PLANNING SCHEME POLICY

HEALTHY WATERS

Mackay Region
PLANNING SCHEME

Mackay REGIONAL COUNCIL

Planning scheme policy – healthy waters

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Amendment history

This planning scheme policy commenced on 24 July 2017 as part of the Mackay Region Planning Scheme 2017. Amendments since this date are listed in the below table.

Version number	Amendment title	Summary of amendment	Date adopted and commenced
1.0	Planning scheme administrative amendment 6, and Planning scheme policy administrative amendment 1	This amendment removed the planning scheme policies from Schedule 6 of the Mackay Region Planning Scheme 2017 and placed them in individual PDFs on Council's website. This amendment introduced standardised formatting, introductory sections and explanatory information regarding intent and legislative relationship for this planning scheme policy. It also updated numbering and cross references.	Adopted 11 December 2019 Commenced 3 February 2020

1 Introduction

1.1 Application

This planning scheme policy supports the Mackay Region Planning Scheme 2017 by providing information on: how to achieve compliance with assessment benchmarks; supporting information/studies required; and/or actions required under the development assessment process. This planning scheme policy has been made by Mackay Regional Council in accordance with Chapter 2, Part 3, Division 2 of the *Planning Act 2016*.

1.2 Relationship with planning scheme

Mackay Region Planning Scheme 2017 refers to this planning scheme policy in assessment benchmarks in the following code/s or any other relevant part of the scheme:

(a) Table 9.4.2.3.A – Healthy waters code

1.3 Purpose

The purpose of this planning scheme policy is to:

1. Ensure development is planned, designed constructed and operated to manage stormwater in ways that will help protect the environmental values of Mackay's waterways.
2. Minimise the amount of pollutants such as sediment, litter, nutrients and oil entering Mackay's waterways and stormwater drains.
3. Minimise and prevent environmental harm to the Mackay Region's waterways and associated ecosystems.
4. Provide an effective stormwater management system that balances environmental, social and economic interests within the Mackay community and incorporates water quantity, quality and waterway corridor controls.
5. Minimise environmental nuisance or harm from land-disturbing activities.

Virtually all construction activity which requires the disturbance of the soil surface and the existing vegetation, naturally predisposes the construction site to erosion. This in turn leads to sediment loss in the resultant run-off water.

Since such soil disturbance is a necessary part of development, it is essential therefore to develop measures which reduce the erosion hazard of any particular construction activity. Having done that, it is necessary to control run-off water, which carries the sediment, in such a way as to reduce the amount of that sediment leaving the site to an acceptable level.

After construction is complete and the site fully rehabilitated, permanent water quality control structures and features commence their role. These include bio-retention basins, constructed wetlands, sand filters and proprietary stormwater quality improvement devices.

1.4 Referenced documents

(a) Council guidelines, policy and specifications:
- (i) SC6.12 – Engineering design guideline – stormwater drainage design
- (ii) MUSIC guideline
- (iii) Stormwater quality management plan for Mackay (2006)
- (iv) Council Policy No. 87 Voluntary Mechanism for Stormwater Quality Management

(b) Queensland legislation:
- (i) *Environmental Protection Act 1994*
- (ii) Environmental Protection Regulation 2008
- (iii) Environmental Protection (Water) Policy 2009
- (iv) *Sustainable Planning Act 2009*
- (v) State Planning Policy (July 2014)
- (vii) *Coastal Protection and Management Act 1995*
- (viii) Coastal Protection and Management Regulation 2003
- (ix) *Fisheries Act 1994*
- (x) *Water Act 2000*
- (xi) *Soil Conservation Act 1986*
- (xii) *Vegetation Management Act 1999*
- (xiii) *Local Government Act 2009*

(c) Queensland authorities:
- (i) Queensland Government (2014) *Soil Management Guidelines v4.0 in Queensland Acid Sulfate Soil Technical Manual*
- (ii) Queensland Government (2009) *Queensland Water Quality Guidelines*
- (iii) Queensland Government (2010) *Urban Stormwater Quality Planning Guidelines*
- (iv) Queensland Department of Transport and Main Roads (2002) *Road Drainage Manual, Chapter 13 Erosion and Sediment Control*
- (v) Acid sulfate soils water quality improvement plan: Mackay – Whitsunday region (J McClurg, Department of Environment and Resource Management, 2009)

(d) Other:

(i) Acid Sulfate Soils of the Sarina Beaches, Hay Point to Armstrong Beach, Queensland (Muller, Peter G)
(ii) Acid sulphate soils and estuarine water quality of the Mackay district (Muller, Peter G)
(iii) ANZECC (2000) *Australian water quality guideline for fresh and marine waters*
(iv) Argue, J.R. (Ed)(2000) *Water sensitive urban design: basic procedures and marine waters*
(v) AustRoads (1994) *Waterway design (a guide to the hydraulic design of bridges, culverts and floodways)*
(vi) Brisbane City Council (2001) *Sediment basin design guidelines*
(vii) Brisbane City Council (2002) *Stormwater outlets in parks and waterways, guidelines*
(viii) Brisbane City Council (2000) *Natural channel design guidelines*
(ix) Brisbane City Council (2003) *Guidelines for pollutant export modelling in Brisbane, version 7 – draft*
(x) Brisbane City Council (2000) *Water quality management guidelines*
(xi) Brisbane City Council, *Water sensitive urban design engineering guidelines: stormwater*
(xii) Engineers Australia (2006) *Australian runoff quality – a guide to water sensitive urban design*
(xiii) Healthy Waterways (2006) *Water sensitive urban design technical design guidelines for south east Queensland*
(xiv) Healthy Waterways, *Construction and establishment guideline*
(xv) *Healthy Waterways (2012) Bioretention Technical Design Guidelines*
(xvi) *Healthy Waterways (2012) Transferring Ownership of Vegetated Stormwater Assets*
(xvii) *Healthy Waterways (2010) Construction and Establishment Guidelines : Swales Bioretention Systems and Wetlands*
(xviii) *Healthy Waterways (2013) Managing and Maintaining Vegetated Stormwater Assets*
(xix) International Erosion Control Association (2008) *Best practice erosion and sediment control*
(xx) *Designflow (2009) Stormwater Quality Performance Curves & Stormwater Quality Objectives for Mackay*

1.5 Terminology

Table 1.5 – Terminology used in Planning scheme policy – healthy waters

Term	Definition
Acid sulfate soils	Acid Sulfate Soils are soils occurring naturally in low lying coastal areas predominantly below 5 m AHD. The term refers to both 'actual' and 'potential' acid sulfate soils as detailed below: (a) Soil or sediment containing highly acidic soil horizons or layers affected by the oxidation of iron sulphides (actual acid sulfate soils); and/or (b) Soil or sediment containing iron sulphides or other sulfacid material that has not been exposed to air and oxidised (potential acid sulfate soils)
Catchment management plans (CMP's)	These documents describe the catchment, waterways, environmental values, water quality objectives, hydrology, water quality and hydraulic issues associated with the catchment. The CMPs also include strategies and action plans to manage a wide range of waterway issues within the catchment, including social, environmental, financial and planning issues.

Term	Definition
	CMPs may be used by: (a) Council to identify and prioritise actions that need to be undertaken in the catchments; (b) Community groups to guide community based activities in their catchment and increase their understanding of the waterway related issues facing their catchment and their waterways; (c) Staff in Council who are developing Priority Infrastructure Plans (PIPs); and (d) Developers or their Consultants who need specific information (eg on existing water quality, waterway health and key local issues) to support their development applications.
Creek catchment	An area of land bounded by natural features such as hills, from which all runoff flows to a common low point (such as a creek, lake, river, bay etc).
Erosion and sediment control (ESC) management plan	A site plan, including brief explanatory notes (usually on the plan) that simply explains to regulators and site personnel how erosion is going to be minimised and sediment runoff controlled. This Plan is usually acceptable for low risk developments.
Erosion and sediment control (ESC) program	A set of documents including ESC Management Plans, supporting documentation, specifications and construction details.
Erosion and sediment control (ESC) measures	Practices and devices used to minimise erosion (eg retaining and/or establishing vegetation) and control sediment (eg installing a sediment fence or sediment basin).
Environmental values (EVs)	Qualities or characteristics of a waterway that support healthy ecosystems and the community's livelihoods and lifestyle. Environmental Values are determined by community preference and reasonable judgement.
High risk development	A development (or development proposal) may be classified as 'high risk' if it falls within one of the following categories: (a) a material change of use for urban purposes that involves a land area greater than 2,500 m^2 that : (i) will result in an impervious area greater than 25 per cent of the net developable area, or (ii) will result in 6 or more dwellings; or (b) reconfiguring a lot for urban purposes that involves a land area greater than 2,500 m^2 and will result in 6 or more lots. or (c) operational works for urban purposes that involve disturbing[1] more than 2,500m^2 of land.
Land-disturbing development	Any carrying out of building work, plumbing or drainage work, land clearing, operational work (e.g. road building, placement of fill) or

[1] Moving or otherwise disturbing soil.

Term	Definition
	reconfiguring a lot (i.e. subdivision) where there is potential for accelerated erosion from wind or water and/or the discharge of sediment to drains or waterways.
Low risk	For development subject to Council approval but not specified as 'high risk development' (see above). Note that for these types of development, water quality impacts need to be minimised by identifying and adopting best practice techniques.
Receiving water	A water body that may receive runoff from the catchment under consideration, and has some environmental value of beneficial use. Natural wetlands are included in the definition of receiving waters, but constructed wetlands that have been built primarily for the purpose of stormwater (or wastewater) treatment, are not.
Riparian	The banks and associated areas that fringe waterways and are linked by physical and ecological processes to the waterway.
Sediment	Solids (typically sand, silt and mud) that are transported by water. Considered to be a 'contaminant' as defined in the *Environmental Protection Act 1994*.
Stormwater	Surface water runoff following a rain event (including piped flows).
Site based acid sulfate soil management plan (SBASSMP)	A SBASSMP shall identify potential on and off site impacts associated with the disturbance of ASS from a development. The Plan should also identify performance outcome and mitigation strategies together with relevant monitoring, reporting and corrective actions. A SBASSMP is required when a development application relates to: (a) an acid sulphate soils affected area, and (b) land at or below 5 m AHD, where the natural ground level is below 20 m AHD, if the application is for a material change of use, or operational works, involving: (i) excavating or otherwise removing 100 m^3 or more of soil or sediment, or (ii) filling of land with 500 m^3 or more of material with an average depth of 0.5 m or more.
Site based stormwater management plan (SBSMP)	A SBSMP shall identify potential on and off site (upstream, downstream and adjacent properties) impacts associated with stormwater for a proposed development. The SBSMP shall also identify a range of stormwater management strategies and action for water quality, water quantity and environmental issues (eg riparian vegetation within the waterways affected by the development). A SBSMP may form part of the development's overall Environmental Management Plan.
Stormwater management plan (SMP)	A plan that evaluates options for the management of stormwater quantity, quality and ecological values within the waterway corridor on a benefit-cost basis. The plan draws upon environmental assessments, as well as hydrologic, hydraulic and water quality

Term	Definition
	modelling. The plan replaces the functions of, and builds upon, the old 'Master Drainage Plan'. The plan is usually developed for developing areas, for example, fringes or pockets of the City that are being urbanised.
Stormwater quality best management practices (SQBMPs)	A range of stormwater management measures which aim to reduce the amount of stormwater runoff and export of pollutants. These practices include: (a) *Source Controls* that aim to prevent the entry of pollutants into stormwater at the pollutant source. These are often non-structural controls that involve public education to modify community behaviour (e.g. drain and kerb labelling, public awareness campaigns). (b) *Runoff Reduction Controls* which lower the volume and peak discharge of stormwater flows. These controls reduce the potential for pollutant wash off and downstream erosion (e.g. on-site detention systems, stormwater recycling systems, dry detention basins). (c) *Infiltration Controls* that include stormwater treatment and/or disposal methods that allow filtration through a porous media (e.g. porous pavements, percolation trenches). (d) *Pollution interception controls* (e.g. Stormwater Quality Improvement Devices – SQIDs) that physically intercept or retain stormwater pollutants for removal or further treatment (eg. filter strips gross pollutant traps, constructed wetlands, vegetated filter strips, grassed swales).
Stormwater quality improvement devices (SQIDs)	Devices used to improve the health of our waterways. SQIDs work by reducing the amounts of pollutants that enter stormwater and waterways. Types of SQIDs include trash racks, gross pollutant traps, constructed wetlands, gully pit baskets.
Uncontaminated runoff	Stormwater runoff that has not been contaminated by sediment from a work site, or has not been directly or indirectly contaminated as a result of actions associated with the work site.
Water quality indicators	A water quality indicator is an indicator for an environmental value, and is a property that can be measured in a quantitative way (e.g. pH, temperature).
Water quality modelling	A technique used to make predictions about the quality of water in waterways. Water quality modelling encompasses pollutant export modelling via models such as MUSIC, which predicts the pollutant loads being discharged from a given area.
Water quality objectives (WQOs)	Measurable goals for the quality of receiving waters to ensure the Environmental Values are protected.

Term	Definition
Water sensitive urban design (WSUD)	WSUD is a relatively new concept in regional Queensland, dealing with the '*interactions between the urban built form (including urban landscapes) and the urban water cycle as defined by the three urban water streams being potable water, wastewater and stormwater'* (Engineers Australia 2003).
Waterway	Any element of a river, creek, stream, gully or drainage channel, including the bed and banks. This term includes waterways indicated on the Planning Scheme Maps.

1.6 Planning and concept design

The Designer is to consider the site characteristics, constraints and opportunities relating to stormwater management at the initial planning phases of the development. This is to ensure that sufficient area is allocated within the development site for appropriate stormwater management infrastructure.

For all IDAS applications, a Site Based Stormwater Management Plan (Concept) shall be submitted with the development application to Council for all developments. This will assist in assessing the impact of the development on the site.

Where an IDAS application disturbs ASS (where defined), a Site Based Acid Sulfate Soils Management Plan (Concept) is to be submitted with the development application.

A Site Based Stormwater Management Plan (Concept) for all Council projects shall be prepared by the Designer, or Consultant, and submitted to Council for approval. The approved concept design shall be included in the Drawings for the project.

A Site Based Acid Sulfate Soil Management Plan (Concept) for Council projects shall be prepared where it would apply to the works if it was a development assessed under IDAS.

1.7 Detailed design

The following documents shall be submitted to Council as part of the detailed engineering design documentation following approval of the concepts from Council and other relevant Government Departments:

(a) Site Based Stormwater Management Plan (SBSMP);

(b) Site Based Acid Sulfate Soils Management Plan (SBASSMP) where applicable; and

(c) Erosion and Sediment Control Program (ESC Program).

The documents are to be site specific and not a generalisation of erosion and sediment control, stormwater quality and acid sulfate soil management philosophies. The documents may also form part of the contract specifications for a contractor to comply with during construction.

For Council projects, the organisation responsible for the preparation of the detailed design of the SBSMP, SBASSMP (where applicable) and ESC Program will depend on whether the Works are to be constructed by Council's staff or by Contract.

Where Council's staff are utilised, the detailed design shall be prepared by Council, or its consultant.

For Works by Contract, the Contractor is responsible for preparing and submitting for approval, the SBSMP and SBASSMP and ESC Program.

These detailed Plans and Program shall be referred to the Designer for a concurrence report in both cases and subsequent consideration for approval by Council's Environmental Engineer.

Documentation required for SBSMPs, ESC Programs and SBASSMPs are detailed in Section 1.16 to 1.19.

Where available, examples of proposed developments detailing locations of water quality structures, sediment and erosion control devices may be obtained from Council and used as a guide when preparing SBSMPs and ESC Programs.

1.8 Construction

No site works shall commence prior to approval of the detailed design documents submitted to Council. All works are to be undertaken in accordance with the approved SBSMP, SBASSMP and ESC Program, ESC Management Plans, local laws, development conditions and environmental regulations.

Implementation of the approved works during construction must be supervised by personnel with appropriate qualifications in soil and water quality management.

The developer (or representative) shall constantly monitor, review and modify soil and water management practices to correct any deficiencies.

Amendments required to the approved documents during construction are to be discussed and approved by Council Officers prior to implementing amended practices.

Random audits may be performed by Council Officers throughout the construction phase of the project to review compliance with approved documentation. Where inconsistencies are noted, written advice will be sent to the developer (or representative) requiring appropriate action within 24 hours.

Where Council Officers notifications are not complied with, the works may be undertaken by Council without further reference to the developer. All costs incurred by Council in carrying out the works will be recovered from the maintenance bond.

1.9 Maintenance

Maintenance plans are to be provided for SQIDs that are to be handed over to Council. The responsibilities for maintenance of SQIDs are to be detailed in the SBSMP. The maintenance plans are to be written for use by Council's maintenance and asset personnel. Examples of SQIDs that require maintenance plans include trash racks, gross pollutant traps, constructed wetlands and ponds. The maintenance plans are to include:

(a) design details;

(b) manufacturer and supplier contact details (where relevant);

(c) inspection frequency;

(d) maintenance frequency;

(e) data collection requirements; and

(f) clean-out procedures that address, at a minimum, public safety, maintenance techniques, equipment requirements, environmental management considerations and occupational health and safety and disposal requirements.

