ballina
shire council

Stormwater Management Standards for Development

prepared by Ballina Shire Council

As referenced Chapter 2, Section 3.9

Ballina Shire Council Development Control Plan 2012

1 February 2016 Amendment

Table of Contents

PART 1 INTRODUCTION

1.1 Role of "Ballina Shire Council Stormwater Management Standards for Development" (SMS)

This document "Ballina Shire Council Stormwater Management Standards for Development" (SMS) is the primary standard referred to in Section 3.9 - Stormwater Management, Chapter 2, Ballina Development Control Plan 2012.

The principal purpose of the SMS is to provide detailed guidance, clarification and details for:

- Compliance with Section 3.9 - Stormwater Management, Chapter 2, Ballina Development Control Plan 2012
- Design, construction and operation of stormwater management systems and infrastructure
- Stormwater related documentation required to accompany development applications and construction certificate applications

1.2 Relationship of SMS with other Standards

The provisions of this standard should be read in conjunction with current relevant plans and policies that apply to development proposals including:

- Ballina Local Environmental Plan 2012 (LEP)
- Ballina Development Control Plan 2012 (DCP)
- Northern Rivers Local Government Development and Design Specifications
- Queensland Urban Drainage Manual
- Australian Rainfall and Runoff (Engineers Australia)

The SMS contains requirements for the stormwater management aspects of development against which proposals will be assessed when submitted to Council. Variations to this standard may be acceptable, provided the applicant is able to demonstrate compliance with the objectives of the standard and Council's DCP. Where a proponent proposes an alternative method to that required by the SMS, such alternatives will be considered on their merits.

PART 2
DEVELOPMENT CONTROLS

Part 2 of the SMS defines, clarifies and quantifies the development controls in Clause 3.9 - Stormwater Management, Chapter 2, Ballina Development Control Plan 2012.

2.1 Stormwater Conveyance and Discharge

2.1.1 Lawful Point of Discharge

1. A development proposal that:
   - increases stormwater
     - peak discharge
     - volume
     - concentration or
   - changes the location of discharge of stormwater runoff

   will not be approved unless the site has a "Lawful Point of Discharge"

2. A "Lawful Point of Discharge" must be on or adjacent to the site and may be:

   - A natural watercourse, waterway or waterbody to which the development site naturally drains (includes a minor stream and higher order streams as defined in the Water Management (General) Regulation 2011)
   - Stormwater conveyance infrastructure under the lawful control of Council that has continuity between the development site and a natural watercourse, waterway or waterbody. Lawful control of Council may include:
     - Council owned land having a drainage function such as drainage reserves and roads
     - A stormwater drainage easement that benefits Council
   - Stormwater conveyance infrastructure or corridors on private property, where the property owner has granted an appropriate stormwater easement to the development site and such easement has continuity between the development site and a natural watercourse, waterway or waterbody.

3. Pump-out systems for stormwater disposal will only be approved for parking basements, unable to gravitate to a lawful point of dischage. The design of pump well storage and pump design is to be in accordance with AS/NZS 3500.3:2003 Plumbing and drainage - Stormwater drainage.

4. Single residential dwelling sites only, with adverse fall (land lower than the adjopining road), unable to gravitate stormwater runoff to a lawful point of discharge, may dispose stormwater to an on-site infiltration system provided:

   - The infiltration system is sized to disperse all stormwater runoff from roof and paved areas without surcharging for up to the 20 Year ARI event
   - Infiltration dimensions are sized with a safety factor of 2, to allow for long term deterioration of the initial infiltration rate
   - Runoff entering infiltration trenches/basins/cells is pre-treated to remove sediment and gross pollutants.
   - The infiltration rate for infiltration devices is determined as follows:

     i. Conduct percolation tests on the site in accordance with Appendix G of AS/NZS. 1547:2012, On-site Domestic wastewater management,

     ii. if the above yields a result <6m/day, the measured rate shall be used for design

     iii. if the result is >6m/day, the rate for design may not exceed 6m/day
   - Infiltration systems are not located in areas where there is risk of these systems increasing land slip, instability or foundation soil deterioration on the subject site or nearby land.

2.1.2 Stormwater Conveyance

2.1.2.1 Principles

New Developments are to provide stormwater runoff conveyance systems in accordance with Section 7 of QUDM and incorporate the Major/Minor System concept as described in QUDM 7.2

2.1.2.2 Hydrology

Hydrology calculations shall be in accordance with Section 4 of QUDM.

In this regard:

- IFD relationships shall be in accordance with Appendix B of this Standard.
- The major and minor systems shall be designed in accordance with the nominated ARIs in Table 3.1 (reproduced in Appendix C) and Table A.1 of the Handbook.
- The preferred method to derive flows and volumes for design of new systems and investigation of existing systems is one that provides a full hydrograph and not just a peak flow. Alternative methods may be used depending on its application in accordance with Table 2.1 below:
- The fraction impervious amounts designated in QUDM Table 4.5.1 shall default to the higher values where a range is given unless it can be demonstrated that the ultimate development will be lower.

Table 2.1: Acceptable methods for deriving flows and volumes

Design/ Application	Probabilistic Rational Method	Rational *Method	Full Hydrograph Method	Empirical Equations
Design of new reticulation ≤ 600mm diameter	NO	YES**	YES	NO
Design of new reticulation >600mm diameter, open channel and trunk drainage	NO	NO	YES	NO
On site Detention	NO	NO	YES	NO
Assessment of capacity of existing infrastructure and determination of permissible site discharges	NO	NO	YES	NO
Rural road culverts and cross drainage	YES	NO	YES	NO

* Notwithstanding above, it is preferable that hydrograph method be used for design of all stormwater infrastructure that will be placed in or transferred to the public domain

** See also the tc limit of 20 minutes in Appendix B.

2.1.2.3 Urban Drainage and Hydraulics

1. Urban drainage and hydraulics shall be designed in accordance with Section 7 of QUDM. Hydraulic calculations and presentation of results shall be in accordance with the recommendations of QUDM 7.16 and in this regard:
    - The hydrological and hydraulic design of new stormwater reticulation systems shall be validated using DRAINS as a preferred method, however other equivalent software packages may be approved by Council. Refer to appendix B for preferred parameters.
    - Where the outlet is tidal, the design downstream control shall not be lower than:
        - 0.6 m AHD for minor system design
        - 1.0m AHD for major system design
    - Where the outlet relies on artificial drains in Nature Reserves, National Parks or on a floodplain, the design outlet level control must assume that these drains are filled back to natural surface

- Where the above drains are tidal, under the lawful control of Council, there is all weather access along at least one side of the drain (to enable maintenance access) and there is planning approval to maintain such drains to their current cross section in perpetuity, the design downstream control may be lowered to 0.6m AHD
- Where major flows are jointly conveyed by underground and overland systems, the overland flow path shall be sized to convey
  - **100%** of major system design flow for land **below RL2.0m** AHD
  - **50%** of major system design flow for all other land

2. Cut-off drains may be required to prevent sheet flow from adjacent properties entering the developed land. These drains must be protected by an easement, connected to stormwater infrastructure and directed to a lawful point of discharge
3. Provision must be made for the future orderly development of adjacent upstream/up slope properties with respect to stormwater drainage where part or the whole of these upslope properties would drain through the development, or the most feasible location for stormwater drainage infrastructure to service those properties is within the development.
   - In this regard, piped drainage connection shall be extended to the boundary of the up-slope site to provide a lawful point of discharge for up-slope development. stormwater infrastructure.
   - Stormwater conveyance infrastructure within the development site catering for up-slope stormwater connections (now or in future) is to be sized for fully developed catchment flows.
4. Easements for stormwater, benefiting upstream land (or Council or the public as may be appropriate) are to be provided where stormwater or groundwater discharge from upstream land is conveyed through the site. Provision of stormwater easements is to be in general accordance with QUDM 3.8 unless varied by this standard. Dimensions of easements shall be in accordance with QUDM 3.8.5, except for private interallotment drainage 225 mm or smaller, easement width may be reduced to 1.5 m.

   The terms of Stormwater Easements shall be as prescribed in Schedule 4A of the Conveyancing Act 1919 and amended by addding the following:

   Full and free right and liberty for the lot benefited and its authorised users to enter upon the lot burdened to lay, maintain, alter, enlarge, replace or duplicate pipes and pits; restore the cross section profile of any overland flow path or channel and permanently remove any obstacles or barriers within such flow paths or channels. The owner of the lot burdened must not erect, construct or place upon the easement any building, outbuilding, garden shed or other structure; or do anything that would compromise the cross section profile of any overland flow path or channel.
5. Freeboard and flow depth and width limitations is to be provided in accordance with QUDM 7.3.12 - 7.3.15 except that for habital buildings the 300 mm freeboard shall be increased to 500 mm.
6. Interallotment and roof drainage shall be in accordance with the requirements and recommendations of QUDM 7.13 except as amended by this standard.
   - Interallotment drainage shall be designed to accept flow from buildings, impervious areas and the overflow of WSUD devices
   - Pipe sizes shall be a minimum 150mm diameter for up to two lots and a minimum 225mm diameter for more than two lots
   - Interallotment drainage, minimum Level II (QUDM Figure 7.13.1), shall be provided for every allotment that does not gravitate to a natural watercourse, public drainage system or a street frontage that contains stormwater drainage infrastructure with sufficient capacity to accommodate such discharge.
7. Overland flow paths conveying runoff from public land in urban residential environments are to be located in public land (ie: drainage reserves/pathways/roads) and not within easements. This is due to clashes with fencing/improvements and the high likelihood of landform changes within the private property. Overland flow paths may be located in easements in rural areas.

2.1.2.4 Limitations of Discharge to Council Infrastructure

1. Connection to kerb and gutter
   - The maximum permissible discharge to kerb and gutter is 30L/s for each kerb

adaptor. Single or multiple hot dip galvanised rectangular hollow sections (RHS) 125/150/200mm wide x 75mm or 100mm high must be used across verges where there is insufficient cover to protect PVC pipelines, or where concrete footpaths or cycleways exist or are proposed.

- Discharge into the high side kerb of a one-way crossfall street is generally not permitted for any development.

2. Piping across a public road

- Piping the property system across the road is not permitted. However, extending Council's stormwater system across the public road to facilitate disposal of stormwater from the property is allowable subject to ensuring that hydraulics of the existing system are not adversely affected.

3. Charged systems

This applies only for single dwellings where it can be demonstrated that the roof gutters are a minimum of 1m above the road gutter to permit drainage by a sealed system.

All charged systems are to provide the following:

- A purge point at the lowest point of the drainage pipe system for cleaning and flushing of the charged line.
- The purge point is to connect to an approved soakage trench with a holding capacity of 1.5 times the volume contained within the charged pipe lines such that purging will not result in flows discharging to downstream properties.
- The charged line is to discharge into a 450mm square grated pit on the inside property boundary at the road frontage. The pit is to drain by gravity at a minimum grade of 1% from the property boundary to the gutter connector. The pit grate level is to be set at a minimum of 200mm above the top of kerb level to which it is draining. A charged line cannot be directly connected to an inter-allotment or Council drainage system.

2.2 Water Sensitive Design

2.2.1 Natural Hydrologic Characteristics of Catchments

The natural hydrologic characteristics of catchments are to be preserved by minimising the quantity of directly connected impervious surfaces and maximising the retention of their surface runoff. Except where dual reticulation is available or planned, opportunities for rainwater/stormwater to be used to reduce site potable water consumption are to be identified, optimised and incorporated into development proposals. In recognising that dual reticulation diverts treated wastewater from discharge to the environment, consideration will be given to assigning to a development, the pollutant reduction (TSS, TP, TN) diverted by this process.

