PERFORMANCE CRITERIA	ACCEPTABLE MEASURES
P5 Provision is made for: (a) minimisation of waste material; (b) separation of recyclable material; (c) storage of waste and recyclable material; (d) collection of waste and recyclable material; **in a manner that minimises adverse impacts on the amenity and safety of surrounding areas.**	**A5.1** Waste minimisation, storage and servicing arrangements are made in accordance with *Planning Scheme Policy No. 5 – Operational Works*.[10]
P6 Erosion and sediment control devices and techniques must prevent adverse impacts on the water quality of downstream stormwater drainage and natural systems.	**A6.1** Erosion and sediment control is undertaken in accordance with the *Planning Scheme Policy No. 14 – Erosion and Sediment Control*.
P7 The integrity of assets to be delivered to Council is protected.	**A7.1** Construction is undertaken in accordance with the standards set out in *Planning Scheme Policy No. 5 – Operational Works*.

10 Council may request the preparation of a Waste Management Plan, in accordance with Planning Scheme Policy No 10 (Preparation of Waste Management Plans).

APPENDICES
Maroochy Shire Council
List of Planning Scheme Policies

General

For Development Contributions

MAROOCHY PLAN MAPS APPENDICES

TITLE	REFERENCE NUMBER	RELEVANT SCHEME REFERENCE
Road Hierarchy	Map 1	Planning Scheme Policy No. 6
Biodiversity Desired Environmental Outcomes	Map 1	Planning Scheme Policy No. 12
Biodiversity Critical and Irreplaceable Values	Map 2	Planning Scheme Policy No. 12
Water Supply Trunk Infrastructure	Figure 1	Planning Scheme Policy DC 1
Sewerage Trunk Infrastructure	Figure 2	Planning Scheme Policy DC 1
Water Supply Zonal Headwords Areas	Figure 3	Planning Scheme Policy DC 1
Sewerage Sub-Catchment Headworks Areas	Figure 4	Planning Scheme Policy DC 1
Bikeways DC2 – South	Figure 1	Planning Scheme Policy DC 2
Bikeways DC2 – North	Figure 2	Planning Scheme Policy DC 2
Bikeways DC2 – Hinterland	Figure 3	Planning Scheme Policy DC 2
Trunk Road Infrastructure	Map 1	Planning Scheme Policy DC 3
Stormwater Quality Improvement Infrastructure Treatment Styles	Figure 4.2.1	Planning Scheme Policy DC 4
Public Parks Infrastructure	Figure 1	Planning Scheme Policy DC 5
Land for Community Facilities	Figure 1	Planning Scheme Policy DC 6

2.11 Bonding

Performance of the revegetation works may be linked to a monetary performance bond. Bond relinquishment may be incremental and linked to a set of floristic and structural milestones to be stipulated within the revegetation plan. Any bonding arrangements are to be commensurate with the total cost of the revegetation works.

MAROOCHY SHIRE COUNCIL PLANNING SCHEME POLICY NO.4

Preparation of Geotechnical Reports

1. Introduction

1.1 Purpose

The purpose of this Planning Scheme Policy is:

- To ensure that development in any area of potential landslip has proper regard to factors affecting land stability; and
- To provide guidance on the preparation and assessment of geotechnical reports for certain types of development.
- To provide guidance on the geotechnical certifications required for certain types and stages of development.

1.2 Applicability

This Policy applies to any development involving works requiring the excavation or filling of land which:

- Has slopes generally greater than 20% (1:5) outside of the Buderim, Coolum and Blackall Range areas as shown on Regulatory Map 1.3 (2 of 2) (Steep Land); or
- Has slopes greater than 15% within the Buderim, Coolum and Blackall Range areas; or
- Is on a site identified on Regulatory Map 1.3 (1 of 2) Landslip Hazard as being of Moderate, High or Very High Landslip Hazard, or;
- In Council's opinion, may be subject to land instability.

Geotechnical investigations are to be part of all stages of a proposed development.

1.3 Background

The stability of land which is steep, erosion prone, or prone to slip can be adversely affected by:

- Earthworks (excavation and filling),
- The erection of buildings and other structures (like swimming pools, tennis courts, retaining walls, roads and driveways),
- On-site disposal of wastewater, and
- Other significant changes to natural drainage patterns.

Inappropriate development on potentially unstable land can have significant risks for property and human safety on the site itself, and in areas both above and downslope of the site. To ensure that such risks are avoided or minimised, Council's Planning Scheme provides for geotechnical reports to be prepared where development may affect or be affected by land instability.

Slope assessments of escarpment areas at Buderim and Mapleton/Maleny have been carried out and published, notably by Coffey and Partners (1981), W.F. Willmott (1983) and Golder Associates (2002) respectively.

Council recognises that site-specific studies are generally more accurate than broader regional or district studies and will assess each geotechnical report accordingly.

1.4 Expertise Required to Prepare a Geotechnical Report

The preparation of geotechnical investigation and report requires specialised skills.

An appropriately qualified professional that must prepare a geotechnical report ("Geotechnical Engineer") is a person holding a degree in civil engineering or engineering geology with current membership of a recognized professional institution and who's primary business (with a minimum of 5 years experience) is in the field of geotechnical engineering or engineering geology. It is highly desirable that the person has local experience with landslip areas, or demonstrable general experience with landslips and their mitigation and rehabilitation. The Geotechnical Engineer must hold and maintain professional indemnity insurance for any one occurrence of at least $20 million.

1.5 Geotechnical Reports Must be Addressed to Council

Geotechnical reports must be addressed to Maroochy Shire Council and clearly state that the report is for the use and reliance upon by Council.

2. Requirements of a Geotechnical Report

2.1 General

A geotechnical report must document investigations of:

(a) A description of the subject land and proposed development

(b) Description of existing conditions of the development site, including assessment of land stability and geotechnical constraints to development (as outlined in Section 2.3 below)

(c) The suitability of the site for the proposed development, having regard to the prevailing geological and topographic conditions. This includes an assessment of likely effects or impacts of the development upon slope stability and landslip potential

(d) Measures recommended to mitigate impacts, including siting, engineering and other measures required to ensure a satisfactory form of development. Such measures must not require high whole of life cycle costs, particularly deep soil drainage within single residential lots or public land

(e) Conclusions and recommendations (as outlined in Sections 2.4 and 2.5 below)

The extent and detail of investigation will depend upon the particular site characteristics and the nature of the development being proposed. Council will require each report to demonstrate a scope and depth of investigation appropriate to the specific proposal. The extent of the work carried out is to be determined by the Geotechnical Engineer, provided that the conclusion of the investigation is that the site, house, retaining wall or other features under assessment have a Factor of Safety of at least 1.5.

Contour plans are to have 1.0 m contours developed from low level aerial photographs using "objective" photogrammetric techniques.

Geotechnical reports are to reference the Australian Geomechanics Society (AGS) 'Landslide Risk Management Concepts and Guidelines' dated March 2007. This document includes 'Some Guidelines for Hillside Construction' which should be included in the geotechnical report.

The preferred format of a geotechnical report is outlined in Appendix 1.

2.2 Previous Geotechnical Reports

Where a geotechnical report has already been provided as support documentation to Council for previous applications over the subject land (i.e. reconfiguring a lot or material change of use), these documents must be clearly referenced in the report prepared as support documentation for the subsequent application (i.e. operational work or building work). Such support documentation is to be available to the Council and be current and specifically relevant to the proposed development.

The guidance in this Policy outlines all matters to be addressed in a geotechnical report, on the basis that such support documentation (earlier geotechnical reports) is not available. In the event that geotechnical reports and certifications for the previous applications are available items already covered in these earlier reports / certifications may be referenced and covered in less detail.

2.3 Investigation of Existing Conditions

The geotechnical report must include an investigation of existing site conditions. This is to include an assessment of the existing stability of the subject land and details of geotechnical constraints on building and/or other development works on the site. The investigation of existing conditions is to include descriptions of:

(a) Existing geology (surface and subsurface materials, soil/rock stratigraphy) and geomorphology (slopes, ground contours, natural features, terrain analysis, landslip features) both locally and regionally in the area of interest. This may include review of information available from published materials, including Regulatory Map No. 1.3 (1 of 2 and 2 of 2), aerial photography, geological maps and reports (i.e. the Geological Survey of Queensland Record Series).

Field investigations and tests using excavators, drill rigs and/or seismic techniques will be required, particularly to assess the following factors:

- Depth of soil overburden within proposed works areas (including roads, infrastructure, building sites, potential swimming pools, tennis courts, garage, access driveways and the like).
- Classification of surface and subsurface materials to determine:

  (1) Erosion potential;

  (2) Foundation conditions that could affect structural performance;

  (3) Suitability for wastewater disposal; and

  (4) Any other relevant characteristics.

(b) Evidence of previous instability (i.e. irregular contours, hummocky topography, scarp faces in area of tension crack(s), curved and/or non-vertical tree trunks, broken kerb and gutters, cracked or uneven roadway surfaces, distressed houses or other buildings). Classification of any existing slips (type, severity and likely mode of failure) should be determined.

(c) Extent and type of any existing occurrences of erosion.

(d) Assessment of surface drainage patterns and characteristics (rapid surface runoff, presence of pools / ponds).

(e) Assessment of sub-surface drainage characteristics (i.e. presence of water table, springs, swampy

areas, wet grass types, presence /depth to / special conditions (artesian) of groundwater, and possible presence of confined aquifer beneath site). Field investigations and tests using excavators, drill rigs and/or seismic techniques will be required to assess groundwater conditions and their likelihood of developing artesian conditions during periods of adverse weather.

(f) Existing vegetation cover.

(g) Any existing site improvements (i.e. buildings, other structures, earthworks).

The results of all field and laboratory tests must be included in the geotechnical report, including the location and level (including datum) of field investigations such as boreholes, trench pits and core penetrometer soundings.

2.4 Conclusions

The geotechnical report must include conclusions about the overall suitability of the land for the proposed development. These are to include clear statements of:

(a) Whether all existing / proposed lots are presently stable;

(b) Whether all lots, and associated completed buildings (i.e. detached house) and infrastructure, will remain stable in the long term – that is, has a factor of safety against failure of at least 1.5; and

(c) Whether any conditions need to be placed on the development of lot/s to maintain long term stability.

2.5 Recommendations

The geotechnical report must include recommendations that clearly outline the following:

(a) Whether the site has any history of landslips

(b) Whether the proposed development (including all lots and buildings where applicable) will alter the present state of stability of the subject land

(c) Whether any portion of the subject land should be excluded from the development and included in natural, undisturbed or rehabilitated areas

(d) Whether the proposed development (including all lots and buildings where applicable) will adversely affect the current state of stability of adjoining land

(e) Whether the proposed development (including all lots and buildings where applicable) should allow cuts and fills and if so, to what depth

(f) Whether retaining structures are required and if so, provide necessary foundation design parameters, including drainage requirements

(g) Whether any special design features are required to stabilise or maintain the stability of the subject land, or portions of the subject land (including each lot where applicable)

(h) Whether any special surface and/or subsurface drainage measures need to be taken to improve or maintain the stability of the subject land, or portions of the subject land (including each lot where applicable)

(i) Whether on site disposal of liquids should be allowed

(j) Whether any follow-up inspections are required by the Geotechnical Engineer during construction

The recommendations must also provide guidance on appropriate measures required to make the site suitable for the proposed development, including:

- Preferred locations for buildings, other structures, driveways, etc
- Foundation requirements such as bearing pressures, piling parameters, special techniques for expansive clays, etc
- Pavement types and design
- Construction methods to avoid problem areas associated with loose materials and groundwater seepage
- Preferred excavation / retention / stabilisation techniques and suitability of excavated materials for use in on-site earthworks
- Surface and subsurface drainage requirements. Deep soil drainage within single residential lots or public land is not acceptable to Council
- Preferred methods of wastewater disposal
- Vegetation protection and revegetation requirements

3. Required Certifications by Geotechnical Engineer

3.1 General

Formal certifications by a Geotechnical Engineer will be relied upon by Council to make judgements on the suitability of developing land for residential purposes and on approving stages of developments.

Certifications must be prepared by a Geotechnical Engineer and be addressed to Maroochy Shire

Council. Where a member of an engineering company, certification should be by the engineering company or an appropriate officer or employee of the engineering company on behalf of the company.

Additional certifications may be required by Council in special circumstances.

3.2 Reconfiguring a Lot

3.2.1 Council's endorsement of the plan of survey

(a) Certification that:

(1) A stable building area exists on each lot;

(2) Stable driveway crossovers / driveways and services can be constructed to service each lot in accordance with Maroochy Council Standard Drawings R-0050, R-0056 or AS 2890;

(3) Each roadway cutting or fill can be retained or treated to maintain its long-term stability;

(4) All necessary services (water mains, stormwater drains and sewer lines and the like) can be installed within the natural slopes or fills without detrimentally affecting the long-term stability of the natural or altered slopes;

(5) The proposed roadworks, services and house development earthworks will not interfere with the natural seepage of water from the slopes;

(6) The proposed works, including provision of services, will not adversely affect the stability of the stable building areas; and

(7) The stable building area on each block will remain stable over the long term.

Analyses must show a minimum factor of safety against landslip of 1.5.

(b) Certification that the works have been designed according to the Geotechnical Engineer's recommendations and have a minimum factor of safety against landslip of 1.5.

3.3 Material Change of Use

3.3.1 Prior to Commencement of Use

(a) Certification that the design works associated with the use have been undertaken according to the Geotechnical Engineer's recommendations and have a minimum factor of safety against landslip of 1.5.

3.4 Operational Work

3.4.1 With application

(a) Certification that the operational work plans address all likely geotechnical risks associated with construction works proposed for the site, and that the works undertaken in accordance with the plans will not pose any significant risk to the stability of the site or adjacent properties. Analyses must show a minimum factor of safety against landslip of 1.5.

(b) Certification that the stability of the road and driveway cuts, as designed, have been analysed using conservative soil parameters and that the net impact of the cuts is such that it will not adversely affect the stability of the road or the surrounding areas. Analyses must show a minimum factor of safety against landslip of 1.5.

(c) Certification that all cuts have been designed and analysed using conservative soil parameters and that the net impact of the cuts is such that it will not adversely affect the stability of the site or the surrounding areas. Analyses must show a minimum factor of safety against landslip of 1.5.

(d) Certification that any retaining walls are designed to carry any load that could reasonably be applied. Particular consideration must be given to possible home-sites and driveways. A plan showing the carrying capacity of all the proposed retaining walls is required to assist future construction within the development. Analyses must show a minimum factor of safety against landslip of 1.5.

3.4.2 Upon completion of works

(a) Certification that the works have been constructed according to the Geotechnical Engineer's recommendations and have a minimum factor of safety against landslip of 1.5.

3.5 Building Work

3.5.1 To be provided with application

(a) Certification that the building plans address all likely geotechnical risks associated with construction works proposed for the site, and that the works undertaken in accordance with the plans will not pose any significant risk to the stability of the site or adjacent

properties. Analyses must show a minimum factor of safety against landslip of 1.5.

(b) Certification that the footing design is appropriate to support the structure under the existing and potential site conditions and that the footing system and associated cuts will not adversely affect the stability of the site or the surrounding areas. Analyses must show a minimum factor of safety against landslip of 1.5.

(c) Certification that all cuts have been designed and analysed using conservative soil parameters and that the net impact of the cuts is such that it will not adversely affect the stability of the site or the surrounding areas. Analyses must show a minimum factor of safety against landslip of 1.5.