A hand-over meeting must occur between the developer (or representative), previously responsible maintenance personnel, Council's Maintenance Co-ordinator and Environmental Engineer.

In the event that the SQID is not complying with approved conditions, Council is under no obligation to accept responsibility of the asset.

2 Stormwater quality management

2.1 Stormwater quality management

Council is committed to improving stormwater quality. This is demonstrated in Council's Stormwater Quality Management Plan (SWQMP), which has been prepared for Mackay's urban areas. An Urban Stormwater Quality Management Plan is currently being prepared in accordance with the requirements of the Urban Stormwater Quality Planning Guidelines (DERM 2010). This plan is to be finalised by June 2013.

The SWQMP establishes the framework "*to manage stormwater quality in urban waterways in a way that maintains or enhances the state of balance among environmental, social and economic interests within the community*". The goal is consistent with Council's corporate objective for ecological sustainability as described in the Corporate Plan.

Stormwater inlet structures such as gully pits and field inlet pits are to be stencilled or embedded with an environmental awareness message aimed to improve the quality of water entering waterways. Appropriate messages include:

(a) the drain is just for rain;

(b) dump – no waste – flows to creek; and

(c) protect our waterways – flows to the ocean.

Refer to Council's standard drawings for details.

Implementation of on the ground improvements for stormwater quality is to be achieved through catchment-based management strategies, initially focusing on 'at risk' catchments. The SWQMP identifies and prioritises urban catchments within Mackay City.

Catchment Management Plans (CMPs) for these catchments together with Stormwater Management Plans (SMPs) and Waterway Management Plans (WMPs) are progressively being prepared with outcomes form these projects including the definition of Environmental Values (EVs) and Water Quality Objectives (WQOs) in Mackay's waterways.

The Environmental Protection (Water) Policy 2009 (EPP Water) provides the legislative basis for water quality management in Queensland. It identifies the need to establish Environmental Values (EVs) and related Water Quality Objectives (WQOs) for waters.

EVs and WQOs need to be identified to ensure that the quality of affected receiving waters are maintained or enhanced. WQOs includes all measurable water quality goals that have been derived to protect corresponding environmental values.

As the values and objectives are being determined, Council will maintain a set of recommended environmental values and water quality objectives for all of the City's waterways. These will be provided to developers for guidance on the performance objectives that their development is to be designed to achieve for receiving water quality. These are documented in Council's Stormwater Quality Management Plan.

These water quality objectives have been developed based on expert advice and the best information available. However, where a developer wishes to invest in local water quality studies to better define applicable site-specific environmental values and water quality objectives, this may be done in consultation with regulatory authorities, and the resulting site-specific water quality objectives may override Council's recommended water quality objectives.

Council is to be contacted regarding the status of the various CMPs, SMPs and WMPs.

2.2 Stormwater quality risk classification

Small, 'low risk' developments in Mackay do not have to identify EVs and WQOs for receiving waters. Proposals for these developments need to demonstrate achievement of best management practices for the type of pollutants that are likely to be generated.

Developments in Mackay considered a 'high risk' in relation to impacts on stormwater quality require the identification of EVs and WQOs for receiving waters within and/or downstream of the development. Proposals for these developments need to demonstrate that stormwater draining from the site will not threaten the relevant environmental values and their corresponding water quality objectives, in affected receiving waters through the use of appropriate SQBMPs.

2.3 Stormwater quality best management practices (SQBMP)

Stormwater quality best management practices is a term given to a collection of practices and devices that improve stormwater quality through the prevention, minimisation and/or trapping of pollutants. They include non-structural and structural controls as described below.

Non structural source controls

(a) Community awareness (education) programs

(b) enforcement on littering and ESC on construction sites;

(c) incentives for adopting innovation in SQBMP;

(d) street cleaning;

(e) rehabilitating, expanding and protecting buffer zones; and

(f) environmental awareness message on stormwater inlet structures

Structural source controls (or stormwater quality improvement devices (SQIDs))

(a) *Primary practices/devices* – remove gross pollutants and coarse sediment:
   (i) in-ground GPT
   (ii) oil/grit separators
   (iii) sediment traps
   (iv) litter and trash racks
   (v) downwardly inclined screens

(vi) floating litter booms
(vii) end of pipe litter nets
(viii) litter baskets
(ix) side entry traps or gully pit gross pollutant traps

(b) *Secondary practices/devices* – remove sediments, with partial removal of heavy metals and bacteria:
(i) filter strips
(ii) grass swales
(iii) sand / bioretention filters
(iv) infiltration trench / basin
(v) porous pavements
(vi) detention basins (dry)

(c) *Tertiary practices/devices* – remove nutrients, bacteria, fine sediments and heavy metals:
(i) water quality ponds (with pre-treatment)
(ii) constructed wetlands

The design of structural source controls or SQIDs should be prepared in accordance with the reference and source documents contained in 1.4.

2.4 Determining stormwater quality design objectives[2]

The EPP (Water) 2009 establishes the EVs in receiving waters. The associated WQOs form the basis for defining the required water quality of urban stormwater entering and mixing in local waterways. There are three ways to estimate the level of stormwater quality improvement necessary for a site to ensure WQOs are taken into account to help protect the EVs for waterways (refer Figure 2.4).

For the site scale these are:

(a) monitoring – actual stormwater quality can be compared with receiving water quality to establish the level of treatment necessary to protect EVs, where sufficient monitoring data are available from the same development type in similar landscape conditions.

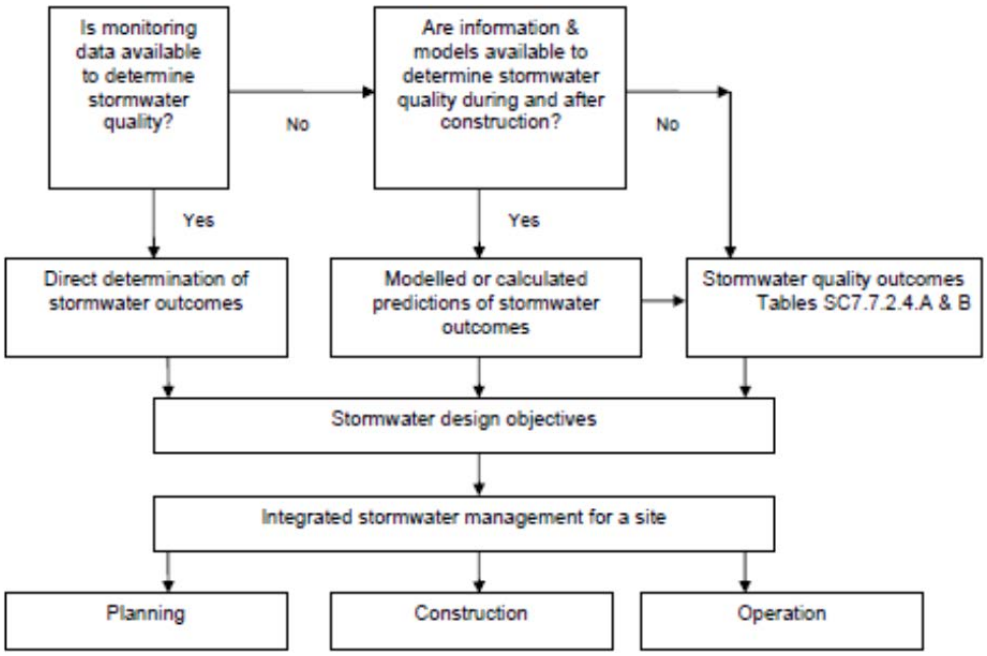
(b) modelling – stormwater quality and its potential impact on receiving waters can be mathematically modelled to determine treatment requirements (design objectives). Some monitoring data are usually required to validate such models.

(c) best management practices – best available data on the performance efficacy of current best practice treatment technologies can be used to establish minimum standards of performance (typically expressed as minimum average annual pollutant load reductions, or minimum average percentage reductions in pollutant loads – see Table 2.4.A and Table 2.4.B).

In rapidly urbanising catchments, the wet-weather impacts of the construction phase of the land development phase need to be considered as well as the post-development or permanent settlement phase, as the issues and impact assessment methodology are different. Critical impact factors include soil erosion hazard of the landscapes being developed, and increased rainfall run-off coefficients which occur when land is cleared and topsoil removed.

Figure 2.4 – Approaches for determining stormwater design objectives and their context in integrated stormwater management for a site

[2] Please note, the following sections are extracted from the Queensland Government's Urban Stormwater Quality Planning Guidelines 2010. Amendments have been made to reflect the Mackay Region's requirements.



The preferred method for determining the required level of treatment is by use of monitoring data from a similar development. However, the inherent variability in water quality experienced in waterways and stormwater systems means that an extensive monitoring program is usually required to obtain sufficient data for such assessments.

Modelling provides an ability to predict likely changes in water quality associated with proposed urban developments. Such water quality models can be used to establish performance outcomes for stormwater systems. These are limited by the availability of local water quality data and the understanding of the biological and physical processes that influence water quality and the receiving water environment. There are often significant limits on the confidence with which predictions can be made using water quality models at the site scale.

Despite the uncertainty of modelling, adopting predictive modelling techniques to quantify estimates of stormwater pollutant concentrations and loads from urban land surfaces and the pollutant removal efficacy of current best practice stormwater treatment infrastructure is an accepted method for establishing best practice stormwater management 'treatment train' design for regions where limited or no monitoring data exists. Refer to *Stormwater Quality Performance Curves & Stormwater Quality Objectives for Mackay* (DesignFlow, April 2009).

Stormwater quality and flow management design objectives for the construction phase of development are provided in Table 2.4.A and focus on suspended solids and gross pollutants. The construction phase design objectives were derived from a review of the current design objectives found in local government jurisdictions and review of contemporary literature on erosion and sediment control. The construction phase design objectives for suspended solids will typically differ from the operational phase design objectives because of the risk of exposing large areas of bare soil, timing of the exposure in the context of rainfall, and the relative range of activities on the site.

Stormwater quality management design objectives for the operational phase are provided in Table 2.4.B with a focus on suspended sediments and nutrients. Stormwater flow management design objectives for the operational phase are provided in Table 2.4.A.

The stormwater quality management design objectives for the operational phase were derived from predictive modelling using local climatic data and best available information on:

(a) hydrologic characteristics of soils;

(b) pollutant concentrations generated from different land surfaces;

(c) pollutant removal efficacy of contemporary stormwater treatment infrastructure designed to current best practice standards, configured in a 'treatment train' and sized to operate at each treatment technology's point of diminishing return; and

(d) minimum and interim criteria to reduce the impacts of urbanisation on waterway health.

Catchment-specific modelling and local area field studies are always preferred methods to support planning and development design decisions. Where this information is available it should be used to develop site-specific design objectives.

The operational phase design objectives in Table 2.4.B are:

(a) applicable to typical urban developments;

(b) generally achievable by at least two best practice 'treatment train' solutions; and

(c) effective in helping to protect EVs for the waterway.

Table 2.4.A is for the construction phase of development for medium and large scale construction sites (defined as disturbance greater than 2,500m^2). For small scale construction sites (defined as disturbance area less than 2,500m^2) and independent of a larger common development, the implementation of urban stormwater quality management should be in accordance with MRC's *Best Practice Guidelines for Controlling Stormwater Pollution from Building Sites*.

Refer to Section 3 for further information on erosion and sediment control requirements.

Table 2.4.A – Summary of design objectives for management of stormwater quality – construction phase of development (USQPG DERM, 2010)

Construction phase stormwater design objectives	Explanatory notes
Drainage control	
Design life and design storm of temporary drainage works: (a) disturbed area open for <12 months – 39.35% Annual Exceedance Probability (former 2 year ARI) (b) disturbed area open for 12-24 months – 18.13% Annual Exceedance Probability (former 5 year ARI) (c) disturbed area open for > 24 months – 10% Annual Exceedance Probability (former 10 year ARI)	Design capacity excludes minimum 150 mm freeboard. A higher drainage design objective may be required for temporary drainage structures upslope of occupied properties. A revised drainage design storm may be required if these design objectives are found to be impracticable (e.g. in North Queensland).
Erosion control	

Construction phase stormwater design objectives	Explanatory notes
(a) Minimise exposure of disturbed soils at any time (b) Avoid or minimise large construction activities in the wet season (b) Divert water run-off from undisturbed areas around disturbed areas (c) Use erosion risk ratings to determine appropriate erosion control measures	'Wet season' means the high rainfall months, e.g. the four highest rainfall months. For point (d), determine the erosion risk rating using local rainfall erosivity, rainfall depth, or soil loss rate or other acceptable method. A rating scale such as very low, low, moderate, high, extreme should be applied. Such ratings should reflect the local area. Example ratings may be shown in local council guidelines or detailed in best practice guidelines.
Sediment control	
(a) Use soil loss rates to determine appropriate sediment control measures (b) Design storm for sediment control basins should be based on retaining the maximum sediment quantity for the maximum volume of water run-off (c) Site discharge during sediment basin dewatering should not exceed 50 mg/L TSS and pH between 6.5–8.5	For point 1, surrogate determinations may be used such as monthly erosivity or average monthly rainfall. For point 2, a commonly used design storm for basin sizing is 80th% five-day event. Depending on the settling characteristics of local soils, a higher 'operational' design storm can be achieved with chemical dosing operated in flow-through mode in a large storm with rainfall-activated auto-flocculent dosing, and advanced hydraulic efficiency features such as floating offtakes, and a sediment forebay. For example, on the Sunshine Coast operation of the basin can achieve the water quality outcomes in any rainfall event up to 125 mm rainfall depth in any five-day period 2. For point 3, TSS = total suspended solids. Turbidity measurements (e.g. 60 Nephelometric Turbidity Units (NTU)) could be used; however, for accuracy, a sitespecific relationship should be developed between turbidity and total suspended solids.
Water quality outcomes	

Construction phase stormwater design objectives	Explanatory notes
Stormwater flows from undisturbed and disturbed areas – manage to help protect environmental values.	As far as is reasonable and practicable, all run-off from disturbed areas is collected and drained to a sediment basin—up to the design storm event.
(a) *Coarse sediment* – coarse sediment is retained on site. (b) *Fine sediment* – Site discharge during sediment basin dewatering has a TSS concentration less than 50 mg/L.	Achieve site discharge water quality through, for example, appropriate sediment basin design and operation with flocculation as required.
Turbidity – Site discharge during sediment basin dewatering has a turbidity (NTU) less than 10% above receiving waters turbidity – measured immediately upstream of the site.	A site-specific relationship should be developed between turbidity and suspended solids, prior to the commencement of construction on large and medium scale construction site
Nutrients (N and P) – Nitrogen and phosphorus are managed through sediment control.	
pH – Site discharge during sediment basin dewatering has a pH range 6.5–8.5.	May be further limited to prevent mobilisation of specific elements.
Litter and other waste – Prevent litter/waste entering the site, the stormwater system or watercourses that discharge from the site. Also minimise or sufficiently contain on-site litter and waste production and regularly clear waste bins.	Avoid wind blown litter; remove gross pollutants.
Hydrocarbons and other contaminants – Hydrocarbons and other contaminants are prevented from entering the stormwater system or internal watercourses that discharge from the site.	See the prescribed water contaminants in schedule 9 of the *Environmental Protection Regulation 2008*. Waste containing contaminants must be disposed of at authorised facilities. Store oil and fuel in accordance with Australian Standard AS1940—no visible oil or grease sheen on released waters.
Wash down water – Wash down water is prevented from entering the stormwater system or internal watercourses that discharge from the site.	
Cations and anions – Cations and anions including aluminium, iron and sulfate are managed as required under an approved acid sulfate soil management plan.	
Stormwater drainage / flow management	

Construction phase stormwater design objectives	Explanatory notes
Hydraulics and hydrology – Take all reasonable and practicable measures to minimise significant changes to the natural waterway hydraulics and hydrology from: (a) peak flow for the one-year and the 1% Annual Exceedance Probability (inlcuing climate change factor) flood event (respectively for aquatic ecosystems and flood protection) (b) run-off frequency and volumes entering receiving waters (c) uncontrolled release of contaminated stormwater	Including making best use of constructed sediment basins to attenuate the discharge rate of stormwater from the site.

Table 2.4.B – Summary of design objectives for management of stormwater quality – operational (post-construction) phase of development (USQPG DERM, 2010)

Region	Minimum reductions in mean annual loads from unmitigated development (%)				Further information
	Total suspended solids (TSS)	Total phospho-rous (TP)	Total nitrogen (TN)	Gross pollutants > 5 mm	
Mackay	75	60	35	90	DesignFlow (2009) *Stormwater Quality Performance Curves and Stormwater Quality Objectives for Mackay*

2.5 Determining stormwater quantity design objectives

Stormwater quantity management for waterway health enhancement focuses on the management of frequent urban stormwater flows that cause disturbance to aquatic habitats and aquatic ecosystem health, and on waterway geomorphic stability. This is distinct from urban stormwater quantity management for flood management purposes which is concerned with the management of less frequent, more extreme stormwater flows that cause nuisance flooding and potential flood damage. The latter is an important part of integrated stormwater management and should not be compromised in pursuit of the management of frequent flows for waterway health protection. Stormwater management infrastructure can be designed to meet multiple objectives, such as flooding and waterway quality and stability, and thus reduce costs.