2.2.2 Ecological Health of Natural Drainage Systems, Waterways, Waterbodies and associated Riparian Zones

Watercourses and their associated riparian vegetation shall, unless extraordinary circumstances can be justified to Council, be left in an undisturbed a state, without redirection, reshaping or modification. Where these features are degraded on a development site, they shall be restored to natural condition. Works within the riparian corridors of waterfront land under the Water Management Act 2000 shall be in accordance with Guidelines for Riparian Corridors on Waterfront Land (Department of Primary Industries Office Of Water, 2012).

2.2.3 Reduction and Treatment of Stormwater Pollution

Development must achieve the following minimum reductions in pollutant loads (TP, TSS, TN and GP) in relation to untreated runoff from the proposed development (based on a comparison of the unmitigated development case versus the developed mitigated case).

- 80% reduction in total suspended solids (TSS)
- 60% reduction in total phosphorus (TP)
- 45% reduction in total nitrogen (TN)
- 90% reduction in gross pollutants (GP).

The performance of stormwater treatment devices shall be validated by the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) using the parameters in MUSIC modelling guidelines by Water by Design (SEQ Healthy Waterways Partnership, 2010) and Appendix B.

Alternatively eligible development may provide stormwater treatment prescribed in the deemed to comply solutions in Part 3 of this Standard.

2.2.4 When Stormwater Treatment is Not Required

Stormwater treatment is not required by this standard for:

- Runoff form single residential dwellings, dual occupancies and secondary dwellings
- Development sites within a subdivision that has already provided compliant end of pipe stormwater treatment for the whole subdivision

2.2.5 Upstream Flow

The proponent is not required to treat stormwater flows from upstream of the development site on the basis the stormwater management of the development is off-line. This involves maintaining separation between the "clean" upslope runoff and the untreated "dirty" runoff from the site prior to treatment. Where the development's stormwater management system combines untreated runoff with "clean" upslope catchments, the treatment facility shall be sized to cater for the additional loading from upslope catchment area and the development site.

2.2.6 Source Control - v End of Pipe Treatment

For treatment of stormwater in the public realm, the number and size of devices shall be determined to minimise maintenance, cleaning and other whole of lifetime costs. Low maintenance souce controls such as filter strips, buffers and swales are encouraged, however multiple source control devices such as pit inserts which require frequent pollutant removal at multiple sites are not permitted due to their high operating costs.

Lower whole of lifetime cost, centralised, end of pipe systems are preferred.

2.2.7 Catchment Treatment Offsets

Where a number of sub-catchments discharge to a common receiving waterway, conditions permitting, compliance with the standards in 2.2.3 may be for the sum of contributing catchments (i.e. undertreatment in one subcatchment may be offset by equivalent compensating over treatment in another subcatchment).

2.3 Management of Stormwater Runoff from Development

2.3.1 Principles

1. Changes to the natural or pre-development runoff volume, peak discharge rate, frequency, duration and velocity of stormwater by development and associated stormwater systems shall be managed to ensure no significant adverse flooding or ecological impacts on downstream land, landuse and receiving systems.
2. Stormwater runoff shall not be concentrated or diverted in a manner that causes any significant adverse flooding impacts, damages or nuisance to any downstream persons, public property or private property.

2.3.2 When stormwater discharge attenuation is not required

Attenuation of post development stormwater discharge is required in accordance with the design criteria in 2.3.3, except for the following development categories:

General Development

- The site discharges directly into the Richmond River or other tidal waterway or waterbody
- The applicant can demonstrate to Council's satisfaction that, if the total catchment containing the site were developed to its full potential while maintaining the existing infrastructure, stormwater detention on the subject site would not be of benefit in reducing adverse flooding impacts on downstream roads, properties and open watercourses.
- The downstream drainage system has capacity available, has been upgraded, or is proposed to be upgraded by the development to cater for fully developed peak flows from the catchment to Council's standard of service (for major and minor drainage systems) being:
    - to ensure that flows discharging from the site to an existing urban area, up to the design minor storm event, will be contained within the downstream minor system network
    - to ensure the freeboard, flow width and flow depths in the downstream major flow path in the 100 year ARI major event comply with this standard and QUDM 7.2

- to ensure there is no adverse downstream flooding impact in the ARI 20 year and ARI 100 year events.

Brownfield (infill) Development only

- Single residential dwellings, dual occupancies and secondary dwellings, or
- The development will not result in the impervious area of the site exceeding 40% of total area, or
- The development will not increase the impervious area of the site by >300 m2, or
- The development site is located within a 1% AEP local catchment major flow path and is burdened with the requirement to cater for conveyance of overland flow, or
- Development sites within a subdivision that has already provided compliant end of pipe stormwater attenuation for the whole subdivision.

2.3.3 Detention Systems, Design Criteria

Sufficient detention storage and outlet control shall be provided:

(a) Greenfield Development
Method 1 (preferred)

- to ensure that flows discharging from the site to an existing urban area, up to the design minor storm event, will be contained within the downstream minor system network, and
- to ensure the freeboard, flow width and flow depths in the downstream major flow path in the 100 year ARI major event comply with this standard and QUDM 7.2, and
- to ensure there is no adverse downstream flooding impact up to the ARI 100 year event;

Note: If the analysis for Method 1 demonstrates there is sufficient downstream capacity to meet the above performance criteria without detention, or it is proposed to augment downstream conveyance in accordance with 2.3.2, then no detention is required.

Method 2

a) to ensure no increase in pre to post development peak 5, year 20 year and 100 year stormwater discharge from the site and

b) to give full regard to the downstream drainage system to which the development drains to ensure that there is no increase in the frequency of surcharge events and ensure there is no adverse downstream flooding impact up to and including 100 year ARI event.

Note that in instances where existing piped systems have a capacity less than 5 year ARI, it is Councils expectation that a detention system be designed to attenuate lesser ARI's (consistent with the existing downstream system capacity, to satisfy (b) above.

(b) Brownfield Development

- to ensure no increase in pre to post development peak 5, year 20 year and 100 year stormwater discharge from the site

Note: In regard to downstream conveyance data required for analysis for Methods 1 and 2, Council will provide to consultants any available, relevant stormwater models, stormwater management plans/calculations and work as executed plans.

(c) Deemed to comply (sites up to 2,000m^2)

- eligible development defined in 3.3.1 may provide stormwater attenuation prescribed in the deemed to comply solutions in Part 3 of this Standard or
- ensure no increase in pre to post development peak 5, year 20 year and 100 year stormwater discharge from the site justified with hydrological modelling in accordance with the criteria for Brownfield Development

2.3.4 Detention/Retention Systems, Sizing

Sizing and design of detention storage must be justified using a suitable run-off or storage routing model (e.g. DRAINS (ILSAX method), RAFTS, RORB, WBNM) that:

- considers the capacity of an existing stormwater system or overland flow path to which the development drains
- demonstrates there is no increase in flooding as a result of overland flow changes (in excess of the minor system capacity where applicable) through private property
- considers any effect that attenuation has on lagging of the peak hydrograph downstream of the site
- extends sufficiently downstream to a point (such as a major confluence point) downstream where there is no significant change in the hydrograph peak flow rate and time to peak
- considers both the immediate effects of changes to catchment conditions and the cumulative effect of future development.
- uses the methodology and parameters in Appendix B

2.3.5 Detention/Retention Systems, General Design Requirements

1. The design of stormwater detention and retention systems is to refer to QUDM 5. for all design elements, including but not limited to, embankments, spillways, low and high flow outlets, freeboard, basin grade and scour control.

2. Stormwater detention is to be offline existing creeks/flow paths which are second order water courses or greater (unless an exemption is granted by the NSW Department of Primary Industries, Office of Water). Detention systems which receive external catchments must be hydraulically sized (but do not have to attenuate) for total catchment area flows.

3. Where stormwater from any public asset such as a road reserve is directed into a stormwater detention system, these detention systems must be located within public land such as a drainage reserve, but shall not be located within road reserves. Only above-ground detention storages will be permitted in Council-owned lands. Underground tanks in public roads will not be approved.

4. Above-ground detention basins that integrate with water quality treatments shall locate the detention storage requirement above the water quality extended detention depth. Active detention volumes required for attenuation shall exclude extended detention volumes used for the retention and treatment of stormwater.

5. For greenfield subdivisions, the installation of on-site (lot-based) stormwater detention facilities in a residential subdivision on each freehold lot is not an acceptable solution as there are no satisfactory means to ensure these facilities are operated, protected or maintained in perpetuity.

6. The installation of on-site (lot-based) stormwater detention facilities in small infill residential subdivisions on each freehold lot will be considered where there is no public realm alternative.

7. Detention/retention facilities on common property controlled and managed by the body corporate on strata or community title residential subdivisions are acceptable, provided they are accessible to maintenance vehicles.

8. Stormwater detention tanks in non strata/community title commercial or industrial developments are acceptable, if located on privately owned roads/driveways and accessible to maintenance vehicles. Stormwater detention tanks in residential or commercial or industrial strata/community title land are acceptable, provided they are located on common property and accessible to maintenance vehicles.

9. Where applicable, an inspection and maintenance schedule for stormwater management systems and devices shall be incorporated into the Strata By-Laws or Community Title Management Statement.

2.4 Lifecycle of Stormwater Infrastructure

2.4.1 Principles

Stormwater management systems should

- be economically sustainable minimising whole of life cycle costs.
- provide safe conditions for operating personnel and the public
- be readily maintainable
- be provided with suitable maintenance access

2.4.2 Stormwater infrastructure provided for the public realm

1. Development applications that include or require provision of stormwater management infrastructure, must also simultaneously seek approval for ongoing, in perpetuity; operation, maintainance and end of life replacement of such stormwater infrastructure.

2. The type, number and location of stormwater infrastructure devices shall be selected to ensure minimum long term asset ownership costs.

3. Stormwater infrastructure must be designed to: be readily and economically maintained; optimise service life; and minimise total lifecycle costs for operation, maintenance and periodic replacement.

4. Stormwater infrastructure, located off street, shall be provided with a legally enforcable (easement, right of way, etc) and all weather surface constructed access and necessary turnaround facilities for operation, cleaning and maintenance by Council vehicles and plant.

5. All basins shall have an all weather vehicle access ramp minimum 2.5m wide to the base of all basins.
6. All gross/sediment pollutant traps which require vacuum for cleaning must be provided with an all-weather access minimum 3m wide to within 3m of the device access opening. This access must be off any roadway, or be such that traffic control will not be required to facilitate cleaning. Any off street access way shall be designed for a HR vehicle to AS2890.2. Indented parking/service bays onstreet are permissible where safe servicing of devices can be demonstrated.
7. All drainage pits must have an access opening at or above the surface level with minimum of 600 mm internal opening. Access for cleaning/maintenance by means of hatches, doors or lids shall be constructed in high strength, lightweight materials with lockable and easy opening fastening devices. All access covers, pit and pipe components below RL1.0 shall be “marine” grade
8. All infrastructure shall be designed to be safe and minimise risk to operators and the public.
9. Side slopes to drains, basins, swales and other stormwater infrastructure should be max 1:6 for the majority of its length. Steepening of batters to a maximum 1:4 is acceptable for short lengths (less than 20% of total batter length). Retaining walls are not acceptable, where they will restrict safe maintenance access or activities. Minimum longitudinal grade of constructed vegetated channels and swales shall be 0.5%.

