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WATER CYCLE MANAGEMENT GUIDELINES

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1 INTRODUCTION

The Water Cycle Management Guidelines describe the most common design elements that make up Water Sensitive Urban Design (WSUD) and Water Cycle Management (WCM). This guide provides explanations of the elements as well as directions to the appropriate best practice design documentation.

WSUD & WCM allows the designer to reduce, and in some instances remove, conventional pit & pipe drainage infrastructure to provide a more natural drainage system that greatly enhances water quality, reduces water run-off and flooding, enhances the natural & built environment as well as reduce potable water use.

DCP165 - Water Cycle Management, in conjunction with these associated guidelines, seeks to minimise the impact of development on the natural water cycle thus leading to more sustainable outcomes that will protect the environment.

These Guidelines provide numerical outcomes with regard to some specific controls, however for all other areas this document provides guidance to the designer on publications, methodologies and information on how to undertake the design of developments with regard to Water Cycle Management and meeting Council's requirements.

2 STORMWATER MANAGEMENT PLAN

A Stormwater Management Plan (SMP) details the measures to be undertaken within the development site to address issues of stormwater run-off from the site (roof & surface water), and includes site discharge and water quality. A SMP shall be provided where required by Council in conjunction with a proposed development.

The SMP will consist of plans and a written report detailing the stormwater measures to be implemented on the site. Each development type will have different stormwater management requirements, as listed in DCP 165, and the SMP will incorporate one or more of the following elements.

2.1 Reduced Stormwater Discharge

Development causes change in the infiltration rate due to soil compaction and particularly the creation of impervious surface, such as roofs and paving. The effective impervious area can be reduced by retention and detention measures.

In order to provide appropriate stormwater management the volume, peak discharge rates and frequency of stormwater discharging from a site must be reduced. Reduction in site discharge can be achieved through the use of On-site Retention (mandatory for all developments) and On-site Detention (applies only as specified below).

Retention

Stormwater retention is the collection and retention of surface stormwater on a site for the purpose of emulating, as best as possible, site infiltration that would otherwise occur should no development exist.

Full details in Section 12

Onsite Stormwater Detention Requirements

The retention volumes provided by rainwater and stormwater tanks generally only provide flood relief functions for minor rainfall events. Therefore additional discharge control is required in the form of On-site Detention systems for less frequent major storm events that have the potential to cause greater damage to the environment and infrastructure.

Full details in Section 13

2.2 Quality of Stormwater Discharge

Stormwater leaving the development site must not pollute receiving waters, specified in terms of pollutant concentration, event mean concentration or load over a specified time period. As such, Stormwater from roof and hard surface areas of the proposed development must be treated to remove nutrients, gross pollutants, suspended solids, hydrocarbons and other pollutants prior to leaving the site. In some instances Water Quality & Discharge Control may be achieved in the same component, particularly where pollution loads rather than concentrations are the focus for protecting downstream waterways such as wetlands or shallow estuarine lakes that accumulate pollutants.

Full details in Section 10

2.3 Natural Water Courses & Drainage Channels

Where a natural watercourse or drainage channel traverses or adjoins the site, Water Sensitive Urban Design Solutions shall be implemented in addressing the constraint.

Full details in Section 15

2.4 Additional Requirements

Flooding

Where the subject site is flood affected or the proposed development may have an effect upon flooding, the applicant is to ensure the proposed development is acceptable with regard to Council's Flooding & Drainage related Policies.

Full details in Section 19

Reduced Impervious Areas

Pervious area(s) must be made available for stormwater infiltration thus reducing the impacts of stormwater from impervious areas.

Full details in Section 18

Alternative Water

In response to future recycled and grey water initiatives in the Gosford LGA and the development of treatment technologies, each new development shall provide separate (dual - including toilet, laundry & outdoor) plumbing and drainage to allow for retrofit of recycled reticulated water or onsite greywater systems.

Where a development has existing internal connections to a rainwater tank additional dual plumbing is not required.

Development within the Gosford CBD will be required to provide dual pipe plumbing through-out.

Full details in Section 17

Maintenance

Maintenance of water quality and water sensitive urban design features is important in ensuring the continued life and effectiveness of each element within the treatment train.

Full details in Section 16

Point(s) of Discharge

The SMP shall be clearly labelled and marked, indicating where the site stormwater will discharge from the site. This may be to Council drainage such as Kerb & Gutter or open drain or to a private Interallotment drainage line and easement etc, easements shall be clearly marked and evidence provided showing that the easement is in existence. Where a new easement is proposed the plans shall clearly identify the location of the new easement and shall be endorsed by the property owner(s) burdened by the proposed easement. Where existing site grading prevents outflow from the site the plan will identify how and where the stormwater shall be retained and discharged on the site.

3 WATER CYCLE MANAGEMENT PLAN - BUILDING

A Water Cycle Management Plan (WCMP) - Building, details the measures to be undertaken within the development site to address the issues of reducing stormwater run-off from the site (roof and surface water) including site discharge and water quality, and reducing potable water use.

The WCMP will consist of a written report and plans detailing stormwater quality and quantity measures to be implemented on the site as well as the potable water saving measures to be included with the development.

The WCMP must address the following criteria:

3.1 Reduced Potable Water Demand

a. Standard water saving devices

To reduce demand on potable water all internal water fittings shall meet the following standards;

- water saving shower heads - WELS 3 star rating or higher
- dual flush toilets 6/3 or 4/3 and waterless/water efficient urinals or urinal equipment - WELS 3 star rating or higher
- tap aerators or tap equipment of WELS 3 star rating or higher
- clothes washing machines and dishwashers where provided shall achieve a WELS 3 star rating or higher
- Any proposed WELS device shall be rated 3 Star or better

b. Non-Standard water saving devices

In the case where any water using device not specified as a standard (above) is included as part of the development, a specific non-standard WCMP is required. The purpose of the non-standard WCMP is to ensure that water efficient alternatives are identified and implemented. The non standard section of the WCMP shall also be prepared in accordance with best practice water management.

c. Potable Water Substitution

Water uses that do not require potable water quality must have substitution from water supplies other than town water available in the form of either:

- Rainwater tanks
- Stormwater Retention tanks
- On-site Greywater Reuse system
- Other sources

Each development is required to provide a minimum volume of retained/alternate water on site.

Minimum site storage volumes of alternate water are provided in Appendix A

3.2 Onsite Stormwater Detention Requirements

The retention volumes provided by rainwater and stormwater tanks only provide flood relief functions for minor rainfall events. Therefore additional discharge control is required in the form of an On-site Detention system for the less frequent storm events that have the potential to cause greater damage to the environment and infrastructure.

Full details in Section 13

3.3 Quality of Stormwater Discharge

Stormwater leaving the development site must not pollute receiving waters. As such, Stormwater from roof and hard surface areas of the proposed development must be treated to remove nutrients, gross pollutants, suspended solids, and hydrocarbons prior to leaving the site. In some instances Water Quality & Discharge Control may be achieved in the same component.

Full details in Section 10

3.4 Natural Water Courses & Drainage Channels

Where a natural water course or drainage channel traverses or adjoins the site, Water Sensitive Urban Design Solutions shall be implemented in addressing the constraint.

Full details in Section 15

3.5 Additional Requirements

Flooding

Where the subject site is flood affected or the proposed development may have an effect upon flooding, the applicant it to ensure the proposed development is acceptable with regard to Council's Flooding & Drainage related Policies.

Full details in Section 19

Reduced Impervious Areas.

Pervious area(s) must be made available for stormwater infiltration thus reducing the impacts of stormwater from impervious areas.

Full details in Section 18

Alternative Water

In response to future recycled and grey water initiatives in the Gosford LGA and the development of treatment technologies, each new development shall provide separate (dual - including toilet, laundry & outdoor) plumbing and drainage to allow for retrofit of recycled reticulated water or onsite greywater systems.

Where a development has existing internal connections to a rainwater tank additional dual plumbing is not required.

Development within the Gosford CBD will be required to provide dual pipe plumbing though out.

Full details in Section 17

Maintenance

Maintenance of water quality and water sensitive urban design features is important in ensuring the continued life and effectiveness of each element within the treatment train.

Full details in Section 16

Point(s) of Discharge

The WCMP *shall* be clearly labelled and marked, indicating where the site stormwater will discharge from the site. This may be to Council drainage such as Kerb & Gutter or open drain or to a private Interallotment drainage line and easement etc, easements shall be clearly marked and evidence provided showing that the easement is in existence. Where a new easement is proposed the plans shall clearly identify the location of the new easement and shall be endorsed by the property owner(s) burdened by the proposed easement.

Chemical Spills

Where chemicals will be used on the site the WCMP shall identify any areas where chemicals shall be stored and address the potential for a chemical spill and detail the systems in place to ensure any spill will not enter the stormwater system.

4 WATER CYCLE MANAGEMENT PLAN - SUBDIVISION

A Water Cycle Management Plan (WCMP) - Subdivision is required for any subdivision of land as Identified under Section 15 or 16 of DCP 165. *Note, a Comprehensive Water Cycle Management Plan can still be undertaken for smaller subdivisions, in accordance with Section 6 of these guidelines should you wish.*

A WCMP details the measures to be undertaken within the development site to address the issues of reducing stormwater run-off from the site (roof and surface water) including site discharge and water quality and reducing potable water use.

The WCMP will consist of a written report and plans detailing stormwater quality and quantity measures to be implemented on the site as well as any potable water saving measures to be included with the subdivision.

