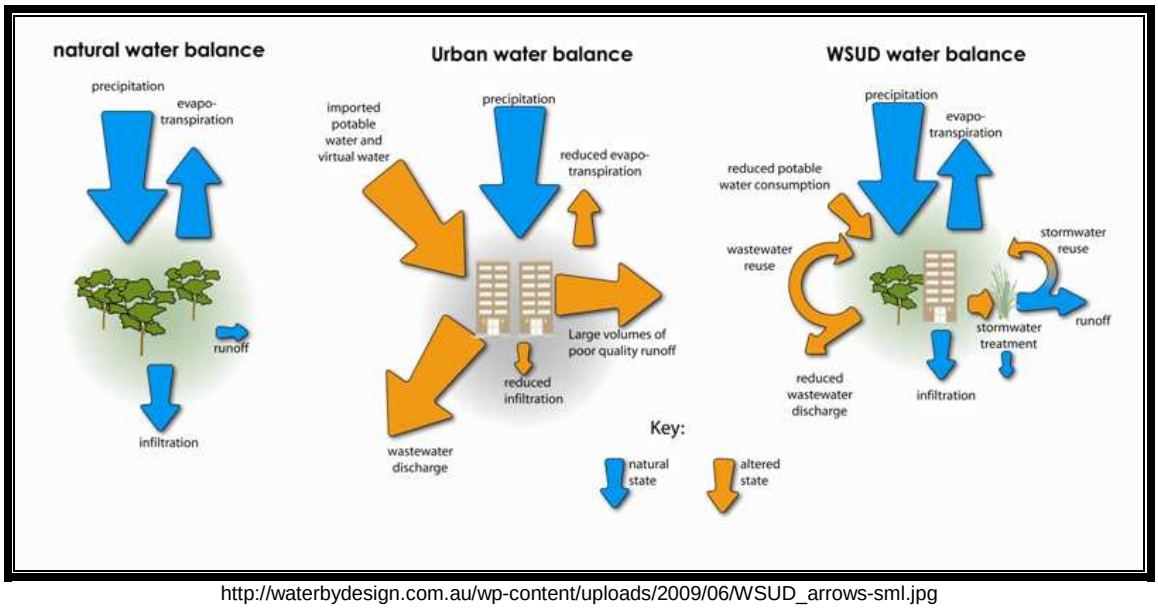
Coffs Harbour City Council

WATER SENSITIVE URBAN DESIGN (WSUD)

GUIDELINE



http://waterbydesign.com.au/wp-content/uploads/2009/06/WSUD_arrows-sml.jpg

Adopted by Council 25 June 2009
Revised August 2012

Table of Contents

1.0 INTRODUCTION

Urban development substantially changes the dynamics of water within our catchments. Under natural conditions, a large amount of rainfall soaks into the ground to replenish groundwater and provide a source of water for plants. Once impervious or hard surfaces such as roads and roofs are introduced to a catchment the opportunities for infiltration are greatly reduced. This results in an increase of water being discharged into our creeks and rivers, carrying with it a range of urban stormwater pollutants (litter, nutrients such as nitrogen, phosphorus and sediments) and increasing the potential for both soil and in-stream erosion.

In Coffs Harbour's urban areas, stormwater is regarded as one of the major impacts to receiving waters which includes the Solitary Islands Marine Park. In recognition of this, Coffs Harbour City Council developed its Urban Stormwater Management Plan, 2000 to manage impacts of stormwater. In order to comply with SEPP 71 (Coastal Protection) and Protection of Environment Operations Act (1997), Coffs Harbour City Council has now developed a Water Sensitive Urban Design Policy to further address and ameliorate site specific issues in relation to development and stormwater and waste water management.

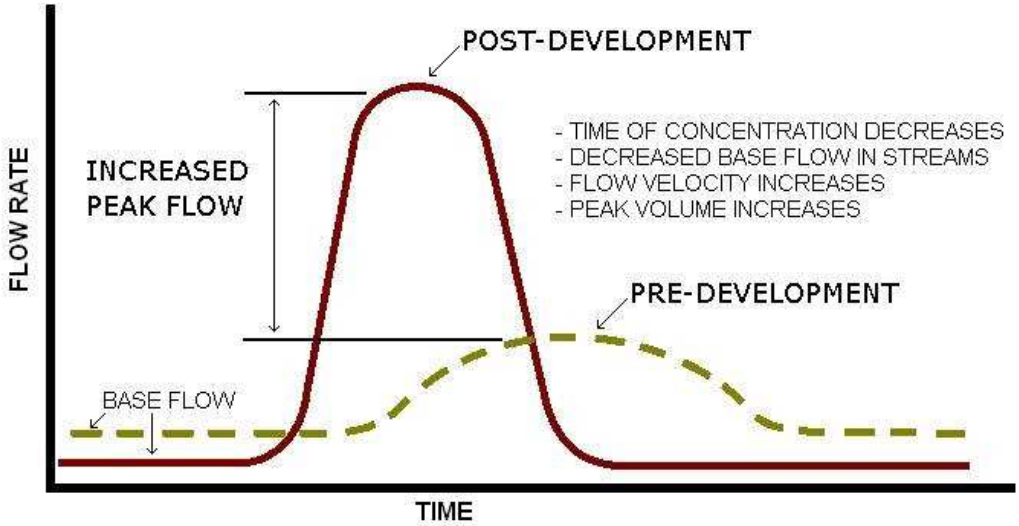
1.1 What is Water Sensitive Urban Design (WSUD)?

Water sensitive urban design (WSUD) is a multi-disciplinary approach which integrates urban planning with water management. Through a holistic approach, WSUD represents opportunities to address compatible urban infrastructure with a site's natural features and thereby aims to reduce the negative impacts on the natural water cycle and protect the health of aquatic ecosystems. Stormwater, water supply and sewage management addressed at the development stage allow for WSUD integration on a site catchment basis, providing for greater opportunity to address urban development impacts.

1.2 Why is WSUD so important?

The impact of urbanisation on the water cycle and natural environment is best illustrated in the following graph. With urbanisation there is typically a large increase in the area of impervious surfaces, therefore stormwater which previously infiltrated the ground now collects and travels along the path of least resistance (traditional stormwater pipes and gutters) to a point of discharge (natural waterways). The flow rate is increased, the level of pollutants high and the frequency of high pollutant concentration events is high (as smaller rain events which generate enough runoff to move settled pollutants from a site are frequent).

Figure 1: Water flows Pre- and Post development



The increased magnitude and frequency of storm flows can lead to significant changes to the morphology of creeks and rivers leading to degradation of aquatic habitats as well as having flooding and public safety ramifications.

WSUD aims to capture these same small and frequent rainfall events and treat the associated runoff through various methods in order to reduce pollutant loads entering natural systems and slow flows such that physical impacts such as sediment movement and erosion are ceased or at least minimised.

1.2.1 WSUD and Climate Change

CHCC has adopted an agreed sea level rise of 0.91 metres for the Local Government Area (LGA) at year 2100. Other aspects associated with climate change that may be expected to influence the LGA include;

- Changes to seasonal rainfall regime – which will place increased importance on efficient water use and require a reduced dependence on surface water during low flow conditions.

  - A lower rainfall incidence will place increased pressure on the natural water cycle and in particular environmental flows will be impacted with likely negative effects on existing natural water courses, other aquatic habitats and availability of surface waters for other species. Water users may experience long-term water restrictions and higher prices as environmental flows are reduced, thereby increasing the importance of on-site water detention for subsequent use.

  - Higher rainfall intensities in the hinterland areas of the catchment mean management of erosion and stormwater quality have increased importance. Increases in brief, heavy rainfalls are expected to increase the likelihood of flooding along urban streams. Towns on coastal plains and near estuaries are likely to suffer additional risk of flooding.

- Increasing temperatures and subsequent evaporation – resulting in drier conditions, potentially increasing bush fire risk, increasing the number of extreme hot days experienced and resulting in water becoming an even more valuable resource for both the urban and natural environment.
- Sea level rise – which will further impact on areas already flood affected, including both urban and natural wetland ecosystems. This has flow on effects for both human populations and biodiversity, through loss and alteration of habitat / homes / infrastructure, costs associated with upgrading infrastructure and further encroachment on natural areas by human development. Increased salination of surface and groundwater will also likely result.
- Storms – increased rainfall intensity (while overall rainfall volume may decrease) and changes to storm surge heights will impact on drainage and water management in urban areas.
- Ecosystem threats - Sea level rise, increased temperatures and changes in hydrology and fire regimes are likely to have a substantial impact on terrestrial and freshwater ecosystems. Vulnerable ecosystems include saline wetlands, low-lying coastal ecosystems and fragmented forests and woodlands in the hinterland.

(sources: Local Government Association of Qld Inc (2007) Adapting to Climate Change – A Queensland Local Government Guide and Climate Change in the Northern Rivers Catchment CSIRO 2007 and Report to Council December 2008 Climate Change Impacts for Coffs Harbour and Coffs Harbour City Council (2010) Climate Change Mitigation and Adaptation Action Plan and NSW Climate Impact Profile - The impacts of climate change on the biophysical environment of New South Wales DECCW 2010)

WSUD techniques can help ameliorate some impacts by reducing flow volumes and rates, storing water for short or long term use/infiltration back into the water cycle and essentially cleaning stormwater before releasing it back into the water cycle.

1.2.2 Catchment Conditions

The unique nature of the Coffs Harbour LGA is characterised by the narrow coastal plain, which runs inland from the ocean to the coastal ranges. The influence of the topography combined with rainfall characteristics and soil type, results in a high volume of surface runoff. Within the LGA, surface runoff has been determined as more than double the average for coastal NSW, and nearly nine times the state average. High flows occur after periods of heavy rainfall, but due to the short catchment length and rainfall duration, are usually short lived. Flooding is a common occurrence after severe storms and is exacerbated in the lower reaches of the creeks when combined with unusually high tides. The majority of pollutant transportation within the Coffs Harbour area occurs in the first flush of the catchment. (source: CHCC USMP 2000)

Our aquatic environments are important to the community as well as the plants and animals that depend upon them. We fish, swim, surf, admire and enjoy our creeks and beaches. However, water quality and aquatic biodiversity continue to be subjected to the pressures of urbanisation through water pollution, changes to natural features, and vegetation removal.

Coastal creeks, estuaries and the sea are highly indicative of the broader state of the environment in the sense that these waterways are the receiving body for most of the activities in the catchments. Their health in terms of water quality, biological integrity and structure provide us with a reasonable picture of the integrity of relevant catchments.

Of the sites used to test water quality by Council, seven locations are **not considered "ecologically healthy"** (for overall ecological well being). Increasing urbanisation of coastal catchments is resulting in alterations to the natural flow regime and subsequently increasing the erosive potential of discharges and pollution loads to waterways. In June 2000, Council prepared a stomwater management plan to assist in rectifying this issue.

In addition to the coastline catchments, there are two catchments on the west of the ridgeline draining into the Clarence River. These are the Orara and the Nymboida river catchments. These rivers form the primary water sources for the Coffs Harbour LGA drinking water supply.

Table 1: Subcatchment Stress Classifications.