2.5 Standards

2.5.1 Compliance with Development Control Plan

The Primary and Secondary standards and QUDM where referenced are to be observed for Compliance with Section 3.9 - Stormwater Management, Chapter 2, Ballina Development Control Plan 2012.

2.5.2 Precedence of Standards

1. The primary standard for provision of stormwater management systems and infrastructure is this document "Ballina Shire Council Stormwater Standards for Development".
2. The Secondary Standard is the "Northern Rivers Local Government Development and Design Manual".
3. Where there is any inconsistency between these standards, the primary standard shall prevail to the extent of the inconsistency.
4. For matters of design detail the Primary Standard has a number of references to "Queensland Urban Drainage Manual" (QUDM) Third Edition 2013 - provisional. In these circumstances QUDM shall prevail to the extent of any inconsistency with the Secondary Standard.

2.5.3 Stormwater Management Plans

1. Stormwater management plans are required for all development proposals (unless exempted by 2.5.3.4) and shall comprise the following elements:
   a) Conveyance:

      Plan of contributing catchments, conveyance system (location/network, sizing and grades) and proposed lawful point of discharge

   b) Detention, Retention and Treatment Systems (including erosion and sediment control):

      Demonstrated compliance with standards, design calculations and plans of devices. Operation, cleaning, performance monitoring and mainenance schedules
2. Stormwater management plans submitted with development applications are to be of concept standard only, but must be sufficiently detailed to identify feasibility and sizing of area/footprint requirements.
3. Stormwater management plans submitted with construction certificate applications must be of detailed design standard and include all necessary drawings and specifications for construction. Completed operation, cleaning, performance monitoring and mainenance schedules for all stormwater management devices must be completed and included with the construction certificate application. Where deemed to comply solutions are submitted they must be accompanied by completed and signed copies of Tables 3.2 and 3.4.
4. Stormwater management plans are not required for:
   - Single dwellings on an allotment and secondary dwellings
   - dual occupancies.

PART 3
DEEMED TO COMPLY SOLUTIONS

3.1 Deemed to Comply Solutions

The categories of development designated in 3.1.1 may utilise deemed to comply solutions in 3.2 and 3.3 for compliance with 2.2.3 (stormwater treatment) and 2.3.4 (detention/retention) standards.

3.1.1 Deemed to Comply - Eligible Development Categories

Industrial, Residential and Business Developments with Total Site Area <2000m2, will meet the design criteria specified in Section 2.2.3 and 2.3.4 by implementing the arrangements shown in 3.2 and 3.3.

3.2 Deemed to Comply Stormwater Treatment

Deemed to comply solutions for stormwater treatment must comply with the Design Criteria in Table 3.1 and the sizing determined by Table 3.2.

Table 3.1 Design Criteria for Stormwater Treatment Devices

Treatment Device	Design Criteria
Rainwater Tanks	• Applies to roof areas Only • Minimum storage of **10L/m²** of Roof Area • Reuse is connected to **outdoor taps** and **toilet cisterns** as a minimum to claim treatment.
Bioretention Basin & Bioretention Swales	• Minimum Filter media of **1m² per 50m² (2%)** of impervious catchment area • Extended detention capture volume of **5L/m²** of impervious catchment area (first 5mm of impervious rainfall)
Infiltration Trenches	• Suitable only for well drained soils with minimum hydraulic conductivity of **50mm/h** • Infiltration footprint area of minimum **1m² per 20m²** of impervious catchment area • Extended detention capture volume of **5L/m²** of impervious catchment area
Permeable Paving	• Suitable only for sandy soils and well drained clay loams (red soils) • 100% impervious catchment claimed for treatment to be permeable paving. External catchments excluded from treated catchment areas. • Pavement Details to be included for approval
Proprietary Devices/GPTs	• Applicable only in conjunction with other treatment devices.

Table 3.2 - Sizing Sheet for Deemed to Comply Stormwater Quality Treatment

Site Address: _____

	Site Details			
1	Total Site Area	…….	Ha	
2	Total Impervious area draining to treatment	…….	Ha	
3	Total Impervious area bypassing treatment	…….	Ha	

	Rainwater Tank Details		*System 1*[1]	*System 2*[1]	*System 3*[1]		
4	Roof area draining to tank		……..	……..	……...	Ha	A
5	Minimum storage Capacity	[A x 100]				KL(m^3)	VOL
6	First Flush Volume	[A x 2000]				L	FF

	Bioretention System Details		*System 1*[1]	*System 2*[1]	*System 3*[1]		
7	Catchment Area of System[1]		……	……...	……...	Ha	B
8	Impervious Fraction		……	……...	……...		C
9	Filter Media Area	[B xC x200]				m^2	AREA
10	Extended Detention Volume	[B xC x50]				m^3	VOL

	Infiltration System Details		*System 1*[1]	*System 2*[1]	*System 3*[1]		
11	Catchment Area of System[1]		……...	……...	……...	Ha	D
12	Impervious Fraction		……...	……...	……...		E
13	Infiltration Area	[D xE x500]				m^2	AREA
14	Extended Detention Volume	[D x E x50]				m^3	VOL

	Permeable Paving Details	*System 1*[1]	*System 2*[1]	*System 3*[1]		
15	Impervious area with permeable paving				m^2	AREA

	Design Checks		
16	Total Impervious Area bypassing treatment <10% of Total Impervious Area	YES	NO
17	Flows can be captured and piped up to minor system design ARI	YES	NO
18	Overflow provided for up to 100 year ARI	YES	NO

Note:

1. Where multiple treatment systems are proposed, details to be provided for each system.

Signature…… Name (print)……

Qualifications…… Date……

3.3 Deemed to Comply Stormwater Detention/Retention

Deemed to comply solutions for stormwater detention/retention must capture at least 90% of impervious surface runoff and comply with the Permissable Site Discharge (PSD) and Site Storage Requirements (SSR) in Table 3.3 and the sizing determined by Table 3.4.

Table 3.1: Rates for Permissible Site Discharge (PSD) and Site Storage Requirement (SSR)

Pre-development Impervious fraction	PSD[1] (L/s/ha)	SSR[2] (m3/ha)
0%	410	315
10%	425	305
20%	440	290
30%	480	260
≥40%	520	215

Notes:

1. PSD is in units of L/s per hectare of **total catchment** area
2. SSR is in units of m^3 per hectare of **impervious** area and is not total area.

Refer to calculation sheet Table 3.4

Table 3.4 - Sizing Sheet for Deemed to Comply Stormwater Retention/Detention

Site Address: _____

	Site Details				
1	Total Site Area	.....	Ha		
2	Existing Fraction Impervious	.....			
3	PSD Rate (per total catchment area)	.....	L/s/ha		A
4	SSR Rate (per impervious catchment area)	.....	m^3/ha		B
5	Developed Total Impervious Area	.....	Ha		C
6	Total Site Storage Requirement	[B x C]		m^3	SSR_T
7	Total Pervious area bypassing detention	.....	Ha		
8	Total Impervious area bypassing detention	.....	Ha		D

	Detention System Details		*System 1*	*System 2*	*System 3*		
9	Catchment Area of System		.....	.....	.....	Ha	E
10	Impervious Fraction		.....	.....	.....		F
11	PSD – System 1	[A x E]				L/s	PSD
12	Top Water Level (TWL)		.....	.....	.....	m AHD	G_1
13	Storage Required at TWL	[E x F x B]				m^3	SR
14	Centre RL of Orifice		.....	.....	.....	m AHD	H
15	Head at TWL	[G – H]	.....	.....	.....	m	I
16	Orifice Diameter					mm	DIA

	Design Checks		
17	Orifice/ Outlet provides free discharge for 100 year ARI HGL	YES	NO
18	Sum of individual storages [SR] achieves [SSR_T]	YES	NO
19	Debris Screen Provided to all discharge control structures	YES	NO
20	No adverse stormwater impacts on adjoining properties	YES	NO

PSD – Permissible Site Discharge

SSR_T – Total Site Storage Requirement

SR - Storage Required for each system

Note: Where multiple storages are proposed, Detention details to be provided for each system.

Signature..... Name (Print).....

Qualifications..... Date.....

3.4 Deemed to Comply Example Drawings

Drawings SW-001, SW002, SW003, SW004, SW005 and SW006 are examples of how to apply the deemed to comply criteria for stormwater treatment and stormwater retention/detention.

PART 4
STORMWATER TREATMENT DEVICES

4.1 Design of Treatment Devices

Table 4.4 outlines the specific criteria and Council standard drawings for respective stormwater treatment devices and references the relevant design guidelines (and chapters) to be referred to when undertaking the detailed design of the devices. Designers of stormwater treatment devices should refer to the following guidelines:

- Technical Design Guidelines for South East Queensland (TDGSEQ) (Moreton Bay Waterways and Catchments Partnership, 2006)
- Bioretention Technical Design Guidelines (BTDG) (Water by Design, 2012)
- Rainwater Tank Design and Installation Handbook (RWDIH) (MPMSAA, 2008)
- Guidelines for Filter Media in Biofiltration Systems (FAWB, 2009)

Appropriate measures shall be undertaken to select a treatment device which is suitable to the site constraints and scale of the development, as not all of the stormwater treatment devices presented in these guidelines is suitable for any given site. Table 4.1 provides a summary of the physical constraints affecting various treatment measures suitable to various site conditions.

Table 4.1: Suitability for Stormwater Treatment Measures for various site constraints (TDGSEQ, 2006)

Stormwater Treatment Measure	Site Condition						
	Steep Site (>5%)	Shallow Bedrock	Acid Sulfate Soils	Low Permeability (Clay and Pug)	High Permeability (Sand)	High Water Table	High Sediment Input
Swales and buffer strips	D	D	D	✓□	✓	D	D
Bioretention swales	C	C	C	✓	✓	C	D
Bioretention basins	D	D	D	✓	✓	D	D
Constructed wetlands	C	D	C	✓	D	D	D
Treatment ponds	D	C	C	✓	D	C	D
Infiltration measures	D	C	C	C	✓	C	C
Rainwater tanks	✓	✓	✓	✓	✓	✓	D
GPTs	✓	D	✓	✓	✓	D	✓
Pit insert traps	✓	✓	✓	✓	✓	D	✓
Porous paving	D	C	D	D	✓	D	D

C - Constraint generally preclude suitability for use
D - Constraint can generally be managed through appropriate design
✓- Generally suitable and not a constraint