The WCM Plan must address the following criteria:

4.1 Existing Environment Conditions

A summary of the current condition of the land and its surroundings, with particular reference to the following issues:

a. natural water courses and/or drainage channels

b. soil conditions

c. flooding

d. water quality conditions

e. existing drainage infrastructure

4.2 Design & Outcomes

The design and outcomes will address issues arising from the above assessment. The design of the subdivision will implement Water Sensitive Urban Design Principles in road/site access, lot and drainage design. The following matters should be addressed:

a. flooding - where applicable

b. OSD

c. WSUD solutions should be proposed where possible to address OSD and drainage design.

d. stream flow, environmental flow, erosion, water-dependent ecosystems such as streams, riparian zones, wetlands and estuaries where natural watercourses are within or in proximity to the site, or are to be created.

e. a minimum area of each lot must be made available for soft landscaping or turfed areas for stormwater management and water quality purposes. The area required shall be as per Table 2 in Section 18.

   this area shall be included on the Title of each lot through the use of Positive Covenant and Restriction-as-to-User or defined areas on the plan of subdivision.

f. water quality both at lot scale and site scale

4.3 Exceptions for Rural Subdivisions

a. OSD - shall not be required subject to compliance with the following:

   i. Stormwater quality is in accordance with Section 10, including prevention of erosion.

   ii. All runoff from buildings, access roads, tracks, and paved areas is to be discharged into absorption trenches or onto heavily vegetated areas so as to prevent an increase in runoff rate into streams/drainage systems. WSUD solutions should be proposed where possible to address drainage design.

   iii. All runoff is to be controlled to ensure it causes no nuisance or concentration of flow to watercourses or neighbouring properties.

Full details in Section 13

4.4 Maintenance

Maintenance of water quality and Water Sensitive Urban Design features is important in ensuring the continued life and effectiveness of each element within the treatment train.

Full details in Section 16

5 COMPREHENSIVE WATER CYCLE MANAGEMENT PLAN - BUILDING

A Comprehensive Water Cycle Management Plan (CWCMP) - Building, is a site study that incorporates all areas of the water cycle including rainwater, stormwater, ground water (infiltration), potable water and wastewater. A CWCMP aims to provide the best possible water management through industry best practice or innovative practices.

A full Water Balance analysis shall be undertaken for the site and the proposed water consuming process(es) and will detail the measures to be undertaken within the development site to address the issues of reducing potable water use, reducing stormwater run-off from the site (roof and surface water) including site discharge and water quality and minimising wastewater.

The CWCMP will consist of a written report and plans detailing the results of the water balance analysis, predicted water use under base line conditions and detail the water saving measures demonstrating industry best practice and stormwater measures to be implemented on the site and must address the following criteria:

5.1 Reduced Potable Water Demand

a. Standard water saving devices

To reduce demand on potable water all internal water fittings shall meet the following standards;

- water saving shower heads - WELS 3 star rating higher
- dual flush toilets 6/3 or 4/3 and waterless/water efficient urinals or urinal equipment - WELS 3 star rating or higher
- tap aerators or tap equipment of WELS 3 star rating or higher
- clothes washing machines and dishwashers where provided shall achieve a WELS 3 star rating or higher
- any proposed WELS device shall be three star or better

b. Non-Standard water saving devices

In the case where any water using device not specified as a standard (above) is included as part of the development, a specific non-standard CWCMP is required. The purpose of the non-standard CWCMP is to ensure that water efficient alternatives are identified and implemented. The non-standard section of the CWCMP shall also be prepared in accordance with best practice water management.

c. Potable Water Substitution and Internal Recycling

Water uses that do not require potable water quality must have substitution from water supplies other than town water available in the form of either:

- Rainwater tanks
- Stormwater Retention tanks
- On-site Greywater Reuse system
- Internally Sourced Recycled Industrial Water

- Other sources

Each development is required to provide a minimum volume of retained/alternate water on site.

Minimum site storage volumes of alternate water are provided in Appendix A

5.2 Onsite Stormwater Detention Requirements

The retention volumes provided by the roofwater and stormwater retention tanks only provide flood relief functions for minor rainfall events. Therefore additional discharge control is required in the form of an On-Site Stormwater Detention system for the less frequent storm events that have the potential to cause greater damage to infrastructure and the environment.

Full details in Section 13

5.3 Quality of Stormwater Discharge

Stormwater leaving the development site must not pollute receiving waters. As such, Stormwater from roof and hard surface areas of the proposed development must be treated to remove nutrients, gross pollutants, suspended solids, and hydrocarbons prior to leaving the site. In some instances Water Quality & Discharge Control may be achieved in the same component.

Full details in Section 10

5.4 Natural Water Courses & Drainage Channels

Where a natural water course or drainage channel traverses or adjoins the site, Water Sensitive Urban Design Solutions shall be implemented in addressing the constraint.

Full details in Section 15

5.5 Additional Requirements

Flooding

Where the subject site is flood affected or the proposed development may have an effect upon flooding, the applicant is to ensure the proposed development is acceptable with regard to Council's Flooding & Drainage related Policies.

Full details in Section 19

Reduced Impervious Areas.

Pervious area must be made available for stormwater infiltration thus reducing the impacts of stormwater from impervious areas.

Full details in Section 18

Alternative Water

Where no alternative water supply has been proposed in Section 5.1 the new development shall provide separate (dual - including toilet, laundry & outdoor) plumbing to allow for retrofit of onsite water treatment systems or recycled reticulated water.

Where a development has existing internal connections to a rainwater tank additional dual plumbing is not required.

Development within the Gosford CBD will be required to provide dual pipe plumbing though out.

Full details in Section 17

Maintenance

Maintenance of water quality and Water Sensitive Urban Design features is important in ensuring the continued life and effectiveness of each element within the treatment train.

Full details in Section 16

Chemical Spills

Where chemicals will be used on the site the CWCM Plan shall identify any areas where chemicals shall be stored and address the potential for a chemical spill and detail the systems in place to ensure any spill will not enter the stormwater system.

Point(s) of Discharge

The CWCMP shall be clearly labelled and marked, indicating where the site stormwater will discharge from the site. This may be to Council drainage such as Kerb & Gutter or open drain or to a private Interallotment drainage line and easement etc, easements shall be clearly marked and evidence provided showing that the easement is in existence. Where a new easement is proposed the plans shall clearly identify the location of the new easement and shall be endorsed by the property owner(s) burdened by the proposed easement.

5.6 Somersby Industrial Area

Where the proposed development lies within the Somersby Industrial Park, refer to Draft LEP 457 and DCP 173 - Somersby Industrial Park for environmental requirements. These requirements shall be integrated with the requirements within DCP 165.

6 COMPREHENSIVE WATER CYCLE MANAGEMENT PLAN - SUBDIVISION

A Comprehensive Water Cycle Management Plan (CWCMP) - Subdivision, is a site study that incorporates all areas of the water cycle including rainwater, stormwater, ground water (infiltration), potable water and wastewater. A CWCMP aims to provide the best possible water management through engineering best practice or innovative practices.

A full Water Balance analysis shall be undertaken for the site and will detail the measures to be undertaken within the subdivision to address the issues of reducing potable water use, reducing stormwater run-off from the site including site discharge and water quality and where possible minimising wastewater.

The CWCM Plans and measures will differ between sites depending on the size of the subdivision, the location and the type of subdivision being undertaken, e.g. Community or Torrens Title.

The CWCMP will consist of a written report and plans detailing predicted water use under base line conditions and detail the water saving measures and stormwater measures to be implemented on the site and must address the following criteria:

6.1 Existing Environment Conditions

A summary of the current condition of the land and its catchment context, with particular reference to the following issues:

a. catchment hydrology and hydrogeology including natural water courses and drainage channels and pipe systems

b. soil conditions

c. vegetation cover, remnant native vegetation and vegetation condition

d. groundwater depth and chemistry

e. site constraints and hazards such as flooding, slope stability, reactive soils, coastal hazards, erosion hazard, urban salinity, acid sulphate soils, salinity and land contamination

f. water quality conditions

g. stream flow regime.

6.2 Design & Outcomes

The design and outcomes will address issues arising from the above assessment. The design of the subdivision will encompass the water cycle, with outcomes that are to be achieved during construction and throughout the life of the development. The following matters should be addressed:

a. water consumption

b. flooding and on-site stormwater detention

c. stream flow, environmental flow, erosion, water-dependent ecosystems such as streams, riparian zones, wetlands and estuaries where natural watercourses are within or in proximity to the site, or are to be created.

d. water balance

e. water quality both at lot scale and site scale

f. erosion and sedimentation

g. biodiversity and habitat conservation

h. groundwater conditions including salinity

i. public health

j. recreational use of waterways and related areas

k. aesthetic, visual and landscape issues

l. treatment train, at source controls where possible rather than large end of pipe solutions.

m. integration of all aspects of water cycle management, including water supply, sewerage, drainage, wastewater treatment and reuse, water quality control, flood risk management, open space provision and ecological protection.

6.3 Maintenance & Monitoring

A maintenance management plan is required to be submitted and should address the following:

a. strategies to ensure effective ongoing maintenance of on-site water management measures, maintenance requirements & responsibilities and proposed enforcement mechanisms (where necessary).

b. arrangements for monitoring the achievement of objectives and performance standards.

6.4 Somersby Industrial Area

Where the proposed development lies within the Somersby Industrial Park, refer to Draft LEP 457 and DCP 173 - Somersby Industrial Park for environmental requirements. These requirements shall be integrated with the requirements within DCP 165.

7 DESIGN AND CERTIFICATION

The design and certification of Water Sensitive Urban Design elements shall be undertaken by an appropriately qualified engineering, surveying or environmental professional.

Stormwater Management Plans required for single dwellings, alterations and additions may be undertaken by designers other than those mentioned above subject to adherence to the requirements as outlined in DCP 165 and these guidelines.