(d) Certification that the retaining walls are designed to carry any load that could reasonably be applied. Analyses must show a minimum factor of safety against landslip of 1.5.

(e) Building plans that have been countersigned by the Geotechnical Engineer to the effect that any special conditions/design features required by the Geotechnical Engineer have been included in the design. Analyses must show a minimum factor of safety against landslip of 1.5.

3.5.2 Prior to Final Inspection Certificate

(a) Certification that the works have been constructed according to the Geotechnical Engineer's recommendations and have a minimum factor of safety against landslip of 1.5.

Appendix 1: Preferred Format of Geotechnical Report

The report must be presented in a format suitable to the individual proposal and illustrated by photographs and sketches as appropriate. A suggested typical report format is as follows:

1. **Introduction**
   - 1.1 Details of Development
   - 1.2 Site Location and Description (including survey co-ordinates/co-ordinate system)
   - 1.3 Method and Scope of Investigations
   - 1.4 Qualifications of Responsible Individual(s) and/or Company
2. **Description of existing conditions**
   - 2.1 Geology (local and regional)
   - 2.2 Topography
   - 2.3 Groundwater
   - 2.4 Surface Drainage
   - 2.5 Vegetation
   - 2.6 Buildings, Other Structures, etc
3. **Assessment of land stability**
   - 3.1 Existing Conditions
   - 3.2 Geotechnical Constraints to Development
4. **Description of proposed development**
   - 4.1 Site Layout
   - 4.2 Proposed Development Components
   - 4.3 Potential Geotechnical Effects
5. **Assessment of development impacts**
   - 5.1 Site Layout
   - 5.2 Roadworks, Driveways and Other Pavements
   - 5.3 Earthworks (excavation, materials usage)
   - 5.4 Foundations
   - 5.5 Surface Drainage
   - 5.6 Wastewater (treatment and disposal)
   - 5.7 Overall Effect of Development on Stability
6. **Measures recommended to mitigate impacts**
7. **Summary and Conclusions**
8. **Site Plan**

APPENDIX – Field and Laboratory Test Results

8.1 Bonding

8.1.1 Purpose

The purpose of this section is to set out the circumstances and processes associated with Council requirements for:

- accepting security for proposed operational works prior to commencement of construction
- accepting security for completion of operational works prior to 'On Maintenance'

The security is required to protect the progress of works by the developer.

'Bonding' is the submission of a financial security to Council by the developer, and is used in the following circumstances:

- To cover all development construction works during the operations and maintenance period.
- To cover incomplete development obligations in order to obtain the early release of Survey Plans.

Note: Development obligations refer to all conditions of approval relative to the development permit. This includes, but is not limited to, Civil Works, Landscaping Works, Park improvements, provision of 'As Constructed' information, test certificates, revegetation, sediment and erosion control.

8.1.2 Process

The following processes shall be completed in relation to Bonding:

- Provide schedule of works, including maintenance, and value which are proposed to be bonded
- Substantiate proposed timing for the completion of outstanding works
- Complete Deed of Agreement
- Pay relevant fees
- Provide suitable security

8.1.3 Prior to Construction

Council may, with agreement of the applicant, request a construction security bond to facilitate and secure the duration of the works until uncompleted works bond can take affect.

The bond is to be accompanied by Council's Security Lodgement Form clearly identifying the purpose of the bond together with the Consulting Engineer's /Ecologist /Landscape Architect/ Environmental /Landscape Consultant certification of the value of the works.

The bond is to protect and assure the following:

- All works, including maintenance are carried out in accordance with approvals;
- Any safety or environmental incident is attended to within reasonable time by the contractor (superintendent to supervise). To be used as security in the event of public safety or potential harm for Council to amend and make safe at developers cost.

8.1.4 Uncompleted Work Bonds

Council may, at the request of the Principal Consultant, agree to release the Plan of Subdivision prior to completion (On Maintenance) of development obligations subject to the following:

a) The plan of the development conforms to the conditions of the development approval.

b) The applicant has prepared and submitted to the Council, engineering drawings, landscape drawings, specifications and test results as required by the Council in the format requested by Council, in conformity with the development approval.

c) Note: Any amendments required during Bonding period and On Maintenance are to be carried out by the applicant and provided to the Council prior to Off Maintenance approval.

The applicant shall demonstrate:

a) 100% bulk earthworks to be completed and stabilised to Council's satisfaction

b) 100% water supply

c) 100% sewerage reticulation

d) 100% pump stations (if applicable)

e) 100% stormwater drainage

f) 100% structures – drainage, bridges, accesses:

g) majority of all approved subdivisional works have been satisfactorily completed

The applicant has provided to the Council:

a) A fully revised priced schedule of development works, including a confirmation of costs for proposed maintenance bond from original submission

b) A list of infrastructure assets (including landscape works) that are proposed to be handed over to Council (detail items to be completed)

c) Certification from a suitably qualified engineer (RPEQ) that the information provided to Council is correct and that the uncompleted works are scheduled for completion within three (3) months of the date of the sealing of plans

d) Payment of prescribed non-refundable administration fee

e) Applicant has entered into a bond agreement (refer Appendix G) with the Council as detailed in the suitable options;

f) The applicant has provided security for the completion of the uncompleted works in the form as provided by the Council.

8.1.5 Special Conditions

The Council may upon receipt of a written submission from the applicant, waive or relax components of the requirements on an individual basis.

In relation to development works given as a condition of approval by the Council, or by referral agency as a condition of the approval, the Council shall specify the works to be completed prior to acceptance of the bond for compliance.

8.1.6 Maintenance Security Bond

A bond, being the greater of 5% of the contract value of the whole works or $10,000, is to be lodged with the Council to guarantee satisfactory maintenance of the works both:

- prior to commencement of work; and
- during the maintenance period.

For landscaping works (excluding rehab & WSUD) a bond, being the greater of 1.5 times the value of the 12 month maintenance works or $10,000, is to be lodged with the Council to guarantee satisfactory maintenance of the works.

The Bond security given shall be in the form of either:

- cash;
- an unconditional bankers undertaking from a bank; or
- such other security as the Council may approve.

8.1.6.1 Subdivisional Uncompleted Works

In respect of engineering works relating to subdivisions (or reconfiguration of lots), an amount of 1.5 times the value of the uncompleted works at the time of the lodgement of the security.

In respect of vegetation rehabilitation, WSUD, wetlands, an amount of 1.5 times the value of the works and maintenance works for a three (3) year period is to be lodged with the Council to guarantee satisfactory performance of the works. The Bond is to be lodged with Council:

- Prior to commencement of work; and
- Prior to survey plan release (if applicable).

The Bond security shall be given in the form of either:

- Cash;
- An unconditional undertaking from a bank; or
- Such other security as the Council may approve.

8.1.6.2 Other Development Works (other than building works)

An amount of 2 times the value of the uncompleted works at the time of the lodgement of security.

8.1.7 Administration of Bonding

For Operational works, the applicant shall prior to the date of sealing the Plan of Subdivision carry out the following:

- Complete and execute the subdivisional works secured by the bonding agreement
- Ensure the works are accepted 'On Maintenance' by the Council in accordance with On Maintenance requirements or unless otherwise bonded.
- Provide a maintenance security deposit in accordance with allowable processes defined by the Council
- Prepare and submit to the Council final 'On Maintenance' 'As Constructed' plans in accordance with Council defined requirements.

8.1.8 Release of Bond

The Council may upon written request of the applicant:

- Reduce the security as the subdivisional works are constructed in accordance with the conditions of the subdivisional approval
- Release the security excluding the maintenance deposit where the applicant has fulfilled the provisions of the bonding agreement

- Release the maintenance security where the applicant has complied with requirements set out in Councils acceptance of 'Off Maintenance'
- The Council may where the applicant has failed to comply with the terms of the Bonding Agreement, serve written notice on the applicant requiring the applicant within seven (7) days of the receipt of the notice to either comply with the terms of the bonding agreement or show cause why the Council shall not call up the security and complete the works
- The Council may call up the security if the applicant has failed to comply with notice served as stated above, and in the interest of public safety, environmental health or structural failure certain works are required to be undertaken by the Council prior to the expiration of the term of the Bonding Agreement

8.1.9 Appeal Process

Any person dissatisfied with a decision of a delegated officer may request that the decision be reviewed.

Where a person requests a review of the decision of a delegated officer, the General Manager, Planning and Development shall refer the request to the Review Board of the following officer, General Manager, Environmental Planning and Development, and any other two delegated officers where available or any other officer acting in their capacity.

The General Manager, Planning and Development shall advise the person who requests a review of the date of the committee meeting and their right to attend the Review Board.

The Board shall meet at the earliest possible date to review the decision of the delegated officer.

The Board shall consider the representations of the person requesting the review, of the persons who address the Committee and the advice of the delegated officer.

The Board shall have delegated authority from the Council to:

- Reaffirm the decision of the delegated officer with or without modifications
- Amend a decision of the delegated officer or
- Reverse the decision of the delegated officer

The General Manager, Planning and Development shall advise the person who has requested the review pursuant to the decision of the Board.

8.1.10 Construction Security Bond

Prior to construction of the works commencing the developer is required to lodge a security bond.

The bond is required to provide security to Council in the event that costs are incurred as a result of the following:

- Protection of on-street works, including landscape works, from damage by contractors, sub-contractors and suppliers
- Repairs to on-street works resulting from damage caused by contactors, sub-contractors and suppliers
- Protection and repair of existing Council services (i.e. sewerage connections, water connections etc)
- Inadequate Soil and Water Quality Management during construction
- Inadequate provision for traffic
- Urgent action required by Council to resolve unsafe construction or emergency repairs required to protect persons and/or property from consequential damages, safety and environmental incidents.

Any costs incurred by Council in responding to the above circumstances will be recovered from the Security Bond.

At the completion of the works and the acceptance of the works 'On Maintenance', the security bond shall be returned to the developer or may be substituted for the maintenance bond.

8.2 Plan Sealing

8.2.1 Introduction

A person who makes application for the sealing of a plan of subdivision shall make the application in the form required by the Council and shall accompany such application with an application fee of an amount which is in accordance with a scale of fees determined by the Council, and subject to resolution as determined.

8.2.2 Submission

The application for sealing of the plan shall not be lodged with Council until:

- all subdivision works have been completed to the satisfaction of Council and accepted 'On Maintenance', unless otherwise bonded; and
- all drawings detailing current 'As Constructed' data excluding outstanding bonded works have been approved by the Council.

8.2.3 Application Requirements

The application made for sealing of the plan shall be:

a) made in writing

b) signed by the applicant or applicants, or :

- in the case of a partnership by one of the partners thereof, or in the case of an incorporated association by an authorised officer thereof
- in the case of a company or body corporate, under the seal of the company or body corporate,
- in the case of a consultant acting on behalf of the applicant the consultant

c) accompanied by the consent in writing of the registered proprietor of the registered lessee of the land as the case may be

d) accompanied by checklist for endorsement of survey plans

e) Accompanied by the plan of subdivision suitable for deposit in the office of the Registrar of Titles which plan shall comply in all respects with the Development Permit for Reconfiguration, the approval of the engineering requirements, drawings and specifications.

f) Accompanied by an approval of road names for any new roads being created prior to the application for Plan Sealing.

g) All fees and Development Contributions in accordance with checklist for endorsement of survey plans shall be paid

h) All contributions or infrastructure charges as detailed in a development approval, infrastructure agreement or infrastructure charges notice shall be paid

i) A electronic file containing an Autocad drawing file or a Civilcad DXF file containing only the allotment layout, street names and allotment numbers. The electronic file shall be accompanied by certification from the registered surveyor that the information provided is identical to that submitted to the Department of Natural Resources for registration.

j) Accompanied by a copy of the approved Flood Study. This Flood Study must be accompanied by a letter of certification from a RPEQ experienced in hydrologic/hydraulic engineering stating that the attached Flood Study is the latest study referenced and approved by Council's relevant Development Permits and incorporates all amendments.

Where a development is staged, the flood study and certification must be provided with every stage.

8.2.4 Plan Details

In no case shall amendments be made which contravene the terms and conditions of the Council approval.

An electronic copy of the plan is to be supplied to Council in DWG format in accordance with the document 'Specification for the Supply of Digital Georeferenced Data'. Copies of this document are available from Council's Customer Service Centres.

The Council shall compare the plan of subdivision for sealing with the Council approved plan of subdivision.

The Council shall compare any new road names shown on the plans for subdivision sealing with the road name proposal approved by Council.

If the Council finds the plan of subdivision conforms with the proposal plan as approved, and no material change, variation or alteration has been made, and all conditions of the subdivision approval have been complied with to the Council's satisfaction, sealing shall be carried out.

Council shall as part of the operation note its approval on the plan of subdivision. and shall return the plan of the subdivision to the applicant to be lodged at the office of the Registrar of Titles.

In the event of the Registrar of Titles, upon lodgement of the plan approved by Council requires an alteration of any such plan in any particular way, the licensed surveyor who prepared the plan shall within a period of one (1) month from the requested alteration, notify the Council and forward two (2) copies.

8.3 As Constructed

8.3.1 General

This section of the Planning Scheme Policy details Council's Construction Guidelines for work that requires Council's approval with regard to its construction, compliance, and acceptance. The submission include:

- As Constructed Submissions
- Standard Civil Works Inspection and Testing Plan (CWITP) 'As Constructed' plans serve three distinct functions:
- Checking: To enable a quantitative check of the 'As Constructed' works against the

approved design, so as to ensure design philosophies and criteria have been achieved

- Recording: To provide an accurate record of the 'As Constructed' locations of underground services.
- Quantity: To provide record of quantity to understand scope of works for maintenance planning.

Information required for the checking function must be presented in a form which allows ready comparison between design and 'As Constructed' data by experienced engineering and landscape staff, whereas information required for the recording function must be presented in a form which allows ready and unambiguous interpretation and understanding by a wide range of users including engineers, parks managers, landscape architects, maintenance and trades persons, and the general public.

8.3.2 Prerequisites For Submission

It is Council's intention to expedite the approval and checking process by reducing the level of checking from rigorous detailed checking to checking on an audit basis. Compliance with these guidelines is essential. In particular, the following points should be strictly adhered to in the supervision of development works and preparation of 'As Constructed' drawings:

- Major departures[14] from approved designs should be approved by Council in writing before implementation and before submission of 'As Constructed' drawings. Refer also to the Statement of Compliance.
- Construction shall generally comply with the approved design (as amended above, if required), within the tolerances cited in the Planning Scheme Policy No. 5 – Operational Works or Council's standard specifications. Refer also to the Statement of Compliance.
- Where tolerances are not stated in the relevant Planning Scheme Policy or Council's standard specifications, tolerances shall be in accordance with the relevant Australian Standard and accepted engineering / landscape and horticultural practice.

14 *Major departures in this context means a change which varies the design intent.*

8.3.3 Submission For Approval

Except as specifically excluded below, every drawing included in the approved design, including stormwater calculation sheets and catchment plans, is to be submitted in certified 'As Constructed' form. It is the responsibility of the developer to ensure all requirements associated with the Council 'As Constructed' details are completed.

As Constructed details are required to help future works identify the real asset location and properties for future reference. Many details may differ during construction from that of the original design, and data records shall be maintained by the consultant during all phases of work.

As Constructed Submission Documentation

'As Constructed Submission Documentation' shall be forwarded to Council prior to the acceptance of the works 'On Maintenance'.