Construction phase quantity design objective

Some Queensland soils have infiltration rates of less than one millimetre per hour and many less than 10 mm/hour. An increase in site surface run-off coefficients begins on most sites when an urban development site is first cleared of vegetation and topsoils removed to expose subsoils. Hence, there is a potential for stream damage through increased flow volume, reduced baseflow, altered stream substrates, and increased frequency of run-off events to waterways during this period, especially if the period of construction is prolonged (in excess of one year from land clearing to end of construction activities). The risk will generally depend on:

(a) the relevant EVs of the receiving waters and their sensitivity to impacts;

(b) climatic region—sites in the Western districts (see Figure 2.5 or Table 2.2) will usually not require specific quantity control measures;

(c) the period that the site has exposed soils, i.e. a high rainfall run-off coefficient compared to the natural condition; and

(d) the area exposed at any one time.

Operational (post-construction) phase

Two stormwater quantity management design objectives are described in Table 2.5—the frequent flow management design objective and the waterway stability management design objective.

Frequent flow management design objective

This objective aims to protect in-stream ecosystems from the significant effects of increased run-off frequency, by capturing the initial portion of run-off from impervious areas. This approach ensures that the frequency, duration and severity of hydraulic disturbance to in-stream ecosystems in developed catchments is similar to predevelopment conditions for small flow events.

Compliance with this objective may be demonstrated by providing a total stormwater capture volume (m^3) calculated as follows:

Capture volume (m^3) = Impervious area (m^2) x target design run-off capture depth (m)

The spatial distribution of the required capture volume may be adapted to suit individual site conditions, provided that the required volume from all impervious areas is captured before leaving the site. Implementing the required capture volume will reduce contaminants, providing a synergistic benefit for water quality. Hence there may be opportunity to incorporate frequent flow and stormwater quality treatment measures. Since the objective requires that this capture volume be available each day, the management system (whether infiltration, evaporation, reuse or discharge via bioretention) must be capable of draining the captured stormwater within 24 hours or have extra storage capacity.

Waterway stability management design objective

This objective aims to prevent accelerated in-stream erosion downstream of urban areas by controlling the magnitude and duration of erosion-generation and sediment-transporting flows.

Compliance with this design objective can be demonstrated using a run-off routing model. The aim is to ensure the one-year average recurrence interval event is maintained at predevelopment levels. At the discretion of the local authority, the adoption of simplified methods for demonstrating compliance for small developments is acceptable.

The document 'Water sensitive urban design—Developing design objectives for water sensitive urban development in South East Queensland' (SEQ Healthy Waterways 2006) provides detailed technical discussions on the frequent flow design objective and the waterway stability management design objective, including an outline of possible methods for demonstrating compliance with these two design objectives.

Table 2.5 – Design objectives for management of stormwater quantity—operational (post-construction) phase of development (USQPG DERM, 2010)

Assessment criteria	Frequent flow management	Waterway stability management
Intent	To minimise the frequency of disturbance to aquatic ecosystems from urban development by managing the volume and frequency of surface run-off during small rainfall events.	To control the impacts of urban development on channel bed and bank erosion by limiting changes in flow rate and flow duration within the receiving waterway.
Design objective	Capture and manage the following design run-off capture depth from all impervious surfaces of the proposed development: (a) for total fraction impervious up to 40%—capture at least the first 10 mm of run-off from impervious surfaces (b) for total fraction impervious >40%—capture at least the first 15 mm of run-off from impervious surfaces (c) run-off capture capacity replenished within 24 hours of the run-off event; or (d) in accordance with locally developed designobjectives which are demonstrated to protect the key hydrologic characteristics of the downstream aquatic ecosystem.	Limit the post-development peak 1 Exceedance per year flood event discharge within the receiving waterway to the pre-development peak 1 Exceedance per year flood event discharge ('pre-development' is defined in Appendix B of Technical Note: Derivation of Design Objectives January 2009).

Assessment criteria	Frequent flow management	Waterway stability management
Recommended application	Applicable where run-off from or within the site passes through or drains only to unlined channels, or non-tidal waterways or wetlands. Also applicable to subdivisional scale development. It is not necessarily applicable to catchment scale planning where the cumulative drainage impacts of multiple developments and other hydrological impacts may need to be considered. The implications of such specific catchment-scale planning may affect these objectives and the local authority may substitute alternative design objectives. Where a receiving waterway is degraded[3] the local or regional authority may choose not to require compliance with this objective, on the basis that the receiving waterway and its associated catchment/s have been identified by the authority as having limited potential for future rehabilitation and/or WSUD retrofitting. Management of captured stormwater should include one or more of the following: (a) stormwater evaporation (b) stormwater reuse (c) diversion of flows from receiving environments (d) infiltration to native soils or otherwise filtered through an appropriately designed soil and plant stormwater treatment system, such as bioretention.	Applicable where run-off from or within the site passes through or drains only to unlined channels, or non-tidal waterways or wetlands. Where a receiving waterway is significantly degraded[5], the local government may choose not to require compliance with this objective, on the basis that the receiving waterway and its associated catchment/s have been identified by the authority as having limited potential for future rehabilitation and/or WSUD retrofitting. Local government may substitute alternative criteria where catchment-scale studies have been undertaken to develop a catchment-specific approach to the management of in-stream erosion impacts.

[3] For the purpose of these guidelines, a waterway is defined as degraded where:
(a) the proportion of impervious area within the catchment, prior to the proposed development, is greater than 30 per cent; or
(b) the waterway is designated as 'highly disturbed' in Schedule 1 of the *Environmental Protection (Water)Policy 2009.*

6.3 Erosion and sediment control

3.1 Erosion and sediment control principles

The principles for effective erosion and sediment control are:

(a) Minimise the extent and duration of soil disturbance.

(b) Control the location and velocity of drainage flow during the construction phase.

(c) Minimise soil erosion initiated by wind, rain or concentrated flow.

(d) Minimise sediment runoff from the site.

(e) Promptly revegetate or stabilise all exposed and or unstable soil surfaces.

(f) Adequately install, operate and maintain all ESC measures.

(g) Develop an Erosion and Sediment Control Program (ESC Program) and amend the program to minimise environmental harm.

3.2 Erosion and sediment control measures

The following list contains control measures that can minimise drainage, erosion and sediment control issues. When these measures are implemented appropriately, the effects of soil erosion and sediment dispersion may be significantly decreased when compared to development without these control measures.

(a) Drainage control techniques:
- (i) water diversion channels/structures
- (ii) temporary and permanent waterway crossings
- (iii) energy dissipators and outlet protection
- (iv) check dams
- (v) chutes and drop pipes
- (vi) grassed channels
- (vii) level spreaders
- (viii) reinforced grassed channels
- (ix) rock and concrete lined channels and protection\Sediment basin spillways
- (x) sediment basin spillways
- (xi) vegetative cover

(b) Erosion control techniques:
- (i) ground covers
- (ii) mulching and seeding
- (iii) erosion control blankets/mats
- (iv) surface roughening
- (v) vegetation/revegetation
- (vi) chemical surface stabilisers
- (vii) soil-cement treatment
- (viii) geosynthetic lined channels
- (ix) control of wind erosion
- (x) turfing
- (xii) vegetation logs and mats

(c) Sediment control techniques:
  (i) entry / exit pads
  (ii) grass filter strips and buffer zones
  (iii) stockpile protection
  (iv) grass swales
  (v) dewatering Activities
  (vi) sand filters
  (vii) infiltration trench / basin
  (viii) water quality ponds and constructed wetlands
  (ix) control of wind erosion
  (x) sediment fences
  (xii) rock filter dams
  (xiii) sediment basins, ponds and weirs
  (xiv) gross pollutant traps

The designer is encouraged to refer to the Reference and Source Documents listed in sub-clause 1.4(d) for assistance in the design of ESC measure listed above.

3.3 Model code of practice provisions – erosion and sediment control

Appendix A presents detailed supporting information to the model code of practice provisions for erosion and sediment control on construction sites.

Compliance with a given performance outcomes can only be achieved by:

(a) complying with the acceptable outcome

(b) formulating an alternative solution which complies with the performance outcomes, or is shown to be at least equivalent to the acceptable outcomes

(c) a combination of (i) and (ii).

Unless otherwise indicated, all outcomes listed within the acceptable outcome must be satisfied in order to comply with the acceptable outcome.

Appendix A forms part of this code. The attachment provides essential information and requirements not otherwise provided within the code.

Please note, where Appendix H and Appendix I are mentioned in this appendix, they refer to the IECA 2008, Best Practice Erosion and Sediment Control, International Erosion Control Association (Australasia), Picton NSW.

If the scheduled works incorporate building activities, then the model code of practice provided in Appendix H (Building sites) shall apply.

If the scheduled works incorporate instream soil disturbances, then the model code of practice provided in Appendix I (Instream works) shall apply.

In the event of a conflict over the desired outcome of a performance outcomes or an acceptable outcome, then the outcome shall be that which best achieves the objective of the code, that being:

(a) To protect the environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

(b) To achieve this objective a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm (s319 *Environmental Protection Act 1994*). In assessing all reasonable and practicable measures, appropriate consideration must be given to:
   (i) the nature of the potential harm
   (ii) the sensitivity of the receiving environment
   (iii) the current state of technical knowledge for the activity
   (iv) the likelihood of successful application of the various measures that might be undertaken
   (v) the financial implications of the various measures relative to the type of activity.

The various recommendations presented in this guideline are an indication of what may be considered reasonable and practicable for the construction industry.

This model code of practice does not provide all the information necessary to adequately control soil erosion and sediment run-off in all situations.

Users of the code should always make their own site-specific evaluation, testing and design, and refer to their own advisers and consultants as appropriate.

Specifically, the adoption of this model code of practice will not necessarily guarantee:

(a) compliance with any statutory obligation; or

(b) avoidance of all environmental harm or nuisance.

Table 3.3 – Model code of practice provisions – erosion and sediment control – assessment criteria

Performance outcomes	Acceptable outcomes
Development planning and design	
PO1 Adequate data is obtained to allow appropriate site planning and design.	**AO1.1** The extent and complexity of data collection is commensurate with the potential environmental risk, and the extent and complexity of the proposed soil disturbance.
	AO1.2 Potential site constraints and zones of high or extreme erosion hazard are identified early in the planning phase.
	AO1.3 A conceptual ESCP is prepared if the construction activities are deemed to represent a high to extreme erosion hazard.
PO2 The design and layout of the development does not cause unnecessary soil disturbance.	**AO2.1** The development is appropriately integrated into the existing site conditions, including the existing topography, such that the need for extensive land reshaping and surface modifications is minimised.

Performance outcomes	Acceptable outcomes
	AO2.2 Wherever reasonable and practicable, 'cut and fill' and 'slab-on-ground' construction practices are not employed on land slopes equal to, or steeper than 15 per cent.
	AO2.3 The design, staging, and layout of the development do not cause unnecessary soil disturbance if an alternative design, staging or layout (which reduces the potential environmental harm) is available that achieves the same or equivalent project outcomes at a reasonable cost.
PO3 The design and layout of the development minimise the risk of environmental harm occurring during the construction phase.	**AO3.1** Potential high-risk construction activities are identified during development planning.
	AO3.2 Essential ESC control measures are appropriately integrated into the project's planning, design and financial analysis.
	AO3.3 Adequate space is provided for the construction and maintenance of essential ESC measures.
	AO3.4 The development layout avoids the placement of critical structures or buildings within the region of the lowest land elevation within any sub-catchment if such a structure would prevent the construction and effective operation of essential ESC measures throughout the construction period.
	AO3.5 The development's design and layout do not cause unnecessary delays to the initiation and satisfactory completion of site stabilisation and final rehabilitation activities.
PO4 The design and layout of the development minimise the risk of environmental harm occurring during the operational phase of the development.	**AO4.1** The development is designed to appropriate drainage standards (permanent drainage works).

Performance outcomes	Acceptable outcomes
	AO4.2 Ongoing erosion problems at the inlet and outlet of permanent drainage systems (pipes or channels) are minimised.
	AO4.3 The development incorporates current best practice stormwater quality controls for the operational phase of the development.
	AO4.4 The development design and layout appropriately recognises and integrates identified site constraints.
	AO4.5 To the maximum degree reasonable and practicable, disturbance to deep-rooted vegetation on slopes susceptible to mass movement is minimised, if not totally avoided.
PO5 The design and layout of the development minimise the risk of environmental harm to downstream waterways.	**AO5.1** All reasonable and practicable measures are taken to minimise changes to the natural water cycle (including volume, frequency, duration and velocity of stormwater run-off) during the operational phase of the development.
	AO5.2 The number of temporary and permanent watercourses crossing is reduced to the minimum necessary.
Construction planning	
PO6 Adequate site data is obtained to allow appropriate construction planning.	**AO6.1** Zones of high to extreme erosion hazard are identified prior to construction planning.
	AO6.2 The extent and complexity of site data, including soil mapping, is commensurate with the potential environmental risk, and the extent and complexity of the soil disturbance.
PO7 Construction planning aims to minimise the risk of environmental harm occurring during the construction phase.	**AO7.1** Development of the ESCP is an integral part of construction planning.

Performance outcomes	Acceptable outcomes
	AO7.2 High-risk construction activities are identified during construction planning.
	AO7.3 High-risk construction activities and disturbances of high to extreme erosion hazard areas are minimised, if no totally avoided, especially during periods of high to extreme erosion potential.
	AO7.4 All reasonable and practicable measures are taken to design/plan the construction layout, programming, staging and methodology to minimise environmental risks associated with high-risk construction activities.
	AO7.5 Construction planning minimises the duration that any and all areas of soil will be exposed to the erosive effects of wind, rain and flowing water, in part through the progressive and prompt stabilisation of disturbed areas.
	AO7.6 Construction site layout, methodology, staging and programming do not cause unnecessary environmental harm if an alternative layout, methodology, staging or program (which reduces unnecessary soil disturbance and/or potential environmental harm) is available that achieves the same or equivalent project outcomes at a reasonable cost.
	AO7.7 On sites with a soil disturbance greater than 2500m2, a water quality monitoring program, and site stabilisation plan, landscape plan, and/or vegetation management plan is prepared and approved by the relevant regulatory authority prior to site establishment.
PO8 Construction planning aims to minimise the risk of environmental harm to downstream waterways.	**AO8.1** To the maximum degree reasonable and practicable, instream disturbances are programmed to occur during the least erosive and environmentally damaging periods of the year.

Performance outcomes	Acceptable outcomes
	AO8.2 The number of temporary watercourse crossings is minimised.
Erosion and sediment control plan (ESCP)	
PO9 An ESCP is prepared prior to site disturbance that provides sufficient information to achieve the required environmental protection.	**AO9.1** The design standard of drainage, erosion and sediment controls comply with the requirements of the relevant regulatory authority, or where such a standard does not exist, are designed in accordance with current best practice.
	AO 9.2 As a minimum, the ESC design standard applied to a site at any given instant is commensurate with the degree of environmental risk, and the type, cost, and scope of the proposed works.
	AO9.3 The level of information and detail supplied in the ESCP is commensurate with the potential environmental risk and the complexity of the proposed works; and of sufficient clarity to allow on-site personnel to appropriately implement the plan.
PO10 The ESCP is prepared by, or under the supervision of, suitably qualified and experienced personnel.	**AO10.1** The qualifications and experience of the personnel preparing and/or supervising the preparation of the ESCP is commensurate with the potential environmental risk, and the extent and complexity of the soil disturbance.
	AO10.2 The design of each sediment basin is signed off by a suitably qualified and experienced professional.
	AO10.3 On sites with a soil disturbance greater than 2500m^2, the ESCP is signed off by a suitably qualified and experienced professional.
	AO10.4 On sites with a soil disturbance greater than one hectare, or where the ESCP incorporates a sediment basin, the ESCP is signed off by an engineer experienced in hydrology and hydraulics.

Performance outcomes	Acceptable outcomes
	AO10.5 Where the ESCP incorporates a sediment basin with a constructed earth embankment with a height greater than one metre, the ESCP is signed off by an appropriate geotechnical specialist.
PO11 The ESCP is appropriate for the site conditions and the potential environmental risk.	**AO11.1** The extent and complexity of data collected prior to finalisation of the ESCP is commensurate with the potential environmental risk, and the extent and complexity of the soil disturbance.
	AO11.2 In preparation of the ESCP, priority is given to the prevention, or at least the minimisation, of soil erosion, rather than just the trapping of displaced sediment.
	AO11.3 The stormwater drainage requirements of the construction phase are appropriately integrated into the ESCP through the use of best-practice drainage control measures and design standards.
PO12 The ESCP remains relevant, at all times, to the current site conditions.	**AO12.1** The ESCP remains both effective and flexible, and is based on anticipated soil, weather, and construction conditions (as may vary from time to time).
	AO12.2 The ESCP is appropriately amended if the implemented works fail to achieve the 'objective' of the ESCP, the required performance standard, or the State's environmental protection requirements.
	AO12.3 Once the works commence, a revised ESCP is prepared should the works not be completed within 12 months, with further reviews undertaken thereafter at half-yearly intervals.
	AO12.4 All amended ESCPs are prepared by, or under the supervision of, suitably qualified and experienced personnel.
P13 Potential harm to wildlife as a result of ESC measures is minimised.	**A13.1** Synthetic (plastic) reinforced fabrics are not specified within, or adjacent to, bushland areas, riparian zones and watercourses if such materials are likely to cause harm to wildlife or wildlife habitats.