OSD design or total catchment analysis shall only be undertaken by those listed in Section 13

The design of the water quality elements shall be undertaken utilising the methods as outlined in the following publications:

- *Australian Runoff Quality (ARQ)*
- *WSUD Engineering Procedures*
- *WSUD Technical Guidelines for Western Sydney*
- *WSUD: basic procedures for 'source control' of stormwater – "a Handbook for Australian practice"*
- Stormwater Modelling shall be undertaken in accordance with Chapter 14 of ARQ.

Each design shall be certified by the designing professional stating their qualifications, professional accreditation, and that they have designed the proposed works in accordance with the applicable standards and best management practice.

The Designer shall be mindful of the urban constrains such as services, access (vehicular and pedestrian) and maintenance. Each chapter of *ARQ* provides guidance on urban constraints.

To ensure the appropriate parameters have been addressed within the design, a Design Checklist shall be submitted, listing all the parameters that were addressed within the design. Appropriate design checklists can be found in:

- *WSUD Engineering Procedures*
- *WSUD Technical Guidelines for Western Sydney*

NOTE:

WSUD features and design publications are not a complete substitution for conventional drainage design and associated design publications, especially in the estimation and conveyance of floodwaters.

Whilst the above publications will cover most of the design types required, other publications and resources are available to the designer. Where methods other than those contained in the above publications are utilised, the relevant publication shall be referenced and details of the design procedure and reasons for use provided to Council.

Additional information on design sources is contained in Appendix C

8 CONSTRUCTION

The ability of any water quality element or treatment train to meet the prescribed water quality and quantity outcomes can be highly dependent on the construction being in accordance with the design specifications. This is especially important in the use of design specified soils and filtration media, where the incorrect mix can greatly inhibit the effectiveness of the system.

To ensure the quality of construction is achieved the following shall be undertaken for any project incorporating a Water Quality Element:

- submission of a construction checklist detailing the elements and construction requirements with the Construction Certificate Application, or Road Opening Request for approval.
- construction of each element in accordance with the approved construction checklist and design.
- the completed construction checklist shall be submitted with Works As Executed (WAE) plans. The checklist and WAE plans shall be endorsed and certified by the Principal Certifying Authority (PCA) stating that construction has been in accordance with the design criteria and that the systems as built will perform to the design criteria.

Construction checklists shall be prepared by the applicant and list all the critical inspections required to ensure compliance with the design. Appropriate checklists can be found in:

- *WSUD Engineering Procedures*

9 WATER QUALITY MODELLING

Computer modelling of stormwater quality devices and the integrated water cycle has improved over the years and continues to do so. Whilst currently no one program excels in all areas, good quality conceptual and detailed design modelling is possible to determine the effects of a catchment on stormwater quality and quantity, through a number of models.

Modelling shall be undertaken in accordance with Chapter 14 of ARQ. Preliminary information for development application stage should be provided through a MUSIC model. Detailed design should be undertaken with a model that best suits the proposed development catchment and the proposed WSUD elements.

10 CONTROLLING STORMWATER POLLUTION

Urban development typically introduces greater quantities and a broader variety of pollutants to the land surface. The replacement of natural ground surfaces and vegetation by buildings, roads and other impermeable surfaces in turn significantly increases the potential for these pollutants to be transported to streams and waterways by stormwater runoff. The majority of pollutants reaching streams are washed from impermeable surfaces during regular rainfall events (those with an average recurrence interval of up to 6-12months).

Stormwater generated by these rainfall events can be captured and treated by a variety of management measures. Runoff from both roofs and paved areas needs to be treated.

Significant water quality improvements can be achieved by configuring a sequence of treatment measures (a 'treatment train'). Some measures may provide a variety of subsidiary benefits, such as urban flood control and water conservation. The suitability of treatment measures will depend largely on site conditions. For example, Infiltration devices may not be suitable in areas with heavy clay soils or which are affected by potential urban salinity.

The performance standard is based on the stormwater treatment objectives recommended by the Gosford City Council Urban Stormwater Management Plan (1999).

Expected average annual post-development pollutant loads in stormwater discharges from the site must achieve the following values:

TABLE 1

Pollutant	Stormwater Treatment Requirements
Suspended Solids (TSS)	80% retention of the annual average load in the Narara Creek, Erina Creek and Coastal catchments 70% retention of the average annual load in the Brisbane Water, Broken Bay and Lower Hawkesbury River catchments
Total phosphorus (TP)	45% retention of the average annual load in the Narara Creek, Erina Creek and Coastal catchments 30% retention of the annual average load in the Brisbane Water, Broken Bay and Lower Hawkesbury River catchments
Total nitrogen (TN)	45% retention of the average annual load in the Narara Creek, Erina Creek and Coastal catchments 30% retention of the average annual load in the Brisbane Water, Broken Bay and Lower Hawkesbury River catchments
Litter	Retention of litter greater than 40mm in size for flows up to 25% of the 1 year ARI peak flow in all catchments
Oil and grease	No oil or grease to be visible downstream of urban and industrial areas for flows up to 25% of the 1 year ARI peak flow in all catchments

Note: for Catchments not listed above the maximum retention values for TSS, TP and TN shall apply.

Pollutant **retention** relates to the percentage of the **baseline annual** pollutant load retained on the site through water quality measures. The **baseline annual** pollutant load is the expected post-development pollutant load that would be discharged from the site over the course of an average year if no stormwater reuse or treatment measures were applied.

10.1 STORMWATER QUALITY CONTROLS FOR BUILDING DEVELOPMENT

Stormwater leaving a development site must not pollute the receiving waters. As such, Stormwater from roof and hard surface areas must be treated to remove nutrients, gross pollutants, suspended solids, hydrocarbons and other pollutants (such as metals) prior to leaving the site. In some instances Water Quality & Discharge Control may be achieved via the same treatment component.

The following areas of new development will require stormwater quality treatment prior to discharge from the site:

- Roofwater
- Surface Water from Driveways & Parking Areas
- Surface Water from all other Impervious Areas.
- Surface run-off from unstabilised Landscaped areas.

  TABLE 1 summarises pollutant reduction requirements whilst the specific treatment measures are set out in the subsections below.

Stormwater quality modelling shall be undertaken to demonstrate the effectiveness of proposed measures to meet the targets in TABLE 1, for developments that;

- incorporate 15 or more dwellings, or
- accommodate 50 or more residents, or
- involve the development of 2,500m² of land or more
- or where Council considers development may adversely impact upon areas of environmental importance.

Building developments other than above, shall be deemed to satisfy the water quality requirements of TABLE 1 through the installation of one or more of the following elements for roof and surface water quality (elements listed within Section 11 may also be used).

Roofwater Treatment

The following devices must be installed:

a. *First Flush Disposal* - The First Flush device is required with the installation of rainwater tanks.

b. Overflow from the rainwater tank shall be directed to an appropriate disposal point as listed:

   - an infiltration trench (where ground conditions are appropriate) of a size that reflects the roof area and soil infiltration rates, or

- a pervious soft landscaped area of not less than 20m² (runoff shall not cause erosion or be directed onto adjoining properties), or
- connected to the street kerb, table drain, Council drainage line, inter allotment drainage line or dispersion trench as appropriate (or directed by Council).

c. *Other* - Proposals for systems other than a. & b. above, are to be submitted with detailed information to Council for evaluation.

Gutter Protection Devices are not mandatory but are recommended where high levels of leaf material are expected to accumulate in gutters. It should be noted however that they will require regular maintenance to ensure optimum rainwater collection. Gutter Protection Devices may also reduce bushfire hazard and may be required under other Development Controls as a bushfire protection measure.

Further Details in Appendix B & Appendix C

Surface Water Treatment for Driveways, Parking Areas and All Other Impervious Areas

Choose one (or more) of the following elements to treat each impervious area:

a. *Grading to Landscaping and/or Vegetated Swales* - Water from driveways and parking areas is graded to soft landscaping or vegetated swales prior to leaving the site. Vegetated Centre strips within driveways will provide an excellent vegetation strip for stormwater cleaning.

b. *Diversion* - Flow from the driveway or parking area is captured by pits and grated drains and transported by pipes to an infiltration trench or stabilised soft landscaped area - a stabilised soft landscaped area is one that will not erode where an outlet pipe releases water.

c. *Proprietary Treatment* - Flow from the driveway or parking area is captured by pits and grated drains and transported by pipes to a proprietary environmental pit system within the property prior to leaving the site.

   Proprietary products should only be utilised where the stormwater design is by a qualified professional as listed in Section 7.

d. *Porous Paving* - Allows water to filter through the paved layer to reach the soils underneath, whilst trapping pollutants. There are a number of restrictions on the use of porous paving.

   Porous paving is not suitable for:

   i. slopes greater than 5% and

   ii. soils with:

      - high water table levels (less then 1.5m deep)
      - soil salinity hazard
      - wind blown or loose sands
      - clay soils that collapse in contact with water

- soils with a hydraulic conductivity of less than 0.36 mm/hr.

Where soils may not be conducive to direct infiltration through porous paving, there is the opportunity to utilise porous paving through the installation of an impermeable layer and subsurface drainage and filter media beneath the paving to take the water to a treatment pit elsewhere on the site

e. *Other* - Proposals for systems other than those above are to be submitted with detailed information to Council for evaluation.

NOTE:

Council requires that overland flows from impervious areas must be adequately directed so as not to cause intensification, concentration or inappropriate flow over neighbouring properties.

Where the proposed development lies within the Somersby Industrial Park, refer to Draft LEP 457 and DCP 173 - Somersby Industrial Park for environmental requirements.

Further Details in Appendix B & Appendix C

11 WATER SENSITIVE URBAN DESIGN (WSUD) ELEMENTS

Sediment Basins

Sediment Basins are used to collect coarse sediment from runoff and are often used as the first treatment device in a treatment train to protect the downstream elements.