Catchment	Creek Catchment area (km2)	Hydrological Stress (based on stream flows and extraction rates)	Environmental Stress (indicators considered bank and bed erosion, riparian vegetation, landuse, fish barriers, water quality (total phosphorus, turbidity, salinity, pH), macro-invertebrates, algal blooms, fish kills, point source discharges, levee banks, acid runoff)
COASTAL CATCHMENTS			
Arrawarra Creek*	**20**	**L**	**M**
Boambee Creek*	**51**	**H**	**H**
Bonville Creek	**54**	**H**	**H**
Coffs Harbour Creek*	**27**	**H**	**H**
Corindi River*	**92**	**H**	**M**
Dirty Creek	**21**	**L**	**L**
Double Crossing Creek*	**12**	**L**	**H**
Korora Basin	**15**	**H**	**H**
Moonee Creek*	**45**	**H**	**M**
Pine-Bundagaree Creek	**77**	**H**	**L**
Red Bank River	**41**	**L**	**H**
Station Creek	**22**	**L**	**L**
Woolgoolga Creek*	**31**	**H**	**H**
ORARA RIVER			
Bucca Bucca Creek	**118**	**L**	**H**

Lower Orara River	**530**	**L**	**H**
Mid Orara River*	**1504**	**H**	**M**
Upper Orara River*	**132**	**M**	**H**
NYMBOIDA RIVER			
Blicks River	**353**	**L**	**L**
Boyd River	**950**	**L**	**L**
Little Nymboida River	**367**	**L**	**L**
Lower Nymboida River*	**778**	**H**	**M**
Mid Nymboida River	**386**	**L**	**L**
Upper Nymboida River	**609**	**L**	**M**
* Primary stress factors include urban activities such as water supply, sewerage and stormwater management. L – Low, M – Medium, H - High			

Source: Coffs Harbour Water IWCM Concept Study (2006) *which sourced table from NSW DLWC (1999) Stressed Rivers Assessment report – Clarence, Coffs Harbour Waterways and Bellinger Catchments*.

By effectively and efficiently managing stormwater as a resource, we have the opportunity to improve our catchment conditions while achieving a broad range of other WSUD objectives.

1.3 Relationships to other documents and legislation

This WSUD Guideline is intended to be a generic guide to the various WSUD treatments available. It aims to assist in the selection of a treatment type for your proposed development. It identifies what development types require WSUD treatments and provides generic conditions of consent which apply to elements of these developments.

This Guideline does not provide detailed technical design elements. This type of advice is available in the third document of the WSUD series, the CHCC WSUD Technical Specifications, accessible from Councils website.

The WSUD Policy, Guideline and Technical Specifications, are consistent with the provisions of Coffs Harbour City Council Local Environmental Plan, Coffs Harbour City Council relevant policies, Development Control Plans and State Environmental Planning Policies.

NB: The following listed DCPs take precedent over this Guideline in relation to WSUD treatment types required of development occurring in these areas (until such time as these DCPs are reviewed)**;**

- Hearnes Lake/Sandy Beach DCP

1.3.1 Coffs Harbour City Council Plans and Policies:

- Coffs Harbour City Council Local Environmental Plan 2010 (to be completed 2010)
- CHCC Vision 2030
- Coffs Harbour Water Integrated Water Cycle Management Concept Plan (2006)
- Coffs Harbour City Council Urban Stormwater Management Plan, 2000
- Biodiversity Action Strategy, 2002
- Estuary Management Plans
- Floodplain Risk Management Plan
- Subdivision and Development Guidelines
- Development specification design (2009) – 1102 control of erosion and sedimentation
- Tradewaste Policy
- Potentially Flood Prone Land Information Sheet
- Contaminated Land Information Sheet
- Acid Sulfate Soils Information Sheet
- Landform Modification Information Sheet
- Urban Rainwater Tank Policy

1.3.2 NSW State Government legislation, State Environmental Planning Policies

- State Environmental Planning Policy No. 71 (2005) – Coastal Protection
- State environmental Planning Policy No. 14 (2008) – Coastal Wetlands
- NSW Coastal Policy 1997
- Environmental Planning and Assessment Act (1979)
- Local Government Act (1993)
- NSW Building Sustainability Index (BASIX)
- New South Wales Ministry of Energy and Utilities "Best Practice Management of Water Supply and Sewage Guidelines" (2007)
- CMA Catchment Action Plan
- Protection of Environment Operations Act (1997)

State Environmental Planning Policy No. 71 (2005) – Coastal Protection Reg 16 requires that the consent authority (Council) must not grant consent to a development application to carry out development on land to which this Policy applies if the consent authority is of the opinion that the development will, or is likely to, discharge untreated stormwater into the sea, a beach, or an estuary, a coastal lake, a coastal creek or other similar body of water, or onto a rock platform.

1.3.3 Commonwealth Policy

- This Policy is consistent with many of the principles of the Commonwealth's Water Initiatives – including; management of urban water, water for the environment, water conservation, use and re-use and adapting to climate change.

1.5 BASIX

Introduced by the NSW Government, BASIX, the Building Sustainability Index, ensures homes are designed to use less potable water and be responsible for fewer greenhouse gas emissions by setting energy and water reduction targets for houses and units.

New development has the potential to further increase pollutant loadings in both the stormwater system and the receiving waters, relative to those occurring under pre-development conditions. The planning stage provides the opportunity to implement stormwater control measures to improve water quality. At this stage, control measures can be integrated into developments with maximum efficiency and effectiveness, rather than attempting to retro-fit controls after the development has been completed.

The BASIX water target is considered the minimum requirement for developments in terms of reduction in reliance on potable water supply, however BASIX does not rule out the need for further treatment on-site as required to achieve the WSUD Policy water quality objectives.

The revised CHCC DCP C8 Integrated (Natural) Water Cycle Management includes BASIX derived water conservation measures that apply to all non-residential developments.

1.6 Sediment and Erosion Control

Sediment and erosion control is a supporting aspect of WSUD in that it aims to maintain stormwater quality leaving a site by implementing methods to prevent erosion of soil and movement of sediment from a site.

Effective sediment and erosion control is vital to ensuring WSUD treatments installed remain in working order throughout the development of any land parcel. Without adequate sediment and erosion control, WSUD treatments will almost always fail as the treatment train becomes clogged with sediment laden run-off. Some WSUD treatments, such as basins, may be used during the

construction phase as a sediment basin, which is then cleaned out and re-used as a bioretention basin at the site once it is fully developed.

Council have adopted the Landcom (2004) Managing Urban Stormwater – Soils and Construction Vol 1 (Blue Book) as the standard Sediment and Erosion Control Policy and Procedures to be applied to all land modification activities. This contains technical advice on selection of and implementation of appropriate sediment and erosion control techniques.

Applicants are also required to refer to the CHCC Planning and Design and Construction specifications located on Councils website;

http://www.coffsharbour.nsw.gov.au/www/html/4075-overview.asp

2.0 WSUD PRINCIPLES

WSUD gives emphasis to the collection, treatment and utilisation of stormwater at or near source, as a part of an integrated 'treatment train' that may be applied in addition to, or in lieu of, conventional stormwater infrastructure.

WSUD measures aim to mimic the influence of natural processes of the small and frequent runoff events that are of greatest environmental significance, as opposed to the conventional approach to stormwater management that focuses solely on flood risk management. The Coffs Catchment requires an integrated approach that incorporates both management and alleviation of flood events and improved management of stormwater/wastewater.

The six key principles of WSUD are:

1. Protection and enhancement of natural water systems including their associated vegetation communities, natural features and ecological processes (creeks, rivers, wetlands etc) within urban catchments;
2. Protection and enhancement of water quality, by improving the quality of stormwater runoff (removing pollutants close to their source) which drains from urban developments/catchments;
3. Minimising changes in water balance and flow regime resulting from urban development to reduce runoff and peak flows;
4. Integrating stormwater management into the landscape by using stormwater treatment systems that incorporate multiple uses providing a variety of benefits, including water quality protection, stormwater detention and retention, public open space, and recreational and visual amenity of the community;
5. Adding long-term value while minimising development costs. Downstream drainage infrastructure required is reduced thus minimising development costs for drainage, due to reduced peak flows and runoff, whilst natural features such as rivers and lakes are enhanced which adds value to the properties of the area.; and
6. Reducing potable water demand by using stormwater as a resource for non-potable purposes, such as toilet flushing, car washing, garden, etc.

The principles of WSUD can be adopted at a lot, precinct or regional scale.

2.1 WSUD elements include:

- Appropriate planning and construction practices and controls (eg. sediment and erosion control, design appropriate to site constraints, appropriate maintenance regimes)
- Capture and reuse of rainwater (eg. toilet flushing, washing machines, garden watering and car washing)
- Capture and reuse of stormwater runoff or treated wastewater (eg. irrigation, car washing, toilet flushing or industrial purposes)

- Infiltration of stormwater to underground aquifers where appropriate (possibly for subsequent extraction and reuse during dry weather)
- Specially designed landscaping for conveyance and treatment of runoff including the use of grass swales, infiltration or bioretention trenches, instead of kerb and gutter in roadways
- Use of porous paving in appropriate areas to minimise runoff rates and volumes, and limit changes to the site water balance
- Minimisation of site disturbance (including cut and fill) to protect native vegetation and conserve habitat, and
- Protection and restoration of stream and riparian corridors for their environmental, recreational and cultural values.

2.2 Selecting WSUD Treatments

There are a range of WSUD elements or techniques which can be selected to formulate water sensitive forms of urban development through stand alone installation or as components of a 'treatment train'. These elements and techniques are selected and used on the basis of site characteristics, and stormwater and other objectives applying to the site.

Refer to Section 6 of this document for a brief description of WSUD treatment types.

Applicants are advised to seek professional advice to ensure you select the most site appropriate treatment in order to achieve the water quality objectives required by Council's Policy. Council officers are available to provide assistance and further reference material and sources are listed in the 'Where to go for further information and technical guidance' section at the end of this document. SEQ WBD Concept Design Guidelines detail step by step the WSUD conceptual design process which is a valuable starting point for applicants.

Council recommends applicants refer to the South East Queensland Water By Design Guidelines and Technical documents in the design and development of WSUD treatments. Council endorse the Water By Design series of documents as being suitable for use within the Coffs Harbour Local Government Area.

The following documents are available to view only at Councils City Services Department – however applicants wishing to obtain copies of any of these documents will need to contact Water By Design directly.

- Concept Design Guidelines
- Construction and Establishment Guidelines; Swales, Bioretention Systems and Wetlands
- MUSIC Modeling Guidelines
- Deemed to Comply Solutions – Stormwater Quality Management
- Stormwater Harvesting Guidelines
- A Business Case for Best Practice Stormwater Management

3.0 DEVELOPMENT TO WHICH THE POLICY APPLIES

This Policy applies to all development of the following types;

Deemed to Comply – Residential greater than 2 lots/dwellings, MUDs, Commercial and Industrial

If your proposed development mirrors the development scenarios detailed by the South East Queensland Water By Design Deemed to Comply Solutions – then Council will consider accepting your Application as deemed to comply.

Applicants are advised to discuss their proposed development with Council's WSUD Officers prior to lodging application in this instance.