Table 4.2 Design Criteria for Stormwater Quality Treatment Devices

Treatment Measure	Specific Criteria	Design Guide Reference
Turf Swales and buffer strips	• Minimum longitudinal Slope 1%[2] to Maximum Slope 4% • Minimum base width 1m • Maximum batter slope 1V:6H • Buffer strip to be provided for all paved surfaces directly draining to swale and incorporate a minimum 50mm step down from pavement edge • Base width designed to have **50mm** maximum depth of flow at **60% of 1 year ARI** flow rate (manning n=0.1) • 100 year ARI flow V<2m/s and VxD<0.4	TDGSEQ (Chapter 2)
Bioretention basins	• Maximum batter slope 1V:6H preferred 1V:4H absolute max • Filter media depth **0.3m** minimum **0.7m** maximum • Filter media as specified in standard drawing SW-104 (Appendix A) • Catchments >1Ha to provide pre-treatment by GPT • 3.0m wide Maintenance access path to be provided • Buffer strip to be provided for all paved surfaces directly draining to bioretention and incorporate a minimum 50mm step down from pavement edge	BTDG FAWB
Bioretention swales	• Minimum Longitudinal Slope 0.5% to Maximum Slope 2% • Minimum base width 1m • Maximum batter slope 1V:6H for buffer 1V:4H absolute max for swale • Filter media depth **0.4m** • Filter media as specified in standard drawing SW-104 (Appendix A) • Buffer strip to be provided for all paved surfaces directly draining to swale and incorporate a minimum 50mm step down from pavement edge • 100 year ARI flow V<1m/s and VxD<0.4	BTDG FAWB
Constructed wetlands[1]	*(Consult Council officers for design criteria)*	
Treatment ponds[1]	*(Consult Council officers for design criteria)*	
Infiltration Measures	• Suitable only for well drained soils with minimum hydraulic conductivity of 50mm/h • Must provide overflow to legal point of discharge Must be located a minimum 2.0m from property boundaries and 3.0m from buildings	TDGSEQ (Chapter 7)

TREATMENT MEASURE	SPECIFIC CRITERIA	DESIGN GUIDE REFERENCE
Rainwater tanks	• Reuse must be connected to all cisterns and a minimum of 1 outdoor tap to claim pollutant removal. • Not acceptable as treatment system for dual reticulation sites (recycled water), but, see also 2.2.1. 20L First flush diverter to be provided per 100m2 of roof area for all tanks to be used for internal use.	RWDIH
GPTs	• Treatable Flow Rate 60% of 1 year ARI peak discharge • Must include High Flow Bypass • Headloss across the unit in bypass must be accounted for in the hydraulic gradeline analysis in stormwater reticulation design for the appropriate design ARI	
Pit insert traps	• Acceptable only for temporary strategy only eg. Land release prior to construction of basins	
Permeable paving	• Suitable only for well drained soils	

Notes:

1. Council discourages the use of wet basins for use in stormwater treatment due to maintenance and mosquito habitat. Consideration may be given to constructed wetlands and treatment ponds on a precinct or regional scale in consultation with Council officers to determine design requirements.
2. A reduced grade of 0.5% may be acceptable with the incorporation of subsoil drainage.

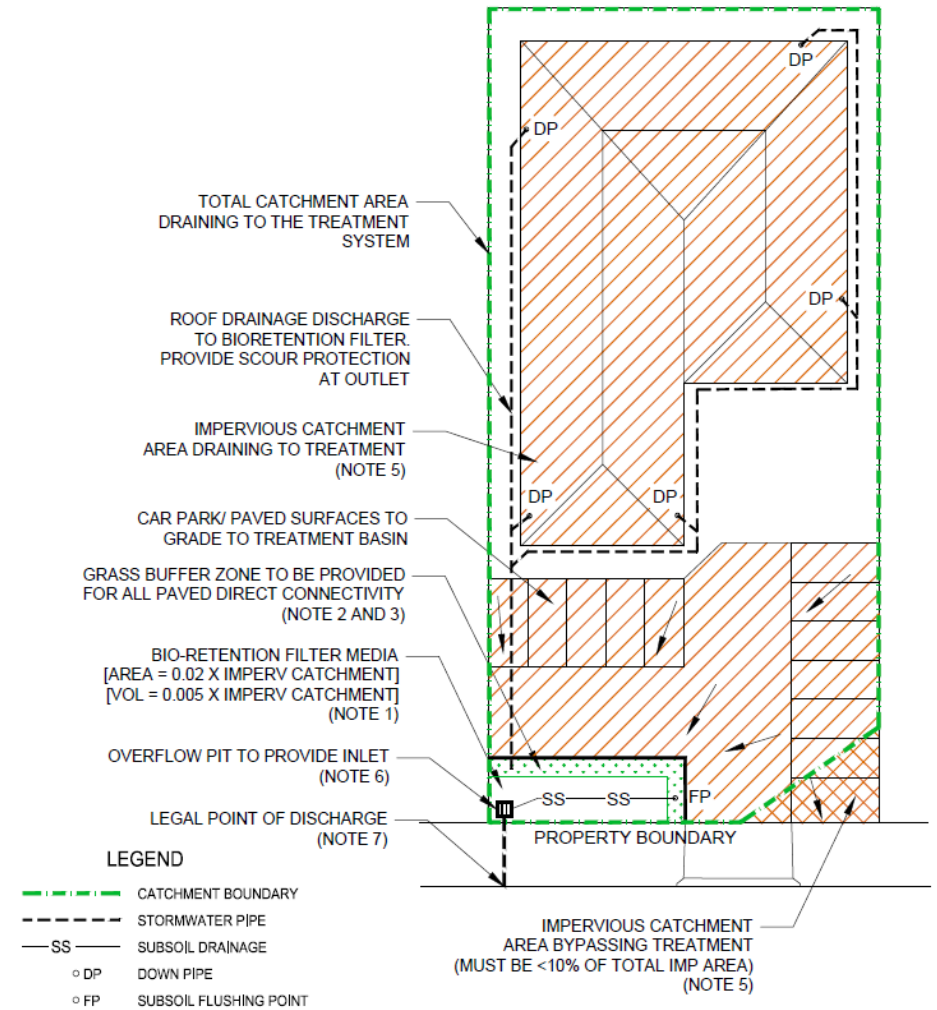
List of Abbreviations and Definitions

AEP	Annual Exceedance Probability
AHD	Australian Height Datum
ARI	Average Recurrence Interval
AS	Australian Standard
BTDG	Bioretention Technical Design Guidelines (Water by Design, 2012)
Brownfield Development	Redevelopment of a site(s) within an existing urban area
Council	Ballina Shire Council
CSMP	Comprehensive Stormwater Management Plan
D5	Northern Rivers Local Government Development Design Specification D5, Stormwater Drainage Design
Dia	Diameter
DCP	Ballina Development Control Plan 2012
EP&A Act	Environmental Planning and Assessment Act, 1979
EPAR	Environmental Planning and Assessment Regulation, 2000
EPI	Environmental Planning Instruments including SEPPs and LEPs
ESD	Ecologically Sustainable Development
FAWB	Guidelines for Filter Media in Biofiltration Systems (FAWB, 2009)
FPL	Flood Planning Level
GP	Gross Pollutants
GPT	Gross Pollutant Trap
Greenfield Subdivision	Subdivision development of land for urban purposes that takes place on land that has not been subject to urban land uses in the past.
Handbook	Northern Rivers Local Government Handbook of Stormwater Drainage Design
LEP	Ballina Local Environmental Plan 2012
LG Act	Local Government Act, 1993
MGA94	Map Grid of Australia Based on the geographic coordinate system ‘Geodetic Datum of Australia 1994’
NRLGDM	Northern Rivers Local Government Design Manual

NSW	New South Wales
OSD	On Site Detention
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
PSD	Permissible Site Discharge
QUDM	Queensland Urban Drainage Manual, Third edition 2013 - provisional
RWDIH	Rainwater Tank Design and Installation Handbook (MPMSAA, 2008)
SEPP	State Environmental Planning Policy
SMP	Stormwater Management Plan
SMS	Ballina Shire Stormwater Management Standards (this document)
SSR	Site Storage Requirement
TDGSEQ	Technical Design Guidelines for South East Queensland (Moreton Bay Waterways and Catchments Partnership, 2006)
TN	Total Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
Water Management Act	Water Management Act, 2000
WSUD	Water Sensitive Urban Design

Appendix A
STANDARD DRAWINGS

Drawing Number	Drawing Title	Revision	Date
000 Series	TYPICAL LAYOUT PLANS FOR SWMP (<2000m2)		
SW-001	Arrangement 1 – Incorporating Bioretention		
SW-002	Arrangement 2 – Incorporating Rainwater Tanks		
SW-003	Arrangement 3 – Incorporating Infiltration		
SW-004	Arrangement 4 – Incorporating Above Ground OSD		
SW-005	Arrangement 5 – Incorporating Rainwater Tanks for OSD		
SW-006	Arrangement 6 – Incorporating Below Ground OSD		



	Site Details		
1	Total Site Area	.....	Ha
2	Total Impervious area draining to treatment	.....	Ha
3	Total Impervious area bypassing treatment	.....	Ha

	Bioretention System Details		*System 1*[†]	*System 2*[†]	*System 3*[†]		
7	Catchment Area of System[1]		.....	.....	.....	Ha	**B**
8	Impervious Fraction		.....	.....	.....	%	**C**
9	Filter Media Area	[B xC x200]				m^2	**AREA**
10	Extended Detention Volume	[B xC x50]				m^3	**VOL**

NOTES

1. THE BIO-RETENTION ZONE CAN BE BROKEN DOWN INTO NUMEROUS SEPARATE BASINS. THE SIZE OF EACH BASIN SIZE IS DETERMINED ACCORDING TO THE CATCHMENTS DRAINING TO THE RESPECTIVE BASINS. AMALGAMATION OF AREA ANALYSIS OF MULTIPLE BASINS IS NOT ACCEPTABLE.
2. A BUFFER ZONE SHALL BE PROVIDED FOR ALL DIRECTLY CONNECTED PAVED SURFACES DRAINING TO THE BIORETENTION BASIN. THE BUFFER ZONE IS TO BE PLACED AROUND THE BIO-RETENTION ZONE SO THAT WATER LEAVING THE CAR PARK WILL TRAVEL OVER THE BUFFER ZONE.
3. ROOF WATER DOES NOT NEED TO TRAVEL OVER THE BUFFER ZONE. IN THE CIRCUMSTANCE WHERE ONLY ROOF WATER IS ENTERING THE BIO-RETENTION ZONE THEN NO BUFFER IS REQUIRED.
4. BUFFER ZONES CAN BE REPLACED BY ADDITIONAL BIORETENTION FILTER MEDIA WHERE DESIRABLE.
5. ALL IMPERVIOUS SURFACES ARE TO DRAIN TO THE STORMWATER TREATMENT FACILITY WHERE PRACTICABLE. WHEN THIS CANNOT BE ACHIEVED, IMPERVIOUS AREA CAN BYPASS THE SYSTEM WHERE IT IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA AND WILL NOT DIRECT NUISANCE RUNOFF TO ADJOINING PROPERTIES.
6. OVERFLOW PIT TO BE PROVIDED FOR ALL BASINS WITH A MINIMUM INLET CAPACITY OF THE PIPED SYSTEM DESIGN ARI WITH A 50% BLOCKAGE FACTOR APPLIED TO THE GRATE.
7. THE STORMWATER DRAINAGE SYSTEM IS TO DRAIN TO A LEGAL POINT OF DISCHARGE.

