SYNOPSIS This management plan establishes responsibilities and procedures for the management of drainage maintenance during Stage 1 of the Kings Forest Development, New South Wales.
SUMMARY

Project 28 Pty Ltd commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare a Drainage Maintenance Management Plan (DMMP) for the Kings Forest Stage 1 Project Application. This DMMP considers the findings of investigations conducted by G&S which are incorporated in the Kings Forest Stage 1 Project Application Drainage Maintenance Impact Assessment (July 2012) produced for Project 28 Pty Ltd by G&S (the “DMIA report”).

The DMIA report identifies several potential impacts associated with drainage maintenance works including; hydrological impacts, the disturbance of acid sulfate soils, water quality impacts, erosion and sedimentation and impacts to flora and fauna, triggering the need for a DMMP.

The Kings Forest Stage 1 Project Application No. MP 08_0194 was lodged in November 2011. The Application and Environmental Assessment Report was advertised from December 2011 to January 2012 following which 302 public submissions and 10 agency submissions were received.

As a result of the submissions, amendments to the project have been made. The amended project contains the following key elements (NB: these elements will be revised and updated as the amended project is finalised):

• Subdivision to create new lots for future development;
  o Bulk earthworks across the site;
  o Road works comprising:
    - construction of the entrance road into the site and associated intersection works on Tweed Coast Road;
    - alignment and construction of the proposed Kings Forest Parkway from Tweed Coast Road via Precincts 4 and 5 through to the western precincts; and
    - alignment and part construction of two proposed roads through SEPP 14 areas to access the southern precincts;
• Development of 2,036 m² of floor space for rural supplies development and access arrangements within Precinct 1;
• Construction of subdivision and infrastructure works along the Kings Forest Parkway and within Precincts 1 and 5;
The Plan of Development for Precinct 5.

Based on historical need, it is estimated that Blacks Creek would only require maintenance once every ten years to retain the existing hydraulic capacity. Reduced hydraulic capacity is allowed for in the flood modelling, which provides for a reduced maintenance regime. This DMMP is designed to ensure that all drainage maintenance conducted at the Kings Forest development site is conducted in accordance with proven management techniques. The DMMP provides a clear management protocol based on operational policies, performance criteria, implementation strategies and corrective actions, should they be necessary. The DMMP identifies who is responsible for each specific aspect of drainage maintenance management.

The DMMP provides a working tabular format with provision for amendment if required.

This revised report addresses the amendments to the project and the key issues raised in the submissions.

Response to Submissions

Submitter: Department of Planning and Infrastructure

Issue: Drainage maintenance and impacts to threatened species

Response: The DMMP has been revised removing the need for weed spraying or the removal of snags.

Submitter: Tweed Shire Council

Issue: Reporting requirements

Response: Council have been added to the reporting requirements where water quality non-conformances are identified.

Submitter: Tweed Shire Council

Issue: Fish passage

Response: Culvert and causeways will be maintained in accordance with NSW Fisheries ‘Why do Fish Need to Cross the Road?’

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1 Fairfull, S. & Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla
Submitter: NSW EPA

Issue: Scope of proposed works and potential impacts

Response: The DMMP has been revised removing the need for weed spraying or the removal of snags. The disposal of sediment spoil is addressed in Table 13.4.3. Existing roads will be used to access Blacks Creek for mechanical maintenance (Table 13.4.1).

Submitter: Fisheries NSW

Issue: Policy for dredging and reclamation

Response: Mechanical maintenance would be conducted in stages to minimise disturbance to aquatic species. Disturbance of deeper holes, snags and gravel bars would be avoided as per Table 13.4.1.

Submitter: Fisheries NSW

Issue: Policy for minimising water pollution

Response: The spraying of waterways to remove aquatic weeds has been removed from the DMMP.

Submitter: Fisheries NSW

Issue: Policy for snag (large woody debris) management

Response: The removal of snags has been removed from the DMMP.