Performance outcomes	Acceptable outcomes
Site establishment	
PO14 Site personnel are provided with all necessary information prior to site establishment.	**AO14.1** The development approval conditions, development permit, ESCP, monitoring and maintenance program, landscape and/or site rehabilitation plan, and any other document required for the management of soil erosion and sediment control, are provided to the principal contractor prior to the commencement of land disturbing activities.
	AO14.2 On sites with a soil disturbance greater than one hectare, a vegetation management plan, and procedures for conducting a site shutdown (whether programmed or unprogrammed), are provided to the principal contractor prior to the commencement of land disturbing activities.
PO15 Appropriate personnel are engaged to implement and monitor all necessary ESC measures prior to commencement of site disturbance.	**AO15.1** Prior to the commencement of any construction activities or soil disturbance, appropriately trained and experienced personnel are engaged to undertake regular ESC audits of the site.
	AO15.2 Prior to commencement of site works, a 'chain of command' in relation to the implementation, modification, and maintenance of ESC measures is established.
PO16 Site establishment does not cause unnecessary soil disturbance or environmental harm.	**AO16.1** No land-disturbing activities occur on the site until all perimeter ESC measures, sediment traps, and associated temporary drainage controls, have been constructed in accordance with the ESCP and best practice erosion and sediment control.
	AO16.2 All site office facilities and operational activities are located such that all effluent, including wash-down water, can be totally contained and treated within the site.
	AO16.3 Adequate waste collection areas/bins are provided on-site and maintained such that environmental harm is minimised.
PO17 Site access is appropriately managed to minimise the risk of environmental harm.	**AO17** Authorised site access is confined to the minimum practicable number of locations.

Performance outcomes	Acceptable outcomes
	AO17 Access onto the site, where authorised or unauthorised, is appropriately managed to minimise the risk of sediment being tracked onto adjoining sealed roadways.
	AO17 All reasonable and practicable measures are taken to ensure stormwater run-off from access roads and stabilised entry/exit systems, drains to an appropriate sediment control device.
Site management	
PO18 The work site is managed such that environmental harm is minimised.	**AO18.1** No land-disturbing activities are undertaken prior to appropriate consideration being given to erosion and sediment control issues.
	AO18.2 All works subject to an ESCP are carried out in accordance with the ESCP (as amended from time to time) unless circumstances arise where compliance with the ESCP would increase the potential for environmental harm as assessed by a recognised authority.
	AO18.3 All ESC measures are installed, operated and maintained in accordance with current best management practice.
	AO18.4 Land-disturbing activities are undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to: (a) allow stormwater to pass through the site in a controlled manner and at non-erosive flow velocities (b) minimise soil erosion resulting from wind, rain and flowing water (c) minimise the duration that disturbed soils are exposed to the erosive forces of wind, rain and flowing water (d) prevent, or at least minimise, environmental harm (including public nuisance and safety issues) resulting from work-related soil erosion and sediment run-off.
	AO18.5 Site spoil is lawfully disposed of in a manner that does not result in ongoing soil erosion or environmental harm.

Performance outcomes	Acceptable outcomes
PO19 Those responsible for erosion and sediment control are appropriately trained and equipped.	**AO19** Site managers and/or the nominated responsible ESC personnel achieve and maintain a good working knowledge of the correct installation and operational procedures of all ESC measures used on the site.
PO20 Disturbance to ESC measures by on-site personnel is minimised.	**AO20.1** On-site personnel are appropriately instructed and educated as to the purpose and operation of adopted drainage, ESC measures, and the need to maintain such measures in proper working order at all times.
	AO20.2 Unnecessary disturbance to ESC measures by on-site personnel, sub-contractors and construction traffic (including site management and material delivery vehicles) is minimised.
PO21 The adopted ESC measures remain relevant at all times to the current site conditions.	**AO21.1** Performance of the site's ESC measures is monitored in accordance with the site's monitoring and maintenance program.
	AO21.2 The adopted erosion and sediment control measures are appropriately amended if site conditions significantly change, or are expected to significantly change, from those conditions assumed during development of the ESCP.
	AO21.3 The adopted erosion and sediment control measures are appropriately amended if the implemented works fail to achieve the 'objective' of the ESCP, or the required performance standard, or the State's environmental protection requirements, or unacceptable environmental harm is occurring or is likely to occur.
	AO21.4 In circumstances where addition or alternative erosion and sediment control measures are required on a site, and a revised ESCP needs to be prepared, then only those works necessary to minimise environmental harm are conducted prior to preparation of the revised ESCP.
PO22 The work site is appropriately prepared for imminent construction activities and weather conditions.	**AO22.1** Adequate supplies of drainage, erosion and sediment control, and relevant pollution clean-up materials, are retained on-site during the construction period.

Performance outcomes	Acceptable outcomes
	AO22.2 Appropriate short-term drainage control measures (e.g. flow diversion around recently opened trenches and excavations) are installed and operational prior to impending storms.
	AO22.3 A minimum stockpile of flocculating agents is securely stored on-site to provide for at least three complete treatments of all chemically treated sediment traps.
PO23 Land disturbing activities do not cause unnecessary soil disturbance.	**AO23.1** Land-disturbing activities do not cause unnecessary soil disturbance if an alternative construction process (that reduces potential environmental harm) is available that achieves the same or equivalent project outcomes at a reasonable cost.
	AO23.2 The extent of unnecessary soil disturbance, including disturbances outside the designated work area, is minimised.
PO24 Damage to retained or protected vegetation is minimised.	**AO24.1** Prior to the commencement of land disturbing activities within any given area, all protected vegetation and significant areas of retained vegetation within that area, are appropriately identified to minimise the risk of disturbance to such areas.
	AO24.2 No damage is allowed to occur to roots, trunk or branches of 'retained' vegetation, unless under the direction of an appropriate vegetation management plan.
PO25 Adopted work practices minimise the release of pollutants into receiving waters.	**AO25.1** Emergency and pollution control procedures are commensurate with the site conditions, local environmental values, and the type, cost, scope and complexity of the works.
	AO25.2 All liquid chemicals, including petroleum products, that could potentially be washed or discharged from the site in association with sediment, are stored and handled on-site in accordance with relevant standards such as AS1940.

Performance outcomes	Acceptable outcomes
	AO25.3 Cement-laden run-off, concrete waste, and chemical products (including petroleum and oil-based products), are managed on-site in accordance with current best management practice.
	AO25.4 Brick, tile and masonry-cutting activities are carried out in accordance with current best management practice.
	AO25.5 Washing of tools and painting equipment is carried out in accordance with current best management practice.
	AO25.6 Newly sealed hard-stand areas (e.g. roads, driveways and car parks) are swept thoroughly as soon as practicable after surfacing to minimise the risk of components of the surfacing compound (e.g. bitumen and gravel) entering stormwater drains.
	AO25.7 All pollutants washed or blown from the site are collected and secured as soon as practicable.
PO26 The application of liquid or chemical-based dust suppression measures does not cause an environmental hazard.	**AO26.1** The application of dust suppression measures complies with state-approved environmental controls and manufacturer's instructions (whichever is the most restrictive or environmentally conservative).
	AO26.2 Vegetation watering and dust suppression activities are conducted in a manner that ensures sediment-laden run-off from such activities does not create a traffic or safety hazard.

Performance outcomes	Acceptable outcomes
PO27 Environmental harm, safety issues, and nuisance or damage to public and private property resulting from off-site sediment deposits, material spills, and/or the adopted ESC measures is minimised.	**AO27.1** Sediment and other material originating from the work area, or as a result of the transportation of materials to or from the work area, that collects on sealed roads, or within gutters, drains or waterways outside the immediate work area, is removed: (a) immediately if rain is occurring or imminent (b) immediately if considered a safety hazard (c) if items (a) or (b) do not apply, as soon as practicable, but before completion of the day's work. Washing/flushing of sealed surfaces only occurs where sweeping has failed to remove sufficient sediment, and there is a compelling need to remove the remaining sediment (e.g. for safety reasons).
	AO27.2 Sediment deposits that cause nuisance to, or adversely affect the use or value of, neighbouring properties are removed and the area rehabilitated as soon as practicable.
	AO27.3 The adopted ESC measures do not adversely affect drainage or flooding conditions within neighbouring properties.
PO28 Potential safety risks to site workers and the public as a result of ESC measures are minimised.	**AO28.1** Operational safety issues (public and site personnel) are given appropriate consideration during the installation, operation, maintenance and removal of ESC measures.
	AO28.2 Publicly accessible sediment basins are fenced (i.e. exclusion fencing) where there is considered to be an unacceptable safety risk.
PO29 Potential harm to wildlife as a result of ESC measures is minimised.	**AO29.1** Disturbance to wildlife habitats is limited to the minimum necessary to complete the approved works.
	AO29.2 Large sediment traps allow appropriate egress of wildlife where such wildlife could enter the trap.

Performance outcomes	Acceptable outcomes
	AO29.3 Synthetic (plastic) reinforced fabrics are not placed within, or adjacent to, bushland areas, riparian zones, and watercourses if such materials are likely to cause harm to wildlife or wildlife habitats.
PO30 Disturbance to natural watercourses is minimised.	**AO30.1** Instream works are conducted in accordance with an approved code of practice for instream works.
	AO30.2 No instream land-disturbing activities are undertaken prior to development of a vegetation management plan.
	AO30.3 Disturbance to natural watercourses (including bed and bank vegetation) and their associated riparian zones is limited to the minimum necessary to complete the approved works.
	AO30.4 The number, location, type, and size of temporary watercourse crossing are such that the overall adverse impact on the environment is minimised.
	AO30.5 All temporary watercourse crossings, including their approach roads, employ appropriate drainage, erosion and sediment controls to minimise sediment inflow into the watercourse.
PO31 Site shutdowns are conducted in a manner that minimises potential environmental harm.	**AO31.1** Procedures for initiating a site shutdown incorporate appropriate revegetation of all soil disturbances unless otherwise stipulated within an approved site management plan.
	AO31.2 Revegetation procedures associated with a programmed site shutdown commence at least 30 days prior to the nominated shutdown time.
	AO31.3 Adopted site stabilisation measures do not rely upon the longevity of non-vegetated erosion control blankets and short-term soil binders.
Land clearing	
PO32 Potential environmental harm resulting from land clearing is minimised.	**AO32.1** All land clearing is conducted in accordance with State and local government vegetation protection and/or preservation requirements and/or policies.

Performance outcomes	Acceptable outcomes
	AO32.2 On sites with a soil disturbance greater than one hectare, no land clearing is undertaken prior to approval of a vegetation management plan.
	AO32.3 Limits on the extent and duration of soil disturbance are commensurate with the potential erosion risk and/or erosion hazard.
	AO32.4 Compliance with performance outcome PO24.
PO33 Land clearing is limited to the minimum necessary.	**AO33.1** Land clearing does not cause unnecessary soil disturbance if an alternative process (which reduces the potential environmental harm) is available that achieves the same or equivalent project outcomes at a reasonable cost.
	AO33.2 Land clearing at any given time during periods of potential soil erosion is restricted to only those areas required for the current stage of works.
	AO33.3 Wherever reasonable and practicable, land clearing is limited to five metres from the edge of proposed constructed works, two metres of essential construction traffic routes, and a total of 10 metres width for construction access.
PO34 Soil erosion during and following land clearing is minimised.	**AO34.1** Land clearing within any sub-area is delayed as long as reasonable and practicable.
	AO34.1 Land clearing and site rehabilitation are staged to minimise the extent and duration that any and all areas of soil are exposed to the erosive effects of wind, rain and flowing water.
	AO34.1 If tree clearing is required well in advance of future earthworks, then tree clearing methods that will minimise potential soil erosion are employed, especially in areas of high to extreme erosion risk.
PO35 Sediment releases to receiving water (within or outside the site) are minimised during land clearing operations.	**AO35.1** No land clearing is undertaken unless preceded or accompanied by the installation of adequate drainage and sediment control measures.

Performance outcomes	Acceptable outcomes
	AO35.2 No part of a sediment basin catchment area is grubbed of vegetation, or stripped of topsoil, until the basin is constructed and fully operational.
Soil and stockpile management	
PO36 The 'soil structure' of soils that are to be revegetated is not unnecessarily damaged.	**AO36** Soils that are to be revegetated are not unnecessarily disturbed when they are either too wet, or too dry.
PO37 Maximum benefit is obtained from existing topsoil.	**AO37.1** The topsoil is managed (i.e. stripped, treated, stockpiled and reused) in accordance with the recommendations of an approved vegetation management plan or similar.
	AO37.2 Topsoil is stripped, stockpiled, placed, and where necessary treated, in accordance with current best practice.
	AO37.3 Topsoil originating from the site is respread as the topsoil to maximise erosion control and revegetation, except where it has been assessed that such soil will not improve erosion control and/or revegetation on the site.
PO38 Environmental harm caused by the temporary stockpiling of erodible material is minimised.	**AO38** Stockpiles of erodible material are: (a) located fully within the relevant property; (b) appropriately protected from wind, rain and excessive surface flows in accordance with current best practice; and (c) located at least two metres from hazardous areas, retained vegetation, and overland flow paths; and (d) located up-slope of an appropriate sediment control system.
PO39 Exposed dispersive soils are managed such that the risk of ongoing soil erosion is minimised.	**AO39** Construction details for drainage systems and bank stabilisation works within dispersive soil areas clearly demonstrate how these soils will be managed to prevent future erosion problems.
PO40 Exposed potential acid sulfate soils are appropriately managed.	**AO40.1** If acid sulfate soils conditions exist on site, then appropriate warnings are placed on the ESCP.

Performance outcomes	Acceptable outcomes
	AO40.2 All exposed actual or potential acid sulfate soils are managed in accordance with current best practice.
	AO40.3 On-site personnel involved in the disturbance of actual or potential acid sulfate soils are appropriately trained and/or supervised.
Drainage control	
PO41 Temporary drainage control measures are designed, constructed and maintained to an appropriate standard.	**AO41.1** The standard of drainage control complies with the requirements of the relevant regulatory authority, or where such a standard does not exist, drainage controls are designed in accordance with current best practice.
	AO41.2 Stormwater drainage during each stage of earth works is managed in accordance with the appropriate ESCP or construction drainage plan (as amended from time to time).
	AO41.3 All drainage channels, whether temporary or permanent, are constructed and maintained (at all times) with sufficient size, gradient and surface conditions to maintain their required hydraulic capacity.
	AO41.4 The adopted drainage control measures remain relevant, at all times, to the current and imminent site conditions.
PO42 Stormwater movement through the site is appropriately managed to minimise soil erosion.	**AO42.1** If the drainage area up-slope of a soil disturbance exceeds 1500 m^2, and the average monthly rainfall exceeds 45 mm, all stormwater discharged from this area (up to the design storm) is diverted around or through the soil disturbance in a manner that minimises soil erosion.
	AO42.2 Appropriate drainage controls are installed above an exposed earth batter to minimise soil erosion on the batter.

Performance outcomes	Acceptable outcomes
	AO42.3 The spacing of cross-slope drainage systems down long exposed, non-vegetated or recently seeded slopes, does not exceed that standard set by the relevant regulatory authority, or in the absence of such standard, are designed in accordance with current best practice.
	AO42.4 Flow velocities within drainage channels and at the entrance and exit of all drainage structures (including chutes, slope drains, and spillways) are controlled in such a manner that prevents soil erosion during all discharges up to the relevant design discharge.
PO43 Stormwater movement through the site is appropriately managed to minimise environmental harm.	**AO43.1** All temporary and permanent drainage systems are installed as soon as practicable.
	AO43.2 'Clean' water is diverted around sediment traps in a manner that maximises the sediment trapping efficiency of the sediment trap.
	AO43.3 All reasonable and practicable measures are taken to ensure stormwater run-off entering an area of soil disturbance is diverted around or through that area in a manner that minimises soil erosion and contamination of that water for all discharges up to the specified design discharge.
	AO43.4 Adequate drainage controls (e.g. cross drainage systems and/or longitudinal drainage) are applied to all unsealed roads and tracks to minimise erosion on, and sediment run-off from, such surfaces.
	AO43.5 All reasonable and practicable measures are taken to ensure sediment-laden run-off from access roads and stabilised entry/exit systems drains to an appropriate sediment control device.
	AO43.6 All reasonable and practicable measures are taken to divert stormwater around excavations and trenches.