The 'As Constructed' Submission provides for the following activities:-

- Checking
- Recording
- Compliance and Acceptance
- Asset Data Capture and Recording
- Acceptance of works on maintenance

The 'As Constructed' information is to be presented in hard copy plans as well as an electronic format for use and direct transfer to Council's Geographic Information system (GIS) and Asset Management Systems.

8.3.3.1 Statement Of Compliance – Non-Complying Works

It is recognised that, despite the most diligent efforts of the consultant/applicant, some non-complying works may be discovered on review of the 'As Constructed' information.

The Statement of Compliance is intended to place responsibility for identifying and reporting non- conforming works with the consultant and to expedite Council checking and approval. The Statement shall:

- identify the nature and number of non-complying items;
- nominate the Consultant's proposals for rectification or Council acceptance; and
- provide Council with a fixed time frame for completion of the rectification works

It is expected that in many cases, a short, comprehensive and accurate Statement of

Compliance will enable Council to grant immediate 'On Maintenance' provided all other requirements have been satisfied.

8.3.3.2 Properties

Correct street names and lot numbers shall be shown on all relevant drawings.

8.3.3.3 Earthworks

Certification of design plan(s) require that sufficient levels are provided to show that works have been constructed in accordance with the approval and conform to the level of tolerances below:

- general cut and fill: + 100 mm
- in nominated flood free areas: + 100 mm /- 25 mm

8.3.3.4 Roadworks

Certification of design plan(s) is sufficient provided that 'As Constructed' grade and cross-sectional information is confirmed in areas where roadway overland flow capacities are critical.

Confirm that permanent street, warning, and regulatory signs are placed in accordance with the approved drawings and standard locations. Accurate survey is not required.

'As Constructed' pavement thickness and composition, including minimum CBR values for the pavement materials shall be noted on the longitudinal sections.

8.3.3.5 Stormwater Drainage – Minor and Major Flow Systems

Certification of design plan(s). Details are to be amended only where the tolerances below are exceeded:

- invert levels: + 25 mm, – 25 mm
- surface levels: per earthworks above
- structure locations: Lateral ±100mm along line ± 300 mm
- pipe diameters: note if varied from design
- pipe classes/types: note if varied from design

'As Constructed', departures from design, exceeding the above tolerances, will be accepted where the consultant/applicant can demonstrate and certify that the design intent is not compromised.

Only where the drainage systems have been constructed out of tolerance and they may be extended by future development either upstream or downstream; and in exceptional circumstances such as incorrect pipe sizes and major out of tolerance construction, shall the design calculation sheets be amended to reflect the 'As Constructed' performance of the systems.

8.3.3.6 Stormwater Drainage – Major Flow System

Amend levels and sections to critical overland flow paths in roadways, pathways and parks to 'As Constructed'.

Confirm that critical overland flow paths perform to approved design criteria. Critical overland flow paths are these where design storm flows approach flow path's capacity.

8.3.3.7 Stormwater drainage – Detention Basins

Crest and spillways shall be trimmed to a tolerance of +50 mm -25 mm. Crest levels, spillway levels, profile and volume shall be amended to 'As Constructed' values.

8.3.3.8 Interlot Drainage

'As Constructed' roof water longitudinal sections are not required. 'As Constructed' departures from design in excess of the tolerances nominated below will be accepted, if the Supervising Engineer/applicant certifies that Council's design criteria have been achieved.

Information required:

- Manholes/pits
  - Location (two ties)
  - surface level
  - invert levels
- Lines
  - dia., class, type
  - length
  - grade
  - alignment
- House connections
  - location (two ties)
  - surface level
  - invert level
- Tolerances
  - invert level: +25 mm, -25 mm
  - surface level: as per earthworks above
  - location: 1000 mm from design

provided that such deviation does not result in conflict or interference with any other existing

or proposed structure or service, including property boundaries.

8.3.3.9 Landscape Works

Certification of design plans require certification that landscape works, assets and infrastructure have been installed in accordance with approved specifications including but not limited to:

- Approved plan(s)
- Conditions of the Decision Notice
- Relevant environmental and horticultural standards such as Australian standards, national specifications and Council standard drawings.

8.3.3.10 'As Constructed' Documentation

Development works will not be accepted 'On Maintenance', or as practically complete, until the following documentation has been submitted to Council:

- As Constructed Plans – hardcopy and electronic
- Inspection and testing certification by the applicant(s)/supervising engineer
- Certification of all landscape works by qualified landscape architect, horticulturalist, environmental scientist, ecologist contractor, arborist.
- Certification of Foundation Conditions by the applicant(s)/supervising engineer (where applicable)
- All Operation and Maintenance Manuals eg: water supply and sewerage pumping equipment, Stormwater Quality Improvement Devices, Playground equipment, Wetland Management Reports, Landscaping
- 'As Constructed' data for electrical wiring diagrams for pumping stations, etc.
- Manufacturers details and maintenance procedure for GPT's
- Wiring diagrams for traffic lights
- Copies of test results on:
  - compaction of fill
  - subgrade CBR
  - CBR 15 material quality
  - CBR 15 compaction
  - subsoil drain filter media grading
  - base, subbase and subgrade replacement course material quality
  - base, subbase, subgrade and subgrade replacement course compaction
  - prime or primer seal spray and application rates
  - AC core tests
  - playground soft fall impact attenuation tests
  - soil for horticultural purposes
  - sewer vacuum tests
  - grading of sewer bedding
  - grading to water main bedding
  - water main pressure tests
  - water main water quality tests
  - any concrete testing required by the technical specifications
  - any other job specific testing carried out or required by Council if used.

Should any of the above test results fail to meet specification, the applicant is to include in the submission to Council, details of retesting/ rectification carried out.

The documentation should be presented in a logically assembled and bound document including a table of contents confirming completeness.

8.3.3.11 Plan Format

All plans are to be provided in signed hardcopy format and also in electronic format.

8.3.3.12 Legibility of Paper Plans

As all 'As Constructed' drawings are imaged, linework and lettering shall be of suitable thickness and clarity to be legible when imaged typically, 0.25 mm black lettering.

Numerical amendments are usually denoted as a diagonal line through the design value with the 'As Constructed' value noted adjacent. Other amendments are usually denoted by encircling with a notated cloud.

8.3.3.13 Electronic Plans

Electronic plans are to be supplied for the following:

- As Constructed Survey Plan of Lot layout and all civil works.
- Full set of amended approved design plans showing all as constructed changes.

All electronic plans are to be supplied to Council on either CD or by e-mail and must be accompanied by a 'Document Transmittal Form'.

All electronic data supplied in the form of Computer Aided Drafting (CAD) files must comply to the specifications in the document 'Specifications for the Supply of Digital Georeferenced Data'. Copies of this document are available from Council's Customer Service Centres.

8.3.3.14 'As Constructed' Drawings

'As Constructed' drawings for roadworks and drainage, are to be submitted on completion of the works.

It is strongly recommended that 'As Constructed' information be collected and checked as the works progress to identify construction errors as early as possible so that their rectification or the seeking of Council's approval for the change does not delay granting of 'On Maintenance'.

'As Constructed' drawings for water and sewerage reticulation mains will be prepared by Council Officers at the applicant's expense.

Prior to release of the plan of survey and/ or acceptance of the works on-maintenance, the supervising engineer is to supply a DWG. Drawing file (at a scale of 1:500) of the final lot layout and any external works, including approved street names, lot numbers and landscaping, complete with the engineer's title description of the development. In the case of subdivisional works, the data is to be accompanied by written certification that the submitted information is identical to the RP plan lodged with Council for plan sealing. If the submitted RP plan is altered, a copy of the amended information in DWG Format, must be forwarded to Council within 7 days.

Development works will not be accepted 'On Maintenance' until such time as all of the 'As Constructed' drawings have been received, checked and approved.

8.4 On & Off Maintenance

8.4.1 General

This section defines the requirements to be applied prior to 'On Maintenance' approval and 'Off Maintenance' asset handover by the representatives from Maroochy Shire Council.

8.4.2 Acceptance of Works 'On Maintenance'

Council will accept operational works 'On Maintenance' on completion of those works to an acceptable standard, period of twelve months (for most issues) except where defined in activity register, and compliance with any conditions of the development permit which may include:

- completion of works in accordance with the requirements and conditions of the development permit
- submission of all 'As Constructed' documentation
- payment of any headworks or other contributions or charges specified in the development permit or levied by Council
- Submission of Engineer's certification that the works have been undertaken in accordance with the approved plans and specification and to Council's requirements.
- Submission of all test results required by the approved Inspection and Testing Plan
- Submission of location and AHD values of Permanent Survey Marks installed in the subdivision.
- Landscaping maintenance programs submitted.

Prior to acceptance of any works 'On Maintenance' it will be necessary for the works to be inspected.

In the event of the works being unacceptable, a reinspection fee is to be charged for subsequent inspections. Fees are defined under infrastructure charges obtained from Maroochy Shire Council representatives.

Following a satisfactory 'On Maintenance' inspection and acceptance of the 'As Constructed' drawings and documentation, the applicant is to submit a written request for acceptance of the works 'On Maintenance' and release or reduction of any uncompleted works bond within seven (7) days.

Council will, upon confirming that the maintenance security bond amount has been approved and received, and all other relevant fees and charges paid, confirm acceptance of the works 'On Maintenance' and arrange for release or reduction of any uncompleted works bond held.

During the maintenance period the applicant is to pay the full cost of any necessary repairs to roadworks, drainage and associated work, water and sewerage reticulation, pump stations and associated equipment. The costs are also to cover all required reoccurring maintenance and testing to satisfy the Councils requirements, and for the developer to prove development criteria set out in original submission.

The applicant or the applicant's agent or representative will be advised of works required and a time in which repairs must be completed.

The applicant is responsible for maintenance works during the maintenance period and advising Council of any significant works.

Should a safety issue of either a technical or operational perspective be identified during the maintenance period, it shall be the responsibility of the developer to attend to the issue to ensure public safety is maintained. If the issue cannot be addressed immediately, safety of the site shall be carried out within 24 hours, and signed until repairs can be undertaken. Advice of all operations shall be provided to the Councils Shire Services unit.

Should the make safe attendance not be carried out by the developer or nominated representative within 24 hours, the Council shall be able to complete required safety works and all costs be borne by the developer of concern from the security bond.

8.4.3 'On Maintenance' Inspections

The consultant is to arrange for representatives from the Principal Contractor to be present in conjunction with a representative from the key nominated divisions from Maroochy Shire Council.

Failure to do so may result in cancellation of the inspection and/or the charging of a reinspection fee.

Notwithstanding the above, the works will not be formally accepted 'On Maintenance' until the maintenance security deposit has been lodged, and 'As Constructed' drawings and documentation have been submitted and approved.

8.4.4 Acceptance of Works 'Off Maintenance'

On completion of the maintenance period the applicant may request release of the maintenance bond.

Prior to final acceptance of the works by Council 'Off Maintenance' it will be necessary for the works to be inspected.

Should the works require refurbishment due to an extended maintenance period, the cost shall be borne by the applicant (ie landscape areas have reached their useful life and require replacement).

The applicant is to be responsible for ensuring that all Council requirements are satisfied prior to requesting an 'Off Maintenance' inspection.

In the event of the works being unacceptable, a reinspection fee may be charged for subsequent inspections.

Following a satisfactory 'Off Maintenance' inspection the applicant is to submit a written request for acceptance of the works 'Off Maintenance' and release of the maintenance security bond.

The Council will upon confirmation that no outstanding accounts arising from the development are due to Council, confirm acceptance of the works 'Off Maintenance' and arrange for the release of the maintenance security bond.

Should the applicant wish to maintain the works beyond the maintenance period, a separate agreement shall be entered into between the Applicant and the Council.

APPENDICES

Appendix A: Compliance Certificate

MAROOCHY SHIRE COUNCIL

STATEMENT OF COMPLIANCE

ENGINEERING DESIGN

This form duly completed and signed by an authorised agent of the Consulting Engineer shall be submitted with the Engineering Drawings for Council Approval as part of Operational Works Policy.

Name of Development _____

Location of Development _____

Applicant _____

Consulting Engineer _____

Drawings No. _____

It is hereby certified that the Engineering Drawings, and supporting reports, calculations and outlined details submitted herewith have been prepared, checked and amended in accordance with the requirements of the Maroochy Shire Council's Operational Works Policy and that the completed works comply with the requirements therein

We being Director(s) / Associate(s) of the Consulting Engineering Firm nominated above and being duly authorised on their behalf do hereby declare that our firm is qualified in the engineering fields relevant to this application, and that the attached engineering drawings, specifications and supporting calculations have been prepared where practicable, in conformance with all the condition of Councils subdivision approval dated the ___/___/___ and in compliance with the Maroochy Shire Councils requirements and planning policies, the Operational Works Policy, and with accepted engineering practice.

We further declare that our firm has / has not been engaged to provide Construction Inspection Services as detailed in the attached construction requirements and we shall facilitate the completion of the Inspection and test Plan requirements. In the provision of the Construction Inspection Services we undertake to exercise reasonable skill and diligence in order to ensure that the works referred to in this application shall be executed in accordance with.

(a) Councils Development Approval Conditions;

(b) Councils relevant policies;

(c) Council approved drawings, specifications and relevant industry and Australian Standards;

(d) Maroochy Shire Council codes and operational works policy

Consulting Engineer _____ **RPEQ No** _____

Name in Full _____

P.I. Insurance No. & Company _____

Signature _____ Date _____

PLANNING SCHEME POLICY NO. 12

Biodiversity

1 Introduction

1.1 Purpose

The purpose of this Planning Scheme Policy is to provide guidance regarding compliance with the Code for Nature Conservation and Biodiversity in the assessment of relevant development applications under Maroochy Plan 2000. This guidance is based on the outcomes of the Maroochy Biodiversity Strategy.

1.2 Applicability

This Policy applies to any code- or impact-assessable development application requiring assessment against the Code for Nature Conservation and Biodiversity. Applicable developments are outlined in the Tables of Development Assessment (Sections 4-6 of Volume 1).

1.3 Abbreviations

BAMM: Biodiversity Assessment and Mapping Methodology

CAR: Comprehensive, adequate and representative

DEO: Desired environmental outcome[1]

DNRM: Department of Natural Resources and Mines

EVR: Endangered, vulnerable or rare species according to the *Nature Conservation Act 1992* or the *Commonwealth Environmental Protection & Biodiversity Conservation Act 1999*

IPA: *Integrated Planning Act 1997*

RE: Regional Ecosystem

1.4 Reference

Maroochy Biodiversity Strategy, Ecotone Environmental Services, Econcern & Paul Summers Planning Strategies 2006

1 *For the purposes of this Policy, the term DEOs refers only to DEOs outlined in Map 1 and Table 1, and not those under Maroochy Plan 2000. It is noted however that compliance with these DEOs will assist in achieving compliance with those of Maroochy Plan 2000.*

2 Development Assessment Considerations

This section of the Policy outlines development assessment considerations for compliance with the Code for Nature Conservation and Biodiversity.

2.1 Impact- or Code-Assessable Applications under Chapter 3 of the IPA

(a) In determining impact- or code-assessable applications **lodged prior to commencement of this Policy**, Council will:

(i) Determine applications on the basis of compliance with the Code for Nature Conservation and Biodiversity; and

(ii) If commencement of this Policy is:

(1) Before the day the decision stage for the application started; or

(2) If the decision stage has stopped – before the day the decision stage is restarted:

Give weight to the extent it considers appropriate:

(1) Provision of clear protection and enhancement of the Critical and Irreplaceable Values depicted on Map 2; and

(2) Consistency with the DEOs depicted on Map 1 and explained in Table 1; or

(iii) If commencement of this Policy is:

(1) After the day the decision stage for the application started; or

(2) If the decision stage has stopped – after the day the decision stage is restarted:

Exclude specific consideration of the DEOs depicted on Map 1 and explained in Table 1, and the Critical and Irreplaceable Values depicted on Map 2. However, this Policy does not prevent Council negotiating improved biodiversity outcomes, particularly to maximise protection and enhancement of the Critical and Irreplaceable Values depicted on Map 2.