PRELIMINARY

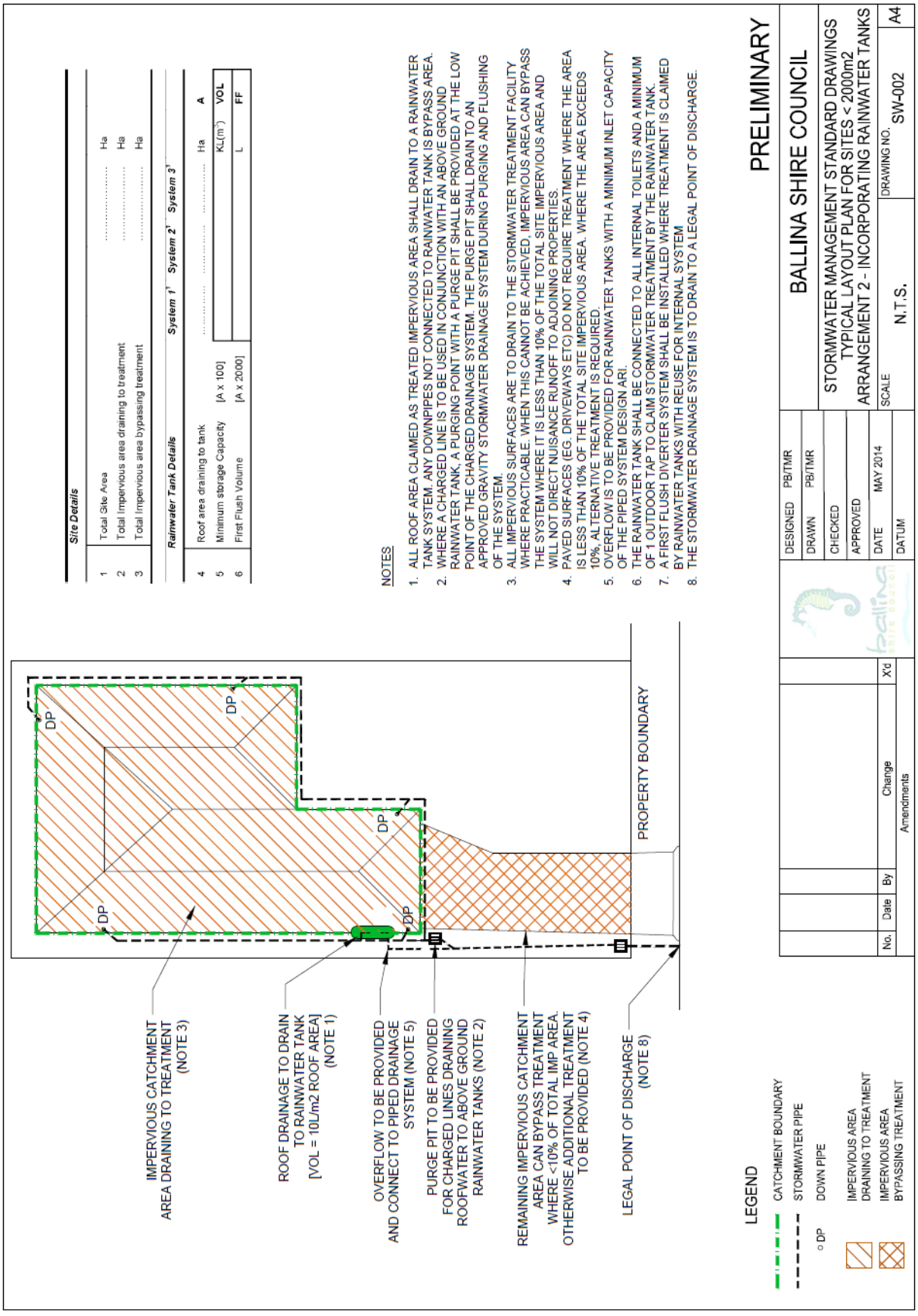
No.	Date	By	Change	X'd
Amendments				

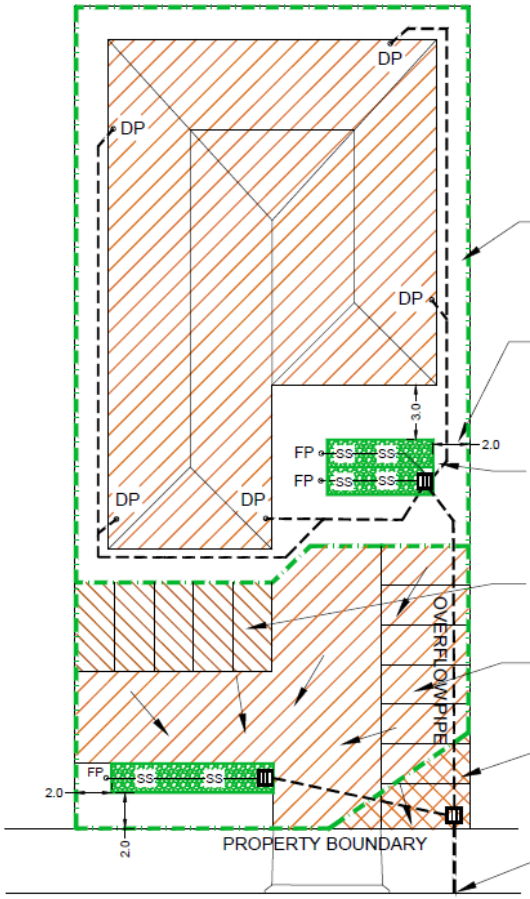
DESIGNED	PB/TMR
DRAWN	PB/TMR
CHECKED	
APPROVED	
DATE	MAY 2014
DATUM	

BALLINA SHIRE COUNCIL

STORMWATER MANAGEMENT STANDARD DRAWINGS
TYPICAL LAYOUT PLAN FOR SITES < 2000m2
ARRANGEMENT 1 - INCORPORATING BIORETENTION

SCALE	DRAWING NO.	
N.T.S.	SW-001	A4


Site Details
1 Total Site Area ..... Ha
2 Total Impervious area draining to treatment ..... Ha
3 Total Impervious area bypassing treatment ..... Ha
Rainwater Tank Details System 1' System 2' System 3'
4 Roof area draining to tank ..... Ha A
5 Minimum storage Capacity [A x 100] ..... KL(m³) VOL
6 First Flush Volume [A x 2000] L FF
NOTES
1. ALL ROOF AREA CLAIMED AS TREATED IMPERVIOUS AREA SHALL DRAIN TO A RAINWATER TANK SYSTEM. ANY DOWNPIPES NOT CONNECTED TO RAINWATER TANK IS BYPASS AREA.
2. WHERE A CHARGED LINE IS TO BE USED IN CONJUNCTION WITH AN ABOVE GROUND RAINWATER TANK, A PURGING POINT WITH A PURGE PIT SHALL BE PROVIDED AT THE LOW POINT OF THE CHARGED DRAINAGE SYSTEM. THE PURGE PIT SHALL DRAIN TO AN APPROVED GRAVITY STORMWATER DRAINAGE SYSTEM DURING PURGING AND FLUSHING OF THE SYSTEM.
3. ALL IMPERVIOUS SURFACES ARE TO DRAIN TO THE STORMWATER TREATMENT FACILITY WHERE PRACTICABLE. WHEN THIS CANNOT BE ACHIEVED, IMPERVIOUS AREA CAN BYPASS THE SYSTEM WHERE IT IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA AND WILL NOT DIRECT NUISANCE RUNOFF TO ADJOINING PROPERTIES.
4. PAVED SURFACES (EG. DRIVEWAYS ETC) DO NOT REQUIRE TREATMENT WHERE THE AREA IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA. WHERE THE AREA EXCEEDS 10%, ALTERNATIVE TREATMENT IS REQUIRED.
5. OVERFLOW IS TO BE PROVIDED FOR RAINWATER TANKS WITH A MINIMUM INLET CAPACITY OF THE PIPED SYSTEM DESIGN ARI.
6. THE RAINWATER TANK SHALL BE CONNECTED TO ALL INTERNAL TOILETS AND A MINIMUM OF 1 OUTDOOR TAP TO CLAIM STORMWATER TREATMENT BY THE RAINWATER TANK.
7. A FIRST FLUSH DIVERTER SYSTEM SHALL BE INSTALLED WHERE TREATMENT IS CLAIMED BY RAINWATER TANKS WITH REUSE FOR INTERNAL SYSTEM.
8. THE STORMWATER DRAINAGE SYSTEM IS TO DRAIN TO A LEGAL POINT OF DISCHARGE.
DP
IMPERVIOUS CATCHMENT AREA DRAINING TO TREATMENT (NOTE 3)
ROOF DRAINAGE TO DRAIN TO RAINWATER TANK [VOL = 10L/m2 ROOF AREA] (NOTE 1)
OVERFLOW TO BE PROVIDED AND CONNECT TO PIPED DRAINAGE SYSTEM (NOTE 5)
PURGE PIT TO BE PROVIDED FOR CHARGED LINES DRAINING ROOFWATER TO ABOVE GROUND RAINWATER TANKS (NOTE 2)
REMAINING IMPERVIOUS CATCHMENT AREA CAN BYPASS TREATMENT WHERE <10% OF TOTAL IMP AREA. OTHERWISE ADDITIONAL TREATMENT TO BE PROVIDED (NOTE 4)
LEGAL POINT OF DISCHARGE (NOTE 8)
PROPERTY BOUNDARY
LEGEND
CATCHMENT BOUNDARY
STORMWATER PIPE
DP DOWN PIPE
IMPERVIOUS AREA DRAINING TO TREATMENT
IMPERVIOUS AREA BYPASSING TREATMENT
No. Date By Amendments
Change X'd
PRELIMINARY
DESIGNED PB/TMR
DRAWN PB/TMR
CHECKED
APPROVED
DATE MAY 2014
DATUM
BALLINA SHIRE COUNCIL
STORMWATER MANAGEMENT STANDARD DRAWINGS
TYPICAL LAYOUT PLAN FOR SITES < 2000m2
ARRANGEMENT 2 - INCORPORATING RAINWATER TANKS
SCALE N.T.S.
DRAWING NO. SW-002
A4



TOTAL CATCHMENT AREA DRAINING TO THE TREATMENT SYSTEM

INFILTRATION TRENCH TO PROVIDE MINIMUM OFFSETS TO BOUNDARY AND BUILDINGS (NOTE 3)

INFILTRATION TRENCH [AREA = 0.05 X IMPERV CATCHMENT] [VOL = 0.005 X IMPERV CATCHMENT] (NOTE 1)

PAVED SURFACES INCORPORATING PERMEABLE PAVING CAN BE OMITTED FROM SIZING OF INFILTRATION TRENCH

IMPERVIOUS CATCHMENT AREA DRAINING TO TREATMENT (NOTE 4)

IMPERVIOUS CATCHMENT AREA BYPASSING TREATMENT (MUST BE <10% OF TOTAL IMP AREA) (NOTE 5 & 6)

LEGAL POINT OF DISCHARGE (NOTE 7)

LEGEND

- CATCHMENT BOUNDARY
- STORMWATER PIPE
- SS — SUBSOIL DRAINAGE
- INFILTRATION TRENCH
- IMPERVIOUS AREA WITH PERMEABLE PAVING
- IMPERVIOUS AREA DRAINING TO TREATMENT
- IMPERVIOUS AREA BYPASSING TREATMENT
- ○ DP — DOWN PIPE
- ○ FP — SUBSOIL FLUSH POINT

	Site Details		
1	Total Site Area	.....	Ha
2	Total Impervious area draining to treatment	.....	Ha
3	Total Impervious area bypassing treatment	.....	Ha

	Infiltration System Details		*System 1*[†]	*System 2*[†]	*System 3*[†]		
11	Catchment Area of System[1]		.....	.....	.....	Ha	D
12	Impervious Fraction		.....	.....	.....	%	E
13	Infiltration Area	[D xE x500]				m^2	AREA
14	Extended Detention Volume	[D x E x50]				m^3	VOL

	Permeable Paving Details	*System 1*[†]	*System 2*[†]	*System 3*[†]		
15	Impervious area with permeable paving				m^2	AREA

