shall be constructed prior to earthworks in accordance with the ESCP.

When sediment controls are required outside the construction site the following shall be adhered to:

- where increased stormwater runoff is likely to accelerate erosion of any downstream watercourse, the necessary remedial work shall be undertaken;
- all immediate downstream drainage inlets shall have appropriate controls installed in accordance with the approved engineering drawings; and
- all disturbed areas on other property are to be reinstated to the original condition.

Outside the construction area of each stage, existing surface water conditions to be maintained wherever possible.

Regular site inspections shall be undertaken to monitor the effectiveness of sediment and erosion controls. A site inspection and monitoring program shall include:

- weekly site inspections;
- inspections immediately following rainfall events that cause runoff; and
- inspections immediately before site closure.

Surface water quality to be monitored monthly and during rainfall events in accordance with the following:

Water Quality Parameter	Release Criteria	Criteria Type
pH	As developed from background monitoring	Range
Electrical conductivity	<1.5dS m ⁻¹	Maximum
Suspended solids	<50mg L ⁻¹	Maximum
Turbidity	As developed from background monitoring	Maximum
Dissolved oxygen	60-105% saturation	Minimum
Litter and gross pollutants	No man made material >5mm in any dimension	--

	Oil and grease	No visible film, no detectable odour	--	
Auditing	Regular site inspections shall be carried out in accordance with the above monitoring requirements. Additional visual inspections to be carried out monthly and after rainfall events to verify that control measures are in place and properly maintained.			
Reporting	Signed, site inspection records, original test results, weekly and other result sheets shall be kept on site and made available on request to TSC officers and other relevant statutory authorities.			
Identification of incident or failure	Falling water quality as identified by environmental consultant. Build-up of sediment.			
Corrective action	Apply remedial measures to improve sediment and erosion control including the incorporation of additional measures, including but not limited to, silt fences and flocculation of water quality control ponds. Should additional measures prove unsuccessful, consultation with an environmental consultant and/or construction site erosion and sedimentation control specialist.			

Commitment

The contractor will ensure best management practices are implemented into work practices throughout bulk earthworks to minimise sediment transport off site.

6.9 Acid sulfate soil identification

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Acid sulfate soil identification
Operational policy	Excavated material will be managed in accordance with the site's Acid Sulfate Soils Management Plan (Gilbert & Sutherland June 2011).
Performance criteria	All ASS & PASS are appropriately identified prior to treatment.
Implementation strategy	All soils excavated across the site (below RL5.0) will be sampled according to the following phase 2 sampling protocols undertaken concurrently with the bulk earthworks (or ahead of the excavation face). Frequency: Take a minimum of 1 soil sample collected at each colour or texture change with a minimum of 1 sample every 500m³ of all excavated soils analysed by the SPOCAS method (or Chromium suite), either from investigative boreholes or the excavated profile face. Sample size: Soil samples approximately 0.3kg each with a brief soil texture description accompanying each sample. Sampling: Soil samples to be tested onsite or collected in sealed containers that exclude air for temporary storage prior to testing onsite. Handling and storage: Samples destined for storage shall be frozen or dried within 24 hours of collection. The volume of material being excavated shall be timed to ensure sufficient space is available to accommodate the number of treatment or liming pads for the drying and neutralisation of the ASS in accordance with Table 6.10 'Acid sulphate soil assessment and treatment' of the SBMP. The timing of the excavation works shall also take into consideration the expected laboratory turnaround time to ensure the phase 2 (identification) and phase 3 (verification) results are obtained prior to the excavation and treatment of the next layer. Should issues arise which disrupt the anticipated timing of the excavation, changes shall be made to the earthworks strategy. Temporary short-term stockpiling of untreated ASS shall only be undertaken for a maximum period of 5 days in accordance with the <i>Acid Sulfate Soils Manual 1998</i> (ASSMAC). The total volume of stockpiled material should not exceed 20% of a day's total extraction. In the event that operational delay times (for instance inclement weather) require the stockpiling of untreated ASS exceeding 5 days, medium-term stockpiles may be established for a maximum duration of 28 days. Should this be required, the relevant administering authority shall be notified and justification provided. Stockpiled untreated ASS soils will be stored taking into account the following considerations:

	• Stockpiles will be located away from hazard areas, including but not limited to watercourses, drainage lines and native vegetation, taking into account slope, soil type and surface area. • For all medium-term stockpiles, a guard layer will be in place. The amount of neutralising agent used will be 0.3 times the average potential and existing acidity of the stockpile/m² per vertical metre of soil that is to be temporarily placed in the stockpile. • All stockpiles will be appropriately bunded and protected from surface flows by the installation of diversion banks upslope of the stockpile. • Any leachate generated as result of the stockpile material will be contained and tested prior to release in accordance with Table 6.11 'Acid sulphate soil leachate monitoring'. • Downslope erosion and sediment controls will be installed in accordance with Table 6.7 'Erosion controls' and Table 6.8 'Sediment control' and dust mitigation measures adopted (if required) as per Table 6.16 'Air quality and dust management' for stockpiled ASS material. Groundwater and surface water monitoring shall be undertaken to facilitate the detection of potential or emerging changes as a result of the exposure of ASS. Geotechnical investigations shall be undertaken in accordance with Table 6.28 'Geotechnical investigation & analysis' of the SBMP to allow for the identification of potential disturbances to <i>in situ</i> ASS as a result of filling activities, including pre-loading.
Monitoring	Laboratory analysis will employ the SPOCAS Method (Method 23) or Chromium Suite (Method 22B). Laboratory analysis will be undertaken in the Gilbert & Sutherland on-site ASS laboratory. Material (spatial) tracking of dry and wet excavated material will be undertaken by the environmental consultant and site supervisor. Records shall be kept of volumes excavated, location of excavated material and acid sulfate soil testing frequency.
Auditing	Regular inspections to be undertaken to ensure compliance with the above implementation strategies.
Reporting	ASS analytical results including interpretation and liming rates shall be reported to the site supervisor and kept onsite.
Identification of incident or failure	Insufficient sampling or failure to sample as identified by material tracking records and/or test results and/or procedures.
Corrective action	Undertake additional sampling as required to completely characterise the nature of the material to be disturbed. Consultation with an Environmental Consultant to determine appropriate rates for additional sampling.

Commitment

The contractor will undertake all necessary investigations to identify the occurrence and severity of PASS, AASS and acidic soils during the bulk earthworks phase.

6.10 Acid sulfate soil assessment and treatment (dry and wet excavation)

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Acid sulfate soil assessment & treatment.
Operational policy	No acid sulfate soils are to be disturbed or excavated without appropriate testing and/or treatment by neutralisation of the acid generation potential (AGP) of the material. Excavated material will be managed in accordance with the site's <i>Acid Sulfate Soils Management Plan</i> (Gilbert & Sutherland June 2011).
Performance criteria	No material will be covered until phase 3 validation tests indicate compliance with acceptance criteria based on the action levels of oxidisable sulfur or TPA, as outlined in the <i>Acid Sulfate Soils Manual 1998</i> (ASSMAC).
Implementation strategy	All material identified as AASS or PASS in accordance with the protocol detailed in Table 6.9 'Acid sulfate soil identification' of the SBMP, shall be treated as follows: Lime Treatment All excavated soils will be treated with lime or neutralising agent to neutralise their equivalent net acid generating potential (TPA or equivalent oxidisable sulphur concentrations). Lime treatment will be required where the following thresholds are exceeded: Potential soil acidity (S_{POS} or S_{CR}): $>0.3\%$, Actual soil acidity (TAA): $>18 \text{ mol H}^+/\text{t}$, If $\text{pH}_{\text{KCl}} < 4.5$ and/or if jarosite is present, retained soil acidity analysis (SNAS or SRAS) will also be required. A mixing factor of safety of 1.5 shall be implemented. Material will be placed in spatially tracked lots within bunded areas. The bunded areas shall have a leachate collection system. Water collected within these bunded areas shall be tested and treated in accordance with Table 6.11 'Acid sulfate soil leachate monitoring' of the SBMP. Materials used to construct the bunds will be free from acid sulfate soils. The bunded area will be prepared with surface lime at the rate of $0.2 \times$ average net acid generating potential (NAGP) per metre depth of material to be placed or at the minimum rate of $5\text{kg}/\text{m}^2/\text{metre depth of material}$. Material will be placed to a depth of $<300\text{mm}$, limed at the rate determined by Phase 2 testing outlined in Section 6.9 and mixed with a rotary hoe or disc plough to a minimum depth of 300mm. Excavation faces and exposed sides of open drains/pits will be surface limed with lime slurry immediately after excavation at a rate of $5\text{kg}/\text{m}^2$. All

	areas will be regularly monitored and lime reapplied as required. Validation testing Following lime treatment, validation (Phase 3) testing will be performed by SPOCAS (or similar method agreed with DECCW) plus ANC sampled at the rate of one sample per 1,000m³ of treated material. Subsequent treatment layers (<300mm) will not be placed within the treatment pad until Validation (Phase 3) testing results are obtained, indicating the complete neutralisation of the treated material. Excavation works and timing of stockpiling/treatment All excavation works and stockpiling of untreated acid sulfate materials shall be carried out in such a manner that: • The surface area of materials exposed to oxidation is minimised. • The length of time the untreated materials are exposed to air is minimised. • It provides for a system of suitable diversion drains or embankments to divert surface waters away from the stockpiles and the excavation area. • It ensures that any unforeseen groundwater seepage and/or leachate and/or stormwater runoff within the excavation area is collected and not released from the site, untreated to any stormwater drain or waters (including groundwater). • It ensures that any leachate and/or stormwater runoff which has been in contact with acid sulfate materials or contaminants is collected and not released from the site, untreated to any stormwater drain or waters (including groundwater). Supply of neutralising agent A supply of neutralising agent or agricultural lime shall be kept onsite at all times for treatment of acid sulfate soils. The supply shall be stored in a covered and bunded area to prevent accidental release to the environment. A supply of hydrated lime shall be kept onsite at all times for treatment of acidic waters (if encountered). Storage requirements for hydrated lime shall be as specified for a neutralising agent or agricultural lime and in accordance with the manufacturer's MSDS.
Monitoring	Soil that has been treated by neutralisation shall meet the following performance criteria: 1. Acid base accounting shall be used to demonstrate that there is an excess amount of acid neutralising capacity of at least 0.5 times the potential plus existing acidity of the soil (i.e. the 1.5 safety factor). If the excess acid neutralising capacity (ANC) is less than 0.2 times the potential plus existing acidity, the soil shall be re-treated. ANC shall also be moderated by the use of a fineness factor of at least 1.5. 2. Post-neutralisation, the soil pH is to be greater than 6.5; and 3. Excess neutralising agent shall remain within the soil until all acid

Auditing	generation reactions are complete and the soil has no further capacity to generate acidity. Collect lime delivery dockets and compare with calculated amounts required. All validated materials shall be stored separately to non-validated materials.
	Monthly auditing of testing and treatment procedures including review of lime treatment dockets and spatial tracking to be undertaken.
Reporting	Records including testing results and lime delivery dockets are to be kept on site during the construction phase and should be available for inspection at all times. Records shall be made available to DECCW and TSC upon request.
Identification of incident or failure	Further investigation would only be required if: • Verification (Phase 3) sampling tests fail, indicating the insufficient application of lime. • The formation of jarosite in exposed or excavated soils was observed. • Areas of green-blue water or extremely clear water occurred. • Rust-coloured deposits on plants and on the banks of drains or water bodies were noted. • A sulfurous odour was detected. • The pH of related water bodies dropped substantially below background levels.
Corrective action	Retesting of materials in vicinity of excavation using ASSMAC approved method. Any need for additional lime in specific lots would be assessed and applied with thorough mixing.

Commitment

The contractor will appropriately treat any PASS and ASS excavated in the course of construction, in accordance with the recommended liming rates determined by Phase 2 testing.

6.11 Acid sulfate soil leachate monitoring

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Water quality monitoring.		
Operational policy	Waters ponded within the bunded treatment pads or associated with acid sulfate soil stockpiles will be managed in accordance with the site's <i>Acid Sulfate Soils Management Plan</i> (Gilbert & Sutherland June 2011).		
Performance criteria	All waters ponded within the bunded treatment pads or associated with acid sulfate soil stockpiles and discharged from the site or to on-site drains or watercourses will comply with the following criteria.		
	Surface Water Quality Parameter	Release Criteria	Criteria Type
	pH*	As developed from background monitoring	Range
	Electrical conductivity	<1.5dS m ⁻¹	Maximum
	Suspended solids	<50mg L ⁻¹	Maximum
	Turbidity	As developed from background monitoring	Maximum
	Dissolved oxygen	60-105% saturation	Minimum
	Dissolved Iron	<0.3mg L ⁻¹	Maximum
	Aluminium	As developed from background monitoring	Maximum
	Litter and gross pollutants	No man made material >5mm in any dimension	--
	Oil and grease	No visible film, no detectable odour	--
Implementation strategy	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in '<i>Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range</i>'.⁸ A similar pH range of 4.2 to 7.2 is identified in '<i>Threatened frogs of New South Wales: Habitats, Status and Conservation</i>'.⁹		
	Surface water monitoring will be undertaken prior to discharge of waters ponding in ASS treated areas. Existing surface water conditions shall be maintained outside the construction area. Runoff will be directed around the bunded PASS treatment areas to		

⁸ White, A. W. & Pyke, G. H., 2006, '*Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range*'. Unpublished paper submitted to Journal of Herpetology.

⁹ Ehmann, H. 1997 (ed), '*Threatened frogs of New South Wales: Habitats, Status and Conservation*'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

	minimise the potential for leaching and the possibility of the bund breaching prior to the testing and treatment of the contained water. All ponded surface and/or groundwater within excavations in estuarine soils below 5m AHD shall be tested within the excavation and treated if necessary prior to discharge in accordance with Table 6.13 'Groundwater seepage monitoring.' Low pH waters (i.e. pH<6.5) that need to be amended to be consistent with receiving environment waters of pH >6.5 may be ameliorated in-situ by the use of hydrated lime or crushed ag-lime to achieve a pH>6.5 and <9.0 prior to release. In using hydrated lime, all care shall be undertaken to ensure pH is not above 9.0. Low pH waters consistent with receiving environment waters of pH 4.2-6.7 and that contain dissolved iron above 0.3mg L⁻¹ will require treatment to reduce dissolved iron to acceptable levels prior to discharge. A supply of hydrated lime shall be kept on site at all times for treatment of acidic waters (if encountered). Storage requirements for hydrated lime shall be in accordance with the manufacturer's MSDSs.
Monitoring	The contractor or site manager shall inspect site works weekly and following rainfall events for any evidence of ponded acidic waters. Pre-discharge monitoring will be undertaken as outlined above to ensure compliance with the release criteria and results will be documented. All monitoring will be undertaken using equipment regularly calibrated, with samples sent to a NATA registered laboratory where appropriate. Daily rainfall to be recorded by the civil contractor.
Auditing	Environmental consultant to audit water quality results to ensure all discharges comply with the performance criteria.
Reporting	Result sheets to be compiled for monitoring results relating to water quality of ponded water. These results to be kept onsite for inspection by local and state government officers upon request. These results to be included in monthly reports to the supervising engineer until completion of works.
Identification of incident or failure	Discharge of waters ponded within PASS treatment areas that are outside the specified limits for the site.
Corrective action	If ponded water is detected outside the criteria range, all such waters will be contained until such time as the water quality is adjusted to within the range specified by the outcome of background monitoring or other criteria stated above. Correction of water quality will be undertaken in consultation with the environmental consultant.

Commitment

The contractor will ensure water that is trapped within bunded areas established for the treatment of PASS is monitored and treated to ensure that acidic water is not discharged from the site.

6.12 Groundwater monitoring

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Groundwater monitoring.
Operational policy	To establish the stable groundwater conditions and verify by monitoring that development management is appropriate. Groundwater monitoring is to be undertaken in accordance with the site's <i>Groundwater Assessment and Management Plan</i> (Gilbert & Sutherland June 2011).
Performance criteria	Water quality objectives for the bulk earthworks phase of works would be devised using DECCW guidelines for groundwater monitoring. These proposed objectives would be submitted to TSC for review and approval prior to implementation. Groundwater monitoring will be undertaken for the following parameters: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L^{-1}); • total nitrogen and nitrate, nitrite and ammonium (mg L^{-1}); • total and soluble phosphorus (mg L^{-1}); • total and soluble iron and filtered aluminium; • oil and grease (visual inspection); • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and • colour. Laboratory analysis for total acidity (titratable) and total alkalinity should also be undertaken.
Implementation	Monitoring of groundwater levels should be undertaken fortnightly during

strategy	the construction phase to determine any effect excavation and dewatering activities may have on groundwater levels. Groundwater samples are to be collected monthly and analysed for the parameters specified above.
Monitoring	Carry out fortnightly groundwater level monitoring and monthly groundwater quality monitoring at locations to be specified. Sample recovery and in-situ analysis will be performed by onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory.
Auditing	The environmental consultant is to audit water quality to ensure that no deleterious effects are resulting from any excavation, filling and dewatering operations at the site. The data from the water level measurement shall be collated quarterly and evaluated against the background monitoring data. It will also be used to verify the predictive model for groundwater behaviour.
Reporting	Quarterly reports are to be submitted to TSC within one (1) month of the collection of water quality data. The quarterly reports to TSC shall include raw data, a results summary and a discussion comparing results with baseline values and ANZECC guidelines. Result sheets to be compiled for monitoring results. All results shall be made available for inspection by local and state government officers when requested.
Identification of incident or failure	Degradation of groundwater quality at the monitoring points to below the "Performance Criteria" levels (to be derived following baseline monitoring). Variations in groundwater levels beyond typical seasonal fluctuations.
Corrective action	If the test results for any parameter fails to meet the performance criteria (to be determined based on background monitoring), further investigations will be conducted. This will involve fortnightly groundwater quality monitoring (or more frequent if deemed necessary by the environmental consultant) of the subject parameter(s). The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in groundwater quality is present. If a trend exists for declining groundwater quality, the likely source(s) of contamination will be identified. Should the investigation indicate that site activities are triggering the incident/failure, the following will be implemented: • Locate the source of the contamination/level variation and take all possible actions to contain and control the contaminant/level variation. Investigate the cause of the contamination/level variation and take action to prevent a recurrence.

- All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted.

The quality of the dewatered groundwater being discharged to recharge trenches shall be reviewed to confirm compliance with the performance criteria detailed below.

Water Quality Parameter	Release Criteria	Criteria Type
pH	As developed from background monitoring	Range
Oil and grease	No visible film, no detectable odour	-

Commitment

The contractor will seek to establish stable groundwater conditions and verify by monitoring that development management is appropriate.

6.13 Groundwater seepage monitoring

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Groundwater seepage monitoring.																																				
	Management of groundwater seepage quality entering excavation areas.																																				
Operational policy	To minimise and manage the generation of acidic waters entering the onsite excavation areas through seepage. To provide for monitoring and treatment of these waters prior to disposal. Groundwater monitoring is to be undertaken in accordance with the site's <i>Groundwater Assessment and Management Plan</i> (Gilbert & Sutherland June 2011).																																				
Performance criteria	Daily pH monitoring of any seepage within the excavation areas is to be undertaken prior to the disposal of these waters via dewatering. All waters discharged from the excavation areas to the recharge trenches during the construction phase should comply with the following criteria: <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>pH</td><td>As developed from background monitoring</td><td>Range</td></tr><tr><td>Oil and grease</td><td>No visible film or detectable odour</td><td>--</td></tr></table> Where the discharge of dewatered groundwater to on-site or nearby drains and waterways is intended, water quality will satisfy the following performance criteria prior to release at the controlled discharge locations: <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>pH*</td><td>As developed from background monitoring</td><td>Range</td></tr><tr><td>Electrical conductivity</td><td><1.5mS cm⁻¹</td><td>Maximum</td></tr><tr><td>Suspended solids</td><td><50mg L⁻¹</td><td>Maximum</td></tr><tr><td>Turbidity</td><td>As developed from background monitoring</td><td>Maximum</td></tr><tr><td>Dissolved oxygen</td><td>60-105% saturation</td><td>Minimum</td></tr><tr><td>Total and dissolved Iron</td><td><0.3mg L⁻¹</td><td>Maximum</td></tr><tr><td>Total and dissolved Aluminium</td><td>As developed from background monitoring</td><td>Maximum</td></tr><tr><td>Litter and gross</td><td>No man made material</td><td>-</td></tr></table>	Water Quality Parameter	Release Criteria	Criteria Type	pH	As developed from background monitoring	Range	Oil and grease	No visible film or detectable odour	--	Water Quality Parameter	Release Criteria	Criteria Type	pH*	As developed from background monitoring	Range	Electrical conductivity	<1.5mS cm ⁻¹	Maximum	Suspended solids	<50mg L ⁻¹	Maximum	Turbidity	As developed from background monitoring	Maximum	Dissolved oxygen	60-105% saturation	Minimum	Total and dissolved Iron	<0.3mg L ⁻¹	Maximum	Total and dissolved Aluminium	As developed from background monitoring	Maximum	Litter and gross	No man made material	-
Water Quality Parameter	Release Criteria	Criteria Type																																			
pH	As developed from background monitoring	Range																																			
Oil and grease	No visible film or detectable odour	--																																			
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Total and dissolved Aluminium	As developed from background monitoring	Maximum																																			
Litter and gross	No man made material	-																																			

	pollutants	>5mm in any dimension	
	Oil and grease	No visible film, no detectable odour	-
	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in '<i>Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range</i>'.¹⁰ A similar pH range of 4.2 to 7.2 is identified in '<i>Threatened frogs of New South Wales: Habitats, Status and Conservation</i>'.¹¹		
Implementation strategy	The site contractor shall be equipped with reliable pH monitoring equipment that will be calibrated on a weekly basis (at least). Dewatered groundwater will undergo appropriate treatment to ensure compliance with the above criteria prior to release into recharge trenches. Where disposal to surface water bodies is intended monitoring will be undertaken at the controlled discharge points by the environmental consultant monthly and during rainfall events (defined as >25mm in any 24 hour period). Records of the measured pH, time of monitoring, calibration records and treatment measures employed are to be kept on site for inspection by the environmental consultant and TSC. The total acid risk of seepage waters shall be determined from the total acidity (titratable) results measured during the background monitoring program. These results will be considered during the preparation of a treatment program for any dewatered acidic groundwater. Outside the construction area of each stage existing surface water conditions shall be maintained in accordance with Table 6.14 'Surface water quality'. If acidic seepage waters are encountered, the batter slopes of the excavation face should be subject to blanket liming as required at a predetermined rate in accordance with an acid sulfate management plan provisions. The addition of liquid lime to acidic seepage waters may also be required. The environmental consultant should be consulted to determine the need for this treatment and the required addition rate in accordance with Table 6.11 'Acid sulfate soil leachate monitoring' of the SBMP. Where recharge trenches are required, the base and sides of the trench should also be blanket limed at a predetermined rate prior to the disposal of dewatered groundwater in accordance with Table 6.10 'Acid sulfate soil		

¹⁰ White, A. W. & Pyke, G. H., 2006, '*Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range*'. Unpublished paper submitted to Journal of Herpetology.

¹¹ Ehmann, H. 1997 (ed). '*Threatened frogs of New South Wales: Habitats, Status and Conservation*'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

	assessment and treatment' of the SBMP. Before undertaking any earthworks in drains or watercourses, the drain or watercourse will be bunded and contained in a staged manner, with water tested and treated prior to discharge. Particular attention will be given to watercourses containing high levels of organic matter that may also have the potential to form monosulfidic black oozes (MBOs). Existing MBOs will be managed, with organic material within the drain kept to a minimum and dissolved oxygen concentrations within water-bodies monitored and increased if necessary (in accordance with the recommendations outlined in Tulau (2007). Titratable Actual Acidity contents and water pH levels of water-bodies will also be monitored and adjusted as necessary.
Monitoring	Carry out daily pH monitoring of seepage waters entering excavations during the construction phase prior to disposal into recharge trenches. Where disposal to surface water bodies is intended, all waters leaving the site at the controlled discharge points will be monitored for pH, electrical conductivity, suspended solids, dissolved oxygen, oil and grease monthly and during rainfall events. Analysis for total algae numbers will also be conducted monthly and during rainfall events once the waterbody(ies) have been brought online and are operational. Monitoring for aluminium and total and dissolved iron will occur on a monthly basis at water holding locations prior to discharge off site. Samples will be forwarded to a NATA registered laboratory for analysis when required.
Auditing	A visual inspection of the contractor's monitoring and treatment records shall be undertaken to verify sufficient monitoring and treatment is being undertaken. Management to audit water quality results monthly to verify that discharges comply with the performance criteria.
Reporting	Recording of monitoring results and treatment procedures is required. Results are to be available onsite at all times.
Identification of incident or failure	Discharge of ground waters to recharge trenches that do not satisfy the nominated pH range for this site.
Corrective action	Take necessary steps to address the problem and apply remedial measures to prevent the generation of excessive acid seepage waters (i.e. blanket liming of excavated faces and recharge trenches).

Commitment

The contractor will minimise and manage the generation of acidic waters entering the onsite excavation areas through seepage and to monitor and treat these waters prior to disposal.

6.14 Surface water quality

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Surface water controls.		
Operational policy	To establish background water quality conditions and maintain these conditions wherever practicable during the construction phase.		
Performance criteria	All water discharged from the controlled discharge points will comply with the following criteria:		
	Water Quality Parameter	Release Criteria	Criteria Type
	pH*	As developed from background monitoring	Range
	Electrical conductivity	<1.5mS/cm	Maximum
	Suspended solids	<50mg L ⁻¹	Maximum
	Turbidity	As developed from background monitoring	Maximum
	Dissolved oxygen	60-105% saturation	Minimum
	Total and dissolved Iron	<0.3mg L ⁻¹	Maximum
	Filtered Aluminium	As developed from background monitoring	Maximum
	Litter and gross pollutants	No man made material >5mm in any dimension	--
	Oil and grease	No visible film, no detectable odour	--
	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in ' <i>Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range</i> '. ¹² A similar pH range of 4.2 to 7.2 is identified in ' <i>Threatened frogs of New South Wales: Habitats, Status and Conservation</i> '. ¹³		
Implementation	Construction of internal bio-retention and filter basins used as temporary sediment detention basins. other temporary sediment detention basins.		

¹² White, A. W. & Pyke, G. H., 2006, '*Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range*'. Unpublished paper submitted to Journal of Herpetology.

¹³ Ehmann, H. 1997 (ed). '*Threatened frogs of New South Wales: Habitats, Status and Conservation*'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

strategy	clean-water diversion channels, swales and vegetated filter strips will be constructed prior to the commencement of earthworks. Stormwater control will be achieved by directing as much runoff from disturbed areas as practicable to the sediment detention basins. Clean water diversion channels will be used to divert clean water from construction areas. Monitoring of the sediment detention basins for compliance with background conditions will take place prior to any discharge of stormwater (controlled or uncontrolled) from the site. Samples are to be collected monthly and during rainfall events (defined as >25mm in any 24 hour period) at the upstream and downstream sampling locations and water quality control pond discharge point and analysed for the above parameters. Where water quality fails to meet the established criteria, corrective measures will be undertaken (e.g. if sediment problems are identified, settling in the sediment detention ponds shall be aided by dosing with flocculation agents) to achieve compliance with the water quality release criteria. Treated water is to be re-tested prior to release to establish the effectiveness of treatment measures. Landscaping activities and revegetation will occur as soon as possible during/after the construction phase of development. Only appropriate herbicides and fertilisers are to be used in accordance with TSC specifications. Silt fences will be placed along the downstream extents of all construction. Clean-up of GPT's on a quarterly basis or after significant rainfall events.
Monitoring	Monitoring for pH, electrical conductivity, suspended solids, turbidity, dissolved oxygen, litter and gross pollutants and oil and grease will be conducted monthly and during rainfall events. Analysis for total algae numbers will also be conducted monthly and during rainfall events once any waterbody(ies) specified by the erosion and sediment control plan have made operational. Monitoring for aluminium and total and dissolved iron will occur on a monthly basis at water holding locations prior to discharge off site. If iron floc, sediments or iron staining are observed at the discharge points, samples should also be taken for laboratory analysis and discharge halted until water has been treated to adequate levels. Iron indicator strips will be used if practicable. Sample recovery and in-situ analysis will be performed by trained onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory. Sediment and erosion control measures will be inspected daily by the site manager during periods of rainfall.
Auditing	Environmental consultant to audit water quality results to ensure all

	discharges comply with the performance criteria.
Reporting	Result sheets to be compiled for monitoring results relating to water quality of water bodies. These results to be kept onsite for inspection by local and state government officers. Monthly reports to be submitted to TSC until completion of works. These reports will be submitted to TSC within 30 working days upon receipt of the laboratory results. The water quality reports will be prepared by a suitably qualified and experienced Environmental Consultant. These reports will detail: • The results for each of the environmental indicators monitored. • An assessment of the monitoring results against the release criteria. • An evaluation, if applicable, of the environmental conditions if monitoring results fall outside the limits of the release criteria. • Recommendations that are relevant to ensuring a high level of water quality is maintained. Each report will include previous water quality results in tabular format for comparative purposes and trend graphs will be provided. Laboratory certificates will be provided.
Identification of incident or failure	The results of the water quality monitoring indicating concentrations exceeding the release limits specified in the 'performance criteria' for a single water quality parameter.
Corrective action	All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted. Specific strategies to be implemented are as follows: pH In the event that the pH of waters falls outside of the critical limits, such waters will be contained and the pH adjusted to within the target range prior to release. Low pH waters (i.e. pH<6.5) that need to be amended to be consistent with receiving environment waters of pH >6.5 may be ameliorated in-situ by the use of hydrated lime or crushed ag-lime to achieve a pH>6.5 and <9.0 prior to release. In using hydrated lime, all care shall be undertaken to ensure pH is not above 9.0. Low pH waters consistent with receiving environment waters of pH 4.2-6.7 and that contain dissolved iron above 0.3mg L⁻¹ will require treatment to reduce dissolved iron to acceptable levels prior to discharge. Electrical conductivity If electrical conductivity exceeds 1.5 dS m⁻¹, the waters will be contained onsite until adequate EC levels are reached. Further monitoring of upstream waters will be conducted to assess the impact of the development on the absolute change to water quality.

Rainfall data will also be assessed at such times to determine the impact that rainfall has had on the water quality of the site and discharging waters.

Suspended solids and turbidity

If total suspended solids exceed 30mg L^{-1} the waters will be contained onsite for a period sufficient to allow suspended solids to settle out prior to release, or treated with a flocculent. After gypsum has been applied, the stored waters will be retested immediately prior to discharge.

Erosion control devices will be immediately inspected and cleaned if necessary. Additional devices will be installed if a need is detected to prevent future breaches of the suspended solids criteria. The placement of stockpiles and management of disturbed areas will be reviewed with regard to the SBMP Table 6.7 'Erosion controls' and Table 6.8 'Sediment control'.

Dissolved oxygen

In the event that dissolved oxygen levels drop below 6.5mg L^{-1} , the waters will not be released until visual inspections for algae has been carried out. If algae are present, further laboratory tests will be carried out to determine the type of algae in the waters.

A general investigation will be carried out of the flow conditions of the affected waters, to assess the flow rates and volume of water passing through the monitoring locations.

Litter and gross pollutants

In the event that litter and gross pollutants with a dimension greater than 5mm are observed, this material will be clean up and appropriately disposed of as soon as practicable. The contractor shall inform staff of the appropriate waste disposal procedures and reiterate the importance and sensitivity of the surrounding ecosystems.

Oil and grease

In the event that oil and grease are visible and/or an odour is detected within a waterbody, management strategies will be implemented. Specifically, the waters shall be contained and the oil and grease isolated through the use of booms, containments bunds or other appropriate measures. Remediation works shall be implemented in consultation with the environmental consultant and DECCW.

Commitment

The Contractor will maintain background water quality conditions as much as practicable during construction phase of the development.

6.15 Vegetation clearing and soil disturbance

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager

Issue	Vegetation clearing & soil disturbance. Minimisation of the removal or disturbance of trees, shrubs and ground covers.
Operational policy	To maintain existing vegetation where possible during construction works. Vegetation to be retained is detailed in the <i>Vegetation Management Plan</i> (JWA 2011).
Performance criteria	No vegetation is to be removed prior to TSC approval.
Implementation strategy	Koala survey to be undertaken by appropriately qualified person prior to any clearing in areas of potential Koala habitat. An ecologist should be present during vegetation clearing. Trees to be cleared will be inspected immediately prior to clearing. Orphaned fauna encountered shall be managed in accordance with Table 6.29 'Fauna & flora protection – general provisions'. Erosion and sediment control measures shall be installed in accordance with Table 6.7 'Erosion controls' and Table 6.8 'Sediment control' of the SBMP. Compaction of ground in the drip line of trees to be retained shall be minimised. The area of disturbance shall be clearly delineated to keep vehicles, building materials and refuse away from areas to be conserved. The number of access points onto the site shall be minimised in accordance with Table 6.26 'Traffic management'. Vegetation buffer zones shall be maintained where possible. Where practicable vegetative debris shall be salvaged as logs or woodchip. Research into appropriate timbers and uses will be carried out prior to selection of salvaged logs. Vegetative debris set out to be salvaged for logs will be clearly marked and stockpiled onsite until required. Timber for woodchips will be chipped onsite and stockpiled within control measures until required. Where possible, shakedown devices shall be utilised to minimise sediment transport onto public roads.
Monitoring	Regular inspections shall be carried out to ensure that construction work areas are kept within stage boundaries.

Auditing	A weekly safety audit shall be conducted of the retained vegetation.
	Management to examine the boundary of the works weekly.
Reporting	No reporting is necessary unless areas are inadvertently cleared outside approved stage boundaries.
Identification of incident or failure	Clearing of designated retained vegetation.
	Clearing outside of stage boundaries.
Corrective action	Reinstate and revegetate overcleared areas where necessary, unless the area is to be used for future staging.

Commitment

The contractor will maintain existing vegetation where possible during construction works.