(b) In determining impact- or code-assessable applications **lodged after commencement of this Policy**, Council will seek development outcomes that:

(i) Provide clear protection and enhancement of the Critical and Irreplaceable Values depicted on Map 2;

(ii) Are consistent with the DEOs depicted on Map 1 and explained in Table 1; and

(iii) Comply with the provisions of the Code for Nature Conservation and Biodiversity.

2.2 Applications to Change Approvals or Conditions under Sections 3.5.24 or 3.5.33 of the IPA

In determining applications for changes to approvals or conditions, Council will have regard to the matters Council considered in the original application, as outlined in Section 2.1 of this Policy.

2.3 Applications to Extend Currency Periods under Section 3.5.22 of the IPA

Irrespective of the date of the original approval of the application, Council will seek development outcomes that:

(a) Provide clear protection and enhancement of the Critical and Irreplaceable Values depicted on Map 2;

(b) Are consistent with the DEOs depicted on Map 1 and explained in Table 1; and

(c) Comply with the provisions of the Code for Nature Conservation and Biodiversity.

To achieve these outcomes, the applicant may seek a concurrent application to change the approval or conditions under Sections 3.5.24 or 3.5.33 of the IPA.

Table 1: Biodiversity Desired Environmental Outcomes (Depicted on Map 1)

DESIRED ENVIRONMENTAL OUTCOME	BIODIVERSITY ATTRIBUTE
DEO 1 This land should: (a) Have any potential for broad-acre development[2] removed; (b) Be reserved under the CAR reserve system where ecologically viable and where satisfying CAR principles; and (c) Be buffered from potentially impacting peripheral land use.	Endangered vegetation within a habitat core
	Endangered vegetation within a habitat mosaic
	Endangered vegetation outside a habitat core
	Endangered vegetation outside a habitat core or mosaic
	Of concern vegetation within a habitat core
	Not of concern vegetation within a habitat core
DEO 2 This land should be further investigated to determine which areas may serve as compensatory habitat for loss of DEO 1 lands to development. Land that can serve as compensatory habitat should: (a) Have any potential for broad-acre development[4] removed; (b) If committed as compensatory habitat, be reserved under a CAR reserve system where ecologically viable and satisfying CAR principles; and (c) Be buffered from potentially impacting peripheral areas.	Regrowth vegetation within a habitat core
DEO 3 For the larger habitat cores of the Mary Valley and Ranges landscape element (C06a, C07a, C10a, C15a and C17a), land should: (a) Be retained for low intensity development focussed on strategically less significant areas not amounting to a proportion of more than 5% of the overall area of the particular habitat core; and (b) Be retained for revegetation and rehabilitation purposes. **DEO 4** For habitat cores not included in DEO 3 above[3], the land should be retained for revegetation and rehabilitation purposes	Non-remnant or non-regrowth within a habitat core

2 *e.g. urban and rural settlement, agriculture and forestry.*

3 *i.e. Smaller habitat cores of the Ranges and Mary Valley and habitat cores in the Midlands and Coastal landscape elements. These cores are of lower ecological viability due to smaller size; linear or convoluted shape; and pressures from adjacent high impact land use and could not support additional pressure from more intense development. The non-remnant and non-regrowth vegetation areas within these cores need to be revegetated and rehabilitated to bolster core viability.*

4 *Section 7.4 of the Biodiversity Strategy.*

DESIRED ENVIRONMENTAL OUTCOME	BIODIVERSITY ATTRIBUTE
DEO 5 This land should: (a) Have any potential for broad-acre development[4] removed from: (i) Remnant vegetation patches within 500m of habitat cores; (ii) Remnant vegetation patches adjacent to endangered REs; (iii) Remnant vegetation patches in the habitat mosaic where they form part of a defined linkage; and (iv) Remnant vegetation patches that have been identified as having particularly significant biodiversity values, comprising: • Core habitat for EVR species (BAMM Criterion A-very high); • Local endangered REs (BAMM Criterion B3); • Threshold of concern REs (as identified by DNRM); • Local threshold of concern REs (refer analysis in s7.4[4]); • Very high local relative ecosystem size (BAMM Criterion D3); • Very high ecosystem diversity (BAMM Criterion F); • Very high context and connection (BAMM Criterion G); and • Any other remnant vegetation tracts that are larger than 2ha in area. (b) Be supported by strategic rehabilitation of non-vegetated areas within the mosaic that: (i) Form part of a defined linkage; or (ii) Buffer remnant vegetation identified as having particularly significant biodiversity values [as defined by DEO 5(a)(iv) above]. **DEO 6** In areas where the potential for broad-acre development[4] is retained and exercised, compensatory habitat should be provided in habitat cores or mosaics and focus on areas to be revegetated and rehabilitated under DEO 3 above and strategic rehabilitation under DEO 5 above.	Of concern vegetation within a habitat mosaic Not of concern vegetation within a habitat mosaic
DEO 7 This land should have any potential for broad-acre development[4] removed from threshold bioregional of concern REs and threshold local of concern REs. Such threshold areas should: (a) Be reserved under a CAR reserve system where ecologically viable and where satisfying CAR principles; and (b) Be buffered from potentially impacting peripheral land use.	Of concern vegetation outside a habitat core or mosaic
DEO 8 This land should be further investigated to determine which areas may serve as compensatory habitat for loss of DEO 5 and DEO 6 lands to development. Land that can serve as compensatory habitat should have any potential for broad-acre development[4] removed.	Regrowth vegetation within a habitat mosaic

DESIRED ENVIRONMENTAL OUTCOME	BIODIVERSITY ATTRIBUTE
DEO 9 This land should: (a) Be retained for revegetation and rehabilitation purposes where it: (i) Occurs within 100m of a habitat core; (ii) Forms part of a defined linkage; (iii) Occurs within 50m of remnant vegetation identified as having particularly significant biodiversity values [as defined by DEO 5(a)(iv) above]; or (iv) Occurs within 50m of any other remnant vegetation tract greater than 2ha in area; and (b) Be retained for low intensity development.	Non-remnant and non-regrowth areas within a habitat mosaic
DEO 10 This land should retain development outcomes that result in moderate-low and low threats.	Remnant (not habitat specific)
	Regrowth (not habitat specific)
	Non-remnant and non-regrowth areas (not habitat specific)

PLANNING SCHEME POLICY NO. 13

Preparation of a Bushfire Management Plan

1. Introduction

1.1 Purpose

The purpose of this Planning Scheme Policy is to outline the information requirements required to be included in a Bushfire Management Plan.

1.2 Expertise Required to Prepare a Bushfire Management Plan

A Bushfire Management Plan should be prepared by a suitably qualified professional with appropriate technical expertise in the identification and mitigation of bushfire hazard. Suitable professionals may include those in the environmental management, landscape architecture, architecture, town planning and civil engineering fields.

1.3 Consultation

The Bushfire Management Plan should be developed after consulting with Council, responsible Rural and/or Urban Fire Brigade, and managers of adjacent parks or reserves. It is also desirable to consult other agencies or individuals, such as previous owners of the site or neighbours, who may have knowledge of the severity and nature of the bushfire hazard.

1.4. Other Reference Documents

State Planning Policy 1/03 – Mitigating the Adverse Impacts of Flood, Bushfire and Landslide (2003).

2 Specific requirements of a bushfire management plan

The Bushfire Management Plan:

a) is documented in writing, supported by appropriately scaled maps as required to assist in relating the Bushfire Management Plan to the particulars of the proposed development;

b) includes a statement of the aim and objectives, or purpose of the plan (e.g. to define the level of hazard on the land and identify actions and responsibilities for the management of the hazard);

c) summarises the results of any Bushfire Hazard Assessment Report prepared for the land, including identification of whether the land or different parts of the land have been determined to be High Bushfire Hazard Areas, Medium Bushfire Areas or Low Bushfire Hazard Areas;

d) is prepared by a person who holds qualifications consistent with those outlined in section 1.2 above;

e) incorporates consultation with the local Fire Brigade and where the land adjoins Council, State or Commonwealth land, the relevant land manager;

f) covers the whole of the proposed development site, including any parts of the land on which no development can occur;

g) includes consideration of potential off-site sources of fire hazard including particular land uses or physical features of the surrounding area (including details of properties within 100 metres of the boundary);

h) addresses the impact of the proposed development on the level of fire hazard experienced by other land in the surrounding area, including any land containing water, electricity, gas or telecommunications infrastructure;

i) addresses any implications for significant ecological areas[1], areas of cultural heritage importance or areas of landscape significance, including steps taken to minimise the potential impacts of specified fire hazard mitigation measures;

j) addresses the potential impacts of bushfire hazard mitigation measures on slope stability and on water quality in local receiving waters;

k) specifies fire hazard mitigation measures such as:

- elements of the development design, including the layout of roads and driveways, the location, size and orientation of buildings;
- specifications and materials for building design and construction;

1 Significant ecological areas includes areas identified in the Nature Conservation and Biodiversity Code, the Waterways and Wetlands Code or Planning Scheme Policy No. 12 Biodiversity.

- fire fighting infrastructure, including water supply and storage, equipment and fittings, fire breaks and maintenance/ access trails;
- specifications for vegetation clearing and landscape design, installation and maintenance;
- information for occupants, including required training for persons employed on the site during both construction and operational phases;
- details of long term management requirements including the frequency, extent and intensity of burning in areas proposed to be subject to regular controlled ignitions;
- details areas subject to mosaic or patch burning techniques, manual fuel reduction zones;
- site specific flora and fauna management considerations/objectives and proposed management techniques.

l) identifies parties responsible for specific actions taken under the Bushfire Management Plan;

m) justifies any variation from the fire hazard mitigation measures outlined in the Code for Development in Bushfire Hazard Areas (or Code for the Development of Detached Houses and Display Homes as applicable).

PLANNING SCHEME POLICY NO.14

Erosion and sediment control

Contents

Appendices

1 Introduction

1.1 Purpose

The purpose of this Planning Scheme Policy is:

a) To provide a reference and technical support to the Code for Erosion and Sediment Control; and

b) To provide guidance on the preparation of:

- Erosion Risk Assessments,
- Erosion and Sediment Hazard Evaluation Reports,
- Erosion and Sediment Plans (including Concept, Minor and Major Plans).

c) To guide environmental performance standards on land development sites in order to achieve the environmental management objectives.

1.2 Applicability

This policy applies to all assessable development for which the Operational Works Code is applicable.

2 Environmental Management Objectives

The environmental management objectives of this policy are to protect the environmental values of our natural waterways, and the healthy functioning of aquatic marine and wetland ecosystems, natural processes, and habitat.

This will be achieved by ensuring that the influence of site topography, soils and climate is adequately considered when decisions are made, and by minimising the impact of development with respect to:

2.1 Hydrological Processes

Minimising changes to the natural hydrological characteristics of a catchment, including percentage imperviousness, stream power, frequency of runoff events, and base flows.

2.2 Natural Vegetation and Riparian Zones

Maximising ground surface and channel protection through the preservation of a natural vegetative cover, especially preservation of indigenous riparian, floodplain and foreshore vegetation. Clearing should not take place in these areas or in close proximity to wetlands unless it is in the overriding public interest.

2.3 Aquatic Habitat and Ecosystems

Protecting aquatic habitats and ecosystems, such as maintaining natural stream substrates, meander form, channel roughness and geometry.

2.4 Water Quality

Minimising the amount of pollution such as sediment and soil nutrients entrained in stormwater runoff, through appropriate erosion and sediment controls, and removing entrained pollutants by implementing best practice stormwater management.

3 Qualifications

Erosion and Sediment Risk Assessments, Hazard Evaluation Reports and Control Plans must be prepared by a registered professional such as a Registered Professional Engineer (Qld) who has appropriate experience and demonstrated skills in erosion and sediment control. This person must have completed an advanced specialised training course in erosion and sediment control, provided under the auspices of a reputable body such as the International Erosion Control Association.

Mass movement/slip potential assessments in an Erosion Hazard Evaluation Report must be prepared by a Registered Professional Engineer (Qld), skilled and experienced in geotechnical surveys.

4 Information Supporting Development Applications

The type and extent of information required in support of an application depends on the environmental risk and the stage of the approval process. See Figure 1.

4.1 Erosion Risk Assessment

All developments to which this Policy applies require an initial **Erosion Risk Assessment** to assess the level of further investigation required, and ultimately the kind of erosion and sediment control plan needed.

The assessment is made by calculating the predicted total soil loss from the site for the entire duration of the site disturbance. This involves using the Revised Universal Soil Loss equation (RUSLE), factoring in the area of disturbance and the time the area is to be disturbed.

The formula for calculating the predicted total soil loss is:

$$R = A \times B \times T$$

Where

R = predicted total soil loss in tonnes

A = calculated soil loss in tonnes/hectare/year (see Revised Universal Soil Loss Equation (RUSLE))

B = surface area of disturbance (hectares)

T = predicted duration of the disturbance (months disturbed/12)

The RUSLE application is freely available in a computer program called SOILOSS (Rosewell, 1993[1]). The local input data for the RUSLE equation can be found in the Maroochy Manual for Erosion and Sediment Control (MESC).

Development applications will need to be accompanied by calculations and supporting information.

Alternatively, applicants may use the Site Data Sheet to derive soil loss (see Appendix 5).

The assessment will categorise the development as either:

a) low risk site (150 tonnes or less of soil loss over the period of disturbance);

OR

b) high risk site (greater than 150 tonnes of soil loss over the period of disturbance).