NOTES

1. THE INFILTRATION TRENCHES CAN BE BROKEN DOWN INTO A NUMEROUS SEPARATE TRENCHES. THE SIZE OF EACH TRENCH IS DETERMINED ACCORDING TO THE CATCHMENTS DRAINING TO THE RESPECTIVE TRENCHES. AMALGAMATION OF AREA ANALYSIS OF MULTIPLE TRENCHES IS NOT ACCEPTABLE.
2. ONLY SITES COMPRISING OF WELL DRAINED SOILS WITH A MINIMUM OF 50mm/h HYDRAULIC CONDUCTIVITY ARE SUITABLE FOR INFILTRATION AS STORMWATER TREATMENT.
3. INFILTRATION TRENCHES MUST PROVIDE A MINIMUM OFFSET DISTANCE OF 2m TO PROPERTY BOUNDARIES AND 3m TO BUILDINGS.
4. ALL IMPERVIOUS AREAS OF PAVED SURFACES WHICH INCORPORATE PERMEABLE PAVING CAN BE EXCLUDED FROM THE IMPERVIOUS AREA CALCULATION USED TO SIZE INFILTRATION TRENCHES. PERMEABLE PAVING HOWEVER SHOULD BE INCLUDED IN "TOTAL IMPERVIOUS AREA".
5. A LITTER BASKET INSERT IS TO BE PROVIDED FOR ALL PITS DRAINING SURFACE WATER FOR INFILTRATION, EXCEPT ROOF AREAS.
6. ALL IMPERVIOUS SURFACES ARE TO DRAIN TO THE STORMWATER TREATMENT FACILITY WHERE PRACTICABLE. WHEN THIS CANNOT BE ACHIEVED, IMPERVIOUS AREA CAN BYPASS THE SYSTEM WHERE IT IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA AND WILL NOT DIRECT NUISANCE RUNOFF TO ADJOINING PROPERTIES.
7. INFILTRATION TRENCHES SHALL NOT BE USED AS A MEANS FOR STORMWATER DISPOSAL WITHOUT COUNCIL APPROVAL. OVERFLOW SHALL BE PROVIDED FOR ALL TRENCHES WITH A MINIMUM INLET CAPACITY OF THE PIPED SYSTEM DESIGN ARI.
8. THE STORMWATER DRAINAGE SYSTEM IS TO DRAIN TO A LEGAL POINT OF DISCHARGE.

PRELIMINARY

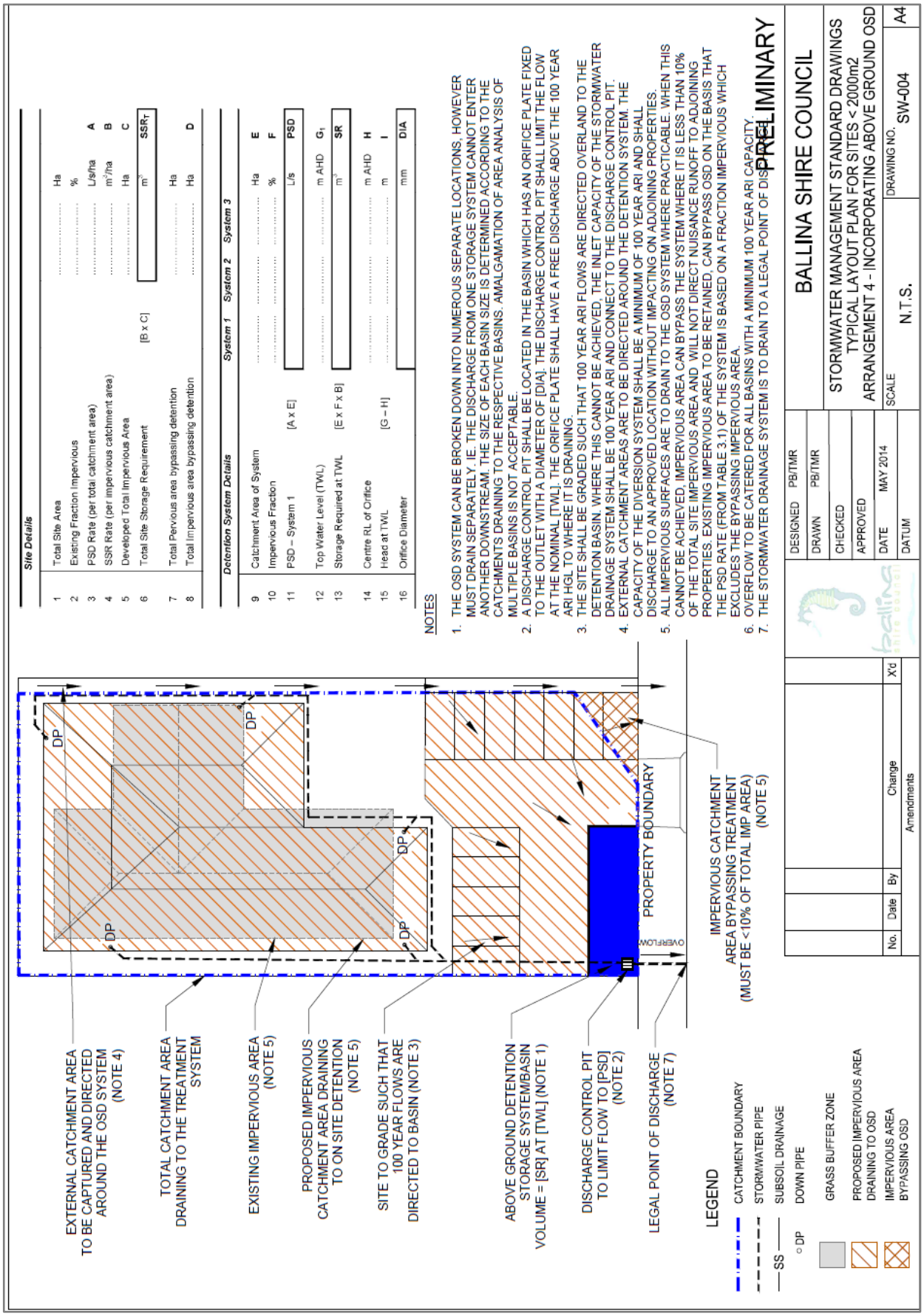
No.	Date	By	Change	X'd
Amendments				

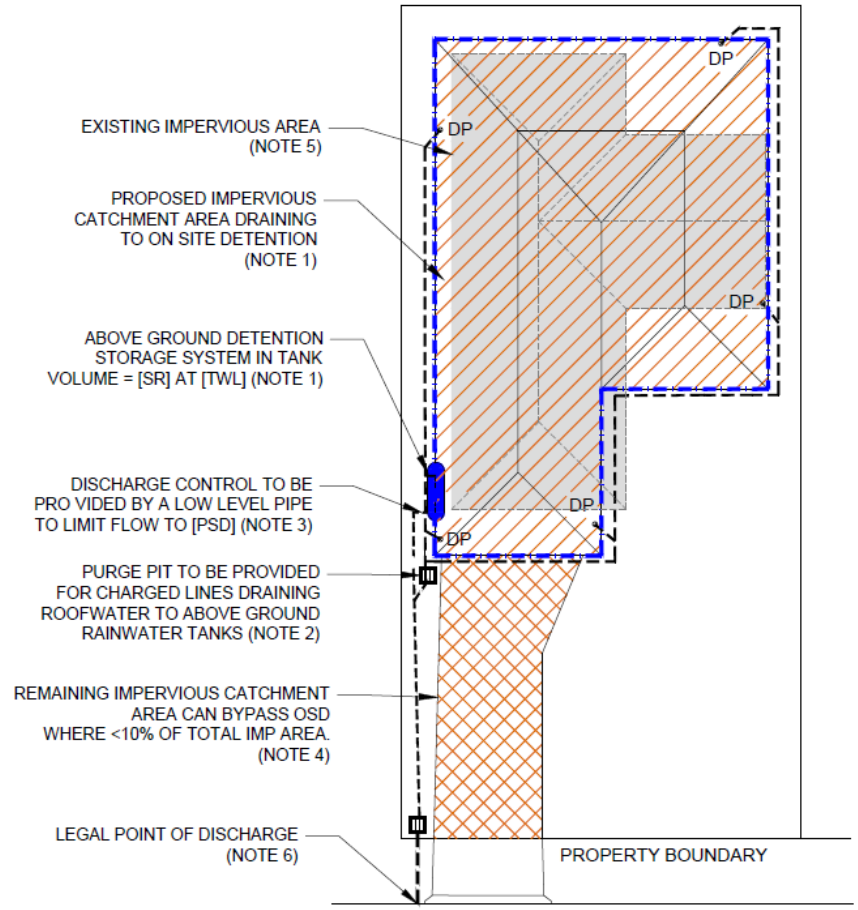
DESIGNED	PB/TMR
DRAWN	PB/TMR
CHECKED	
APPROVED	
DATE	MAY 2014
DATUM	

BALLINA SHIRE COUNCIL

STORMWATER MANAGEMENT STANDARD DRAWINGS
TYPICAL LAYOUT PLAN FOR SITES < 2000m2
ARRANGEMENT 3 - INCORPORATING INFILTRATION