6.16 Air quality and dust management

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager

Issue	Air quality & dust management. Minimisation of movement of dust offsite.
Operational policy	To achieve acceptable air quality standards through the control of the movement of dust offsite from construction works.
Performance criteria	The target level for complaints by nearby residents is no more than one in any seven day period. Ambient air quality should not deteriorate by more than 30% over a period of seven consecutive days. Dust deposition at any nearby residence should not exceed $100\text{mg m}^{-2} \text{d}^{-1}$.
Implementation strategy	The minimisation of the movement of dust offsite will be achieved through the following onsite practices: • Construction works shall be staged to limit the areas exposed at any one time. • Erosion and sediment control measures shall be installed in accordance with Table 6.7 'Erosion controls' and Table 6.8 'Sediment control'. • All permanent bunds and reshaped areas will be revegetated within 10 days after completion of earthworks (including excavation and backfilling of services trenches). • Stockpiling onsite will be minimised where possible. • Ground surfaces will be kept damp (not wet). • Surfaces shall be left in a rough cloddy condition to increase roughness and slow surface wind speed. • An on-site water cart will be available at all times. • All work to cease if wind speed exceeds 10m/sec. • Protective ground covers shall be provided where appropriate, including mulches, vegetation, organic binders or dust retardants. • Traffic movements on any disturbed areas shall be minimised in accordance with Table 6.18 'Site management' and Table 6.26 'Traffic management' of the SBMP.
Monitoring	Daily inspections will be carried out to verify that dust mitigation measures are being implemented. Dust monitoring will be conducted upon receipt of complaints by residents in accordance with Table 6.21 'Incidents & complaints management' of the SBMP. If dust monitoring is to take place, the following will occur: • Temporary dust deposition gauges will monitor the movement of dust offsite at the nearest residences adjacent to the active construction

Auditing	stages and within the predominant wind directions. Monitoring will be undertaken in accordance with AS3580.10.1 (2003).
	Management to examine the complaints register weekly and review corrective action taken in accordance with Table 6.21 'Incidents & complaints management' of the SBMP.
Reporting	The contractor to notify the DECCW of a possible environmental nuisance on receipt of three (3) or more dust-related complaints in any 24 hour period. Reports will be provided to TSC upon request. Complaints by residents are to be recorded in a Complaints Register in accordance with Table 6.21 'Incidents & complaints management' of the SBMP and TSC notified.
Identification of incident or failure	Any dust-related complaints by residents will indicate a failure of the dust control measures.
Corrective action	Locate the source of the dust and implement the following measures: • apply water sprays to vegetation; • cover or water exposed areas; and • if dust persists, cease the dust creating activities and amend construction strategies. All dust complaints are to be addressed in consultation with the environmental consultant. Council shall be advised of the remedial measures taken to address dust complaints.

Commitment

The contractor will maintain acceptable air quality standards through the control of the movement of dust offsite from construction works.

6.17 Noise and vibration management

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Noise & vibration management.
Operational policy	To minimise noise and vibration impacts to the surrounding environment and nearby noise receptors.
Performance criteria	Compliance with the local area Noise policy of DECCW and TSC. No vibration impacts on nearby dwellings or structures.
Implementation strategy	Working hours onsite shall be restricted to between those specified by regulation and/or bylaws of TSC. Noise sensitive locations and potential noise hazards shall be identified prior to the commencement of construction works of each stage. Equipment and machinery usage shall be scheduled taking into consideration these locations. Other strategies to be considered include: • Moving equipment away from noise sensitive receptors. • Optimising the placement of haul roads and fixed plant and equipment. • The provision of sound walls and acoustical screening, including the use of earth embankments. • Incorporating buffer zones and setback distances between the noise source and receiver. • Using existing vegetation and landscaping as a shield and dissipater. Construction works shall be programmed so as to minimise noise generating activities occurring early and late in the day. Staff training shall be conducted and include adequate information on typical noise exposures and methods for noise management in accordance with this policy. Plant and equipment shall be maintained and operated in accordance with manufacturer's specifications. Plant and equipment shall be fitted with exhaust and radiator silencers where appropriate. The use of horns, sirens and reverse signals shall be restricted to where required for the satisfaction of workplace health and safety. Blasting (if required) shall be coordinated to reduce the level of ground vibration by altering drilling patterns, incorporating delays, controlling spacing and orientation and establishing blast timing to suit local conditions.
Monitoring	Daily inspections will be carried out by the Site Manager of all noise and vibration generating plant. Inspection notes to be recorded in the Site Diary.

	All noise and vibration related complaints shall be recorded in the Incidents/Complaints Register in accordance with Table 6.21 'Incidents & complaints management'. This register shall be reviewed by management weekly.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes, including any control measures implemented, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by TSC (or other relevant authorities) upon request. Upon the receipt of three or more noise-related complaints within a 24-hour period, TSC and the DECCW shall be notified. Reports detailing any incidents and/or complaints and corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	Receipt of three or more noise-related complaints within a 24-hour period. Ongoing, repetitive complaints.
Corrective action	Corrective actions will be implemented upon receipt of complaints (which have been investigated and determined to be legitimate). This shall involve identifying the source of the offending noise, and the implementation of the following measures (if applicable): Compliance with the approved hours of operations for the construction works. The removal of noise producing works (where possible) from areas in close proximity to residential properties: • Improving the noise rating of offending equipment. • Providing acoustic enclosures/shielding for offending equipment. • Improving acoustic buffering at the site boundary. • If excessive noise levels persist, cease the noise creating activities and review site activities and procedures. If, for the purpose of complaint resolution, noise auditing/monitoring is requested by TSC or the DECCW, the following will occur: • Monitoring of noise levels (including background levels) at the site by an independent noise consultant. • Measuring the contributing noise from the development at the nearest sensitive receptor (residence).

Commitment

The contractor will minimise noise and vibration impacts to the surrounding environment and nearby noise receptors.

6.18 Site management

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager

Issue	Site management.
Operational policy	To ensure that the site works are undertaken in such a manner as to provide a safe and efficient workplace, whilst minimising any potential disturbances to the surrounding community and preventing environmental harm.
Performance criteria	Effective control of site access and fencing. Site-specific induction training to ensure all personnel are aware of his/her responsibilities under the SBMP. All persons entering/visiting the site are appropriately informed of site requirements.
Implementation strategy	All construction activities, materials, equipment and personnel shall be restricted to within the boundaries of the site. Fencing around the perimeter of the work area shall be maintained for the duration of the construction activities. Hours of operation will be consistent with the requirements of the NSW DECCW guidelines and TSC bylaws. The gates at the site access points shall be maintained and secured after hours. All persons working on the project, including sub-contractors, shall undertake site induction training on the provisions of the SBMP prior to commencing activities onsite in accordance with the provisions of Table 6.23 'Personnel training'.
Monitoring	Weekly inspections shall be carried out by the Site Manager to verify: • construction activities are being conducted within the approved hours of operation and within the staged boundaries; and • the integrity of the perimeter fencing, gates and locks. The Site Manager shall ensure that contractors/sub-contractors are conforming to site requirements.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes shall be recorded in the Site Diary. A record of all staff working onsite shall be maintained and available for

Identification of incident or failure	inspection upon request.
	A training attendance register shall be established, recording the name of the trainee and trainer, date trained and the elements of training delivered.
	A logbook shall be kept onsite to record all visitors to the construction area.
Corrective action	An Incidents/Complaints Register shall be maintained (Table 6.21 'Incidents & complaints management) onsite and will be available for inspection by TSC (or other relevant authorities) upon request. Trespassing incidents are to be investigated immediately.
	Unauthorised access to the construction site.
	Site management procedures are to be reviewed.
	Environmental induction training to be conducted regularly for new staff and repeated for staff responsible for any non-conformances.

Commitment

The contractor will ensure that the site works are undertaken in such a manner as to provide a safe and efficient workplace, whilst minimising any potential disturbances to the surrounding community and preventing environmental harm.

6.19 Contractor management

Applies to:	Bulk earthworks Phase
Person responsible:	Proponent

Issue	Contractor management.
Operational policy	To ensure the Proponent's duty of care is met by ensuring the contractor is aware of his/her responsibilities under the terms of the SBMP.
Performance criteria	Each contractor is fully aware of its responsibilities under the terms of the SBMP and its obligation to respond to environmental issues arising from construction activities.
Implementation strategy	The SBMP (and approved variations) will be included in the contract documentation and become a contractual obligation for all contractors performing any civil or earthworks. The contractor will integrate the SBMP (and approved variations) with the construction approach and staging. The development will comply with the SBMP at all times throughout the construction and operational phases. When assessing site conditions, the contractor shall and implement the relevant SBMP provisions in conjunction with the approved plans, drawings and documents. Monitoring and verifying that the SBMP is adhered to at all times and taking action if the specifications are not followed. Ensuring the contractor is aware of the SBMP arrangements and clarifying the expectations (with regards to specific environmental requirements) as they relate to each contractor. The proper and adequate coordination of contractors to ensure the integration of interrelated issues identified in the SBMP. The provision of advice, information and training to contractors and staff with regards to the implementation of the SBMP provisions in accordance with Table 6.23 'Personnel training' of the SBMP. Review of the SBMP and the construction phase contracts at the end of each stage of works. Feedback shall be sought to the satisfaction of works being completed. If required, the Proponent shall manage the transition to new contractors. Remedies for breach of contract shall be enforced.
Monitoring	Weekly site inspections to be carried out by the Proponent's representative to ensure the provisions of the SBMP are being adequately implemented. Monitoring the contractor's continuing performance against contract obligations. Continuous monitoring of contractor work to ensure high productivity and

	reasonable progress towards performance outcomes of the SBMP. Liaison with internal managers, users and suppliers to identify and resolve any issues that arise. The contractor shall provide Tweed Shire Council, its employees and agents access to the site, on the giving of 24 hours written notice to the owner, to all water quality control and treatment systems, for the purpose of inspection, testing, sampling and recording.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Full details shall be available to the contractor together with suggested corrective actions (if required).
Identification of incident or failure	Not applicable.
Corrective action	The Proponent has the right to call a halt to any activity being undertaken which is deemed in conflict with the provisions of the SBMP. The SBMP shall be regularly reviewed and updated to reflect changes to the construction project.

Commitment

The Proponent will ensure all contractors are managed to ensure compliance with the SBMP.

6.20 Hazardous and dangerous goods handling & storage

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Materials handling and storage management, and hazardous substance management.
Operational policy	To ensure that fuel, grease and other hazardous substances present onsite are managed in a safe and environmentally responsible manner.
Performance criteria	No fuel, grease and/or oil contamination of the environment shall result due to construction activities in accordance with Table 6.24 'Pollution control' and Table 6.25 'Refuelling of construction equipment & vehicles'. Appropriate facilities will be available for the storage of hazardous materials. No fuel, grease or oil shall escape containment bunds and contaminate the site soils, surface water or leave the site.
Implementation strategy	All materials shall be stored within the boundaries of the active construction area. Storage facilities shall be constructed prior to hazardous material being brought to the site. Stockpile and storage areas shall be identified and any contained products shall be clearly marked. Minimum practical quantities of fuels, grease and other hazardous substances shall be located onsite. These materials shall be stored in sheltered, impervious and bunded areas (or as required by the applicable regulations). Containment bund capacity shall be 110% of the volume of the tank stored within it. Where multiple tanks are stored within the one bund, the capacity will be 110% of the largest tank. Material Safety Data Sheets (MSDS) will be available onsite for all hazardous materials used or stored onsite for the duration of the construction works. An emergency response plan shall be developed for the site to control risk to the environment from hazardous materials. This shall include spill prevention and pollution control programs and an operating procedure for containing and cleaning up spills in accordance with Table 6.18 'Site management'. Suitable quantities of absorbent materials shall be stored onsite to accommodate minor spills. Relevant staff shall be trained in chemical and fuel handling, spill containment and clean up procedures in accordance with Table 6.23

	'Personnel training'. Personnel protection equipment shall be made available onsite as required for the use of hazardous substances. All suppliers shall be informed of procedures and restrictions required, and deliveries supervised during off-loading by appropriately trained personnel. Materials shall be adequately secured and loads covered where there is risk of spillage or loss of load. Imported materials shall be free of weeds, litter and contaminants. All regulated waste shall be removed and disposed of by an appropriately licensed waste contractor at an appropriately licensed waste disposal facility.
Monitoring	Weekly inspections will be carried out by the site manager to verify the integrity of material storage facilities and bunding. Visual inspections for spills and land contamination shall also be conducted.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes shall be recorded in the Site Diary. An incidents/complaints register shall be maintained onsite (Table 6.21 'Incidents & complaints management') and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. In the event of potential or actual environmental harm or nuisance, the site manager shall notify the DECCW and corrective actions implemented as directed. Reports detailing any incidents and/or complaints and associated corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	Land or water contamination.
Corrective action	The immediate containment of spillages with booms, containment bunds or other appropriate measures. Remediation of site contamination in consultation with environmental consultant and DECCW.

Commitment

The Proponent will ensure the handling and storage of construction materials onsite is managed in a safe and environmentally responsible manner.

6.21 Incidents & complaints management

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager

Issue	Incidents & complaints management.
Operational policy	An Incidents/Complaints Register shall be maintained for the duration of the construction works.
Performance criteria	All incidents and complaints from the local community and onsite staff shall be recorded and corrective actions implemented as required.
Implementation strategy	An Incidents/Complaints Register shall be maintained onsite for the duration of the construction works. For each incident/complaint notified, the following information shall be recorded: • Date and time of incident/complaint. • Nature of incident/complaint and associated information. • Location of incident or source of complaint. • Name of person or body reporting the incident/complaint. • Employee who received notice of the incident/complaint. • Contractors review and comment. • Recommend corrective action to resolve incident/complaint. • Outcome of corrective actions undertaken subsequent to incident/complaint being recorded. • Date of resolution of incident/complaint. A complaints handling procedure for reporting complaints from the affected community and employees shall be developed for the site. This procedure shall be written in plain, non-technical language, identify simple steps to be followed, be widely available to all staff and include investigation and review processes. All staff shall be aware of the complaints handling procedure and understand his/her responsibilities within the handling system. Training on the procedure, the benefits of good complaints handling and interpersonal skills (listening, questioning and conflict management) shall be provided for appropriate staff in accordance with Table 6.23 'Personnel training'. The complaints management procedure shall be easily accessible and publicised both internal and external to the site through the use of posters and signage. The contact information of the site manager or designated complaints manager shall be advertised.

	Where practical, staff shall assist members of the public making a complaint by providing advice on the complaint system, formulating the complaint and reporting the complaint.
Monitoring	Management to monitor the progress of complaints by examining the complaints register on a weekly basis and reviewing corrective actions taken.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	An Incidents/Complaints Register shall be maintained onsite and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. The local authorities and the DECCW are to be notified and directions sought regarding corrective actions for incidents that have the potential to cause environmental harm.
Identification of incident or failure	Ongoing, repetitive complaints from the general public or staff. Serious or material environmental harm.
Corrective action	All complaints shall be treated as legitimate and investigated without prejudice. A response to each complaint shall be provided promptly, courteously and in accordance with their urgency. Corrective actions shall be implemented in the event of continued and sustained complaints and the failure to respond adequately to complaints from the public or authorities. Construction activities and procedures shall be adjusted accordingly. Corrective actions shall be in accordance with the provisions of the SBMP Table 6.16 'Air quality and dust management' and Table 6.17 'Noise and vibration management' or alternative management plan. In the event that serious or material environmental harm is caused or threatened by an activity, corrective actions shall be implemented in consultation with DECCW. Undertake a review and evaluation of the complaints handling procedure and identify possible systematic weaknesses and opportunities for improvement.

Commitment

The contractor will ensure all incidents and complaints resulting from construction activities are promptly addressed and corrective actions implemented.

6.22 Light management

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager

Issue	Light management.
Operational policy	To prevent artificial light affecting premises, roadways and wildlife.
Performance criteria	Compliance with Australian Standard AS4282 – 1997 'Control of Obtrusive Effects of Outdoor Lighting'. Compliance with relevant nuisance legislation. Compliance with Tweed Shire Council conditions with respect to hours of operation.
Implementation strategy	All temporary lighting infrastructure shall be designed to prevent or minimise adverse effects on adjoining premises, roadways and wildlife. Professional advice on the design, operation and maintenance of all external lighting proposed for the site shall be sought prior to installation. The erection of lighting shielding walls, the provision of appropriate earth or vegetation barriers or other similar strategies shall be utilised to minimise light nuisance to neighbouring sensitive receptors.
Monitoring	All outdoor lighting erected in association with the construction works shall be assessed to ensure compliance with the performance criteria. All light related complaints shall be recorded in the Incidents/ Complaints Register in accordance with Table 6.21 'Incidents & complaints management'. This register shall be reviewed by management weekly.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes, including any control measures implemented, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. Reports detailing any incidents and/or complaints and corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	Receipt of three or more light-related complaints within a 24-hour period. Ongoing, repetitive complaints.
Corrective action	Where light complaints occur, which have been investigated and determined to be legitimate, appropriate corrective action shall be taken.

Commitment

The contractor will ensure artificial light emitted from the construction operations will be minimised wherever possible.

6.23 Personnel training

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager

Issue	Personnel training.
Operational policy	To ensure that all personnel understand the environmental issues involved with construction operations.
Performance criteria	• All personnel appropriately and adequately trained. • All incidents are managed efficiently and corrective actions promptly implemented in accordance with the provisions of Table 6.18 'Site management'.
Implementation strategy	• All personnel involved in the construction of the project shall undergo induction training on the provisions of the SBMP prior to commencing activities onsite. • Training handouts will be made available to all personnel. • Additional training shall be provided for employees involved in specialised construction activities (if applicable) so that the appropriate skills and competencies to participate in these activities are attained.
Monitoring	• Management to examine the training attendance records and ensure appropriate training procedures are in place. • Regular liaison with the contractors to keep onsite staff informed of any issues that arise with regards to the requirements of the SBMP.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	An attendance register shall be established and all attendees recorded following the completion of the training.
Identification of incident or failure	Not applicable.
Corrective action	Additional training or refresher courses shall be provided for new staff members or for those requiring additional training and performance review.

Commitment

The contractor will ensure personnel have adequate training to be aware of the provisions of the SBMP as they relate to site operations.

6.24 Pollution control

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Pollution control.
Operational policy	To minimise the incidents of pollution through controlling risks and hazards onsite.
Performance criteria	No pollution incidents during the construction phase.
Implementation strategy	- Petroleum and other chemical products shall be prevented from containing surface water and soil. - Any onsite fuel storage areas shall comply with Australian Standards. - Adequate trade waste and litter bins shall be provided onsite and serviced regularly in accordance with the provisions in Table 6.27 'Waste management'. - Concrete wastes and washouts shall not be deposited in any location where the wastes or washings can flow, or can be washed into, any areas of retained vegetation or receiving waters.
Monitoring	Weekly inspections shall be carried out on containment structures and washout areas.
Auditing	Not applicable.
Reporting	Weekly checklists shall be completed detailing any containment structure failures.
Identification of incident or failure	Pollution incidents causing environmental harm.
Corrective action	- Chemical or fuel spillages shall be reported to the DECCW and the Superintendent. - Immediately contain spillages with booms, containment bunds or other appropriate measures immediately. The cause of any leak shall be established and appropriate action shall be undertaken to prevent a reoccurrence. - Remediate any resultant site contamination in consultation with environmental consultant. - Ensure management of fuels, oils and hazardous materials is occurring in accordance with the provisions detailed in Table 6.20 'Hazardous and dangerous goods handling & storage'.

Commitment

The contractor will ensure construction works are managed in such a manner that minimises the risk of pollution.

6.25 Refuelling of construction equipment & vehicles

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Refuelling of construction equipment & vehicles.
Operational policy	To ensure that fuel, grease and other hazardous substances present onsite are managed in a safe and environmentally responsible manner.
Performance criteria	No fuel, grease and/or oil contamination of the environment shall result due to construction activities.
Implementation strategy	Where reasonably practical, plant shall be refuelled offsite. Maintenance of machinery onsite is to be minimised and completed offsite wherever possible. The storage, preparation, use and disposal of fuels and oils shall take place under the supervision of the earthmoving contractor who will be responsible for any decontamination. Only appropriately trained personnel (as detailed in Table 6.23 'Personnel Training') shall conduct refuelling. An operating procedure for containing and cleaning up oil spills will be in place and all staff will be trained in these procedures. Suitable quantities of products designed to contain and absorb oil spills will be available onsite. Contaminated materials used in the clean up of a fuel/oil spill will be disposed of by a commercial waste contractor offsite at an appropriately licensed waste disposal facility in accordance with Table 6.24 'Pollution control'.
Monitoring	Weekly inspections will be carried out by the Site Manager of: • the integrity of any temporary sumps or fuels storage areas; and • the quantity and condition of products designed to contain and absorb oil spills.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site (refer to Table 6.21 'Incidents & Complaints management') and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. In the event of potential or actual environmental harm arising from a spill,

Identification of incident or failure	the site manager shall notify the DECCW and corrective actions implemented as directed.
	Reports detailing any incidents and/or complaints and corrective actions shall be provided to statutory authorities upon request.
Corrective action	Land or water contamination.
	The immediate containment of spillages with booms, containment bunds or other appropriate measures. Remediation of site contamination in consultation with environmental consultant and DECCW. Corrective actions (to be implemented in the event of land contamination) include: • identifying the source of contamination and reporting the incident to the appropriate authorities immediately; and • arranging for the source of the contamination to be rectified and for the contaminated area to be remediated. Action for fuel/oil spillage: • All ignition sources to be removed from vicinity of spill. • All equipment in vicinity of storage to be turned off. • Identification of source of spillage and take action to ensure similar incidents are avoided in future.

Commitment

The contractor will ensure all employees are trained in the clean-up procedures of spillages of oils and chemicals to prevent potential land contamination.

6.26 Traffic management

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager; Civil Engineering Consultant

Issue	Traffic management.
Operational policy	To provide a safe and efficient working environment and to minimise potential disturbance to the community as a result of vehicular movement onsite.
Performance criteria	Effective control of construction traffic to ensure that where possible traffic is kept off public roads and away from existing developed properties.
Implementation strategy	Haul roads shall be constructed across the subject site. The use of Haul roads in lieu of public roads, where possible, shall become a contractual obligation for the contractors. All access points to the construction site shall be clearly defined and appropriate signage erected. All access roads shall be adequately maintained, including the erection of signage and dust suppression to ensure safe travel is maintained at all times. Speed limits shall be enforced for all access roads. Limits shall be reduced during times of high winds to prevent the production of excessive dust. Sufficient parking areas and loading zones shall be provided for staff and suppliers. Workers, materials or trucks will not obstruct existing footpaths and roads. Fencing shall be constructed at the site access points to restrict pedestrian access from local streets for the duration of the construction works.
Monitoring	Continual vigilance shall be maintained by the Site Manager to ensure all contractual obligations are met. Weekly inspections shall be carried out by the site manager to verify: • The condition of site access points and any haul roads. • The provision of sufficient parking and loading zones. • The erection of adequate signage. Inspection notes are to be recorded in the Site Diary.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP. Management to examine the complaints register weekly and review corrective actions taken.

Reporting	A copy of all Site Diary notes and any other correspondence relating to traffic shall be forwarded to the Contract Superintendent on a monthly basis.
	An incidents/complaints register shall be maintained onsite and will be available for inspection by TSC (or other relevant authorities) upon request.
	A record of any breach of contractual obligations and of any complaints from adjoining residents shall be kept in the Site Diary.
	Any complaints from adjoining residents shall immediately be conveyed to the Contract Superintendent.
Identification of incident or failure	Vehicles operating in breach of contractual conditions.
Corrective action	Review procedures to ensure compliance with the SBMP.
	Amend site access and parking regimes to reflect onsite constraints during the construction process.
	Issue written instructions to persons in breach of contractual obligations.

Commitment

The contractor will manage traffic generated by the development in compliance with the provisions of the SBMP.

6.27 Waste management

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Waste management.
Operational policy	To minimise the amount of solid and liquid waste produced as a result of construction activities. To ensure all waste generated is appropriately stored, removed and disposed of. To minimise potential environmental and social impacts from waste and waste handling. To maintain the construction site in a neat and tidy state. To ensure that all waste generated by the construction activities is disposed of in accordance with the applicable legislation.
Performance criteria	Compliance with relevant legislation. No evidence of construction waste or litter accumulating onsite, outside of designated container areas.
Implementation strategy	Waste management methods which employ reduction, reuse or recycling practices shall be used where practicable. The site will be managed in accordance with Table 6.18 'Site management' and be kept in a clean and tidy state, free from loose waste or litter. Waste material, including vegetation, litter, human waste, used oils and other construction wastes, shall not be disposed of by burning or burying onsite or in adjacent areas. All wastes shall be stored onsite in confined areas and managed to prevent environmental harm or nuisance from occurring. An appropriate number of covered waste receptacles shall be located onsite, with the provision of areas or additional receptacles for the storage of reusable and recyclable materials. Waste containers shall be emptied on a regular basis (or as required) by a licensed contractor. Areas used to store oils and other hazardous liquids during construction shall be bunded and located away from waterways and drainage lines in accordance with Table 6.14 'Surface water quality management'. Any spillage will be collected and disposed of offsite at an approved facility. All wastes transported from the site shall be covered or otherwise handled to prevent spillage or nuisance to the community and environment. Any waste material that is unable to be reused, reprocessed or recycled shall be disposed of at a landfill licensed by the DECCW to receive that type of waste.

Monitoring	The site manager shall conduct weekly inspections of all work areas (specifically the waste containment areas and the property boundary) to ensure there is no accumulation of waste material. Inspection notes shall be recorded in the Site Diary and all waste management issues promptly addressed in accordance with the control measures detailed in the SBMP. All waste-related complaints shall be recorded in the Incidents/ Complaints Register in accordance with Table 6.21 'Incidents & complaints management'. This register shall be reviewed by management weekly.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Records of waste removal invoices shall be maintained and kept onsite. Site inspection notes, including the amount and type of waste observed onsite and any corrective actions implemented, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. When there is potential or actual environmental harm as a result of waste management, the site manager shall notify the DECCW and corrective actions implemented as directed. Waste management reports shall be prepared and provided to statutory authorities upon request.
Identification of incident or failure	Ongoing and repetitive waste-related complaints. Contamination resulting from poor waste management practices.
Corrective action	The Site Manager shall direct clean-up operations as required on the basis of site inspections. Corrective actions will be implemented upon receipt of complaints (which have been investigated and determined to be legitimate). This shall involve identifying the source of waste and the implementation of the following measures (if applicable): • The establishment of additional waste management areas including the provision of additional waste containers. • Increasing the awareness among staff of the acceptable methods for storage and disposal of waste onsite.

Commitment

The contractor will ensure waste is managed to ensure proper controls, removal and disposal systems are in place at all times.

6.28 Geotechnical investigation & analysis

Applies to:	Bulk earthworks Phase
Person responsible:	Contractor's Site Manager; Geotechnical Consultant

Issue	Geotechnical investigation & analysis.
Operational policy	To manage the iterative process of investigation, design and construction monitoring to enable geotechnical design constraints to be formulated at the end of construction that are consistent with the proposed future use of the site.
Performance criteria	Compliance with the recommendations of the Geotechnical Investigation for Proposed Residential Subdivision (Cardno Bowler October 2010) and any other future Geotechnical Engineering Management Plan (GEMP) prepared by qualified engineers and approved by TSC. Construction control testing and monitoring to assess progress of foundation treatment and determine when surcharge may be removed. Review of data and specification of geotechnical design constraints for infrastructure and buildings on development platforms.
Implementation strategy	Development and use of a Geotechnical Engineering Management Plan.
Monitoring	Placement and compaction of engineered fill shall be carried out under a Level 1 Overview as defined by AS3798-1996 "Guidelines on Earthworks for Commercial and Residential Development". A construction control testing program shall be carried out in accordance with AS3798-1996. During the period of placement and compaction of engineered fill and surcharge, monitoring shall be carried out of settlement monitoring stations to measure the magnitudes of settlement caused by consolidation. Monitoring shall be carried out of piezometers to measure excess pore water pressure.
Auditing	The geotechnical consultant shall review the results of construction control materials testing, excess pore water pressure measurements and settlement monitoring to determine whether the data arising during the construction phase indicate suitable materials and procedures are adopted. During placement and compaction of engineered fill and the period of surcharge, excess pore water pressures around the perimeter of each fill area shall be reviewed and compared with target values required to achieve acceptable factors of safety against instability. Where the target values are exceeded, further placement of engineered fill and surcharge shall be delayed until advised by the geotechnical consultant. Surcharge shall not be removed until directed by the geotechnical consultant having regard to the monitoring data and any revised design assumptions.

Reporting	The results of all reviews shall be provided to TSC in a written format within 20 business days of completion of the reviews. If the Council makes a written request for information in relation to the submitted results, the geotechnical consultant shall provide the requested information in a written format within 10 business days of receipt of the written request. The likely future settlement that may occur on the development platforms is to be assessed and the geotechnical design constraints for infrastructure and buildings on the development platforms are to be specified. On completion of bulk earthworks, the geotechnical consultant shall prepare a comprehensive report on all additional site investigations/testing, construction monitoring of settlement and geotechnical construction overview of earthworks.
Identification of incident or failure	A significant difference between monitored data and design assumptions. Excess pore water pressures beneath the perimeter of a fill area exceeding target values.
Corrective action	Any significant difference between monitored data and design assumptions will require a review to be carried out of the design and construction program. Where excess pore water pressures beneath the perimeter of a fill area exceed target values, further placement of engineered fill and surcharge shall be delayed until advised by the geotechnical consultant.

Commitment

The contractor will ensure the appropriate geotechnical investigations are conducted to ensure construction works being undertaken are consistent with the design assumptions and the proposed future use of the site.

6.29 Fauna & flora protection – general provisions

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Fauna & flora protection.
Operational policy	To minimise the impact of construction activities on existing vegetation and fauna. Bulk earthworks will be controlled by the Vegetation Management Plan and Threatened Species Management Plan (JWA 2011).
Performance criteria	No clearing or damage of vegetation beyond the limits of the construction site. Minimal disturbance to native fauna.
Implementation strategy	Flora management Existing vegetation shall be retained in accordance with the indicative golf course development plan. Temporary fencing shall be erected around all habitat or significant vegetation that is to be retained or avoided in the field. Buffer zones shall be maintained around protected areas to avoid encroachment by construction activities. The movement and parking of vehicles and stockpiling of materials shall be avoided within the drip line of trees to be retained. Vegetation shall only be cleared from within the designated clearing area. Vegetation to be cleared shall be clearly marked with flagging tape prior to any clearing activities. Where practicable, vegetation shall be salvaged for use in future rehabilitation/revegetation works. Topsoil, subsoil, root stock and cleared vegetation shall also be retained for use in rehabilitation. Where practicable, chipping or mulching of cleared vegetation shall be undertaken for use in stabilisation activities. If chipping or mulching is not possible, disposal shall be in accordance with local requirements. Where surface grades are modified, surface drainage shall be directed away from retained trees. Any underground services which are installed within the drip line of a tree that is part of a tree retention area are to be installed by means of tunnel boring or a similar technique. Within the tree retention area: • Earthworks are not to be undertaken except for the installation of underground services.

	• If underground services are to be installed through the root zone of a tree, tunnel boring or a similar technique shall be used. • Trees shall not be removed unless TSC are reasonably satisfied that the removal of the tree would not adversely impact on visual amenity or the tree represents a danger to the safety of persons or property. Fauna management Light, noise and vibration shall be managed in accordance with Table 6.22 'Light management' and Table 6.17 'Noise and vibration management' to avoid excessive disturbance to local fauna. All construction and maintenance staff shall be aware of the possibility of encountering fauna and shall inspect vegetation immediately before clearing. Orphaned or injured fauna shall be reported immediately to NSW PWS. Fauna shall only be captured or handled by qualified staff.
Monitoring	The site manager shall conduct weekly inspections of vegetation adjacent to areas of works to ensure no damage to the retained vegetation has occurred.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP. Management to examine the complaints register weekly and review corrective action taken in accordance with Table 6.21 'Incidents & complaints management'.
Reporting	Site inspection notes shall be recorded in the Site Diary. An incidents/complaints register shall be maintained on-site and will be available for inspection by TSC (or other relevant authorities) upon request. Details shall be recorded of any fauna encountered and actively removed or treated during the project works, including action by NSW PWS.
Identification of incident or failure	Evidence of disturbance, introduction of noxious weeds or pest animals.
Corrective action	Any trees or vegetation inadvertently damaged or destroyed as a result of construction works shall be repaired or replaced. Dangerous limbs shall be removed by a suitably qualified arborist. Harmed or orphaned fauna shall be reported to NSW PWS and treated accordingly.

Commitment

The contractor will ensure existing flora (identified for retention) and fauna is protected at all times during construction works.

6.30 Freshwater ecology

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Freshwater ecology.																								
Operational policy	To maintain and/or enhance the value of freshwater ecosystems within and downstream of the site.																								
Performance criteria	Water to comply with the following criteria: <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>pH</td><td>As developed from background monitoring</td><td>Range</td></tr><tr><td>Electrical conductivity</td><td><1.5dS m⁻¹</td><td>Maximum</td></tr><tr><td>Suspended solids</td><td><50mg L⁻¹</td><td>Maximum</td></tr><tr><td>Dissolved oxygen</td><td>60-105% saturation</td><td>Minimum</td></tr><tr><td>Total algae numbers</td><td><50,000cells mL⁻¹</td><td>Maximum</td></tr><tr><td>Litter and gross pollutants</td><td>No man made material >5mm in any dimension</td><td>--</td></tr><tr><td>Oil and grease</td><td>No visible film, no detectable odour</td><td>--</td></tr></table> *Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in ‘<i>Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range</i>’. ¹⁴ A similar pH range of 4.2 to 7.2 is identified in ‘<i>Threatened frogs of New South Wales: Habitats, Status and Conservation</i>’. ¹⁵	Water Quality Parameter	Release Criteria	Criteria Type	pH	As developed from background monitoring	Range	Electrical conductivity	<1.5dS m ⁻¹	Maximum	Suspended solids	<50mg L ⁻¹	Maximum	Dissolved oxygen	60-105% saturation	Minimum	Total algae numbers	<50,000cells mL ⁻¹	Maximum	Litter and gross pollutants	No man made material >5mm in any dimension	--	Oil and grease	No visible film, no detectable odour	--
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Total algae numbers	<50,000cells mL ⁻¹	Maximum																							
Litter and gross pollutants	No man made material >5mm in any dimension	--																							
Oil and grease	No visible film, no detectable odour	--																							
	Water may be discharged from the site that exhibits a suspended solids concentration greater than 50mg L⁻¹, providing the concentration in the discharge is 10% less than the concentration exhibited in the receiving water. No decline in macroinvertebrate species richness.																								
Implementation	Water levels maintained throughout construction phase.																								