They are used primarily for trapping sediment from construction sites and as a pre-treatment for wetlands where there is insufficient sediment removal available through other measures up stream of the wetland.

Sediment basins can serve a double function as stormwater detention basins

Bioretention Swales

Bioretention Swales or Biofiltration trenches are linear bioretention systems that are located at the low point of a vegetated swale and provide fine filtration treatment of stormwater as it is conveyed along the upper portions of the urban drainage network.

They provide retardation of flow for frequent storm events through filtration and retention capacity (through infiltration); remove some dissolved chemical pollutants and efficiently remove nitrogen and other dissolved and fine particulate contaminants.

They are an attractive element in road design and are often used in median strips and carparks.

Bioretention Basins

A bioretention basin operates like a bioretention swale without the conveyance of stormwater. They work by filtering stormwater through densely planted vegetation, which is then percolated through a prescribed filter media, often incorporating composted organic material or carbon to aid removal of soluble pollutants and to maintain good soil structure and high infiltration rates in the long-term. High flows are then diverted to an additional system or standard drainage system. Except during storm events they do not retain any surface water.

They can be used at many different scales providing flexibility for the designer. They can be applied at a small scale on development lots and roadside treatments (often called **rain-gardens**), to large-scale implementations in retarding basins.

As a small-scale element they are a good source control option or as a large-scale element they will often be the most down stream element. The versatility of the Bioretention Basin makes it applicable to both redevelopment and greenfield sites.

Rain-gardens

Rain-gardens are effectively small scale Bioretention Basins (see above) designed to synergistically enhance the landscape qualities of a development or roadway.

Sand Filters

Sand filters operate in a similar manner to bioretention systems, however sand filters generally do not incorporate vegetation or organic material. Stormwater percolates downwards through a filter media and is then intercepted by perforated pipes which take the treated water from the device.

Due to the lack of vegetation, pre-treatment to remove litter, debris and high levels of sediments is required prior to entering the filter media (typically sand). Sand filters are effective at removing particulate pollutants, but provide poor removal of soluble pollutants, such as metals. Over time, however, deposition of organic material on the sand surface can improve removal of soluble pollutants in a similar manner to bioretention basins, but at the expense of infiltration rates.

During higher flows, water may pond on the surface of the sand filter, particularly if they are clogged by organic matter or fine (clay and silt) sediment. Placing a sand filter in a detention basin increases the volume of water that can be treated, with flows in excess of the storage diverted to protect the sand media from scour.

In some instances such as with sand filters that are open to the elements, vegetation will be used such as turf or other native grasses to prevent erosion.

Vegetated Swales (Buffer Strips)

Vegetated Swales or buffer strips are used to convey stormwater downstream through a swale that has vegetation in the form of plants, turf or a combination - there is no biofiltration. Swales have mild slopes to convey water at a slow flow rate.

The vegetation within the swale aids in reducing the flow rate and increasing even flow distribution. The reduced flow rate and vegetation allows for coarse sediments to be retained. Swales can be incorporated into urban designs along roads, parks and reserves and adds to the aesthetic nature of the area.

Constructed Wetlands & Ponds

Constructed wetlands are shallow, extensively vegetated water bodies that use sedimentation, fine filtration and biological uptake processes to remove fine pollutants from stormwater. Water levels rise during rainfall events and outlets are configured to slowly release flows, typically over two or three days, until dry weather water levels are restored. Wetlands can also be subsurface systems.

Pre-treatment of inflows to remove high levels of suspended sediment is essential to prevent damage to the wetland capacity and biological functions. Similarly, wetlands need to be sized in proportion to the catchment they serve so that hydraulic and nutrient loads do not exceed their capacity. Water depths, species selection, wetland shape, and a capacity to physically regulate water levels, are all essential design elements.

Wetlands can be constructed on many scales from the size of a residential block to large catchment systems and regional areas. They can form part of the streetscape or public open space and at catchment and regional levels can provide habitat for wildlife.

Ponds or Lakes use phytoplankton for the adsorption of nutrients, promote particle sedimentation and use UV (ultraviolet) disinfection and can be used as storage for stormwater reuse schemes and often wetlands will discharge into a pond.

Like wetlands, ponds if used on their own, will require pre-treatment in the form of sediment basins or some other system. Algal blooms are a risk in pond systems and thus the ponds need to be well designed to reduce this risk.

Infiltration Measures

Infiltration measures encourage stormwater to infiltrate into the surrounding soils. Infiltration measures will require significant pre-treatment of stormwater prior to infiltration to prevent clogging of the system and surrounding soils as well as to protect ground water from soluble pollutants.

Infiltration measures detain a certain design volume of water for infiltration into the soil, they reduce runoff, especially for the smaller high frequency rainfall events, with larger less frequent storms overflowing or bypassing the system. They can be vegetated to provide greater pollutant removal.

Groundwater will have an effect on the ability to infiltrate water, as will the type of surrounding soil and infiltration rates (hydraulic conductivity). The deeper the groundwater and more conductive the soil, the more effective infiltration will be. Distances to buildings will also be governed by the soil type and hydraulic conductivity.

Feasibility of infiltration will be based upon soil testing and the infiltration rate(s) (hydraulic conductivity) of the soil(s).

Rainwater Tanks

Rainwater tanks (roofwater tanks) are those that collect rainwater water solely from building roof areas. Provided adequate pre-storm draw down is achieved they reduce site run-off, retard minor flooding events and, although the water is already relatively clean, will reduce pollutant discharge.

First Flush devices improve the quality of water from the roof by collecting the first portion of runoff that typically has debris and diverting it away from the tank.

Gross Pollutant Traps

Gross Pollutant Traps (GPTs) are either proprietary structural products, or hard engineered concrete and steel devices built on-site, that remove gross pollutants as well as some other pollutants and sediments, depending on the type of device. GPTs come in many sizes, from gully pit inserts for inline road drainage, to large 'end of pipe' systems servicing entire catchments.

Large end of pipe GPT solutions are less favourable due to specialised maintenance costs. Source controls are the preferred option to meet Council's stormwater quality requirements.

Porous Paving / Permeable Pavements

Porous paving is an alternative to conventional impermeable pavements with many stormwater management benefits. These surfaces allow stormwater to be filtered by a coarse sub-base, and may infiltrate into the underlying soil or to a specific collection system.

Porous pavements are either:

- Monolithic (permeable pavement) - porous concrete or porous asphalt

or

- Modular which includes
    - porous pavers - which may be porous through their composition or porous as there are specific gaps in the pavers' shape -
    - modular lattice structures - which may be concrete or plastic.

Hydrocarbon Management

Hydrocarbon Management refers to the specific measures implemented on sites to reduce the impacts of hydrocarbons (oils & fuels) on the environment, specifically through stormwater conveyance. Hydrocarbons enter stormwater through carparks, spills on roadways and commercial / industrial uses.

The aim of hydrocarbon pollution management is to contain hydrocarbons at the source by implementing best practice management at all possible source points for hydrocarbon pollution.

Aquifer Storage & Recovery (ASR)

ASR is a less common technique that utilises either natural or man-made aquifers to store captured stormwater for either environmental recharge or reuse through extraction.

ASR involving natural aquifers requires the quality of the water to be such that it does not pose an environmental risk to groundwater supplies or the environments and extraction uses that rely on the aquifer. Other environmental issues may also affect the viability of ASR.

Man-made aquifers are systems constructed usually under new parks or reserves, where an aquifer is formed using rock filled void formers (polymer based drainage cells). Water is stored underground, and at the same time it is treated, as it flows from the inlet to the outlet. Pre-treatment is required to some degree to remove suspended solids which reduces the likelihood of silting up the system. Man-made aquifers can be confined or unconfined to allow infiltration.

Landscaping

Landscaping of any kind can be made more suitable to local conditions through the implementation of WSUD principles. The fact sheets and practice notes listed at the end of this document will provide guidance on how WSUD integrates with landscaping.

Further information on any of these elements can be found in the publications and websites listed in Section 7 as well as Appendix B and Appendix C

12 STORMWATER HARVESTING & RETENTION

12.1 Stormwater Harvesting

Stormwater harvesting is the collection, storage and treatment of surface stormwater (and sometimes roofwater) for reuse where potable water quality is not required.

Stormwater harvesting covers many varied collection types and sizes as well as uses. Harvesting may be on a lot scale, such as stormwater from a carpark in an industrial/commercial development, to offline storage and treatment of stormwater harvested from the trunk drainage of a sub-catchment or catchment. Some issues to consider in planning and designing follow:

Size of the system will be dependant upon:

- catchment area and available stormwater
- design storm event for capture e.g. 3mth, 1yr, 5yr ARI
- available storage area
- storage method
- collection system e.g. online, offline, pumping etc
- cost / benefit
- *demand volume*

Treatment of the harvested water will be governed by such factors as:

- end use of the water e.g. industrial or irrigation
- NSW Department of Health requirements
- pre & post treatment storage method
- available area
- cost / benefit.

Other issues to consider:

- flooding
- topography
- maintenance
- lifespan of structures
- public safety and liability

These are only a few common issues that need to be addressed and due to the varied collection, treatment and reuse possibilities available with stormwater harvesting each proposal must be assessed on its merits and in context with its location, application and objectives.

The planning and design of any stormwater harvesting scheme shall be undertaken by consultants qualified in the associated fields and should be guided by the publications:

Managing Urban Stormwater: Harvesting and Reuse, Department of Environment and Conservation, 2006

This document and other information is available at:
http://www.dec.nsw.gov.au

National Water Quality Strategy - Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1) - November 2006

This document and other information is available at:
http://www.ephc.gov.au/ephc/water_recycling.html

12.2 Stormwater Retention

Stormwater retention is the collection and retention of surface stormwater on a site in tanks for the purpose of emulating as best as possible site infiltration that would occur should no development exist.