Deemed to comply developments include the following (as per SEQ Deemed to Comply Solutions 2010);

Table 2: Deemed to Comply development scenarios

Land use	Development scenario	scale
Residential	Residential greater than 2 lots up to 20 lots	N/A
	Residential greater than 2 dwellings (townhouse style up to 2 storeys)	≤ 12,500 m^2
	Residential high density multiple dwelling apartments (flats, high rise)	≤ 12,500 m^2
Commercial and / or Industrial	Commercial and / or industrial	≤ 12,500 m^2

NB Alterations and additions either comply with deemed to comply requirements above depending on size of the alteration/addition proposed
ie use deemed to comply methodology according to the size of the alteration/addition on the site, such that the new work is considered as a stand alone work separate to existing site conditions
OR
refer to requirements below which require works to adhere to Council Policy Objectives (ie water quality targets) such that you may consider the existing site conditions in conjunction with new works

The Deemed to Comply Solutions are available to view at Council's City Services Design Department or from http://waterbydesign.com.au/deemedtocomply/.

When using the SEQ **Deemed to Comply Solutions** applicants are to use the **climatic subregion – south coast**.

Subdivision

- Subdivision developments greater than 20 Lots, including;

  - All greenfield development
  - All brownfield development

Commercial Development

- All new commercial development
- Alterations and additions to commercial developments/buildings where there is a 50% or greater increase in the total site roofed and/or impervious area

Note: fit outs, refurbishments, internal works which do not disturb the external ground may only need to comply with the DCP water conservation requirements (Section 3.1.6).

Industrial Development

- All new industrial developments
- Alterations and additions to industrial developments/buildings where there is a 50% or greater increase in the total site roofed and/or impervious area

Note: fit outs, refurbishments, internal works which do not disturb the external ground may only need to comply with the DCP water conservation requirements (Section 3.1.6).

Tourist Development

- All new tourist developments
- Alterations and additions to tourist developments/buildings where there is a 50% or greater increase in the total site roofed and/or impervious area

Note: fit outs, refurbishments, internal works which do not disturb the external ground may only need to comply with the DCP water conservation requirements (Section 3.1.6).

3.1 Standard Design Guidelines

WSUD elements are to be developed in accordance with contemporary best practice WSUD guidelines, such as SEQ WBD Technical Design Guideline and Construction and Establishment Design Guidelines, or other guidelines considered more relevant. The applicant must identify which guidelines they have used and state why that choice was made.

These documents can be viewed at Council's City Services Design Department or from http://waterbydesign.com.au/TechGuide/

Additionally, Council have available to view IPWEA Queensland WSUD Standard Drawings.

For any proposed biofiltration systems using plants (vegetation) refer to Facility for Advanced Water Biofiltration (FAWB) Stormwater Biofiltration Systems Adoption Guidelines (2009) or other relevant guide – again state which guide has been used and why within the application.

If you are proposing to use temporary sediment basins, refer to Landcom Bluebook for details on construction requirements.

The following design guidelines apply to all developments;

3.1.1 water sensitive street design and layout

(i) The design is to retain the existing land form. Cut, fill and infill is to be avoided in the first instance and minimised where avoidance is not possible.
(ii) Water courses/natural drainage lines and associated riparian vegetation are to be retained and compensatory planting/rehabilitation carried out where vegetation is removed.
(iii) The design is to minimise stormwater runoff and peaks by avoiding the channelling and concentration of flow to maintain natural drainage patterns of catchments.
(iv) The existing site topography, natural drainage lines, soils and native vegetation are to be integrated in the treatment train - to treat, detain, retain and infiltrate stormwater.
(v) Streets are not to be constructed within natural drainage lines
(vi) Road crossings over natural drainage lines are to be fauna/habitat sensitive
(vii) Carriageway widths are to be designed to minimise the amount of impermeable area
(viii) Street design is to take into account the cleansing of stormwater through the use of landscaping, grass swales, filter strips, infiltration pits and oil/grit separators
(ix) The design of the road cross section is to take into account the major stormwater runoff events whilst allowing for vehicle safety
(x) Minimise soil loss and erosion and associated impacts of soils on receiving waters for the long term as well as during construction
(xi) Reduce the costs of and demands on urban water infrastructure by encouraging efficient water resource use and measures which reduce the volumes of contaminants in wastewater and stormwater discharged into waterways

(xii) Add value while minimising development and maintenance costs (e.g. drainage infrastructure costs)
(xiii) Increase social amenity in urban areas through multi-purpose greenspace, landscaping and integrating water into landscape to enhance visual, social, cultural and ecological values
(xiv) Enhance habitat connectivity and conservation through use of WSUD techniques
(xv) Management of captured stormwater to include one or more of the following;
- stormwater evaporation
- stormwater reuse (including roofwater collection and reuse)
- infiltration to native soils or otherwise filtered through an appropriately designed soil and plant stormwater treatment system such as bioretention

(xvi) Protect the biodiversity values of riparian areas, watercourse, habitat and corridors with native vegetation through application of the buffer widths as required by CHCC DCP B8 Biodiversity requirements;

3.1.2 carparks, driveways, and other hardstand areas

(i) maximize stormwater re-use and infiltration.
(ii) utilize surface depressions for on site detention.
(iii) Where parking is NOT limited to roadside/nature strip - provide grass swales adjacent to roads and driveways instead of kerb and gutter.
(iv) Where parking is required on roadside/nature strip - pass surface runoff over grassed filter strips prior to collection in formed drains.
(v) incorporate stormwater management into landscaping, use landscaped areas for filtering runoff, swale drains, wetlands, retention, detention and infiltration.
(vi) incorporate GPTs, litter baskets or racks, etc at inlets to stormwater system or as end of pipe solutions to improve stormwater discharge.

3.1.3 shops, shopping centres

(i) design site works in accordance with 3.1.1 and 3.1.2 above.
(ii) adopt management procedures that minimize generation of stormwater pollution (managing litter, reduced use of packaging, disposable bags and utensils at shops, reduced car dependence to minimize parking areas).

3.1.4 large buildings

(i) design site works in accordance with 3.1.1 and 3.1.2 above.
(ii) collect and reuse roof water.
(iii) dispose of excess roofwater by infiltration where feasible, otherwise dispose to stormwater collection system.

3.1.5 factories, industrial areas

(i) design site works in accordance with 3.1.1 and 3.1.2 above.
(ii) use bunded, impervious areas where contaminants are used or stored.
(iii) prevent contaminated water from entering stormwater system.
(iv) collect and reuse stormwater for industrial use.
(v) collect and dispose of contaminated water as trade waste to sewer (as per Council's Trade Waste Guideline).
(vi) maximize use of porous pavements for clean activities.
(vii) pass surface runoff over filter strips prior to collection in concrete drains.
(viii) maximize use of infiltration for surface and roof water.

(ix) adopt management procedures that minimize generation of stormwater pollution (managing stockpiles, raw materials, packaging, industrial process and waste disposal to ensure material does not escape the stormwater system).

For further advice refer to Water by Design Fact Sheet: Water Sensitive Urban Design in Industrial Areas available at;
http://waterbydesign.com.au/wp- content/uploads/drupals/wbd_factsheet_no3_final.pdf

3.1.6 water conservation requirements for non-residential building developments

Refer to CHCC DCP C8 Integrated (Natural) Water Cycle Management requirements

3.1.7 subdivisions

(i) As far as possible WSUD features proposed within lots are to be provided at subdivision stage.
(ii) Preserve existing ecosystems and natural topographic features. Integrated water cycle management should be adopted where possible.
(iii) Preserve and restore natural watercourses, aquatic habitat and riparian vegetation
(iv) Use water catchments as basis for subdivision planning.
(v) Where consistent with adjacent land use requirements, grassed swale drainage is to be used in preference to pipes or hard lined gutter and channels.
(vi) Maximize open space/water management dual use opportunities; incorporate stormwater management systems into road reserves, public open space and drainage corridors; use landscaped areas for filtering runoff, swale drains, wetlands, retention, detention and infiltration.
(vii) Maximize use of porous pavements where soils are suitable for this treatment type.
(viii) Design site works in accordance with 3.1.1 and 3.1.2 above.

Note: swales are not suitable treatments at kerb and gutter in the following instances

(i) where on street parking is required, unless cars can be excluded from swale area;
(ii) on roads serving small lots with numerous driveways;
(iii) where gradients are <1% or >4%; or
(iv) as median strip treatment.

3.1.8 Single households, dual occupancies, multi-unit dwellings and associated driveways, paths and landscaped areas – optional additional works to minimum BASIX requirements

(i) minimize surface runoff by use of porous pavements in driveways and paths where soil type suits this treatment.
(ii) maximize dispersion of internal runoff onto grassed areas, minimize concentration, collection and piping of runoff to the street gutter or underground stormwater system.
(iii) design internal driveways with side slopes to direct surface runoff to grassed (filter strips) or landscaped areas.
(iv) minimize surface runoff from internal driveways to the street by internally grading or providing humps that direct surface runoff onto grassed areas within the allotment.
(v) divert roof runoff from street gutter outlets and direct to site infiltration trenches.
(vi) collect roof runoff in tanks and reuse.
(vii) utilise surface depressions in landscaping for on site detention and infiltration.

Where deemed to comply (DTC) solutions relate to these types of developments, applicants are required to submit relevant information as it applies to their DTC development.

For any other developments not covered by the DTC scenario, these will be covered by BASIX requirements and the need to capture and treat first flush eg through use of landscaping as filter medium, water tanks. However should an applicant wish to do more to enhance water quality, this is welcomed and encouraged by Council.

3.1.9 Landscaping requirements

(i) Landscaping is to be designed to retain, restore or rehabilitate the natural landscape.
(ii) Landscaping is to provide habitat for indigenous species including the provision of fauna habitat measures such as ponds, wetlands, shrubs, hollowed tree's, nest and roost boxes
(iii) Landscaping is to be water efficient and ideally use stormwater or greywater for irrigation.
(iv) Landscaping is to be designed so as to minimise the needs for nutrients and herbicides.
(v) The natural topography be retained with cut, fill and infill avoided where possible.
(vi) Watercourses and other water features are to be retained or rehabilitated if required.
(vii) Degraded riparian areas are to be revegetated to at least 10 m from the top of the bank (bank means the limit of the bed of any river as defined in the Soil Conservation Act 1938).
(viii) Riparian, dunal and other vegetation is to be retained in buffer areas.
(ix) Vegetation retention required along creeks, drainage lines, all streams (ie streams classified by stream order numbers 1, 2, 3, etc) and habitat corridors.
(x) Vegetation retention and rehabilitation to include upper, middle and understorey layers.
(xi) The use of indigenous grasses or mulched indigenous planting is to be used in preference to turf in areas that do not provide a recreational function that necessitates the use of turf.
(xii) Areas which require a high water demand are to use a water efficient water irrigation systems and ideally be irrigated with non potable water supplies such as harvested roofwater.
(xiii) Landscaping should be designed to promote the slow down, detain, capture and infiltrate stormwater though the use of depressions, swales, sedges, reed beds or similar.
(xiv) Stormwater outlets and discharge into landscaped areas are to be fitted with energy dissipation devices and protection so as to prevent scour and erosion.
(xv) WSUD treatments in landscaped areas are to be designed to fit in with the aesthetics of the site.
(xvi) Where possible, weed control should be managed with the use of mulch.