¹⁴ White, A. W. & Pyke, G. H., 2006, 'Habitat and Movements of the Wallum Froglet *Crinia tinnula* at the Southern Part of its Range'. Unpublished paper submitted to Journal of Herpetology.

¹⁵ Ehmann, H. 1997 (ed). 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

strategy	Sediment and erosion control measures to protect water from sedimentation and turbidity in accordance with Table 6.7 'Erosion controls', Table 6.8 'Sediment control' and Table 6.14 'Surface water quality'. Only locally endemic macrophyte species planted suited to site conditions. Monitoring strategies to be implemented incorporating water quality, weed removal and macroinvertebrate sampling.
Monitoring	Refer to Table 6.31 'Waterways & wetlands management' of the SBMP for monitoring strategy. Monitoring of macroinvertebrates in freshwater wetlands as a biological indicator of ecosystem health. Standard sampling and interpretation methods to be followed, such as the Stream Pollution Index.
Auditing	Appropriately qualified environmental consultant to undertake monthly assessment of specified criteria.
Reporting	Maintenance and compilation of assessment sheets to be appropriately stored onsite for inspection by local and state government officers upon request.
Identification of incident or failure	Observation of element(s) outside nominated criteria. Degradation of water quality at the monitoring points to below the 'Performance Criteria' levels. Decreased ecosystem health as indicated by macroinvertebrate sampling.
Corrective action	Identification and source control. Review of construction and/or management methods.

Commitment

The contractor will ensure the integrity of the freshwater ecosystems is maintained for the duration of the construction works.

6.31 Waterways & wetlands management

Applies to:	Bulk earthworks phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Wetlands & waterways management.																
Operational policy	To establish and maintain the health of wetlands and waterways during the bulk earthworks phase. To ensure strong plant growth and satisfactory water quality.																
Performance criteria	Maintain surface water quality objectives identified for bulk earthworks: <table border="1"> <thead> <tr> <th>Water Quality Parameter</th><th>Water Quality Objective</th></tr> </thead> <tbody> <tr> <td>pH</td><td>As developed from background monitoring</td></tr> <tr> <td>Electrical conductivity</td><td><1.5 dS m⁻¹</td></tr> <tr> <td>Suspended solids</td><td><50 mg L⁻¹</td></tr> <tr> <td>Dissolved oxygen</td><td>60-105% saturation</td></tr> <tr> <td>Total algae numbers</td><td><50,000cells/mL</td></tr> <tr> <td>Litter and gross pollutants</td><td>No man made material >5mm in any dimension</td></tr> <tr> <td>Oil and grease</td><td>No visible film, no detectable odour</td></tr> </tbody> </table> *Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the Threatened Species Management Plan (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in 'Habitat and Movements of the Wallum Froglet <i>Crinia tinnula</i> at the Southern Part of its Range'.¹⁶ A similar pH range of 4.2 to 7.2 is identified in 'Threatened frogs of New South Wales: Habitats, Status and Conservation'.¹⁷ Water may be discharged from the site that exhibits a suspended solids concentration greater than 50mg L⁻¹, providing the concentration in the discharge is 10% less than the concentration exhibited in the receiving water. Plant establishment success rate >80%.	Water Quality Parameter	Water Quality Objective	pH	As developed from background monitoring	Electrical conductivity	<1.5 dS m ⁻¹	Suspended solids	<50 mg L ⁻¹	Dissolved oxygen	60-105% saturation	Total algae numbers	<50,000cells/mL	Litter and gross pollutants	No man made material >5mm in any dimension	Oil and grease	No visible film, no detectable odour
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Total algae numbers	<50,000cells/mL																
Litter and gross pollutants	No man made material >5mm in any dimension																
Oil and grease	No visible film, no detectable odour																
Implementation strategy	The operational work shall be developed in stages to minimise the potential for soil erosion and water pollution. The site can then be																

¹⁶ White, A. W. & Pyke, G. H., 2006, 'Habitat and Movements of the Wallum Froglet *Crinia tinnula* at the Southern Part of its Range'. Unpublished paper submitted to Journal of Herpetology.

¹⁷ Ehmann, H. 1997 (ed). 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

progressively developed and rehabilitated.

All waters from the active construction areas shall be treated (if required) prior to being discharged into completed areas. The wetlands will come progressively online as staged construction is completed.

All runoff from disturbed areas is to be collected by means of surface drains and diverted to internal water bodies.

Protection of waterways and wetlands from sediment

All sediment and erosion control devices shall be installed prior to commencement of work in each stage in accordance with Table 6.7 'Erosion controls' and Table 6.8 'Sediment control' in the SBMP.

These devices include (but are not limited to):

- Diversion of upslope runoff around cleared and/or disturbed areas in a way that minimises erosion, minimises the upslope catchment and diverts waters to a legal point of discharge.
- Sediment control fences or other measures at the downslope perimeter of cleared and/or disturbed areas.
- Maintenance of all erosion control measures at operational capacity until land is effectively rehabilitated.
- Material accumulated behind sediment barriers shall be cleaned out as soon as practicable to minimise the potential for the transfer of sediment off the construction site. Sediment shall be removed to a secure stockpile location.

Maintenance of water quality

Sediment is to be removed from each internal waterbody/sediment basin once 70% of the total available sediment storage component has been reached and weirs are to be regularly maintained and cleaned.

Sediment basins/internal waterbodies shall be dosed with flocculating agents when required to ensure that water quality meets required limits.

Bypass flows from sediment traps shall be directed to stable areas.

The operational water bodies and associated wetland shall be de-silted, replanted as necessary and assessed for any acid sulphate oxidation effects prior to refilling with water at the end of the construction phase.

To protect constructed wetlands and receiving environments, discharge of water not complying with nominated parameters must be avoided.

Maintenance of plant health in shallow vegetated wetlands

Wetlands planted with locally endemic species suited to site conditions. These species ensure minimisation of water usage. As wetlands are planted, water levels will be maintained via pumping of water that satisfies water quality objectives from sediment basins following rainfall events and stormwater flows.

Particular attention should be given to weed management during the early

Monitoring	stages of wetland vegetation development.
	Sediment and erosion controls Regular site inspections shall be undertaken to monitor the effectiveness of sediment and erosion controls. A site inspection and monitoring program shall include: • weekly site inspections; • inspections immediately following rainfall events that cause runoff; and • inspections immediately before site closure. Surface water quality Surface water monitoring will be conducted at appropriate locations external and internal to the construction area as each wetland and waterway is constructed. Monitoring will be conducted monthly and during rainfall events for: pH, EC, suspended solids, dissolved oxygen, oil and grease. Sample recovery and in-situ analysis will be performed by a NATA accredited sampler and, when required, samples will be forwarded to a NATA accredited laboratory. Visual inspection of wetland plant health, algae presence, weeds, pests including mosquitoes and cane toads.
	Auditing Environmental consultant to audit water quality and plant health results monthly to ensure compliance with the performance criteria. Additional visual inspections to be carried out monthly and after rainfall events to verify that control measures are in place and properly maintained.
	Reporting Results sheet and site inspection records to be compiled for monitoring results of water quality of water bodies and erosion and sediment control measures. To be kept onsite for inspection by local and state government officers. Recording of wetland health, establishment, weeds and pests.
	Identification of incident or failure • Degradation of surface water quality at the monitoring points to below background level. • Excessive build-up of sediment. • Loss of wetland plants. • Algal blooms. • Emergence of pest species.
Corrective action	Apply remedial measures to improve sediment and erosion control. Incorporate additional measures including, but not limited to, silt fences and flocculation of the water quality control ponds. If pH is outside the criteria range, then waters will be contained and the pH adjusted to within the range prior to release.

If total suspended solids exceed the water quality criteria then water will be contained onsite for a period sufficient to allow suspended solids to settle out prior to release or treated with a flocculent.

To increase dissolved oxygen, re-circulation and or aeration should be undertaken.

Replanting of wetland species if losses exceed 20%. Review and choose alternative species if necessary.

Commitment

The Contractor will ensure construction works are managed in a manner that will protect and enhance the integrity of the waterway and wetland system.

7 Management of potential impacts – landform stabilisation phase

7.1 Intent

This part of the SBMP specifies those matters which must be complied with by the Proponent during the landform stabilisation phase, being the period following completion of bulk earthworks when each precinct is at final grade and stabilised, but prior to the commencement of civil construction.

7.2 Aquatic flora & weed management and maintenance

Applies to:	Landform stabilisation phase
Person responsible:	Proponent, Environmental Consultant

Issue	Aquatic flora and weed management and maintenance.
Operational policy	To maintain healthy aquatic plant life and control weeds to promote the ecosystem health of wetlands and waterbodies.
Performance criteria	Macrophyte establishment success rate >70%. The suppression of aquatic weeds and algae. Maintenance of hydraulic performance between waterbodies.
Implementation strategy	Weed strategy An expectation of avoidance or total removal of aquatic weeds within the waterway and wetland system is not realistic as weeds are present within the catchment and neighbouring sites. Management of macrophytes via removal of vegetation within flow paths to maintain hydraulic conductance. Particular attention should be given to weed management to prevent obstruction of hydraulic conductance. When removing weeds, care must be taken not to damage the growth of native aquatic plants or interrupt natural ecosystem function by adhering to the following methods: • Avoid overspray through use of correct equipment and not spraying in windy conditions. • Bag and removal of weeds offsite. • Manage access to wetlands to avoid damage via trampling. • Should mechanical harvesting of weed growth be required. • Access to waterbodies will be selected to achieve minimal impact and access points will be rehabilitated at the end of the harvesting period. Algae strategy Regular monitoring, particularly in Spring and Summer, is required to

	reduce the potential for algal blooms. Proposed management methods include: • Ability to isolate separate on-stream system pools to contain algal blooms. • Emergency aeration and/or mixing. • Safety signage during algal outbreaks. See Table 7.8 'Maintenance of water treatment measures' of the SBMP for further details. Off-stream waterway and wetland system: • Containment of blooms within off-stream waterway and wetland system (no release of water if blue green algae levels exceed 50,000 cells/ml). • Emergency turnover. • Emergency vertical aeration and/or mixing. • Safety signage during algal outbreaks.
Monitoring	Routine quarterly monitoring during the landform stabilisation phase. Routine quarterly visual inspection of treatment trains for vegetation establishment, damage, weed invasion and clogging.
Auditing	Reviews are to be carried out on a quarterly basis to assess the appropriateness of the implementation strategy. A checklist is to be completed which assesses the effectiveness of strategies detailed above.
Reporting	An Aquatic Flora Report shall be submitted to TSC annually. Maintenance and compilation of assessment sheets to be appropriately stored onsite for inspection by local and state government officers.
Identification of incident or failure	Non compliance with agreed performance criteria will be identified by: • Vegetative losses >20%; • Weed growth that impacts upon ecosystem function and/or hydraulic conductance; and • Algal blooms exceeding 50,000 cells/ml.
Corrective action	If vegetation fails, new vegetation should be planted and established. Vegetation may require supplementary replanting. Macrophyte density to be maintained at prescribed levels to achieve hydraulic conductance and pollutant removal.

Commitment

The Proponent will ensure the health of the wetland and waterbody ecosystems is maintained during the landform stabilisation phase through active weed and algae monitoring and management.

7.3 Threatened species - Wallum froglet

Applies to:	Species: Wallum Froglet (<i>Crinia signifera</i>) Landform stabilisation phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, all personnel, ecologist.

Issue	Protection of habitat. Provision of habitat from construction of artificial wetland areas – constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats. Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Wallum Froglet habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	• Minimise impacts on Wallum Froglet habitat. • Colonisation of constructed wetlands by Wallum Froglet. • Maintenance of water quality (pH, nutrient levels) within constructed and naturally occurring habitat. • Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Wallum Froglet). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	• Design of constructed wetlands (liaison with relevant personnel). • Construction of wetlands. • Landscaping /revegetation works. • Re-evaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Wallum Froglet activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a weekly basis; and • frog monitoring on a monthly basis with an emphasis on monitoring in breeding season (June – August).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any water quality testing. Results of monitoring to be collated and presented as report to Council, and other relevant authorities.

Identification of incident or failure	• Physical failure of constructed wetlands (e.g. breach). • Inappropriate pH levels. • Records of high nutrient input. • Absence or decline of Wallum Froglet.
Corrective action	Apply remedial measures to correct issues of water quality and habitat suitability.

Commitment

The contractor will commit to monitoring Wallum Froglet populations to ensure that constructed wetlands are appropriately constructed and maintained.

7.4 Threatened species - Olongburra frog

Applies to:	Species: Olongburra Frog (<i>Litoria olongburensis</i>) Landform stabilisation phase – disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor site manager, all personnel, ecologist.

Issue	Protection and restoration of habitat (2 constructed dams which currently occur in precincts 12 and 13, one of which requires repair). Provision of habitat from construction of artificial wetland areas – constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats. Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Olongburra Frog habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	• Minimise impacts on Olongburra Frog habitat. • Colonisation of constructed wetlands by Olongburra Frog. • Maintenance of water quality (pH, nutrient levels). • Maintenance of aquatic vegetation and dense reedland. • Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Olongburra Frog). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	• Design of constructed wetlands (liaison with relevant personnel). • Construction of habitat areas. • Landscaping /revegetation works. • Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Olongburra Frog activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a weekly basis; and • frog monitoring on a monthly basis with an emphasis on monitoring in breeding season (June – August).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any testing. Results of monitoring to be collated and presented as report to, Council and other relevant statutory authorities.
Identification of	• Physical failure of constructed wetlands (e.g. breach).

incident or failure	• Inappropriate pH levels. • Records of high nutrient input. • Absence or decline of Olongburra Frogs.
Corrective action	Apply remedial measures to correct issues of water quality and habitat suitability.

Commitment

The contractor will commit to monitoring Olongburra Frog populations to ensure that constructed wetlands are appropriately constructed and maintained.

7.5 Threatened species - Bush stone-curlew

Applies to:	Species: Bush Stone-curlew (<i>Burhinus grallarius</i>) Landform stabilisation phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, All personnel, ecologist.

Issue	Protection and restoration of habitat (Scribbly Gum woodland and regrowth heath in the south eastern margins of precincts 12 and 13). Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of vegetation and golf course management.
Operational policy	Protection and improvement of Bush Stone-curlew habitat in accordance with <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	Minimise impacts on Bush Stone-curlew habitat Survival of planted trees to ensure additional habitat creation
Implementation strategy	- Identifying area to be set aside for habitat protection. - Surveying & fencing area to exclude vehicle access. - Signage installed stating 'Habitat Area – Keep Out'. - Weed control & planting of additional Scribbly Gum to increase suitability of habitat. - Placement of woody debris to augment habitat requirements. - Retain existing vegetation where possible. - Reevaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: - Ensure no works take place within habitat area. - Ensure fencing and signage are maintained. - Assess growth of planted trees & monitor weed invasion. - Survey for presence of Bush Stone-curlew.
Auditing	Periodic monitoring inspections of planted trees to be completed at stated intervals (e.g. every 3 months) in addition to weed assessment & control (if required). Bush Stone-curlew surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring planted trees and weed control works to be filled in by landscape maintenance staff/bush regenerators. Survey pro-formas to be completed by ecologist and presented as report to client and TSC and any other relevant statutory authorities.

Identification of incident or failure	• Contractors working within identified habitat area. • Accidental removal of trees. • Poor survival of planted trees. • Removal of fencing or signage. • Weed invasion. • Absence or decline of Bush Stone-curlew population.
Corrective action	Educate contractors so that works (e.g. vegetation clearing) are not undertaken in habitat areas. Replacement of any dead trees with new stock as soon as detected. Responsibility for corrective actions rests with construction management, contractors and landscape staff or bush regenerators.

Commitment

The contractor will commit to monitoring Bush Stone-curlew populations and ensuring that the habitat area is appropriately protected and maintained.

7.6 Threatened species - Grass owl

Applies to:	Species: Grass Owl (<i>Tyto capensis</i>) Landform stabilisation phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, all personnel, ecologist.

Issue	Protection and restoration of habitat – tall rank grassland and heathland. Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of golf course management.
Operational policy	Protection of Grass Owl habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	- Minimise impacts on Grass Owl habitat. - Maintenance of rank grasslands and heathland vegetation.
Implementation strategy	- Identifying area to be set aside for habitat protection. - Surveying & fencing area to exclude vehicle access. - Signage installed stating 'Habitat Area – Keep Out'. - Weed control (if required). - Retain existing vegetation where possible. - Re-evaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: - Ensure no works take place within habitat area. - Ensure fencing and signage are maintained. - Monitor (& control) weed invasion. - Survey for presence of Grass Owl.
Auditing	Periodic weed assessment & control (if required) at 3 month intervals. Grass Owl surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client and TSC and any other relevant statutory authorities.
Identification of incident or failure	- Contractors working within identified habitat area. - Weed invasion. - Removal of fencing or signage. - Absence or decline of Grass Owl population.

Corrective action	Educate contractors so that works (e.g. vegetation clearing) are not undertaken in habitat areas. Replacement of any dead trees with new stock as soon as detected. Responsibility for corrective actions rests with construction management, contractors and landscape staff or bush regenerators.
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Commitment

The contractor will commit to monitoring Grass Owl populations ensuring that identified habitat area is appropriately protected and maintained.

7.7 Threatened species - Koala

Author:	James Warren & Associates Pty Ltd
Applies to:	Species: Koala (<i>Phascolarctos cinereus</i>) Landform stabilisation phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Contractor's site manager, all personnel, ecologist.

Issue	Protection and restoration of habitat. Predation by feral dogs. Injury/death from vegetation clearing. Injury/death from vehicle strike.
Operational policy	Protection and creation of Koala habitat in accordance with the <i>Koala Plan of Management</i> ('KPoM', JWA 2011).
Performance criteria	- Minimise loss of Koala feed trees as identified in the KPoM. - Planting of additional feed trees in accordance with rehabilitation and maintenance targets prescribed in the KPoM (JWA 2011). - Creation of habitat corridors for movement & foraging.
Implementation strategy	- Identify all areas of Core Koala habitat to be retained and surround with barrier fencing prior to any works commencing. - Inform all contractors that these areas are to be retained. - Contractors are prohibited to bring dogs on to site. - Establish Koala sighting logbook for contractors to fill out while on site. All sightings, including mortalities, to be reported in accordance with KPoM. - Identify potential areas for tree/corridor plantings. - Survey and fence corridor planting areas and erect signage 'Restoration Area – Keep Out'. - Vehicles restricted to a maximum speed of 50kph, only operating in daylight hours. - Planting of preferred Koala food tree species within planting areas identified in the KPoM (JWA 2011). - Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: - Monitor fenced areas have not been breached. - Monitor health of plantings. - Survey for Koala presence & use of habitat areas.
Auditing	Periodic assessment of plantings & weed assessment & control (if required) within habitat areas at 3 month intervals. Koala surveys to be

	completed on a periodic basis (e.g. every 6 months).
Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client and TSC and any other relevant statutory authorities. A Koala Monitoring Report is to be prepared by a suitably qualified person on an annual basis, from the date of commencement of bulk earthworks, for 5 years or as otherwise determined by the Director-General. Reports to be submitted to DoP, DECCW, TSC and DPI Fisheries.
Identification of incident or failure	• Contractors working within identified habitat area. • Removal of any marked Koala feed trees. • Weed invasion & decline in planting health. • Death of planted trees. • Absence or decline of Koala population.
Corrective action	Educate staff that no clearing of Koala feed trees occurs, and that works do not occur within fenced Koala habitat areas. Replacement of any dead trees with new stock as soon as detected, and weed control undertaken in restoration areas.

Commitment

The contractor will commit to monitoring Koala populations and liaising with construction management to ensure that identified habitat area is appropriately protected and maintained.

7.8 Maintenance of water treatment measures

Applies to:	Landform stabilisation phase
Person responsible:	Proponent

Issue	Maintenance of stormwater quality treatment devices.
Operational policy	To ensure that the stormwater quality treatment devices are maintained at an appropriate operational standard.
Performance criteria	No significant change in the physical characteristics of treatment devices. No significant change in the physicochemical and/or biological characteristics of the treatment devices.
Implementation strategy	Routine visual inspections and monitoring and maintenance.
Monitoring	Routine monthly visual inspection of treatment trains and vegetated open space for: • Litter. • Erosion. • Excessive sediment deposition. • Clogging (bio-retention). • Vegetation damage (e.g. die off, weed growth). • Damaged or failed treatment devices. • Change in physical characteristics: • water level; and • area, depth or bed profile of any bio-retention basin. waterway and wetland system.
Auditing	Audit inspections are to be carried out on a quarterly basis to verify that the stormwater quality control structures are properly maintained by the contractor.
Reporting	A checklist is to be completed which assesses the strategies listed above and includes the following: A record of inspection details and; A record of details of all maintenance activities (including volume of silt removed from each GPT or other control structure). Results to be made available to TSC at all times. A summary of the inspection checklist findings shall be included in the annual water quality monitoring report.
Identification of incident or failure	Non compliance with the criteria will be identified by: • Blockage of stormwater system.

Corrective action	• Build up of sediment & litter or re-entrainment of trapped sediments. • Excessive erosion. • Vegetation damage. • Poorly maintained, damaged or failed control devices. • A change in the physical characteristics. • A change in the physicochemical and/or biological characteristics. • Impeded drainage of bio-retention and filter basins. • Deterioration of water quality downstream of the control structure/s.
	Bio-retention and filter basin maintenance Regular harvesting to ensure vegetation is maintained at acceptable levels. Removal of a portion of vegetation to maintain nutrient and biomass balance Removed vegetation to be composted and reused on landscaping in other parts of development site Soil renovation (as required) to maintain permeability Removal of litter. Gross pollutant traps Removal of trapped material in accordance with manufacturer's specifications. Vegetated rough Regular mowing and maintenance of rough filter characteristic by mulching organic matter back into rough soil profile. Ensure vegetation is maintained at acceptable levels (minimum 85% foliage protective cover). Removal of litter within the swale. Waterway and wetland system As per weed management program Sediment/sludge removal Sludge and sediments are expected to settle in the inlet zones of the wetlands and other water bodies. In the operational state this is expected to be minor and de-silting will only be required on an infrequent basis (maybe every 50 years). Prior to works the recommended best practice method of sediment/sludge removal of the time will be used.

Commitment

The Proponent will ensure management measures are implemented (if required) to ensure the stormwater quality treatment devices are maintained at operational standard.

7.9 Stormwater management

Applies to:	Landform stabilisation phase
Person responsible:	Proponent; Environmental Consultant

Issue	Stormwater quality management.																		
Operational policy	To ensure water discharged from the completed Stage 1 area during the landform stabilisation phase meets specified water quality objectives.																		
Performance criteria	Water discharged from the completed Stage 1 area during the landform stabilisation phase shall meet the designated criteria. The quality of discharge from the site should achieve the following water quality targets. <table border="1"> <thead> <tr> <th>Water Quality Parameter</th><th>Water Quality Objective</th></tr> </thead> <tbody> <tr> <td>pH</td><td>As developed from background monitoring</td></tr> <tr> <td>Dissolved oxygen</td><td>>60-105% saturation</td></tr> <tr> <td>Electrical conductivity</td><td><1.5dS m⁻¹</td></tr> <tr> <td>Suspended solids</td><td><50mg L⁻¹</td></tr> <tr> <td>Turbidity</td><td>As developed from background monitoring</td></tr> <tr> <td>Total algae numbers</td><td><50,000cells mL⁻¹</td></tr> <tr> <td>Litter and gross pollutants</td><td>No man made material >5mm in any dimension</td></tr> <tr> <td>Oil and grease</td><td>No visible film, no detectable odour</td></tr> </tbody> </table> *Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in '<i>Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range</i>'.¹⁸ A similar pH range of 4.2 to 7.2 is identified in '<i>Threatened frogs of New South Wales: Habitats, Status and Conservation</i>'.¹⁹	Water Quality Parameter	Water Quality Objective	pH	As developed from background monitoring	Dissolved oxygen	>60-105% saturation	Electrical conductivity	<1.5dS m ⁻¹	Suspended solids	<50mg L ⁻¹	Turbidity	As developed from background monitoring	Total algae numbers	<50,000cells mL ⁻¹	Litter and gross pollutants	No man made material >5mm in any dimension	Oil and grease	No visible film, no detectable odour
Water Quality Parameter	Water Quality Objective																		
pH	As developed from background monitoring																		
Dissolved oxygen	>60-105% saturation																		
Electrical conductivity	<1.5dS m ⁻¹																		
Suspended solids	<50mg L ⁻¹																		
Turbidity	As developed from background monitoring																		
Total algae numbers	<50,000cells mL ⁻¹																		
Litter and gross pollutants	No man made material >5mm in any dimension																		
Oil and grease	No visible film, no detectable odour																		
Implementation strategy	Local site catchment stormwater quality control is achieved through treatment trains consisting of: At source bio retention system.																		

¹⁸ White, A. W. & Pyke, G. H., 2006, '*Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range*'. Unpublished paper submitted to Journal of Herpetology.

¹⁹ Ehmann, H. 1997 (ed). '*Threatened frogs of New South Wales: Habitats, Status and Conservation*'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

Monitoring	• Gross Pollutant Trap (GPT). • Vegetated swales.
	Routine monthly visual inspection of treatment trains and vegetated open space for: • litter; • erosion; • excessive sediment deposition; • clogging (bio-retention); • vegetation damage (e.g. die off, weed growth); and • damaged or failed treatment devices. Sample recovery and in-situ analysis will be performed by staff on site on a quarterly basis and samples will be forwarded to a NATA accredited laboratory.
Auditing	Reviews are to be carried out on a monthly basis during establishment to assess the implementation strategy. A checklist is to be completed which assesses the strategies listed above.
Reporting	A Water Quality Report for all water quality monitoring results and assessments shall be submitted to TSC annually.
Identification of incident or failure	Non compliance with agreed performance criteria will be identified by: • Visual inspections identifying build up of sediment & litter, excessive erosion and vegetation damage. • Poorly maintained, damaged or failed control devices. • Deteriorated water quality identified by the environmental consultant as being attributable to the construction activities.
Corrective action	If build up of sediment and litter occurs, remove material, identify cause, inspect all treatment techniques, revise design or review different alternatives and install if necessary. If erosion occurs, fill, vegetate and/or install velocity dissipation in accordance with <i>'Managing Urban Stormwater: Soils and Construction'</i> March 2004 by Landcom, Australia. If vegetation fails, new vegetation should be planted and established. Vegetation may require supplementary watering and replanting. If water quality objectives are not met, inspect all treatment techniques, revise designs or review different alternatives and install if necessary. If silt fences fail, replace and monitor more frequently. If release of silt and other material off the site occurs, clean up, inspect all treatment techniques, revise designs and review different alternatives and install; otherwise reduce the rate of excavation. All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted.

Specific strategies to be implemented are as follows:

Suspended solids and turbidity

If total suspended solids exceed the site specific target the waters will be contained onsite for a period sufficient to allow suspended solids to settle out prior to release, or treated with a flocculent. After gypsum has been applied, the stored waters will be retested immediately prior to discharge.

Erosion control devices will be immediately inspected and cleaned if necessary. Additional devices will be installed if a need is detected to prevent future breaches of the suspended solids criteria. The placement of stockpiles and management of disturbed areas will be reviewed with regard to the sediment and silt control provisions.

Dissolved oxygen

In the event that dissolved oxygen levels drop below the site specific target, the waters will not be released until visual inspections for algae has been carried out. If algae is present, further laboratory tests will be carried out to determine the type of algae in the waters.

A general investigation will be carried out of the flow conditions of the affected waters, to assess the flow rates and volume of water passing through the monitoring locations.

Litter and gross pollutants

In the event that litter and gross pollutants with a dimension greater than 5mm are observed, this material will be clean up and appropriately disposed of as soon as practicable. The contractor shall inform staff of the appropriate waste disposal procedures.

Oil and grease

In the event that oil and grease are visible and/or an odour is detected within a waterbody, management strategies will be implemented (Hazardous and dangerous goods handling and storage). Specifically, the waters shall be contained and the oil and grease isolated through the use of booms, containments bunds or other appropriate measures. Remediation works shall be implemented in consultation with the environmental consultant and DECCW.

Commitment

The Proponent will ensure the quality of the discharge from the site meets the water quality objectives to ensure no detrimental impacts on the downstream environment, including the waterway and wetland system.

7.10 Surface water monitoring

Applies to:	Landform stabilisation phase
Person responsible:	Proponent, Environmental Consultant

Issue	Surface water monitoring.
Operational policy	To ensure: • That any waters discharged from the site meet the specified water quality objectives (WQOs). • That the water quality in the waterway and wetland system remains at an acceptable level.
Performance criteria	The quality of discharge from the site should achieve the long term WQOs. The WQOs will reflect background monitoring results for: • pH; • dissolved oxygen; • total phosphorous; • total nitrogen; • turbidity; • suspended solids; • chlorophyll 'a'; • faecal coliforms; • total algae numbers; • litter and gross pollutants; and • oil and grease. In addition to the above WQOs no release from the off-stream waterway and wetland system shall occur if blue green algae levels exceed 5,000 cells/mL.
Implementation strategy	Routine surface water quality monitoring to be undertaken.
Monitoring	Frequency: Routine quarterly monitoring for one year following the completion of bulk earthworks, including quarterly rainfall event (>25mm/24hrs) monitoring campaigns for the year. Parameters: temperature, dissolved oxygen, pH, conductivity, salinity, turbidity, suspended solids, total nitrogen, total phosphorous, faecal coliforms, chlorophyll 'a' and algae identification and count. Vertical Profiling: Routine quarterly monitoring of temperature, dissolved oxygen, pH, conductivity, salinity and turbidity at 0.5m depths of all off-stream deep water bodies. Every three months, water quality monitoring of each defined off-site

Auditing	discharge point will be carried out. Sample recovery and in-situ analysis will be performed by a NATA accredited sampler and, when required, samples will be forwarded to a NATA accredited laboratory.
	Reviews are to be carried out on an annual basis during establishment to assess the implementation strategy. A checklist is to be completed which assesses the strategies listed above.
Reporting	A Water Quality Report for all water quality monitoring results and assessments shall be submitted to TSC annually. The water quality reports will be prepared by a suitably qualified and experienced Environmental Consultant. These reports will detail: • The results for each of the environmental indicators monitored. • An assessment of the monitoring results against the release criteria. • An evaluation, if applicable, of the environmental conditions if monitoring results fall outside the limits of the release criteria. • Recommendations that are relevant to ensuring a high level of water quality is maintained. Each report will include previous water quality results in tabular format for comparative purposes and trend graphs will be provided. Laboratory certificates will be provided.
Identification of incident or failure	Surface water quality parameter monitoring identifying exceedance of WQOs.
Corrective action	If exceedance of WQOs continues to occur, inspect all treatment techniques, revise designs or review different alternatives and install if necessary.

Commitment

The Proponent will ensure routine monitoring is carried out to ensure water quality is in accordance with the water quality objectives during the land stabilisation phase.

7.11 Site stabilisation

Applies to:	Landform stabilisation phase
Person responsible:	Contractor's Site Manager

Issue	Landform stabilisation at the completion of the bulk earthworks phase Stage 1 works.
Operational policy	Landscaping, stabilisation and revegetation of completed areas to aid the treatment of surface water and minimise sediment transport.
Performance criteria	No sediment transport from completed areas.
Implementation strategy	- Progressive stabilisation and revegetation of completed areas. - The landscaping and rehabilitation program shall be programmed to ensure that minimal time delay occurs between final land shaping and permanent rehabilitation (a period of 20 days is to be provided). All temporary erosion and sediment control works are to be removed once works are complete and revegetation is successfully established in formerly disturbed areas.
Monitoring	Routine weekly inspections undertaken by the contractor's site manager until the stage is stabilised.
Auditing	A checklist is to be completed which assesses the strategies listed above.
Reporting	Completed checklists to be kept onsite for inspection by TSC upon request.
Identification of incident or failure	- Failure of vegetated areas - Signs of erosion onsite. - Damaged or failed erosion control devices. - Decline in water quality as identified by environmental consultant.
Corrective action	- Test topsoil if revegetation works have been unsuccessful to determine the possible problem. - Review procedures in consultation with landscape architect and/or horticulturalist. Apply remedial measures to improve sediment and erosion control including the incorporation of additional measures, including but not limited to hay bales, silt fences and flocculation of water quality control ponds.

Commitment

The Proponent will ensure each stage or precinct is stabilised once final grade is achieved.

7.12 Groundwater monitoring

Applies to:	Landform stabilisation phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Groundwater monitoring.
Operational policy	To establish the stable groundwater conditions and verify by monitoring that development management is appropriate. Groundwater monitoring is to be undertaken in accordance with the site's <i>Groundwater Assessment and Management Plan</i> (Gilbert & Sutherland June 2011).
Performance criteria	Water quality objectives for the construction phase of works would be devised using DECCW guidelines for groundwater monitoring. These proposed objectives would be submitted to TSC for review and approval prior to implementation. Groundwater monitoring will be undertaken for the following parameters: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L⁻¹); • total and nitrate, nitrite and ammonium (mg L⁻¹); • total and soluble phosphorus (mg L⁻¹); • total and soluble iron and filtered aluminium; and • oil and grease (visual inspection). • calcium; • magnesium; • potassium • sodium • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and • colour. Laboratory analysis for total acidity (titratable) and total alkalinity should also be undertaken.