The following supporting information, prepared in accordance with this policy, is required for:

1 *Rosewell, C.J. (1993). "SOILOSS-A program to assist in the selection of management practices to reduce erosion" NSW DNR web-site*

4.2 Material Change of Use or Reconfiguration of a Lot

All material change of use applications and reconfiguration of a lot (other than low risk sites) require an:

a) *Erosion and Sediment Hazard Evaluation Report* (see section 5 below); and

b) *Concept Erosion And Sediment Control Plan*

4.3 Operational Works and Building Works

All applications for Operational Works Approval and Building Works Approval (other than low risk sites) require:

a) an *Erosion and Sediment Hazard Evaluation Report*, and

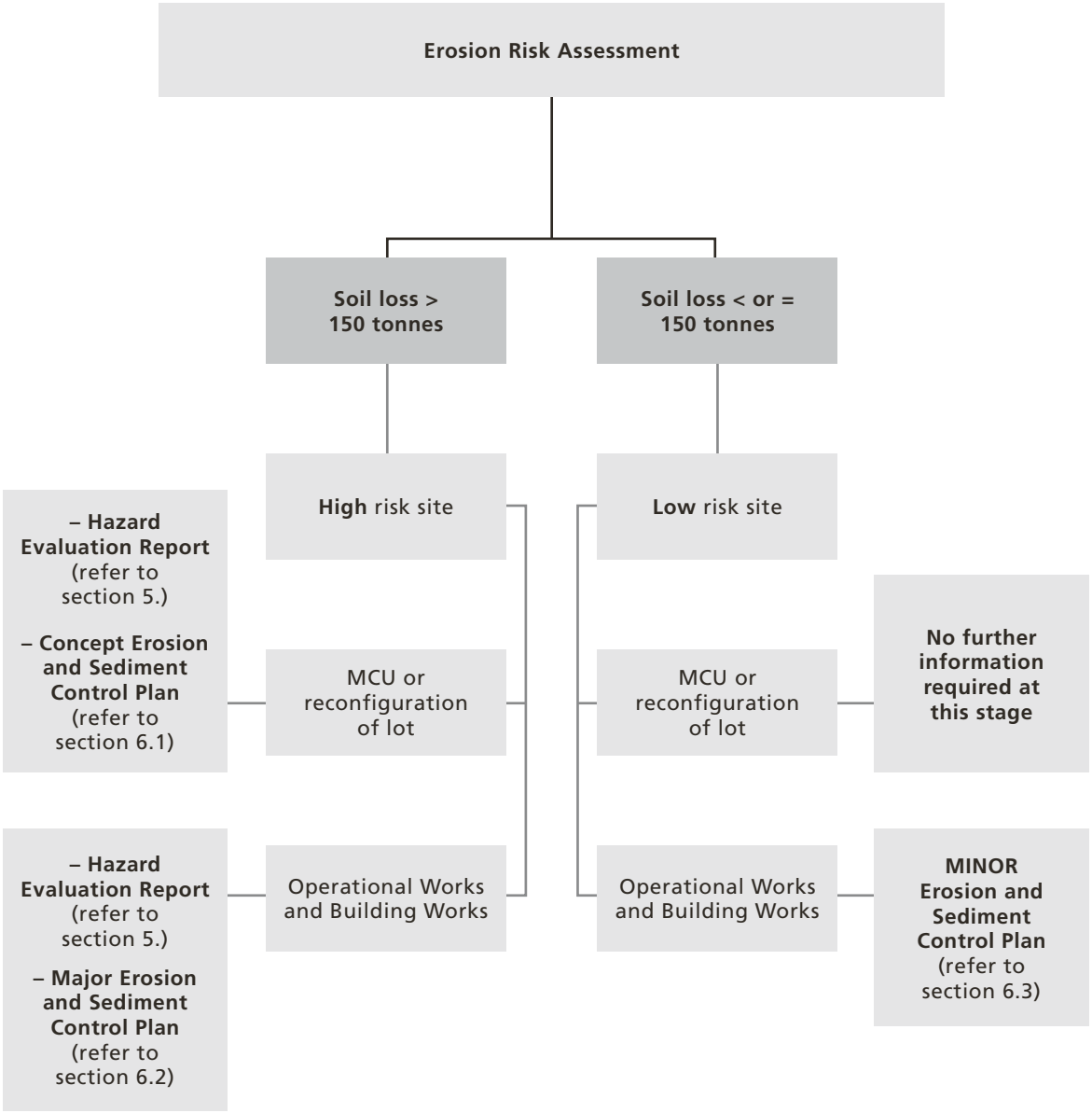
b) a ***Major*** *Erosion and Sediment Control Plan.*

All applications for Operational Works Approval and Building Works Approval which have been calculated as low risk sites require only a ***Minor*** *Erosion and Sediment Control Plan*.

4.4 Prior Approvals

Where a requirement for an Erosion and Sediment Hazard Evaluation Report, or a Concept Erosion and Sediment Control Plan has been met as part of a prior approval for a site, and that Plan or Report is still relevant, the prior Assessment, Plan or Report can be presented in support of a current application.

Figure 1 Summary Site Assessment and Control Plan Requirements.



5 Erosion and Sediment Hazard Evaluation Reports – High Risk Sites

The Report must be prepared in accordance with the Maroochy Manual for Erosion and Sediment Control (2007).

The Report must be set out in the following format and address the specified issues:

5.1 Hydrologic Impact

Effects on receiving waterways, in terms of geomorphology, water quality and ecosystems as a consequence of the proposal including consideration of:

a) increased imperviousness; and

b) increased runoff during clearing, bulk earthworks and construction activities.

5.2 Physical Characteristics, Constraints and Opportunities

This includes erosion hazard, topography, hydrology, seasonal weather patterns and risks, and riparian and wetland protection issues.

It involves preparation of a contour plan to scale, and assessment of factors which could preclude the siting or effective implementation of any required erosion and sediment control measure, including:

a) site characteristics, e.g. topography (slope gradient and aspect), landform attributes (site morphology, slope morphology, landform elements), site condition (percentage ground cover, current condition, expected dry condition), lithology (rock outcrop, identification method, substrate material), hydrology (presence and depth of free water, permeability, profile drainage), erosion hazards, salinity, erosion, etc.;

b) soil profile and regolith characteristics, e.g. layer depth, colour, mottles, pH, layer boundary. Examine soil profiles to a depth of at least 1.5 metres or maximum depth of proposed disturbance and/or to bedrock;

c) soil water status, field texture, structure (grade, size, shape), ped coating, fabric, coarse fragments (type, amount, size), pans, segregations, consistence, lithology of parent material, etc.;

d) laboratory data, including:

- particle size analysis (<0.002 mm, 0.002 to 0.02mm, 0.02 to 0.2 mm, 0.2 to 2.0 mm and 2 to 75 mm) (AS 1289 C6.2),
- dispersion percentage (Ritchie, 1963) and Emerson Aggregate Test (AS 1289 C8.1). Note: with strongly subplastic soils (generally, those stabilised by iron and red in colour, e.g. Krasnozems) particle size analysis for determination of erodibility should be undertaken without the use of dispersing agents, such as Calgon;
- electrical conductivity, exchangeable cations, cation exchange capacity, and soil nutrient status; and
- other information at the discretion of the soil scientist to support designation of constraints and in consideration of any land use requirement, such as profile permeability class, soil wet strength, and mass movement hazard.

Where published soils data exists for a site (eg in the Maroochy Manual for Erosion and Sediment Control) this may be used to the extent of the dataset, which will usually only **partially** meet these requirements. At least one confirmatory full lab analysis test is required for every site, except for small sites where exempted in Table 1. This includes one borehole with a representative analysis of each major soil horizon and, where site geomorphology is variable, a competent borehole examination is required of each different landform element (eg drainage depression, foot slope, ridge) to assess whether further lab tests are necessary in each unique soil unit identified.

In areas not covered by the soils maps, or where confirmatory testing shows soils diverging from the map data, testing utilising a NATA laboratory is required, conforming with the methodology in the Maroochy Manual for Erosion and Sediment Control, at the intensity shown in Table 1.

Table 1 Soil sampling intensity for *Erosion Hazard Evaluation* for all sites outside Council soil maps.

Area of site disturbance	Number of Boreholes (Level 1 Assessment)	Number of Boreholes (Level 2 & 3 Assessments)
< 250 m²	No testing generally required	No testing generally required
< 1000 m²	2 holes	1 hole
Up to ½ ha	4 holes	2 holes
Up to 1 ha	4 holes	3 holes
1-2 ha	6 holes	4 holes
2-3 ha	8 holes	6 holes
3-4 ha	10 holes	8 holes
> 4 ha	5 holes / 2 ha	2 holes / ha

The methodology should, except as specified otherwise here, conform with the latest version of the document *Brisbane City Council Soil Sampling & Testing Guideline for Erosion Potential*.

In certain circumstances, more detailed levels of information might be required, such as in sensitive locations where a detailed land capability survey is required or where further site-specific information is required, e.g. suitability for onsite domestic waste water disposal. In these circumstances, where appropriate guidelines for collection of site data exist, they should be followed.

For Operational Works applications, soil nutrient analysis is also required to be included for revegetation purposes. This involves testing topsoils typically for pH, cation exchange capacity (CEC), exchangeable cations (calcium, magnesium, potassium, manganese, sodium and aluminium) as a percentage of CEC, calcium/magnesium ratio, phosphorus, nitrate nitrogen, conductivity (salt), trace elements, and organic carbon.

6 Erosion and Sediment Control Plans

This policy provides for three types of Erosion and Sediment Control Plans (E&SC Plans):

a) **Concept E&SC Plans**

b) **Minor E&SC Plans**

c) **Major E&SC Plans**

The type of E&SC Plan required is dependant on the type of application and the erosion risk associated with the site. Figure 1 above clearly sets out which type of E&SC Plan is required.

All E&SC Plans must:

a) be prepared by an appropriately qualified person (refer to section 3);

b) be submitted for approval prior to commencement of any site works;

c) provide a suite of measures which collectively constitute best practice environmental management and which are likely to enable the objectives of this Policy to be met;

d) where erosion and sediment control plans and calculations are required, be submitted to the standard and in the form shown in the appropriate Appendix herein;

e) be prepared in accordance with the Maroochy Manual for Erosion and Sediment Control (2007).

6.1 Concept E&SC Plans

Concept E&SC Plans are prepared as part of material change of use and lot reconfiguration applications for high erosion risk sites. Their purpose is to establish, for the benefit of Council and the proponent, that it is feasible to control receiving water impacts using cost-effective measures. Normally, conceptual plans do not contain engineering drawings of structures.

Such a plan must demonstrate the following:

a) The design, intensity, configuration and establishment of development, is compatible with the physical constraints of the site and receiving environment.

b) The natural hydrologic regime and catchment imperviousness is not altered to the extent that changes to waterway flow, or channel geometry are likely, or aquatic ecosystems and habitats are likely to be adversely affected.

c) The feasibility of effective erosion and sediment control measures being implemented is substantiated, including consideration of the impacts of the overall development until permanent stabilisation of the site, providing a drawing showing a conceptual treatment train, and giving preliminary calculations for the sizing of a sediment basin or basins.

It must include a contoured site plan showing natural features and location of the proposed control structures, including sediment basins, and an overview strategy for the site outlining the sequence of development, and temporary and permanent management mechanisms, until commissioning of permanent water sensitive design features.

Finally, it must take full account of the findings of the site Erosion and Sediment Hazard Evaluation Report. For example site geology or high groundwater levels may preclude the installation of a conventional sediment basin. This should be assessed and made clear, as it could have serious implications ultimately for project costs and therefore project feasibility.

6.2 Major Erosion and Sediment Control Plans – Higher Risk Sites

A major E&SC Plan must be prepared, submitted and approved before land disturbance activities occur on any non rural lands.

The focus of the E&SC Plan is soil and water management during the land disturbance phase of development. A separate Integrated Water Management Plan is typically required to address post-construction stage stormwater management. These plans need to be developed in a complementary and integrated manner.

Design Procedures

Procedures should provide a mechanism for feedback between those preparing major E&SC Plans and those preparing many other plans for the works. This might include:

a) works in or close to a watercourse;

b) layout of lots, roads, cycle and pedestrian access corridors;

c) provision of recreation facilities, public open space or natural heritage reservations;

d) drainage of stormwater;

e) provision of services; and

f) rehabilitation of the site.

In planning for an integrated development, these and other requirements will influence and modify planning for each other; soil and water management should not be an *ad hoc* add-on option. The major E&SC Plans should be prepared at the same time as engineering design for all construction works and include them as part of the final engineering plans. Once engineering plans are complete, integration can be very difficult to achieve. Cross referencing soil and water management planning with site rehabilitation is also important.

Detail design procedures and standard drawings for most aspects of Operational Works are set out more fully in the Maroochy Manual for Erosion and Sediment Control, and for service installation, refer to Soils & Construction Volume 2A (see section 10 References).

Data Input to Major E&SC Plans

Major E&SC Plans should be based on an assessment of the physical constraints and opportunities to develop at the particular site, including those for soil, landform type and gradient, and hydrology.

Accordingly, the soil and water management team should include members with relevant tertiary qualifications or proven skills recognized by the appropriate authorities.

Content of Major E&SC Plans

Major plans should:

a) provide a set of contour drawings showing the real property description, north point, roads, site layout, boundaries and features. Contours on, and surrounding, the site should be shown so that catchment boundaries can be considered;

b) be at a suitable scale for the size of the project (as a guide around 1:1000 at A3 for a 2 hectare development and 1:500 at A3 for a 3000m^2 development);

c) provide background information including site boundaries, contour maps, existing vegetation, location of site access and other impervious areas and existing and proposed drainage pathways with discharge points also shown; and

d) show the location of lots, public open space, stormwater drainage systems;

e) show the location of land designated or zoned for special uses;

f) provide a program of works containing details on the nature and specific location of works (revegetation, cut and fills, run-off diversions, stockpile management, access protection), timing of measures to be implemented and maintenance requirements (extent and frequency);

g) show the way that works will modify the landscape and surface and subsurface drainage patterns (adding new, or modifying existing constraints). In this regard, the E&SC Plan should result from a consideration of layout options, each of which harmonise with the overall planning strategy and with each assessed for economy, aesthetics and function;

h) include a number of E&SC Plan drawings (see Model Plan Appendix 2 and 3) for major developments (more than 5 lots) to show the staging of works, and scheduling of progressive and final rehabilitation as civil works progress;

i) identify the riparian buffers and areas of vegetation which are to be protected and fenced off to prevent vehicle access;

j) indicate the location and provide engineering details with supporting design calculations for all necessary sediment basins;

k) the location and diagrammatic representations of all other necessary erosion and sediment control measures;

l) identify the clean and disturbed catchments, and flow paths, showing:

- diversion of clean runoff;
- collection drains and banks, batter chutes and stream crossings;
- location of discharge outlet points; and
- water quality monitoring locations.

m) show calculated flow velocities, sizing and channel lining protection, and velocity/energy checks required for all stormwater diversion and collection drains, banks, chutes, and outlets to streams;

n) show streams (perennial and non-perennial) and detail of stabilisation measures for all temporary stream crossings;

o) locate topsoil stockpiles;

p) provide details of chemical flocculation proposed, including equipment, chemical, dosing rates and procedures, quantities to be stored and storage location, and method of decanting any sediment basin.

In addition to the above data, major E&SC Plans require the following information:

a) the location and basic details of any other facilities proposed to be included as part of the development or works, such as:

- constructed wetlands;
- gross pollutant traps;
- trash racks or trash collection/separator units; and
- water sensitive stormwater treatment measures, such as bioretention systems, vegetated swales and infiltration measures.

Detailed design criteria for these latter facilities should be sourced from other manuals/reports and are not an integral part of a construction phase E&SC Plan – except that it is essential to demonstrate that across the two plans, water quality is adequately and continuously protected through all phases of the development to commencement of the off-maintenance period.

Note that the above listed works should not be located in or very near to watercourses. This is to avoid compromising the values and functions of the watercourses and their current or future riparian zones.

Major plans should also:

a) provide a site based management plan (SBMP) or equivalent documentation setting out maintenance and monitoring measures including monitoring of sediment basin(s);

b) the SBMP[2] should include adaptive and contingency management measures for the site to ensure E&SC measures are effective at all times, particularly just prior to, during and after wet weather;

c) prepare an Inspection and Test Plan[3].

6.3 Minor Erosion and Sediment Control Plans – Lower Risk Sites

These plans should be prepared for sites including:

a) minor developments where approval is required from Council; and

b) minor civil infrastructure works, including:

- urban and rural road construction and reconstruction;
- stormwater pipelines, including culverts;
- sewerage pipelines;
- water pipelines;
- bulk earthworks, including retention basins and sports fields; and
- electricity, telephone and natural gas lines.

Notwithstanding the above, Council may vary this requirement and require submission of a major E&SC Plan where, in its view, a high risk of polluting receiving waters exists[4].