SCALE	DRAWING NO.	
N.T.S.	SW-003	A4


Site Details
1 Total Site Area ..... Ha
2 Existing Fraction Impervious ..... %
3 PSD Rate (per total catchment area) ..... L/s/ha A
4 SSR Rate (per impervious catchment area) ..... m³/ha B
5 Developed Total Impervious Area ..... Ha C
6 Total Site Storage Requirement [B x C] m³ SSR_T
7 Total Pervious area bypassing detention ..... Ha
8 Total Impervious area bypassing detention ..... Ha D
Detention System Details System 1 System 2 System 3
9 Catchment Area of System ..... Ha E
10 Impervious Fraction ..... % F
11 PSD – System 1 [A x E] L/s PSD
12 Top Water Level (TWL) ..... m AHD G1
13 Storage Required at TWL [E x F x B] m³ SR
14 Centre RL of Orifice ..... m AHD H
15 Head at TWL [G – H] ..... m I
16 Orifice Diameter ..... mm DIA
NOTES
1. THE OSD SYSTEM CAN BE BROKEN DOWN INTO NUMEROUS SEPARATE LOCATIONS. HOWEVER MUST DRAIN SEPARATELY. IE. THE DISCHARGE FROM ONE STORAGE SYSTEM CANNOT ENTER ANOTHER DOWNSTREAM. THE SIZE OF EACH BASIN SIZE IS DETERMINED ACCORDING TO THE CATCHMENTS DRAINING TO THE RESPECTIVE BASINS. AMALGAMATION OF AREA ANALYSIS OF MULTIPLE BASINS IS NOT ACCEPTABLE.
2. A DISCHARGE CONTROL PIT SHALL BE LOCATED IN THE BASIN WHICH HAS AN ORIFICE PLATE FIXED TO THE OUTLET WITH A DIAMETER OF [DIA]. THE DISCHARGE CONTROL PIT SHALL LIMIT THE FLOW AT THE NOMINAL [TWL]. THE ORIFICE PLATE SHALL HAVE A FREE DISCHARGE ABOVE THE 100 YEAR ARI HGL TO WHERE IT IS DRAINING.
3. THE SITE SHALL BE GRADED SUCH THAT 100 YEAR ARI FLOWS ARE DIRECTED OVERLAND TO THE DETENTION BASIN. WHERE THIS CANNOT BE ACHIEVED, THE INLET CAPACITY OF THE STORMWATER DRAINAGE SYSTEM SHALL BE 100 YEAR ARI AND CONNECT TO THE DISCHARGE CONTROL PIT.
4. EXTERNAL CATCHMENT AREAS ARE TO BE DIRECTED AROUND THE DETENTION SYSTEM. THE CAPACITY OF THE DIVERSION SYSTEM SHALL BE A MINIMUM OF 100 YEAR ARI AND SHALL DISCHARGE TO AN APPROVED LOCATION WITHOUT IMPACTING ON ADJOINING PROPERTIES.
5. ALL IMPERVIOUS SURFACES ARE TO DRAIN TO THE OSD SYSTEM WHERE PRACTICABLE. WHEN THIS CANNOT BE ACHIEVED, IMPERVIOUS AREA CAN BYPASS THE SYSTEM WHERE IT IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA AND WILL NOT DIRECT NUISANCE RUNOFF TO ADJOINING PROPERTIES. EXISTING IMPERVIOUS AREA TO BE RETAINED, CAN BYPASS OSD ON THE BASIS THAT THE PSD RATE (FROM TABLE 3.1) OF THE SYSTEM IS BASED ON A FRACTION IMPERVIOUS WHICH EXCLUDES THE BYPASSING IMPERVIOUS AREA.
6. OVERFLOW TO BE CATERED FOR ALL BASINS WITH A MINIMUM 100 YEAR ARI CAPACITY.
7. THE STORMWATER DRAINAGE SYSTEM IS TO DRAIN TO A LEGAL POINT OF DISCHARGE.
PRELIMINARY
EXTERNAL CATCHMENT AREA TO BE CAPTURED AND DIRECTED AROUND THE OSD SYSTEM (NOTE 4)
TOTAL CATCHMENT AREA DRAINING TO THE TREATMENT SYSTEM
EXISTING IMPERVIOUS AREA (NOTE 5)
PROPOSED IMPERVIOUS CATCHMENT AREA DRAINING TO ON SITE DETENTION (NOTE 5)
SITE TO GRADE SUCH THAT 100 YEAR FLOWS ARE DIRECTED TO BASIN (NOTE 3)
ABOVE GROUND DETENTION STORAGE SYSTEM/BASIN VOLUME = [SR] AT [TWL] (NOTE 1)
DISCHARGE CONTROL PIT TO LIMIT FLOW TO [PSD] (NOTE 2)
LEGAL POINT OF DISCHARGE (NOTE 7)
IMPERVIOUS CATCHMENT AREA BYPASSING TREATMENT (MUST BE <10% OF TOTAL IMP AREA) (NOTE 5)
PROPERTY BOUNDARY
OVERFLOW
DP
LEGEND
CATCHMENT BOUNDARY
STORMWATER PIPE
SUBSOIL DRAINAGE
DOWN PIPE
GRASS BUFFER ZONE
PROPOSED IMPERVIOUS AREA DRAINING TO OSD
IMPERVIOUS AREA BYPASSING OSD
No. Date By Amendments Change X'd
DESIGNED PB/TMR
DRAWN PB/TMR
CHECKED
APPROVED
DATE MAY 2014
DATUM
BALLINA SHIRE COUNCIL
STORMWATER MANAGEMENT STANDARD DRAWINGS
TYPICAL LAYOUT PLAN FOR SITES < 2000m2
ARRANGEMENT 4 - INCORPORATING ABOVE GROUND OSD
SCALE N.T.S.
DRAWING NO. SW-004
A4



	Site Details				
1	Total Site Area		.....	Ha	
2	Existing Fraction Impervious		.....	%	
3	PSD Rate (per total catchment area)		.....	L/s/ha	A
4	SSR Rate (per impervious catchment area)		.....	m^3/ha	B
5	Developed Total Impervious Area		.....	Ha	C
6	Total Site Storage Requirement	[B x C]		m^3	SSR_T
7	Total Pervious area bypassing detention		.....	Ha	
8	Total Impervious area bypassing detention		.....	Ha	D

	Detention System Details		System 1	System 2	System 3		
9	Catchment Area of System		.....	.....	.....	Ha	E
10	Impervious Fraction		.....	.....	.....	%	F
11	PSD – System 1	[A x E]				L/s	PSD
12	Top Water Level (TWL)		.....	.....	.....	m AHD	G_1
13	Storage Required at TWL	[E x F x B]				m^3	SR
14	Centre RL of Orifice		.....	.....	.....	m AHD	H
15	Head at TWL	[G – H]	.....	.....	.....	m	I
16	Orifice Diameter					mm	DIA

NOTES

1. ALL ROOF AREA CLAIMED AS TREATED IMPERVIOUS AREA SHALL DRAIN TO A RAINWATER TANK SYSTEM AND HAVE 100 YEAR ARI CAPACITY. ANY DOWNPIPES NOT CONNECTED TO RAINWATER TANK IS BYPASS AREA.
2. WHERE A CHARGED LINE IS TO BE USED IN CONJUNCTION WITH AN ABOVE GROUND RAINWATER TANK, A PURGING POINT WITH A PURGE PIT SHALL BE PROVIDED AT THE LOW POINT OF THE CHARGED DRAINAGE SYSTEM. THE PURGE PIT SHALL DRAIN TO AN APPROVED GRAVITY STORMWATER DRAINAGE SYSTEM DURING PURGING AND FLUSHING OF THE SYSTEM.
3. THE TANK IS TO BE FITTED WITH A LOW LEVEL CHOKE PIPE WHICH HAS AN INTERNAL DIAMETER OR ORIFICE DRILLED INTO AN END CAP WITH A DIAMETER OF [DIA]. THE DISCHARGE CONTROL PIT SHALL LIMIT THE FLOW AT THE NOMINAL TWL TO THE DETERMINED PSD. THE ORIFICE PLATE SHALL HAVE A FREE DISCHARGE ABOVE THE 100 YEAR ARI HGL TO WHERE IT IS DRAINING.
4. PAVED SURFACES (EG. DRIVEWAYS ETC) DO NOT REQUIRE TREATMENT WHERE THE AREA IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA OR THE EXISTING (PREDEVELOPED) IMPERVIOUS AREA , WHICHEVER IS THE GREATER. IN SUCH INSTANCES, THE PSD RATE OF THE RAINWATER TANK SYSTEM SHALL EXCLUDE BYPASS FRACTION IMPERVIOUS.
5. OVERFLOW TO BE CATERED FOR ALL BASINS WITH A MINIMUM 100 YEAR ARI CAPACITY.
6. THE STORMWATER DRAINAGE SYSTEM IS TO DRAIN TO A LEGAL POINT OF DISCHARGE.

PRELIMINARY

LEGEND

- CATCHMENT BOUNDARY
- STORMWATER PIPE
- DP DOWN PIPE
- EXISTING IMPERVIOUS AREA
- PROPOSED IMPERVIOUS AREA DRAINING TO OSD
- IMPERVIOUS AREA BYPASSING OSD

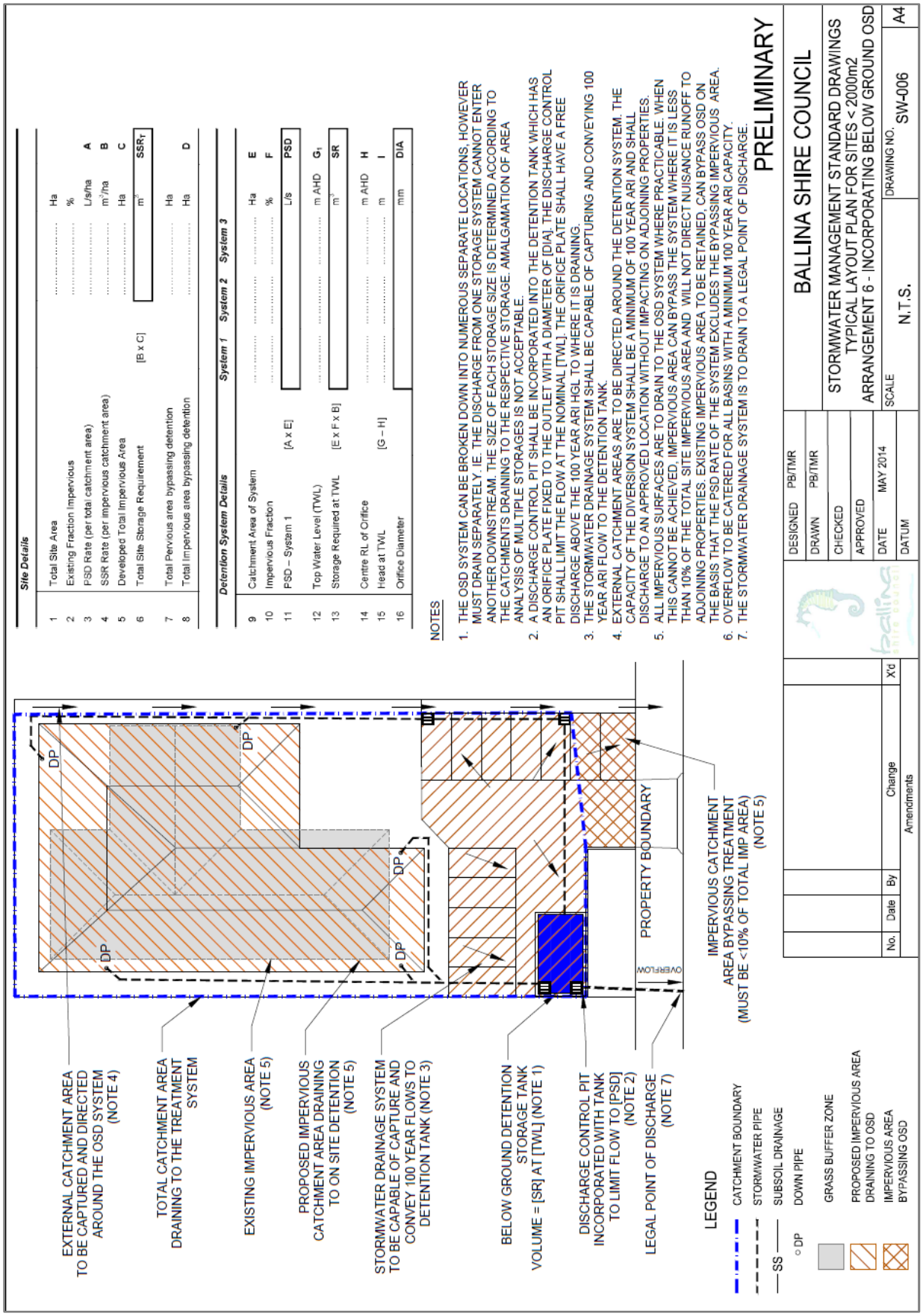
No.	Date	By	Change	X'd
Amendments				

DESIGNED	PB/TMR
DRAWN	PB/TMR
CHECKED	
APPROVED	
DATE	MAY 2014
DATUM	

BALLINA SHIRE COUNCIL

STORMWATER MANAGEMENT STANDARD DRAWINGS
TYPICAL LAYOUT PLAN FOR SITES < 2000m2
ARRANGEMENT 5 – INCORPORATING RAINWATER TANKS FOR OSD