Implementation strategy	Monitoring of groundwater levels should be undertaken quarterly during the landform stabilisation phase.
	Groundwater samples are to be collected quarterly and analysed for the parameters specified above.
Monitoring	Carry out quarterly groundwater level and quality monitoring at locations to be specified.
	Sample recovery and in-situ analysis will be performed by onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory.
Auditing	The environmental consultant is to audit water quality annually to ensure that no deleterious effects are resulting from any excavation, filling and dewatering operations at the site.
Reporting	Annual reports are to be submitted to TSC.
	The annual reports to TSC shall include raw data, a results summary and a discussion comparing results with baseline values and ANZECC guidelines. Result sheets to be compiled for monitoring results. All results shall be made available for inspection by local and state government officers when requested.
Identification of incident or failure	Degradation of groundwater quality at the monitoring points to below the "Performance Criteria" levels (to be derived following baseline monitoring).
	Variations in groundwater levels beyond typical seasonal fluctuations.
Corrective action	If the test results for any parameter fails to meet the performance criteria (to be determined based on background monitoring), further investigations will be conducted. This will involve fortnightly groundwater quality monitoring (or more frequent if deemed necessary by the environmental consultant) of the subject parameter(s). The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in groundwater quality is present. If a trend exists for declining groundwater quality, the likely source(s) of contamination will be identified. Should the investigation indicate that site activities are triggering the incident/failure, the following will be implemented: • Locate the source of the contamination/level variation and take all possible actions to contain and control the contaminant/level variation. Investigate the cause of the contamination/level variation and take action to prevent a recurrence. • All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted.
	The quality of the dewatered groundwater being discharged to recharge

trenches shall be reviewed to confirm compliance with the performance criteria detailed below.

Water Quality Parameter	Release Criteria	Criteria Type
pH	As per background monitoring	Range
Oil and grease	No visible film, no detectable odour	-

Commitment

The contractor will seek to establish stable groundwater conditions and verify by monitoring that development management is appropriate.

8 Management of potential impacts – Civil construction

8.1 Intent

This part of the SBMP specifies those matters which must be complied with by the Proponent during the civil construction phase, being the period after the landform stabilisation phase but before the on-maintenance phase commences in each stage.

8.2 Aquatic flora & weed management and maintenance

Applies to:	Civil construction phase
Person responsible:	Proponent, Environmental Consultant

Issue	Aquatic flora and weed management and maintenance.
Operational policy	To maintain healthy aquatic plant life and control weeds to promote the ecosystem health of wetlands and waterbodies.
Performance criteria	Macrophyte establishment success rate >70%. The suppression of aquatic weeds and algae. Maintenance of hydraulic performance between waterbodies.
Implementation strategy	Weed strategy An expectation of avoidance or total removal of aquatic weeds within the waterway and wetland system is not realistic as weeds are present within the catchment and neighbouring sites. Management of macrophytes via removal of vegetation within flow paths to maintain hydraulic conductance. Particular attention should be given to weed management to prevent obstruction of hydraulic conductance. When removing weeds, care must be taken not to damage the growth of native aquatic plants or interrupt natural ecosystem function by adhering to the following methods: • Avoid overspray through use of correct equipment and not spraying in windy conditions. • Bag and removal of weeds offsite. • Manage access to wetlands to avoid damage via trampling. • Should mechanical harvesting of weed growth be required, access to waterbodies will be selected to achieve minimal impact and access points will be rehabilitated at the end of the harvesting period. Algae strategy Regular monitoring, particularly in Spring and Summer, is required to reduce the potential for algal blooms. Proposed management methods

Monitoring	include: • Ability to isolate separate on-stream system pools to contain algal blooms. • Emergency aeration and/or mixing. • Safety signage during algal outbreaks. See Table 9.12 'Maintenance of water treatment measures' of the SBMP for further details. Off-stream waterway and wetland system • Containment of blooms within off-stream waterway and wetland system (no release of water if blue green algae levels exceed 50,000 cells/ml). • Emergency turnover. • Emergency vertical aeration and/or mixing. • Safety signage during algal outbreaks.
	Routine monthly monitoring for two years following the completion of construction onsite. Routine monthly visual inspection of treatment trains for vegetation establishment, damage, weed invasion and clogging.
	Reviews are to be carried out on a quarterly basis to assess the appropriateness of the implementation strategy. A checklist is to be completed which assesses the effectiveness of strategies detailed above.
	An Aquatic Flora Report shall be submitted to TSC annually. Maintenance and compilation of assessment sheets to be appropriately stored onsite for inspection by local and state government officers.
	Non compliance with agreed performance criteria will be identified by: • Vegetative losses >20%. • Weed growth that impacts upon ecosystem function and/or hydraulic conductance. • Algal blooms exceeding 500 cells/ml.
	If vegetation fails, new vegetation should be planted and established. Vegetation may require supplementary replanting. Macrophyte density to be maintained at prescribed levels to achieve hydraulic conductance and pollutant removal. If blue green algae numbers exceed 500 cells/ml: • Increase turnover mixing until numbers are brought back to lower levels. • Fertiliser activity to be limited. • Maintain regular monitoring. If blue green algae numbers exceed 2,000 cells/ml:

- Increase mixing:
 - Increase turnover through additional pumping of the recirculation system.
 - Vertical mixing through emergency compressed air or mechanical mixing devices.
- Fertiliser activity and sprinkling to be limited where possible in the vicinity of the test sites of concern.
- Harvest and land dispose of any dead fish.
- Monitoring frequency to be increased at affected sites to once a month.

If blue green algae numbers exceed 15,000 cells/ml:

- All fertiliser activity and sprinkling to be stopped in the vicinity of the sites of concern.
- Warning signs to be posted around the sites of concern.
- All site personnel to be notified.
- Monitoring frequency to increase at affected sites to once a week.
- Contingency measures are to be considered including:
 - Increased mixing.
 - Harvesting and land disposal of algae and dead fish.
 - Allowing bloom to run its course.

Commitment

The land user will ensure the health of the wetland and water body ecosystems is maintained - through active weed and algae monitoring and management.

8.3 Threatened species - Wallum froglet

Applies to:	Species: Wallum Froglet (<i>Crinia signifera</i>) Civil construction phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Proponent, Ecological Consultant

Issue	Protection of habitat. Provision of habitat from construction of artificial wetland areas (Constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats). Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Wallum Froglet habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	• Minimise impacts on Wallum Froglet habitat. • Colonisation of constructed wetlands by Wallum Froglet. • Maintenance of water quality (pH, nutrient levels) within constructed and naturally occurring habitat. • Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Wallum Froglet). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	• Maintenance of natural constructed wetlands (liaison with relevant personnel) and landscaping /revegetation works. • Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Wallum Froglet activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a Quarterly basis; and • frog monitoring on an annual basis with an emphasis on monitoring in breeding season (June – August).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any water quality testing. Results of monitoring to be collated and presented as report to client, Council and any other relevant statutory authorities.
Identification of incident or failure	• Physical failure of constructed wetlands (e.g. breach). • Inappropriate pH levels.

Corrective action	• Records of high nutrient input. • Absence or decline of Wallum Froglet.
	Apply remedial measures to correct issues of water quality as determined by monitoring.

Commitment

The land user will commit to monitoring Wallum Froglet populations to ensure that habitats are maintained.

8.4 Threatened species - Olongburra frog

Applies to:	Species: Olongburra Frog (<i>Litoria olongburensis</i>) Civil construction phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Proponent, Ecological Consultant

Issue	Protection and restoration of habitat (2 constructed dams which currently occur, one of which requires repair). Provision of habitat from construction of artificial wetland areas (Constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats). Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Olongburra Frog habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	- Minimise impacts on Olongburra Frog habitat. - Colonisation of constructed wetlands by Olongburra Frog. - Maintenance of water quality (pH, nutrient levels). - Maintenance of aquatic vegetation and dense reedland. - Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Olongburra Frog). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	- Maintenance of natural and constructed wetlands (liaison with relevant personnel) as well as landscaping /revegetation works. - Re-evaluation of monitoring and actions annually.
Monitoring	Regular inspections to: - monitor water quality; and - monitor Olongburra Frog activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: - water quality monitoring on a quarterly basis; and - frog monitoring on an annually basis with an emphasis on monitoring in breeding season (spring & summer).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any testing. Results of monitoring to be collated and presented as report to client, ecologist, Council and any other relevant statutory authorities.
Identification of incident or failure	- Physical failure of constructed wetlands (e.g. breach). - Inappropriate pH levels.

Corrective action	• Records of high nutrient input. • Absence or decline of Olongburra Frogs.
	Apply remedial measures to correct issues of water quality as determined by monitoring outcomes.

Commitment

The land user will commit to monitoring Olongburra Frog populations to ensure that wetlands are appropriately maintained.

8.5 Threatened species - Bush stone-curlew

Applies to:	Species: Bush Stone-curlew (<i>Burhinus grallarius</i>) Civil construction phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Proponent, Ecological Consultant

Issue	Protection and restoration of habitat (Scribbly Gum woodland and regrowth heath in the south eastern margins of precincts 12 and 13). Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of vegetation and golf course management.
Operational policy	Protection and improvement of Bush Stone-curlew habitat in accordance with the <i>Threatened Species Management Plan</i> (JWA 2011).
Performance criteria	Minimise impacts on Bush Stone-curlew habitat. Survival of planted trees to ensure additional habitat creation.
Implementation strategy	Maintain: • area to be set aside for habitat protection; • surveying & fencing area to exclude vehicle access; • signage installed stating 'Habitat Area – Keep Out'; • weed control & planting of additional Scribbly Gum to increase suitability of habitat; • placement of woody debris to augment habitat requirements; and • re-evaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: • ensure minimal disturbance within habitat area; • assess growth of planted trees & monitor weed invasion; and • survey for presence of Bush Stone-curlew.
Auditing	Periodic monitoring inspections of planted trees to be completed at stated intervals (e.g. every 3 months) in addition to weed assessment & control (if required). Bush Stone-curlew surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring planted trees and weed control works to be filled in by landscape maintenance staff/bush regenerators. Survey pro-formas to be completed by ecologist and presented as report to client, ecologist, Council and any other relevant statutory authorities.
Identification of	• Disturbance within identified habitat area.

incident or failure	• Accidental removal of trees. • Poor survival of planted trees. • Weed invasion. • Absence or decline of Bush Stone-curlew population.
Corrective action	• Minimise disturbance of habitat areas. • Replacement of any dead trees with new stock as soon as detected.

Commitment

The land user will commit to monitoring Bush Stone-curlew populations and ensuring that the habitat area is appropriately protected and maintained.

8.6 Threatened species - Grass owl

Applies to:	Species: Grass Owl (<i>Tyto capensis</i>) Civil construction phase
Person responsible:	Proponent, Ecological Consultant.

Issue	Protection and restoration of habitat – tall rank grassland and heathland. Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of golf course management.
Operational policy	Protection of Grass Owl habitat.
Performance criteria	- Minimise impacts on Grass Owl habitat. - Maintenance of rank grasslands and heathland vegetation.
Implementation strategy	Maintain: - area to be set aside for habitat protection; - exclusion of vehicle access; - signage installed stating ‘Habitat Area – Keep Out’; - weed control (if required); and - re-evaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: - ensure no disturbance takes place within habitat area; - monitor (& control) weed invasion; and - survey for presence of Grass Owl.
Auditing	- Periodic weed assessment & control (if required) at 3 month intervals. - Grass Owl surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators. Survey pro-formas to be completed by ecologist and presented as report to client, Council and any other relevant statutory authorities.
Identification of incident or failure	- Contractors working within identified habitat area. - Weed invasion. - Absence or decline of Grass Owl population.
Corrective action	Minimise disturbances in habitat areas. Replacement of any dead trees with new stock as soon as detected.

Commitment

The land user will commit to monitoring Grass Owl populations and ensuring that the identified habitat area is appropriately protected and maintained.

8.7 Threatened species - Koala

Applies to:	Species: Koala (<i>Phascolarctos cinereus</i>) Civil construction phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Proponent, Ecological Consultant

Issue	Protection and restoration of habitat. Predation by feral dogs. Injury/death from vegetation clearing. Injury/death from vehicle strike.
Operational policy	Protection and creation of Koala habitat in accordance with the <i>Koala Plan of Management</i> ('KPoM', JWA 2011).
Performance criteria	- Minimise loss of Koala feed trees as identified in the KPoM. - Planting of additional feed trees in accordance with rehabilitation and maintenance targets prescribed in the KPoM (JWA 2011). - Creation of habitat corridors for movement & foraging.
Implementation strategy	- Identify all areas of Core Koala habitat to be retained and surround with barrier fencing prior to any works commencing. - Inform all contractors that these areas are to be retained. - Contractors are prohibited to bring dogs on to site. - Establish Koala sighting logbook for contractors to fill out while on site. All sightings, including mortalities, to be reported in accordance with KPoM. - Identify potential areas for tree/corridor plantings. - Survey and fence corridor planting areas and erect signage 'Restoration Area – Keep Out'. - Vehicles restricted to a maximum speed of 50kph, only operating in daylight hours. - Planting of preferred Koala food tree species within planting areas identified in the KPoM (JWA 2011). - Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: - monitor fenced areas have not been breached; - monitor health of plantings; and - survey for Koala presence & use of habitat areas.
Auditing	- Periodic assessment of plantings & weed assessment & control (if required) within habitat areas at 3 month intervals. - Koala surveys to be completed on a periodic basis (e.g. every 12

Reporting	months).
	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client and Council and any other relevant statutory authorities.
	A Koala Monitoring Report is to be prepared by a suitably qualified person on an annual basis, from the date of commencement of bulk earthworks, for 5 years or as otherwise determined by the Director-General. Reports to be submitted to DoP, DECCW, TSC and DPI Fisheries.
Identification of incident or failure	• Contractors working within identified habitat area. • Removal of any marked Koala feed trees. • Weed invasion & decline in planting health. • Death of planted trees. • Absence or decline of Koala population.
Corrective action	Replacement of any dead trees with new stock as soon as detected, and weed control undertaken in restoration areas. Responsibility for corrective actions rests with construction management, contractors and landscape staff or bush regenerators.

Commitment

The Proponent will commit to monitoring Koala populations and ensuring that identified habitat area is appropriately protected and maintained.

8.8 Waste management

Applies to:	Civil construction phase
Person responsible:	Proponent, contractor

Issue	Waste management.
Operational policy	To minimise the amount of solid and liquid waste produced as a result of general operations. To ensure all waste generated is stored, removed and recycled or disposed of in an appropriate manner. To minimise potential environmental and social impacts from waste and waste handling. Site is kept in a neat and tidy state. To ensure that all waste generated at the site is disposed of in accordance with the applicable legislation.
Performance criteria	No evidence of excessive waste or litter accumulating onsite, outside of designated containment areas.
Implementation strategy	General strategies Waste management methods that employ reduction, reuse or recycling practices shall be used where practicable. The site shall be kept in a clean and tidy state, free from loose waste or litter. Waste material, including vegetation, litter, human waste, used oils and other wastes, shall not be disposed of by burning or burying onsite or in adjacent areas. All wastes shall be stored onsite in confined areas and managed to prevent environmental harm or nuisance from occurring. An appropriate number of covered waste receptacles shall be located onsite, with the provision of areas or additional receptacles for the storage of reusable and recyclable materials. Waste containers shall be emptied on a regular basis (or as required). All wastes transported from the site shall be covered or otherwise handled to prevent spillage or nuisance to the community and environment. Any waste material that is unable to be reused, reprocessed or recycled shall be disposed of at a landfill licensed by the DECCW to receive that type of waste. Organic waste Tree prunings, grass clippings and other organic materials from the golf course area are to be collected and composted in a small, purpose built composting facility.

	Only category 1 organic materials will be composted in the facility. The composting facility will be located in any infrastructure zones. The compost facility will be constructed and operated in accordance with the NSW guidelines for composting facilities (even though it is not of sufficient size to warrant licensing). Composted organic materials will be used on landscaping projects in other areas of the urban foot print and landscaping. Golf course effluents Effluents from the golf course will be either contained by impermeable membranes (such as the case with the tees and greens) or directed towards the bio-retention and filter basins for renovation and storage. The effluents will be reused on the fairways and factored in the nutrient and water balance determinations of the site.
Monitoring	The contractor site manager shall conduct weekly inspections of all work areas (specifically the waste containment areas and the property boundary) to ensure there is no accumulation of waste material.
Auditing	Annual environmental audits of site activities, complaints and corrective actions.
Reporting	Records of waste removal invoices shall be maintained and kept onsite. Site inspection notes, including the amount and type of waste observed onsite and any corrective actions, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by TSC (or other relevant authorities) upon request. When there is potential or actual environmental harm as a result of waste management, the site manager shall notify the appropriate authority and corrective actions implemented as directed. Annual waste management reports shall be prepared and provided to statutory authorities upon request.
Identification of incident or failure	Ongoing and repetitive waste-related observations.
Corrective action	The contractor site manager shall direct clean-up operations as required on the basis of site inspections. Additional corrective actions may be: - Identifying the source of waste and the implementation of the following measures (if applicable): - The establishment of additional waste management areas including the provision of additional waste containers; and - Increasing the awareness among staff of the acceptable methods for storage and disposal of waste onsite.

Commitment

The land user will ensure waste is managed to ensure proper controls, removal and disposal systems are in place at all times.

8.9 Machinery, workshops, and dangerous goods handling & storage

Applies to:	Civil construction phase
Person responsible:	Contractor site manager; All personnel

Issue	Materials handling and storage management, and hazardous substance management.
Operational policy	To ensure that fuel, grease and other hazardous substances present onsite are managed in a safe and environmentally responsible manner.
Performance criteria	No fuel, grease and/or oil contamination of the environment shall result due to operational activities. Appropriate facilities will be available for the storage of hazardous materials in accord with the relevant acts and best management practices. No fuel, grease, oil or other hazardous substances shall escape containment bunds and contaminate the site soils, surface water or leave the site.
Implementation strategy	All materials shall be stored within the boundaries of an area designated as a storage and containment zone for materials on site. The zone is to be located away from the surrounding SEPP 14 wetlands and environmental protection areas in the central golf course infrastructure development area (outside of buffer zones). Storage facilities shall be constructed prior to hazardous material being brought to the site. Stockpile and storage areas shall be identified and any contained products shall be clearly marked. Minimum practical quantities of fuels, grease and other hazardous substances shall be located onsite. These materials shall be stored in sheltered, impervious and bunded areas (or as required by the applicable regulations). Containment bund capacity shall be 110% of the volume of the tank stored within it. Where multiple tanks are stored within the one bund, the capacity will be 110% of the largest tank. Material Safety Data Sheets (MSDS) will be available onsite for all hazardous materials used or stored onsite for the duration of the construction works. An emergency response plan shall be developed for the site to control risk to the environment from hazardous materials. This shall include spill prevention and pollution control programs and an operating procedure for containing and cleaning up spills. Suitable quantities of absorbent materials shall be stored onsite to accommodate minor spills.

	Relevant staff shall be trained in chemical and fuel handling, spill containment and clean up procedures. Personnel protection equipment shall be made available onsite as required for the use of hazardous substances. All suppliers shall be informed of procedures and restrictions required, and deliveries supervised during off-loading by appropriately trained personnel. Materials shall be adequately secured and loads covered where there is risk of spillage or loss of load. Imported materials shall be free of weeds, litter and contaminants. All regulated waste shall be removed and disposed of by an appropriately licensed waste contractor at an appropriately licensed waste disposal facility.
Monitoring	Weekly inspections will be carried out by the site manager to verify the integrity of material storage facilities and bunding. Visual inspections for spills and land contamination shall also be conducted.
Auditing	Annual environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes (a checklist of visual inspections) shall be recorded in a Site Diary. An incidents/complaints register shall be maintained onsite and will be available for inspection by Tweed Shire council (or other relevant authorities) upon request. In the event of potential or actual environmental harm or nuisance, the site manager shall notify the NSW DECCW and corrective actions implemented as directed. Reports detailing any incidents and/or complaints and associated corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	Land or water contamination.
Corrective action	The immediate containment of spillages with booms, containment bunds or other appropriate measures. Remediation of site contamination in consultation with environmental consultant and DECCW. Corrective actions (to be implemented in the event of land contamination) include: - Identifying the source of contamination and reporting the incident to the appropriate authorities immediately. - Arranging for the source of the contamination to be rectified and for the contaminated area to be remediated.

Action for fuel/oil spillage:

- All ignition sources to be removed from vicinity of spill.
- All equipment in vicinity of storage to be turned off.
- Identification of source of spillage and take action to ensure similar incidents are avoided in future.

Commitment

The land user will ensure the handling and storage of machines and materials onsite is managed in a safe and environmentally responsible manner.

8.10 Erosion controls

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; Consulting Engineer

Issue	Erosion controls.
Operational policy	To prevent the displacement of sediment and soil across and offsite during storm events. To manage erosion controls in accordance with the <i>Erosion and Sediment Control Plan</i> (Gilbert & Sutherland April 2011).
Performance criteria	No visual indication of erosion on stages under construction, including evidence of rilling (an indicator of sheet erosion).
Implementation strategy	Erosion and sediment control devices shall be installed prior to the commencement of work in each stage in accordance with the site's ESCP. No site disturbance shall commence until the appropriate approvals have been obtained. Where possible, the construction program shall be scheduled to minimise the potential for soil loss to occur. Where construction activities cannot be altered, additional controls shall be implemented in the areas of high erosion potential. Runoff and erosion controls shall be installed prior to clearing and include: • Diversion of upslope runoff around cleared and/or disturbed areas in a way that minimises erosion, minimises the upslope catchment and diverts waters to a legal point of discharge. • Sediment control fences or other measures at the downslope perimeter of cleared and/or disturbed areas. • Regular maintenance of all erosion control measures at operational capacity until land is effectively rehabilitated. Temporary erosion measures are to be employed onsite during construction in accordance with the site's ESCP or where reasonably deemed necessary by TSC from an assessment of slope and soil type. Such measures shall be maintained at, or above, their design capacity. Such measures should be in accordance with the recommendations in Council's 'Code of Practice for Soil and Water Management on Construction Works – Annexure A of Development Design Specification D7 – Stormwater Quality,' and 'Managing Urban Stormwater: Soils and Construction' March 2004 by Landcom, Australia. On stages where more than 1,000m² are to be disturbed, runoff controls are also to include: • the use of barrier fencing; • the use of exclusion zones; and

	• minimising slope lengths of disturbed, uncontrolled areas. Stripped topsoil shall be separated from subsoil materials and shall only be stripped from the areas designated on the appropriate plans. Stockpiled soil should be stored taking into account the following considerations: • Stockpiles are not to be located on public footpaths, nature strips, roads, road shoulders or any other public land. • They will be located at least 2m away from any hazard areas. • They will be protected from upslope surface flows. • Downslope sediment filters will be provided. • Fill batters shall be located to avoid established trees. • Unless otherwise specified, trenches must be backfilled and compacted to 95% standard compaction and capped with topsoil. Excess spoil may be retained onsite provided the stockpile area is prepared by stripping topsoil from beneath the fill site for further use in revegetation. Outside the construction area of Stage 1, existing surface water conditions should be maintained wherever possible. All stockpiles, including preload, should be seeded within a fortnight of final forming with an appropriate mix.
Monitoring	Regular site inspections shall be undertaken to monitor the effectiveness of sediment and erosion controls. A site inspection and monitoring program shall include: • weekly site inspections; • inspections immediately following rainfall events that cause runoff; and • inspections immediately before site closure. Surface water to be monitored at discharge points during rainfall events for suspended solids/turbidity in accordance with Section 6.14.
Auditing	Regular site inspections shall be carried out in accordance with the above monitoring requirements. Additional visual inspections to be carried out weekly and after rainfall events to verify that control measures are in place and properly maintained.
Reporting	Signed site inspection records, original test results, weekly and other result sheets shall be kept on site and made available on request to TSC officers and other relevant statutory authorities.
Identification of incident or failure	• Signs of erosion on site. • Damaged or failed erosion control devices.

Corrective action	• Decline in water quality as identified by environmental consultant.
	Apply remedial measures to improve sediment and erosion control including the incorporation of additional measures, including but not limited to hay bales, silt fences and flocculation of water quality control ponds. Should additional measures prove unsuccessful, consultation with an environmental consultant and/or construction site erosion and sedimentation control specialist.

Commitment

The Contractor will ensure best management practices are implemented during civil construction phase to minimise erosion.

8.11 Sediment control

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; Consulting Engineer

Issue	Sediment control.												
Operational policy	To prevent the displacement of sediment and soil across and offsite during storm events. To manage sediment controls in accordance with the <i>Erosion and Sediment Control Plan</i> (Gilbert & Sutherland April 2011).												
Performance criteria	Offsite discharges to comply with requirements for suspended sediments, turbidity and litter/gross pollutants as detailed below. <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>Suspended solids</td><td><50mg L⁻¹</td><td>Maximum</td></tr><tr><td>Turbidity</td><td>As developed from background monitoring</td><td>Maximum</td></tr><tr><td>Litter and gross pollutants</td><td>No man made material >5mm in any dimension</td><td>--</td></tr></table>	Water Quality Parameter	Release Criteria	Criteria Type	Suspended solids	<50mg L ⁻¹	Maximum	Turbidity	As developed from background monitoring	Maximum	Litter and gross pollutants	No man made material >5mm in any dimension	--
Water Quality Parameter	Release Criteria	Criteria Type											
Suspended solids	<50mg L ⁻¹	Maximum											
Turbidity	As developed from background monitoring	Maximum											
Litter and gross pollutants	No man made material >5mm in any dimension	--											
Implementation strategy	All sediment control measures and facilities must be installed and stabilised prior to the commencement of construction activities. No site disturbance shall commence until the appropriate approvals have been obtained. Temporary erosion measures (e.g. silt fences) are to be employed onsite during construction where reasonably deemed necessary by TSC from an assessment of slope and soil type. Such measures should be in accordance with the recommendations in Council's '<i>Code of Practice for Soil and Water Management on Construction Works – Annexure A of Development Design Specification D7 – Stormwater Quality</i>,' and '<i>Managing Urban Stormwater: Soils and Construction</i>' March 2004 by Landcom, Australia. Silt fence geotextiles are to be replaced when damaged or permanently blocked. Level markers shall be installed within all sediment ponds. Internal waterbodies or waterways shall be dosed with flocculating agents when required to ensure that discharge water quality meets required limits specified in the above performance criteria. Sediment shall be cleaned out of sediment ponds when accumulated sediment volume reaches 70%. Removed materials must be disposed of												

Monitoring

in a manner that does not cause pollution.

All weather access tracks shall be constructed to all internal water bodies, trash racks and gross pollutant traps.

Where practical, surface waters from undisturbed lands shall be diverted away from construction areas.

Sediment detention basins and clean-water diversion channels shall be constructed prior to earthworks in accordance with the ESCP.

When sediment controls are required outside the construction site, the following shall be adhered to:

- Where increased stormwater runoff is likely to accelerate erosion of any downstream watercourse, the necessary remedial work shall be undertaken;
- All immediate downstream drainage inlets shall have appropriate controls installed in accordance with the approved engineering drawings;
- All disturbed areas on other property are to be reinstated to the original condition.

Outside the construction area of each stage, existing surface water conditions to be maintained wherever possible.

Regular site inspections shall be undertaken to monitor the effectiveness of sediment and erosion controls. A site inspection and monitoring program shall include:

- weekly site inspections;
- inspections immediately following rainfall events that cause runoff; and
- inspections immediately before site closure.

Surface water quality to be monitored monthly and during rainfall events in accordance with the following:

Water Quality Parameter	Release Criteria	Criteria Type
pH	As developed from background monitoring	Range
Electrical conductivity	<1.5dS m ⁻¹	Maximum
Suspended solids	<50mg L ⁻¹	Maximum
Turbidity	As developed from background monitoring	Maximum
Dissolved oxygen	60-105% saturation	Minimum
Total algae numbers	<50,000cells mL ⁻¹	Maximum
Litter and gross pollutants	No man made material >5mm in any dimension	--
Oil and grease	No visible film, no detectable odour	--

	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the Threatened Species Management Plan (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in '<i>Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range</i>'.²⁰ A similar pH range of 4.2 to 7.2 is identified in '<i>Threatened frogs of New South Wales: Habitats, Status and Conservation</i>'.²¹	
Auditing	Regular site inspections shall be carried out in accordance with the above monitoring requirements. Additional visual inspections to be carried out monthly and after rainfall events to verify that control measures are in place and properly maintained.	
Reporting	Signed, site inspection records, original test results, weekly and other result sheets shall be kept on site and made available on request to TSC officers and other relevant statutory authorities.	
Identification of incident or failure	• Falling water quality as identified by environmental consultant. • Build-up of sediment.	
Corrective action	Apply remedial measures to improve sediment and erosion control including the incorporation of additional measures, including but not limited to, silt fences and flocculation of water quality control ponds. Should additional measures prove unsuccessful, consultation with an environmental consultant and/or construction site erosion and sedimentation control specialist.	

Commitment

The contractor will ensure best management practices are implemented into work practices throughout the civil construction phase to minimise sediment transport off site.

²⁰ White, A. W. & Pyke, G. H., 2006, '*Habitat and Movements of the Wallum Froglet Crinia tinnula at the Southern Part of its Range*'. Unpublished paper submitted to Journal of Herpetology.

²¹ Ehmann, H. 1997 (ed). '*Threatened frogs of New South Wales: Habitats, Status and Conservation*'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

8.12 Groundwater monitoring

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Groundwater monitoring.
Operational policy	To establish the stable groundwater conditions and verify by monitoring that development management is appropriate. Groundwater monitoring is to be undertaken in accordance with the site's <i>Groundwater Assessment and Management Plan</i> (Gilbert & Sutherland June 2011).
Performance criteria	Water quality objectives for the construction phase of works would be devised using DECCW guidelines for groundwater monitoring. These proposed objectives would be submitted to TSC for review and approval prior to implementation. Groundwater monitoring will be undertaken for the following parameters: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L^{-1}); • total nitrogen and nitrate, nitrite and ammonium (mg L^{-1}); • total and soluble phosphorus (mg L^{-1}); • total and soluble iron and filtered aluminium; and • oil and grease (visual inspection). • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and • colour. Laboratory analysis for total acidity (titratable) and total alkalinity should also be undertaken.

Implementation strategy	Monitoring of groundwater levels should be undertaken monthly during the civil construction phase.
	Groundwater samples are to be collected monthly and analysed for the parameters specified above.
Monitoring	Carry out monthly groundwater level and quality monitoring at locations to be specified.
	Sample recovery and in-situ analysis will be performed by onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory.
Auditing	The environmental consultant is to audit water quality annually to ensure that no deleterious effects are resulting from any excavation, filling and dewatering operations at the site.
Reporting	• Annual reports are to be submitted to TSC. • The annual reports to TSC shall include raw data, a results summary and a discussion comparing results with baseline values and ANZECC guidelines. • Result sheets to be compiled for monitoring results. All results shall be made available for inspection by local and state government officers when requested.
Identification of incident or failure	• Degradation of groundwater quality at the monitoring points to below the “Performance Criteria” levels (to be derived following baseline monitoring). • Variations in groundwater levels beyond typical seasonal fluctuations.
Corrective action	If the test results for any parameter fails to meet the performance criteria (to be determined based on background monitoring), further investigations will be conducted. This will involve fortnightly groundwater quality monitoring (or more frequent if deemed necessary by the environmental consultant) of the subject parameter(s). The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in groundwater quality is present. If a trend exists for declining groundwater quality, the likely source(s) of contamination will be identified. Should the investigation indicate that site activities are triggering the incident/failure, the following will be implemented: • Locate the source of the contamination/level variation and take all possible actions to contain and control the contaminant/level variation. Investigate the cause of the contamination/level variation and take action to prevent a recurrence. • All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted.
	The quality of the dewatered groundwater being discharged to recharge

trenches shall be reviewed to confirm compliance with the performance criteria detailed below.

Water Quality Parameter	Release Criteria	Criteria Type
pH	As developed from background monitoring	Range
Oil and grease	No visible film, no detectable odour	-

Commitment

The contractor will seek to establish stable groundwater conditions and verify by monitoring that development management is appropriate.

8.13 Groundwater seepage monitoring

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Groundwater seepage monitoring.																											
	Management of groundwater seepage quality entering excavation areas.																											
Operational policy	To minimise and manage the generation of acidic waters entering the onsite excavation areas through seepage. To provide for monitoring and treatment of these waters prior to disposal. Groundwater monitoring is to be undertaken in accordance with the site's <i>Groundwater Assessment and Management Plan</i> (Gilbert & Sutherland June 2011).																											
Performance criteria	Daily pH monitoring of any seepage within the excavation areas is to be undertaken prior to the disposal of these waters via dewatering. All waters discharged from the excavation areas to the recharge trenches during the construction phase should comply with the following criteria: <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>pH</td><td>As developed from background monitoring</td><td>Range</td></tr><tr><td>Oil and grease</td><td>No visible film or detectable odour</td><td>--</td></tr></table> Where the discharge of dewatered groundwater to on-site or nearby drains and waterways is intended, water quality will satisfy the following performance criteria prior to release at the controlled discharge locations: <table><tr><th>Water Quality Parameter</th><th>Release Criteria</th><th>Criteria Type</th></tr><tr><td>pH</td><td>As developed from background monitoring</td><td>Range</td></tr><tr><td>Electrical conductivity</td><td><1.5mS/cm</td><td>Maximum</td></tr><tr><td>Suspended solids</td><td><50mg L⁻¹</td><td>Maximum</td></tr><tr><td>Turbidity</td><td>As developed from background monitoring</td><td>Maximum</td></tr><tr><td>Dissolved oxygen</td><td>60-105% saturation</td><td>Minimum</td></tr></table>	Water Quality Parameter	Release Criteria	Criteria Type	pH	As developed from background monitoring	Range	Oil and grease	No visible film or detectable odour	--	Water Quality Parameter	Release Criteria	Criteria Type	pH	As developed from background monitoring	Range	Electrical conductivity	<1.5mS/cm	Maximum	Suspended solids	<50mg L ⁻¹	Maximum	Turbidity	As developed from background monitoring	Maximum	Dissolved oxygen	60-105% saturation	Minimum
Water Quality Parameter	Release Criteria	Criteria Type																										
pH	As developed from background monitoring	Range																										
Oil and grease	No visible film or detectable odour	--																										
Water Quality Parameter	Release Criteria	Criteria Type																										
pH	As developed from background monitoring	Range																										
Electrical conductivity	<1.5mS/cm	Maximum																										
Suspended solids	<50mg L ⁻¹	Maximum																										
Turbidity	As developed from background monitoring	Maximum																										
Dissolved oxygen	60-105% saturation	Minimum																										

	Total and dissolved Iron	<0.3mg L ⁻¹	Maximum
	Total and dissolved Aluminium	As developed from background monitoring	Maximum
	Litter and gross pollutants	No man made material >5mm in any dimension	--
	Oil and grease	No visible film, no detectable odour	-
	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the Threatened Species Management Plan (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in 'Habitat and Movements of the Wallum Froglet <i>Crinia tinnula</i> at the Southern Part of its Range'.²² A similar pH range of 4.2 to 7.2 is identified in 'Threatened frogs of New South Wales: Habitats, Status and Conservation'.²³		
Implementation strategy	The release criteria for aluminium and total and dissolved iron concentrations will be consistent with the receiving water quality.		
	The site contractor shall be equipped with reliable pH monitoring equipment that will be calibrated on a weekly basis (at least). Dewatered groundwater will undergo appropriate treatment to ensure compliance with the above criteria prior to release into recharge trenches. Where disposal to surface water bodies is intended monitoring will be undertaken at the controlled discharge points by the environmental consultant monthly and during rainfall events (defined as >25mm in any 24 hour period). Records of the measured pH, time of monitoring, calibration records and treatment measures employed are to be kept on site for inspection by the environmental consultant and TSC. The total acid risk of seepage waters shall be determined from the total acidity (titratable) results measured during the background monitoring program. These results will be considered during the preparation of a treatment program for any dewatered acidic groundwater. Outside the construction area of each stage existing surface water conditions shall be maintained in accordance with Table 8.14 'Surface water quality'. If acidic seepage waters are encountered, the batter slopes of the excavation face should be subject to blanket liming as required at a predetermined rate in accordance with an acid sulfate management plan		

²² White, A. W. & Pyke, G. H., 2006, 'Habitat and Movements of the Wallum Froglet *Crinia tinnula* at the Southern Part of its Range'. Unpublished paper submitted to Journal of Herpetology.