Performance outcomes	Acceptable outcomes
PO44 Stormwater movement through the site is appropriately managed to minimise site wetness within active work areas.	**AO44.1** Roof water does not unreasonably increase soil wetness within work areas.
	AO44.2 Roof water drainage systems are installed prior to placement of the roof.
	AO44.3 Roof water drainage systems are connected to an approved stormwater drainage system immediately after placement of the roof.
PO45 Stormwater entering into, or discharged from, the site is appropriately managed to minimise flooding, damage and nuisance to neighbouring properties.	**AO45.1** All waters discharged during the construction phase are discharged onto stable land, in a non-erosive manner, and at a legal point of discharge.
	AO45.2 All drainage channels up-slope of neighbouring properties are constructed and maintained with sufficient size, gradient and surface conditions to maintain the required hydraulic capacity.
	AO45.3 Stormwater is not unlawfully diverted into neighbouring properties.
Erosion control	
PO46 Erosion control measures are designed, installed and maintained to an appropriate standard.	**AO46.1** The standard of erosion control complies with the requirements of the relevant regulatory authority, or where such a standard does not exist, erosion controls are designed in accordance with current best practice.
	AO46.2 As a minimum, the type and degree of erosion control are commensurate with the expected site conditions, soil type, potential environmental risk, and the type, cost, and scope of the works.
	AO46.3 The adopted erosion control measures remain relevant, at all times, to the current and imminent site conditions.
PO47 The control of soil erosion is given appropriate priority.	**AO47.1** Wherever reasonable and practicable, priority is given to the prevention, or at least minimisation, of soil erosion, rather than allowing soil erosion to occur and trying to trap the resulting sediment.

Performance outcomes	Acceptable outcomes
	AO47.2 The existence of best practice sediment control measures within a given sub-catchment does not diminish the need for the application of best-practice erosion control measures.
PO48 Soil erosion is minimised.	**AO48.1** Appropriate erosion control measures are incorporated into all stages of a development, including each phase of earthworks.
	AO48.2 Site activities are carried out in a manner that minimises the duration that any and all disturbed soil surfaces are exposed to the erosive forces of wind, rain and flowing water.
	AO48.3 Erosion control measures are applied to exposed soils as soon as practicable after earthworks have been completed within each sub-area.
	AO48.4 The application of necessary erosion control measures is not unnecessarily delayed for the purpose of coordinating such activities with final site rehabilitation / revegetation.
	AO48.5 Appropriate drainage and erosion control measures are implemented and maintained around the site office area and on temporary access roads to minimise raindrop impact erosion and the generation of mud.
PO49 Soil erosion resulting from rainfall is minimised.	**AO49.1** Soil disturbing activities are programmed to minimise soil exposure during periods when: (a) the monthly rainfall erosivity is expected to exceed 1500; or (b) the monthly rainfall is expected to exceed 225 mm.
	AO49.2 Existing ground covers are protected from damage and retained as long as practicable.
	AO49.3 Exposed dispersible soils are either treated or covered with a layer of non-dispersible soil before being covered with vegetation, mulch or erosion control blankets.

Performance outcomes	Acceptable outcomes
PO50 Soil erosion resulting from surface water flow is minimised.	**AO50** Service trenches are backfilled, compacted and rehabilitated in a manner that prevents undesirable water flow and soil erosion along the trench.
PO51 Soil erosion resulting from wind erosion is minimised.	**AO51.1** Erosion control measures used to control wind erosion are commensurate with soil exposure and the expected wind conditions in terms of speed and direction.
	AO51.2 Stockpiles of erodible material are covered during periods of strong wind or when strong winds are imminent.
Sediment control	
PO52 Sediment control measures are designed, installed, operated and maintained to an appropriate standard.	**AO52.1** The standard of sediment control complies with the requirements of the relevant regulatory authority, or where such a standard does not exist, sediment controls are designed in accordance with current best practice.
	AO52.2 As a minimum, the type and degree of sediment controls are commensurate with the site conditions, soil type, potential environmental risk, and the type, cost, and scope of the works.
	AO52.3 No sub-catchment relies solely on ‘supplementary’ sediment traps unless site conditions prevent the use of other more appropriate sediment control systems.
	AO52.4 As-constructed plans are prepared for all constructed sediment basins and associated emergency spillways.
	AO52.5 The adopted sediment control measures remain relevant at all times to the current and imminent site conditions.
Sediment control	
PO53 The on-site retention of sediment is maximised.	**AO53.1** All reasonable and practicable measures are taken to prevent, or at least minimise, the release of sediment from the site, or into water where it is likely to cause environmental harm.

Performance outcomes	Acceptable outcomes
	AO53.2 Appropriate sediment controls are installed and made operational before any up-slope soil disturbance occurs.
	AO53.3 All sediment-laden run-off from the site is directed to an appropriate sediment control device in accordance with the required treatment standard.
	AO53.4 The site's sediment control standard does not rely on operation of off-site sediment control systems.
	AO53.5 Optimum benefit is made of every opportunity to trap sediment within the work site.
	AO53.6 Sediment is trapped as close to its source as possible.
	AO53.7 Appropriate sediment control measures are applied to all temporary building and construction works, including the site office, car park, stockpile areas and watercourse crossings.
	AO53.8 Sediment traps are designed, constructed, maintained and operated to collect and retain sediment.
	AO53.9 All type F and type D sediment basins are maintained at a minimum achievable water level between rainfall events.
PO54 Sediment displaced off-site by vehicular traffic is minimised.	**AO54.1** Number of site entry/exit points is limited to the minimum practical number.
	AO54.2 Site entry/exit points are appropriately designed and stabilised to minimise sediment being washed off the site by stormwater and/or being transported off the site by vehicles.
	AO54.3 All reasonable and practicable measures are taken to ensure sediment-laden stormwater run-off from access roads and stabilised entry/exit systems drains to an appropriate sediment control device.

Performance outcomes	Acceptable outcomes
PO55 Sediment-related environmental harm resulting from de-watering activities is minimised.	**AO55.1** Flow diversion barriers, or other appropriate systems, are used to minimise the quantity of watering entering excavations and trenches.
	AO55.2 All sediment control measures implemented for the control of sediment-laden discharge from de-watering activities are designed to satisfy, as a minimum, current best practice discharge standards.
	AO55.3 As a minimum, the type and degree of sediment controls utilised during de-watering operations are commensurate with the site conditions, soil type, potential environmental risk, and the type, cost, and scope of the works.
PO56 Sediment control measures are located within the property boundary.	**AO56** All sediment control measures are located within the property boundary, unless: (a) it is that portion of the entry/exit pad located between the property boundary and the sealed road; or (b) the sediment control measure is required to collect sediment wash-off from building works located along the property boundary; and (c) approval has been obtained from the relevant regulatory authority and the relevant landowner or asset manager.
Site stabilisation and rehabilitation	
PO57 Site rehabilitation, including site revegetation, is designed, installed and maintained to an appropriate standard.	**AO57.1** The standard of site rehabilitation complies with the requirements of the relevant regulatory authority or, where such a standard does not exist, complies with current best practice.
	AO57.2 As a minimum, the type and degree of site rehabilitation is commensurate with the expected site conditions, soil type, potential environmental risk, and the type, cost and scope of the works.
	AO57.3 Site rehabilitation, including site revegetation, remains, at all times during the construction and specified maintenance period, relevant to the current and imminent site conditions.
PO58 Adequate site data is obtained to allow the appropriate design of site rehabilitation measures.	**AO58** All necessary site data, including soil data, is obtained to appropriately plan, design, implement and maintain site revegetation and stabilisation.

Performance outcomes	Acceptable outcomes
PO59 Site rehabilitation methods and procedures minimise the risk of environmental harm.	**AO59.1** Site revegetation, excluding temporary revegetation conducted for purposes of erosion control, is conducted in accordance with a site stabilisation plan, landscape plan, revegetation plan, or vegetation management plan, where such a plan exists.
	AO59.2 Disturbed soil surfaces are appropriately stabilised to minimise the risk of short-term soil erosion.
	AO59.3 Site stabilisation and/or revegetation are commenced as soon as practicable after earthworks are completed within any given manageable drainage area.
	AO59.4 The construction schedule and/or ESC installation sequence clearly indicates the staging of site stabilisation and revegetation measures.
	AO59.5 All temporary ESC measures are removed and the land rehabilitated as soon as practicable after they are no longer needed.
PO60 Optimum soil conditions are achieved prior to revegetation.	**AO60.1** Soil surfaces that are to be vegetated, are left in an appropriate roughened state, and an appropriate physical and chemical condition, to encourage rapid revegetation.
	AO60.2 Required adjusts to the soil condition are made prior to seeding/planting.
PO61 Site rehabilitation methods, procedures, and outcomes are compatible with site conditions and local environmental values.	**AO61.1** The qualifications and experience of the personnel preparing and/or supervising the preparation of any site stabilisation plan, vegetation management plan, or similar, are commensurate with the potential environmental risk, and the extent and complexity of the works.
	AO61.2 Plant selection and landscape design are compatible with identified environmental values.

Performance outcomes	Acceptable outcomes
Site inspection and monitoring	
PO62 A monitoring and maintenance program is prepared by, or under the supervision of, suitably qualified and experienced personnel.	**AO62** The qualifications and experience of the personnel preparing and/or supervising the preparation of the monitoring and maintenance program is commensurate with the potential environmental risk, and the extent and complexity of the works.
PO63 The performance of the site's drainage, erosion and sediment control measures is regularly monitored.	**AO63.1** The extent and complexity of site monitoring (including water quality monitoring) is commensurate with the potential environmental risk, and the extent and complexity of the works.
	AO63.2 A record is maintained of the site's compliance and non-compliance with erosion and sediment control approval requirements.
	AO63.3 All site monitoring data including environmental incidents, rainfall records, dates of water quality testing, testing results, and records of controlled water releases for the site, are kept in an on-site register.
PO64 The site's drainage, erosion and sediment control measures remain relevant at all times to the current site conditions.	**AO64** All ESC measures are inspected by site personnel: (a) at least daily (when work is occurring on-site); (b) at least weekly (when work is not occurring on-site); (c) within 24 hours of expected rainfall; and (d) within 18-hours of a rainfall event of sufficient intensity and duration to cause run-off on the site.
Site maintenance	
PO65 All ESC measures are maintained in proper working order at all times during their required operational life.	**AO65.1** All ESC measures are maintained in proper working order for the duration of the period in which their operation is required in order to satisfy the required treatment standard, and/or the objective of the ESCP.
	AO65.2 All sediment control measures are maintained in accordance with the requirements of the relevant regulatory authority, or where such a standard does not exist, in accordance with current best practice.

Performance outcomes	Acceptable outcomes
	AO65.3 As a minimum, the maintenance of all ESC measures is commensurate with the expected site conditions, and potential environmental risk.
	AO65.4 Suitable access is provided to allow the proper installation and maintenance of sediment traps.
	AO65.5 The ESCP clearly indicates what degree of site stabilisation is required prior to the decommissioning of any ESC measure.
PO66 The maintenance of ESC measures does not increase the risk of soil erosion.	**AO66.1** Excess vegetation cleared for the purpose of restoring the hydraulic capacity of open drains is selectively cut and trimmed so as to leave a short, dense, live ground cover with a grass length no shorter than 50mm.
	AO66.2 Maintenance mowing is done in a manner that does not damage the profile of formed, soft edges, such as the crest of earth embankments.
PO67 The maintenance of ESC measures does not cause environmental harm.	**AO67** All materials removed from ESC devices during maintenance or decommissioning, whether solid or liquid, is lawfully disposed of in a manner that does not cause ongoing soil erosion or environmental harm.

4 Acid sulphate soils management

Acid Sulfate Soils (ASS) can have major environmental, economic, engineering, and health impacts that may provide constraints to activities in coastal areas. Acid sulfate soils, if oxidised (through exposure of the pyrite to air), produce sulfuric acid that can result in soil and groundwater/surface waters becoming acidic. Exposure to ASS can occur naturally, through soil disturbance or from lowering of the water table.

If managed inappropriately the acid generated can corrode steel and concrete and release toxic levels of aluminium, iron, and heavy metals from the breakdown of clays and silts. Toxic levels of these metals combined with acid conditions, pose a significant risk to vegetation, concrete and steel infrastructure, and aquatic organisms.

In coastal situations, proposals that involve earthworks or disturbances to hydrology/drainage patterns must consider ASS. Any development that alters the existing conditions of ASS can trigger the oxidation of iron sulfides. The potential risk to the environment must be quantified, and management techniques proposed to mitigate the environmental impacts associated with the proposed activity both on and off the site.

Where disturbances of ASS is unavoidable, preferred management strategies are:

(a) minimisation of disturbance;

(b) neutralisation;

(c) hydraulic separation of sulfides, either on its own or in conjunction with dredging;

(d) strategic re-burial (reinterment); and

(e) other management measures may be considered, but may pose increasingly higher or even unacceptably high risks.

A detailed assessment of the site is an essential prerequisite before deciding on a management approach. There are many options for managing, handling and treating actual and potential acid sulfate soils. The Soil Management Guidelines (NRM, 2002) in the *Queensland Acid Sulfate Soil Technical Manual* documents risk based management procedures for ASS and provides guidance on how to achieve best practice environmental management (BPEM).

5 Managing nutrients of concern for coastal algal blooms

5.1 Coastal algal blooms

Coastal algae includes photosynthetic algae, cyanobacteria (often referred to as blue-green algae), dinoflagellates and diatoms in estuarine and coastal waters such as *Trichodesmium* spp, *Lyngbya majuscula* (Lyngbya) and *Hinksia sordida*[1]. Whilst algae occur naturally within aquatic ecosystems, the occurrence of an algal bloom usually indicates that the processes, which normally control the algal population, have failed (for example, a lack of grazers or an increase in nutrient levels). Blooms may be the result of a natural set of processes or changes associated with human activity.

The increased occurrence of coastal algal blooms is a worldwide phenomenon that has been linked to nutrient-enrichment of coastal waters. This is also a concern in Queensland, where blooms have increased in incidence, duration and intensity. Such blooms have had negative impacts on seagrass and coral reef communities and pose a significant threat to human health, biodiversity, water quality, marine megafauna and the recreational and commercial values of coastal waterways.

Land-based development and management activities that disturb soils and sediments or alter the natural hydrological regime (including groundwater levels and composition and surface-water run-off) can result in the mobilisation and transport of increased loads of nutrients into coastal waters. Nutrients of concern that are known to contribute to increased algal growth include iron, phosphorus, nitrogen and organic matter (dissolved organic carbon).

Practices associated with agriculture, forestry, extractive industry, sewage treatment, intensive animal industries, marine infrastructure and other urban, commercial and industrial development can potentially result in the release and movement of nutrients of concern through surface run-off and alteration to groundwater levels. Activities such as land and vegetation clearing, tree harvesting, cultivation, fire management, drainage, fertiliser use, irrigation, waste disposal, dewatering, excavation/filling, extractive operations, disturbance of acid sulfate soils (ASS) and dredging, can also mobilise and increase nutrients of concern entering coastal waters/waterways (if not appropriately managed).

5.2 Development

Development is to consider and demonstrate compliance against the "Outcomes and measures for coastal algal bloom nutrient management" provisions (Appendix 2) within the guideline for *Implementing Policies and Plans for Managing Nutrients of Concern for Coastal Algal Blooms in Queensland* (prepared by the Queensland Government, 2011).

6 Documentation

6.1 Site based stormwater management plan

A Site Based Stormwater Management Plan (SBSMP) identifies stormwater management strategies and actions to address:

(a) water quality;

(b) water quantity; and

(c) waterway corridor issues.

The contents of the SBSMP are dependent on the stage of development (concept or detailed design) and the level of risk for the proposed development ('low' or 'high').

The SBSMP should contain sufficient detail to determine whether the stormwater controls are acceptable. An example of the contents of a SBSMP is described below.

All drawings and documentation to be submitted to Council for approval shall conform to the requirements of Council's Guideline D20 - *Drawings and Documentation*. A copy of these Guidelines will be made available on request.

Failure to comply with Council's *Drawings and Documentation Guidelines* may result in the drawings and/or documentation being returned to the designer without consideration by Council.