Submitter: Fisheries NSW


Response: As per recommendations in the TCEMP:

- On-going water quality monitoring will be conducted at the locations shown on Drawing No. 10927.1.1 of the Kings Forest Stage 1 Project Application Erosion and Sediment Control Plan (G&S 2012).
- Riparian vegetation to be retained adjacent to Blacks Creek as shown on Drawing 10468.4.1 of the Kings Forest Stage 1 Project Application Erosion and Sediment Control Plan (G&S 2012).
- Minimum core riparian zone widths will be adhered to as outlined in the NSW Office of Water's “Guidelines for riparian corridors on waterfront land”.
Submitter: NSW Office of Water

Issue: Removal of snags be deleted from any management plan
Response: The removal of snags is no longer proposed under the DMMP

Submitter: NSW Office of Water

Issue: Consideration of the NSW Office of Water's ‘Guidelines for riparian corridors on waterfront land’ (July 2012)
Response: The DMMP has been amended to include the minimum core riparian zone widths outlined in the NSW Office of Water's ‘Guidelines for riparian corridors on waterfront land’.

Submitter: NSW Office of Water

Issue: Impacts of on-going routine drainage maintenance
Response: The DMMP has been revised removing the need for weed spraying or the removal of snags to ensure Blacks Creek is managed as a functioning waterway.

Submitter: NSW Office of Water

Issue: Surface water quality monitoring parameters
Response: The water quality monitoring parameters (Table 13.4.4) have been expanded to include those listed by the NSW Office of Water.

The implementation table included in the front of this management plan details the actions, responsibilities and performance criteria upon which monitoring and auditing may be implemented.
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<th>Location (reference to Map)</th>
<th>Purpose</th>
<th>TIMING and FREQUENCY</th>
<th>RESPONSIBILITY</th>
<th>PERFORMANCE MEASURE</th>
<th>MONITORING and reporting</th>
<th>Further Details</th>
</tr>
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<td>DMMP 1</td>
<td>Mechanical drainage maintenance</td>
<td>Existing access roads on Blacks Creek</td>
<td>To minimise soil disturbance during the mechanical removal of sediment from Blacks Creek</td>
<td>As necessary (approximately once every ten years)</td>
<td>Contractor’s Site Manager, Environmental Consultant</td>
<td>Drain maintenance operations should aim to minimise physical drain disturbance during sediment removal</td>
<td>Visual inspections of bank stability and vegetation root stock during drain maintenance works. Records of sedimentation, flooding, water quality and aquatic species mortality will be retained on site</td>
<td>Table 13.4.1</td>
</tr>
<tr>
<td>DMMP 2</td>
<td>Acid sulfate soil treatment</td>
<td>Blacks Creek</td>
<td>No acid sulfate drain spoil is to be disturbed or excavated without appropriate treatment</td>
<td>In conjunction with drain maintenance</td>
<td>Contractor’s Site Manager, Environmental Consultant</td>
<td>All material excavated from drains to be limed at prescribed rate before stockpiling</td>
<td>Records of lime delivery and calculated liming rates to be kept on site during maintenance operations and available for inspection at all times</td>
<td>Table 13.4.2</td>
</tr>
<tr>
<td>DMMP 3</td>
<td>Sediment and erosion control</td>
<td>Blacks Creek</td>
<td>To prevent the displacement of sediment and soil from drains particularly during storm events</td>
<td>Visual inspections following rainfall events (&gt;25mm in 24hrs)</td>
<td>Consulting Engineer, Contractor’s Site Manager</td>
<td>Minimise erosion and the resultant turbidity of discharge waters</td>
<td>Reporting to TSC, only required if insufficient sediment and erosion measures are identified</td>
<td>Table 13.4.3</td>
</tr>
<tr>
<td>DMMP 4</td>
<td>Surface water quality management</td>
<td>Drawing No. 10927.1.1 of the Kings Forest Stage 1 Project Application Erosion and Sediment Control Plan (G&amp;S 2012)</td>
<td>To prevent adverse impacts to surface water quality in the downstream receiving environment</td>
<td>Daily in situ testing and weekly collection of samples for laboratory analysis during drain maintenance works</td>
<td>Contractor’s Site Manager</td>
<td>Surface water quality downstream of sediment and erosion control measures to comply with Table 13.4.4.</td>
<td>• Results to be recorded and kept onsite • TSC to be notified immediately of breaches. • Water quality reports to be provided to TSC or DECCW upon request</td>
<td>Table 13.4.4</td>
</tr>
</tbody>
</table>
13.1 Introduction

13.1.1 Background
Project 28 Pty Ltd commissioned Gilbert & Sutherland Pty Ltd (G&S) to prepare a Drainage Maintenance Management Plan (DMMP) for the Stage 1 Project Application for the proposed Kings Forest development at Kings Forest, New South Wales.