Refer to CHCC DCP Component C3 Landscaping requirements and Council's Waterwise Garden Guide available on Council's web page for further information.

3.2 Construction phase requirements

The construction/building phase can deliver significant impacts on the environment predominantly through the physical removal of vegetation and disturbance of soil. Off site environmental impacts may also result due to the inappropriate storage of machinery, materials and waste products.

Compaction of infiltration areas may occur when vehicles constantly traverse an area. Streambank and/or habitat disturbance may result with the inappropriate removal of vegetation and failure to prevent access to easily disturbed areas. The staging and planning stages of construction and building works are imperative for successful sediment and erosion control and site rehabilitation.

3.2.1 Erosion and Sediment Control (ESC)

All works in any construction phase must comply with Landcom (2004) Managing Urban Stormwater – Soils and Construction Vol 1 (Blue Book) and the site specific ESCP submitted with the Application.

See also CHCC DCP D2 Erosion and Sediment Control Requirements and Section 4.3 of this Guideline.

3.2.2 Vegetation Removal.

(i) No vegetation is to be removed prior to approval from Council to start work on any stage, and not before the approved ESC measures are in place.
(ii) Vegetation removal is to be staged to avoid the complete removal of vegetation on site, and allow the regeneration of vegetation cover.
(iii) The removal or disturbance of native trees, shrubs and ground covers shall be minimised.
(iv) Vegetation which is to remain on site is to be clearly marked and fenced off at x metres from trunk, where x = DBH (diameter at breast height @ 1.4 m above ground) x 12. The immediate areas around vegetation to be retained, is to be kept free of vehicle storage, vehicle thoroughfare and material storage.
(v) Retained vegetation and buffers must be protected by a suitable fence barrier. Fenced areas shall be clearly signposted “No Access Area”.
(vi) Where practical, vegetative debris must be salvaged either as logs or woodchip for later reuse to control erosion or to rehabilitate the site. Non salvageable material, such as stumps and roots, may be removed.
(vii) Water body buffer zones are to be clearly marked and identified as “No Access Area”. No materials are to be stockpiled in buffer zones. Vehicles are not to traverse or be parked in the buffer zone and the buffer zone should be kept free from pedestrian use.

3.2.3 Protection of Stormwater Assets and Treatment Areas.

(i) Existing or planned infiltration/grass swale areas are to be clearly marked and identified as “No Access Area”. No materials are to be stockpiled in these areas. Vehicles are not to traverse the area or be parked in the area and the site should be kept free from heavy pedestrian use to maintain infiltration properties.
(ii) The footpath or nature strip adjoining construction and building sites must not be disturbed by construction activities other than shown on the plan for:
  - o access to the site;
  - o installation of services;
  - o other works specifically approved by Council;

(iii) When roof structures and piped or artificial stormwater systems are in place, discharged water is to be managed in a manner that reduces the likelihood of erosion.
(iv) The stormwater system must prevent sediment from being eroded from the site and deposited downstream.

3.2.4 Access and Roads.

(i) Vehicular access must be confined to a maximum of two locations. Such locations will be shown on the ESC Plan and are subject to approval by Council.
(ii) Access to construction sites of 1 hectare or more shall be fitted with a shakedown device. A shakedown device shall be either:

- shaker grid (metal bar cattle grid minimum length 7m), placed to ensure vehicles crossing the grid have sufficient speed to shake off mud and contaminants from vehicles or
- 10m long shake down area constructed with 50mm diameter crushed rock

(iii) The shakedown device shall be located along the haul route, immediately before the intersection with the public road.

(iv) Regular maintenance of shake down devices is required to ensure no material is deposited on public roads. Metal shall be cleaned/replaced when the exposed height of aggregate is less than 30mm.

(v) Shaker grids are required on sites where more than 1,000m3 of material per month is hauled off site.

(vi) If material is deposited on a public street, it shall be swept up and removed before the end of that working day.

(vii) If after using shakedown device, material is still adhering to truck wheels and being deposited on public roads, a wheel washing device must be installed and used at site exit locations to ensure no further material is carted off site and deposited on public roads.

(viii) Runoff from access surfaces must be drained into an adjacent sediment trapping device before leaving the site. Where appropriate, devices to remove soil particles from vehicles must be placed at site exit locations.

(ix) On subdivision work, priority must be given to road and shoulder stabilisation based on erosion hazards. Where circumstances preclude the sealing of road shoulders and/or the construction of kerb and gutter, and:

- where grades permit grass shoulder (< 5%), the shoulders and associated table drains must be topsoiled and turfed, having dimensions that simplify maintenance mowing; and
- where grades do not permit grass shoulders (> 5%), the shoulders and associated table drains must be stabilised with appropriate erosion control measures (e.g. jute mesh and bitumen, cross drains, erosion matting etc.) and revegetated.

(x) On subdivision work newly sealed hard stand areas must be swept thoroughly after sealing/surfacing to prevent excess aggregate or gravel entering street drains.

3.2.5 Waste Management, Material Storage and Pollution Control

(i) No construction materials, building materials, fill material, chemicals, waste, bins, skips or other, are to be stored either in the gutter, footpath or otherwise outside of the site boundary.

(ii) Petroleum and other chemical products must be prevented from entering the stormwater system or contaminating the soil.

(iii) Impervious bunds must be constructed around all fuel, oil or chemical storage areas with an enclosed volume large enough to contain 110% of the volume held in the largest tank.

(iv) Waste on site is to be stored in a manner which:

- Prevents rainwater entry.
- Has stormwater diverted around it to prevent contamination of surface waters.
- Prevents wind blown litter from escaping.

(v) Adequate trade waste and litter bins must be provided onsite and serviced regularly.

(vi) Concrete wastes or washings from concrete mixers must not be deposited in any location where those wastes or washings can flow, or can be washed into any areas of retained vegetation or receiving waters.

3.2.6 Site Rehabilitation Requirements.

(i) Vegetated ground cover is to be re-established within 30 days from any disturbance.

(ii) All ground disturbed must be progressively stabilised and rehabilitated so it no longer acts as a source of sediment.
(iii) The final rehabilitation or landscaping program is to be scheduled so that a duration of less than 20 working days will elapse from final land shaping to permanent rehabilitation.
(iv) All landscaping and rehabilitation must be completed before occupation or use of buildings or premises.
(v) Sediment fences must be left in place until vegetated ground cover is established.
(vi) Topsoil shall be used in accordance with the relevant Council DCP or Landcom Blue Book (2004).
(vii) Revegetation shall be in accordance with the relevant Council DCP or Landcom Blue Book (2004).

4.0 WHAT YOU ARE REQUIRED TO SUBMIT WITH YOUR APPLICATION – WSUD component

DA Stage – you need to submit

- Concept Stormwater Design Plan (as per section 4.1)
- MUSIC Model in electronic format (as per section 4.2.2) – exempt for any DTC solutions provided, including calculations (ie show how you have arrived at the figures submitted within the MUSIC model)
- Concept Erosion and Sediment Control Plan (as per Section 4.3)
- DTC Development Assessment Checklist (as per Appendix C DTC Solutions SEQ WBD)

CC Stage – you will need to submit

- detailed Stormwater/WSUD Design
- Stormwater Management Plan (as per Section 4.2)
- revised MUSIC model in electronic format (if changed from original DA submission) (as per Section 4.2.2), including any revised calculations (ie show how you have arrived at the figures submitted within the MUSIC model)
- Detailed Erosion and Sediment Control Plan (as per Section 4.3)
- Operations and Maintenance Plan for each device type (as per 4.4.2 below)

4.1 STORMWATER QUALITY CONCEPTUAL DESIGN PLAN (adapted from Logan City Council)

In order to demonstrate compliance with the stormwater quality load reduction objectives, a Stormwater Quality Conceptual Design Plan must be submitted. This plan must include all information requested below, submitted to the satisfaction of Council, before planning approval will be given.

STEP 1: Provide an existing site plan layout

This is to show that existing site characteristics have been integrated into the stormwater design. Information shown on the existing site plan layout must include:

- contours and overland flow paths
- boundaries and labels for each catchment and sub-catchment .

STEP 2: Describe the treatment train/s for each sub-catchment

This step is to ensure that stormwater quality ‘treatment trains’ (sequence of treatment removal devices) for the site will remove all target pollutant types effectively. To comply with the section, the proposal must provide the following:

- a clear statement of each treatment train for each sub-catchment, including treatment assets for each type of target pollutant (primary, secondary and tertiary pollutants as outlined in the table below)
- a description of the order of treatment train assets, ensuring primary pollutant assets are located at the beginning of the treatment train and tertiary pollutant assets are positioned at the end
- a description of each individual asset, including dimensions (width, height, depth, surface area), design flow and features (eg, high flow bypass size/position, vegetation height).

STEP 3: Provide a draft plan layout of stormwater treatment

Applicants are advised to submit a draft layout of stormwater treatment to Coffs Harbour City Council to ensure it meets our requirements, before undertaking further work. Information shown on the draft plan layout must include:

- a plan layout of the post-development sub-catchments and discharge points
- the on-ground position of treatment train assets (consistent with STEP 2) compared to the proposed lot layout for the development.

STEP 4: Model pollutant removal effectiveness

Please use the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) to model pollutant removal. To demonstrate that MUSIC has been used correctly, please submit the information in the form detailed in Appendix B of the SEQ MUSIC modeling guidelines along with an electronic copy of the model.

STEP 5: Demonstrate compliance with the stormwater quality pollutant load reduction objectives

Please provide a table demonstrating compliance with the Stormwater Quality Pollutant Load Reduction Objectives by comparing the developed unmitigated scenario and the developed mitigated scenario.

STEP 6: Demonstrate lot layout space allocation for treatment

To comply with this section, please provide a scale plan layout of stormwater treatment train in relation to the proposed lot layout. This is to ensure there is sufficient space allocation for each asset within the proposed lot layout. If sufficient space does not exist, then either the proposed lot layout or the proposed stormwater treatment system must be amended. If the stormwater quality treatment plan is to be amended, the applicant must re-submit the information from STEP 1 to STEP 6.

4.2 Stormwater Management Plan

A Stormwater Management Plan (SMP) is to be prepared demonstrating how relevant treatment measures and general WSUD principles specified in this Policy are to be adopted into a 'treatment train' approach to address water quality, hydrology and flooding requirements and to reduce potable water demand. Demonstration shall require modeling of the site and development using a recognized modeling tool (MUSIC). The SMP shall be prepared by a person with relevant expertise, and certified as being a practical and achievable method for satisfying the objectives and submitted with other relevant Subdivision documentation and studies.

The Stormwater Management Plan shall include stormwater quality data to certify that the development will achieve the objectives required. Report will include relevant modeling to support the treatment options selected and demonstrate how objective targets will be attained.

- Design calculations and checklists
- Conceptual design drawings

- MUSIC model (including lifecycle costing information)
- Maintenance plans
- Lifecycle costing information (from MUSIC)

Stormwater Management Plans are to provide detail on any changes to the plan as required by a staged development process.