²³ Ehmann, H. 1997 (ed). 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

	provisions. The addition of liquid lime to acidic seepage waters may also be required. The environmental consultant should be consulted to determine the need for this treatment and the required addition rate in accordance with Table 6.11 'Acid sulfate soil leachate monitoring' of the SBMP. Where recharge trenches are required, the base and sides of the trench should also be blanket limed at a predetermined rate prior to the disposal of dewatered groundwater in accordance with Table 6.10 'Acid sulfate soil assessment and treatment' of the SBMP. Before undertaking any earthworks in drains or watercourses, the drain or watercourse will be bunded and contained in a staged manner, with water tested and treated prior to discharge. Particular attention will be given to watercourses containing high levels of organic matter that may also have the potential to form monosulfidic black oozes (MBOs). Existing MBOs will be managed, with organic material within the drain kept to a minimum and dissolved oxygen concentrations within water-bodies monitored and increased if necessary (in accordance with the recommendations outlined in Tulau (2007). Titratable Actual Acidity contents and water pH levels of water-bodies will also be monitored and adjusted as necessary.
Monitoring	Carry out daily pH monitoring of seepage waters entering excavations during the construction phase prior to disposal into recharge trenches. Where disposal to surface water bodies is intended, all waters leaving the site at the controlled discharge points will be monitored for pH, electrical conductivity, suspended solids, dissolved oxygen, oil and grease monthly and during rainfall events. Analysis for total algae numbers will also be conducted monthly and during rainfall events once the waterbody(ies) have been brought online and are operational. Monitoring for aluminium and total and dissolved iron will occur on a monthly basis at water holding locations prior to discharge off site. Samples will be forwarded to a NATA registered laboratory for analysis when required.
Auditing	A visual inspection of the contractor's monitoring and treatment records shall be undertaken to verify sufficient monitoring and treatment is being undertaken. Management to audit water quality results monthly to verify that discharges comply with the performance criteria.
Reporting	Recording of monitoring results and treatment procedures is required. Results are to be available onsite at all times.
Identification of incident or failure	Discharge of ground waters to recharge trenches that do not satisfy the nominated pH range for this site.
Corrective action	Take necessary steps to address the problem and apply remedial measures to prevent the generation of excessive acid seepage waters (i.e.

blanket liming of excavated faces and recharge trenches).

Commitment

The contractor will minimise and manage the generation of acidic waters entering the onsite excavation areas through seepage and to monitor and treat these waters prior to disposal.

8.14 Surface water quality

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Surface water controls.		
Operational policy	To establish background water quality conditions and maintain these conditions wherever practicable during the construction phase.		
Performance criteria	All water discharged from the controlled discharge points will comply with the following criteria:		
	Water Quality Parameter	Release Criteria	Criteria Type
	pH	As developed from background monitoring	Range
	Electrical conductivity	<1.5mS/cm	Maximum
	Suspended solids	<50mg L ⁻¹	Maximum
	Turbidity	As developed from background monitoring	Maximum
	Dissolved oxygen	60-105% saturation	Minimum
	Total algae numbers	<50,000cells/mL	Maximum
	Total and dissolved Iron	<0.3mg L ⁻¹	Maximum
	Total and dissolved Aluminium	As developed from background monitoring	Maximum
	Litter and gross pollutants	No man made material >5mm in any dimension	--
	Oil and grease	No visible film, no detectable odour	--

	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the Threatened Species Management Plan (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in 'Habitat and Movements of the Wallum Froglet <i>Crinia tinnula</i> at the Southern Part of its Range'.²⁴ A similar pH range of 4.2 to 7.2 is identified in 'Threatened frogs of New South Wales: Habitats, Status and Conservation'.²⁵
Implementation strategy	Completion of internal bio-retention and filter basins, waterbodies, swales and vegetated filter strips as specified at detailed design and approved by TSC. Monitoring of the sediment detention basins for compliance with background conditions will take place prior to any discharge of stormwater (controlled or uncontrolled) from the site. Samples are to be collected monthly and during rainfall events (defined as >25mm in any 24 hour period) at the upstream and downstream sampling locations and water quality control pond discharge point and analysed for the above parameters. Where water quality fails to meet the established criteria, corrective measures will be undertaken (e.g. if sediment problems are identified, settling in the sediment detention ponds shall be aided by dosing with flocculation agents) to achieve compliance with the water quality release criteria. Treated water is to be re-tested prior to release to establish the effectiveness of treatment measures. Landscaping activities and revegetation will occur as soon as possible during/after the construction phase of development. Only appropriate herbicides and fertilisers are to be used in accordance with TSC specifications. Silt fences will be placed along the downstream extents of all construction. Clean-up of GPT's on a quarterly basis or after significant rainfall events.
Monitoring	Monitoring for pH, electrical conductivity, suspended solids, turbidity, dissolved oxygen, litter and gross pollutants and oil and grease will be conducted monthly and during rainfall events. Analysis for total algae numbers will also be conducted monthly and during rainfall events once any waterbody(ies) specified by the erosion and sediment control plan have made operational. Monitoring for aluminium and total and dissolved iron will occur on a monthly basis at water holding locations prior to discharge off site. If iron floc, sediments or iron staining are observed at the discharge points, samples should also be taken for laboratory analysis and

²⁴ White, A. W. & Pyke, G. H., 2006, 'Habitat and Movements of the Wallum Froglet *Crinia tinnula* at the Southern Part of its Range'. Unpublished paper submitted to Journal of Herpetology.

²⁵ Ehmann, H. 1997 (ed). 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

Auditing	discharge halted until water has been treated to adequate levels. Iron indicator strips will be used if practicable. Sample recovery and in-situ analysis will be performed by trained onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory. Sediment and erosion control measures will be inspected daily by the site manager during periods of rainfall.
	Environmental consultant to audit water quality results to ensure all discharges comply with the performance criteria.
Reporting	Result sheets to be compiled for monitoring results relating to water quality of water bodies. These results to be kept onsite for inspection by local and state government officers. Monthly reports to be submitted to TSC until completion of works. These reports will be submitted to TSC within 30 working days upon receipt of the laboratory results. The water quality reports will be prepared by a suitably qualified and experienced Environmental Consultant. These reports will detail: The results for each of the environmental indicators monitored: • An assessment of the monitoring results against the release criteria. • An evaluation, if applicable, of the environmental conditions if monitoring results fall outside the limits of the release criteria. • Recommendations that are relevant to ensuring a high level of water quality is maintained. Each report will include previous water quality results in tabular format for comparative purposes and trend graphs will be provided. Laboratory certificates will be provided.
	The results of the water quality monitoring indicating concentrations exceeding the release limits specified in the “performance criteria” for a single water quality parameter.
Corrective action	All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted. Specific strategies to be implemented are as follows: pH In the event that the pH of waters falls outside of the critical limits, such waters will be contained and the pH adjusted to within the target range prior to release. Monitoring of the pH level shall be carried out immediately prior to release. Low pH waters (i.e. pH<6.5) that need to be amended to be consistent with receiving environment waters of pH >6.5 may be ameliorated in-situ by the use of hydrated lime or crushed ag-lime to achieve a pH>6.5 and

<9.0 prior to release. In using hydrated lime, all care shall be undertaken to ensure pH is not above 9.0.

Low pH waters consistent with receiving environment waters of pH 4.2-6.7 and that contain dissolved iron above 0.3mg L^{-1} will require treatment to reduce dissolved iron to acceptable levels prior to discharge.

Electrical conductivity

If electrical conductivity exceeds 1.5 dS m^{-1} , the waters will be contained onsite until adequate EC levels are reached. Further monitoring of upstream waters will be conducted to assess the impact of the development on the absolute change to water quality.

Rainfall data will also be assessed at such times to determine the impact that rainfall has had on the water quality of the site and discharging waters.

Suspended solids and turbidity

If total suspended solids exceed 30mg L^{-1} the waters will be contained onsite for a period sufficient to allow suspended solids to settle out prior to release, or treated with a flocculent. After gypsum has been applied, the stored waters will be retested immediately prior to discharge.

Erosion control devices will be immediately inspected and cleaned if necessary. Additional devices will be installed if a need is detected to prevent future breaches of the suspended solids criteria. The placement of stockpiles and management of disturbed areas will be reviewed with regard to the SBMP Table 6.7 'Erosion controls' and Table 6.8 'Sediment control'.

Dissolved oxygen

In the event that dissolved oxygen levels drop below 6.5mg L^{-1} , the waters will not be released until visual inspections for algae has been carried out. If algae are present, further laboratory tests will be carried out to determine the type of algae in the waters.

A general investigation will be carried out of the flow conditions of the affected waters, to assess the flow rates and volume of water passing through the monitoring locations.

Litter and gross pollutants

In the event that litter and gross pollutants with a dimension greater than 5mm are observed, this material will be clean up and appropriately disposed of as soon as practicable. The contractor shall inform staff of the appropriate waste disposal procedures and reiterate the importance and sensitivity of the surrounding ecosystems.

Oil and grease

In the event that oil and grease are visible and/or an odour is detected within a waterbody, management strategies will be implemented.

Specifically, the waters shall be contained and the oil and grease isolated through the use of booms, containments bunds or other appropriate measures. Remediation works shall be implemented in consultation with the environmental consultant and DECCW.

Commitment

The Contractor will maintain background water quality conditions as much as practicable during the civil construction phase of the development.

8.15 Vegetation clearing and soil disturbance

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager

Issue	Vegetation clearing & soil disturbance. Minimisation of the removal or disturbance of trees, shrubs and ground covers.
Operational policy	To maintain existing vegetation where possible during construction works. Vegetation to be retained is detailed in the <i>Vegetation Management Plan</i> (JWA 2011).
Performance criteria	No vegetation is to be removed prior to TSC approval.
Implementation strategy	Trees to be conserved are to be flagged with surveyors marking tape. Trees to be cleared will be inspected immediately prior to clearing. Orphaned fauna encountered shall be managed in accordance with Table 6.29 'Fauna & flora protection – general provisions'. Erosion and sediment control measures shall be installed in accordance with Table 6.7 'Erosion controls' and Table 6.8 'Sediment control' of the SBMP. Compaction of ground in the drip line of trees to be retained shall be minimised. The area of disturbance shall be clearly delineated to keep vehicles, building materials and refuse away from areas to be conserved. The number of access points onto the site shall be minimised in accordance with Table 6.26 'Traffic management'. Vegetation buffer zones shall be maintained where possible. Where practicable vegetative debris shall be salvaged as logs or woodchip. Research into appropriate timbers and uses will be carried out prior to selection of salvaged logs. Vegetative debris set out to be salvaged for logs will be clearly marked and stockpiled onsite until required. Timber for woodchips will be chipped onsite and stockpiled within control measures until required. Where possible, shakedown devices shall be utilised to minimise sediment transport onto public roads.
Monitoring	Regular inspections shall be carried out to ensure that construction work areas are kept within stage boundaries.
Auditing	• A weekly safety audit shall be conducted of the retained vegetation. • Management to examine the boundary of the works weekly.

Reporting	No reporting is necessary unless areas are inadvertently cleared outside approved stage boundaries.
Identification of incident or failure	• Clearing of designated retained vegetation. • Clearing outside of stage boundaries.
Corrective action	Reinstate and revegetate overcleared areas where necessary, unless the area is to be used for future staging.

Commitment

The contractor will maintain existing vegetation where possible during construction works.

8.16 Air quality and dust management

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager

Issue	Air quality & dust management. Minimisation of movement of dust offsite.
Operational policy	To achieve acceptable air quality standards through the control of the movement of dust offsite from construction works.
Performance criteria	The target level for complaints by nearby residents is no more than one in any seven day period. Ambient air quality should not deteriorate by more than 30% over a period of seven consecutive days. Dust deposition at any nearby residence should not exceed $100\text{mg m}^{-2} \text{d}^{-1}$.
Implementation strategy	The minimisation of the movement of dust offsite will be achieved through the following onsite practices: • Construction works shall be staged to limit the areas exposed at any one time. • Erosion and sediment control measures shall be installed in accordance with Table 6.7 'Erosion controls' and Table 6.8 'Sediment control'. • All permanent bunds and reshaped areas will be revegetated within a fortnight after completion of earthworks (including excavation and backfilling of services trenches). • Stockpiling onsite will be minimised where possible. • Ground surfaces will be kept damp (not wet). • Surfaces shall be left in a rough cloddy condition to increase roughness and slow surface wind speed. • An on-site water cart will be available at all times. • All work to cease if wind speed exceeds 10m/sec. • Contractors staff to be trained to implement dust minimisation measures in accordance with Table 6.16 'Air quality and dust management' of the SBMP. • Protective ground covers shall be provided where appropriate, including mulches, vegetation, organic binders or dust retardants. • Traffic movements on any disturbed areas shall be minimised in accordance with Table 6.18 'Site management' and Table 6.26 'Traffic management' of the SBMP.
Monitoring	Daily inspections will be carried out to verify that dust mitigation measures are being implemented. Dust monitoring will be conducted upon receipt of complaints by residents in accordance with Table 6.21 'Incidents & complaints management' of the SBMP. If dust monitoring is to take place, the following will occur:

Auditing	- Temporary dust deposition gauges will monitor the movement of dust offsite at the nearest residences adjacent to the active construction stages and within the predominant wind directions. - Monitoring will be undertaken in accordance with AS3580.10.1 (2003).
	Management to examine the complaints register weekly and review corrective action taken in accordance with Table 6.21 'Incidents & complaints management' of the SBMP.
Reporting	Management to examine the complaints register weekly and review corrective action taken in accordance with Table 6.21 'Incidents & complaints management' of the SBMP.
	The contractor to notify the DECCW of a possible environmental nuisance on receipt of three (3) or more dust-related complaints in any 24 hour period. Reports will be provided to TSC upon request. Complaints by residents are to be recorded in a Complaints Register in accordance with Table 6.21 'Incidents & complaints management' of the SBMP and TSC notified.
Identification of incident or failure	Any dust-related complaints by residents will indicate a failure of the dust control measures.
Corrective action	Locate the source of the dust and implement the following measures: - apply water sprays to vegetation; - cover or water exposed areas; and - if dust persists, cease the dust creating activities and amend construction strategies. All dust complaints are to be addressed in consultation with the environmental consultant. Council shall be advised of the remedial measures taken to address dust complaints

Commitment

The contractor will maintain acceptable air quality standards through the control of the movement of dust offsite from construction works.

8.17 Noise and vibration management

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Noise & vibration management.
Operational policy	To minimise noise and vibration impacts to the surrounding environment and nearby noise receptors.
Performance criteria	Compliance with the local area Noise policy of DECCW and TSC. No vibration impacts on nearby dwellings or structures.
Implementation strategy	Working hours onsite shall be restricted to between those specified by regulation and/or bylaws of TSC. Noise sensitive locations and potential noise hazards shall be identified prior to the commencement of construction works of each stage. Equipment and machinery usage shall be scheduled taking into consideration these locations. Other strategies to be considered include: • Moving equipment away from noise sensitive receptors. • Optimising the placement of haul roads and fixed plant and equipment. • The provision of sound walls and acoustical screening, including the use of earth embankments. • Incorporating buffer zones and setback distances between the noise source and receiver. • Using existing vegetation and landscaping as a shield and dissipater. Construction works shall be programmed so as to minimise noise generating activities occurring early and late in the day. Staff training shall be conducted and include adequate information on typical noise exposures and methods for noise management in accordance with this policy. Plant and equipment shall be maintained and operated in accordance with manufacturer's specifications. Plant and equipment shall be fitted with exhaust and radiator silencers where appropriate. The use of horns, sirens and reverse signals shall be restricted to where required for the satisfaction of workplace health and safety. Blasting (if required) shall be coordinated to reduce the level of ground vibration by altering drilling patterns, incorporating delays, controlling spacing and orientation and establishing blast timing to suit local conditions.
Monitoring	Daily inspections will be carried out by the Site Manager of all noise and vibration generating plant. Inspection notes to be recorded in Site Diary.

Auditing	All noise and vibration related complaints shall be recorded in the Incidents/Complaints Register in accordance with Table 6.21 'Incidents & complaints management'. This register shall be reviewed by management weekly.
	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes, including any control measures implemented, shall be recorded in the Site Diary.
	An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by TSC (or other relevant authorities) upon request. Upon the receipt of three or more noise-related complaints within a 24-hour period, TSC and the DECCW shall be notified. Reports detailing any incidents and/or complaints and corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	The receipt of three or more noise-related complaints within a 24hr period. Ongoing, repetitive complaints.
Corrective action	Corrective actions will be implemented upon receipt of complaints (which have been investigated and determined to be legitimate). This shall involve identifying the source of the offending noise, and the implementation of the following measures (if applicable): • Compliance with the approved hours of operations for the construction works. • The removal of noise producing works (where possible) from areas in close proximity to residential properties. • Improving the noise rating of offending equipment. • Providing acoustic enclosures/shielding for offending equipment. • Improving acoustic buffering at the site boundary. • If excessive noise levels persist, cease the noise creating activities and review site activities and procedures. If, for the purpose of complaint resolution, noise auditing/monitoring is requested by TSC or the DECCW, the following will occur: • monitoring of noise levels (including background levels) at the site by an independent noise consultant; and • measuring the contributing noise from the development at the nearest sensitive receptor (residence).

Commitment

The contractor will minimise noise and vibration impacts to the surrounding environment and nearby noise receptors.

8.18 Site management

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager

Issue	Site management.
Operational policy	To ensure that the site works are undertaken in such a manner as to provide a safe and efficient workplace, whilst minimising any potential disturbances to the surrounding community and preventing environmental harm.
Performance criteria	Effective control of site access and fencing. Site-specific induction training to ensure all personnel are aware of his/her responsibilities under the SBMP. All persons entering/visiting the site are appropriately informed of site requirements.
Implementation strategy	All construction activities, materials, equipment and personnel shall be restricted to within the boundaries of the site. Fencing around the perimeter of the work area shall be maintained for the duration of the construction activities. Hours of operation will be consistent with the requirements of the NSW DECCW guidelines and TSC bylaws. Gates at the site access points shall be maintained and secured after hours. All persons working on the project, including sub-contractors, shall undertake site induction training on the provisions of the SBMP prior to commencing activities onsite in accordance with the provisions of Table 6.23 'Personnel training'.
Monitoring	Weekly inspections shall be carried out by the Site Manager to verify: • construction activities are being conducted within the approved hours of operation and within the staged boundaries; and • the integrity of the perimeter fencing, gates and locks. The Site Manager shall ensure that contractors/sub-contractors are conforming to site requirements.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes shall be recorded in the Site Diary. A record of all staff working onsite shall be maintained and available for inspection upon request.

Identification of incident or failure	A training attendance register shall be established, recording the name of the trainee and trainer, date trained and the elements of training delivered. A logbook shall be kept onsite to record all visitors to the construction area. An Incidents/Complaints Register shall be maintained (Table 6.21 'Incidents & complaints management) onsite and will be available for inspection by TSC (or other relevant authorities) upon request. Trespassing incidents are to be investigated immediately.
	Unauthorised access to the construction site.
	Site management procedures are to be reviewed. Environmental induction training to be conducted regularly for new staff and repeated for staff responsible for any non-conformances.

Commitment

The contractor will ensure that the site works are undertaken in such a manner as to provide a safe and efficient workplace, whilst minimising any potential disturbances to the surrounding community and preventing environmental harm.

8.19 Contractor management

Applies to:	Civil construction Phase
Person responsible:	Proponent

Issue	Contractor management.
Operational policy	To ensure the Proponent's duty of care is met by ensuring the contractor is aware of his/her responsibilities under the terms of the SBMP.
Performance criteria	Each contractor is fully aware of its responsibilities under the terms of the SBMP and its obligation to respond to environmental issues arising from construction activities.
Implementation strategy	The SBMP (and approved variations) will be included in the contract documentation and become a contractual obligation for all contractors performing any civil or earthworks. The contractor will integrate the SBMP (and approved variations) with the construction approach and staging. The development will comply with the SBMP at all times throughout the construction and operational phases. When assessing site conditions, the contractor shall and implement the relevant SBMP provisions in conjunction with the approved plans, drawings and documents. Monitoring and verifying that the SBMP is adhered to at all times and taking action if the specifications are not followed. Ensuring the contractor is aware of the SBMP arrangements and clarifying the expectations (with regards to specific environmental requirements) as they relate to each contractor. The proper and adequate coordination of contractors to ensure the integration of interrelated issues identified in the SBMP. The provision of advice, information and training to contractors and staff with regards to the implementation of the SBMP provisions in accordance with Table 6.23 'Personnel training' of the SBMP. Review of the SBMP and the construction phase contracts at the end of each stage of works. Feedback shall be sought to the satisfaction of works being completed. If required, the Proponent shall manage the transition to new contractors. Remedies for breach of contract shall be enforced.
Monitoring	Weekly site inspections to be carried out by the Proponent's representative to ensure the provisions of the SBMP are being adequately implemented. Monitoring the contractor's continuing performance against contract obligations. Continuous monitoring of contractor work to ensure high productivity and reasonable progress towards performance outcomes of the SBMP.

Auditing	Liaison with internal managers, users and suppliers to identify and resolve any issues that arise.
	The contractor shall provide Tweed Shire Council, its employees and agents access to the site, on the giving of 24 hours written notice to the owner, to all water quality control and treatment systems, for the purpose of inspection, testing, sampling and recording.
Reporting	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Identification of incident or failure	Full details shall be available to the contractor together with suggested corrective actions (if required).
Corrective action	Not applicable.
	The Proponent has the right to call a halt to any activity being undertaken which is deemed in conflict with the provisions of the SBMP.
	The SBMP shall be regularly reviewed and updated to reflect changes to the construction project.

Commitment

The Proponent will ensure all contractors are managed to ensure compliance with the SBMP.

8.20 Hazardous and dangerous goods handling & storage

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Materials handling and storage management, and hazardous substance management.
Operational policy	To ensure that fuel, grease and other hazardous substances present onsite are managed in a safe and environmentally responsible manner.
Performance criteria	No fuel, grease and/or oil contamination of the environment shall result due to construction activities in accordance with Table 6.24 'Pollution control' and Table 6.25 'Refuelling of construction equipment & vehicles'. Appropriate facilities will be available for the storage of hazardous materials. No fuel, grease or oil shall escape containment bunds and contaminate the site soils, surface water or leave the site.
Implementation strategy	All materials shall be stored within the boundaries of the active construction area. Storage facilities shall be constructed prior to hazardous material being brought to the site. Stockpile and storage areas shall be identified and any contained products shall be clearly marked. Minimum practical quantities of fuels, grease and other hazardous substances shall be located onsite. These materials shall be stored in sheltered, impervious and bunded areas (or as required by the applicable regulations). Containment bund capacity shall be 110% of the volume of the tank stored within it. Where multiple tanks are stored within the one bund, the capacity will be 110% of the largest tank. Material Safety Data Sheets (MSDS) will be available onsite for all hazardous materials used or stored onsite for the duration of the construction works. An emergency response plan shall be developed for the site to control risk to the environment from hazardous materials. This shall include spill prevention and pollution control programs and an operating procedure for containing and cleaning up spills in accordance with Table 6.18 'Site management'. Suitable quantities of absorbent materials shall be stored onsite to accommodate minor spills. Relevant staff shall be trained in chemical and fuel handling, spill containment and clean up procedures in accordance with Table 6.23 'Personnel training'.

Monitoring	Personnel protection equipment shall be made available onsite as required for the use of hazardous substances.
	All suppliers shall be informed of procedures and restrictions required, and deliveries supervised during off-loading by appropriately trained personnel.
	Materials shall be adequately secured and loads covered where there is risk of spillage or loss of load.
	Imported materials shall be free of weeds, litter and contaminants.
	All regulated waste shall be removed and disposed of by an appropriately licensed waste contractor at an appropriately licensed waste disposal facility.
Auditing	Weekly inspections will be carried out by the site manager to verify the integrity of material storage facilities and bunding. Visual inspections for spills and land contamination shall also be conducted.
Reporting	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Identification of incident or failure	Site inspection notes shall be recorded in the Site Diary.
	An incidents/complaints register shall be maintained onsite (Table 6.21 'Incidents & complaints management') and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request.
	In the event of potential or actual environmental harm or nuisance, the site manager shall notify the DECCW and corrective actions implemented as directed.
Corrective action	Reports detailing any incidents and/or complaints and associated corrective actions shall be provided to statutory authorities upon request.
	Land or water contamination.
Corrective action	The immediate containment of spillages with booms, containment bunds or other appropriate measures.
	Remediation of site contamination in consultation with environmental consultant and DECCW.

Commitment

The Proponent will ensure the handling and storage of construction materials onsite is managed in a safe and environmentally responsible manner.

8.21 Incidents & complaints management

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager

Issue	Incidents & complaints management.
Operational policy	An Incidents/Complaints Register shall be maintained for the duration of the construction works.
Performance criteria	All incidents and complaints from the local community and onsite staff shall be recorded and corrective actions implemented as required.
Implementation strategy	An Incidents/Complaints Register shall be maintained onsite for the duration of the construction works. For each incident/complaint notified, the following information shall be recorded: • Date and time of incident/complaint. • Nature of incident/complaint and associated information. • Location of incident or source of complaint. • Name of person or body reporting the incident/complaint. • Employee who received notice of the incident/complaint. • Contractors review and comment. • Recommend corrective action to resolve incident/complaint. • List of organisations to be contacted with regard to incident/complaint. • Outcome of corrective actions undertaken subsequent to incident/complaint being recorded. • Date of resolution of incident/complaint. A complaints handling procedure for reporting complaints from the affected community and employees shall be developed for the site. This procedure shall be written in plain, non-technical language, identify simple steps to be followed, be widely available to all staff and include investigation and review processes. All staff shall be aware of the complaints handling procedure and understand his/her responsibilities within the handling system. Training on the procedure, the benefits of good complaints handling and interpersonal skills (listening, questioning and conflict management) shall be provided for appropriate staff in accordance with Table 6.23 'Personnel training'. The complaints management procedure shall be easily accessible and publicised both internal and external to the site through the use of posters and signage. The contact information of the site manager or designated complaints manager shall be advertised.

Monitoring	Where practical, staff shall assist members of the public making a complaint by providing advice on the complaint system, formulating the complaint and reporting the complaint.
	Management to monitor the progress of complaints by examining the complaints register on a weekly basis and reviewing corrective actions taken.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	An Incidents/Complaints Register shall be maintained onsite and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request.
	The local authorities and the DECCW are to be notified and directions sought regarding corrective actions for incidents that have the potential to cause environmental harm.
Identification of incident or failure	Ongoing, repetitive complaints from the general public or staff. Serious or material environmental harm.
Corrective action	All complaints shall be treated as legitimate and investigated without prejudice. A response to each complaint shall be provided promptly, courteously and in accordance with their urgency. Corrective actions shall be implemented in the event of continued and sustained complaints and the failure to respond adequately to complaints from the public or authorities. Construction activities and procedures shall be adjusted accordingly. Corrective actions shall be in accordance with the provisions of the SBMP Table 6.16 'Air quality and dust management' and Table 6.17 'Noise and vibration management' or alternative management plan. In the event that serious or material environmental harm is caused or threatened by an activity, corrective actions shall be implemented in consultation with DECCW. Undertake a review and evaluation of the complaints handling procedure and identify possible systematic weaknesses and opportunities for improvement.

Commitment

The contractor will ensure all incidents and complaints resulting from construction activities are promptly addressed and corrective actions implemented.

8.22 Light management

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager

Issue	Light management.
Operational policy	To prevent artificial light affecting premises, roadways and wildlife.
Performance criteria	Compliance with Australian Standard AS4282 – 1997 'Control of Obtrusive Effects of Outdoor Lighting'. Compliance with relevant nuisance legislation. Compliance with TSC conditions with respect to hours of operation.
Implementation strategy	All temporary lighting infrastructure shall be designed to prevent or minimise adverse effects on adjoining premises, roadways and wildlife. Professional advice on the design, operation and maintenance of all external lighting proposed for the site shall be sought prior to installation. The erection of lighting shielding walls, the provision of appropriate earth or vegetation barriers or other similar strategies shall be utilised to minimise light nuisance to neighbouring sensitive receptors.
Monitoring	All outdoor lighting erected in association with the construction works shall be assessed to ensure compliance with the performance criteria. All light related complaints shall be recorded in the Incidents/ Complaints Register in accordance with Table 6.21 'Incidents & complaints management'. This register shall be reviewed by management weekly.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes, including any control measures implemented, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. Reports detailing any incidents and/or complaints and corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	The receipt of three or more light-related complaints within a 24hr period. Ongoing, repetitive complaints.
Corrective action	Where light complaints occur, which have been investigated and determined to be legitimate, appropriate corrective action shall be taken.

Commitment

The contractor will ensure artificial light emitted from the construction operations will be minimised.

8.23 Personnel training

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager

Issue	Personnel training.
Operational policy	To ensure that all personnel understand the environmental issues involved with construction operations.
Performance criteria	All personnel appropriately and adequately trained. All incidents are managed efficiently and corrective actions promptly implemented in accordance with the provisions of Table 6.18 'Site management'.
Implementation strategy	• All personnel involved in the construction of the project shall undergo induction training on the provisions of the SBMP prior to commencing activities onsite. • Training handouts will be made available to all personnel. • Additional training shall be provided for employees involved in specialised construction activities (if applicable) so that the appropriate skills and competencies to participate in these activities are attained.
Monitoring	• Management to examine the training attendance records and ensure appropriate training procedures are in place. • Regular liaison with the contractors to keep onsite staff informed of any issues that arise with regards to the requirements of the SBMP.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	An attendance register shall be established and all attendees recorded following the completion of the training.
Identification of incident or failure	Not applicable.
Corrective action	Additional training or refresher courses shall be provided for new staff members or for those requiring additional training and performance review.

Commitment

The contractor will ensure personnel have adequate training to be aware of the provisions of the SBMP as they relate to site operations.

8.24 Pollution control

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager; Environmental Consultant

Issue	Pollution control.
Operational policy	To minimise the incidents of pollution through controlling risks and hazards onsite.
Performance criteria	No pollution incidents during the construction phase.
Implementation strategy	Petroleum and other chemical products shall be prevented from containing surface water and soil. Any onsite fuel storage areas shall comply with Australian Standards. Adequate trade waste and litter bins shall be provided onsite and serviced regularly in accordance with the provisions in Table 6.27 'Waste management'. Concrete wastes and washouts shall not be deposited in any location where the wastes or washings can flow, or can be washed into, any areas of retained vegetation or receiving waters.
Monitoring	Weekly inspections shall be carried out on containment structures and washout areas.
Auditing	Not applicable.
Reporting	Weekly checklists shall be completed detailing any containment structure failures.
Identification of incident or failure	Pollution incidents causing environmental harm.
Corrective action	Chemical or fuel spillages shall be reported to the DECCW and the Superintendent. Immediately contain spillages with booms, containment bunds or other appropriate measures immediately. The cause of any leak shall be established and appropriate action shall be undertaken to prevent a reoccurrence. Remediate any resultant site contamination in consultation with environmental consultant. Ensure management of fuels, oils and hazardous materials is occurring in accordance with the provisions detailed in Table 6.20 'Hazardous and dangerous goods handling & storage'.

Commitment

The contractor will ensure construction works are managed in such a manner that minimises pollution risk.

8.25 Refuelling of construction equipment & vehicles

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Refuelling of construction equipment & vehicles.
Operational policy	To ensure that fuel, grease and other hazardous substances present onsite are managed in a safe and environmentally responsible manner.
Performance criteria	No fuel, grease and/or oil contamination of the environment shall result due to construction activities.
Implementation strategy	Where reasonably practical, plant shall be refuelled offsite. Maintenance of machinery onsite is to be minimised and completed offsite wherever possible. The storage, preparation, use and disposal of fuels and oils shall take place under the supervision of the earthmoving contractor who will be responsible for any decontamination. Only appropriately trained personnel (as detailed in Table 6.23 'Personnel Training') shall conduct refuelling. An operating procedure for containing and cleaning up oil spills will be in place and all staff will be trained in these procedures. Suitable quantities of products designed to contain and absorb oil spills will be available onsite. Contaminated materials used in the clean up of a fuel/oil spill will be disposed of by a commercial waste contractor offsite at an appropriately licensed waste disposal facility in accordance with Table 6.24 'Pollution control'.
Monitoring	Weekly inspections will be carried out by the Site Manager of: - the integrity of any temporary sumps or fuels storage areas; and - the quantity and condition of products designed to contain and absorb oil spills.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes shall be recorded in the Site Diary. Incidents/Complaints Register to be maintained on-site (refer to Table 6.21 'Incidents & Complaints management') and be available for inspection by TSC (or other relevant authorities) upon request. In the event of potential or actual environmental harm arising from a spill, the site manager shall notify the DECCW and corrective actions implemented as directed.