The Director General of the Department of Planning issued amended Environmental Assessment Requirements (DGRs) for the project application on 23 December 2010. The DGRs require that specialist advice be provided to address the following Key Issue:

Key Issue 7.6: Assess the necessity of drains currently in operation across the site and, for those required into the future, assess the impact of any ongoing maintenance required to ensure their effectiveness.

The DMIA report identifies several potential impacts associated with drainage maintenance works including; hydrological impacts, the disturbance of acid sulfate soils, water quality impacts, erosion and sedimentation and impacts to flora and fauna.

The identification of these issues necessitates the production of a DMMP. This management plan has taken into consideration the NSW Office of Water’s ‘Guidelines for riparian corridors on waterfront land’ (July 2012).

13.1.2 The project application
The Kings Forest Development site covers approximately 870 hectares and is situated southwest of the town of Cudgen. The Kings Forest development will require excavation works. Proposed lake excavations will be to a depth of greater than 4.5m below Natural Surface Level (NSL), whilst the majority of other required excavation at the site will be less than 2m below NSL. The Kings Forest Stage 1 Project Application proposes earthworks across the site involving total cut volumes of approximately 1,731,012m³, total fill volumes of approximately 1,833,254m³ and approximately 361,894m³ of imported fill.

The Project Application incorporates the following elements:

- Subdivision to create new lots for future development;
  - Bulk earthworks across the site;
  - Road works comprising:
    - construction of the entrance road into the site and associated intersection works on Tweed Coast Road;
    - alignment and construction of the proposed Kings Forest Parkway from Tweed Coast Road via Precincts 4 and 5 through to the western precincts;
    - alignment and part construction of two proposed roads through SEPP 14 areas to access the southern precincts;
- Development of 2,036 m² of floor space for rural supplies development and access arrangements within Precinct 1;
- Construction of subdivision and infrastructure works along the Kings Forest Parkway and within Precincts 1 and 5;
- The Plan of Development for Precinct 5.

13.1.3 Objectives
This report constitutes a DMMP for the Stage 1 Project Application for the Kings Forest development. The aim of this report is to detail strategies to mitigate the potential environmental impacts associated with the ongoing maintenance of Blacks Creek at the Kings Forest site in terms of:

- hydrological impacts
- disturbance of acid sulfate soils
- surface water quality impacts
- erosion and sedimentation
- impacts to flora and fauna.
13.2 Site drainage

Drainage at Kings Forest has been studied by several previous investigations. The site drainage network was the subject of a report by Phillip Bell & Partners (Kings Forest Stormwater Management Plan, 2001). The drainage system ranges from natural, largely unmodified waterways to minor overland flow paths.

The site is located within the Cudgen Creek catchment and is predominantly drained in an easterly direction by Blacks Creek. Runoff from the site also enters Cudgen Creek under Old Bogangar Road to the north of the site and via the lowlands adjacent to the southern site boundary.

Drainage from the north-eastern portion of the site flows into a State Environmental Planning Policy No. 14 (SEPP14) wetland area prior to discharging from the Kings Forest site. There is no statutory definition that can be applied for the classification of a SEPP 14 wetland. Determination of SEPP 14 wetlands was undertaken as a mapping exercise, based upon a set of ‘botanical indicators, which were deemed, for the purposes of the survey, to characterise wetlands’ (Adam et al., 1985, p. 28).

13.2.1 Drainage maintenance

The flood modelling conducted previously for the site assumed that only Blacks Creek would be maintained to minimise potential build up of sediment and growth of vegetation within and across the channel.

In response to submissions received, the management regime has been modified and the flood modelling has been revised to reflect a much less intrusive management regime, which would not involve clearing or trimming of vegetation or the removal or realignment of snags. However, it may be necessary to address sedimentation within the drain at some time in the future and this management plan provides appropriate management techniques to minimise potential impacts associated with any necessary maintenance activity within Blacks Creek.

All other drains are modelled as not maintained. The resolution of the model is such that the drainage function of the minor drains has been disregarded by the model, so the maintenance of these drains is not required to achieve the level of flood immunity predicted for the developed site.

Black’s Creek may need to be maintained to provide adequate drainage for the site and to ensure appropriate flood conveyance. The likely frequency of disturbance would be low (approximately once every ten years) however, necessary maintenance works could potentially result in hydrological impacts, the disturbance of acid sulfate soils, water quality impacts, erosion and sedimentation, impacts to flora and fauna.