Due to high levels of impermeable areas, retention of rainwater that falls upon a site must be provided for reuse on the site to assist in emulating natural infiltration and reduce nuisance flooding during minor rainfall events. This retention also reduces the cumulative detrimental effect on streams, creeks, rivers and receiving water bodies.

Retention on residential development shall meet the following criteria:

a. must have either rainwater tanks or stormwater retention tanks, at least of a size as set out in Appendix A, capturing water from at least 90% of the total roof area, that are connected to all toilet cisterns and cold washing machine taps, to create adequate draw down for OSD purposes. Where the roof area of the total development is less than 150m², external use on its own is acceptable.

b. Where the volume of total retention storage does not meet the minimum requirements set out in Appendix A then additional on-site storage will be required within an OSD system to meet the short fall of retention.

c. The required retention volume may be provided by either:

   i. roofwater retention (rainwater tanks);

   ii. surfacewater retention (stormwater tanks); or

   iii. a combination of the above.

Subject to the requirements set out elsewhere in these guidelines and/or DCP 165, the designer shall choose rainwater tanks, stormwater retention tanks or a combination that best suits the site constraints.

The Retention Volumes required for each development type are listed in Appendix A

The Volumes in Appendix A are the minimum total site retention required for the development. Where BASIX is applied and a rainwater tank is required, the volume specified by the BASIX Certificate will be included as part of the total retention volume, not an addition.

Note:

- Retained surface stormwater will need to be treated and used in accordance with guidelines provided by the **NSW Department of Health**. For information on treatment levels contact the Local Area Health Department or visit http://www.health.nsw.gov.au .

- Where both roofwater tanks and stormwater retention tanks are utilised the stormwater retention component may be used solely for irrigation purposes subject to 60% of the total retention volume being achieved within the rainwater tanks, unless shown otherwise through appropriate water use modelling.
- Overflow from roofwater tanks is to be directed to the OSD system (where one is required for the development) or to an interallotment drainage line or kerb outlet or infiltration trench or dispersion trench (where soil conditions do not allow for infiltration)

Rainwater Tanks

i. Rainwater storage may be either a multiple tank system, or a single tank system. The system utilised will need to be chosen based upon the site constraints, development type and water usage.

ii. Where a storage system supplies more than one dwelling it should be located wholly within common property, otherwise appropriate easements, restrictions & covenants will be required over the lots to ensure maintenance and access is achievable if required. Maintenance shall be assigned to the appropriate lot, strata management or body corporate as best fits the situation.

iii. Plumbing of combined storage systems will need to take into account the pumping requirements of all dwellings and whether potable water backup connection for toilets and washing machines is made at the dwelling or at the rainwater tank.

iv. It should be noted that during periods of water use restrictions, tanks that are connected to an internal supply/device will be subject to the same restrictions as mains water use.

To avoid the possibility of having restrictions on the use of rainwater tanks, it is possible to:

a. divide the volume of retention required into 2 (or more) tanks. One tank to be connected for internal uses only, the other for external use only.
In dividing the retention between 2 (or more) tanks, at least 60% of the required retention volume must be contained within the tank(s) connected to internal uses, and serve at least 60% of the total roof area unless shown otherwise through appropriate water use modelling.

Additional Rainwater Tank Information, Appendix B & Appendix C

Stormwater Tanks

i. Retained ***untreated*** stormwater can be utilised for irrigation (not on edible plants).

ii. ***Treated*** stormwater may be utilised for all irrigation purposes as well as connection to toilet cisterns and cold water washing machine taps. Stormwater must be treated and used as per the requirements of the NSW Department of Health prior to utilisation

for purposes other than irrigation. Regarding the type and level of treatment required for the reuse of stormwater for toilet cisterns and washing machines contact the Local Area Heath Department or visit http://www.health.nsw.gov.au

iii. Should treated stormwater be utilised for internal plumbing, the design will need to take into account the pumping requirements to reach all dwellings and how mains water top-up for toilets and washing machines is integrated into the system.

iv. Stormwater retention systems should be located wholly within common property. Appropriate easements, restrictions & covenants will be required to allow for access and maintenance

13 ONSITE STORMWATER DETENTION

On-site Stormwater Detention (OSD) shall be provided where required by Council in conjunction with a proposed development.

OSD will not be required on alterations, additions, ancillary structures, second storey additions, single dwelling & dual occupancies, except where:

- the volume of total retention storage provided does not correspond to the requirements in Appendix A, in such instances the OSD system shall meet the short fall of retention volume and have a Permissible Site Discharge (PSD) of 8L/s, or
- it is required under a specific Council Plan of Management, DCP, LEP or other Council Plan.

OSD will be required for all other developments, except where:

- the development is located at a point within the catchment considered by Council not to warrant OSD, or
- an OSD system has been previously constructed to accommodate the proposed development, or
- the applicant undertakes a detailed total catchment analysis proving that the proposed development has no effect on properties and infrastructure down stream or upstream of the catchment. The study shall be undertaken by a Certified Practicing Engineer - The Institution of Engineers Australia, or
- the development is in a rural area and the following measures are implemented
    - all runoff from rural buildings, tracks and paved areas is to be discharged into absorption trenches or onto heavily vegetated areas so as to prevent an increase in the rate of runoff into streams.
    - all runoff is to be controlled so that it causes no nuisance or concentration of flow to watercourses or neighbouring properties.
    - all runoff is to be controlled so as to prevent erosion.

  Regardless of the points above, where Council considers development may adversely impact upon areas of environmental importance, drainage infrastructure or as deemed necessary, Council may determine that stormwater detention is required.

Design

All design is to conform to best engineering practice, Australian Standards and OH&S requirements, and shall be undertaken by a person who retains one of the following standings:

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- Practicing Civil Engineer with appropriate qualifications and experience to be eligible for Membership to the Institution of Engineers Australia;

- Surveyors Certificate of Accreditation in On-Site Detention and Drainage Design (Institution of Surveyors, NSW and the Association of Consulting Surveyors, NSW)

A stormwater detention report and accompanying plans shall be prepared, by a person accredited as above, and submitted with the development application.

The following General design parameters will apply:

- limit post development flows from the proposed development site to less than or equal to predevelopment flows for all storm events up to and including the 1% AEP storm event.
- Predevelopment coverage shall be taken as the natural vegetation that would normally occur on the entire site with no impervious areas. Appropriate infiltration rates for the natural vegetated state and underlying soils shall be applied and provided in the calculation report.
- A maximum of 50% of the Volume of Rainwater/Stormwater Retention Tanks can be claimed as part of the OSD Volume.
- A Runoff Routing method is to be used for developments.
- Where no road pipe drainage system exists, the maximum permissible site discharge (PSD) from a development to either the kerb and gutter or table drain shall be 30 litres/sec unless otherwise advised by Council's Engineer.
- discharged water shall not be concentrated onto adjoining properties, unless through a formalised (legal) drainage system
- Site controls will sometimes overflow. Council requires that overland flows must be adequately directed so as not to cause intensification, concentration or inappropriate flow over neighbouring properties.

Additional Subdivision parameters

- OSD shall be designed as either a single device servicing all lots and other impervious areas (including roads paths and other hard stand) or as single devices servicing each separate lot and road system.
- A maximum of 50% of the total volume of rainwater tanks can be claimed as part of the OSD volume subject to a Positive Covenant and Restriction-as-to-User being placed on the title of the lots requiring a minimum size rainwater tank be installed with building works or further development.
- Where OSD is proposed on a lot basis the requirement to construct the OSD system can be deferred subject to a Positive Covenant and Restriction-as-to-User being placed on the title of the lots requiring OSD facilities complying with these provisions to be constructed at the time of each allotments development.
- Wherever possible Council will prefer the construction of privately owned community detention systems.
- Site controls will sometimes overflow. Council requires that overland flows must be adequately directed so as not to cause intensification, concentration or inappropriate flow over neighbouring properties.

- To the extent possible, OSD and drainage design should be integrated with other WSUD measures, such as landscaping, road design, development layouts, provision of habitat, recreational open space etc.

Rural Subdivision

- OSD - shall not be required subject to compliance with the following:
  - Stormwater quality is in accordance with Section 10, including prevention of erosion.
  - All runoff from buildings, access roads, tracks, and paved areas is to be discharged into absorption trenches or onto heavily vegetated areas so as to prevent an increase in runoff rate into streams/drainage systems.
  - All runoff is to be controlled to ensure it causes no nuisance or concentration of flow to watercourses or neighbouring properties.
  - Inclusion of other WSUD solutions that can be reasonably demonstrated to address stormwater flow and water quality issues to the required level.

Construction

A person holding accreditation as a certifier under the Environmental Planning and Assessment Act 1979 in the relevant discipline shall provide the certification for the approved works. The PCA is to certify that the detention system as built will perform to the criteria set down by the designing professional and that all stormwater drainage and related work has been constructed in accordance with the Construction Certificate.

Works-As-executed plans (in accordance with GCC Civil Construction & Civil Design Specifications) are to be supplied to Council in respect of:

a. invert levels of structures:

b. surface and pavement levels

c. installed proprietary stormwater treatment systems

d. maximum water surface level for the 100 year ARI flood event and depths.

The datum for all levels is to be Australian Height Datum.

A positive covenant shall be created on all lots containing an onsite stormwater detention system to ensure:

a The system will remain in place and fully operational.

b The system is maintained so that it operates in a safe and efficient manner.

c Council is permitted to inspect and repair the system.

d Council is indemnified against all claims of compensation caused by the system.