SCALE	DRAWING NO.	
N.T.S.	SW-005	A4


Site Details
1 Total Site Area ..... Ha
2 Existing Fraction Impervious ..... %
3 PSD Rate (per total catchment area) ..... L/s/ha A
4 SSR Rate (per impervious catchment area) ..... m³/ha B
5 Developed Total Impervious Area ..... Ha C
6 Total Site Storage Requirement [B x C] m³ SSR_T
7 Total Pervious area bypassing detention ..... Ha
8 Total Impervious area bypassing detention ..... Ha D
Detention System Details System 1 System 2 System 3
9 Catchment Area of System ..... Ha E
10 Impervious Fraction ..... % F
11 PSD – System 1 [A x E] L/s PSD
12 Top Water Level (TWL) ..... m AHD G_t
13 Storage Required at TWL [E x F x B] m³ SR
14 Centre RL of Orifice ..... m AHD H
15 Head at TWL [G – H] ..... m I
16 Orifice Diameter mm DIA
NOTES
1. THE OSD SYSTEM CAN BE BROKEN DOWN INTO NUMEROUS SEPARATE LOCATIONS, HOWEVER MUST DRAIN SEPARATELY. IE. THE DISCHARGE FROM ONE STORAGE SYSTEM CANNOT ENTER ANOTHER DOWNSTREAM. THE SIZE OF EACH STORAGE SIZE IS DETERMINED ACCORDING TO THE CATCHMENTS DRAINING TO THE RESPECTIVE STORAGE. AMALGAMATION OF AREA ANALYSIS OF MULTIPLE STORAGES IS NOT ACCEPTABLE.
2. A DISCHARGE CONTROL PIT SHALL BE INCORPORATED INTO THE DETENTION TANK WHICH HAS AN ORIFICE PLATE FIXED TO THE OUTLET WITH A DIAMETER OF [DIA]. THE DISCHARGE CONTROL PIT SHALL LIMIT THE FLOW AT THE NOMINAL [TWL]. THE ORIFICE PLATE SHALL HAVE A FREE DISCHARGE ABOVE THE 100 YEAR ARI HGL TO WHERE IT IS DRAINING.
3. THE STORMWATER DRAINAGE SYSTEM SHALL BE CAPABLE OF CAPTURING AND CONVEYING 100 YEAR ARI FLOW TO THE DETENTION TANK.
4. EXTERNAL CATCHMENT AREAS ARE TO BE DIRECTED AROUND THE DETENTION SYSTEM. THE CAPACITY OF THE DIVERSION SYSTEM SHALL BE A MINIMUM OF 100 YEAR ARI AND SHALL DISCHARGE TO AN APPROVED LOCATION WITHOUT IMPACTING ON ADJOINING PROPERTIES.
5. ALL IMPERVIOUS SURFACES ARE TO DRAIN TO THE OSD SYSTEM WHERE PRACTICABLE. WHEN THIS CANNOT BE ACHIEVED, IMPERVIOUS AREA CAN BYPASS THE SYSTEM WHERE IT IS LESS THAN 10% OF THE TOTAL SITE IMPERVIOUS AREA AND WILL NOT DIRECT NUISANCE RUNOFF TO ADJOINING PROPERTIES. EXISTING IMPERVIOUS AREA TO BE RETAINED, CAN BYPASS OSD ON THE BASIS THAT THE PSD RATE OF THE SYSTEM EXCLUDES THE BYPASSING IMPERVIOUS AREA.
6. OVERFLOW TO BE CATERED FOR ALL BASINS WITH A MINIMUM 100 YEAR ARI CAPACITY.
7. THE STORMWATER DRAINAGE SYSTEM IS TO DRAIN TO A LEGAL POINT OF DISCHARGE.
PRELIMINARY
EXTERNAL CATCHMENT AREA TO BE CAPTURED AND DIRECTED AROUND THE OSD SYSTEM (NOTE 4)
TOTAL CATCHMENT AREA DRAINING TO THE TREATMENT SYSTEM
EXISTING IMPERVIOUS AREA (NOTE 5)
PROPOSED IMPERVIOUS CATCHMENT AREA DRAINING TO ON SITE DETENTION (NOTE 5)
STORMWATER DRAINAGE SYSTEM TO BE CAPABLE OF CAPTURE AND CONVEY 100 YEAR FLOWS TO DETENTION TANK (NOTE 3)
BELOW GROUND DETENTION STORAGE TANK VOLUME = [SR] AT [TWL] (NOTE 1)
DISCHARGE CONTROL PIT INCORPORATED WITH TANK TO LIMIT FLOW TO [PSD] (NOTE 2)
LEGAL POINT OF DISCHARGE (NOTE 7)
PROPERTY BOUNDARY
OVERFLOW
IMPERVIOUS CATCHMENT AREA BYPASSING TREATMENT (MUST BE <10% OF TOTAL IMP AREA) (NOTE 5)
DP
LEGEND
CATCHMENT BOUNDARY
STORMWATER PIPE
SUBSOIL DRAINAGE
DOWN PIPE
GRASS BUFFER ZONE
PROPOSED IMPERVIOUS AREA DRAINING TO OSD
IMPERVIOUS AREA BYPASSING OSD
No. Date By Change X'd
Amendments
DESIGNED PB/TMR
DRAWN PB/TMR
CHECKED
APPROVED
DATE MAY 2014
DATUM
SCALE N.T.S.
BALLINA SHIRE COUNCIL
STORMWATER MANAGEMENT STANDARD DRAWINGS
TYPICAL LAYOUT PLAN FOR SITES < 2000m2
ARRANGEMENT 6 - INCORPORATING BELOW GROUND OSD
DRAWING NO. SW-006
A4

Appendix B Preferred Parameters for Hydrologic Modelling of Stormwater Facilities

B.1 Design Rainfall Intensities and Temporal Patterns

The design rainfall intensities used for hydrological modelling shall be the Intensity- Frequency Data given in Table A.1 of the Northern Rivers Local Government Handbook of Stormwater Drainage Design (Aus-Spec 2013). For short duration storms (being in the order of less than 3 hours), Australian Rainfall and Runoff – Volume 2 (IEA, 1987) IFD may be used. Temporal Pattern Hyetographs shall be adopted from Australian Rainfall and Runoff – Volume 2 (IEA, 1987).

B.2 Rainfall/Runoff Models

The parameters recommended for the following selected rainfall/runoff computer programs are Council's preferred parameters for modelling of detention systems for purposes of design and determining storage required to achieve the permissible site discharges.

Council encourages the use of parameters derived through calibration against gauged flood frequency curves or historic data when available and can be used in lieu of the following generic values on the basis that full details of the calibration and validation are submitted and approved by Council.

B.2.1 Rafts

(a) Rainfall Loss Rates

The Rafts program offers a choice between two approaches to rainfall loss estimation. They are the initial/continuing loss (ILCL) model and the infiltration/water balance procedure which utilises the Australian Representative Basins Model (ARBM). The use of the ARBM loss model shall only be used in preference to the initial/continuing loss model where calibration and validation of parameters has been undertaken.

Catchments with a fraction impervious greater than 10% are to be modelled with separate sub-catchments for the pervious and impervious fractions. The values for the ILCL loss model to be adopted are given in Table B.1.

(b) Surface Runoff Routing

The recommended surface runoff routing parameters in Table B.1 shall be adopted.

Table B.1 Rafts Model Parameters

PARAMETER	IMPERVIOUS FRACTION	PERVIOUS FRACTION
Initial Loss (IL) -sand Initial Loss (IL) -other	1 1	5 10
Continued Loss (CL) – sand Continued Loss (CL) – other	0 0	10 2.5
Non-linearity coefficient (default)	0.285	0.285
B_x	1.0	1.0
Roughness Coefficient (PERN) Urban Rural Bush/Forest	 0.02 N/A N/A	 0.035 0.045 0.07

B.2.2 DRAINS/ILSAX

(a) Rainfall Loss Rates

The ILSAX program incorporates the Horton's infiltration equation to determine rainfall losses occurring on pervious surfaces. ILSAX also requires that a catchment soil type and antecedent moisture condition be specified. The rainfall loss parameter values in Table B.2 shall be adopted.

Table B.2 ILSAX Rainfall Loss Parameters

PARAMETER	VALUE
Impervious (paved) depression storage	1mm
Supplementary depression storage	1mm
Pervious (grassed) depression storage	5mm
Soil Type – Sands Soil Type – Other	2.0 3.0
Antecedent Moisture Content	3.0

(b) Time of Concentration

The time of concentration for impervious, supplementary and grassed areas for conventional pits and pipes and detention basin drainage design shall be as per Table B.3 below.

Table B.3 ILSAX time of concentration (source: DRAINS User Manual, 2013)

SURFACE	TIME OF CONCENTRATION (MINUTES)
Paved	5
Supplementary	1
Grassed with Average slope	
>15%	5
10%-15%	8
6%-10%	10
3%-6%	13
<3%	15

Where the table above underestimates the time of concentration for larger catchments or for modelling lumped catchments, an alternative time of concentration can be calculated as per Northern Rivers Local Government Handbook of Stormwater Drainage Design (Aus-Spec 2013). In such cases the calculations and basis for alternative time of concentration shall be included in submissions for approval. Not with standing this, the maximum inlet time shall be **20 minutes**. Catchments requiring longer time of concentrations shall use alternative methods of calculating flows such as runoff-routing in lieu of the time-area method (ILSAX).

B.2.3 Other Methods and Models

The intention of this guideline is not to exclude the use of other propriety hydrological methods or models; however approval is to be sought prior to use. As a minimum demonstration of its adequacy to the satisfaction of Council officers will require a comparison with the Rational Method or one of the rainfall/runoff models described herein.

The submission shall include full details of the method or model to be used including all assumptions made, recommended parameter values, and tabulated flow comparisons for major and minor system ARIs.

B.3 Stormwater Quality Models

B.3.1 MUSIC

MUSIC model parameters are to be in accordance with Water by Design (SEQ Healthy Waterways Partnership) MUSIC modelling guidelines 2010. Other reference materials may be considered on application.

The rainfall and evaporation data from the Alstonville Tropical Fruit Research Station shall be used for simulations across the shire.

Appendix C Reproduction of Table 3.1 from the Handbook

Table 3.1 from the Handbook (as applies to Ballina Shire Council)

DESCRIPTION	ARI (1 in X years)
MAJOR SYSTEM (ARI 1 in X years)	100
MINOR SYSTEM (ARI 1 in X years)	
Parks & Reserves	1
Rural Residential	5
Urban Residential	5
Commercial/Industrial	10
MAJOR ROAD	
Kerb & Gutter	10
Cross Drainage - Culverts, Bridges etc	50
Minor Road (Clooector & Local)	
Kerb & Gutter	As per zoning
Cross Drainage - Culverts, Bridges etc	20

The above Design ARI's are subject to the following conditions:

a. The design ARI for the minor drainage system in a major road / traffic route shall be that nominated for the major road, not the zoning of the adjacent area.

b. Culverts under roads should be designed to accept the full flow for the minor system ARI shown and the minimum freeboard permitted shall be up to the subgrade level. In addition the consultant must ensure that the 100 year ARI backwater does not enter adjacent or upstream properties. If upstream properties are at a relatively low elevation it may be necessary to install culverts of capacity greater than that for the minor system ARI design storm to ensure flooding of upstream properties does not occur. In addition causeway embankments may need scour protection where overtopping is likely to occur

c. Notwithstanding, Council may require a higher recurrence interval based on particular locality considerations that may generally include:
   - Ability to accommodate the major event
   - RMS or other authority's flood requirements
   - Afflux considerations
   - Future strategic planning considerations
   - Counter disaster planning considerations
   - Historical records of flood events
   - Safety considerations in flood events
   - The ability to access isolated or single entry communities.