Identification of incident or failure	Reports detailing any incidents and/or complaints and corrective actions shall be provided to statutory authorities upon request.
	Land or water contamination.
Corrective action	The immediate containment of spillages with booms, containment bunds or other appropriate measures. Remediation of site contamination in consultation with environmental consultant and DECCW. Corrective actions (to be implemented in the event of land contamination) include: • Identifying the source of contamination and reporting the incident to the appropriate authorities immediately. • Arranging for the source of the contamination to be rectified and for the contaminated area to be remediated. Action for fuel/oil spillage: • All ignition sources to be removed from vicinity of spill. • All equipment in vicinity of storage to be turned off. • Identification of source of spillage and take action to ensure similar incidents are avoided in future.

Commitment

The contractor will ensure all employees are trained in the clean-up procedures of spillages of oils and chemicals to prevent potential land contamination.

8.26 Traffic management

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager; Civil Engineering Consultant

Issue	Traffic management.
Operational policy	To provide a safe and efficient working environment and to minimise potential disturbance to the community as a result of vehicular movement onsite.
Performance criteria	Effective control of construction traffic to ensure that where possible traffic is kept off public roads and away from existing developed properties.
Implementation strategy	Haul roads shall be constructed across the subject site. The use of Haul roads in lieu of public roads, where possible, shall become a contractual obligation for the contractors. All access points to the construction site shall be clearly defined and appropriate signage erected. All access roads shall be adequately maintained, including the erection of signage and dust suppression to ensure safe travel is maintained at all times. Speed limits shall be enforced for all access roads. Limits shall be reduced during times of high winds to prevent the production of excessive dust. Sufficient parking areas and loading zones shall be provided for staff and suppliers. Workers, materials or trucks will not obstruct existing footpaths and roads. Fencing shall be constructed at the site access points to restrict pedestrian access from local streets for the duration of the construction works.
Monitoring	Continual vigilance shall be maintained by the Site Manager to ensure all contractual obligations are met. Weekly inspections shall be carried out by the site manager to verify: • the condition of site access points and any haul roads; • the provision of sufficient parking and loading zones; and • the erection of adequate signage. Inspection notes are to be recorded in the Site Diary.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP. Management to examine the complaints register weekly and review corrective actions taken.

Reporting	A copy of all Site Diary notes and any other correspondence relating to traffic shall be forwarded to the Contract Superintendent on a monthly basis.
	An incidents/complaints register shall be maintained onsite and will be available for inspection by TSC (or other relevant authorities) upon request.
	A record of any breach of contractual obligations and of any complaints from adjoining residents shall be kept in the Site Diary.
Identification of incident or failure	Any complaints from adjoining residents shall immediately be conveyed to the Contract Superintendent.
	Vehicles operating in breach of contractual conditions.
Corrective action	Review procedures to ensure compliance with the SBMP.
	Amend site access and parking regimes to reflect onsite constraints during the construction process.
	Issue written instructions to persons in breach of contractual obligations.

Commitment

The contractor will manage traffic generated by the development in compliance with the provisions of the SBMP.

8.27 Waste management

Applies to:	Civil construction phase
Person responsible:	Contractor's Site Manager; All personnel

Issue	Waste management.
Operational policy	To minimise the amount of solid and liquid waste produced as a result of construction activities. To ensure all waste generated is appropriately stored, removed and disposed of. To minimise potential environmental and social impacts from waste and waste handling. To maintain the construction site in a neat and tidy state. To ensure that all waste generated by the construction activities is disposed of in accordance with the applicable legislation.
Performance criteria	Compliance with relevant legislation. No evidence of construction waste or litter accumulating onsite, outside of designated container areas.
Implementation strategy	Waste management methods which employ reduction, reuse or recycling practices shall be used where practicable. The site shall be managed in accordance with Table 6.18 'Site management' and be kept in a clean and tidy state, free from loose waste or litter. Waste material, including vegetation, litter, human waste, used oils and other construction wastes, shall not be disposed of by burning or burying onsite or in adjacent areas. All wastes shall be stored onsite in confined areas and managed to prevent environmental harm or nuisance from occurring. An appropriate number of covered waste receptacles shall be located onsite, with the provision of areas or additional receptacles for the storage of reusable and recyclable materials. Waste containers shall be emptied on a regular basis (or as required) by a licensed contractor. Areas for the storage of oils and other hazardous liquids used during construction shall be bunded and located away from waterways and drainage lines in accordance with Table 6.14 'Surface water quality management'. Any spillage will be collected and disposed of offsite at an approved facility. All wastes transported from the site shall be covered or otherwise handled to prevent spillage or nuisance to the community and environment. Any waste material that is unable to be reused, reprocessed or recycled

Monitoring	shall be disposed of at a landfill licensed by the DECCW to receive that type of waste.
	The site manager shall conduct weekly inspections of all work areas (specifically the waste containment areas and the property boundary) to ensure there is no accumulation of waste material. Inspection notes shall be recorded in the Site Diary and all waste management issues promptly addressed in accordance with the control measures detailed in the SBMP. All waste-related complaints shall be recorded in the Incidents/ Complaints Register in accordance with Table 6.21 'Incidents & complaints management'. This register shall be reviewed by management weekly.
Auditing	Monthly environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Records of waste removal invoices shall be maintained and kept onsite. Site inspection notes, including the amount and type of waste observed onsite and any corrective actions implemented, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by Tweed Shire Council (or other relevant authorities) upon request. When there is potential or actual environmental harm as a result of waste management, the site manager shall notify the DECCW and corrective actions implemented as directed. Waste management reports shall be prepared and provided to statutory authorities upon request.
Identification of incident or failure	Ongoing and repetitive waste-related complaints. Contamination resulting from poor waste management practices.
Corrective action	The Site Manager shall direct clean-up operations as required on the basis of site inspections. Corrective actions will be implemented upon receipt of complaints (which have been investigated and determined to be legitimate). This shall involve identifying the source of waste and the implementation of the following measures (if applicable): • the establishment of additional waste management areas including the provision of additional waste containers; and • increasing the awareness among staff of the acceptable methods for storage and disposal of waste onsite.

Commitment

The contractor will ensure waste is managed to ensure proper controls, removal and disposal systems are in place at all times.

8.28 Geotechnical investigation & analysis

Applies to:	Civil construction Phase
Person responsible:	Contractor's Site Manager; Geotechnical Consultant

Issue	Geotechnical investigation & analysis.
Operational policy	To manage the iterative process of investigation, design and construction monitoring to enable geotechnical design constraints to be formulated at the end of construction that are consistent with the proposed future use of the site.
Performance criteria	Compliance with the recommendations of the Geotechnical Investigation for Proposed Residential Subdivision (Cardno Bowler October 2010) and any other future Geotechnical Engineering Management Plan (GEMP) prepared by qualified engineers and approved by TSC. Construction control testing and monitoring to assess progress of foundation treatment and determine when surcharge may be removed. Review of data and specification of geotechnical design constraints for infrastructure and buildings on development platforms.
Implementation strategy	Development and use of a Geotechnical Engineering Management Plan.
Monitoring	Placement and compaction of engineered fill shall be carried out under a Level 1 Overview as defined by AS3798-1996 "Guidelines on Earthworks for Commercial and Residential Development". A construction control testing program shall be carried out in accordance with AS3798-1996. During the period of placement and compaction of engineered fill and surcharge, monitoring shall be carried out of settlement monitoring stations to measure the magnitudes of settlement caused by consolidation. Monitoring shall be carried out of piezometers to measure excess pore water pressure.
Auditing	The geotechnical consultant shall review the results of construction control materials testing, excess pore water pressure measurements and settlement monitoring to determine whether the data arising during the construction phase indicate suitable materials and procedures are adopted. During placement and compaction of engineered fill and the period of surcharge, excess pore water pressures around the perimeter of each fill area shall be reviewed and compared with target values required to achieve acceptable factors of safety against instability. Where the target values are exceeded, further placement of engineered fill and surcharge shall be delayed until advised by the geotechnical consultant. Surcharge shall not be removed until directed by the geotechnical consultant having regard to the monitoring data and any revised design assumptions.

Reporting	The results of all reviews shall be provided to TSC in a written format within 20 business days of completion of the reviews. If the Council makes a written request for information in relation to the submitted results, the geotechnical consultant shall provide the requested information in a written format within 10 business days of receipt of the written request. The likely future settlement that may occur on the development platforms is to be assessed and the geotechnical design constraints for infrastructure and buildings on the development platforms are to be specified. On completion of bulk earthworks, the geotechnical consultant shall prepare a comprehensive report on all additional site investigations/testing, construction monitoring of settlement and geotechnical construction overview of earthworks.
Identification of incident or failure	A significant difference between monitored data and design assumptions. Excess pore water pressures beneath the perimeter of a fill area exceeding target values.
Corrective action	Any significant difference between monitored data and design assumptions will require a review to be carried out of the design and construction program. Where excess pore water pressures beneath the perimeter of a fill area exceed target values, further placement of engineered fill and surcharge shall be delayed until advised by the geotechnical consultant.

Commitment

The contractor will ensure the appropriate geotechnical investigations are conducted to ensure construction works being undertaken are consistent with the design assumptions and the proposed future use of the site.

8.29 Golf course water conservation

Applies to:	Civil construction phase of golf course, precincts 12 and 13
Person responsible:	Proponent, golf course manager

Issue	All water flows must be controlled and managed to allow the effective use of the onsite water within a total water cycle. Essential to the ecological stability of the golf course and surrounding wetland and ecological protection zone is the maintenance of water quantities to both golf course and ecosystems.
Operational policy	To manage the rainfall on site to effectively distribute water supply to both the golf course and the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground water levels to be maintained within and adjacent to golf course with critical levels to be in accord with the seasonal variation in ground water height. Monitoring periods to be divided into Summer recharge period and Winter depletion period.
Implementation strategy	Harvesting • All water directed to bio-retention basins. • Held to recharge groundwater. • Golf course graded towards the basins. Volume • Maintain constant volumes by maintaining course infiltration rate and fairways runoff directed to swales for detention and infiltration to ground water. Storage • Subsurface storage. • Central dam of surface run-off collection and ground water window. • Habitat storages within landscape plan. Treatment • Bio-detention and filter basins to remove nutrients. • Sediments removed by filtering through rough and percolation through Bio-detention and filter basin floor. Distribution • 30% annual average recharge to ecosystem. • 70 % to landscape in golf course. Maintenance of treatment basins • Basins maintained to ensure nutrient stripping and water infiltration.

Monitoring	Fortnightly monitoring of groundwater height.
Auditing	Environmental consultant will audit the groundwater monitoring procedures and outcomes of the monitoring on a monthly basis.
Reporting	Results of monitoring will be reported quarterly to the Tweed shire council and NSW Department of Planning.
Identification of incident or failure	Ground water heights outside of critical limits to water level.
Corrective action	Groundwater lower than the critical level – Irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 40% to ecosystem 60% to golf course. Continue to monitor. Ground water still outside limits – Irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 60% to ecosystem 40% to golf course. Continue to monitor. Ground water still outside limits – Irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 80% to ecosystem 20% to golf course. Seek alternate sources of water for golf course irrigation and undertake environmental management and plan for the import of water supply to site. Continue to monitor. Ground water still outside limits – implement alternate water supply. Groundwater higher than critical level – determine source of excess water. High rainfall events – do nothing incident is self correcting. Golf course groundwater mounding – alter irrigation regime to decrease irrigation input to site.

Commitment

The land user will ensure the water table heights in the vicinity of the golf course will be maintained within the critical limits identified in the site based management plan.

8.30 Water management (golf course irrigation)

Applies to:	Civil construction of golf course, precincts 12 and 13
Person responsible:	Proponent, golf course manager

Issue	All water flows must be controlled and managed to allow the effective use of the onsite water within a total water cycle. Essential to the ecological stability of the golf course and surrounding wetland and ecological protection zone is the maintenance of water quantities to both golf course and ecosystems.
Operational policy	To manage the irrigation applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground water levels to be maintained within and adjacent to golf course with critical levels to be in accord with the seasonal variation in ground water height. Monitoring periods to be divided into Summer recharge period and Winter depletion period.
Implementation strategy	Source of water - Extraction at central point of development which is distant from ground water dependant ecosystems. Distribution - Pipe mains and lateral distribution. - Spray irrigation for distribution efficiency. - Irrigation on tees greens and fairways only (allowing for minor over-spray on adjacent roughs). - Pump stations and associated infrastructure, including sprinkler heads, to be sized and installed in accordance with recommendations in ePar (2009, pp10). Irrigation scheduling - Install weather station and computerised control system to ensure efficient irrigation in accordance with recommendations in ePar (2009, pp9). - Irrigation to occur at dawn or dusk (generally characterised by lower relative humidity, air temperature and wind speed). - Soil water deficit based trigger for irrigation. - Effective soil depth for schedule 0-200mm. - Refill point to be set at 70% plant available soil moisture depletion. - Irrigation applied to 98% of field capacity. Water allocation model - Sustainable yield applied to irrigation set at 70 % recharge potential.

Monitoring	• Recycling. • Fairways constructed with gradient towards bio-detention basins. • Capture of irrigation runoff in detention basins for treatment and groundwater recharge. • Tees and greens captured separately and recycled to fairways. Soil management • Soil amendment to improve moisture holding (zeolite etc). • Maintenance of soil organic matter for soil structure maintenance. • Minimise compaction by machinery selection and operating procedures. • Control traffic. Plant selection and management • Native species and naturalised species endemic to local area. • Species selection dependant on landscape location eg Drought tolerant plants in elevated areas, waterlog tolerant plants in depressions.
	Fortnightly Height monitoring: • Surface water – dams, basins, adjacent ecosystem water bodies. • Ground water transect from detention basins to protection area (e.g. of groundwater monitoring bore transect through golf course and extending into adjacent SEPP 14 wetland). Parameters: • Height (AHD); pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure). Daily • Soil water – Soil water monitoring for refill point - methods to be selected as appropriate to soil and turf management conditions, for instance: tensiometers (150 mm depth), or Penman's estimation etc.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a quarterly basis.
	Reporting Results of monitoring will be reported quarterly to the Tweed shire council and other appropriate authorities.
	Identification of incident or failure Ground water heights outside of critical limits to water level.
Corrective action	Groundwater lower than the critical level – Irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 40% to ecosystem 60% to golf course. Continue to monitor. Ground water still outside limits – Irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 60%

	to ecosystem 40% to golf course.
	Continue to monitor.
	Ground water still outside limits – Irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 80% to ecosystem 20% to golf course. Seek alternate sources of water for golf course irrigation and undertake environmental management and plan for the import of water supply to site.
	Continue to monitor.
	Ground water still outside limits – Implement alternate water supply.
	Groundwater higher than critical level – Determine source of excess water.
	High rainfall events – do nothing if incident is self-correcting.
	Golf course groundwater mounding – alter irrigation regime to decrease irrigation input to site.

Commitment

The land user will ensure the water table heights in the vicinity of the golf course will be maintained within the critical limits identified in the site based management plan.

8.31 Golf course nutrient management

Applies to:	Civil construction of golf course, precincts 12 and 13
Person responsible:	Golf course manager

Issue	The nutrients applied to maintain the vigour of the golf course must not gain access to the surrounding environment. All nutrients must be controlled and managed to allow the effective use of the onsite water and to ensure to the ecological stability of the golf course and surrounding wetland and ecological protection zone.
Operational policy	To manage the nutrients applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground and surface water nutrient levels to be maintained within and adjacent to golf course within critical levels in accord with the seasonal variation in ground water. Monitoring periods to be divided into Summer recharge period and Winter depletion period. <i>Critical criteria set at:</i> • Critical limits set as per background monitoring. <i>Parameters:</i> • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L⁻¹); • total nitrogen and nitrate, nitrite and ammonium (mg L⁻¹); • total and soluble phosphorus (mg L⁻¹); • total and soluble iron and filtered aluminium; and • oil and grease (visual inspection); • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and • colour.

Implementation strategy

Tees

- Impervious membrane under green set at 0.6m below NSL, leachate collected in containment well and reused on fairways.
- Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity).
- Fertiliser selection – slow release and specialty fertilisers for tee maintenance.
- Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. Fertiliser rates to be determined in consultation with the recommendations in ePar (2009, pp8) or the site's Fertiliser Management Plan.
- Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off).
- Clippings removed and composted for reuse on landscaping.

Greens

- Impervious membrane under green set at 0.6m below NSL, leachate collected in containment well and reused on fairways.
- Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity).
- Fertiliser selection – slow release and specialty fertilisers for green maintenance.
- Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management.
- Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off).
- Clippings removed and composted for reuse on landscaping.

Fairways

- Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity).
- Fertiliser selection – slow release and specialty fertilisers for tee maintenance.
- Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. In addition,

Monitoring	a mass balance method will be used to identify fertiliser rates – inputs of water nutrients, fertiliser and effluent from tees and greens, output soil store, biomass and percolation. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (e.g., turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off). • Irrigation maximum refill set to 98% field capacity to ensure first rainfall infiltrates and not runs off.
	Rough • No fertiliser used. • Rough to act as irrigation, sediment and nutrient buffer. • Biomass mulched back into rough.
	Swales and detention basins • No fertiliser used. • Maintenance removal of biomass to composting and reuse in landscaping.
	Groundwater <i>Monthly</i> • Ground water quality samples (from all height monitoring bores). • Multiple group lysimeters set at 1 m depth in four (4) locations in golf course fairways– leachate samples. • Parameters: pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure); N – Total, NH₄, NO₃ P – Total, Ortho; Calcium; Magnesium; Sodium; Potassium; Total and dissolved iron; Dissolved manganese; Filtered aluminium; Bicarbonate; Carbonate; Chloride; Sulfate; and Colour. Surface water <i>Monthly</i> • Central irrigation supply. • Surface habitat water bodies. • Parameters: pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure); N – Total, NH₄, NO₃ P – Total, Ortho; Calcium; Magnesium; Sodium; Potassium; Total and dissolved iron; Dissolved manganese; Filtered aluminium; Bicarbonate; Carbonate; Chloride; Sulfate; and Colour. <i>Monthly</i> • Central irrigation supply. Parameters: • Irrigation water quality, N & P.

	Soils 6 monthly • Soil fertility sampling as per standard practice for turf (agricultural) management.
	Biomass <i>Quarterly</i> • Fairway reference sites set at four locations within golf course. • The reference sites will have the biomass collected (weighed) and analysed for N & P. (Data to be used in estimating mass balance for monitoring purposes). <i>Biannually</i> • SEPP 14 wetland and environmental protection zone to be monitored with two (2) reference transects to outline floristic structure and function.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
	Reporting Results of monitoring will be reported annually to the Tweed Shire Council and NSW Department of Planning.
	Identification of incident or failure • Groundwater analyses in excess of critical limits for two consecutive sample events. • Critical limit set considering background monitoring.
	Corrective action Fertiliser regime re-assessed and fertiliser management plan altered by change of fertiliser form, rate or application technology. Continue to monitor.

Commitment

The land user will ensure the water table and surface water areas associated with the golf course does not input excess nutrients into the surrounding SEPP14 wetlands and ecological protection zones.

8.32 Golf course herbicide management

Applies to:	Civil construction of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Herbicides may be used within the golf course to manage turf weeds. The use of herbicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the herbicides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	No foliar damage to surrounding environment from herbicide applications.
Implementation strategy	The use of herbicides is an action of last resort. Primary control of weeds will be achieved by: - Physical removal of weed species prior to turf area development and for selected weeds post development. - Soil management methods such as ameliorating compaction, improving drainage, shade management and nutrient management techniques such as avoiding N applications during weed active stages. - Turf management methods such as (but not restricted to) mowing height and frequency, restricting traffic and insect control. - Spraying as a last resort as either spot spraying or contained spraying consistent with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Specialist outcomes for each golf course zones as below: Tees - Isolated from ground waters by membrane at depth. - Adopt best management principles for herbicide application. Greens - Isolated from ground waters by membrane at depth. - Adopt best management principles for herbicide application. Fairways - No herbicide use on extensive basis. - Spot and strip spraying as last resort. Rough - No herbicide use on extensive basis. - Spot spraying as last resort.

Monitoring	Swales • No herbicide use on extensive basis. • Spot spraying as last resort.
	Visual inspection of adjacent areas for evidence of over-spray – e.g. Herbicide damage to leaves. Monitoring to be timed one to two weeks after spraying events.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
Reporting	A chemical use register to be maintained for each fairway, tee, and green. Spot spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
	Foliage damage observed.
Corrective action	Damage foliage removed and mulched on site, plants to be monitored and dead plants replaced with suitable seedlings, or seed stocks.

Commitment

The land user will ensure the minimisation of herbicide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

8.33 Golf course pesticide management (control of arthropods)

Applies to:	Civil construction phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Pesticides to control arthropods may be used within the golf course to manage turf pests. The use of these herbicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the pesticides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	No pesticide escape into the surrounding environment beyond AS/NZS standards of pesticide contamination of fresh waters.
Implementation strategy	Implement an integrated pest management program by monitoring, pest injury assessment, threshold of aesthetic and environmental damage determination, control method selection, timing and extent assessment, evaluate pest destruction outcome. The use of pesticides is an action of last resort. Primary control of weeds will be achieved by: • Site quarantine and hygiene by ensuring imported materials are free of pests. • Modifying pest habitat either soil or environmental conditions. • Selection of host resistant turf plants when available. • Biological control measures – natural parasites and predators. • Last resort chemical control - Spraying as a last resort with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Chemical control preferences should be: • Attractants (food and/or sex pheromone) and traps. • Inorganic materials (e.g. elemental sulfur and similar approaches). • Bioinsecticides (e.g. <i>Baccillus thuringiensis</i>). • Botanical extracts. • Synthetic organics (chemicals). Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application.

	Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Fairways • No pesticide use on extensive basis. • Spot and strip spraying as last resort. Rough • No pesticide use on extensive basis. Swales • No pesticide use on extensive basis. Pesticide storage, containment, security, preparation and wash down areas to be located away from ecological and golf course area in designated infrastructure and facilities area of the development. A shrouded Controlled Droplet Applicator (CDA) should be used to reduce spray drift, chemical and water use. Pesticide application rate may be reduced by 1/3 where shrouded CDA's are used (ePar 2009, pp12).
	Monitoring Annual monitoring of surface waters adjacent (within 100m) to areas subjected to pesticide use. Parameters selected for monitoring to be consistent with the chemicals used on site.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
	Reporting A chemical use register to be maintained for each fairway, tee, and green. Spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
	Identification of incident or failure Pesticide contamination of water body beyond AS/NZS Standard for fresh waters.
	Corrective action Pesticide application to cease. Re-assess pesticide control methods – e.g. selection of methods, application technology.

Commitment

The land user will ensure the minimisation of pesticide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

8.34 Golf course fungicide management

Applies to:	Civil construction phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Fungicides may be used within the golf course to manage turf disease. The use of these Fungicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the Fungicides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Minimise Fungicide escape into the surrounding environment.
Implementation strategy	Implement a turf disease management program by monitoring, disease injury assessment, threshold of aesthetic and environmental damage determination, control method selection, timing and extent assessment, evaluate disease control outcome. The use of fungicides is an action of last resort. Primary control of disease will be achieved by: • Site quarantine and hygiene by ensuring imported materials are free of disease. • Modifying either soil or environmental conditions. • Selection of disease resistant turf plants when available. • Last resort chemical control - Spraying as a last resort with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth • Adopt best management principles for pesticide application Greens • Isolated from ground waters by membrane at depth • Adopt best management principles for pesticide application Fairways roughs and swales • No fungicide use on extensive basis Fungicide storage, containment, security, preparation and wash down areas to be located away from ecological and golf course area in designated infrastructure and facilities area of the development.

Monitoring	Annual monitoring of surface waters adjacent (within 100m) to areas subjected to Fungicide use.
	Parameters selected for monitoring to be consistent with the chemicals used on site, frequency and distribution.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
Reporting	A chemical use register to be maintained for each fairway, tee, and green. Spraying of other areas to be recorded separately.
	Records to be maintained and produced upon request by relevant authority.
Identification of incident or failure	Fungicide contamination of water body.
Corrective action	Fungicide application to cease.
	Re-assess fungicide control methods – e.g. selection of methods, application technology.

Commitment

The land user will ensure the minimisation of fungicide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

9 Management of potential impacts – On maintenance phase

9.1 Intent

This part of the SBMP specifies those matters which must be complied with by the Proponent during the 6 months on-maintenance period, being the period after civil construction but before TSC assumes responsibility for the subdivision works. The Proponents' obligations in this Section of the SBMP conclude at the end of the maintenance period for each stage.

9.2 Implementation

At the completion of the construction of the development's civil works, the GPT's (if any have been installed) should be cleaned out to become part of the permanent stormwater quality control treatment train.

9.3 Aquatic flora & weed management and maintenance

Applies to:	On-maintenance phase
Person responsible:	Site manager, Environmental Consultant

Issue	Aquatic flora and weed management and maintenance.
Operational policy	To maintain healthy aquatic plant life and control weeds to promote the ecosystem health of wetlands and waterbodies.
Performance criteria	Macrophyte establishment success rate >70%. The suppression of aquatic weeds and algae. Maintenance of hydraulic performance between waterbodies.
Implementation strategy	Weed strategy An expectation of avoidance or total removal of aquatic weeds within the waterway and wetland system is not realistic as weeds are present within the catchment and neighbouring sites. Management of macrophytes via removal of vegetation within flow paths to maintain hydraulic conductance. Particular attention should be given to weed management to prevent obstruction of hydraulic conductance. When removing weeds, care must be taken not to damage the growth of native aquatic plants or interrupt natural ecosystem function by adhering to the following methods: • Avoid overspray through use of correct equipment and not spraying in windy conditions. • Bag and removal of weeds offsite. • Manage access to wetlands to avoid damage via trampling. • Should mechanical harvesting of weed growth be required, access to waterbodies will be selected to achieve minimal impact and access points will be rehabilitated at the end of the harvesting period. Algae strategy Regular monitoring, particularly in Spring and Summer, is required to reduce the potential for algal blooms. Proposed management methods include: • Ability to isolate separate on-stream system pools to contain algal blooms. • Emergency aeration and/or mixing. • Safety signage during algal outbreaks. • See Table 9.12 'Maintenance of water treatment measures' of the SBMP for further details.

Monitoring	Off-stream waterway and wetland system • Containment of blooms within off-stream waterway and wetland system (no release of water if blue green algae levels exceed 50,000 cells/ml). • Emergency turnover. • Emergency vertical aeration and/or mixing. • Safety signage during algal outbreaks.
	Routine monthly monitoring. Routine monthly visual inspection of treatment trains for vegetation establishment, damage, weed invasion and clogging.
Auditing	Reviews are to be carried out on a quarterly basis to assess the appropriateness of the implementation strategy. A checklist is to be completed which assesses the effectiveness of strategies detailed above.
Reporting	An Aquatic Flora Report shall be submitted to TSC annually. Maintenance and compilation of assessment sheets to be appropriately stored onsite for inspection by local and state government officers.
Identification of incident or failure	Non compliance with agreed performance criteria will be identified by: • Vegetative losses >20%. • Weed growth that impacts upon ecosystem function and/or hydraulic conductance. • Algal blooms exceeding 500 cells/ml.
Corrective action	If vegetation fails, new vegetation should be planted and established. Vegetation may require supplementary replanting. Macrophyte density to be maintained at prescribed levels to achieve hydraulic conductance and pollutant removal. If blue green algae numbers exceed: <i>500 cells/ml</i> • Increase turnover mixing until numbers are brought back to lower levels. • Fertiliser activity to be limited. • Maintain regular monitoring. <i>2,000 cells/ml</i> Increase mixing: • Increase turnover through additional pumping of the recirculation system. • Vertical mixing through emergency compressed air or mechanical mixing devices.

- Fertiliser activity and sprinkling to be limited where possible in the vicinity of the test sites of concern.
- Harvest and land dispose of any dead fish.
- Monitoring frequency to be increased at affected sites to once a month.

15,000 cells/ml

All fertiliser activity and sprinkling to be stopped in the vicinity of the sites of concern.

Warning signs to be posted around the sites of concern.

All site personnel to be notified.

Monitoring frequency to increase at affected sites to once a week.

Contingency measures are to be considered including:

- Increased mixing.
- Harvesting and land disposal of algae and dead fish.
- Allowing bloom to run its course.

Commitment

The land user will ensure the health of the wetland and water body ecosystems is maintained - through active weed and algae monitoring and management.

9.4 Threatened species - Wallum froglet

Applies to:	Species: Wallum Froglet (<i>Crinia signifera</i>) On-maintenance phase - disturbed mixed grassland and regenerating heathland.
Person responsible:	Site manager, ecologist

Issue	Protection of habitat. Provision of habitat from construction of artificial wetland areas (Constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats). Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Wallum Froglet habitat.
Performance criteria	Minimise impacts on Wallum Froglet habitat. Colonisation of constructed wetlands by Wallum Froglet. Maintenance of water quality (pH, nutrient levels) within constructed and naturally occurring habitat. Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Wallum Froglet). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	Maintenance of natural constructed wetlands (liaison with relevant personnel) and landscaping /revegetation works. Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Wallum Froglet activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a Quarterly basis; and • frog monitoring on an annual basis with an emphasis on monitoring in breeding season (June – August).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any water quality testing. Results of monitoring to be collated and presented as report to client, Council and any other relevant statutory authorities.
Identification of incident or failure	• Physical failure of constructed wetlands (e.g. breach). • Inappropriate pH levels.

Corrective action	• Records of high nutrient input. • Absence or decline of Wallum Froglet.
	Apply remedial measures to correct issues of water quality as determined by monitoring.

Commitment

The land user will commit to monitoring Wallum Froglet populations to ensure that habitats are maintained.

9.5 Threatened species - Olongburra frog

Applies to:	Species: Olongburra Frog (<i>Litoria olongburensis</i>) On-maintenance phase
Person responsible:	Site manager, ecologist

Issue	Protection and restoration of habitat (2 constructed dams which currently occur in precincts 12 and 13, one of which requires repair). Provision of habitat from construction of artificial wetland areas (Constructed habitat areas providing suitable acidic conditions (pH 4.2 – 6.7), aquatic vegetation and a variety of microhabitats). Maintenance of constructed habitat areas to limit changes in hydrology, nutrient loading etc.
Operational policy	Protection of Olongburra Frog habitat.
Performance criteria	Minimise impacts on Olongburra Frog habitat. Colonisation of constructed wetlands by Olongburra Frog. Maintenance of water quality (pH, nutrient levels). Maintenance of aquatic vegetation and dense reedland. Minimise any open water areas on the site as this will create optimum conditions for Cane Toads (predator of Olongburra Frog). All ponds should be planted with a dense edge of reeds/sedges, and drainage swales should be well vegetated with reeds/sedges.
Implementation strategy	Maintenance of natural and constructed wetlands (liaison with relevant personnel) as well as landscaping /revegetation works. Reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor water quality; and • monitor Olongburra Frog activity.
Auditing	Regular monitoring inspections to be completed at stated intervals: • water quality monitoring on a quarterly basis; and • frog monitoring on an annually basis with an emphasis on monitoring in breeding season (spring & summer).
Reporting	Standard pro-formas for monitoring to be filled in accordingly including results of any testing. Results of monitoring to be collated and presented as report to client, Council and any other relevant statutory authorities.
Identification of incident or failure	• Physical failure of constructed wetlands (e.g. breach). • Inappropriate pH levels.

Corrective action	• Records of high nutrient input. • Absence or decline of Olongburra Frogs.
	Apply remedial measures to correct issues of water quality as determined by monitoring outcomes.

Commitment

The land user will commit to monitoring Olongburra Frog populations to ensure that wetlands are appropriately maintained.

9.6 Threatened species - Bush stone-curlew

Applies to:	Species: Bush Stone-curlew (<i>Burhinus grallarius</i>) On-maintenance phase
Person responsible:	Site manager, ecologist.

Issue	Protection and restoration of habitat (Scribbly Gum woodland and regrowth heath). Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of vegetation and golf course management.
Operational policy	Protection and improvement of Bush Stone-curlew habitat.
Performance criteria	Minimise impacts on Bush Stone-curlew habitat. Survival of planted trees to ensure additional habitat creation.
Implementation strategy	Maintain: • area to be set aside for habitat protection; • surveying & fencing area to exclude vehicle access; • signage installed stating 'Habitat Area – Keep Out'; • weed control & planting of additional Scribbly Gum to increase suitability of habitat; • placement of woody debris to augment habitat requirements; and • re-evaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: • ensure minimal disturbance within habitat area; • assess growth of planted trees & monitor weed invasion; and • survey for presence of Bush Stone-curlew.
Auditing	Periodic monitoring inspections of planted trees to be completed at stated intervals (e.g. every 3 months) in addition to weed assessment & control (if required). Bush Stone-curlew surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring planted trees and weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client, Council and any other relevant statutory authorities.
Identification of incident or failure	• Disturbance within identified habitat area. • Accidental removal of trees.

Corrective action	• Poor survival of planted trees. • Weed invasion. • Absence or decline of Bush Stone-curlew population.
	Minimise disturbance of habitat areas. Replacement of any dead trees with new stock as soon as detected.

Commitment

The land user will commit to monitoring Bush Stone-curlew populations and ensuring that the habitat area is appropriately protected and maintained.

9.7 Threatened species - Grass owl

Applies to:	Species: Grass Owl (<i>Tyto capensis</i>) On-maintenance phase
Person responsible:	Site manager, ecologist

Issue	Protection and restoration of habitat – tall rank grassland and heathland. Predation by foxes & feral dogs. Disturbance from human visitation & motor vehicles. Disturbance from use of herbicides/pesticides/fertilisers as part of golf course management.
Operational policy	Protection of Grass Owl habitat.
Performance criteria	Minimise impacts on Grass Owl habitat. Maintenance of rank grasslands and heathland vegetation.
Implementation strategy	Maintain: • area to be set aside for habitat protection; • exclusion of vehicle access; • signage installed stating ‘Habitat Area – Keep Out’; • weed control (if required); and • re-evaluation of monitoring and actions annually.
Monitoring	Periodic inspections to: • ensure no disturbance takes place within habitat area; • monitor (& control) weed invasion; and • survey for presence of Grass Owl.
Auditing	Periodic weed assessment & control (if required) at 3 month intervals. Grass Owl surveying on a periodic basis (e.g. every 3 months).
Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client, ecologist, Council and DECC and any other relevant statutory authorities.
Identification of incident or failure	• Contractors working within identified habitat area. • Weed invasion. • Absence or decline of Grass Owl population.
Corrective action	• Minimise disturbances in habitat areas. • Replacement of any dead trees with new stock as soon as detected.