Table 6.1 – Elements required in site based stormwater management plan

Elements (general)		Low Risk	High Risk
1.0	**Introduction**		
	• Proposed development	✓	✓
	• Risk assessment	✓	✓
	• Study team	✓	✓
2.0	**Site Description**		
	• Location	✓	✓
	• Land use (existing and proposed on-site and surrounding land uses)	✓	✓
	• Topography and drainage	✓	✓
	• Soils	✓	✓
	• Watercourses	✓	✓
	• Flora and fauna	✓	✓
3.0	**Data**		
	• Existing stormwater infrastructure	✓	✓
	• Related studies / plans such as catchment management plans, waterway management plans, stormwater management plans	✓	✓
	• Hydrologic and hydraulic needs / wants	x	✓
	• Water quality / stream health data	x	✓

Elements (general)		Low Risk	High Risk
4.0	**Opportunities and Constraints**		
	• Key site characteristics	✓	✓
	• Previous studies / plans	✓	✓
	• Key stakeholder's needs / wants	x	✓
	• Parkland contributions (if required)	✓	✓
5.0	**Stormwater Quantity (Hydrology & Hydraulics)**		
	• Existing conditions	✓	✓
	• Methodology	✓	✓
	• Model analysis	x	✓
	• Comparison of existing and proposed hydrology and hydraulics e.g. catchments, flows and flood levels	✓	✓
	• Designs drawings	✓	✓
	• Proposed mitigation measures	✓	✓
6.0	**Stormwater Quality**		
	• Pollutants of concern	✓	✓
	• Receiving waters	✓	✓
	• Identification of environmental values and water Quality Objectives	x	✓
	• Methodology	✓	✓
	• Model analysis	x	✓
	• Impact of development	✓ (qualitative)	✓
	• Proposed management strategies	✓	✓
7.0	**Stormwater Management Options**		
	• Selection and assessment of stormwater quantity controls	✓	✓
	• Selection and assessment of stormwater quality controls	✓	✓
	• Integration with waterway corridor	✓	✓
	• Stormwater management strategy including actions, responsibilities and program	✓	✓
8.0	**Cost Assessment**		
	• Capital cost of proposed strategy	✓	✓
	• Maintenance Cost of proposed Strategy	✓	✓
	• Asset life of proposed strategy	✓	✓
	• Lifecycle cost of proposed strategy	✓	✓
9.0	**Water Quality Monitoring Program**		
	• Proposed program	x	✓
10.0	**Maintenance Plans**		
	• Responsibilities for maintenance of structural controls	x	✓
11.0	**Asset Handover**		
	• Process and timing for asset handover to council	x	✓
12.0	**References**	x	✓

6.2 Erosion and sediment control program

An erosion and sediment control program (ESC program) is a set of documents including:

(a) erosion and sediment Control Plans (ESC Management Plan);

(b) supporting documentation; and

(c) specification and construction details.

The supporting documentation for an ESC Program may include:

(a) design standards used for ESC Measures;

(b) calculations for the sizing of various ESC measures, particularly sediment basins;

(c) proposed construction staging;

(d) proposed ESC installation sequence.

It is envisaged that a brief description of the site and major site issues and concerns would be highlighted in the SBSMP.

ESC specifications typically cover:

(a) Materials used in construction of ESC measures

(b) Construction or installation procedures

(c) Operational requirements

(d) Inspection and maintenance requirements

(e) Procedures for removal of ESC measures and site rehabilitation.

6.3 Erosion and sediment control management plans

Erosion and Sediment Control Management Plans shall be scaled drawings (no larger than 1:1000) with detailed specifications/diagrams which can be readily understood and applied on site by supervisory staff. All Drawings shall be in accordance with the minimum drafting requirements in D20 – Drawing and Documentation Guidelines.

Items to be included on the ESC Management Plan but not limited to, shall be:

(a) Limits of disturbance such as proposed vegetated buffer strips, vegetation, retention and "no access" areas;

(b) Location of critical areas (vegetated buffer strips, drainage lines and structures, water bodies, unstable slopes, flood plains and seasonally wet areas);

(c) Location and description of existing vegetation;

(d) Soil types;

(e) Location of access haulage tracks and borrow pits;

(f) Location of temporary drainage, erosion and sediment control measures;

(g) Construction details for erosion and sediment control measures; and

(h) Notes relating to:
  (i) site preparation
  (ii) ESC measures
  (iii) procedures for maintenance of ESC measures
  (iv) details for staging of works
  (v) revegetation requirements

6.4 Site based acid sulfate soils management plan

A Site Based Acid Sulfate Soils Management Plan (SBASSMP) is to be prepared to address the management of ASS when a development application relates to:

(a) an acid sulphate soils affected area, and

(b) land at or below 5m AHD, where the natural ground level is below 20m AHD, if the application is for a material change of use, or operational works, involving:
  (i) excavating or otherwise removing 100m^3 or more of soil or sediment, or
  (ii) filling of land with 500m^3 or more of material with an average depth of 0.5m or more.

Appendix A – Information supporting the model code of practice provisions – erosion and sediment control

A.1 Introduction

This Appendix forms part of the Code and provides essential information and requirements not otherwise provided within the Code.

Please note, for various appendices, chapters and tables mentioned throughout this attachment, refer to "International Erosion Control Association (Australasia) (2008) *Best practice erosion and sediment control*".

A.2 Development planning and design

The intent of the development planning and design section is to:

(a) enable erosion and sediment control issues to appropriately influence the planning and design of developments and other land disturbing activities for the purpose of minimising their overall adverse environmental impact;

(b) enable development planners to recognise that along with consideration of the operational phase of a development, appropriate consideration must be given to how something is to be constructed, and the potential adverse impacts of this construction phase; and

(c) recognise the limitations of control measures on constrained sites, e.g. flood prone land.

Acceptable outcome AO1.1

Data collection may include soil testing, identification of potential site constraints, and development of a conceptual erosion and sediment control plan (where such data and/or plans are considered reasonably necessary to enable appropriate site planning and design). Appropriate site planning and design refers to the aim of minimising the potential environmental harm (both during the construction and operational phases) of the development. The extent and complexity of data collection is discussed further in Chapter 3 – Site planning.

Sufficient soil data must be obtained on the site to:

(a) reasonable identify the location of dispersive soils;

(b) reasonable identify the location of potential acid sulfate soils;

(c) allow the appropriate selection, design, and specification of ESC measures; and

(d) maximise the erosion control benefits of the proposed site revegetation and stabilisation works.

The 'potential environmental risk' relates to the potential of a land-disturbing activity to cause harm, whether material, serious, reversible or irreversible, to an environmental value, including nuisance to a neighbouring property or person. The potential environmental risk is related, in part, to the assessed Erosion Hazard (refer to Appendix F – Erosion hazard assessment).

Acceptable outcome AO1.2

Potential site constraints are discussed within Chapter 3 – Site planning, and include:

(a) limitations of the supply of water;

(b) problematic soils and soil conditions, including: acid sulfate soils, dispersive or sodic soils, expansive/reactive soils (cracking clays), soils of extreme pH (less than 5.5 or greater than 8.5), soils of low wet-bearing strength, saline soils, toxic soils, and any other soil that could result in ongoing erosion or environmental harm; and

(c) topographic limitations, including: coastal and intertidal areas, drainage problem areas, existing erosion problems, flood prone land, high groundwater, land prone to mass movement, local microclimates, rock outcrops, steep slope, waterways and wetlands.

Problematic soils are discussed in more detail in Section 3.4 of Chapter 3, and Section C11 of Appendix C – Soils and revegetation.

Zones of high or extreme erosion hazard may be identified through the application of an appropriate Erosion Hazard Assessment scheme such as those discussed in Chapter 3 – Site planning, and Appendix F – Erosion hazard assessment.

Acceptable outcome AO1.3

A conceptual erosion and sediment control plan incorporates plan(s) (no larger than 1:1000) that:

(a) identify the likely need for the construction of sediment basins on the site;

(b) identify that adequate space has been made available for the construction and operation of major sediment traps and essential flow diversion systems;

(c) demonstrate that there is a feasible means of constructing the project while still protecting key environmental values;

(d) identify problem soil areas including, dispersive soils, acid sulfate soils, and areas of potential mass movement; and

(e) identify key environmental features on the site such as protected vegetation.

The preparation of erosion and sediment control plans (ESCPs), including conceptual ESCPs is discussed in Chapter 5 – Preparation of plans.

Environmental risk, project cost, and safety issues must be given appropriate consideration when determining the development layout and construction process.

Construction activities that are deemed to represent a high to extreme erosion hazard include:

(a) any disturbance of high to extreme hazard areas, or a problematic soil that could result in unmanageable soil erosion and/or environmental harm;

(b) any construction or building activity, or procedure, that could potentially cause 'serious' environmental harm; and

(c) any soil disturbance that could cause the transformation of significant quantities of potential acid sulfate soils (PASS) into actual acid sulfate soils (AASS), such as to cause 'material' or 'serious' environmental harm.

Acceptable outcome AO2.2

The development design must aim to minimise, if not totally avoid, disturbance to high or extreme erosion hazard areas, including dispersive soils, acid sulfate soils, and slopes steeper than 20 per cent, wherever reasonable and practicable.

Acceptable outcome AO3.1

Refer to AO1.1 for discussion on 'high-risk construction activities'.

Acceptable outcome AO3.2

Essential ESC control measures include any drainage, erosion or sediment control measures that are considered critical in regards to the protection of environmental values. Such measures usually include:

(a) all Type 1 sediment traps, including sediment basins;

(b) all Type 2 sediment traps located within subcatchments that do not incorporate a Type 1 sediment trap;

(c) all Type 3 sediment traps located within subcatchments that do not incorporate a Type 1 or Type 2 sediment trap;

(d) drainage control measures that allow the diversion of up-slope catchment areas in excess of 2500 metres; and

(e) any instream sediment control or flow diversion system.

Acceptable outcome AO3.3 & AO3.4

The most critical issue is ensuring sufficient space is available to construct and maintain all sediment basins, including associated settling ponds, embankments and spillways.

Acceptable outcome AO3.5

If erosion control practices are reliant on final site revegetation, then to the maximum degree practicable, such activities must be allowed to occur in close association with the staging of soil disturbance for the purpose of minimising the duration that any and all soil surfaces are exposed to the erosive force of wind, rain and flowing water.

Acceptable outcome AO4.1

Reference is to drainage design standards suitable for the operational phase of developments, not the drainage standards presented within this document, which focuses on the construction phase.

Acceptable outcome AO4.2

Ongoing erosion problems can result from any of the following:

(a) changes to the volume, duration, frequency, or rate of stormwater runoff;

(b) excessive (i.e. erosive) flow velocities;

(c) inappropriate distribution of flow velocities throughout the depth and width of flow discharged from a stormwater drain into a receiving water; and

(d) inappropriate direction of flow discharged from a stormwater drain into a receiving water.

Acceptable outcome AO4.4

Refer to AO1.2 for discussion on 'site constraints'.

Acceptable outcome AO4.5

The full impact of the removal of deep-rooted vegetation from steep slopes may not be evident for 5 to 10 years, or until such time as the plant root system begins to fail (assuming that the root system remains within the soil profile after removal of the upper portion of the plant). Planners and designers must appreciate that plants provide many essential roles besides the provision of 'scenery'.

Acceptable outcome AO5.2

'Temporary' watercourse crossings referring to those crossings constructed for use only during the construction phase.

A.3 Construction planning

The intent of the construction planning section is to:

(a) take all reasonable and practicable measures to actively avoid foreseeable soil erosion problems and associated environmental hazards during the construction phase; and

(b) ensure that those involved in construction planning do not assume that the environmental impact of such hazards can be totally resolved (irrespective of the site's layout, methodology, staging, and programming) through applying best practice erosion and sediment control.

'Construction planning' refers to planning the layout, methodology, staging, and programming (timing and scheduling) of the construction phase.

Acceptable outcome AO6.1

Refer to AO1.2 for discussion on ‘zones of high and extreme erosion hazard’.

Acceptable outcome AO6.2

Refer to AO1.1 for discussion on ‘potential environmental risk’.

Acceptable outcome AO7.1

Ideally, ESCPs should be developed in close association with construction planning because the needs and limitations of the construction process represent an important component of the ESCP. In theory, a construction process cannot be finalised without reference to an ESCP, and an ESCP cannot be finalised without knowledge of the construction process.

Acceptable outcomes AO7.2 and AO7.3

Refer to AO1.1 for discussion on ‘high-risk construction activities’.

Refer to AO1.2 for discussion on ‘zones of high and extreme erosion hazard’.
Periods of high and extreme erosion potential refers to the variation in the erosion hazard throughout a calendar year based on variations in the rainfall erosivity as described in Appendix E – Soil loss estimation. Periods of high to extreme erosion potential include:

(a) periods of high to extreme erosion risk as defined in Section 4.4 of Chapter 4 – Design standards and technique selection; and

(b) periods of strong winds sufficient to cause significant dust problems.

Acceptable outcome AO7.6

Reference is made to the extent of unnecessary soil disturbance that can be influenced by the construction planning process. The extent of any unnecessary soil disturbance, including disturbances outside the designated work area, must be minimised in order to minimise the risk of environmental harm.

Minimising the potential environmental harm can be achieved, in part, by scheduling major land disturbances, and disturbances to high and extreme erosion risk areas, for the least erosive periods of the year.

Acceptable outcome AO7.7

Site stabilisation plans, landscape plans, and/or vegetation management plans must show progressive stabilisation of exposed soil for the purposes of erosion control, including but not limited to, all of the following:

(a) schedule for stabilisation of exposed soil area;

(b) specifications for subsoil and topsoil preparation and application;

(c) specification of stabilisation by mulching or other appropriate surface treatment (note, grass seeding without adequate mulching is generally not considered best-practice); and

(d) details on the type and application rate of any tackifiers to be used in the application of mulches (including hydromulch, bonded fibre matrix, and compost blankets).

Water quality monitoring programs must document proposed water quality monitoring, and include:

(a) location of all instream water quality monitoring stations; and

(b) water quality monitoring, sampling, and analysis procedures and standards.

A.4 Erosion and sediment control plan (ESCP)

The intent of this section is to ensure ESCPs are:

(a) appropriate for the site conditions, which may vary from time to time;

(b) prepared by, or under the supervision of, suitable personnel; and

(c) able to achieve the required design standard and environmental protection.

Acceptable outcome AO9.1

Such a clause shall not reduce the responsibility of applying and maintaining, at all times, all necessary sediment control measures in accordance with the sediment control standard.

Acceptable outcome AO9.2

Refer to AO1.1 for discussion on ‘environmental risk’.

It is recognised that the degree of erosion and sediment control is related to the type, cost and scope of works in addition to the environmental risk. This association is acknowledged within the terms of current best practice erosion and sediment control as defined within this document (2008 conditions).

Acceptable outcome AO9.3

On very minor works, such as regular council maintenance activities, or the installation of minor services, the ESCP may be represented by standard drawings prepared by the principle company/organisation as part of an in-house Code of Practice. The key intent is to ensure that appropriate consideration is given to erosion and sediment control requirements before works commence.

On sites with a soil disturbance greater than 2500m^2, the ESCP (including supporting documentation and construction specifications) must include:

(a) north point and plan scale

(b) site and easement boundaries and adjoining roadways

(c) construction access points

(d) site office, car park and location of stockpiles

(e) proposed construction activities and limits of disturbance

(f) retained vegetation including protected trees

(g) general soil information and location of problem soil

(h) location of critical environmental values (where appropriate)

(i) existing site contours (unless the provision of these contours adversely impacts the clarity of the ESCP)

(j) final site contours including locations of cut and fill

(k) construction drainage plans for each stage of earthworks, including land contours for that stage of construction, subcatchment boundaries and location of watercourses

(l) general layout and staging of proposed works

(m) location of all drainage, erosion and sediment control measures

(n) full design and construction details (e.g. cross-sections, minimum channel grades, channel linings) for all drainage and sediment control devices, including diversion channels and sediment basins

(o) construction specifications for adopted ESC measures (as appropriate)

(p) site revegetation requirements (if not contained within separate plans)

(q) site monitoring and maintenance program, including the location of proposed water quality monitoring stations

(r) technical notes relating to:
   (i) site preparation and land clearing
   (ii) extent, timing and application of erosion control measures
   (iii) temporary ESC measures installed at end of working day
   (iv) temporary ESC measure in case of impending storms, or emergency situations
   (v) installation sequence for ESC measures
   (vi) site revegetation and rehabilitation requirements

(vii) application rates (or at least the minimum application rates) for mulching and revegetation measures
(viii) legend of standard symbols used within the plans
(ix) chemical flocculation procedures

(s) calculation sheets for the sizing of ESC measures

(t) a completed ESCP checklist such as presented in [insert publication]

(u) any other relevant information the regulatory authority may require to properly assess the ESCP.

Site-specific ESCPs must address all aspects of proposed site disturbance, temporary drainage works, erosion and sediment control measures, installation sequence, and site rehabilitation for the duration of the construction phase, including (where appropriate) the nominated maintenance period.

If the timing of the proposed construction activity is not known during development of the ESCP, and if rainfall erosivity varies significantly throughout the year, then the erosion control specifications placed on the ESCP must specify appropriate erosion control measures for each level of rainfall erosivity. For example, light mulching may be appropriate during periods of light rainfall, hydromulching during periods of light to moderate rainfall, and erosion control blankets or bonded fibre matrix during those periods of the year when moderate to heavy rainfall is either occurring or expected to occur.

The ESCP must clearly state that no land-disturbing activities shall occur on the site until all associated perimeter ESC measures, including sediment basins and temporary drainage controls, have been constructed in accordance with the ESCP and best practice erosion and sediment control procedures.

Sufficient information and detail includes the provision of sufficient long-sections and cross-section of all Type 1 and Type 2 sediment traps (e.g. sediment basins) relative to existing and/or final ground levels to allow their construction.

On sites with a soil disturbance greater than one (1) hectare, the ESCP must include:

(a) individual ESCPs for the ‘bulk earthworks’ phase, ‘roadworks and drainage’ phase and the ‘practical completion/on-maintenance’ phases of construction. Each phase above must be documented graphically on a dedicated ESCP, or detail shown on an ESCP, and supported by a clearly documented construction sequence, or ESC installation sequence, which describes the timing of key ESC actions on the site; and

(b) procedures for the temporary shutdown of the site, whether a planned or unplanned shutdown.