Content

Where a minor E&SC Plan is required, the following information should be presented in the plan:

a) a set of contour drawings showing the real property description, north point, roads, site layout, boundaries and features;

b) locations and sizing of erosion control measures, drainage and flow management works, and sediment capture devices;

c) where applicable, the diversion of runoff from upslope lands around the disturbed areas;

d) a narrative accompanying the plans to describe how erosion and sediment control measures were chosen and their maintenance requirements;

2 These issues might also be addressed through inclusion of a narrative chapter with checklists attached to the Erosion and Sediment Control Plan

3 Guidance on the preparation of such a plan is provided in the Maroochy Manual for Erosion and Sediment Control Chapter 3

4 Many smaller sites requiring E&SC Plans do not require sediment control basins or wetlands. Nevertheless, the need or otherwise should be investigated and conclusions should be clearly documented.

e) approximate grades, existing and proposed flow paths, with stormwater discharge points;

f) approximate location of trees and other existing vegetation, showing items for removal or retention (consistent with any other plans attached to the E&SC Plan); and

g) location of proposed roads and other impervious areas (e.g. parking areas and site facilities).

On the drawing or in a separate commentary, show how the various soil conservation measures will be carried out on site, including:

a) timing of works;

b) locations of lands where a protective ground cover will, as far as is practicable, be maintained;

c) access protection measures;

d) nature and extent of earthworks, including the amount of any cut and fill;

e) location of all soil and other material stockpiles including topsoil storage, protection and reuse methodology;

f) site rehabilitation proposals, including schedules;

g) frequency and nature of any maintenance program.

7 Other Issues Relating to E&SC Plans

7.1 Inclusion of E&SC Plans in Bill of Quantities

In order to clarify contractual responsibilities, and ensure that proper implementation of the Erosion and Sediment Control Plan is funded, Erosion and Sediment Control measures should be detailed in the Bill of Quantities or Schedule of Rates for the development project.

7.2 Changes to Plans

Major E&SC Plans should reflect the need for changes or modifications to their requirements as development progresses. Large developments may need to submit several stage plans to reflect changing site conditions. Changes to E&SC Plans which increase the risk erosion or sedimentation are not permitted.

Revised E&SC Plans may be required where:

a) changes occur in slope gradients and drainage paths during construction, with their exact form frequently unpredictable before works start;

b) works continue over an extended period, with revisions being required at the beginning of the second year of operations and further revisions at 2-yearly intervals after that. Any revised E&SC Plan should reflect reasonable new standards applying at that time; and

c) the desired outcome (e.g. protection of receiving waters) is clearly not being achieved. Structural measures are only part of the management strategy with other aspects being appropriate implementation, monitoring and corrective action.

Normally, however, changes are not required where the Plan has been properly prepared. Where required, only a suitably qualified person, as per section 3 and ideally the person who prepared the original E&SC Plan, should undertake such changes.

8 Development Standards and Requirements

8.1 Water Release Limits

On site erosion and sediment control measures and management practices must be adequate to achieve the stated release limits.

The release limits for stormwater from the development site, when measured at any point:

a) Entering a waterway; or

b) Entering a drain leading to a waterway; or

c) Leaving the site,

must comply with the following release limits:

- For releases caused by rainfall events which do not exceed the design storm event:
  - 50 milligrams litre (mg/L) of Total Suspended Solids (TSS) as a maximum concentration[5];
  - turbidity (NTU) value less than 10% above background[6];
  - pH value must be in the range 6.5 to 8.0 except where, and to the extent that, the natural receiving waters lie outside this range; and
- dissolved oxygen concentration must be greater than 80% saturation – for flowing waters.

For all releases:

a) Prevent litter/waste entering the site or adjacent stormwater system – minimise on-site production[7];

b) prevent hydrocarbons from entering the stormwater system – control storage, limit application and contain contaminants at source[8];

c) control of anions and cations as required under any relevant Acid Sulfate Soil Management Plan;

d) no other chemical, contaminant or impurity is discharged which is likely to alter the chemical, physical or biological condition of the receiving water[9].

Take all reasonable and practical measures to minimise changes to the natural waterway hydraulics and hydrology from:

a) stormwater run-off volumes entering receiving waters; and

b) uncontrolled release of stormwater (confine to defined discharge points).

Note: For a release caused by a rainfall event which exceeds the design capacity of a sediment basin, release limits will not apply to that release, providing that:

- *immediately prior to the rainfall event, the sediment basin had sufficient storage capacity available to capture all the runoff from the design storm event (see Sediment Basins, below); and*
- *all reasonable and practical measures are implemented before, during and after the rainfall event to minimise the discharge of sediment-laden water from the site.*

8.2 Surface Water Management

a) The natural channel geometry and meander form of perennial and non-perennial streams must not be altered, or riparian vegetation disturbed without approval.

b) Where, in exceptional circumstances, approval is obtained for channel or meander alteration or disturbance, works should only be carried out during the lower rainfall months and the involved area is to be promptly rehabilitated conforming to the natural channel form, substrates and riparian vegetation as far as possible.

c) The ground surface within all concentrated flow paths must be protected with turf, jute matting or similar effective protection consistent with the maximum design flow velocity for the surface (refer to Appendix 1).

d) Temporary creek and drainage line vehicle crossings, are to be designed to convey flow and remain stable in the 10-year average recurrence interval (ARI) event of critical duration.

e) Temporary hydraulic structures and their inlet and outlet works are to be constructed to convey water in the design peak flow and remain stable. The applicable design ARI for temporary hydraulic structures (not including basin embankments or spillways) when the consequences of failure are environmental degradation only, is the 10-year ARI event of critical duration.

The 100yr ARI event of critical duration remains the standard of protection applicable to dwellings and to ensure pedestrian and vehicle safety. Reference should be made to the Integrated Water Management Code and Queensland Urban Drainage Manual (QUDM) for applicable criteria including spillways and freeboards. It is the responsibility of the designer to correctly identify and clearly state the design ARI

5 *It is recommended that a site specific relationship is developed between turbidity and suspended solids on large and medium scale construction sites.*

6 *Background refers to receiving waters immediately upstream of site waters entry points.*

7 *Avoid wind blown litter, remove gross pollutants – use approved containment bins (with lids) to store litter and other waste on-site. Ensure regular clearance.*

8 *Store oil and fuel in accordance with Australian Standard AS1940 – no visible sheen on receiving waters.*

9 *See the prescribed contaminant list in the Environmental Protection Regulation 1999.*

selected for the design of all structures based on an analysis of the consequences of failure.

f) Discharges to waterways should mimic natural flows in terms of magnitude, seasonality, frequency and variability. Stream flows immediately downstream during and after construction should mimic the natural range for at least the 2 year ARI event, and desirably the 1 year ARI event, to minimise channel expansion.

g) Calculations are required to ensure that erosion thresholds (tractive forces) in stream channels are not exceeded so as to cause stream channel expansion or changes to stream substrate. This requires knowledge of depth of flow, slope, and the soils of the site, and natural substrates.

h) Concentrated flows of stormwater must be directed to appropriately designed and engineered release points which are capable of withstanding the flow velocities at least up to the 10-year ARI event of critical duration.

i) Where channels and pipes outlet to downstream receiving waters, they are to discharge to stabilised surfaces, and suitable water quality and quantity control structures installed so that discharges meet the performance criteria.

j) Any water quality and quantity control structures, such as oil/grease interceptors, sediment traps/basins, litter traps, constructed wetlands and detention basins, are to be constructed where feasible outside the riparian zone.

k) There must be properly constructed and stable check banks or drains maintained parallel to the contour-line across any area of bare soil which is not being actively worked, constructed at adequate intervals and gradients to ensure runoff flows at non-erosive velocities depending on the slope gradient, but in no case at intervals greater than 90 metres. The concentrated flow from the outlet of such banks or drains must be to drains or areas which are suitably protected against scouring and erosion.

l) Where works are to be conducted within waterways and stormwater drainage, the works must be timed to minimise the potential for exposure to flood events, having regard for the three-day weather Bureau of Meteorology forecast, as far as practicable.

8.3 Sediment Basins

a) Sediment basins must be designed to capture and store all the stormwater runoff from the design storm event (see Table 2).

b) Sediment basins must be designed to store sediment volumes in accordance with Table 2.

c) The calculated storage capacity must be determined in cubic metres.

d) Following the construction of sediment basins, the basin must be surveyed and volumetric capacity must be clearly displayed on a sign beside the basin, and the maximum sediment storage level, at which point sediment removal is required, must also be indicated by a peg.

e) Sediment basins must be maintained with sufficient capacity to capture and store all the runoff from the design storm event (see Table 2).

f) Sediment basins must be maintained in dry weather at a low water level (ie with sufficient capacity to capture the runoff from the design storm event) in readiness for capture, treatment and discharge of further runoff.

g) All stormwater captured in basins must be treated and lawfully disposed of preferably within one (1) day, but not more than five (5) days, of the cessation of any rainfall event.

h) A minimum stockpile of required flocculating agents, where appropriate, must be retained onsite to provide for at least three (3) complete treatments. It must be stored in a secure, bunded, undercover location.

i) Arrangements are to be in place for the continued operation and maintenance of sediment basins, until the total development site is permanently stabilised across 90% of the total surface area. A stable surface here means having a Revised Universal Soil Loss Equation (RUSLE) C-factor of 0.05 (equal to 70% grass coverage).

j) The decommissioning of the sediment basin is to be coordinated with the commissioning of permanent water sensitive design features to, as far as practical, reduce the possibility of sediment leaving the site, and hydrologic impacts.

k) The design of sediment basins including embankments, outlets and spillways, must be certified by a Registered Professional Engineer Queensland with appropriate professional experience.

l) Earthworks for erosion and sedimentation control basins shall be to the planned levels and dimensions shown on the submitted design plans.

8.4 Soils and Vegetation

a) All works that involve any disturbance to the surface of land are to be carried out in accordance with an approved Erosion and Sediment Control Plan (E&SC Plan).

b) No vegetation is to be removed or soil disturbed except where expressly indicated on the approved plan.

c) The stripping and filling operations must be undertaken in stages. The total exposed area at any time is to be kept to a minimum due to the inherent

Table 2 Sediment Basin Design Criteria

Soil Type	Soil characteristics	Treatment process	Basin design capacity Settling zone	Sediment storage zone
Type C (coarse)	Less than 33% finer than 0.02mm and less than 10% of the soil materials are dispersible	Rapid settling in wet or dry basins	Surface area of 4,100 m2/m3/sec in the 3-month ARI flow, minimum depth of 0.6m, and length:width ratio of >3:1	Capacity to store two months sediment loss as estimated by RUSLE. However, can be taken as 100% of the capacity of the settling zone on sites of low erosion hazard (as determined from Chapter 4 of MESC 2007)
Type F (fine)	all soils other than type C	Aided flocculation in wet basins. Capture, treat and release within 1 to 5 days of event.	Capacity to contain all runoff expected from the y percentile, x-day rainfall depth where, depending on the sensitivity of the receiving waters and/or the duration that the structure is in use: x is 2, 5, 10 or 20-days y is the 75th, 80th, 85th or 90th percentile. The default criterion, unless otherwise specified, is the 5 day 80th percentile rainfall depth for development where the works schedule achieves complete site surface protection within 6 months, and 5 day 85th percentile rainfall depth for other developments.	Capacity to store two months sediment loss as estimated by RUSLE. However, can be taken as 50 per cent of the capacity of the settling zone on sites of low erosion hazard (as determined from Chapter 4 of MESC 2007)

limitations of cost-effective structural control measures. The aim is to reduce the area of exposed land not being actively worked, and generating sediment, and hence to minimise nett sediment export from the site. In addition to the general staging as shown on the approved drawings, sub-staging is to be undertaken as necessary such that the total exposed areas do not exceed 2 hectares at any one time. The disturbed area may be increased to 5 hectares only where the proponent demonstrates that this has an over-riding public benefit.

d) For the purposes of compliance with the above condition, 'exposed areas' are defined as any area having less than 70% stabilised surface coverage. Stabilisation may be undertaken using grass seeding, seeded mulch, hydromulch or other methods which must be managed to ensure a stable long-term surface coverage, subject to the required 70% surface coverage being achieved. Hold points will not be required within the substaging or between stages unless the total exposed area exceeds 2 hectares. If this occurs then all soil disturbing activities are to cease until compliance with this condition is achieved.

e) The period between when land is cleared of vegetation and major civil/bulk earthworks commence must be minimised, but such period must not exceed four weeks unless temporary and effective stabilisation measures are immediately implemented after clearing. These requirements may be waived only where the proponent can make a case to demonstrate an alternative approach has an overriding public benefit.

f) There must be no site disturbance, including vegetation clearing, other than for initial survey work, the approved site office and store, and to enable compliance with this condition, until the following measures are implemented:

- Areas to be disturbed have been marked out;
- Vehicle barriers erected around areas to be protected;
- Vehicle stabilised site access point(s);
- Vehicle wash/rumble pad;
- Clean runoff diversion drain installed and stabilised; and
- Sedimentation basins (if applicable) have been installed, stabilised, surveyed, signed and pegged (as per Clause 7.3 (d) above).

g) Natural vegetation on site is to be preserved, except where removal is essential for initial site surveys and the carrying out of approved operational works.

h) Vegetation clearing must be limited, as far as reasonable and practicable, to two (2) metres from the edge of any essential construction activity as shown on the engineering plans, or as otherwise approved.

i) Effective access barriers must be maintained in position at all times to protect areas not to be disturbed by works, including in revegetation areas.

j) Sufficient stockpiles of mulch, geotextile and/or other similar required erosion and sediment control

Table 3 Soil Cover Requirements

Lands	Maximum C-factor	Remarks
Waterways and other areas subjected to concentrated flows post construction. Concentrated flow also requires consideration of flow velocities.	0.05	Coverage to be effective within 10 working days from completion of formation and before they are allowed to carry any concentrated flows. (Note: a *C*-factor of 0.05 can be achieved in various ways including with about 70% groundcover).
Stockpiles	0.10	Applies after 10 working days from completion of formation (Note: a *C*-factor of 0.10 is achieved with about 60% groundcover)
All lands, including waterways and stockpiles during construction	0.15	Coverage to be effective within 20 days of construction inactivity, even though works might continue later (Note: a *C*-factor of 0.15 can be achieved in various ways, including with about 50% groundcover).
All lands, including waterways	0.05	Coverage to be effective on release of the Survey Plan. Note: a *C*-factor of 0.05 can be achieved in various ways, including with about 70% groundcover and 100% synthetic cover.
All high erosion hazard lands during period December to March inclusive	0.1	Except where the 3 day Bureau of Meteorology forecast indicates a low probability for rainfall.

materials and stores must be maintained on site from commencement of earthworks and at all times thereafter to enable ongoing erosion control, as well as for site contingencies (e.g. imminent wet weather) until commencement of "off-maintenance".

k) Exposed soil areas such as embankments, and filled areas especially subject to erosive forces which are completed or are not being actively worked must be fenced off to plant and vehicular traffic, stabilised and protected by the application of seeded mulch, turf (not grass seeding alone), or other effective surface stabilisation measure to ensure that the area exposed, and time that areas are exposed, is minimised in accordance with Table 3.

l) All exposed soil areas are to be rehabilitated immediately on completion where feasible to ensure that the overall area of the site exposed, and time that areas are exposed, is minimised as far as practicable in accordance with Table 3.

m) Where it is impractical to schedule work on high or very high erosion hazard lands to periods when rainfall erosivity is low, such as during winter, the site must be managed such that disturbed lands are to have C-factors higher than 0.1 only when the 3-day forecast suggests that rain is unlikely. In any case, management regimes should be established that facilitate stabilisation within 24 hours should the forecast prove incorrect.

n) Soil stockpiles must be shaped to stable batters, effectively protected by sediment control fencing, not be located within flow paths, and those which are not being actively worked (in any 21 calendar day period) must be provided with effective temporary surface protection without delay, but in any case within 24 hours of cessation of the last activity.

o) Turf, or a turf strip 400mm wide, must be in place continuously adjacent to and parallel with all kerbs, and 70% grass coverage or 100% synthetic cover must be achieved elsewhere including on all exposed allotment areas prior to "on-maintenance" beginning.