The following sections detail the management measures for the management of potential impacts associated with drainage maintenance works.
13.3 DMMP structure

This DMMP acknowledges the potential environmental impacts associated with any future drainage maintenance required at the Kings Forest site, and details strategies to mitigate them.

Each control strategy is based upon proven environmental management methods and is presented as a commitment. The commitments made within this document will form the basis of future assessments, which will be made available to the Tweed Shire Council (TSC) for review.

The DMMP is based on a series of tables for use during drainage maintenance. 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 DMMP. The format is presented below for reference purposes.

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person responsible</td>
<td>This is the person who has accepted the responsibility of implementing the DMMP provisions detailed on this page.</td>
</tr>
<tr>
<td>Issue</td>
<td>The issue with which the table deals.</td>
</tr>
<tr>
<td>Operational policy</td>
<td>The operational policy or management objective that applies to the element.</td>
</tr>
<tr>
<td>Performance criteria</td>
<td>Performance criteria (outcomes) for each element of the operation.</td>
</tr>
<tr>
<td>Implementation strategy</td>
<td>The strategies or tasks (to nominated operational design standards) that will be implemented to achieve the performance criteria.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>The monitoring requirements which will measure actual performance (i.e. specified limits to pre-selected indicators of change).</td>
</tr>
<tr>
<td>Auditing</td>
<td>The auditing requirements, which will verify implementation of, agreed construction and operation phase environmental management strategies and compliance with agreed performance criteria.</td>
</tr>
<tr>
<td>Reporting</td>
<td>Content, timing and responsibility for reporting and auditing of monitoring results.</td>
</tr>
<tr>
<td>Identification of incident or failure</td>
<td>The circumstances under which the agreed performance criteria are unlikely to be met and the risk of environmental harm increases dramatically.</td>
</tr>
<tr>
<td>Corrective action</td>
<td>The action to be implemented in case a performance requirement is not reached and the person(s) / company(s) responsible for action.</td>
</tr>
</tbody>
</table>
Commitment #

What the management has committed the company to.

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

13.3.1 General commitments

Commitment 1
The Developer undertakes to comply with the environmental implementation strategy as contained within the approved Drainage Maintenance Management Plan (DMMP).

Commitment 2
The Developer undertakes to fulfil all commitments made in this DMMP and to carry out its activities on the project site in accordance with relevant current statutory requirements and approved amendments.

13.3.2 Definitions
In this DMMP the terms have the following meanings:

- ASS means Acid Sulfate Soils. This is the collective term for both Actual Acid Sulfate Soils and Potential Acid Sulfate Soils.
- Maintenance means the removal of accumulated sediment from Blacks Creek for the purposes of maintaining conveyance.
- Developer means the party undertaking the development of the land and includes the person nominated as having the responsibility for implementing the provisions of the DMMP.
- Development means the development of the site as defined in this Project Application and future project applications.
- DECCW means the NSW Department of Environment, Climate Change and Water.
- DMMP means the approved Drainage Maintenance Management Plan and includes any amendments that may be approved from time to time.
- Sediment means unconsolidated, fine-grained material (typically derived from the weathering of rocks), that is transported by water and settles on the floor of seas, rivers streams and other bodies of water.
- Silt means sediment having particles finer than sand and coarser than clay (i.e. 2 to 63µm).
- Suspended solids means the concentration of filterable particles in water (retained on a 1.2µm filter) and reported by volume (mg/L).
- TSC means the Tweed Shire Council.
- Turbidity means a measure of the cloudiness of water, which is determined by the amount of light scattered by suspended particles.
13.4 Management of potential impacts – Maintenance phase

The DMMP requires the Developer to mitigate the potential environmental impacts associated with the maintenance of Blacks Creek.

During drain maintenance activities, a visual inspection of water quality within the drain is to be conducted to ensure waters are not excessively turbid or discoloured and that no degradation to flora or fauna has occurred.