Acceptable outcomes AO10.2 and AO10.3

A suitably qualified and experienced professional is defined as a person with all of the following:

(a) training and/or qualifications in erosion and sediment control that are recognised by the regulatory authority

(b) professional affiliations with an engineering, environmental engineering, soil science, and/or scientific organisation (e.g. the International Erosion Control Association; Engineers Australia; Environment Institute of Australia and New Zealand; or the Australian Society of Soil Science Inc

(c) at least two years experience in the management of erosion and sediment control which can be verified by an independent third party.

ESCPs for high-risk sites should be reviewed by a suitably qualified and experienced third party reviewer prior to its implementation.

The assessment and categorisation of high-risk sites may be defined by the relevant Regulatory authority; otherwise, refer to the discussion in Chapter 3 – Site planning, and Appendix F – Erosion hazard assessment.

Acceptable outcome AO10.4

The intent is to ensure the adoption of an appropriate design discharge for sizing the basin and associated emergency spillway, and to ensure the appropriate hydraulic design of the basin's, including the spillway's location, sizing and scour protection.

Acceptable outcome AO10.5

The intent is to ensure the appropriate design and construction specification of the embankment with regard to its structural stability.

Acceptable outcome AO11.1

It is sufficient for the extent and complexity of data collection to be determined by a suitably qualified and experienced professional as defined in AO10.3 above.
On sites with a soil disturbance greater than one (1) hectare, the site needs to be assessed from a hydrological, hydraulic, vegetation, soils, and geological perspective to determine relevant site constraints that may affect the focus or detail of the ESCP.

Acceptable outcome AO11.2

Typically the drainage standard is based on a specified design storm Annual Exceedance Probability, the erosion standard is based on the expected rainfall erosivity, and the sediment control standard is based on the expected soil loss rate. Refer to Chapter 4—Design standards and technique selection for selection of design standards.

Acceptable outcome AO11.3

On disturbances exceeding 2500m^2, construction drainage plans need to be prepared for each stage of earth works.

The intent of construction drainage plans is to show:

(a) flow entry and exit points;

(b) areas of sheet flow and path lines of concentrated flow;

(c) subcatchment boundaries;

(d) all permanent and temporary roads; and

(e) all temporary and permanent drainage control measures expected to exist during the given stage of works.

Acceptable outcome AO12.1

The timing and degree of ESC specified in the ESCP(s) needs to be appropriate for the given soil properties, expected weather conditions, and susceptibility of the receiving waters to environmental harm resulting from sediment-laden runoff. Current (2008) best practice design standard of the drainage, erosion and sediment control measures are outlined in Chapter 4 – Design standards and technique selection.

Acceptable outcome AO12.2

Additional and/or alternative erosion and sediment control measures must be implemented, and a revised ESCP must be prepared and submitted to relevant Regulatory authority for approval (where required) in the event that any of the following apply:

(a) site conditions significantly change from those previously anticipated;

(b) there is a high probability that serious or material environmental harm might occur as a result of sediment leaving the site;

(c) the implemented works fail to achieve the adopted ESC standard, or the State's environmental protection requirements; and

(d) site inspections indicate that the implemented works are failing to achieve the 'objective' of this ESCP.

Acceptable outcome AO12.4

A suitably qualified and experienced professional is defined in AO10.3 above.

Acceptable outcome AO13.1

Synthetic reinforced fabrics include 'plastic' reinforced erosion control blankets, mats and meshes.

A.5 Site establishment

The intent of this section is to ensure that during site establishment:

(a) on-site personnel are provided with all necessary information to fully comply with all legal requirements, minimise environmental harm, and achieve the objective of the ESCP; and

(b) land-disturbing activities proceed in a manner consistent with the objective of the ESCP.

Acceptable outcome AO14.1

Supply of such material is relevant only to that material that exists, or is required to exist.

Acceptable outcome AO14.2

A discussion on site shutdown procedures is provided in Section 6.15 of Chapter 6 — Site management.

Acceptable outcome AO15.1

On low-risk sites, ESC audits (including site inspections and water quality monitoring) may be performed by site personnel; however, as the risk of environmental harm increases, the need for third-party site inspections and water quality monitoring increases.

Personnel undertaking ESC audits of a site must, collectively, have the following capabilities:

(a) an understanding of the local environmental values that could potentially be affected by the proposed works

(b) a good working knowledge of the site's Erosion and Sediment Control (ESC) issues, and potential environmental impacts, that is commensurate with the complexity of the site and the degree of environmental risk

(c) a good working knowledge of current best practice ESC measures for the given site conditions and type of works

(d) ability to appropriately monitor, interpret, and report on the site's ESC performance, including the ability to recognise poor performance and potential ESC problems

(e) ability to provide advice and guidance on appropriate measures and procedures to maintain the site at all times in a condition representative of current best practice, and that is reasonably likely to achieve the required ESC standard

(f) a good working knowledge of the correct installation, operational and maintenance procedures for the full range of ESC measures used on the site.

Acceptable outcome AO15.2

The construction industry's dealing of work place safety issues provides a good model for the development of an appropriate 'chain of command' for the protection of environmental values. The aim is to produce a fair, reasonable and practicable approach based on environmental risk.

As in workplace safety, the responsibility of environmental protection, and therefore erosion and sediment control, rests with all site personnel, whether or not the work site is the normal place of work of any and all personnel. Establishing a 'chain of command' does not diminish the responsibility of each and every person to take all reasonable and practicable measures to minimise environmental harm resulting from their actions as per their 'environmental duty of care'.

Acceptable outcome AO16.1

The exception to this clause is land disturbance necessary to provide access and allow the installation the initial ESC measures.

In general, initial land-disturbing activities should be limited to the establishment of the site compound, site entry/exit points, temporary drainage controls (including drain stabilisation measures), haul road(s), perimeter sediment controls, and any sediment basins/traps required for the first stage of works.

Acceptable outcome AO16.2

'Operational activities' include such things as material stockpiles, storage areas, vehicle maintenance facilities, cleaning stations and concrete waste receptors.

Acceptable outcome AO16.3

'Waste collection areas' include litter bins and receptors for waste concrete.

Acceptable outcome AO17.2

Within the limits of what is considered reasonable and practicable, site managers should take appropriate actions (such as fencing) to minimise the potential environmental harm cause by both authorised and unauthorised access onto the site.

Acceptable outcome AO17.3

It is recognised that it may not be practicable for all stormwater runoff from all areas of site entry/exit paths to be directed to a sediment trap; however, such areas must be limited to the minimum practicable.

A.6 Site management

Acceptable outcome AO18.1

Where appropriate, an ESCP is prepared (in accordance with Appendix 1A, section 6), and where necessary approved by a relevant Regulatory authority, prior to commencing any land-disturbing activities.

Acceptable outcome AO18.2

The potential for environmental harm must be assessed by a recognised expert or authority.

Acceptable outcome AO18.3

Refer to A1(a) for discussion on 'potential environmental risk'.

Acceptable outcome AO18.4

Applies to all land-disturbing activities, whether planned or unplanned, and especially to any works that are required to be conducted without an associated ESCP.

Acceptable outcome A18.4

Includes ensuring that the value and use of land/properties adjacent to the development (including roads) are not diminished as a result of work-related soil erosion and sediment runoff.

Acceptable outcome AO19.1

'Responsible ESC personnel' are those persons employed or contracted by the land owner and/or developer as the principal officer(s) responsible for ensuring appropriate application of the planned ESC measures and for the provision of advice in response to unplanned ESC issues.

Acceptable outcome A020.1

Recommended training requirements are discussed in Section 6.19 of Chapter 6 — Site management.

Acceptable outcome AO20.2

Necessary disturbance to ESC measures would include the short-term removal of an ESC measure to allow the installation of services under the ESC measure, or to allow vehicular or material access.

Performance outcome PO21

Performance outcome PO21 and PO22 require work sites to be appropriately prepared for both current and imminent site conditions. Compliance with these outcomes requires ESCPs to be living documents that remain both effective and flexible, and thus are able to appropriately adapt to changing site conditions.

Acceptable outcome AO21.2

A significant change in site conditions includes:

(a) unseasonable weather conditions

(b) exposure of problematic soil conditions not previously anticipated

(c) significant change in construction methodology, staging or programming of earthworks and/or site stabilisation activities

(d) significant change in the development design or layout

(e) an unprogrammed site shutdown.

Performance outcome PO22

Performance outcome PO21 and PO22 require work sites to be appropriately prepared for both current and imminent site conditions. Compliance with these outcomes requires ESCPs to be living documents that remain both effective and flexible, and thus are able to appropriately adapt to changing site conditions.

Acceptable outcome AO24.1

Appropriate identification depends on the level of risk of damage to protected or retained vegetation. Appropriate identification does not necessarily mean markers, signs or fencing; however, such measures may be appropriate in some areas.

Acceptable outcome AO25.2

AS1940 – The storage and handling of flammable and combustible liquids (as amended from time to time).

In addition to the above:

(a) Impervious bunds must be constructed around all storage areas containing more than 1m of petroleum and oil-based products such that the enclosed volume is large enough to contain 110 per cent of the volume held in the largest, individual storage tank.

(b) On-site personnel involved in the handling and storage of flammable and combustible liquids, including all liquid chemicals, must be appropriately trained and/or supervised, as required in order to allow such personnel to appropriately perform such activities.

Acceptable outcome AO25.3

Current (2008) best practice requires that all reasonable and practicable measures are taken to:

(a) prevent the release of cement-laden runoff, concrete waste, and chemical products (including petroleum and oil-based products), into an internal or external water body, completed internal drainage systems, or any external drainage system, excluding those on-site drains and water bodies specifically designed to contain and/or treat such material;

(b) ensure all solid and liquid waste from concrete production, and concreting equipment (including delivery and placement vehicles), is fully contained within the property; and

(c) ensure cement residue from work activities is:
   (i) retained on a pervious surface (e.g. a grassed or open soil area, or excavated trench); or
   (ii) filtered through a fine-grained, porous earth embankment; or
   (iii) collected and disposed of in a manner that minimises ongoing environmental harm.

Acceptable outcome AO25.4

Current (2008) best practice requires that wherever practicable, the cutting of bricks, concrete, ceramics, and other slurry-producing materials must be carried out in a manner that:

(a) complies with current State guidelines, policies, and legislation; and

(b) fully contains any contaminated waste water for later treatment and/or lawful disposal; or

(c) appropriately filters (e.g. through a fine-grained, porous earth embankment) any contaminated slurry/water prior to its release from the immediate work area.

Acceptable outcome AO25.5

Current (2008) best practice requires that wherever practicable, the washing of tools and painting equipment is carried out in a manner that:

(a) complies with current State guidelines, policies and legislation; and

(b) fully contains any contaminated waste water for later treatment and/or lawful disposal; or

(c) appropriately filters (e.g. through a fine-grained, porous, earth embankment) any contaminated liquid prior to its release from the immediate work area; or

(d) appropriately infiltrates all contaminated liquid matter into an area of porous grass or open soil.

Acceptable outcome AO26.2

Sediment and sediment-laden runoff must not settle or collect on public roadways where such material could result in a traffic or safety hazard.

Acceptable outcome AO27.1

‘Sediment and other material’ includes clay, silt, sand, gravel, soil, mud, cement and fine-ceramic waste.

Acceptable outcome AO27.2

Sealed surfaces include sealed roads and car parks. In circumstances where the washing/flushing of sealed surfaces is required, all reasonable and practicable sediment control measures must be employed to prevent, or at least minimise, the release of sediment into receiving waters. Only those measures that will not cause safety issues or adverse property flooding to third parties shall be employed.

Acceptable outcome AO28.1

'Appropriate consideration' includes taking all reasonable and practicable measures to minimise safety risks. As a general rule, safety issues take a higher priority than ESC issues; however, this does not mean that the existence of potential safety issues diminishes the ESC standard required of a work site.
Public safety risks include potential damage to public vehicles resulting from the use of inappropriate kerb-inlet sediment traps on public roads. The potential safety risk of a proposed sediment trap to site workers and the public must be given appropriate consideration before its installation, especially those sediment traps located within publicly accessible areas.

Performance outcome PO29

The protection of wildlife does not diminish the required ESC standard, or the need to take all reasonable and practicable measures to minimise environmental harm resulting from soil erosion and displaced sediment.

Performance outcome PO30

Further discussion on the protection of waterways and the conducting of instream works is provided in Appendix I – Instream works.

Performance outcome PO31

A discussion on site shutdown procedures is provided in Section 6.15 of Chapter 6—Site management.

A.7 Land clearing

Acceptable outcome AO32.3

Operational restrictions on the extent and duration of land disturbance, including land clearing (as presented by performance outcome PO32 to PO35) only apply when such land disturbance is at risk, or potentially at risk, of erosion by wind, rain, or flowing water.

The potential erosion risk is related (in part) to the potential rainfall erosivity as defined in Section 4.4 of Chapter 4 – Design standards and technique selection. The potential erosion hazard may be identified through the application of an appropriate erosion hazard assessment scheme such as those discussed in Chapter 3 – Site planning, and Appendix F – Erosion hazard assessment.

Acceptable outcome AO33.2

The extent of unnecessary soil disturbance, including disturbances outside the designated work area, must be minimised at all times.

Wherever reasonable and practicable, land clearing must be limited to the current stage of works. Current (2008) best practice recommends that land clearing not extend beyond the parameters indicated in Table 4.4.7 of Chapter 4 – Design standards and technique selection; that being the minimum necessary to provide either of the following:

(a) up to eight (8) weeks of site activity during those months when the expected rainfall erosivity is less than 100, six (6) if between 100 and 285, four (4) weeks if between 285 and 1500, and two (2) weeks if greater than 1500

(b) up to eight (8) weeks of site activity during those months when the actual or average rainfall is less than 45 mm, six (6) if between 45 and 100mm, four (4) weeks if between 100 and 225mm, and two (2) weeks if greater than 22mm.

Condition (b) generally only applies if directed by the relevant regulatory authority.

Acceptable outcome AO33.3

Clause AO33.3 does not imply that land clearing should occur to the full extent of these limits, rather that all reasonable and practicable measures are taken to limit land clearing to no more than these limits. In all cases, land clearing must be limited to the minimum necessary to complete the approved works.

Acceptable outcome AO34.3

During such tree clearing, all reasonable and practicable measures must be taken to minimise unnecessary removal of, or disturbance to, any existing ground cover (organic or inorganic) until just prior to final grubbing and topsoil removal.

In some cases it might be advantageous to perform bulk removal of trees and shrubs at the beginning of each stage of works, followed by the establishment of a temporary grass, mulch or other ground cover. Final grubbing of roots and topsoil removal should then be delayed until just prior to commencement of bulk earthworks.

Acceptable outcome AO35.1

This clause excludes that (minimal) land clearing required for the purpose of installing such ESC measures, in which case only that land clearing required to install such measures shall occur prior to their installation and operation.

A.8 Soil and stockpile management

Acceptable outcome AO36.1

Topsoil should be stripped only while in a moist condition. If the soil is too dry it will pulverise the soil, if too wet it may lead to clodding or hardsetting – particularly if the soil has a high silt or clay content. The soil should be wet enough to form a clump when squeezed, but not wet enough to squeeze-out water. Further discussion on the management of soils is provided in Section 6.11 of Chapter 6 – Site management.

Performance outcome PO37

Applies to all areas of proposed soil disturbance, including footprint of proposed stockpiles prior to placement of soil within such areas. Does not include any material best described as subsoil.

Acceptable outcome AO37.2

Current (2008) best practice recommendations for the management of topsoil are presented in Table 6.2 in Chapter 6 – Site management.

Acceptable outcome AO38.2

The diversion of up-slope stormwater is recommended during those periods when rainfall is possible and the up-slope catchment area exceeds 1500m^2.

Current (2008) best practice recommendations for the protection of sand and soil stockpiles from the erosive effects of wind and rainfall are presented in Table 4.6.1 in Chapter 4 – Design standards and technique selection.

Acceptable outcome AO38.4

Current (2008) best practice recommendations for the selection of an appropriate sediment control system is presented in Table 4.6.2 in Chapter 4 – Design standards and technique selection.

Short-term stockpiles of erodible material located outside of an appropriate sediment control zone must be covered if it is raining, or if rain is imminent or possible.

Acceptable outcome AO39.1

Dispersive soils normally need to be stabilised (i.e. treated with gypsum or lime depending on desired pH adjustment) and/or buried under a layer of non-dispersive soil prior to placement of channel lining (whether rock, gabion, synthetic material, or concrete), or initiation of revegetation.

Refer to Section 6.12 in Chapter 6 – Site management, or Section C11 in Appendix C – Soils and revegetation for further discussion on the management of dispersive soils.

Acceptable outcome AO40.1

Refer to Section 6.12 in Chapter 6—Site management, or Section C11 in Appendix C – Soils and revegetation for further discussion on the management of acid sulfate soils.

Within Queensland, guidelines on the management of acid sulfate soils is provided in State Planning Policy 2/02 Guideline: Planning and Managing Development involving Acid Sulfate Soils, and Dear, et al. 2002, Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines. Department of Natural Resources and Mines, Indooroopilly, Queensland.