4.2.1 Site specific issues to be addressed include:

- Site conditions – topography, soils, groundwater, vegetation, natural streams or watercourses, habitat connectivity, habitat value
- Catchment context and land capability
- Estimates of all water flows (where applicable) including –
- Potable water supply requirements
- Wastewater (black and grey water components)
- Roof water volumes
- Water quality of the receiving waters
- Water quality objectives of the receiving waters
- Water quality monitoring sites shown on site map (sites to be agreed by CHCC staff) for each development stage. Monitoring to be undertaken pre, during and post construction from the same sites – results to be recorded.
- Likely pollutants generated from the development
- Pre development modeled pollutant loads
- Vegetation Management Plan – in relation to macrophytic plants only otherwise this will overlap the usual required VMP
- Post development modeled baseline pollutant loads (without any pollution control measures)
- Pre development hydrology: runoff volumes and peaks
- Post development hydrology: runoff volumes and peaks
- WSUD treatment options selected – including design, location on site plan

4.2.2 MUSIC input parameters

Modeling requires certain input parameters for baseline data for the Coffs Harbour area. In the absence of any site specific data being available at present for the Coffs Harbour LGA, Council have adopted the South East Queensland (SEQ) Water By Design (WBD) MUSIC Modeling Guidelines (2010).

A completed MUSIC model (in electronic format) and accompanying report in format detailed in Appendix B of SEQ MUSIC Modeling Guideline is required to be submitted with the application.

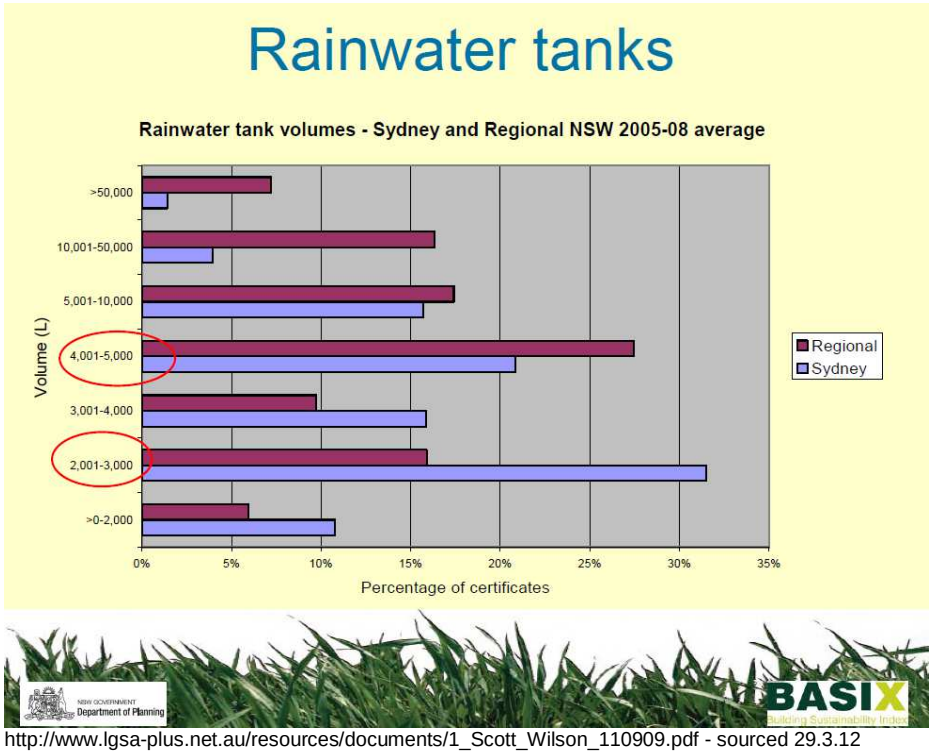
Baseline Data

The SEQ MUSIC Modeling Guide is to be used for baseline data selection for MUSIC nodes when completing modeling required to accompany the development application, in the first instance. The exception being soil storage capacity / field capacity baseline data whereby NSW Draft MUSIC Modelling Guideline is more appropriate to use.

An applicant may use other approved data such as NSW Draft MUSIC Modeling Guideline or MUSIC baseline data, but will be required to include a justification as to why the alternate data set was chosen over the SEQ MUSIC Modeling Guideline. Applicants may refer to Milford 1999 (Soil landscapes of the Coffs Harbour 1:100 000 sheet report and map DLWC) for soil properties or carry out in-situ testing to verify soil parameters on the proposed development site.

Council will consider on a case by case basis whether it is appropriate for the MUSIC model to include private lot treatments (generally this will not be accepted) and whether rainwater tanks above 4000L** will be included within the private lot modeling. The reason for this is that private lot treatments cannot be guaranteed at building stage or beyond – therefore modeling should only include public land treatments proposed and a maximum rainwater tank size per lot (ie 4000L).

** This figure was chosen based on the lower range of the average size reported within BASIX certificates and is closer to the SEQ tank sizes required



http://www.lgsa-plus.net.au/resources/documents/1_Scott_Wilson_110909.pdf - sourced 29.3.12

The SEQ MUSIC Modeling Guideline is available from the following website; http://waterbydesign.com.au/musicguide/ Or you can view the guideline in person at Council's City Services Department.

Lifecycle Analysis

Include in the model and report, the lifecycle analysis of each treatment type modeled as per MUSIC and as detailed in ** below).

** When reporting results from a life cycle costing analysis using MUSIC, the results must be accompanied by a clear statement of the chosen:

- Base date / base year for costing.
- Annual inflation rate.
- Real discount rate.
- The life cycle of the treatment device or span of analysis for the treatment train.
- Costing algorithms / estimates for all of the cost elements (e.g. whether MUSIC's default options were used or whether upper, lower or user-defined estimates were used).
- If user-defined costing estimates are used, a brief description of the origin of, and confidence associated with, these estimates should be provided.

Exfiltration

Exfiltration should be set to zero (0).

However, based on the confirmed soil types of the site (geotech report is required to verify soil types and must accompany application), Council will allow use of the lowest value within the exfiltration rate range for that soil type, as found in the MUSIC program.

Where any higher exfiltration rate is applied in the MUSIC model, the applicant will be required to provide results of geotech investigations (on the post development site conditions), that confirm the water quality assumptions within the MUSIC model are being achieved after the earthworks are completed on site.

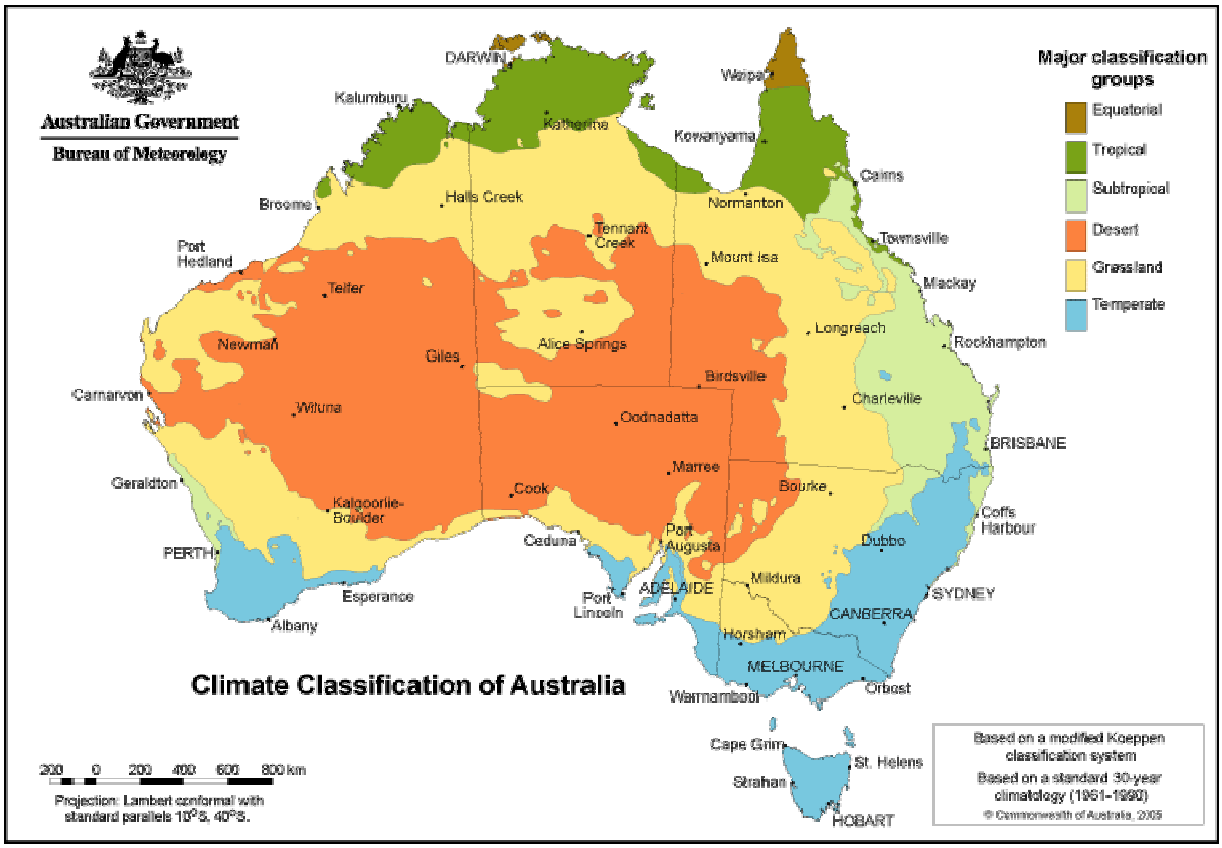
Climate Data

The Climate Data selected for use for Coffs Harbour is detailed in the Draft NSW MUSIC Modeling Guidelines (by WSUD.org) and this Climate Data must be used for modeling purposes.

This data is;

- Rainfall station – Coffs Harbour.
- Period of valid data – 1/1/1999 – 31/12/2003
- Approx mean annual rainfall volume (mm) – 1600

Figure 2: Australian climate zones - major classification groups *Product ID code : IDCJCM0001*



http://www-cluster.bom.gov.au/climate/environ/other/kpn_group.shtml December 2010

4.3 Erosion and Sediment Control Plans (ESCP) including dewatering requirements

ESC Plan is to be prepared by a person with knowledge and experience in the preparation of such plans and is to meet the requirements outlined in Chapter 2 of Landcom Blue Book (2004) and be to the satisfaction of Council. These plans are to address any staged development process clearly.

Effective erosion and sediment controls are to be installed prior to any excavation activity. The controls must prevent sediment entering drainage depressions and watercourses, and must be effectively maintained until the site has been stabilised and grass cover established. Failure to effectively maintain sedimentation controls may result in the responsible individual / corporation receiving an on-the-spot fine under the Protection of the Environment Operations Act 1997.

The following Section documents minimum performance requirements for all developments with relation to water quality management during construction. All developments shall install some degree of erosion and sediment control. Depending on the site of the development in question different requirements apply.