13.4.1 Mechanical maintenance

<table>
<thead>
<tr>
<th>Person responsible</th>
<th>Contractor’s Site Manager, Environmental Consultant</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Issue</th>
<th>Mechanical maintenance and control of sedimentation in Blacks Creek.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational policy</td>
<td>To minimise soil disturbance during the mechanical removal of sediment from Blacks Creek.</td>
</tr>
<tr>
<td>Performance criteria</td>
<td>Drain maintenance operations should aim to minimise physical drain disturbance during sediment removal.</td>
</tr>
</tbody>
</table>
| Implementation strategy | • To ensure existing roads are used to access Blacks Creek for mechanical maintenance (e.g. excavator, sucker trucks).  
• Conduct mechanical maintenance in stages to minimise disturbance to aquatic species.  
• To ensure the disturbance of deeper holes, snags and gravel bars is avoided during any necessary maintenance works.  
• To ensure the minimum core riparian zone widths outlined in the NSW Office of Water’s ‘Guidelines for riparian corridors on waterfront land’ (July 2012) are maintained or established.  
• To control sediment and acid generation, drain maintenance operations should not be conducted during runoff events.  
• Drain maintenance should not enlarge or alter the original drain profile.  
• Drain maintenance operations should aim to maintain drain stability by minimising disturbance to vegetation root stock.  
• To ensure any sediment that is removed is treated in accordance with Table 13.4.2 and disposed of in an appropriate manner, which will not enable it to become re-entrained in surface flows.  
• Culverts and causeways should be maintained in accordance with NSW Fisheries ‘Why do Fish Need to Cross the Road?’² |

² Fairfull, S. & Witheridge, G. (2003) Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings. NSW Fisheries, Cronulla
| Monitoring                                      | Carry out visual inspections during drain maintenance to ensure there has been minimal disturbance to the drain profile.  
|                                                | Visually inspect bank stability and vegetation root stock to ensure it is not excessively disturbed by drain maintenance operations. |
| Auditing                                       | Visual inspections are to be carried out after rainfall events to verify that runoff has not degraded the profile and stability of recently maintained drains. |
| Reporting                                      | The drain maintenance records shall be retained on site for inspection by local and state authorities.  
|                                                | Records of issues such as sedimentation, flooding, water quality and aquatic species mortality within drains shall be maintained on site.  
|                                                | Any fish kills at the site should be recorded. |
| Identification of incident or failure          | Degradation of drain stability.  
|                                                | Excessive removal of vegetation root stock.  
|                                                | Degradation of surface water quality.  
|                                                | A recorded fish kill. |
| Corrective action                              | Identify the reason for stability failure and amend the drain maintenance procedures and/or decrease maintenance intensity as necessary. |

Commitment 3
The Developer will appropriately implement drainage maintenance works to minimise physical drain disturbance during sediment removal.
13.4.2 Acid sulfate soil treatment

<table>
<thead>
<tr>
<th>Person responsible</th>
<th>Contractor’s Site Manager, Environmental Consultant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Issue</strong></td>
<td>Assessment and treatment of acid sulfate soils identified onsite.</td>
</tr>
<tr>
<td><strong>Operational policy</strong></td>
<td>No acid sulfate drain spoil is to be disturbed or excavated without appropriate treatment.</td>
</tr>
<tr>
<td><strong>Performance criteria</strong></td>
<td>All material excavated from drains to be limed at prescribed rate before stockpiling.</td>
</tr>
<tr>
<td><strong>Implementation strategy</strong></td>
<td>Lime treatment of drain spoil removed from drains situated below RL 5.0m AHD is to be undertaken according to the following treatment measures:</td>
</tr>
</tbody>
</table>
| **Lime treatment** | • All spoil removed from drains situated below RL 5.0m AHD is to be treated with lime at a rate of 5kg/m².  
    • To aid mixing, half the lime should be applied to the drain spoil in situ before mechanical maintenance (e.g. weed bucket/sucker truck).  
    • The remaining half of the lime should be applied as a bed onto which the removed drain spoil material is placed.  
    • Exposed drain batters must be surface limed within 24 hours following drain maintenance.  
    • Limed drain spoil should not be stockpiled within 40m of an existing drain.  
    • Lime in the treatment bed is to be thoroughly mixed into the stockpiled drain spoil as soon as the spoil material is dry enough to cultivate.  
    • If iron monosulfides (‘black drain sludge’) are removed from the drain, this material should be limed at the prescribed rate and cultivated into the topsoil as soon as the material is dry.  
    • Verification testing should be conducted to ensure that the spoil material has been appropriately treated. In the event that additional liming is required, the treatment process and verification testing should continue until adequate treatment has been achieved. |
| **Monitoring** | Collect lime delivery dockets and compare with calculated amounts required. |
| **Auditing** | Auditing will be undertaken by the site manager and/or the developer’s nominated representative.  
Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the provisions outlined within the DMMP. |
<table>
<thead>
<tr>
<th>Reporting</th>
<th>Records kept on site during maintenance operations and available for inspection at all times.</th>
</tr>
</thead>
</table>
| Identification of incident or failure | Examination of works for evidence of;
|                                   | • Yellow efflorescence on soil surface,                                                       |
|                                   | • Iron staining of soils or water,                                                             |
|                                   | • Sulphurous odour and;                                                                       |
|                                   | • Low pH in water bodies.                                                                     |
| Corrective action                 | Testing of drain spoil materials using POCAS method and re-evaluation of prescribed liming rate.|