9 Administration

9.1 Operations, Monitoring and Maintenance

a) All erosion and sediment control measures must be properly and effectively maintained and operated, and must be in good working order and fully effective condition at the completion of each day's work.

b) The maintenance of fully effective erosion and sediment control measures must continue until the site has been permanently stabilised and further disturbance of soil by erosion is prevented.

c) Scour of newly-formed cut and fill batters during and after embankment construction shall be minimised by diverting runoff from the formation away from the batter until vegetation is established.

d) Where more than 2,500 square metres of land are disturbed, a self-auditing program must be developed for the site prior to approved works commencing, and be produced at the pre-start plan. A site inspection using a Log Book or Inspection Test Plan (ITP) must be undertaken by the site supervisor:

- at least each week
- immediately before site closure
- immediately following rainfall events that cause runoff.

e) The ITP can take the form of a checklist, completed by simple tick and brief commentaries.

f) The self-audit must be undertaken systematically, recording:

- installation/removal of any erosion and sediment control management practices;
- the condition of each erosion and sediment control management practices employed, noting whether it is likely to continue in an effective condition until the next self-audit.

g) An effective water quality self-monitoring program, including at least one representative measurement of the total suspended solids quality of any flow or release from the site on each day runoff to receiving waters occurs, must be implemented continuously throughout the life of the works which are the subject of this approval.

h) A legible record is to be kept on-site of all self audits and water quality monitoring, and produced promptly to any authorised Council officer on request.

i) Where the findings of the required performance self-monitoring program indicate that any compliance limit is being or is likely to be exceeded, remedial action must be taken without delay to ensure ongoing compliance.

j) Access to the site is to be permitted at all times for any authorised Council officer for the purposes of administration of the approval or administration of any legislation for which Council is an administering authority.

9.2 Bonds and Securement of Works

a) Where there is found to be a failure to adopt or maintain best practice environmental management including failure to carry out any part of an approved Erosion and Sediment Control Plan diligently, a part or all the bond monies held by Council under Planning Scheme Policy for Operational Works can be forfeited at Council's discretion, and used for carrying out any strategy for achieving compliance with the approval, for rectifying any environmental damage, or to recover environmental enforcement costs.

b) Where Council determines that there has been a failure to comply with the conditions of approval possibly justifying a draw down on the bond, it will give a warning in writing to this effect requiring compliance within a specified period of time, and specifying the intended draw-down amount.

c) In the event of a failure to fully comply with such a warning and direction, Council may proceed to draw down on the bond as forecast.

d) Where Council determines that a draw down of the bond is required, the applicant must restore the bond to its full amount within ten (10) working days of a notice in writing from Council to that effect.

e) Half of the bond, or of any portion thereof remaining, may be released, at Council's discretion on commencement of the On Maintenance period, subject to a satisfactory record of ongoing compliance, and after application in writing for a joint compliance inspection for this purpose.

f) The remaining amount of any bond will only be finally released by Council at the termination of the "On Maintenance" period.

9.3 Hold Points

a) No clearing or earthworks, other than to achieve compliance with this condition, may commence until the following erosion and sediment control measures are in place and approval to continue work is given in writing by a Council officer. Such written approval may be given on-site by the Council officer. These measures are:

- Areas to be disturbed marked out;
- Vehicle barriers around areas to be protected;
- Vehicle site access point(s);
- Vehicle wash/rumble pad;
- Clean runoff diversion drain installed and stabilised; and
- Any required sedimentation pond installed and stabilised.

b) Works must not continue after the sub grade approval until compliance with the Erosion and Sediment Control Plan has been verified by a Council officer and approval in writing given to proceed.

c) Works must not continue after the final trim/pre-seal inspection until compliance with the Erosion and Sediment Control Plan has been verified by a Council officer and approval in writing given to proceed. Such written approval may be given on-site by the Council officer.

9.4 Certification

The author or the supervising engineer must provide a completed statement of compliance in the approved form (available on the Sunshine Coast Regional Council website) certifying that all Erosion and Sediment Risk Assessments, Hazard Evaluation Reports and Control Plans have been prepared in accordance with the Maroochy Manual for Erosion and Sediment Control, except as otherwise required by the approval or this Policy.

9.5 Compliance Policy

a) There must be no exceedance of the relevant specified water quality release levels at any time up to the approved design storm event. Where there is reliance on this clause to justify any exceedance, it is incumbent on the holder of the approval or their agent to substantiate the appropriate rainfall data evidence.

b) The occurrence of an extreme event is not justification to fail to adopt best practice environmental management to reduce the hydrologic and sediment impacts of the development before, during and after such events.

c) "Best practice environmental management" is used here as defined in the Environmental Protection Act 1994. An example of a failure of such best practice is neglect to attend the site and manage control measures to prevent water pollution during a major rainfall event, including neglect to do so during wet weather after normal hours of work including weekends.

d) Should an operator find through their own monitoring that, in spite of adopting and maintaining genuine best practices, as advised by a qualified practitioner, that significant exceedance of the objectives is occurring, Council should be promptly advised by email or fax to the Waterways Unit Coordinator.

   This will enable both parties to cooperatively identify, on a "without legal jeopardy" basis, the technological shortfall (in achieving the planning environmental objectives) to enable feedback, to the engineering design and Council planning assessment and approval processes.

10 Reference Documents

The following documents may be referred to for detailed design information and specifications, where appropriate, to achieve compliance with the Erosion and Sediment Control Code and this Policy.

a) Queensland Urban Drainage Manual (QUDM)

b) Australian Rainfall and Runoff (AR&R)

c) Manual for Erosion and Sediment Control, Maroochy Shire Council, 2007 (MESC, 2007)

d) Managing Urban Stormwater – Soils & Construction Volume 2A Installation of Services (NSW Govt Jan 2008)

Appendix 1 Maximum Design Flow Velocities in Concentrated Flow Paths

Material Type	Thickness (m)	Aggregate size (mm)	Critical velocity (m/second)
Gabions and reno mattresses	0.50	120-250	6.4
	0.50	100-200	5.8
	0.30	100-150	5.0
	0.30	70-120	4.2
	0.25	70-100	3.6
	0.17	70-100	3.5

	Weight each (kg)	Turbulent flow	Normal flow
Loose rock (assume 100 percent soil cover)	1,000	4.8	6.6
	500	4.2	5.7
	100	3.3	4.5
	50	2.8	3.8
	10	2.3	3.0

	Form	
Revetment mattresses	Storm mattress	>6.0
	200 mm fp	6.0
	125 mm fp	4.0
	100 mm fp	2.0

Assume that all soils with 10 percent or more dispersible fines have high erodibilities. Of those with less, soils with K-factors below 0.2 have low erodibilities, those between 0.2 and 0.45 have moderate erodibilities, while those above 0.45 have high erodibilities.

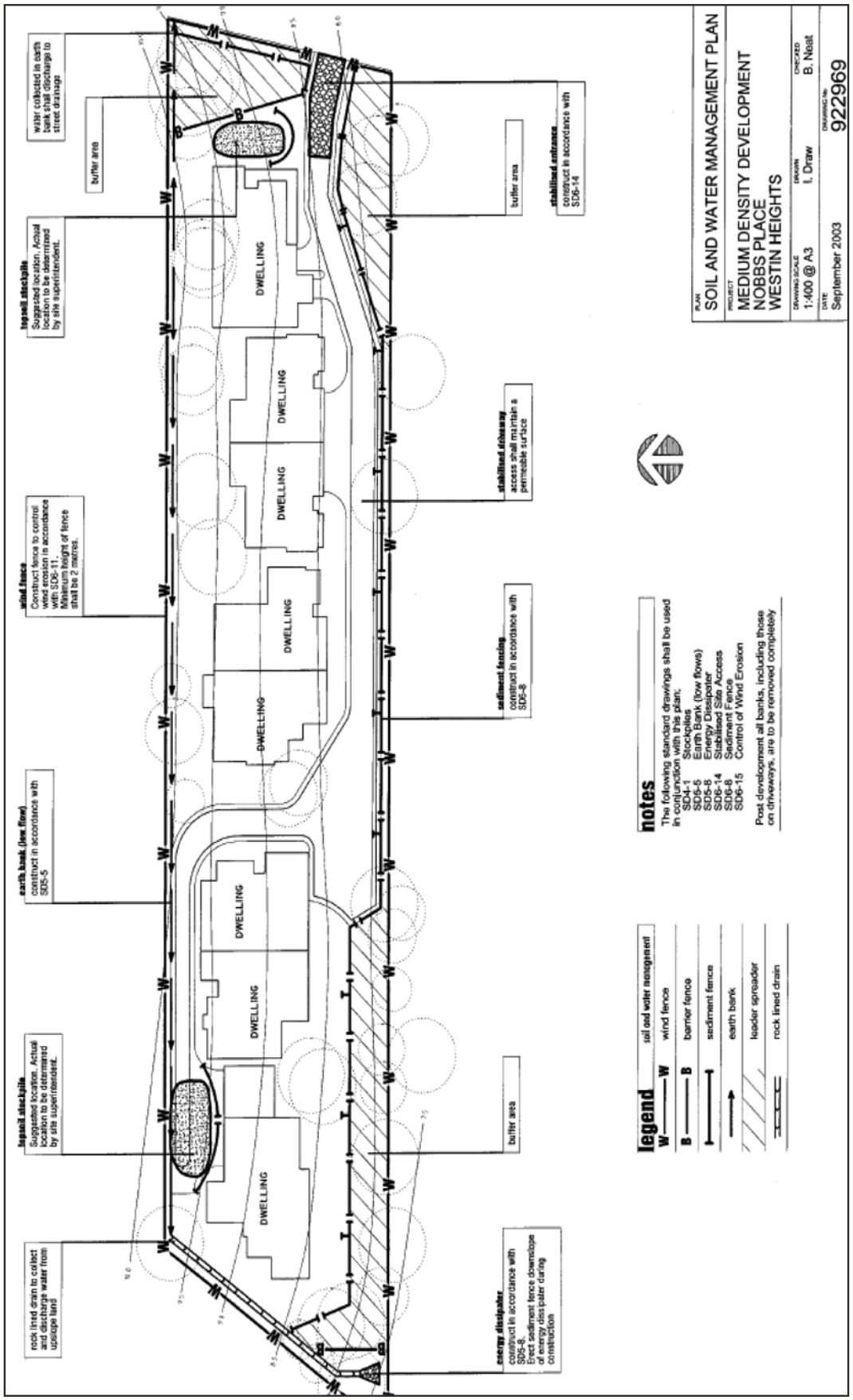
In addition, the figures here assume slope gradients of less than 10 percent and, where appropriate, good (>80 percent) ground cover. If good ground cover is not expected to be maintained properly (might die back seasonally or during short periods of drought) and is critical to the system, reduce all velocities by 1.0 metre per second. Alternately, seek the manufacurer's advice if these conditions are unlikely to be met.

Material [1]	Critical velocity (m/sec) [2]											
	Inundation <6 hours			Inundation <12 hours			Inundation <24 hours			Inundation <48 hours		
	Soil erodibility			Soil erodibility			Soil erodibility			Soil erodibility		
	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
High performance TRM's, vegetated	7.0	7.0	7.0	6.0	6.0	6.0	5.0	5.0	5.0	4.0	4.0	4.0
Medium performance TRM's, vegetated	5.0	5.0	5.0	4.3	4.3.	4.3	3.6	3.6	3.6	3.0	3.0	3.0
Light performance TRM's, vegetated	3.0	2.7	2.4	2.6	2.3	2.0	2.3	2.0	1.8	2.0	1.8	1.6
Mesh reinforced turf	3.0	2.7	2.4	2.6	2.3	2.0	2.3	2.0	1.8	2.0	1.8	1.6
Kikuyu	2.5	2.2	1.9	2.1	1.9	1.6	1.9	1.7	1.4	1.6	1.4	1.2
Jute or coir mesh (close weave, bitumen sprayed)	2.3	2.0	1.7	1.9	1.7	1.5	1.7	1.5	1.3	1.5	1.3	1.1
Coconut/jute fibre mats	2.3	2.0	1.7	1.9	1.7	1.5	1.7	1.5	1.3	1.5	1.3	1.1
Couch, carpet grass, Rhodes grass, etc.	2.0	1.8	1.4	1.7	1.5	1.2	1.5	1.4	1.1	1.3	1.2	0.9
Bare soil	0.7	0.5	0.3	0.6	0.4	0.3	0.5	0.4	0.2	0.4	0.3	0.2

[1] For further information, phone the office of Australasian Chapter of the International Erosion Control Association on 1800 354 322 or (+61 2) 4677 0901.

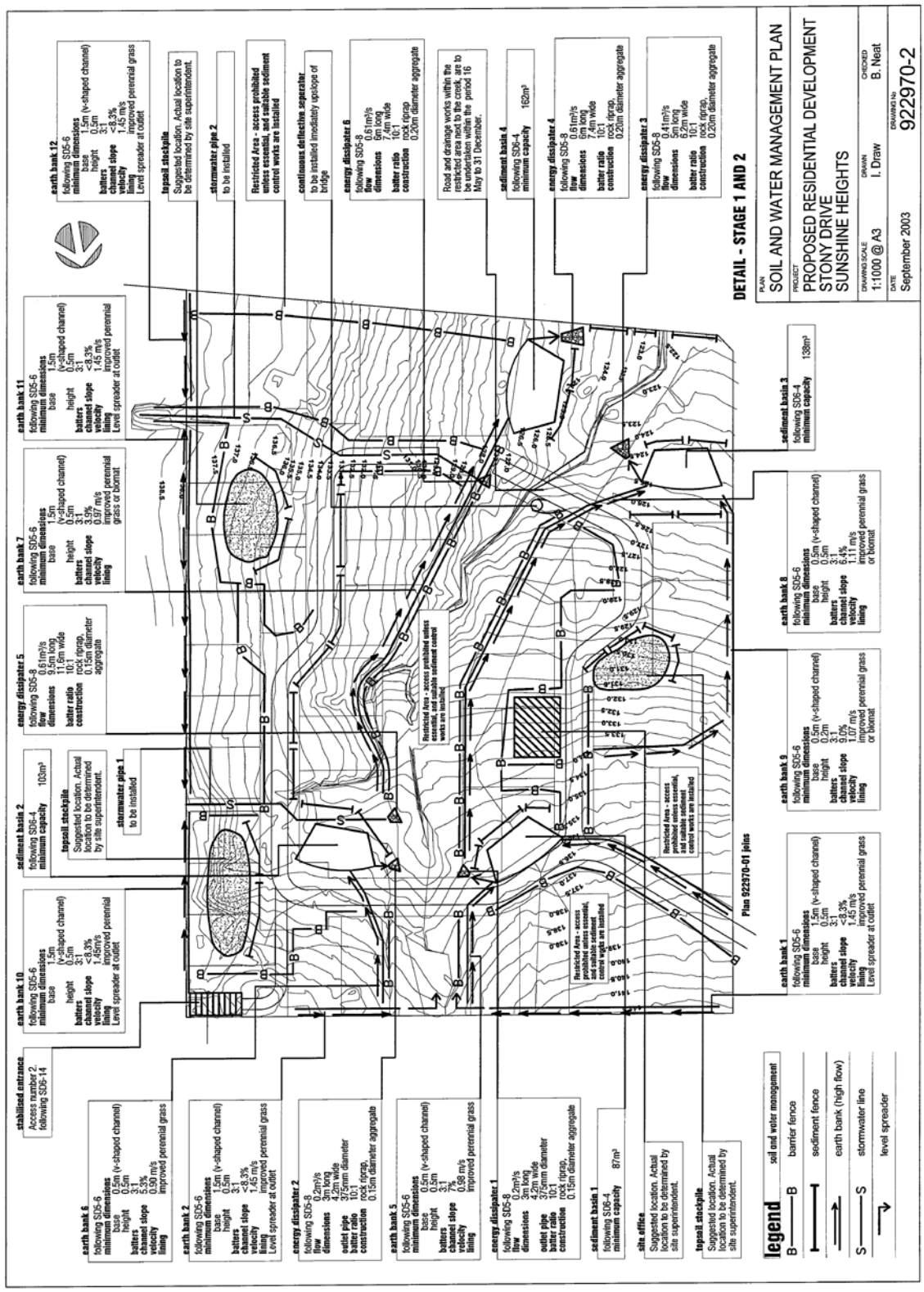
[2] The designer should also check shear stress as this becomes limiting as slope gradient increases.