Table 3: Minimum Water Quality Management (During Construction) Requirements depending on the disturbed area

Area likely to be disturbed by the proposal (m2)	Minimum Requirements	Details
< 800 m^2 of disturbed area	*Basic Control Plan*	Council requires at least a hand marked up plan of proposed works and control measures. This plan must be prepared in accordance with Landcom Blue Book (2004)
800m^2 - 2,500m^2 of disturbed area	*Erosion and Sediment Control Plan (ESCP)*	This must be prepared in accordance with Landcom Blue Book (2004)
>2,500m^2 of disturbed area	*Soil and Water Management Plan (SWMP)*	This must be prepared in accordance with Landcom Blue Book (2004)

The requirements for each of these plans are detailed below.

NB SEQ guide refers to different ESC guide – applicants are to use Landcom as referenced above.

4.3.1 Basic Control Plan - <u>disturbed areas < less than 800m^2</u>

<u>For disturbed areas less than 800m^2, the minimum ESC required is</u>;

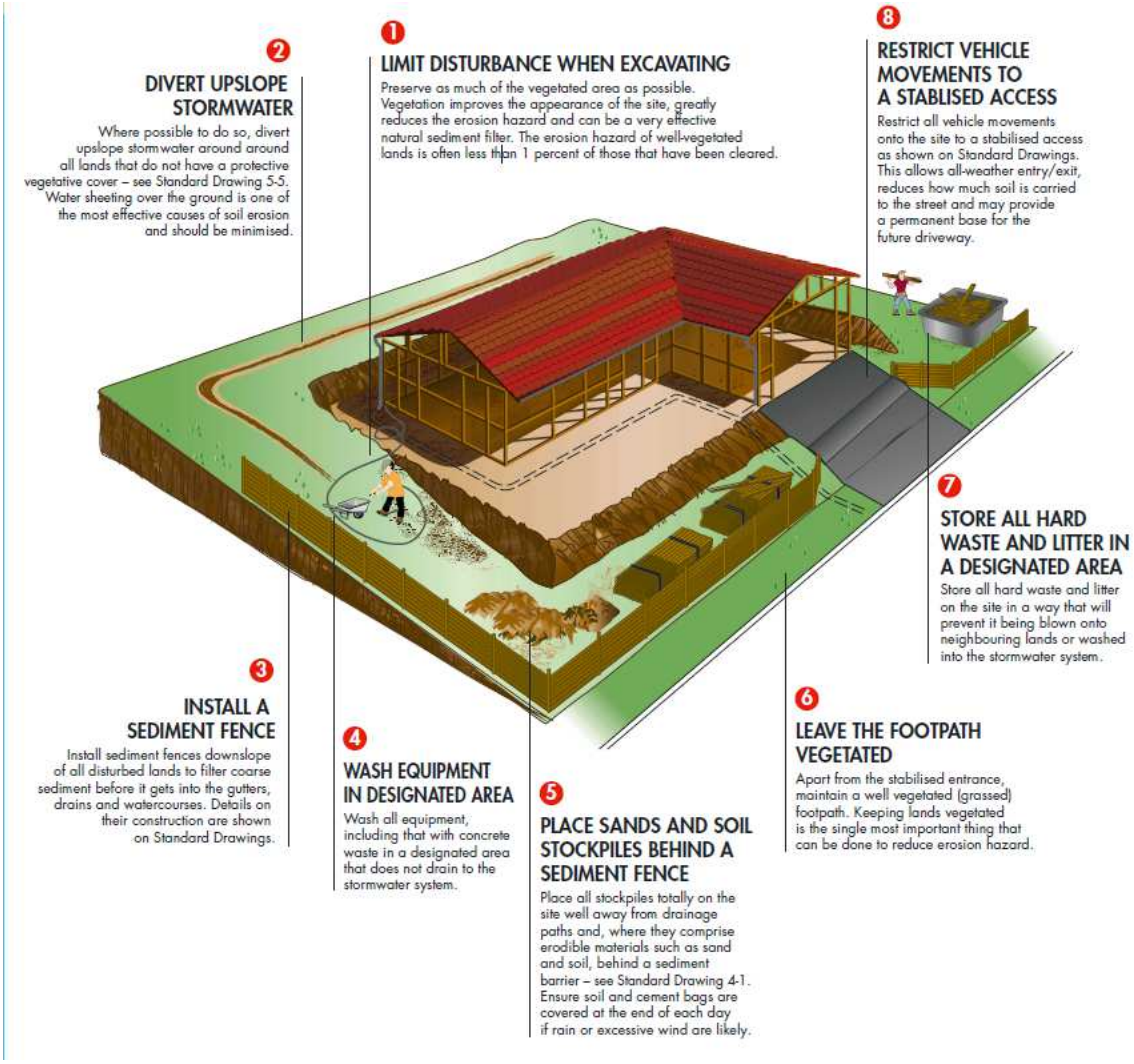
Run-off and erosion controls must be implemented to prevent soil erosion, water pollution or the discharge of loose sediment on the surrounding land by:

(a) diverting uncontaminated run-off (eg from upstream) around actual or proposed cleared or disturbed areas, and
(b) erecting a silt fence to prevent debris escaping into drainage systems and waterways, and
(c) preventing tracking of sediment by vehicles onto roads, and
(d) stockpiling top soil, excavated materials, construction and landscaping supplies and debris within the lot as per SEPP Exempt and Complying Development Codes.

This plan is to be prepared for submission with the DA. The plan may be a simple hand sketch prepared to scale.

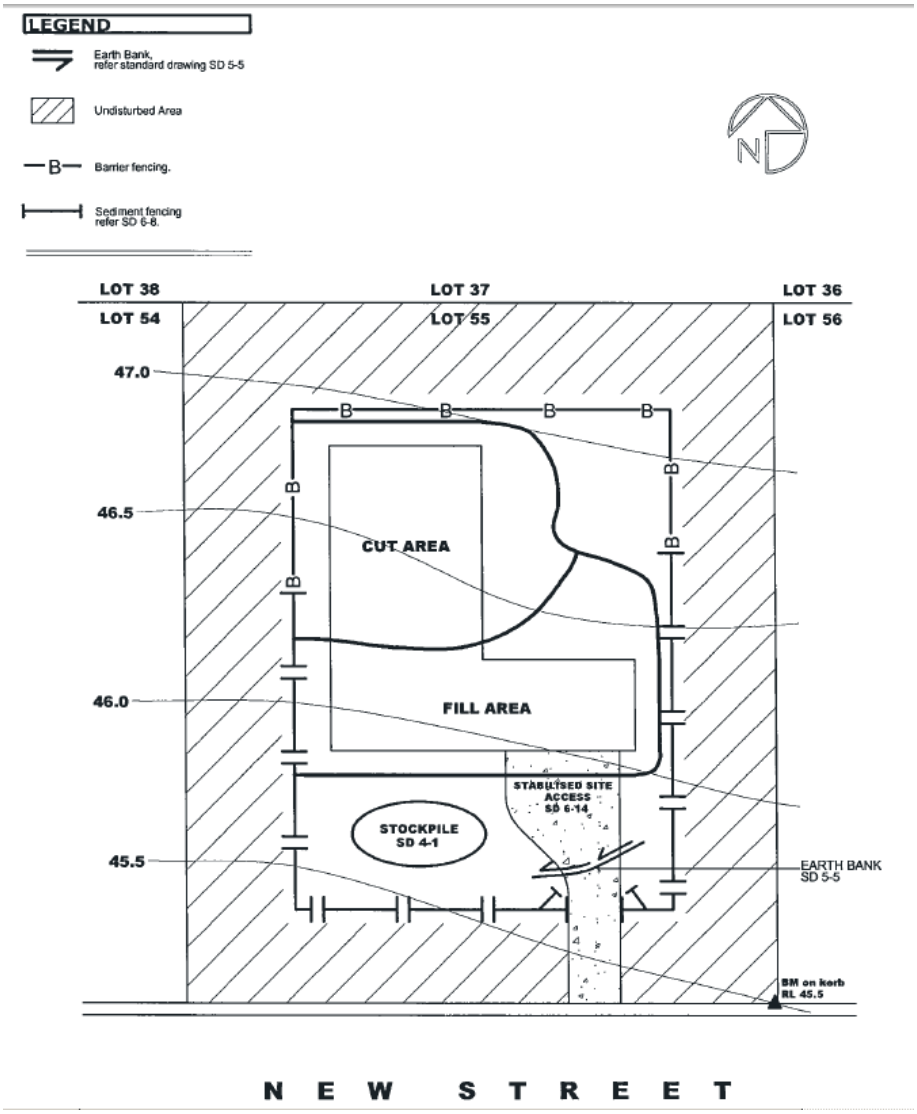
Basic erosion and sediment controls are to be in accordance with Landcom Blue Book (2004).

Figure 3: best practice site Management for small areas of disturbance



Source: LANDCOM Urban Stormwater Flyer

Figure 4: Example basic control plan for small areas of disturbance



Source: LANDCOM Urban Stormwater Flyer

4.3.2 Erosion and Sediment Control Plan (ESCP) - <u>disturbed areas 800m^2 - 2,500m^2</u>

<u>For disturbed areas between 800m^2 and 2,500m^2</u>, an ESCP must be prepared for submission and approval during the DA stage of the development. The Plan must be updated continually throughout the design development process and once a Contractor has been appointed they shall ensure that the plan is updated.

The plan must be executed in accordance with the requirements of the Landcom Blue Book (2004).

All ESCPs must show:

- Site layout;
- Approximate location of best management practices (i.e. programs, systems or structures used to mitigate or prevent pollution of receiving waters) where appropriate;
- Where drawings are to scale, show scale at 1:500 or larger;

• Narrative describing how erosion control and soil and water management will be achieved on site, including ongoing maintenance of structures;
• Location of site boundaries and adjoining roads;
• Approximate grades and indications of direction(s) of fall;
• Approximate location of trees and other vegetation, showing items for removal or retention;
• Location of site access, proposed roads and other impervious areas (e.g. parking areas and site facilities);
• Existing and proposed drainage patterns with stormwater discharge points; and
• North point and scale (if to scale).

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

• Timing of works;
• Locations of lands where a protective ground cover will, as far as is practicable, be maintained;
• Access protection measures;
• Nature and extent of earthworks, including the amount of any cut and fill;
• Where applicable, the diversion of runoff from upslope lands around the disturbed areas;
• Location of all soil and other material stockpiles including topsoil storage, protection and reuse methodology;
• Location and type of proposed erosion and sediment control measures;
• Site rehabilitation proposals, including schedules;
• Frequency and nature of any maintenance program;
• Other site-specific soil or water conservation structures.

4.3.3 Soil and Water Management Plan (SWMP) - disturbed areas > greater than 2,500m^2

For disturbed areas >2,500m^2, a SWMP must be prepared for submission at DA stage and then executed in accordance with the requirements of Landcom Blue Book (2004).

In addition to the data requirements for an ESCP (as listed above), further data requirements for the SWMP include:

• Location of lots, public open space, stormwater drainage systems, an assessment of potential public safety risk;
• Existing site contours (recommended contour interval is 0.5m on gradients of <15%, 1 metre on gradients of 15 to 30% and 2 metres for slopes >30%);
• All necessary erosion and sediment control best management practices (BMPs) (location and general diagrammatic representations);
• Location and engineering details with supporting design calculations for all necessary sediment basins. This must include soil testing to determine the type of basin required and whether flocculation will be required;
• Location and basic details of any other facilities proposed to be included as part of the development or works such as:
    - constructed wetlands
    - gross pollutant traps
    - trash racks or trash collection/separator units
    - "water sensitive" stormwater treatment measures such as bioretention systems,
    - vegetated swales and infiltration measures

• Inspection and Test Plans (ITPs) should be presented as an element of the SWMP identifying:
    - the activity to be undertaken
    - the standard or specification compliance that is being sought
    - the relevant acceptance criteria the method of inspection and/or test and the frequency at which it is to be performed
    - who is responsible for carrying out the inspection and/or test

- what documentation is to be produced as a record of the inspection and/or test

• Any "witness" or "hold points" required during the works should be identified.