A.9 Drainage control

The intent of this section is to take all reasonable and practicable measures to prevent, or at least minimise, environmental harm and public nuisance resulting from the exposure of soil to the erosive forces of flowing water. It is not the intent to unfairly burden those performing land-disturbing activities with the cost and inconvenience of installing and maintaining drainage control measures if there is no risk of such environmental harm and public nuisance.

Acceptable outcome A041.1

Current (2008) best practice construction phase drainage standards are presented in Table 4.3.1 of Chapter 4 – Design standards and technique selection. Drainage systems must be designed to have a minimum non-erosive hydraulic capacity (excluding 150mm freeboard) in accordance with this table.

Acceptable outcome AO41.2

Construction Drainage Plans are normally prepared for sites with a soil disturbance exceeding 2500m^2. Further discussion on the requirements of Construction Drainage Plans is presented in acceptable outcome AO11.4.

Acceptable outcome AO41.4

This clause requires compliance with performance outcome PO21 and PO22.

Acceptable outcome AO42.2

Sandbag flow diversion banks, catch drains, and flow diversion banks are examples of appropriate drainage systems that can be used to divert stormwater around excavations and other soil disturbances.

Acceptable outcome AO42.3

Current (2008) best practice for the lateral spacing of drainage channels down open soil (non vegetated) slopes is presented in Table 4.3.2 of Chapter 4—Design standards and technique selection.

Acceptable outcome AO42.4

The relevant design discharge is related to acceptable outcome A41(a). The 'design flow' or 'design discharge' is the design hydraulic capacity of that component of the drainage system. All temporary and permanent drainage systems must be able to accept the design flow within 10 days of construction. This may require the application of an appropriate permanent or temporary channel liner, or the use of velocity control check dams.

Acceptable outcome AO43.1

'Temporary' drainage systems are only utilised during the construction phase, and only until the permanent drainage systems are constructed and made operational.
The intent of installing the permanent drainage system as soon as practicable is to maximise the effective passage of 'clean' water through the site without the risk of contamination by on-site sediment.

Acceptable outcome AO43.2

'Clean' water is defined as water that either enters the property from an external source and has not been further contaminated by sediment within the property; or water that has originated from the site and is of such quality that it either does not need to be treated in order to achieve the required water quality standard, or would not be further improved if it was to pass through the type of sediment trap specified for the site.

Acceptable outcome AO43.6

Does not refer to excavations and trenches that form or act as sediment traps.

Performance outcome PO44

'Active work areas' includes site office and car park areas.

Acceptable outcome AO44.1

The intent is to minimise soil erosion and sediment runoff, and on-site safety issues, by reducing the generation of mud within active work areas.

The roof water drainage system needs to be installed before the roof covering is laid. Appropriate roof water drainage systems may be formed from either temporary (i.e. temporary solid or flexible) downpipe, or the permanent drainage system.

Acceptable outcome AO44.3

Does not apply to contaminated (e.g. sediment-laden) roof water.

A.10 Erosion control

The intent of this section is to take all reasonable and practicable measures to prevent, or at least minimise, environmental harm and public nuisance resulting from the exposure of soil, sand, silt, mud or cement to the erosive forces of wind, rain and flowing water. It is not the intent to unfairly burden those performing land-disturbing activities with the cost and inconvenience of installing and maintaining erosion control measures if there is no risk of such environmental harm and public nuisance.

Acceptable outcome AO46.1

Current (2008) best practice (construction phase) land clearing and site rehabilitation standards are presented in Table 4.4.7 of Chapter 4 – Design standards and technique selection. Unless otherwise stated by the relevant Regulatory authority, the potential erosion risk is based on the rating outlined in Table 4.4.1 of Chapter 4 – Design standards and technique selection.

In addition, all temporary earth banks, flow diversion systems, and sediment basin embankments should be machine-compacted, seeded and mulched within ten (10) days of formation for the purpose of establishing a vegetative cover, unless otherwise stated within an approved Site Stabilisation Plan, Revegetation Plan, or Vegetation Management Plan.

Acceptable outcome AO46.2

Erosion control measures primarily focus on the control of fine sediments such as clay and silt-sized particles. Thus, with respect to the value of ‘erosion control measures’, potential environmental harm is strongly related to the susceptibility of the receiving waters to environmental harm resulting from turbid runoff (i.e. suspended fine sediments).

Erosion control measures need to be appropriate for the land slope and the expected wind, rain and hydraulic conditions. Application of effective drainage control measures should help to control hydraulic conditions such that damage to adopted erosion control measures during regular rainfall events is minimised.

Acceptable outcome AO46.3

This clause requires compliance with performance outcome PO21 and PO22.

Acceptable outcome AO47.1

Such a clause shall not reduce the responsibility to apply and maintain, at all times, all necessary sediment control measures.

The minimisation of soil erosion requires the application of effective drainage and erosion control throughout each and all subcatchments.

Acceptable outcome AO48.2

Compliance with this clause requires:

(a) soil disturbance within any subcatchment to be delayed as long as possible, and ideally, not until the principal on-site activities within that area are ready to commence;

(b) soil disturbance at any given time to be limited to the minimum necessary to perform the required works; and

(c) the extent of unnecessary soil disturbance, including disturbances outside the designated work area, to be minimised.

Disturbed soils associated with non-completed earthworks that are likely to be exposed to rainfall are protected from soil erosion:

(a) if further soil disturbances are likely to be delayed for more than 30 days during those months when the expected rainfall erosivity is less than 100, or 20 days if between 100 and 285, or 10 days if between 285 and 1500, or 5 days if greater than 1500: or

(b) where directed by the regulatory authority, further soil disturbances are likely to be delayed for more than 30 days during those months when the expected rainfall is less than 45 mm, or 20 days if between 45 and 100mm, or 10 days if between 100 and 225mm, or 5 days if greater than 225mm.

Acceptable outcome AO48.3

Compliance with the requirements outlined within Table 4.4.7 of Chapter 4 – Design standards and technique selection does not diminish the need to apply all reasonable erosion control measures as soon as practicable.

A ‘sub-area’ is an area within a given subcatchment fully contained within a set of drainage control structures designed to minimise the risk of rill erosion within that area.

Acceptable outcome AO48.4

If the adopted erosion control measures incorporate temporary or permanent grassing, then the application of that grass cover must not be unnecessarily delayed simply because it is (inappropriately) viewed by the principal contractor as part of site revegetation that has been subcontracted to another contractor. In cases where it is not possible for the principal contractor to apply a temporary grass cover (for the purposes of erosion control), then alternative erosion control measures must be applied to protect the site during the intervening period.

Acceptable outcome AO49.1

Condition (b) generally only applies if directed by the relevant regulatory authority.

Acceptable outcome AO49.2

Existing ground covers include mulch (organic or inorganic), grasses, and other low-growing plants. This clause required compliance with performance outcome PO34.

Acceptable outcome AO49.3

Dispersive soils normally need to be stabilised (i.e. treated with gypsum or lime depending on desired pH adjustment) and/or buried under a layer of non-dispersive soil prior to placement of channel lining (whether rock, gabion, synthetic material, or concrete), or initiation of revegetation.

Refer to Section 6.12 in Chapter 6 – Site management, or Section C11 in Appendix C – Soils and revegetation for further discussion on the management of dispersive soils.

Acceptable outcome AO50.1

All stormwater, sewer line and other service trenches not in streets are mulched and seeded, or otherwise appropriately stabilised, within 7 days after backfill, or otherwise rehabilitated in accordance with an approved Site Stabilisation Plan, Landscape Plan, Revegetation Plan, or Vegetation Management Plan.

Acceptable outcome AO51.2

This clause requires compliance with performance outcome PO38.

A.11 Sediment control

The intent of this section is to take all reasonable and practicable measures to prevent, or at least minimise, environmental harm and public nuisance resulting from the exposure, placement, or displacement of sediment (including soil, sand, silt, mud and cement). It is not the intent to unfairly burden those performing land-disturbing activities with the cost and inconvenience of installing and maintaining sediment control measures if there is no risk of such environmental harm and public nuisance.

Acceptable outcome AO52.1

Current (2008) best practice (construction phase) sediment control standards are presented in Table 4.5.1 of Chapter 4 – Design standards and technique selection.

Acceptable outcome AO52.2

Relevant site conditions include the soil type, design flow rate, flow condition (i.e. sheet flow or concentrated flow), and erosion hazard. The erosion hazard may be related to the expected soil loss rate (as presented in Table 4.5.1 of Chapter 4, and Appendix E – Soil loss estimation), or other factors such as discussed in Appendix F – Erosion hazard assessment.

Unless otherwise noted within this document, or specified by the regulatory authority, the design storm for sediment traps (excluding de-watering and instream sediment control measures) must be taken as 0.5 times the 1 Exceedance per year flood event peak discharge.

The ‘potential environmental risk’ is discussed in acceptable outcome AO1.1, and is summarised in Table 5.1 of Chapter 5 – Preparation of plans.

Acceptable outcome AO52.3

A ‘supplementary’ sediment trap is a minor sediment trap, such as grass filter strips and most kerb inlet sediment traps, that is not effective enough to be classified as Type 3 sediment trap. Refer to Table 4.5.4 of Chapter 4 – Design standards and technique selection.

Acceptable outcome AO52.4

Such plans must appropriately verify the basin's dimensions, surface level elevation, and surface area (Type C basins) and/or volumes (Type F and Type D basins) comply with the approved design drawings.

Acceptable outcome AO53.1

Compliance with this clause means that no sediment control system is utilised if another more appropriate system (of equivalent treatment standard, i.e. Type 1, 2 or 3) is available. This means that straw bale sediment traps (appropriately wrapped in filter cloth) must not be used unless site conditions prevent the use of any other more appropriate sediment control systems.

Acceptable outcome AO53.2

This means that the catchment area of a sediment basin is not grubbed of vegetation, or stripped of topsoil, until the basin is fully constructed and operational.

Acceptable outcome AO53.4

This means that sediment control within a development site does not rely on the operation of an off-site sediment trap such as a downstream, council-operated, gross pollutant trap, or other stormwater treatment system.

Acceptable outcome AO53.5

This means that independent of the required sediment control standard within a given subcatchment, the following actions are taken:

(a) all reasonable and practicable measures are taken to utilise additional sediment traps of an equivalent or lower efficiency (including 'supplementary' sediment traps) throughout the subcatchment; and

(b) every reasonable and practicable opportunity is taken to trap sediment as close to its source as possible.

Acceptable outcome AO53.6

This does not mean that sediment traps should be placed in inappropriate locations; an inappropriate location being one where existence of the sediment trap would likely result in the hydraulic failure of the sediment trap, or unacceptable soil erosion during moderate to heavy rainfall.

Acceptable outcome AO53.8

This clause means that sediment traps are not designed to simply divert sediment and sediment-laden waters away from stormwater inlets.

Compliance with this clause includes the following actions:

(a) Wherever practical, sediment fences are located along the contour to maintain 'sheet' flow conditions down-slope of each fence. Where this is not practical, regular returns are utilised to allow water to pond at regular intervals along the length of the fence; and

(b) Adopted roadside kerb inlet sediment traps are appropriate for the type of inlet (i.e. sag or on-grade), for further discussion refer to Principle 8.14 in Chapter 2 – Principles of erosion and sediment control.

Acceptable outcome AO55.1

The intent of this clause is to minimise the quantity of water that needs to be de-watered from excavations and trenches. Thus, if water does not need to be de-watered from such areas, then the clause does not apply.

Acceptable outcome AO55.2

Current (2008) best practice sediment control standards for de-watering activities are outlined in Table 4.5.13 of Chapter 4 – Design standards and technique selection.
Alternatively, Table 4.5.14 of Chapter 4 presents a water quality standard for de-watering operations based on Nephelometric Turbidity Units (NTU).

Appropriate sediment controls placed down-slope of material stockpiles during the de-watering of such stockpiles are summarised in Table 4.5.14 of Chapter 4 – Design standards and technique selection.

Acceptable outcome AO55.3

The 'potential environmental risk' is discussed in acceptable outcome AO1.1, and is summarised in Table 5.1 of Chapter 5 – Preparation of plans.

A.12 Site stabilisation and rehabilitation

Acceptable outcome AO57.1

Current (2008) best-practice site rehabilitation standards are presented in Table 4.4.7 of Chapter 4 – Design standards and technique selection. Unless otherwise stated by the relevant Regulatory authority, the potential erosion risk shall be based on the rating outlined in Table 4.4.1 of Chapter 4.

Acceptable outcome AO58.1

Data collection necessary to assist the design of site revegetation is outlined in Sections C3 and C9 of Appendix C – Soils and revegetation.

Acceptable outcome AO59.1

Temporary revegetation conducted for the purpose of erosion control must be conducted in accordance with a Site Stabilisation Plan, Landscape Plan, Revegetation Plan, or Vegetation Management Plan, where such a plan specifically refers to such activities.

Acceptable outcome AO59.2

The type of permanent vegetation applied to completed earthworks must be compatible with the anticipated long-term land use, current and ongoing erosion risk, environmental requirements (including weed control), and associated components of the site rehabilitation.

Acceptable outcome AO59.3

A 'manageable drainage area' refers to an area of open soil that can be managed (at any given time) within the limits of the specified ESC treatment standard without the need for the placement of erosion control measures (e.g. mulching) on any part of the soil.

On a well-managed site, it is typical for a 'manageable drainage area' to consist of a series of 'sub-areas' interconnected by temporary or permanent drainage channels. A 'sub-area' is an

area within a given subcatchment fully contained within a set of drainage control structures designed to minimise the risk of rill erosion within that area.

Acceptable outcome AO60.1

Compliance with this clause required compliance with performance outcome PO37.

Unless otherwise directed by an approved Site Stabilisation Plan, Landscape Plan, Revegetation Plan, or Vegetation Management Plan, topsoil should be placed at a minimum depth of 75mm on slopes 4:1 (H:V) or flatter, and 50mm on slopes steeper than 4:1.

Further discussion on soil preparation and treatment prior to planting is provided in Appendix C—Soils and revegetation.

Performance outcome PO61

Local environment includes local wildlife.

A.13 Site inspection and monitoring

Acceptable outcome AO62.1

Personnel preparing and/or supervising the preparation of the Monitoring and Maintenance Program must, collectively, have all of the following capabilities:

(a) an understanding of the local environmental values that could potentially be affected by the proposed works

(b) a good working knowledge of the site's ESC issues, and potential environmental impacts, that is commensurate with the complexity of the site and the degree of environmental risk

(c) a good working knowledge of current best practice ESC measures appropriate for the given site conditions and type of works

(d) a good working knowledge of the correct installation, operational and maintenance procedures for the full range of ESC measures used on the site.

Refer to AO1.1 for discussion on 'potential environmental risk'.

Acceptable outcome AO63.1

Discussion on scheduling and conducting site inspections by internal and external parties is provided in Chapter 7 – Site inspection.

In those instances where specific site monitoring stations are identified within the monitoring and maintenance program, then:

(a) during periods of water discharge from the site, water quality samples are collected at each monitoring station at least once on each calendar day until such discharge stops

(b) a minimum of three (3) water samples are taken and analysed, and the average result used to determine quality.

Sediment basin water quality samples are taken at a depth no greater than 200 mm above the top surface of the settled sediment within the basin.

Current (2008) best-practice procedures for 'high-risk' sites, requires regular ESC audits to be:

(a) undertaken by a person suitably qualified and experienced in erosion and sediment control that can be verified by an independent third-party (this person must not be an employee or agent of the principal contractor)

(b) conducted on the next business day following a rainfall event in which greater than 10 mm of rainfall has been recorded by the Bureau of Meteorology rain gauge nearest to the site

(c) conducted at intervals of not more than one (1) calendar month commencing from the day of site disturbance until all disturbed areas have been adequately stabilised against erosion to the acceptance of the relevant Regulatory authority

(d) conducted using an appropriate Site Inspection Checklist.

'High-risk sites' are work sites that do either of the following:

(a) satisfy the requirements of a high-risk site as defined by either the State or local government; or

(b) satisfy the requirements of those risk categories greater than high-risk (such as extreme-risk) where such categories have been defined (i.e. score a hazard rating equal to or greater than the 'critical hazard value').

Discussion on the assessment of erosion hazard and site risk assessment is presented in Chapter 3 – Site planning, and Appendix F – Erosion hazard assessment.

ESC audits must include, as a minimum, all of the following:

(a) copies of all original site inspection checklists;

(b) non-conformance and corrective action reports;

(c) sediment basin water quality and site discharge water quality monitoring results;

(d) a plan showing the areas of completed soil stabilisation; and

(e) rainfall records including date and rainfall depth.

Acceptable outcome AO64

Discussion on scheduling and conducting of site inspections is provided in Chapter 7 — Site inspection.

A.14 Site maintenance

Performance outcome PO65

Proper working order includes maintaining the required hydraulic capacity and operational effectiveness.

Acceptable outcome AO65.2

Current (2008) best practice requirements for the maintenance of sediment control devices requires these devices to be maintained and made fully operational as soon as reasonable and practicable in accordance with Table 6.1 of Chapter 6 – Site management.

The top of a sediment basin's sediment storage volume must be clearly identified by the horizontal member of a marker post (cross).