Commitment

The land user will commit to monitoring Grass Owl populations and ensuring that the identified habitat area is appropriately protected and maintained.

9.8 Threatened species - Koala

Applies to:	Species: Koala (<i>Phascolarctos cinereus</i>) On-maintenance phase
Person responsible:	Site manager, ecologist

Issue	Protection and restoration of habitat – areas of Swamp Mahogany and Scribbly Gum. Predation by feral dogs. Injury/death from vegetation clearing. Injury/death from vehicle strike.
Operational policy	Protection and creation of Koala habitat.
Performance criteria	Minimise loss of Koala feed trees (Swamp Mahogany, Scribbly Gum). Planting of additional feed trees. Creation of habitat corridors for movement & foraging.
Implementation strategy	• Tree planting (Swamp Mahogany, Scribbly Gum, Pink Bloodwood) within identified habitat areas in the Vegetation Management Plan (JWA 2011). • Residential vehicles restricted to a maximum speed of 60kph. • Prior to the sale of subdivided lots, purchasers must be provided with a Koala information pamphlet in accordance with the KPoM. • Swimming pools to be constructed with reference to recommendations in the KPoM. Maintain: • Swamp Mahogany and Scribbly Gum; • areas for tree/corridor plantings; • fence corridor planting areas and erect signage 'Restoration Area – Keep Out'; • dog exclusion fencing and signage; • tree planting (Swamp Mahogany, Scribbly Gum, Pink Bloodwood) within identified habitat areas; and • reevaluation of monitoring and actions annually.
Monitoring	Regular inspections to: • monitor fenced areas have not been breached; • monitor health of plantings; and • survey for Koala presence & use of habitat areas.
Auditing	Periodic assessment of plantings & weed assessment & control (if required) within habitat areas at 3 month intervals. Koala surveys to be completed on a periodic basis (e.g. every 12 months).

Reporting	Standard pro-formas for monitoring weed control works to be filled in by landscape maintenance staff/bush regenerators Survey pro-formas to be completed by ecologist and presented as report to client, ecologist, Council and DECC and any other relevant statutory authorities. A Koala Monitoring Report is to be prepared by a suitably qualified person on an annual basis, from the date of commencement of bulk earthworks, for 5 years or as otherwise determined by the Director-General. Reports to be submitted to DoP, DECCW, TSC and DPI Fisheries.
Identification of incident or failure	• Contractors working within identified habitat area. • Removal of any marked Koala feed trees. • Weed invasion & decline in planting health. • Death of planted trees. • Absence or decline of Koala population.
Corrective action	Replacement of any dead trees with new stock as soon as detected, and weed control undertaken in restoration areas. Responsibility for corrective actions rests with construction management, contractors and landscape staff or bush regenerators.

Commitment

The land user will commit to monitoring Koala populations and ensuring that identified habitat area is appropriately protected and maintained.

9.9 Waste management

Applies to:	On-maintenance phase
Person responsible:	Golf course manager

Issue	Waste management.
Operational policy	To minimise the amount of solid and liquid waste produced as a result of general operations. To ensure all waste generated is stored, removed and recycled or disposed of in an appropriate manner. To minimise potential environmental and social impacts from waste and waste handling. The site is kept in a neat and tidy state. To ensure that all waste generated at the site is disposed of in accordance with the applicable legislation.
Performance criteria	No evidence of excessive waste or litter accumulating onsite, outside of designated containment areas.
Implementation strategy	General strategies Waste management methods that employ reduction, reuse or recycling practices shall be used where practicable. The site shall be kept in a clean and tidy state, free from loose waste/litter. Waste material, including vegetation, litter, human waste, used oils and other wastes, shall not be disposed of by burning or burying onsite or in adjacent areas. All wastes shall be stored onsite in confined areas and managed to prevent environmental harm or nuisance from occurring. An appropriate number of covered waste receptacles shall be located onsite, with the provision of areas or additional receptacles for the storage of reusable and recyclable materials. Waste containers shall be emptied on a regular basis (or as required). All wastes transported from the site shall be covered or otherwise handled to prevent spillage or nuisance to the community and environment. Waste material that is unable to be reused, reprocessed or recycled shall be disposed of at a landfill licensed by the DECCW to receive that type of waste. Organic waste Tree prunings, grass clippings and other organic materials from the golf course area are to be collected and composted in a small, purpose built composting facility. Only category 1 organic materials will be composted in the facility. The composting facility will be located in an infrastructure zone. The compost facility will be constructed and operated in accordance with

	the NSW guidelines for composting facilities (even though it is not of sufficient size to warrant licensing). Composted organic materials will be used on landscaping projects in other areas of the urban foot print and site landscaping. Effluents from golf course Effluents from the golf course will be either contained by impermeable membranes (such as the case with the tees and green) or directed towards the bio-retention and filter basins for renovation and storage. The effluents will be reused on the fairways and factored in the nutrient and water balance determinations of the site.
Monitoring	The site manager shall conduct weekly inspections of all work areas (specifically the waste containment areas and the property boundary) to ensure there is no accumulation of waste material.
Auditing	Biannual environmental audits of site activities, complaints and corrective actions.
Reporting	Records of waste removal invoices shall be maintained and kept onsite. Site inspection notes, including the amount and type of waste observed onsite and any corrective actions, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by TSC (or other relevant authorities) upon request. When there is potential or actual environmental harm as a result of waste management, the site manager shall notify the DECCW and corrective actions implemented as directed. Annual waste management reports shall be prepared and provided to statutory authorities upon request.
Identification of incident or failure	Ongoing and repetitive waste-related observations.
Corrective action	The site manager shall direct clean-up operations as required on the basis of site inspections. Additional corrective actions may be: • Identifying the source of waste and the implementation of the following measures (if applicable): • The establishment of additional waste management areas including the provision of additional waste containers; and • Increasing the awareness among staff of the acceptable methods for storage and disposal of waste onsite.

Commitment

The land user will ensure waste is managed to ensure proper controls, removal and disposal systems are in place at all times.

9.10 Surface water quality

Applies to:	On-maintenance phase
Person responsible:	Site manager; Environmental Consultant

Issue	Surface water controls.		
Operational policy	To maintain background water quality conditions wherever practicable during the on-maintenance phase.		
Performance criteria	All water discharged from the controlled discharge points will comply with the following criteria:		
	Water Quality Parameter	Release Criteria	Criteria Type
	pH	As developed from background monitoring	Range
	Electrical conductivity	<1.5mS/cm	Maximum
	Suspended solids	<50mg L ⁻¹	Maximum
	Turbidity	As developed from background monitoring	Maximum
	Dissolved oxygen	60-105% saturation	Minimum
	Total N	As developed from background monitoring	Maximum
	Total P	As developed from background monitoring	Maximum
	Total algae numbers	<50,000cells mL ⁻¹	Maximum
	Litter and gross pollutants	No man made material >5mm in any dimension	--
	Oil and grease	No visible film, no detectable odour	--
	*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 6.5 – 8.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the Threatened Species Management Plan (JWA 2011) for habitat requirements for Wallum Froglet (<i>Crinia signifera</i>) and Olongburra Frog (<i>Litoria olongburensis</i>). This pH range of 4.2 to 6.7 is also identified in 'Habitat and Movements of the Wallum Froglet <i>Crinia tinnula</i> at the Southern Part of its Range'.²⁶ A similar pH range of 4.2 to 7.2 is identified in 'Threatened frogs of New South Wales: Habitats, Status and Conservation'.²⁷		

²⁶ White, A. W. & Pyke, G. H., 2006, 'Habitat and Movements of the Wallum Froglet *Crinia tinnula* at the Southern Part of its Range'. Unpublished paper submitted to Journal of Herpetology.

²⁷ Ehmann, H. 1997 (ed). 'Threatened frogs of New South Wales: Habitats, Status and Conservation'. Published by Frog and Tadpole Study Group of NSW Inc., Sydney.

Implementation strategy	Maintenance of internal bio-retention and filter basins, waterbodies, swales and vegetated filter strips as specified at detailed design and approved by TSC. Samples are to be collected monthly and during rainfall events (defined as >25mm in any 24 hour period) at the upstream and downstream sampling locations and water quality control pond discharge point and analysed for the above parameters. Where water quality fails to meet the established criteria, corrective measures will be undertaken to achieve compliance with the water quality release criteria. Treated water is to be re-tested prior to release to establish the effectiveness of treatment measures. Only appropriate herbicides and fertilisers are to be used in accordance with TSC specifications. Clean-up of GPT's on a quarterly basis or after significant rainfall events.
Monitoring	Monitoring for pH, electrical conductivity, suspended solids, turbidity, dissolved oxygen, total N, total P, litter and gross pollutants and oil and grease will be conducted monthly and during rainfall events. Analysis for total algae numbers will also be conducted monthly and during rainfall events once any waterbody(ies) specified by the erosion and sediment control plan have made operational. Monitoring for aluminium and total and dissolved iron will occur on a monthly basis at water holding locations prior to discharge off site. If iron floc, sediments or iron staining are observed at the discharge points, samples should also be taken for laboratory analysis and discharge halted until water has been treated to adequate levels. Iron indicator strips will be used if practicable. Sample recovery and in-situ analysis will be performed by trained onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory. Sediment and erosion control measures will be inspected daily by the site manager during periods of rainfall.
Auditing	Environmental consultant to audit water quality results to ensure all discharges comply with the performance criteria.
Reporting	Result sheets to be compiled for monitoring results relating to water quality of water bodies. These results to be kept onsite for inspection by local and state government officers. Biannual report to be submitted to TSC within 30 working days upon receipt of the laboratory results. The water quality reports will be prepared by a suitably qualified and experienced Environmental Consultant. These reports will detail: The results for each of the environmental indicators monitored:

	• An assessment of the monitoring results against the release criteria. • An evaluation, if applicable, of the environmental conditions if monitoring results fall outside the limits of the release criteria. • Recommendations that are relevant to ensuring a high level of water quality is maintained. Each report will include previous water quality results in tabular format for comparative purposes and trend graphs will be provided. Laboratory certificates will be provided.
Identification of incident or failure	The results of the water quality monitoring indicating concentrations exceeding the release limits specified in the “performance criteria” for a single water quality parameter.
Corrective action	All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted. Specific strategies to be implemented are as follows: pH In the event that the pH of waters falls outside of the critical limits, such waters will be contained and the pH adjusted to within the target range prior to release. Monitoring of the pH level shall be carried out immediately prior to release. Low pH waters (i.e. pH<6.5) that need to be amended to be consistent with receiving environment waters of pH >6.5 may be ameliorated in-situ by the use of hydrated lime or crushed ag-lime to achieve a pH>6.5 and <9.0 prior to release. In using hydrated lime, all care shall be undertaken to ensure pH is not above 9.0. Low pH waters consistent with receiving environment waters of pH 4.2-6.7 and that contain dissolved iron above 0.3mg L⁻¹ will require treatment to reduce dissolved iron to acceptable levels prior to discharge. Electrical conductivity If electrical conductivity exceeds 1.5 dS m⁻¹, the waters will be contained onsite until adequate EC levels are reached. Further monitoring of upstream waters will be conducted to assess the impact of the development on the absolute change to water quality. Rainfall data will also be assessed at such times to determine the impact that rainfall has had on the water quality of the site and discharging waters. Suspended solids and turbidity If total suspended solids exceed 30mg L⁻¹ the waters will be contained onsite for a period sufficient to allow suspended solids to settle out prior to release, or treated with a flocculent. After gypsum has been applied, the stored waters will be retested immediately prior to discharge. Erosion control devices will be immediately inspected and cleaned if

necessary. Additional devices will be installed if a need is detected to prevent future breaches of the suspended solids criteria. The placement of stockpiles and management of disturbed areas will be reviewed with regard to the SBMP Table 6.7 'Erosion controls' and Table 6.8 'Sediment control'.

Dissolved oxygen

In the event that dissolved oxygen levels drop below 6.5mg L^{-1} , the waters will not be released until visual inspections for algae has been carried out. If algae are present, further laboratory tests will be carried out to determine the type of algae in the waters.

A general investigation will be carried out of the flow conditions of the affected waters, to assess the flow rates and volume of water passing through the monitoring locations.

Litter and gross pollutants

In the event that litter and gross pollutants with a dimension greater than 5mm are observed, this material will be clean up and appropriately disposed of as soon as practicable. The contractor shall inform staff of the appropriate waste disposal procedures and reiterate the importance and sensitivity of the surrounding ecosystems.

Oil and grease

In the event that oil and grease are visible and/or an odour is detected within a waterbody, management strategies will be implemented. Specifically, the waters shall be contained and the oil and grease isolated through the use of booms, containments bunds or other appropriate measures. Remediation works shall be implemented in consultation with the environmental consultant and DECCW.

Commitment

The manager will maintain background water quality conditions as much as practicable during the on-maintenance phase of the development.

9.11 Groundwater monitoring

Applies to:	On-maintenance phase
Person responsible:	Site manager; Environmental Consultant

Issue	Groundwater monitoring.
Operational policy	To maintain stable groundwater conditions and verify by monitoring that development management is appropriate. Groundwater monitoring is to be undertaken in accordance with the site's Groundwater Assessment and Management Plan (Gilbert & Sutherland June 2011).
Performance criteria	Water quality objectives for the on-maintenance phase of works would be devised using DECCW guidelines for groundwater monitoring. These proposed objectives would be submitted to TSC for review and approval prior to implementation. Groundwater monitoring will be undertaken for the following parameters: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L^{-1}); • total nitrogen and nitrate, nitrite and ammonium (mg L^{-1}); • total and soluble phosphorus (mg L^{-1}); • total and soluble iron and filtered aluminium; • oil and grease (visual inspection); • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and • colour. Laboratory analysis for total acidity (titratable) and total alkalinity should also be undertaken.

Implementation strategy	Monitoring of groundwater levels should be undertaken monthly during the on-maintenance phase. Groundwater samples are to be collected monthly and analysed for the parameters specified above.
Monitoring	Carry out monthly groundwater level and quality monitoring at locations to be specified. Sample recovery and in-situ analysis will be performed by onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory.
Auditing	The environmental consultant is to audit water quality biannually to ensure that no deleterious effects are resulting from any excavation, filling and dewatering operations at the site.
Reporting	Biannual reports are to be submitted to TSC. The annual reports to TSC shall include raw data, a results summary and a discussion comparing results with baseline values and DECCW guidelines. Result sheets to be compiled for monitoring results. All results shall be made available for inspection by local and state government officers when requested.
Identification of incident or failure	Degradation of groundwater quality at the monitoring points to below the "Performance Criteria" levels (to be derived following baseline monitoring). Variations in groundwater levels beyond typical seasonal fluctuations.
Corrective action	If the test results for any parameter fails to meet the performance criteria (to be determined based on background monitoring), further investigations will be conducted. This will involve fortnightly groundwater quality monitoring (or more frequent if deemed necessary by the environmental consultant) of the subject parameter(s). The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in groundwater quality is present. If a trend exists for declining groundwater quality, the likely source(s) of contamination will be identified. Should the investigation indicate that site activities are triggering the incident/failure, the following will be implemented: • Locate the source of the contamination/level variation and take all possible actions to contain and control the contaminant/level variation. Investigate the cause of the contamination/level variation and take action to prevent a recurrence. • All development activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted.

Commitment

The manager will seek to maintain stable groundwater conditions and verify by monitoring that development management is appropriate.

9.12 Maintenance of treatment measures

Applies to:	On-maintenance phase
Person responsible:	Proponent, site manager

Issue	Maintenance of stormwater quality treatment devices.
Operational policy	To ensure that the stormwater quality treatment devices are maintained at an appropriate operational standard.
Performance criteria	No significant change in the physical characteristics of treatment devices. No significant change in the physicochemical and/or biological characteristics of the treatment devices.
Implementation strategy	Routine visual inspections and monitoring and maintenance.
Monitoring	Routine monthly visual inspection of treatment trains and vegetated open space for: • litter; • erosion; • excessive sediment deposition; • clogging (bio-retention); • vegetation damage (e.g. die off, weed growth); and • damaged or failed treatment devices. Change in physical characteristics: • water level; and • area, depth or bed profile of any bio-retention basin, waterway and wetland system.
Auditing	Audit inspections are to be carried out on a quarterly basis to verify that the stormwater quality control structures are properly maintained by the contractor.
Reporting	A checklist is to be completed which assesses the strategies listed above and includes the following: • A record of inspection details and; • A record of details of all maintenance activities (including volume of silt removed from each GPT or other control structure). Results to be made available to TSC at all times. A summary of the inspection checklist findings shall be included in the annual water quality monitoring report.
Identification of incident or failure	Non compliance with the criteria will be identified by: • Blockage of stormwater system.

Corrective action	• Build up of sediment & litter or re-entrainment of trapped sediments. • Excessive erosion. • Vegetation damage. • Poorly maintained, damaged or failed control devices. • A change in the physical characteristics. • A change in the physicochemical and/or biological characteristics. • Impeded drainage of bio-retention and filter basins. • Deterioration of water quality downstream of the control structure/s.
	Bio-retention and filter basin maintenance • Regular harvesting to ensure vegetation is maintained at acceptable levels. • Removal of a portion of vegetation to maintain nutrient and biomass balance. • Removed vegetation to be composted and reused on landscaping in other parts of development site. • Soil renovation (as required) to maintain permeability. • Removal of litter. Gross pollutant traps • Removal of trapped material in accordance with manufacturer's specifications. Vegetated rough • Regular mowing and maintenance of rough filter characteristic by mulching organic matter back into rough soil profile • ensure vegetation is maintained at acceptable levels (minimum 85% foliage protective cover). • Removal of litter within the swale. Waterway and wetland system will be as per weed management program

Commitment

The manager will ensure management measures are implemented (if required) to ensure the stormwater quality treatment devices are maintained at operational standard.

9.13 Machinery, workshops, and dangerous goods handling & storage

Applies to:	On-maintenance phase
Person responsible:	Site manager; all personnel

Issue	Materials handling and storage management, and hazardous substance management.
Operational policy	To ensure that fuel, grease and other hazardous substances present onsite are managed in a safe and environmentally responsible manner.
Performance criteria	No fuel, grease and/or oil contamination of the environment shall result due to operational activities. Appropriate facilities will be available for the storage of hazardous materials in accord with the relevant acts and best management practices. No fuel, grease, oil or other hazardous substances shall escape containment bunds and contaminate the site soils, surface water or leave the site.
Implementation strategy	All materials shall be stored within the boundaries of an area designated as a storage and containment zone for materials on site. The zone is to be located away from the surrounding SEPP 14 wetlands and environmental protection areas in the central golf course infrastructure development area (outside of buffer zones). Storage facilities shall be constructed prior to hazardous material being brought to the site. Stockpile and storage areas shall be identified and any contained products shall be clearly marked. Minimum practical quantities of fuels, grease and other hazardous substances shall be located onsite. These materials shall be stored in sheltered, impervious and bunded areas (or as required by the applicable regulations). Containment bund capacity shall be 110% of the volume of the tank stored within it. Where multiple tanks are stored within the one bund, the capacity will be 110% of the largest tank. Material Safety Data Sheets (MSDS) will be available onsite for all hazardous materials used or stored onsite for the duration of the construction works. An emergency response plan shall be developed for the site to control risk to the environment from hazardous materials. This shall include spill prevention and pollution control programs and an operating procedure for containing and cleaning up spills. Suitable quantities of absorbent materials shall be stored onsite to accommodate minor spills.

	Relevant staff shall be trained in chemical and fuel handling, spill containment and clean up procedures. Personnel protection equipment shall be made available onsite as required for the use of hazardous substances. All suppliers shall be informed of procedures and restrictions required, and deliveries supervised during off-loading by appropriately trained personnel. Materials shall be adequately secured and loads covered where there is risk of spillage or loss of load. Imported materials shall be free of weeds, litter and contaminants. All regulated waste shall be removed and disposed of by an appropriately licensed waste contractor at an appropriately licensed waste disposal facility.
Monitoring	Weekly inspections will be carried out by the golf course manager to verify the integrity of material storage facilities and bunding. Visual inspections for spills and land contamination shall also be conducted.
Auditing	Annual environmental audits of site activities, complaints, corrective actions and reporting by an independent consultant during the construction phase of the development to assess compliance with the SBMP.
Reporting	Site inspection notes (a checklist of visual inspections) shall be recorded in a Site Diary. An incidents/complaints register shall be maintained onsite and will be available for inspection by Tweed Shire council (or other relevant authorities) upon request. In the event of potential or actual environmental harm or nuisance, the golf course manager shall notify the NSW DECCW and corrective actions implemented as directed. Reports detailing any incidents and/or complaints and associated corrective actions shall be provided to statutory authorities upon request.
Identification of incident or failure	Land or water contamination.
Corrective action	The immediate containment of spillages with booms, containment bunds or other appropriate measures. Remediation of site contamination in consultation with environmental consultant and DECCW. Corrective actions (to be implemented in the event of land contamination) include: - Identifying the source of contamination and reporting the incident to the appropriate authorities immediately. - Arranging for the source of the contamination to be rectified and for the contaminated area to be remediated.

Action for fuel/oil spillage:

- All ignition sources to be removed from vicinity of spill.
- All equipment in vicinity of storage to be turned off.
- Identification of source of spillage and take action to ensure similar incidents are avoided in future.

Commitment

The manager will ensure the handling and storage of machines and materials onsite is managed in a safe and environmentally responsible manner.

9.14 Golf course water conservation

Applies to:	On-maintenance Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	All water flows must be controlled and managed to allow the effective use of the onsite water within a total water cycle. Essential to the ecological stability of the golf course and surrounding wetland and ecological protection zone is the maintenance of water quantities to both golf course and ecosystems.
Operational policy	To manage the rainfall on site to effectively distribute water supply to both the golf course and the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground water levels to be maintained within and adjacent to golf course with critical levels to be in accord with the seasonal variation in ground water height. Monitoring periods to be divided into Summer recharge period and Winter depletion period.
Implementation strategy	Harvesting • All water directed to bio-retention basins. • Held to recharge groundwater. • Golf course graded towards the basins. Volume • Maintain constant volumes by maintaining course infiltration rate and fairways runoff directed to swales for detention and infiltration to ground water. Storage • Subsurface storage. • Central dam of surface run-off collection and ground water window. • Habitat storages within landscape plan. Treatment • Bio-detention and filter basins to remove nutrients. • Sediments removed by filtering through rough and percolation through Bio-detention and filter basin floor. Distribution • 30% annual average recharge to ecosystem. • 70 % to landscape in golf course.

	Maintenance of treatment basins Basins maintained to ensure nutrient stripping and water infiltration. An Environmental Management System (EMS) for the golf course should be developed and implemented to ensure staff and contractors are familiar with the above strategies.
Monitoring	Monthly monitoring of groundwater height.
Auditing	Environmental consultant will audit the groundwater monitoring procedures and outcomes of the monitoring on an annual basis.
Reporting	Results of monitoring will be reported biannually to the Tweed shire council and NSW Department of Planning.
Identification of incident or failure	Ground water heights outside of critical limits to water level.
Corrective action	Groundwater lower than the critical level – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 40% to ecosystem 60% to golf course. Continue to monitor. Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 60% to ecosystem 40% to golf course. Continue to monitor. Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 80% to ecosystem 20% to golf course. Seek alternate sources of water for golf course irrigation and undertake environmental management and plan for the import of water supply to site. Continue to monitor. Ground water still outside limits – implement alternate water supply. Groundwater higher than critical level – determine source of excess water. High rainfall events – do nothing incident is self correcting. Golf course groundwater mounding – alter irrigation regime to decrease irrigation input to site.

Commitment

The land user will ensure the water table heights in the vicinity of the golf course will be maintained within the critical limits identified in the site based management plan.

9.15 Water management (golf course irrigation)

Applies to:	On-maintenance Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	All water flows must be controlled and managed to allow the effective use of the onsite water within a total water cycle. Essential to the ecological stability of the golf course and surrounding wetland and ecological protection zone is the maintenance of water quantities to both golf course and ecosystems.
Operational policy	To manage the irrigation applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground water levels to be maintained within and adjacent to golf course with critical levels to be in accord with the seasonal variation in ground water height. Monitoring periods to be divided into Summer recharge period and Winter depletion period.
Implementation strategy	Source of water - Extraction at central point of development which is distant from ground water dependant ecosystems. Distribution - Pipe mains and lateral distribution. - Spray irrigation for distribution efficiency. - Irrigation on tees greens and fairways only (allowing for minor over-spray on adjacent roughs). - Pump stations and associated infrastructure, including sprinkler heads, to be sized and installed in accordance with recommendations in ePar (2009, pp10). Irrigation scheduling - Install weather station and computerised control system to ensure efficient irrigation in accordance with recommendations in ePar (2009, pp9). - Irrigation to occur at dawn or dusk (generally characterised by lower relative humidity, air temperature and wind speed). - Soil water deficit based trigger for irrigation. - Effective soil depth for schedule 0-200mm. - Refill point to be set at 70% plant available soil moisture depletion. - Irrigation applied to 98% of field capacity. Water allocation model - Sustainable yield applied to irrigation set at 70 % recharge potential.

Monitoring	Recycling • Fairways constructed with gradient towards bio-detention basins. • Capture of irrigation runoff in detention basins for treatment and groundwater recharge. • Tees and greens captured separately and recycled to fairways. Soil management • Soil amendment to improve moisture holding (zeolite etc). • Maintenance of soil organic matter for soil structure maintenance. • Minimise compaction by machinery selection and operating procedures. • Control traffic. Plant selection and management • Native species and naturalised species endemic to local area. • Species selection dependant on landscape location eg Drought tolerant plants in elevated areas, waterlog tolerant plants in depressions.
	Monthly <i>Height monitoring:</i> • Surface water – dams, basins, adjacent ecosystem water bodies. • Ground water transect from detention basins to protection area (e.g. of groundwater monitoring bore transect through golf course and extending into adjacent SEPP 14 wetland). <i>Parameters:</i> • Height (AHD); pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure). Daily • Soil water – Soil water monitoring for refill point - methods to be selected as appropriate to soil and turf management conditions, for instance: tensiometers (150 mm depth), or Penman's estimation etc.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
	Reporting Results of monitoring will be reported biannually to the Tweed shire council and NSW Department of Planning.
	Identification of incident or failure Ground water heights outside of critical limits to water level.
Corrective action	Groundwater lower than the critical level – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 40% to ecosystem 60% to golf course. Continue to monitor.

Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 60% to ecosystem 40% to golf course.

Continue to monitor.

Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 80% to ecosystem 20% to golf course. Seek alternate sources of water for golf course irrigation and undertake environmental management and plan for the import of water supply to site.

Continue to monitor.

Ground water still outside limits – implement alternate water supply.

Groundwater higher than critical level – determine source of excess water.

High rainfall events – do nothing if incident is self correcting.

Golf course groundwater mounding – alter irrigation regime to decrease irrigation input to site.

Commitment

The land user will ensure the water table heights in the vicinity of the golf course will be maintained within the critical limits identified in the site based management plan.

9.16 Golf course nutrient management

Applies to:	On-maintenance Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	The nutrients applied to maintain the vigour of the golf course must not gain access to the surrounding environment. All nutrients must be controlled and managed to allow the effective use of the onsite water and to ensure to the ecological stability of the golf course and surrounding wetland and ecological protection zone.
Operational policy	To manage the nutrients applied to the golf course to minimise its impact on the surrounding ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground and surface water nutrient levels to be maintained within and adjacent to golf course within critical levels in accord with the seasonal variation in ground water. Monitoring periods to be divided into Summer recharge period and Winter depletion period. Critical criteria set at: • Critical limit set as per background monitoring. Parameters: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L⁻¹); • total nitrogen and nitrate, nitrite and ammonium (mg L⁻¹); • total and soluble phosphorus (mg L⁻¹); • total and soluble iron and filtered aluminium; • oil and grease (visual inspection); • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and

Implementation strategy	• colour. Tees • Impervious membrane under green set at 0.6m below NSL, leachate collected in containment well and reused on fairways. • Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity). • Fertiliser selection – slow release and specialty fertilisers for tee maintenance. • Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. Fertiliser rates to be determined in consultation with the recommendations in ePar (2009, pp8) or the site's Fertiliser Management Plan. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off). • Clippings removed and composted for reuse on landscaping. Greens • Impervious membrane under green set at 0.6m below NSL, leachate collected in containment well and reused on fairways. • Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity). • Fertiliser selection – slow release and specialty fertilisers for green maintenance. • Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off). • Clippings removed and composted for reuse on landscaping. Fairways • Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity). • Fertiliser selection – slow release and specialty fertilisers for tee maintenance. • Fertiliser rate – minimal for turf stability as determined by soil testing
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	consistent with standard best practice for turf management. In addition, a mass balance method will be used to identify fertiliser rates – inputs of water nutrients, fertiliser and effluent from tees and greens, output soil store, biomass and percolation. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off). • Irrigation maximum refill set to 98% field capacity to ensure first rainfall infiltrates and not runs off. Rough • No fertiliser used. • Rough to act as irrigation, sediment and nutrient buffer. • Biomass mulched back into rough. Swales and detention basins • No fertiliser used. • Maintenance removal of biomass to composting and reuse in landscaping.
Monitoring	Groundwater Monthly: • Ground water quality samples (from all height monitoring bores). • Multiple group lysimeters set at 1 m depth in four (4) locations in golf course fairways– leachate samples. • Parameters: pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure); N – Total, NH₄, NO₃, P – Total, Ortho; Calcium; Magnesium; Sodium; Potassium; Total and dissolved iron; Dissolved manganese; Filtered aluminium; Bicarbonate; Carbonate; Chloride; Sulfate; and Colour. Surface water Monthly: • Central irrigation supply. • Surface habitat water bodies. • Parameters: pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure); N – Total, NH₄, NO₃, P – Total, Ortho; Calcium; Magnesium; Sodium; Potassium; Total and dissolved iron; Dissolved manganese; Filtered aluminium; Bicarbonate; Carbonate; Chloride; Sulfate; and Colour. Quarterly: • Central irrigation supply. • Parameters: irrigation water quality, N & P.

	Soils 6 monthly: Soil fertility sampling as per standard practice for turf (agricultural) management. Biomass Quarterly: • Fairway reference sites set at four locations within golf course. • The reference sites will have the biomass collected (weighed) and analysed for N & P. (Data to be used in estimating mass balance for monitoring purposes). Biannually: • SEPP 14 wetland and environmental protection zone to be monitored with two (2) reference transects to outline floristic structure and function.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
	Reporting Results of monitoring will be reported biannually to the Tweed Shire Council and NSW Department of Planning.
	Identification of incident or failure • Groundwater analyses in excess of critical limits for two consecutive sample events. • Critical limit set considering background monitoring.
	Corrective action Fertiliser regime re-assessed and fertiliser management plan altered by change of fertiliser form, rate or application technology. Continue to monitor.

Commitment

The land user will ensure the water table and surface water areas associated with the golf course does not input excess nutrients into the surrounding SEPP14 wetlands and ecological protection zones.

9.17 Golf course herbicide management

Applies to:	On-maintenance Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Herbicides may be used within the golf course to manage turf weeds. The use of herbicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the herbicides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	No foliar damage to surrounding environment from herbicide applications.
Implementation strategy	The use of herbicides is an action of last resort. Primary control of weeds will be achieved by: • Physical removal of weed species prior to turf area development and for selected weeds post development. • Soil management methods such as ameliorating compaction, improving drainage, shade management and nutrient management techniques such as avoiding N applications during weed active stages. • Turf management methods such as (but not restricted to) mowing height and frequency, restricting traffic and insect control. • Spraying as a last resort as either spot spraying or contained spraying consistent with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for herbicide application. Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for herbicide application. Fairways • No herbicide use on extensive basis. • Spot and strip spraying as last resort. Rough • No herbicide use on extensive basis. • Spot spraying as last resort.

Monitoring	Swales • No herbicide use on extensive basis. • Spot spraying as last resort.
	Visual inspection of adjacent areas for evidence of over-spray – e.g. Herbicide damage to leaves. Monitoring to be timed one to two weeks after spraying events.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
Reporting	• A chemical use register to be maintained for each fairway, tee, and green. • Spot spraying of other areas to be recorded separately. • Records to be maintained and produced upon request by relevant authority.
Identification of incident or failure	Foliage damage observed.
Corrective action	Damage foliage removed and mulched on site, plants to be monitored and dead plants replaced with suitable seedlings, or seed stocks.

Commitment

The land user will ensure the minimisation of herbicide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

9.18 Golf course pesticide management (control of arthropods)

Applies to:	On-maintenance Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Pesticides to control arthropods may be used within the golf course to manage turf pests. The use of these herbicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the pesticides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	No pesticide escape into the surrounding environment beyond AS/NZS standards of pesticide contamination of fresh waters.
Implementation strategy	Implement an integrated pest management program by monitoring, pest injury assessment, threshold of aesthetic and environmental damage determination, control method selection, timing and extent assessment, evaluate pest destruction outcome. The use of pesticides is an action of last resort. Primary control of weeds will be achieved by: • Site quarantine and hygiene by ensuring imported materials are free of pests. • Modifying pest habitat either soil or environmental conditions. • Selection of host resistant turf plants when available. • Biological control measures – natural parasites and predators. • Last resort chemical control - Spraying as a last resort with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Chemical control preferences should be: • Attractants (food and/or sex pheromone) and traps. • Inorganic materials (eg elemental sulfur and similar approaches). • Bioinsecticides (eg Baccillus thuringiensis). • Botanical extracts. • Synthetic organics (chemicals). Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application.

Monitoring	Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Fairways • No pesticide used on extensive basis. • Spot and strip spraying as last resort. Rough • No pesticide used on extensive basis. Swales • No pesticide used on extensive basis. Pesticide storage, containment, security, preparation and wash down areas to be located away from ecological and golf course area in designated infrastructure and facilities area of the development. A shrouded Controlled Droplet Applicator (CDA) should be used to reduce spray drift, chemical and water use. Pesticide application rate may be reduced by 1/3 where shrouded CDA's are used (ePar 2009, pp12).
	Annual monitoring of surface waters adjacent (within 100m) to areas subjected to pesticide use. Parameters selected for monitoring to be consistent with the chemicals used on site.
	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
	A chemical use register to be maintained for each fairway, tee, and green. Spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
	Pesticide contamination of water body beyond AS/NZS Standard for fresh waters.
	Pesticide application to cease. Re-assess pesticide control methods – e.g. selection of methods, application technology.