Appendix 2 Example Erosion and Sediment Control Plan for a Medium Density Development

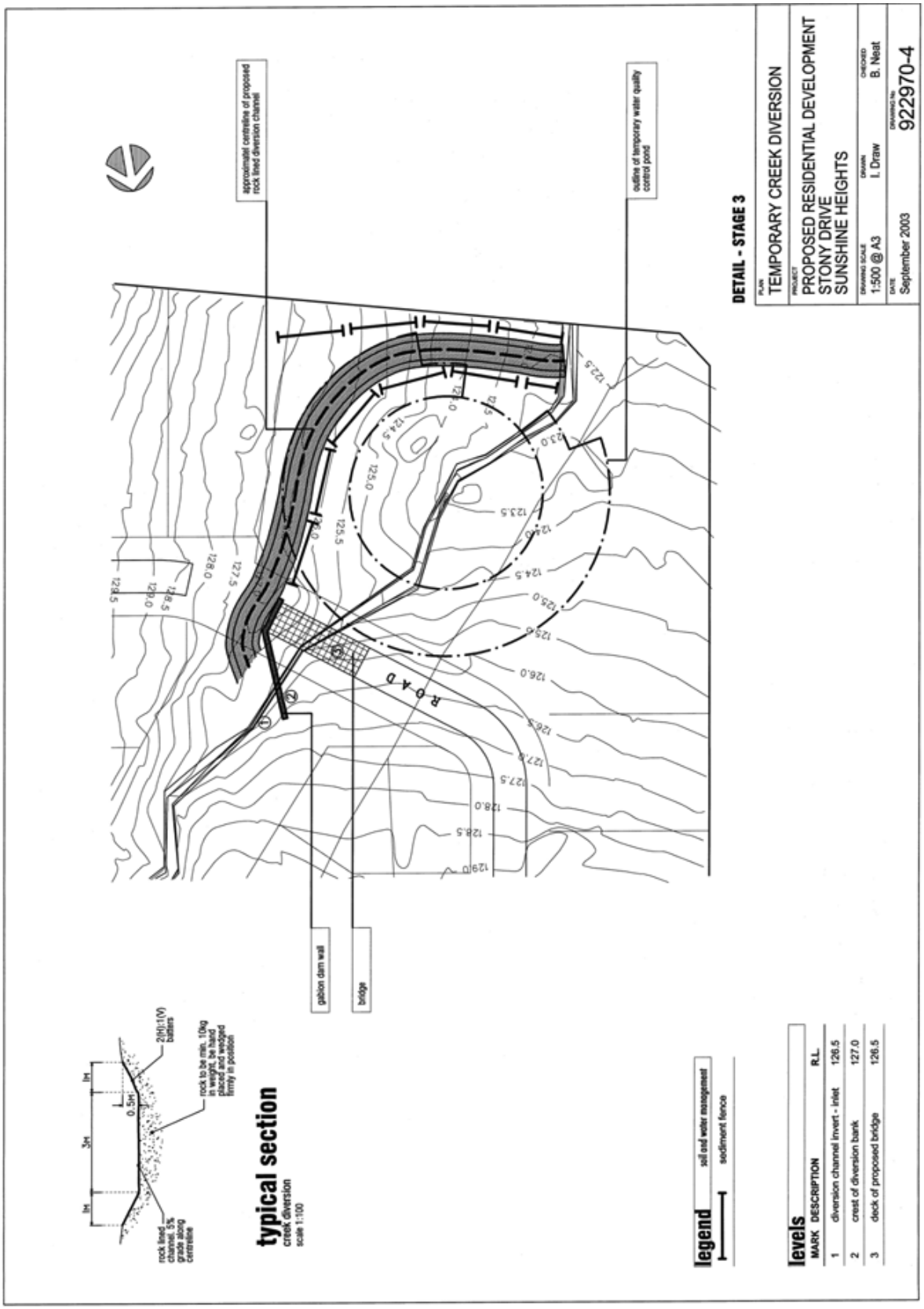


Appendix 3 Example Erosion and Sediment Control Plan for a Subdivision Development.

Note for a development of this scale several diagrams are generally required to reflect the changing conditions on site as the works proceed.



Appendix 4 Example Erosion and Sediment Control Plan for a Temporary Creek Diversion



Appendix 5 Site Data Sheet

All applications involving a total land area in excess of one hectare are to present technical information in the Site Data Sheet Format below

Note: These initial "Standard Calculation" spreadsheets relate only to erosion hazard lands of 4000 square metres to 1 hectare requiring a sediment basin, where the designer chooses to not use the RUSLE to size sediment basins. The more "Detailed Calculation" spreadsheets should be used on lands greater than one hectare or where the designer chooses to run the RUSLE in calculations.

1. Site Data Sheet

Site name:							
Site location:							
Precinct:							
Description of site:							
Site area	**Site**						**Remarks**
Total catchment area (ha)							
Disturbed catchment area (ha)							
Impervious area before development (ha)							
Impervious area after development (ha)							
Stream flows for the natural range for the 2 year ARI event							
Stream flows during and after disturbance for the same range, 2 year ARI event							
Stream flows immediately downstream during and after construction to mimic the natural range to avoid channel expansion							
Soil analysis (refer AS1289)							
Soil landscape							
Soil Texture Group							
Dispersion Index							
Particle size distribution							
Electrical conductivity & pH value							
Soil Hydrologic Group							
Sub Soil K Value							
Sediment type (C, D, or F)							
Acid sulfate potential							
Rainfall data							
Design rainfall depth (days)							
Design rainfall depth (percentile)							
x-day, y-percentile rainfall event							
Rainfall intensity: 2-year, 6-hour storm							See IFD chart for the site
Rainfall erosivity (R-factor)							Automatic calculation from above data
Comments:							

2. Storm Flow Calculations

Peak flow is given by the Rational Formula:

$Q_y = 0.00278 \times C_{10} \times F_Y \times I_{y,tc} \times A$

where: Qy is peak flow rate (m^3/sec) of average recurrence interval (ARI) of "Y" years

C_{10} is the runoff coefficient (dimensionless) for ARI of 10 years. Rural runoff coefficients are given in Volume 2, figure 5 of Pilgrim (1998), while urban runoff coefficients are given in Volume 1, Book VIII, figure 1.13 of Pilgrim (1998) and construction runoff coefficients are given in Appendix F

F_y is a frequency factor for "Y" years. Rural values are given in Volume 1, Book IV, Table 1.1 of Pilgrim (1998) while urban coefficients are given in Volume 1, Book VIII, Table 1.6 of Pilgrim (1998)

A is the catchment area in hectares (ha)

$I_{y,tc}$ is the average rainfall intensity (mm/hr) for an ARI of "Y" years and a design duration of "tc" (minutes or hours)

Time of concentration (t_c) = $0.76 \times (A/100)^{0.38}$ hrs (Volume 1, Book IV of Pilgrim, 1998)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

Peak flow calculations, 1

Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			$1_{yr,tc}$	$5_{yr,tc}$	$10_{yr,tc}$	$20_{yr,tc}$	$50_{yr,tc}$	$100_{yr,tc}$	

Peak flow calculations, 2

ARI yrs	Frequency factor (F_y)	Peak flows						Comment
		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	
$1_{yr,tc}$								
$5_{yr,tc}$								
$10_{yr,tc}$								
$20_{yr,tc}$								
$50_{yr,tc}$								
$100_{yr,tc}$								

3. Volume of Sediment Basins: *Type C* Soils

Basin volume = settling zone volume + sediment storage volume

Settling Zone Volume

The settling zone volume for *Type C* soils is calculated to provide capacity to allow the design particle (e.g. 0.02 mm in diameter) to settle in the peak flow expected from the design storm (e.g. 0.25-year ARI). The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle. Peak flow/discharge for the 0.25-year, ARI storm is given by the Rational Formula:

$Q_{tc,\,0.25} = 0.5 \times [0.00278 \times C_{10} \times F_y \times I_{1yr,\,tc} \times A\,]$ (m^3/sec)

where:

$Q_{tc,0.25}$ = flow rate (m^3/sec) for the 0.25 ARI storm event

C_{10} = runoff coefficient (dimensionless for ARI of 10 years)

F_y = frequency factor for 1 year ARI storm

$I_{1\,yr,tc}$ = average rainfall intensity (mm/hr) for the 1-year ARI storm

A = area of catchment in hectares (ha)

Basin surface area (A) = area factor x $Q_{tc,\,0.25}$ m^2

Particle settling velocities under ideal conditions (Section 6.3.5(e))	
Particle Size	**Area Factor**
0.100	170
0.050	635
0.020	4100

Volume of settling zone = basin surface area x depth (Section 6.3.5(e)(ii))

Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 100 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE (Section 6.3.5(e)(iv)), in which case the "Detailed Calculation" spreadsheets should be used.

Total Basin Volume

Site	$Q_{tc,\,0.25}$ (m^3/s)	Area factor	Basin surface area (m^2)	Depth of settling zone (m)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)	Basin shape		
								L:W Ratio	Length (m)	Width (m)
		4100								
		4100								
		4100								
		4100								

4. Stormwater storage volume of Sediment Basins for *Type F* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

$$V = 10 \times C_v \times A \times R_{y\text{-}\%ile,\ x\text{-}day} \ (m^3)$$

where:

10 = a unit conversion factor

C_v = the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period

R = is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events

A = total catchment area (ha)

Sediment Storage Zone Volume

In the standard calculation, the sediment storage zone is 50 percent of the setting zone. However, designers can work to capture the 2-month soil loss as calculated by the RUSLE in which case the "Detailed Calculation" spreadsheets should be used.

Total Basin Volume

Site	C_v	R x-day y-%ile	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)

Note: For urban catchments the time of concentration should be determined by more precise calculations or reduced by a factor of 50 per cent.

Peak flow calculations, 1

Site	A (ha)	tc (mins)	Rainfall intensity, I, mm/hr						C_{10}
			$1_{yr,tc}$	$5_{yr,tc}$	$10_{yr,tc}$	$20_{yr,tc}$	$50_{yr,tc}$	$100_{yr,tc}$	

Peak flow calculations, 2								
ARI (yrs)	Frequency factor (F_y)	Peak flows						Comment
		(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)	
1 yr,tc								
5 yr,tc								
10 yr,tc								
20 yr,tc								
50 yr,tc								
100 yr,tc								

3. Volume of Sediment Basins: *Type C* Soils

Basin volume = settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type C* soils is calculated to provide capacity to allow the design particle (e.g. 0.02 mm in diameter) to settle in the peak flow expected from the design storm (e.g. 0.25-year ARI). The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle. Peak flow/discharge for the 0.25-year, ARI storm is given by the Rational Formula:

$Q_{tc,0.25} = 0.5 \times [0.00278 \times C_{10} \times F_y \times I_{1yr,\,tc} \times A\,]$ (m^3/sec)

where:

$Q_{tc,0.25}$ = flow rate (m^3/sec) for the 0.25 ARI storm event

C_{10} = runoff coefficient (dimensionless for ARI of 10 years)

F_y = frequency factor for 1 year ARI storm

$I_{1\,yr,tc}$ = average rainfall intensity (mm/hr) for the 1-year ARI storm

A = area of catchment in hectares (ha)

Basin surface area (A) = area factor x $Q_{tc,\,0.25}$ m^2

Particle settling velocities under ideal conditions (Section 6.3.5(e))	
Particle Size	**Area Factor**
0.100	170
0.050	635
0.020	4100

Volume of settling zone = basin surface area x depth (Section 6.3.5(e)(ii))

Sediment Storage Zone Volume

In the detailed calculation on Soil Loss Classes 1 to 4 lands, the sediment storage zone can be taken as 100 percent of the settling zone capacity. Alternately designers can design the zone to store the 2-month soil loss as calculated by the RUSLE (Section 6.3.5(e)(iv)). However, on Soil Loss Classes 5, 6 and 7 lands, the zone must contain the 2-month soil loss as calculated by the RUSLE (Section 6.3.5(e)(v)).

Place an "X" in the box below to show the sediment storage zone design parameters used here:

☐ 100% of settling zone capacity,

☐ 2 months soil loss calculated by RUSLE

Total Basin Volume										
Site	$Q_{tc, 0.25}$ (m^3/s)	Area factor	Basin surface area (m^2)	Depth of settling zone (m)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)	Basin shape		
								L:W Ratio	Length (m)	Width (m)
		4100								
		4100								
		4100								
		4100								

4. Volume of Sediment Basins *Type F* Soils

Basin volume	=	settling zone volume + sediment storage zone volume

Settling Zone Volume

The settling zone volume for *Type F* and *Type D* soils is calculated to provide capacity to contain all runoff expected from up to the y-percentile rainfall event. The volume of the basin's settling zone (V) can be determined as a function of the basin's surface area and depth to allow for particles to settle and can be determined by the following equation:

V	=	10 x Cv x A x Rx-day, y-%ile (m3)
where:		
10	=	a unit conversion factor
Cv	=	the volumetric runoff coefficient defined as that portion of rainfall that runs off as stormwater over the x-day period
Rx-day, y-%ile	=	is the x-day total rainfall depth (mm) that is not exceeded in y percent of rainfall events. (See Sections 6.3.4(d), (e), (f), (g) and (h)).
A	=	total catchment area (ha)

Sediment Storage Zone Volume

In the detailed calculation on Soil Loss Classes 1 to 4 lands, the sediment storage zone can be taken as 50 percent of the settling zone capacity. Alternately designers can design the zone to store the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(ii)). However, on Soil Loss Classes 5, 6 and 7 lands, the zone must contain the 2-month soil loss as calculated by the RUSLE (Section 6.3.4(i)(iii).

Place an "X" in the box below to show the sediment storage zone design parameters used here:

☐ 50% of settling zone capacity,
☐ 2 months soil loss calculated by RUSLE

Total Basin Volume

Site	C_v	$R_{x\text{-day, y-\%ile}}$	Total catchment area (ha)	Settling zone volume (m^3)	Sediment storage volume (m^3)	Total basin volume (m^3)