A Restriction as to User shall be created on all lots containing an onsite stormwater detention system to prevent:

a Any building, structure or obstruction being constructed over the system.
b Any alteration to the approved system.

The authority empowered to release, vary and modify the restriction or positive covenant is Gosford City Council.

Infiltration Measures with OSD

In some areas, infiltration of OSD Discharge into the ground is desired to recharge ground water aquifers, prevent saline water from encroaching on freshwater aquifers and reduce runoff to the piped stormwater systems that do not have adequate capacity for the increase in development.

In these areas, Council may require installation of infiltration measures as part of the stormwater detention facility, or as an alternative to stormwater detention structures. The only area currently identified for the application of infiltration measures - to dispose of OSD discharge or in lieu of OSD as noted above - is in the sand plain area of the Woy Woy Peninsula.

For other areas an analysis of the hydraulic conductivity of the site shall be undertaken under saturated conditions by a NATA approved company, prior to consideration of infiltration to dispose of OSD discharge.

14 EROSION AND SEDIMENT CONTROL

An Erosion & Sediment Control Plan (ESC Plan) is required for implementation on the site during construction and shall be maintained following construction where erosion or sediment movement may occur due to disturbed areas that are yet to be stabilised.

The ESC Plan shall be prepared in accordance with Gosford City Council's Policy D6.46 Erosion & Sediment Control. Council's Policy includes the Code for Erosion Sedimentation Control and references 'Managing Urban Stormwater: Soils and Construction' (the "Blue Book") Landcom, which will also provide guidance for designing some elements of a ESC Plan.

Appendix D contains Council's Information Pamphlet on Erosion and Sediment Control principles and how to prepare a suitable ESC Plan.

Site disturbance shall be kept to a minimum during construction. Additionally due regard should be made to minimise site disturbance through the design of the building and its relationship to the site and site topography.

15 NATURAL WATER COURSES & DRAINAGE CHANNELS

Where a natural watercourse or drainage channel (natural or man made) traverses or adjoins the site the following shall apply:

- Development affecting most Natural Water Courses (and sometimes drainage channels) will require the assessment and approval from relevant State Government Authorities such as Department of Natural Resources, NSW Fisheries (Department of Primary Industries) or Department of Environment and Conservation.
- Natural Watercourses shall be retained in a natural state and shall only be altered, where works are proved necessary to restore the watercourse or prevent damage associated with development, using WSUD principles. Where a watercourse is in a degraded state, or does not conform to current practices, all works as necessary to remediate the stream within the site, shall be undertaken by the developer in conjunction with the development.
- Post development flows within the watercourse shall not be detrimental to the quality and stability of the watercourse arising from changes in flow volumes, peak discharge rates and/or discharge frequency.
- Plans and a report shall be prepared and submitted with the development application detailing the existing conditions and how issues of water quality and quantity shall be addressed. They shall identify where any necessary works to remediate or protect the watercourse and/or drainage channel are to be undertaken. The report and plans shall be prepared by an appropriately qualified consultant as identified in Section 7.
- Alteration of the drainage channel (not requiring State Department assessment) shall only take place following written confirmation from Council that the channel can be altered.
- In the assessment of *natural* watercourses and drainage channels Council may require a flood study to be undertaken to assess the effect of any proposed development upon upstream and down stream property and infrastructure in accordance with Council's Flooding & Drainage Related Policies and the State Governments Flood Prone Land Policy.
- Development in accordance with Council's Policy D6.47, Setback Policy for Creeks, Rivers and Lagoons
- A range of Water Sensitive Urban Design Solutions should be implemented in addressing these constraints to minimise impacts on the waterways through consideration of the whole water cycle and the potential for multiple environmental, social and drainage objectives to be met concurrently.
- The property owner shall be responsible for any ongoing maintenance required.
- **Somersby Industrial Area**

  Where the proposed development lies within the Somersby Industrial Park, refer to Draft LEP 457 and DCP 173 - Somersby Industrial Park for environmental requirements.

16 MAINTENANCE

WSUD systems may decrease in performance over time where inadequate maintenance is provided for either the soft engineering ("green") assets and hard engineering (concrete and steel) assets. Both types of assets play crucial roles in achieving flow and water quality drainage objectives, as well as noon-drainage outcomes, such as recreational open space amenity, provision of habitat and water supply. Detailed operation and maintenance programs for WSUD measures are crucial to optimise their long-term performance.

Maintenance of designed systems, both structural and non-structural, needs to be considered during the planning and design stage of the process. Lack of consideration at the planning stage may greatly inhibit the maintenance and thus the long-term viability of the system.

Every design shall be accompanied by a maintenance management plan that details:

- the type and frequency of maintenance and/or monitoring required for each element
- a check list for each element
- manufactures/designers maintenance requirements for proprietary products (including maintenance providers and replacement product suppliers)
- where necessary, the parties responsible for the upkeep of the system such as property owners and/or the Body Corporate / Strata Management.

Appropriate maintenance requirements can be found in:

- *WSUD Engineering Procedures*
- *WSUD Technical Guidelines for Western Sydney Section 6 - Operation &* Maintenance
- Constructed Wetland Manual Vol 1& 2

Where a proprietary stormwater quality product is selected, the associated maintenance requirements shall be included with the Maintenance Plan.

17 ALTERNATE WATER - GREYWATER REUSE & WATER RECYCLING

In response to future recycled and grey water initiatives in the Gosford LGA and the development of greywater treatment technologies, each new development shall provide separate (dual) plumbing to allow for the retrofit of recycled reticulated water or on-site greywater systems.

Development within the Gosford CBD will be required to provide dual pipe plumbing through out.

Greywater

There are two forms of greywater reuse, Greywater Diversion Device and Greywater Treatment System

Greywater Diversion Device

- A Greywater Diversion Device (GDD) diverts greywater from the washing machine, bath or sink (not kitchen sinks) to a subsurface irrigation system without treatment.
- Overflow from the system is connected to the sewer system.
- GDDs must be connected to a subsurface irrigation system and cannot be used for surface irrigation uses or internally.
- A GDD does not require approval for installation from Council providing the device is installed to the requirements of the NSW Code of Practice Plumbing and Drainage July 2006, by a qualified plumber.

Greywater Treatment System

- A Greywater Treatment System (GTS) collects greywater from the washing machine, bath or sink (not kitchen sinks) and treats the water via a chemical or biological process to remove pollutants.
- Overflow from the system is connected to the sewer system.
- Produces water that can be reused internally for flushing toilets, coldwater washing machine taps and for external surface irrigation.
- All GTSs require approval by Council.
- The following is required to prepare your development for future installation of a greywater treatment system or provision of reticulated recycled water:
  - o provide separate greywater and blackwater drainage within the development. They can be joined again prior to discharge to the sewer system.
  - o all greywater pipes should be connected at a single point just outside the building footprint.

  mains water plumbing for toilet cisterns the laundry and external uses should be separated from other water supplies at a point external to the building. These pipes are to be installed in accordance with the NSW Code of Practice for Plumbing and Drainage 3rd Edition 2006 and AS/NZS 3500 Plumbing and Drainage.

Further information on greywater reuse can be found at:

NSW Department of Health
http://www.health.nsw.gov.au and search on "greywater"

NSW Department of Energy Utilities and sustainability
http://www.deus.nsw.gov.au/water/Plumbing.asp
http://www.deus.nsw.gov.au/water/Greywater/Greywater.asp

NSW Legislation
http://www.legislation.nsw.gov.au and search on "Domestic Greywater"

Please contact Council for further details on the application and approval for Greywater Treatment Systems.

Recycled Water

Recycled water is the treatment of blackwater to produce high quality water for uses within the house, other than for sinks. Reticulated recycled water is proposed for the Gosford CBD and may extend to other areas of Gosford LGA

To prepare a development for future recycled water initiatives the following should be undertaken:

- mains water plumbing for toilet cisterns, laundry and external uses should be separated from other water supplies at a point external to the building. These pipes are to be installed in accordance with the NSW Code of Practice for Plumbing and Drainage 3rd Edition 2006 and AS/NZS 3500 Plumbing and Drainage.

18 REDUCED IMPERVIOUS AREAS

A reduction in impervious areas associated with building developments is necessary to improve site infiltration, assist in stormwater quality and quantity discharge and thus reduce the impacts of stormwater from impervious areas.

The pervious areas shall be of soft landscaping and, except in rain gardens or bioretention basins, should utilise drought tolerant species (preferably native) to reduce watering needs. These areas shall be integrated in the site management plan.

The following numerical requirements for pervious area shall apply.

TABLE 2

Development Type	Minimum Pervious* Areas Required
Single Dwellings & Dual Occupancy	50m² or 30%# of the site - which ever is greater
Medium Density Residential	50m², or 25% of the site - which ever is greater
Higher Density Residential	50m², or 10% of the site - which ever is greater.
Other Development	50m², or 10% of the site - which ever is greater.
Industrial	200m², or 5% of the site - which ever is greater.

* Pervious areas refer to soft landscaping and turfed areas only.

\# Variations to the 30% area may be considered where the applicant can demonstrate to Council's satisfaction that; site geology prevents adequate infiltration and/or excessive site slope requires extra site coverage for access and building purposes.

The Landscaping Practice Notes and Fact Sheets provide information on how to provide WSUD in landscaping.

NOTE:
The percentages and areas for minimum required pervious areas above are for stormwater purposes only and represent the minimum required to aid in stormwater treatment. Site coverage and landscaping requirements of other Council Development Controls may require minimum soft landscaping areas in excess of the minimums listed above. In such instances the greater area shall be taken.

19 FLOODING

All development shall address flooding to ensure there is no adverse affect on risk to life or damage to property.