Commitment

The land user will ensure the minimisation of pesticide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

9.19 Golf course fungicide management

Applies to:	On-maintenance Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Fungicides may be used within the golf course to manage turf disease. The use of these fungicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the fungicides applied to the golf course to minimise its impact on the surrounding ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Minimise Fungicide escape into the surrounding environment.
Implementation strategy	Implement a turf disease management program by monitoring, disease injury assessment, threshold of aesthetic and environmental damage determination, control method selection, timing and extent assessment, evaluate disease control outcome. The use of fungicides is an action of last resort. Primary control of disease will be achieved by: • Site quarantine and hygiene by ensuring imported materials are free of disease. • Modifying either soil or environmental conditions. • Selection of disease resistant turf plants when available. • Last resort chemical control - Spraying as a last resort with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Fairways roughs and swales • No fungicide use on extensive basis. Fungicide storage, containment, security, preparation and wash down areas to be located away from ecological and golf course area in designated infrastructure and facilities area of the development.

Monitoring	Annual monitoring of surface waters adjacent (within 100m) to areas subjected to Fungicide use. Parameters selected for monitoring to be consistent with the chemicals used on site, frequency and distribution.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
Reporting	A chemical use register to be maintained for each fairway, tee, and green. Spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
Identification of incident or failure	Fungicide contamination of water body.
Corrective action	Fungicide application to cease. Re-assess fungicide control methods – e.g. selection of methods, application technology.

Commitment

The land user will ensure the minimisation of fungicide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

10 Management of potential impacts – operational phase

10.1 Intent

This part of the SBMP specifies those matters which should be complied with by the Golf Course Golf course management during the operational phase, being the period after which each stage has been accepted off-maintenance by Council. The Proponent's obligations end following cessation of the on-maintenance period.

10.2 Aquatic flora & weed management and maintenance

Applies to:	Operational period of golf course
Person responsible:	Golf course golf course management

Issue	Aquatic flora and weed management and maintenance.
Operational policy	To maintain healthy aquatic plant life and control weeds to promote the ecosystem health of wetlands and waterbodies.
Performance criteria	• Macrophyte establishment success rate >70%. • The suppression of aquatic weeds and algae. • Maintenance of hydraulic performance between waterbodies.
Implementation strategy	Weed strategy An expectation of avoidance or total removal of aquatic weeds within the waterway and wetland system is not realistic as weeds are present within the catchment and neighbouring sites. Management of macrophytes via removal of vegetation within flow paths to maintain hydraulic conductance. Particular attention should be given to weed management to prevent obstruction of hydraulic conductance. When removing weeds, care must be taken not to damage the growth of native aquatic plants or interrupt natural ecosystem function by adhering to the following methods: • Avoid overspray through use of correct equipment and not spraying in windy conditions. • Bag and removal of weeds offsite. • Manage access to wetlands to avoid damage via trampling. • Should mechanical harvesting of weed growth be required, access to waterbodies will be selected to achieve minimal impact and access points will be rehabilitated at the end of the harvesting period. Algae strategy Regular monitoring, particularly in Spring and Summer, is required to reduce the potential for algal blooms. Proposed management methods could include:

	• Ability to isolate separate on-stream system pools to contain algal blooms. • Emergency aeration and/or mixing. • Safety signage during algal outbreaks. Off-stream waterway and wetland system Proposed management methods include: • Containment of blooms within off-stream waterway and wetland system. • Emergency turnover. • Emergency vertical aeration and/or mixing. • Safety signage during algal outbreaks.
Monitoring	Routine quarterly monitoring for two years following the completion of the on-maintenance phase of works. Routine quarterly visual inspection of treatment trains for vegetation establishment, damage, weed invasion and clogging.
Auditing	Reviews to be carried out on a quarterly basis to assess the appropriateness of the implementation strategy. A checklist is to be completed which assesses the effectiveness of strategies detailed above.
Reporting	Maintenance and compilation of assessment sheets to be appropriately stored onsite for inspection by local and state government officers.
Identification of incident or failure	Non compliance with agreed performance criteria will be identified by: • Vegetative losses >20%. • Weed growth that impacts upon ecosystem function and/or hydraulic conductance. • Algal blooms exceeding 500 cells/ml.
Corrective action	If vegetation fails, new vegetation should be planted and established. Vegetation may require supplementary replanting. Macrophyte density to be maintained at prescribed levels to achieve hydraulic conductance and pollutant removal. If blue green algae numbers exceed: <i>500 cells/ml</i> • Increase turnover mixing until numbers are brought back to lower levels. • Fertiliser activity to be limited. • Maintain regular monitoring. <i>2,000 cells/ml</i> • Increase mixing. • Increase turnover through additional pumping of the recirculation system.

- Vertical mixing through emergency compressed air or mechanical mixing devices.
- Fertiliser activity and sprinkling to be limited where possible in the vicinity of the test sites of concern.
- Harvest and land dispose of any dead fish.
- Monitoring frequency to be increased at affected sites to once a month.

15,000 cells/ml

- All fertiliser activity and sprinkling to be stopped in the vicinity of the sites of concern.
- Warning signs to be posted around the sites of concern.
- All site personnel to be notified.
- Monitoring frequency to be increased at affected sites to once a week.

Contingency measures are to be considered including:

- Increased mixing.
- Harvesting and land disposal of algae and dead fish; and
- Allowing bloom to run its course.

Commitment

The golf course management will ensure the health of the wetland and waterbody ecosystems is maintained through active weed and algae monitoring and management.

10.3 Groundwater monitoring

Applies to:	Operational phase
Person responsible:	Golf course manager

Issue	Groundwater monitoring.
Operational policy	To maintain stable groundwater conditions and verify by monitoring that development management is appropriate. Groundwater monitoring is to be undertaken in accordance with the site's <i>Groundwater Assessment and Management Plan</i> (Gilbert & Sutherland June 2011).
Performance criteria	Water quality objectives for the operational phase of works would be devised from DECCW guidelines for groundwater monitoring. These proposed objectives would be submitted to TSC for review and approval prior to implementation. Groundwater monitoring will be undertaken for the following parameters: • pH (field measurement); • EC (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L⁻¹); • total nitrogen and nitrate, nitrite and ammonium (mg L⁻¹); • total and soluble phosphorus (mg L⁻¹); • total and soluble iron and filtered aluminium (mg L⁻¹); • oil and grease (visual inspection); • calcium; • magnesium; • total and dissolved iron; • dissolved manganese; • filtered aluminium; • bicarbonate; • carbonate; • chloride; • sulfate; and • colour. Laboratory analysis for total acidity (titratable) and total alkalinity should also be undertaken.
Implementation	Monitoring of groundwater levels should be undertaken quarterly during

strategy	the operational phase. Groundwater samples are to be collected quarterly and analysed for the parameters specified above.
Monitoring	Carry out quarterly groundwater level and quality monitoring at locations to be specified. Sample recovery and in-situ analysis will be performed by onsite staff and, when required, samples will be forwarded to a NATA accredited laboratory.
Auditing	The environmental consultant is to audit water quality biannually to ensure that no deleterious effects are resulting from site activities.
Reporting	Annual reports are to be submitted to TSC. The annual reports to TSC shall include raw data, a results summary and a discussion comparing results with baseline values and DECCW groundwater guidelines. Result sheets to be compiled for monitoring results. All results shall be made available for inspection by local and state government officers when requested.
Identification of incident or failure	Degradation of groundwater quality at the monitoring points to below the "Performance Criteria" levels (to be derived following baseline monitoring). Variations in groundwater levels beyond typical seasonal fluctuations.
Corrective action	If the test results for any parameter fails to meet the performance criteria (to be determined based on background monitoring), further investigations will be conducted. This will involve monthly groundwater quality monitoring (or more frequent if deemed necessary by the environmental consultant) of the subject parameter(s). The results of the investigation should ascertain if the incident/failure is an anomaly or if a sustained decline in groundwater quality is present. If a trend exists for declining groundwater quality, the likely source(s) of contamination will be identified. Should the investigation indicate that site activities are triggering the incident/failure, the following will be implemented: • Locate the source of the contamination/level variation and take all possible actions to contain and control the contaminant/level variation. Investigate the cause of the contamination/level variation and take action to prevent a recurrence. • All activities taking place at the time of incident/failure shall be reviewed to verify compliance with the SBMP provisions and, if necessary, construction methods and procedures shall be adjusted.

Commitment

The golf course manager will seek to maintain stable groundwater conditions and verify by monitoring that management is appropriate.

10.4 Maintenance of water treatment measures

Applies to:	Operational period of golf course
Person responsible:	Golf course manager

Issue	Maintenance of stormwater quality treatment devices.
Operational policy	To ensure that the stormwater quality treatment devices are maintained at an appropriate operational standard.
Performance criteria	No significant change in the physical characteristics of treatment devices. No significant change in the physicochemical and/or biological characteristics of the treatment devices.
Implementation strategy	Routine visual inspections and monitoring and maintenance.
Monitoring	Routine quarterly visual inspection of treatment trains and vegetated open space for: • Litter. • Erosion. • Excessive sediment deposition. • Clogging (bio-retention). • Vegetation damage (e.g. die off, weed growth). • Damaged or failed treatment devices: • Change in physical characteristics. • Water level. • Area, depth or bed profile of any bio-retention basin, waterway and wetland system.
Auditing	Audits are to be carried out on an annual basis to assess the implementation strategy.
Reporting	A checklist is to be completed which assesses the strategies listed above.
Identification of incident or failure	Non compliance with the criteria will be identified by: • Blockage of stormwater system. • Build up of sediment & litter or re-entrainment of trapped sediments. • Excessive erosion. • Vegetation damage. • Poorly maintained, damaged or failed control devices. • A change in the physical characteristics. • A change in the physicochemical and/or biological characteristics. • Impeded drainage of bio-retention and filter basins. • Deterioration of water quality downstream of the control structure/s.

Corrective action	Bio-retention and filter basin maintenance • Regular harvesting to ensure vegetation maintained at acceptable levels. • Removal of a portion of vegetation to maintain nutrient and biomass balance. • Removed vegetation to be composted and reused on landscaping in other parts of development site. • Soil renovation (as required) to maintain permeability. • Removal of litter. Gross pollutant traps • Removal of trapped material in accordance with manufacturer's specifications. Vegetated rough • Regular mowing and maintenance of rough filter characteristic by mulching organic matter back into rough soil profile. • ensure vegetation is maintained at acceptable levels (minimum 85% foliage protective cover). • Removal of litter within the swale. Waterway and wetland system • As per weed management program Sediment/sludge removal • Sludge and sediments are expected to settle in the inlet zones of the wetlands and other water bodies. In the operational state this is expected to be minor and de-silting will only be required on an infrequent basis (maybe every 50 years). Prior to works the recommended best practice method of sediment/sludge removal of the time will be used.
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Commitment

The golf course manager will ensure management measures are implemented (if required) to ensure the stormwater quality treatment devices are maintained at operational standard.

10.5 Open space management

Applies to:	Operational period of golf course
Person responsible:	Golf course golf course management

Issue	Open space management.
Operational policy	Ensure that the living landscape has been adequately established and is fully functional for its designed purpose.
Performance criteria	The ongoing and safe use of the facilities provided within the Conservation Zone, Dedicated Public Open Space and ecological buffers and General Use Recreation areas. The ecological values and ecosystem functions of the open space areas are maintained.
Implementation strategy	Formal access to the zone shall be limited and regular, programmed maintenance undertaken. Firebreaks, incorporating radiation zones, shall be maintained on the outer margins of the Conservation Zones to the rear of lots, or incorporated within parts of the road network or trail system that run adjacent the Conservation Zones. Weed management strategies to be implemented in accordance with Table 8.2 'Aquatic flora & weed management and maintenance' of the SBMP. Signage shall be erected to direct visitors to litter bins located outside of the Conservation Zone. Residents shall be advised of the risks to wildlife presented by domestic cats and dogs, and Golf course management rules initiated to keep them indoors at night. Accidentally introduced feral species (cane toads, hares, foxes, dogs, cats) shall be managed through the implementation of survey, trap and removal of such species in order that a reasonable degree of control is achieved. Maintenance to the stormwater management infrastructure and works located within this zone shall be undertaken in accordance with Table 9.12 'Maintenance of treatment measures' of the SBMP. Bollards and signage shall be used to delineate boundaries between the different types of open space. Maintenance practices will be implemented along the edges of zones including the clear delineation of radiation zones and the pathway network. Dedicated public open space zone Litter receptacles shall be located at strategic points within the public open space zone.

	General use recreation zone • Routine maintenance shall be carried out on the public-access canoe trail system, picnic and barbecue facilities, seating, play equipment, informal kick and throw areas, and other facilities associated with local neighbourhood parks. • Litter receptacles shall be located at strategic points within the recreation zone.
	Monitoring
	Auditing
	Reporting
	Identification of incident or failure
	Corrective action

Commitment

The golf course manager will ensure the open space zones are managed and maintained to ensure that these areas provide a safe environment for use by local residents.

10.6 Surface water monitoring

Applies to:	Operational period of golf course
Person responsible:	Golf course golf course management

Issue	Surface water monitoring.
Operational policy	- Any waters discharged from the site should meet the specified water quality objectives (WQOs). - Water quality in the waterway and wetland system should remain at an acceptable level.
Performance criteria	The quality of discharge from the site should achieve the long term WQOs. The WQOs will reflect background monitoring for: - pH; - dissolved oxygen; - total and soluble phosphorous; - total nitrogen and nitrate, nitrite and ammonium; - turbidity; - suspended solids; - chlorophyll 'a'; - faecal coliforms; - total algae numbers; - litter and gross pollutants; and - oil and grease.
Implementation strategy	Routine surface water quality monitoring to be undertaken.
Monitoring	Frequency: Routine quarterly monitoring for two years following the completion of the on-maintenance period, with biannual rainfall event (>25mm/24hrs) monitoring campaigns. Parameters: temperature, dissolved oxygen, pH, conductivity, salinity, turbidity, suspended solids, total nitrogen, total phosphorous, faecal coliforms, chlorophyll 'a' and algae identification and count. Vertical Profiling: Routine biannual monitoring of temperature, dissolved oxygen, pH, conductivity, salinity and turbidity at 0.5m depths of all off-stream deep water bodies. Sample recovery and in-situ analysis will be performed by a NATA accredited sampler and, when required, samples will be forwarded to a NATA accredited laboratory.
Auditing	Reviews are to be carried out on a 6 monthly basis to assess the implementation strategy. A checklist is to be completed which assesses the strategies listed above.

Reporting	Annual Water quality report to be held by Tweed Shire Council.
Identification of incident or failure	Surface water quality parameter monitoring identifying exceedance of WQOs.
Corrective action	If exceedance of WQOs continues to occur, inspect all treatment techniques, revise designs or review different alternatives and install if necessary.

Commitment

The golf course management will ensure routine monitoring is carried out to ensure water quality is in accordance with the water quality objectives.

10.7 Golf course water conservation

Applies to:	Operational Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	All water flows must be controlled and managed to allow the effective use of the onsite water within a total water cycle. Essential to the ecological stability of the golf course and surrounding wetland and ecological protection zone is the maintenance of water quantities to both golf course and ecosystems.
Operational policy	To manage the rainfall on site to effectively distribute water supply to both the golf course and the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground water levels to be maintained within and adjacent to golf course with critical levels to be in accord with the seasonal variation in ground water height. Monitoring periods to be divided into Summer recharge period and Winter depletion period.
Implementation strategy	Harvesting • All water directed to bio-retention basins. • Held to recharge groundwater. • Golf course graded towards the basins. Volume • Maintain constant volumes by maintaining course infiltration rate and fairways runoff directed to swales for detention and infiltration to ground water. Storage • Subsurface storage. • Central dam of surface run-off collection and ground water window. • Habitat storages within landscape plan. Treatment • Bio-detention and filter basins to remove nutrients. • Sediments removed by filtering through rough and percolation through Bio-detention and filter basin floor. Distribution • 30% annual average recharge to ecosystem. • 70 % to landscape in golf course. Maintenance of treatment basins • Basins maintained to ensure nutrient stripping and water infiltration.

	An Environmental Management System (EMS) for the golf course should be developed and implemented to ensure staff and contractors are familiar with the above strategies.
Monitoring	Monthly monitoring of groundwater height.
Auditing	Environmental consultant will audit the groundwater monitoring procedures and outcomes of the monitoring on an annual basis.
Reporting	Results of monitoring will be reported biannually to the Tweed shire council and NSW Department of Planning.
Identification of incident or failure	Ground water heights outside of critical limits to water level.
Corrective action	Groundwater lower than the critical level – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 40% to ecosystem 60% to golf course. Continue to monitor. Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 60% to ecosystem 40% to golf course. Continue to monitor. Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 80% to ecosystem 20% to golf course. Seek alternate sources of water for golf course irrigation and undertake environmental management and plan for the import of water supply to site. Continue to monitor. Ground water still outside limits – implement alternate water supply. Groundwater higher than critical level – determine source of excess water. High rainfall events – do nothing incident is self correcting. Golf course groundwater mounding – alter irrigation regime to decrease irrigation input to site.

Commitment

The golf course management will ensure the water table heights in the vicinity of the golf course will be maintained within the critical limits identified in the site based management plan.

10.8 Water management (golf course irrigation)

Applies to:	Operational Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	All water flows must be controlled and managed to allow the effective use of the onsite water within a total water cycle. Essential to the ecological stability of the golf course and surrounding wetland and ecological protection zone is the maintenance of water quantities to both golf course and ecosystems.
Operational policy	To manage the irrigation applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground water levels to be maintained within and adjacent to golf course with critical levels to be in accord with the seasonal variation in ground water height. Monitoring periods to be divided into Summer recharge period and Winter depletion period.
Implementation strategy	Source of water - Extraction at central point of development which is distant from ground water dependant ecosystems. Distribution - Pipe mains and lateral distribution. - Spray irrigation for distribution efficiency. - Irrigation on tees greens and fairways only (allowing for minor over-spray on adjacent roughs). - Pump stations and associated infrastructure, including sprinkler heads, to be sized and installed in accordance with recommendations in ePar (2009, pp10). Irrigation scheduling - Install weather station and computerised control system to ensure efficient irrigation in accordance with recommendations in ePar (2009, pp9). - Irrigation to occur at dawn or dusk (generally characterised by lower relative humidity, air temperature and wind speed). - Soil water deficit based trigger for irrigation. - Effective soil depth for schedule 0-200mm. - Refill point to be set at 70% plant available soil moisture depletion. - Irrigation applied to 98% of field capacity.

Monitoring	Water allocation model • Sustainable yield applied to irrigation set at 70 % recharge potential. • Recycling. • Fairways constructed with gradient towards bio-detention basins. • Capture of irrigation runoff in detention basins for treatment and groundwater recharge. • Tees and greens captured separately and recycled to fairways. Soil management • Soil amendment to improve moisture holding (zeolite etc). • Maintenance of soil organic matter for soil structure maintenance. • Minimise compaction by machinery selection and operating procedures. • Control traffic. Plant selection and management • Native species and naturalised species endemic to local area. • Species selection dependant on landscape location eg Drought tolerant plants in elevated areas, waterlog tolerant plants in depressions.
	Biannually <i>Height monitoring:</i> • surface water – dams, basins, adjacent ecosystem water bodies; and • ground water transect from detention basins to protection area (e.g. of groundwater monitoring bore transect through golf course and extending into adjacent SEPP 14 wetland). <i>Parameters:</i> • Height (AHD); pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure). Daily • Soil water – Soil water monitoring for refill point - methods to be selected as appropriate to soil and turf management conditions, for instance: tensiometers (150 mm depth), or Penman's estimation etc.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
	Reporting Results of monitoring will be reported annually to the Tweed shire council and NSW Department of Planning.
Identification of incident or failure	Ground water heights outside of critical limits to water level.

Corrective action	Groundwater lower than the critical level – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 40% to ecosystem 60% to golf course. Continue to monitor. Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 60% to ecosystem 40% to golf course. Continue to monitor. Ground water still outside limits – irrigation extraction rate of golf course to be modified to redistribute the recharge potential to a new regime of 80% to ecosystem 20% to golf course. Seek alternate sources of water for golf course irrigation and undertake environmental management and plan for the import of water supply to site. Continue to monitor. Ground water still outside limits – implement alternate water supply. Groundwater higher than critical level – determine source of excess water. High rainfall events – do nothing if incident is self-correcting. Golf course groundwater mounding – alter irrigation regime to decrease irrigation input to site.
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Commitment

The golf course management will ensure the water table heights in the vicinity of the golf course will be maintained within the critical limits identified in the site based management plan.

10.9 Waste management

Applies to:	Operational phase of golf course
Person responsible:	Golf course manager

Issue	Waste management.
Operational policy	To minimise the amount of solid and liquid waste produced as a result of general operations. To ensure all waste generated is stored, removed and recycled or disposed of in an appropriate manner. To minimise potential environmental and social impacts from waste and waste handling. Golf course is kept in a neat and tidy state. To ensure that all waste generated by the golf course is disposed of in accordance with the applicable legislation.
Performance criteria	No evidence of excessive waste or litter accumulating onsite, outside of designated containment areas.
Implementation strategy	General strategies • Waste management methods that employ reduction, reuse or recycling practices shall be used where practicable. • The golf course shall be kept in a clean and tidy state, free from loose waste or litter. • Waste material, including vegetation, litter, human waste, used oils and other wastes, shall not be disposed of by burning or burying onsite or in adjacent areas. • All wastes shall be stored onsite in confined areas and managed to prevent environmental harm or nuisance from occurring. • An appropriate number of covered waste receptacles shall be located onsite, with the provision of areas or additional receptacles for the storage of reusable and recyclable materials. • Waste containers shall be emptied on a regular basis (or as required). • All wastes transported from the site shall be covered or otherwise handled to prevent spillage or nuisance to the community and environment. • Any waste material that is unable to be reused, reprocessed or recycled shall be disposed of at a landfill licensed by the DECCW to receive that type of waste. Organic waste • Tree prunings, grass clippings and other organic materials from the golf course area are to be collected and composted in a small, purpose built composting facility. • Only category 1 organic materials will be composted in the facility. • The composting facility will be located in an infrastructure zone with the

	other infrastructure for the course. • The compost facility will be constructed and operated in accordance with the NSW guidelines for composting facilities (even though it is not of sufficient size to warrant licensing). • Composted organic materials will be used on landscaping projects in other areas of the urban footprint and golf course landscaping. Effluents • Effluents from the golf course will be either contained by impermeable membranes (such as the case with the tees and green) or directed towards the bio-retention and filter basins for renovation and storage. • The effluents will be reused on the fairways and factored in the nutrient and water balance determinations of the site.
Monitoring	The golf course manager shall conduct weekly inspections of all work areas (specifically the waste containment areas and the property boundary) to ensure there is no accumulation of waste material.
Auditing	Annual environmental audits of site activities, complaints and corrective actions.
Reporting	Records of waste removal invoices shall be maintained and kept onsite. Site inspection notes, including the amount and type of waste observed onsite and any corrective actions, shall be recorded in the Site Diary. An Incidents/Complaints Register shall be maintained on-site and will be available for inspection by TSC (or other relevant authorities) on request. When there is potential or actual environmental harm as a result of waste management, the site manager shall notify the DECCW and corrective actions implemented as directed. Annual waste management reports shall be prepared and provided to statutory authorities upon request.
Identification of incident or failure	Ongoing and repetitive waste-related observations
Corrective action	The golf course manager shall direct clean-up operations as required on the basis of site inspections. Additional corrective actions may be: • Identifying the source of waste and the implementation of the following measures (if applicable): • The establishment of additional waste management areas including the provision of additional waste containers; and • Increasing the awareness among staff of the acceptable methods for storage and disposal of waste onsite.

Commitment

The golf course management will ensure waste is managed to ensure proper controls, removal and disposal systems are in place at all times.

10.10 Golf course nutrient management

Applies to:	Operational Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	The nutrients applied to maintain the vigour of the golf course must not gain access to the surrounding environment. All nutrients must be controlled and managed to allow the effective use of the onsite water and to ensure to the ecological stability of the golf course and surrounding wetland and ecological protection zone.
Operational policy	To manage the nutrients applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Ground and surface water nutrient levels to be maintained within and adjacent to golf course within critical levels in accord with the seasonal variation in ground water. Monitoring periods to be divided into Summer recharge period and Winter depletion period. Critical criteria set at: • Mean ground water nutrient level considering background monitoring. Parameters: • pH (field measurement); • electrical conductivity (field measurement); • turbidity (field measurement); • dissolved oxygen (field measurement); • temperature (field measurement); • suspended solids (mg L^{-1}); • total nitrogen and nitrate, nitrite and ammonium (mg L^{-1}); • total and soluble phosphorus (mg L^{-1}); • total and soluble iron and filtered aluminium; • oil and grease (visual inspection); • calcium; • magnesium; • potassium; • sodium; • dissolved manganese; • bicarbonate; • carbonate; • chloride; • sulfate; and

Implementation strategy	• colour..
	Tees • Impervious membrane under green set at 0.6m below NSL, leachate collected in containment well and reused on fairways. • Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity). • Fertiliser selection – slow release and specialty fertilisers for tee maintenance. • Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. Fertiliser rates to be determined in consultation with the recommendations in ePar (2009, pp8) or the site’s Fertiliser Management Plan. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (e.g. turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off). • Clippings removed and composted for reuse on landscaping.
	Greens • Impervious membrane under green set at 0.6m below NSL, leachate collected in containment well and reused on fairways. • Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity). • Fertiliser selection – slow release and specialty fertilisers for green maintenance. • Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off) • Clippings removed and composted for reuse on landscaping. Fairways • Soil conditioning to improve nutrient retention and moisture holding capacity (e.g. Zeolite incorporated top 100mm, development and maintenance of soil organic matter for soil structure and cation exchange capacity). • Fertiliser selection – slow release and specialty fertilisers for tee maintenance.

Monitoring	• Fertiliser rate – minimal for turf stability as determined by soil testing consistent with standard best practice for turf management. In addition, a mass balance method will be used to identify fertiliser rates – inputs of water nutrients, fertiliser and effluent from tees and greens, output soil store, biomass and percolation. • Application method – split application at low rates, timed with other fairway operations that incorporate nutrients into turf (eg, turf renovation and top dressing, fertiliser incorporation irrigation events to prevent contamination of surface run-off). • Irrigation maximum refill set to 98% field capacity to ensure first rainfall infiltrates and not runs off.
	Rough • No fertiliser used. • Rough to act as irrigation, sediment and nutrient buffer. • Biomass mulched back into rough.
	Swales and detention basins • No fertiliser used. • Maintenance removal of biomass to composting and reuse in landscaping.
	Groundwater Quarterly • Ground water quality samples (from all height monitoring bores). • Multiple group lysimeters set at 1m depth in four (4) locations in golf course fairways– leachate samples. • Parameters: pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure); N – Total, NH₄, NO₃, P – Total, Ortho; Calcium; Magnesium; Sodium; Potassium; Total and dissolved iron; Dissolved manganese; Filtered aluminium; Bicarbonate; Carbonate; Chloride; Sulfate; and Colour. Surface water Quarterly • Central irrigation supply. • Surface habitat water bodies. • Parameters: pH (field measure); EC (field measure); Dissolved oxygen (field measure); Temperature (field measure); N – Total, NH₄, NO₃, P – Total, Ortho; Calcium; Magnesium; Sodium; Potassium; Total and dissolved iron; Dissolved manganese; Filtered aluminium; Bicarbonate; Carbonate; Chloride; Sulfate; and Colour. Quarterly • Central irrigation supply.

	- Parameters: irrigation water quality, N & P. Soils Annually - Soil fertility sampling as per standard practice for turf (agricultural) management. Biomass Annually - Fairway reference sites set at four locations within golf course. - The reference sites will have the biomass collected (weighed) and analysed for N & P. (Data to be used in estimating mass balance for monitoring purposes). SEPP 14 wetlands Annually - SEPP 14 wetland and environmental protection zone to be monitored with two (2) reference transects to outline floristic structure and function.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
Reporting	Results of monitoring will be reported annually to the Tweed Shire Council and NSW Department of Planning.
Identification of incident or failure	- Groundwater analyses in excess of critical limits for two consecutive sample events. - Critical limit set at considering background monitoring.
Corrective action	Fertiliser regime re-assessed and fertiliser management plan altered by change of fertiliser form, rate or application technology. Continue to monitor.

Commitment

The golf course management will ensure the water table and surface water areas associated with the golf course does not input excess nutrients into the surrounding SEPP14 wetlands and ecological protection zones.

10.11 Golf course herbicide management

Applies to:	Operational Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Herbicides may be used within the golf course to manage turf weeds. The use of herbicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the herbicides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	No foliar damage to surrounding environment from herbicide applications.
Implementation strategy	The use of herbicides is an action of last resort. Primary control of weeds will be achieved by: • Physical removal of weed species prior to turf area development and for selected weeds post development. • Soil management methods such as ameliorating compaction, improving drainage, shade management and nutrient management techniques such as avoiding N applications during weed active stages. • Turf management methods such as (but not restricted to) mowing height and frequency, restricting traffic and insect control. • Spraying as a last resort as either spot spraying or contained spraying consistent with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for herbicide application. Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for herbicide application. Fairways • No herbicide use on extensive basis. • Spot and strip spraying as last resort. Rough • No herbicide use on extensive basis. • Spot spraying as last resort.

Monitoring	Swales • No herbicide use on extensive basis. • Spot spraying as last resort.
	Visual inspection of adjacent areas for evidence of over-spray – e.g. Herbicide damage to leaves Monitoring to be timed one to two weeks after spraying events.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
Reporting	A chemical use register to be maintained for each fairway, tee, and green. Spot spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
Identification of incident or failure	Foliage damage observed.
Corrective action	Damage foliage removed and mulched on site, plants to be monitored and dead plants replaced with suitable seedlings, or seed stocks.

Commitment

The golf course management will ensure the minimisation of herbicide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

10.12 Golf course pesticide management (control of arthropods)

Applies to:	Operational Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Pesticides to control arthropods may be used within the golf course to manage turf pests. The use of these herbicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the pesticides applied to the golf course to minimise its impact on the surrounding Ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	No pesticide escape into the surrounding environment beyond AS/NZS standards of pesticide contamination of fresh waters.
Implementation strategy	Implement an integrated pest management program by monitoring, pest injury assessment, threshold of aesthetic and environmental damage determination, control method selection, timing and extent assessment, evaluate pest destruction outcome. The use of pesticides is an action of last resort. Primary control of weeds will be achieved by: • Site quarantine and hygiene by ensuring imported materials are free of pests. • Modifying pest habitat either soil or environmental conditions. • Selection of host resistant turf plants when available. • Biological control measures – natural parasites and predators. • Last resort chemical control - Spraying as a last resort with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Chemical control preferences should be: • Attractants (food and/or sex pheromone) and traps. • Inorganic materials (eg elemental sulfur and similar approaches). • Bioinsecticides (eg Baccillus thuringiensis). • Botanical extracts. • Synthetic organics (chemicals). Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application.

	Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Fairways • No pesticide used on extensive basis. • Spot and strip spraying as last resort. Rough • No pesticide used on extensive basis. Swales • No pesticide used on extensive basis. Pesticide storage, containment, security, preparation and wash down areas to be located away from ecological and golf course area in designated infrastructure and facilities area of the development. A shrouded Controlled Droplet Applicator (CDA) should be used to reduce spray drift, chemical and water use. Pesticide application rate may be reduced by 1/3 where shrouded CDA's are used (ePar 2009, pp12).
	Monitoring Annual monitoring of surface waters adjacent (within 100m) to areas subjected to pesticide use. Parameters selected for monitoring to be consistent with the chemicals used on site.
	Auditing Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on an annual basis.
	Reporting A chemical use register to be maintained for each fairway, tee, and green. Spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
	Identification of incident or failure Pesticide contamination of water body beyond AS/NZS Standard for fresh waters.
	Corrective action Pesticide application to cease. Re-assess pesticide control methods – e.g. selection of methods, application technology.

Commitment

The golf course management will ensure the minimisation of pesticide impacts on the surrounding SEPP14 wetlands and ecological protection zones.

10.13 Golf course fungicide management

Applies to:	Operational Phase of golf course, precincts 12 and 13
Person responsible:	Golf course Manager

Issue	Fungicides may be used within the golf course to manage turf disease. The use of these Fungicides may have an impact on the flora adjacent to the golf course and strategies are needed to minimise these impacts.
Operational policy	To manage the Fungicides applied to the golf course to minimise its impact on the surrounding ecological zones (SEPP14 wetland and Ecological protection zones).
Performance criteria	Minimise Fungicide escape into the surrounding environment.
Implementation strategy	Implement a turf disease management program by monitoring, disease injury assessment, threshold of aesthetic and environmental damage determination, control method selection, timing and extent assessment, evaluate disease control outcome. The use of fungicides is an action of last resort. Primary control of disease will be achieved by: • Site quarantine and hygiene by ensuring imported materials are free of disease. • Modifying either soil or environmental conditions. • Selection of disease resistant turf plants when available. • Last resort chemical control - Spraying as a last resort with the requirements of best practice spraying and the obligations under the NSW Pesticides Act. Specialist outcomes for each golf course zones as below: Tees • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Greens • Isolated from ground waters by membrane at depth. • Adopt best management principles for pesticide application. Fairways roughs and swales • No fungicide use on extensive basis. Fungicide storage, containment, security, preparation and wash down areas to be located away from ecological and golf course area in designated infrastructure and facilities area of the development.

Monitoring	Annual monitoring of surface waters adjacent (within 100m) to areas subjected to Fungicide use. Parameters selected for monitoring to be consistent with the chemicals used on site, frequency and distribution.
Auditing	Environmental consultant will audit the monitoring procedures and outcomes of the monitoring on a biannual basis.
Reporting	A chemical use register to be maintained for each fairway, tee, and green. Spraying of other areas to be recorded separately. Records to be maintained and produced upon request by relevant authority.
Identification of incident or failure	Fungicide contamination of water body.
Corrective action	Fungicide application to cease. Re-assess fungicide control methods – e.g. selection of methods, application technology.

Commitment

The golf course management will ensure the minimisation of fungicide impacts on the surrounding SEPP14 wetlands and ecological protection zones.