Commitment 4

The Developer will ensure that no acid sulfate drainage spoil is disturbed or excavated without appropriate treatment.
### 13.4.3 Sediment and erosion control

<table>
<thead>
<tr>
<th>Person Responsible</th>
<th>Consulting Engineer, Contractor’s Site Manager</th>
</tr>
</thead>
</table>

#### Issue
- Sediment and erosion control.

#### Operational policy
- To prevent the displacement of sediment and soil from drains particularly during storm events.
- Compliance with the NSW POEO Act (1997).

#### Performance criteria
- Drain maintenance operations should aim to minimise erosion and the resultant turbidity of discharge waters.

#### Implementation strategy
- To contain sediment during drain maintenance, temporary sediment and erosion control measures (including silt fences, floating silt curtains and sediment fence isolation barriers) are to be installed prior to maintenance works.
- To ensure any sediment that is removed is treated in accordance with Table 13.4.2 and disposed of in an appropriate manner, which will not enable it to become re-entrained in surface flows.
- Sediment and erosion control measures will be implemented in accordance with sections 12.3.3 and 12.3.4 of the *Kings Forest Stage 1 Project Application Erosion and Sediment Control Plan* (G&S 2012) – Section 12 of the *Kings Forest Stage 1 Management Plan*.

#### Monitoring
- Carry out visual inspections after rainfall events (>25mm in 24hrs) to ensure that erosion measures are in place and operational to suit the activities taking place at the time.

#### Auditing
- Visual inspections to be carried out monthly and after rainfall events to verify that control measures are in place and properly maintained.

#### Reporting
- Reporting only required if insufficient sediment and erosion measures are identified.

#### Identification of incident or failure
- Signs of erosion on site.
- Damaged or failed erosion control devices.
- Declining/deteriorating water quality as identified by Environmental Consultant.
- Excessive build-up of sediment.

#### Corrective action
- Apply remedial measures to improve sediment and erosion measures. This may include:
  - the installation of additional erosion and sediment control measures
  - maintenance of existing controls
  - additional controls or structures as directed by the Environmental Consultant or the developer’s nominated representative.

### Commitment 5

The Developer will ensure that appropriate and adequate erosion and sediment control measures are installed and maintained for the duration of drainage maintenance works.
13.4.4 Surface water quality management

| Person responsible | Contractor’s Site Manager |

**Issue**
- Surface water quality in the receiving environments, including Cudgen Creek.

**Operational policy**
- To prevent adverse impacts to surface water quality in the downstream receiving environment.

**Performance criteria**
- It is proposed that site-specific water quality data would be collected over a minimum of twelve months in accordance with Table 12.2.1 of the *Kings Forest Stage 1 Project Application Erosion and Sediment Control Plan Report* (G&S 2012) – Section 12 of the *Kings Forest Stage 1 Management Plan* and used to establish water quality criteria for the purpose of comparison with construction and operational phase water quality results.

The following interim water quality criteria based on data collected by TSC would be adopted for any surface water downstream of sediment and erosion control measures (e.g. silt curtains or sediment fence isolation barriers).