The procedures for preparing the SWMPs are quite involved and guidelines are set out in Landcom Blue Book (2004). These plans must be prepared by a suitably experienced person.

Additional Notes
All materials being delivered to the site and all waste materials must be stored within the confines of the site. If you require materials or waste storage on Council road reserve or other reserve, then you will require a lease from Council prior to using the reserve.

4.3.4 Dewatering stormwater or groundwater from the construction site

Refer to CHCC DCP Component D2 Erosion and Sediment Control Requirements. Applicants are advised the NSW Office of Water should be contacted for dewatering requirements for any groundwater.

4.4 Bond, defects and liability period for WSUD treatments

Bond periods will apply to all WUSD treatments. The bond period will be determined on a case by case basis and will depend on the development proposed and size / technical complexity of treatment device proposed for example establishing a wetland may require a longer bond period, to ensure its success. However an indicative example is two (2) years, for example where WSUD treatments require vegetation to be established.

The dollar ($) amount applied to the WSUD device for the bond will be calculated from the lifecycle analysis (within MUSIC model) required to be submitted with the application.

The timing for handover of all installed WSUD treatments to Council will be determined at the DA approval stage with any bond period applied taken into account.

On handover WSUD devices must only be treating natural rainfall events – not development sediment runoff. The developer will be required to provide Council with the documents specified in Section 4.3.2, to allow Council to adequately manage the assets in the long term.

4.4.1 Operations and Maintenance Plan Requirements for established WSUD Elements

These plans are to be supplied at the end of the prescribed maintenance period for the development.

- Location and type of WSUD element (including details of it's operation and design, include plan and design drawings, access points for vehicles / machinery, schematic of the device, connections to drainage system and description of operations, full schematic and as constructed electrical diagrams for all electrical components, etc)
- Brief description of the catchments characteristics (land use, area, etc)
- Estimate pollutant types, loads and indicative sources
- Intended maintenance responsibility (ie. either Council OR Property Owner)
- Inspection method, estimated frequency and data collection requirements required to assess performance of system, stakeholder notification requirements when undertaking maintenance
- Adopted design cleaning / maintenance frequency
- Dewatering and waste disposal procedures – including names and locations of licensed operators able to transport and accept the waste

- Estimated life-cycle costs, including; estimate costs for maintenance incorporating the likely frequency of cleanout, type of cleanout, costs for transport, vehicle hire, disposal and consumables, replacement cost for the asset
- Site access details (confirmation of legal access, access limitations)
- Description of optimum cleaning method and alternatives (including equipment and personnel requirements)
- Landscape and weed control requirements (including time frame)
- Work method statement for operation and maintenance of the device including mechanisms required to clean device (eg manual removal, backhoe, eductor truck etc)
- Maintenance and inspection report forms which clearly indicate data collection requirements
- Supplier contact for parts, services and/or technical advice
- Consumables required for maintenance of the device
- Any other information necessary for the management, operation and maintenance of the device.

Where a development is staged, the proponent is to provide operations and maintenance plans with projected maintenance costs for each development stage, provided the second stage development does not use the Stage 1 WSUD facilities for water quality treatment.

4.5 Deemed to Comply (DTC) Solutions

Submit details of application in format shown in Appendix C Reporting Tables of SEQ Deemed to Comply Solutions – Stormwater Quality Management Part 1 (available to view at CHCC City Services Office).

The applicant will need to be mindful of any changes required to parameters, such as may be the case for BASIX and shall detail these changes clearly within the application.

5.0 RETROFITTING WSUD TREATMENTS ONTO PUBLIC LAND

Retrofitting areas of public land with WSUD treatments will be considered whenever Council are undertaking works on drainage or upgrades to public areas including open space. Retrofitting may involve installation of water tanks or other water collection devices or altering existing drainage infrastructure to become more water sensitive, for example, if pipes need to be replaced it may be more appropriate and cost effective to install water sensitive treatments in an open space environment that complement the area and still provide the stormwater conveyance required from the site.

Retrofitting is to be considered at the planning and design phase, with costing and consultation carried out prior to final decision being made in relation to any public area.

6.0 WSUD TREATMENTS

6.1 Overview of WSUD Treatments

Applicants should refer to the SEQ Technical Design Guidelines, Concept Design Guide and Construction and Establishment Design Guides for WSUD technical specifications in designing treatment types.

Differences between on-site stormwater retention, detention and infiltration

Retention involves retaining or holding stormwater for extended periods, and not directly discharging it to water courses. These systems remove stormwater pollutants and reduce

stormwater volumes and peak flows by retaining stormwater, and in some cases infiltrating stormwater into the soil. Many of these systems allow for use or application of the harvested water (eg, for gardening, irrigation, toilet flushing, washing). Examples include retention basins, rainwater tanks, gutter storage systems and infiltration systems.

Detention is a method of reducing stormwater volumes and peak flows by storing stormwater for a period of time and reducing the flow rate. Underground tanks, ponds or depressions within landscaped or paved areas are the most common systems in use.

Infiltration systems encourage water to continue in the hydrological cycle via infiltration, percolation and evapotranspiration. They reduce stormwater volumes and peak flows by infiltrating stormwater into the soil. Infiltrations systems consist of a below ground trench, which may incorporate a filtration material (ie. gravel or sand) but primarily provides opportunity for water to infiltrate into the sub-soil.

6.1.1 WSUD Street Layout and Streetscape

WSUD Street Layout is the application of:

- protection of creeklines
- provision of buffers to creeklines
- provision of perimeter roads, separating urban areas from protected areas.

It promotes design that prioritises environmental outcomes. Open space areas are provided along natural drainage lines, and minimises road crossings over drainage lines. Crossings are to be designed to maintain the watercourse and fauna link, and may include opportunity for pedestrian link beneath the roadway.

WSUD streetscape integrated road layout, vehicular and pedestrian requirements with minor stormwater drainage systems. It incorporates a number of principles, and brings together, in an integrated manner, a number of WSUD facilities.

The principles of WSUD Streetscape include:

- Minimise disturbance to landform, natural watercourses and native vegetation.
- Incorporate stormwater source and conveyance controls to minimise stormwater runoff peaks and volumes.
- Streets and minor drainage design incorporate a variety of features, as appropriate, including landscaping, swales, infiltration pits, porous paving, etc.
- Minimises kerb, gutter and pipe networks for minor drainage systems.

6.1.2 Stormwater re-use

Stormwater, other than roof water, can be captured and stored for outdoor irrigation and other low quality purposes, to reduce pollutant loads and peak flow discharges from a site. The likely application for stormwater re-use is for multi-dwelling developments, commercial or industrial developments where there are extensive paved areas for driveways and car parks. Public art and open space stormwater re-use is also an option. Source: http://www.wsud.org/Pic_Pages/public_art.htm


Roma Street Gardens, Brisbane


Sydney Olympic Park


Kogarah Town Square, Sydney

Other WSUD facilities that may be considered

6.1.3 Cluster Style Housing

On difficult sites (slope, poor soils, etc), water quality targets may only be achieved through clustering of buildings, which limits site disturbance and road and driveway lengths while maximising on-site landscaping and space available for WSUD facilities.

6.1.4 Dwelling Type

The modern "slab on ground" dwelling house requires the entire building footprint to be on compacted soil beneath it. Pole houses enable the soil beneath the house retain a more natural function.

6.1.5 Better Backyards

The landscape design and plant selection of backyards can make a significant difference to the impact of stormwater flowing from the site. The ability to avoid application fertilisers will reduce phosphorous and nitrogen loads. Limiting hard surface areas, installation of rain gardens, management and maintenance of on-site infiltration, retention systems or filter strips, and other active measures by the house owner will have significant benefits for the catchment if undertaken by a significant proportion of owners.

6.1.6 WSUD treatments – what we do and don't want

The accepted treatment train order is as follows – primary, secondary and tertiary where required.

Table 4: Treatment train

Primary Treatment Options - screening of gross pollutants	**Secondary Treatment Options** – sedimentation of coarse to medium sediment	**Tertiary Treatment Options** – enhanced sedimentation of fine particulates; adhesion and filtration of very fine/colloidal sediment; biological uptake of dissolved particles
		Above adapted from Logan City Council
On-site detention Sediment traps Kerb inlet detectors (not in residential areas) Catch basins (modified wet sumps) Side entry traps/pit inserts GPT's Litter baskets Oil and grit separators	Vegetated filter strips Grass swales Sand filters – small scale and large scale Filtration/ bioretention basin Porous pavements Detention basins (Wet ponds) Infiltration trench Extended dry basins	Constructed wetlands (with pre-treatment)

In the following list are the treatment types preferred or discouraged by Council.

The preferred treatment types are those that provide long term benefit to the community in terms of maintenance costs being manageable, thus not imposing added pressure on an already restricted community budget, as well as environmental benefits in achieving the water quality targets required

for the Coffs LGA. Preferred treatment systems are to be within public land. Where treatment systems occur on private land they will be assessed on their merit (but are not to be included within MUSIC water quality modeling) and Council may require protection of the systems by an appropriate Section 88E instrument and positive public covenant.

Refer to Section 4.2.2 for information relating to the MUSIC modeling of private treatment options.

- Sediment basins – toward end of catchment, used during construction phase to capture sediment and for conversion to long term bioretention post-construction.
- Biorentention basins
- Infiltration, such as under grassed swales (use of pebble or rock infiltration systems accepted on privately managed lands - due to maintenance issues)
- Nature strip WSUD if Council asset
- Median strip WSUD – ONLY on privately managed lands, Council will be unlikely to accept these assets if they are intended to become a publicly managed asset (due to safety and maintenance issues)
- Constructed wetlands – per catchment
- Sand filters in open space/playing fields/etc – not in road reserves
- Porous paving – within lot, footpaths and reserves where soil properties allow for effective use of this treatment. NB not all soil types/sites in the Coffs area will be suited to this treatment type

All systems proposed will be assessed on their merit, justification for use of any systems not preferred by Council, will be required with the application, and may not be accepted by Council.

For the preferred designs, applicants are encouraged to use the South East Queensland series of guidelines and resources available from Water by Design http://www.waterbydesign.com.au/TechGuide.