Generally the subject site shall address whether it is affected by either mainstream or overland flooding or whether the proposed development may have an affect upon flooding. In addition the development should address access to ensure it has safe access out of the floodplain during a flood event.

In summary the development is to satisfy Council's Flood related policies, LEPs, DCPs, CPs, standards and procedures and also comply with State Governments Flood Prone Land Policy.

Mainstream Flooding

Council has flood maps for most of the major creeks and waterways to define whether the site is subject to mainstream flooding, however there are numerous minor creeks and watercourses that will need flood assessment reports to be arranged by the applicant to define whether their development is affected or will have an impact on flooding or not.

Local Overland Flooding

This type of flooding is generally applicable to urban areas and consists of either direct surface runoff, surcharges and overflows from low points in kerbs, overflows from pipes or from flows following the original watercourse or channel before development. These flows can cause major damage and need to be addressed by the applicant where there is evidence or likely occurrence of overland flooding.

Council has maps which highlight some areas where overland flooding has occurred and been reported in the past. However it is the responsibility of the applicant to assess their site and design their development so as to have minimal impact on flows and to set habitable floor levels at least 0.5m above the 1% AEP flood event, whilst considering potential for blockage of culverts, diversion of flows, etc.

Access

When a flood occurs, access out of the floodplain to a suitable evacuation area or escape route is an essential requirement. This addresses the social impact on persons affected by flooding and also assists rescue volunteers is accessing stranded persons. As such all development, where practical, shall ensure that there is safe flood free access out of the 1% AEP floodplain to a safety or refuge area ie 1% AEP flood free public road. All new subdivisions shall provide flood free access out of the Probable Maximum Flood (PMF) event.

Minimum Floor Levels

Council has completed floodplain risk management plans for most of its major creeks and waterways which set minimum floor levels and other development controls for new development. Where these plans do not exist the applicant is to prepare a flood assessment report for the site and ensure that all habitable areas of new development are at least 0.5m above the 1% AEP flood level of the mainstream flooding or local overland flooding which runs through or runs adjacent to the property.

Study Preparation

All flood study analysis reports are to be prepared by a Certified Practicing Engineer - Institution of Engineers Australia, who is experienced in hydraulic analysis.

Probable Maximum Flood (PMF)

Councils flood planning levels for development are generally based on the 1% AEP flood event, which is consistent throughout Australia. This however is not the largest flood event that can occur.

The PMF is an extremely rare event and is generally accepted to be the largest possible flood event that can occur. Therefore when it does occur it has the potential to cause catastrophic damage and risk to life. It is generally used for emergency response planning purposes to address the safety of people.

Therefore certain types of development that maybe utilised in emergency planning need to address the impact of the PMF on the development with regard to accessibility and its ability to maintain operation. Such emergency planning development may consist of hospitals, ambulance stations, community halls, fire and SES stations, schools, etc.

20 ROAD AND VEHICULAR ACCESS DESIGN

Subdivision

Where works are proposed in and existing Council road reserve, the designer shall seek guidance from Council on the appropriate design requirements to ensure that any proposed works will integrate with existing road and drainage infrastructure.

Introduction of WSUD design elements into the proposed or existing road reserve may require modification to Council's standard road and drainage design development requirements under Council's DCPs covering subdivision of land as well as design & construction specifications. These requirements are to ensure adequate road hierarchy, parking, vehicle access and road drainage is provided to the subdivision.

A report outlining any proposed departures from the DCPs covering subdivision of land and Council specifications, as a result of WSUD requirements, shall be submitted to ensure vehicle access, parking, road hierarchy and street drainage are adequate for the subdivision.

Other Development

Road pavement, kerb & guttering, drainage and footpaths shall be provided in the road reserve where required by Council in conjunction with a proposed development.

In areas where little to no kerb & guttering exists and/or no piped drainage exists and where Council deems these to be inappropriate, alternative WSUD options may be provided within the road reserve in lieu of standard road and drainage design.

21 GLOSSARY

Annual Exceedance Probability - AEP	The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year. (see also ARI)
ARQ	Australian Runoff Quality - *A Guide to Water Sensitive Urban Design*. A Guide to the integrated management of urban stormwater
Aquifer Storage and Recovery (ASR)	The process of recharging water into an aquifer for the purpose of storage and subsequent withdrawal. Injection of recycled water into aquifers for storage, which may be recovered later to meet water demands.
Average Recurrence Interval - ARI	The average, or expected, value of the periods between exceedances of a given rainfall total accumulated over a given duration. It is implicit in this definition that the periods between exceedances are generally random. (see also AEP)
Baseline Mains Water Consumption	Is the expected average daily mains water consumption that would be generated by the development if no water conservation measures were applied.
Baseline Annual Pollutant Load	Is the expected post development pollutant load for a given pollutant that would be discharged from the site over the course of an average year if no stormwater reuse or treatment measures were applied.
BASIX	"BASIX Certificate" The Building Sustainability Index (BASIX). Applicants can generate the BASIX Certificate only on the NSW Department of Planning' BASIX website: www.basix.nsw.gov.au For more information, phone the BASIX Help Line on 1300 650 908.
Biological uptake	Take-up of gas or fluid through a cell membrane.
Blackwater	Wastewater that contains human faecal content, and other waste not considered to be Greywater (see below).
Catchment	A topographically defined area, drained by a stream or drainage system such that all outflow is directed to a single point.
Check banks/dams	Flow spreaders constructed across a channel to decrease velocities and promote uniform flows over a wider length.
Colloidal particles	Particles that remain suspended in a solution (i.e. fail to settle out)
Design flow	Calculated flow used to size engineering structures to a defined standard.

Detention	Detention devices capture and temporarily store stormwater runoff during major (infrequent) storm events. Stormwater is then discharged to the drainage system at a controlled rate. Detention devices act to mitigate potential downstream flooding impacts.
Detention time (wetlands)	The time it takes for a 'parcel' of water to flow from the inlet of a wetland system to the outlet. Detention time is never a constant.
Development Area	Development Area refers to the combined area of all proposed work listed with a development application.
Discharge	The volume of flow passing a predetermined section in a unit time.
Draw down	The use of water from a storage tank (or system) that then provides available storage for the next rainfall event.
Dual pipe plumbing	Secondary internal plumbing that separates drinking water supply from the supply to toilet cisterns and laundry cold taps as well as external supply at a point external to the building.
Extended detention (wetlands)	Volume above wetland normal (permanent/semi-permanent) water level and the overflow weir height in a treatment element (e.g. wetland, bioretention basin, infiltration basin).
Filtration media	Soil media that retain pollutants as stormwater passes through it. *If "amended", it has been modified by the addition of organic carbon in the form of decomposed plan material.*
First flush diverter	Device for directing initial roof water collected during a rainfall event away from storage as it may contain a high concentration of pollutants.
Hard Engineering	Engineered devices, typically using concrete, steel, bitumen etc to convey, treat or hold water and wastewater. They can be purpose designed and built in-situ, or be proprietary products purchased from commercial suppliers.
Greywater	Greywater includes bath, shower and laundry wastewater as well as hand basins. Greywater does NOT include toilets or kitchen sinks. Greywater does not contain human excreta.
Gross Pollutant Trap (GPT)	A structure used to trap large pieces of debris (> 5 mm) transported through the stormwater system.
LGA	Local Government Area
Mains water	Treated drinking quality water supplied by Council's Water Authority through a piped system. (see also potable water)

MUSIC	The acronym used for the Model for Urban Stormwater Improvement Conceptualisation software developed by the Cooperative Research Centre for Catchment Hydrology to model urban stormwater management schemes.
On-site Stormwater Detention - OSD	OSD: temporary storage of stormwater generated within the site so as to restrict the discharge leaving the site to a pre-determined rate.
Permissible Site Discharge - PSD	The maximum rate at which water can be released from a site to the off-site stormwater system or waterway.
Pond	An artificial open water body.
Potable water	Potable water is treated drinking quality water usually provided through water mains by Council's Water Authority, but may also be provided by water carts (tankers) where water mains do not exist. (see also mains water)
Principal Certifying Authority - PCA	Principal Certifying Authority (PCA) is a person or group accredited as a certifier under the Environmental Planning and Assessment Act 1979 in the relevant Discipline, and can be either Council or a registered private certifier. The PCA is responsible for: a. overseeing site construction works; b. ensuring that the relevant development consent conditions are being complied with; c. ensuring each stage of construction has been duly certified by the appropriate qualified professional; d. issuing an Occupation Certificate prior to building occupation or commencing use of the development.
Rainwater Tanks (Roofwater Tank)	Tanks used to collect and store rainfall from household roofs for beneficial use. A rainwater tank captures roof water from gutters or downpipes on a building, and which does not collect water other than roofwater.
Recreational Facilities	Refers to "Recreation and sporting facility", "Recreation area" and Recreation establishment" as defined in Gosford City Council's Gosford Planning Scheme Ordinance (23 May 2006) and Interim Development Order No.122 (24 January 2006)
Retention	Refers to procedures and schemes (such as rainwater tanks) whereby stormwater is held on-site for considerable periods causing water to continue in the water cycle rather than via direct discharge to a drainage system.
Road Opening Request	Application to undertake works within Council road reserve requiring approval under Section 138 of the Roads Act 1993.