<table>
<thead>
<tr>
<th>Water Quality Parameter</th>
<th>Release Criteria</th>
<th>Criteria Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH*</td>
<td>5.5 – 7.5</td>
<td>Range</td>
</tr>
<tr>
<td>Salinity</td>
<td>&lt;12ppt</td>
<td>Maximum</td>
</tr>
<tr>
<td>Suspended solids</td>
<td>10mg L⁻¹</td>
<td>Maximum</td>
</tr>
<tr>
<td>Turbidity</td>
<td>10NTU</td>
<td>Maximum</td>
</tr>
<tr>
<td>Dissolved oxygen</td>
<td>5mg L⁻¹</td>
<td>Minimum</td>
</tr>
<tr>
<td>Total Iron</td>
<td>1.7mg L⁻¹</td>
<td>Maximum</td>
</tr>
<tr>
<td>Total Aluminium</td>
<td>9mg L⁻¹</td>
<td>Maximum</td>
</tr>
<tr>
<td>Litter and gross</td>
<td>No man made material &gt;5 mm in any dimension</td>
<td>--</td>
</tr>
<tr>
<td>pollutants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil and grease</td>
<td>No visible film, no detectable odour</td>
<td>--</td>
</tr>
</tbody>
</table>

*Note that pH will be consistent with receiving water quality. If receiving waters are estuarine, pH should be 5.5-7.5; if receiving waters are acidic, pH should be 4.2 – 6.7 in accordance with the *Threatened Species Management Plan* (JWA 2012) for habitat requirements for Wallum Froglet (*Crinia signifera*) and Olongburra Frog (*Litoria olongburensis*).*

**Implementation strategy**
- Surface water monitoring will be undertaken downstream of sediment and erosion controls (i.e. floating silt curtains or sediment fence isolation barriers).

- Sediment and erosion control measures will be implemented in accordance with sections 12.3.3 and 12.3.4 of the *Kings Forest Stage 1 Project Application Erosion and Sediment Control Plan* (G&S 2012) – Section 12 of the *Kings Forest Stage 1 Management Plan*. 

18 AGRICULTURE WATER ENVIRONMENT
All monitoring equipment shall be maintained in a functional condition, calibrated and serviced at a frequency compliant with the manufacturers’ specifications.

Further visual assessment shall be undertaken for evidence of:
- yellow efflorescence on soil surface
- iron staining of soils or water.

### Monitoring

In situ testing of pH, electrical conductivity, suspended solids, turbidity, dissolved oxygen, litter and gross pollutants and oil and grease will be conducted daily during drainage maintenance works.

Collection of samples for laboratory analysis of total and dissolved iron and aluminium will occur weekly. If iron floc, sediments or iron staining are observed downstream of works, samples should also be taken for laboratory analysis and works halted until water has been treated to adequate levels. Iron indicator strips will be used if practicable.

### Auditing

Auditing will be undertaken by the site manager and/or the developer’s nominated representative.

Alternatively, auditing may be carried out by an independent consultant. The audit should include an inspection of site activities, complaints, corrective actions and reporting to assess compliance with the provisions outlined within the DMMP.

### Reporting of monitoring results

Water quality monitoring results will be recorded and kept onsite for inspection by local and state government officers.

The contractor to notify TSC immediately of breaches with potential to cause harm to the environment.

Water quality monitoring reports will be provided to TSC or DECCW upon request.

### Identification of incident or failure

The results of the water quality monitoring indicating concentrations exceeding the limits specified in the ‘performance criteria’ for a single water quality parameter.

Deterioration in surface water quality downstream of the development resulting from site works or the discharge of waters from the development site.

### Corrective action

Take necessary steps to address the problem to prevent a recurrence.

Addition of hydrated lime to contained waters to increase pH to within the recommended range (consistent with the receiving environment).

Addition of gypsum to contained waters to reduce suspended solids as required.

Drainage maintenance works to cease until appropriate monitoring has occurred and results verify that the release criteria have been met.

Commitment 6

Management will ensure, through inspection and in situ analysis that no adverse impact on surface water quality results from drainage maintenance on site.
13.5   Administration of the DMMP

13.5.1 Amendment of the DMMP
The Developer may make an application to Tweed Shire Council to amend the provisions of this DMMP. The application shall:

• be in writing; and
• specify the provisions of the DMMP to which the application relates; and
• state how the proposed amendments achieve the objectives of the provisions to which the amendments relate.

Tweed Shire Council shall approve the amendment where Council is satisfied, acting reasonably, that the proposed amendments achieve the objective of the provisions to which the amendment relates.

13.5.2 Incident management
The Developer and any person appointed by the Developer as having responsibility for a control strategy set out in this DMMP have clearly defined responsibilities under the NSW Protection of the Environment Operations Act (1997) to report any incidents likely to cause material or serious environmental harm.