7.0 DEFINITIONS

At-grade Crossing	A vehicle driveway that follows the cross-section profile of a grassed swale
Average Recurrence Interval (ARI)	The average or expected value of the period between exceedances of a given rainfall intensity or discharge
Batter	Side slope of a swale or basin
Biofilm	A thin layer of micro-organisms on the surface of vegetation, soils and rocks that are kept constantly wet
Biofiltration Trench	An elongated bioretention system typically installed as part of a bioretention swale
Biological Uptake	The transfer of a substance (typically nutrients) from stormwater to a living organism such as plants or biofilms
Bioretention Basin	A system that collects and infiltrates urban stormwater through a prescribed filter media covered with vegetation to reduce the concentration of stormwater pollutants
Brownfield development	Development of an already developed site eg the site of a petrol station, a paved parking lot or the site of a demolished building
Filter Media	The prescribed soil in a bioretention or sand filter system through which captured stormwater passes and receives treatment via filtration and/or adsorption and biological uptake of pollutants
Bioretention Swale	A vegetated swale with sub-surface filter media and under-drains to convey, infiltrate and treat stormwater runoff
Buffer Strip	A vegetated area separating an impervious surface and a stormwater quality improvement device (typically swales and bioretention systems) designed to capture coarse sediment from sheet inflow
Check Dam	A small weir (typically rock) placed across the invert of a steep swale (>4%) at regular intervals to reduce flow velocity.
Constructed Wetland	A wetland constructed to mimic a natural system and provide treatment to urban stormwater.
Development of land	Subdivision, commercial, industrial, tourist, public building, change of use and residential – as prescribed by Guideline.
Greenfield development	Development of previously undeveloped land eg in a city or rural area, either currently used for agriculture, landscape design, or just left to nature
Groundwater	Sub-surface water in the soil or rock structure
Hydraulic Conductivity	The rate at which water can move through a permeable medium
Impervious	An impermeable surface where the majority of rainfall becomes runoff by limiting the infiltration of water into the underlying soils.
Infiltration	The movement of water from the ground surface into the underlying soil profile
Inlet Zone	The first cell in a constructed wetland designed to function as a sedimentation basin where coarse to medium sized sediment (> 125 µm) is removed prior to flow entering the macrophyte zone. The inlet zone also attenuates peak flows into a constructed wetland
Leaky Well	A device installed below ground (similar to a manhole) designed to capture stormwater runoff and promote infiltration into the surrounding soils via perforated walls and base
Notional Detention Time	The nominated time for the detention of stormwater in a stormwater treatment device
Planters	Small areas within the urban landscape (such as traffic islands and medians) where shrubs and trees can be grown and stormwater treatment measures can be incorporated.
Porosity	The ratio of the volume of soil/rock voids to the total volume of soil/rock.
Rock Pitching	A rock stabilised area at a piped outlet or overflow weir to prevent scour and erosion
Rock Weir	A weir created by piling natural or quarried rock to a designed level to create an energy dissipating weir
Sand Filter	A device in which stormwater is collected and filtered through a prescribed sand filter media to remove medium to fine sediment.
Sedimentation Basin	A stormwater treatment device designed to remove coarse to medium sized sediments (>125µm) by settling them from the water column under quiescent flow conditions.

Soak-away	A sub-surface infiltration device with a large plan area and shallow depth designed to capture and infiltrate stormwater runoff.
Stream order	Refer to NSW Fisheries for advice, generally Strahler (1952) method is used in NSW
Subdivision	the division of land into two or more parts that, after the division, would be obviously adapted for separate occupation, use or disposition. (EP and A Act 1979 Sect 4B)
Swale	A vegetated open channel designed to intercept and convey surface stormwater runoff, promote infiltration, interception of sediment by the vegetation, and provide a landscape feature in urban areas.
Treatment Train	A series of stormwater treatment measures located in a catchment to provide a staged approach to removal of stormwater pollutants from runoff.
Under-drain	A perforated sub-surface pipe which collects runoff that has infiltrated through soil or filter media and conveys it to an outlet point
Urban Water Cycle Management	A holistic approach to the management of urban water by considering natural hydrological and ecological processes carefully in an attempt to reduce the impact of urbanisation.

Adapted from Brisbane City Council DRAFT Water Sensitive Urban Design Engineering Guidelines: Stormwater, August 2005

8.0 EQUIVALENT NSW GOVERNMENT REFERENCES FROM SEQ GUIDES

Table 5: SEQ and NSW WSUD references

SEQ	NSW
Best practice erosion and sediment control (IECA 2008) Manual for erosion and sediment control (Maroochy Shire Council 2007)	LANDCOM Blue book
Qld Development Code MP 4.1, 4.2 and 4.3	SEPP BASIX (www.basix.nsw.gov.au)
South East Queensland Regional Plan Implementation Guideline no. 7 Water Sensitive Urban Design – pollutant load parameters	DECC Managing Urban Stormwater: Environmental Targets
Sustainable Planning Act Qld	
Best practice environmental management guidelines – urban stormwater DERM 2009	
MUSIC Modeling Guidelines	NSW DRAFT MUSIC Modeling Guidelines BMT WBM August 2010 (www.wsud.org)
Any Federal Government or Australia wide references remain useable, applicant to provide explanation for use with application.	
Any published conference papers or alternate State Agency references where there is no NSW equivalent remain useable, applicant to provide explanation for use with application.	

9.0 WHERE TO GO FOR FURTHER INFORMATION AND TECHNICAL GUIDANCE

Healthy Waterways – Water By Design Southeast Queensland
http://www.waterbydesign.com.au/TechGuide

Water Sensitive Urban Design in the Sydney Region
http://www.wsud.org/

Landcom
Landcom WSUD Policy http://www.landcom.com.au/content/publication-and-programs/water-sensitive-urban-design.aspx

Melbourne Water

http://wsud.melbournewater.com.au/ and http://www.waterrecycling.net.au/

Australian Runoff Quality
http://www.arq.org.au/

NSW Stormwater Trust
http://www.epa.nsw.gov.au/stormwater/usp/index.htm

Brisbane City Council WSUD Engineering Guidelines: Stormwater
http://www.brisbane.qld.gov.au/BCC:BASE:263615123:pc=PC_1898

Australian Water Association
http://www.awa.asn.au/

National Water Quality Management Strategy
http://www.deh.gov.au/water/quality/index.html

Stormwater Industry Association
http://www.stormwater.asn.au

DECC Managing Urban Stormwater – Soils and Construction (Vol. 2A Installation of Services)
http://www.environment.nsw.gov.au/resources/stormwater/0801soilsconststorm2a.pdf

DECCW Managing Urban Stormwater: Council Handbook provides guidance to councils and other stormwater managers on preparing stormwater management plans. A draft version of this document was prepared in 1998 and is expected to be finalised in late 2002. The draft contains useful information for stormwater managers.

DECCW Managing Urban Stormwater: Treatment Techniques describes non-proprietary stormwater treatment techniques. A draft version of this document was prepared in 1997and is expected to be finalised in late 2002. The draft contains useful information for stormwater managers.

NSW Draft MUSIC Modelling Guidelines go to WSUD.org web page http://www.wsud.org/tools-resources/
PDF document found here http://www.wsud.org/wp-content/uploads/2010/09/Draft-MUSIC-Modelling-Guidelines-31-08-201011.pdf

10.0 REFERENCES

- Australian Greenhouse Office and Department of Environment and Water Resources (2007) Climate Change Adaptation Actions for Local Government
- BASIX requirements
- BMT WBM Pty Ltd and Sydney Metropolitan Catchment Management Authority (2010) Draft NSW MUSIC Modelling Guidelines
- Brisbane City Council (2005) DRAFT Water Sensitive Urban Design Engineering Guidelines: Stormwater
- Central West Councils Salinity & Water Quality Alliance (2010) S_2S – Stormwater to Smartwater A Water Sensitive Design Plan for adoption into a Development Control Plan
- Central West Councils Salinity & Water Quality Alliance (2010) Stormwater to Smartwater S2S – Supporting Technical Guidelines
- Clarence Valley Council (2004) Sustainable Water Information for Applicants Final version 2
- Coffs Harbour City Council (1997) Erosion and Sediment Control Policy and Procedures
- Coffs Harbour City Council (2000) Urban Stormwater Management Plan
- Coffs Harbour City Council, Council Report (December) 2008 Climate Change Impacts for Coffs Harbour
- Coffs Harbour City Council (2008) State of Environment - Supplementary Report
- CSIRO (2007) Climate Change in the Northern Rivers Catchment
- Department of Environment and Climate Change (DECC) in association with the Sydney Metropolitan Catchment Management Authority (CMA) (Consultation Draft - October 2007) *Managing urban stormwater: an integrated approach*
- Department of Environment and Climate Change (DECC) in association with the Sydney Metropolitan Catchment Management Authority (CMA) (Consultation Draft - October 2007) *Managing urban stormwater: Urban design*
- Department of Environment and Climate Change (DECC) in association with the Sydney Metropolitan Catchment Management Authority (CMA) (Consultation Draft - October 2007) *Managing urban stormwater: Treatment techniques*
- Department of Environment and Climate Change (DECC) in association with the Sydney Metropolitan Catchment Management Authority (CMA) (Consultation Draft - October 2007) *Managing urban stormwater: environmental targets*
- Department of Environment Climate Change and Water, June 2010, NSW Climate Impact Profile - The impacts of climate change on the biophysical environment of New South Wales DECCW 2010/171 ISBN 978 1 74232 259 9
- Gold Coast City Council (2006) MUSIC Modeling Guidelines
- John Wilson and Partners Pty Ltd (2006) Coffs Harbour Water Integrated Water Cycle Management Concept Study
- Landcom (2004), Managing Urban Stormwater – Soils and Construction Vol 1, 4th Edition March 2004 ISBN 0-9752030-3-7
- Landcom (2009) WSUD Book 1 POLICY
- Local Government Association of Queensland Inc. (2007) Adapting to Climate Change – A Queensland Local Government Guide
- Logan City Council – Stormwater Quality Conceptual Design Guidelines (accessed 9/12/10 http://www.logan.qld.gov.au/LCC/logan/environment/waterways/stormwater/designguidelines.htm)
- Office of Urban Management (2009) South East Queensland Regional Plan (2005-2026) (Final Draft) Implementation Guideline No. 7: Water Sensitive Urban Design: Design Objectives for Urban Stormwater Management (Table 2)
- Richmond Valley Council (2005) Development Control Plan No. 9 Water Sensitive Urban Design
- The SUDS Manual, CIRIA C697, London 2007 (http://www.orkneywind.co.uk/advice/SEPA%20Pollution%20Advice/ciria%20c697.pdf?PHPSESSID=q1j1t79tm13f5863bi3ldb5la0)
- Tony H F Wong (nd) Planning and design of stormwater management measures – Chapter 4 Developing stormwater management strategies

- Upper Parramatta River Catchment Trust (2004) Water Sensitive Urban Design Technical Guidelines for Western Sydney
- http://wsud.melbournewater.com.au/content/wsud_key_principles/wsud_key_principles.asp sourced 27th February 2009
- South East Queensland Healthy Waterways Strategy 2007-2012 Final Document Water Sensitive Urban Design Action Plan Prepared by South East Queensland Healthy Waterways Partnership December 2007 Accessed 17.12.10 http://www.healthywaterways.org/TheStrategy/ActionPlanLinks.aspx
- Standards Australia AS 4970 (2009) Protection of trees on development sites, Sydney
- WBM BMT Coffs Harbour City Council (2010) Climate Change Mitigation and Adaptation Action Plan, R.N1717.003.01 Adaptation Action Plan.docx, Final Report July 2010