Second Storey Addition	A Second Storey Addition is building construction above an existing building development - either attached or detached, directly above or offset from the existing building.
Sediment basin	Area where velocities are slowed and coarse sediments settle out of stormwater.
Sedimentation	Process of particles settling out of a water column.
Soft Engineering	Deliberate use of plants, natural edged ponds, waterways and wetlands to achieve specific drainage and/or treatment functions that might traditionally have been addressed using hard engineering structures.
Soft Landscaping	Refers to landscaping measures that do not include hard surface, including permeable/porous pavement.
Stormwater	All surface water runoff from rainfall, predominantly in urban catchments. With regard to Stormwater Harvesting & Retention Systems, stormwater includes all rainwater except that which falls upon roofs.
Stormwater tank	A tank designed to capture and store runoff from paved or other ground surfaces - used for Stormwater Retention or Harvesting Purposes.
Treatment train	A series of treatment processes designed to collectively meet a prescribed water quality objective (e.g. vegetated swales used in conjunction with a wetland system).
Total Nitrogen load (TN load)	Is the average yearly load (generally in kilograms per year) for total nitrogen.
Total Phosphorus load (TP load)	Is the average yearly load (generally in kilograms per year) for total phosphorus.
Total suspended solids load (TSS load)	Is the average yearly load (generally in kilograms per year) for total suspended solids.
Water Balance - Developed	Refers to the relative balance between water use wastewater and stormwater generation associated with the proposed development and the use of alternative water supplies as well as runoff, infiltration and evapotranspiration under developed conditions, that reduces the effect of the development upon natural run-off, infiltration, evapotranspiration, groundwater soil salinity and stream quality as well as water supply.
Water Balance - Natural	Refers to the relative balance between runoff, infiltration and Evapotranspiration under natural (pre-development) conditions, that *establish the pre-development* groundwater, soil salinity and stream flow characteristics.

Water Sensitive Urban Design (WSUD)	An integrated conceptual approach to urban planning and design that aims to minimise the hydrological effect of urban development on the surrounding environment through explicit consideration of the whole water cycle. Generally will involve specialists in engineering, landscaping, ecology, urban planning, wetlands, and others as needed to address multiple engineering, environmental and community objectives.
Water Quality Element	Any element such as swale, bioretention basin, proprietary product etc incorporated into a design that provides water quality functions such as nutrient removal etc.
WCM Guidelines	Water Cycle Management Guidelines for Gosford City Council.

22 REFERENCES

Australian Runoff Quality Authorship Team - Engineers Australia (2006). *Australian runoff Quality - A guide to Water Sensitive Urban Design*. Engineers Media, Crows Nest NSW

Coombes, P. Frost, A. Kuczera, G (2001). *Impact of Rainwater Tank and On-site Detention Options on Stormwater Management in the Upper Parramatta River Catchment*. Upper Parramatta River Catchment Trust / University of Newcastle, Callaghan NSW

Lower Hunter and Central Coast Regional Environmental Management Strategy (2003). *Water Smart Model Planning Provisions*. LHCCREMS (Subsequently HCCREMS) Thornton NSW.
WSUD Planning

Melbourne Water (2006). *WSUD engineering procedures: stormwater.* CSIRO Publishing, Collingwood Vic.

Upper Parramatta River Catchment Trust (2004). *Water Sensitive Urban Design Technical Guidelines for Western Sydney*. UPRCT, Parramatta NSW

Urban Water Resources Centre, University of South Australia (2005). *Water Sensitive Urban Design: Basic Procedures for 'Source Control' of Stormwater - A Handbook for Australian Practice*. UniSA, SA

Water Sensitive Urban Design in the Sydney Region (2003). *Water Sensitive Planning Guide for the Sydney Region*. UPRCT, Parramatta NSW

Pilgrim, D.H. (1987). *Australian Rainfall & Runoff*. Institution of Engineers Australia, Canberra.

Water Smart Practice Note Series & Fact Sheets
(Available at http://www.hccrems.com.au)

Practice Notes
No. 1 *The Water Smart Home* (P. Coombes & R.D. Paskin)
No. 2 *Site Planning* (R.D. Paskin)
No. 3 *Drainage Design* (P. Coombes)
No. 4 *Rainwater Tanks* (P. Coombes)
No. 5 *Infiltration Devices* (P. Coombes)
No. 6 *Paving* (P. Coombes)
No. 7 *Landscape Stormwater Measures* (R.D. Paskin)
No. 8 *Water Efficient Landscape Practices* (R.D. Paskin)

23 APPENDIX A - RETENTION VOLUMES

Volume: 1.0m³ = 1,000L

Alterations, Additions, Auxiliary Structures and Second Storey Additions					
Increase in developed area in m² (rounding up to the nearest 100)	100m²	200m²	300m²	400m²	500m² or more
Minimum Retention Volume Required	1.5m³	2.0m³	3.0m³	4.0m³	5.0m³

Single Dwellings & Dual Occupancy						
Total Site Area in m² (round up to the nearest 100)	500m² or Less	600m²	700m²	800m²	900m²	1000m² or more
Minimum Retention Volume Required	5.0m³	6.0m³	7.0m³	8.0m³	9.0m³	10m³

Medium Density Development						
Total Site Area in m² (round up to the nearest 100)	1000m² or less	1100m²	1200m²	1300m²	1400m²	1500m² or more
Minimum Retention Volume Required	10m³	11m³	12m³	13m³	14m³	15m³

Higher Density						
Total Site Area in m² (round up to the nearest 100)	1000m² or less	1100m²	1200m²	1300m²	1400m²	1500m² or more
Minimum Retention Volume Required	10m³	12m³	14m³	16m³	18m³	20m³

Industrial						
Developed Area in m² (round up to the nearest 100)	2,500m² or less	3,000m²	4,000m²	6,000m²	8,000m²	10,000m² or more
Volume Required	20.0m³	25.0m³	30.0m³	40.0m³	50.0m³	60.0m³

Other Developments						
Developed Area in m² (round up to the nearest 100)	500m² or less	600m²	700m²	800m²	900m²	1000m² or more
Volume Required	5.0m³	6.0m³	7.0m³	8.0m³	9.0m³	10m³

24 APPENDIX B - PRACTICE NOTES, FACT SHEETS & OTHER GUIDELINES

Practice Notes

Available from HCCREMS at http://www.hccrems.com.au

Practice Note No. 1 - Water Sensitive Homes

Practice Note No. 2 - Site Planning

Practice Note No. 3 - Drainage Design

Practice Note No. 4 - Rainwater Tanks

Practice Note No. 5 - Infiltration Devices

Practice Note No. 6 - Paving

Practice Note No. 7 - Landscape Measures

Practice Note No. 8 - Landscape Practices

Other Guides

GCC Design Specification

GCC Civil Construction Specification

NSW Code of Practice Plumbing & Drainage

Standards Australia

Development Application Guidelines

Rainwater Tank Brochure

Rainwater Tank Information Booklet

GCC Water Web Link

25 APPENDIX C - LIST OF USEFUL WEBSITES & PUBLICATIONS

Australian Runoff Quality
http://www.arr.org.au/arq/index.html

Australian Rainfall & Runoff
http://www.arr.org.au

Australian Water Association (AWA)
http://www.awa.asn.au

Austroads: Guidelines for Treatment of Stormwater Runoff From the Road Infrastructure.
Road Runoff & Drainage: Environmental Impacts and Management.
http://www.onlinepublications.austroads.com.au/

Brisbane City Council WSUD
http://www.brisbane.qld.gov.au/BCC:STANDARD:794608097:pc=PC_1898

Constructed Wetland Manual Vol 1& 2 (DLWC, 1998)

Cooperative Research Centre For Catchment Hydrology - Archive Only (see eWater CRC for Active)
http://www.catchment.crc.org.au/

eWater CRC Catchment Modelling Toolkit
http://www.toolkit.net.au/cgi-bin/WebObjects/toolkit

Fed Government Water Efficiency Labelling Scheme
http://www.waterrating.gov.au

Gosford City Council
http://www.gosford.nsw.gov.au

HCCREMS
http://www.hccrems.com.au/cp_urban.html

Managing Urban Stormwater: Harvesting and Reuse, Department of Environment and Conservation, 2006
http://www.dec.nsw.gov.au

NSW Department of Health.
http://www.health.nsw.gov.au .

NSW Department of Energy Utilities and sustainability
http://www.deus.nsw.gov.au

NSW Department of Planning' BASIX
www.basix.nsw.gov.au

Stormwater Industry Association (SIA)
http://www.stormwater.asn.au/

Urban Development Institute of Australia (UDIA)
http://www.udia.com.au/html/

Urbanwater Info - Tool & Information
http://www.urbanwater.info

Water Sensitive Road Design - Design Options For Improving Stormwater Quality Of Road Runoff - Technical Report
http://www.catchment.crc.org.au/pdfs/technical200001.pdf

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

Water Sensitive Urban Design: Basic Procedures for 'Source Control' of Stormwater - A Handbook for Australian Practice.
Available from AWA & SDIA

WSUD Engineering Procedures - Stormwater
http://wsud.melbournewater.com.au

26 APPENDIX D - EROSION & SEDIMENT CONTROL PAMPHLET

This document is available in hard copy from Council's Customer Service Centre - 49 Mann Street, Gosford.

OR

Download from the links below.

GCC Erosion & Sediment Control Pamphlet

http://www.gosford.nsw.gov.au/environment/education/documents/fact-sheets-2/Erosion Combined Low Res.pdf/download

26 APPENDIX E - EXISTING RAINWATER TANKS

In acknowledging that many existing developments have already installed rainwater tanks, Council may - where it is satisfied that the existing rainwater tank(s) is of sufficient size to meet the objectives DCP 165 and the WCM Guidelines - waive the need to install additional tanks.

Each application will be assessed on its merits and whether the stated objectives can be met by the existing tank(s).

To reduce the proliferation of tanks on any one site, existing tanks may (where approved by Council) provide an offset to reduce the volume and thus size of the new required tank, or the existing tank may be removed and replaced with a larger tank of appropriate size.