WARRINGAH COUNCIL

ATTACHMENT BOOKLET

ORDINARY COUNCIL MEETING

TUESDAY 27 OCTOBER 2015

Water Management Policy

Water Management Policy	
Effective Date	Version 1

Table of Contents

1 Purpose of the Policy

This Policy provides the requirements for the effective management of stormwater, rainwater, groundwater and wastewater within the Warringah local government area.

2 Principles

The Water Management Policy aims to:

- Minimise the risk to public health and safety
- Reduce the risk to life and property from flooding
- Manage and minimise stormwater overland flow, nuisance flooding and groundwater related damage to properties
- Protect and improve the ecological condition or our beaches, lagoons, waterways, wetlands and surrounding bushland
- Encourage the reuse of water and alternative water sources
- Integrate water sensitive urban design measures into the built form to maximise amenity
- Protect Council stormwater drainage assets during development works and to ensure Council's drainage rights are not compromised
- Align development controls with the objectives of the Water Sensitive Warringah Strategic Plan and Environmental Sustainability Strategy.

3 Development to Which this Policy Applies

This Policy applies to All development in the Warringah Local Government Area subject to Part 4 of the *Environmental Planning & Assessment Act 1979* including Development Applications, Exempt and Complying Development.

This Policy shall be read in conjunction with the Warringah Local Environmental Plan, Warringah Development Control Plan 2011 and other documentation as referred to within this policy.

3.1 Identifying Planning Controls Which Apply

To identify which planning controls apply to the development, applicants must refer to both Table 1 and Table 2.

Table 1 identifies sections that apply to particular development type, and Table 2 identifies sections which apply based on the site and development characteristics (one or more may apply).

Table 1 – Development Types

Development Types		Sections which Apply				
		Section 4.0 – Standard of Design, Construction & Installation	Section 5 – Disposal of Stormwater	Section 8.1 – Stormwater Quality	Section 8.3 – Erosion, Sediment and Pollution Controls	Section 9.1 – Onsite Stormwater Detention
Single Lot Residential Development		✓	✓		✓	✓
Residential Flat Buildings or Multi-residential dwelling houses	Development with a site area less than 2500m^2	✓	✓		✓	✓
	Development with a site area greater than 2500m^2	✓	✓	✓	✓	✓
Commercial or Mixed Use or Industrial	Development with a site area less than 2500m^2	✓	✓		✓	✓
	Development with a site area greater than 2500m^2	✓	✓	✓	✓	✓
Subdivision	Subdivision resulting in the creation of: two (2) lots where the total post development impervious area of the new lots exceeds 40%.	✓	✓		✓	✓
	Subdivision resulting in the creation of: • three (3) lots or more.	✓	✓	✓	✓	✓

Table 2 – Site/Development Characteristics (more than one requirement may apply)

Site/Development Characteristics		Sections which Apply							
		Section 6 – Building Over or Adjacent to Council Drainage Systems and Easements	Section 7.2 – On-site Sewage Management	Section 8.2 – Groundwater Management	Section 8.3 – Erosion, Sediment and Pollution Controls	Section 9 – Flood Risk Management	Section 9.1 – Onsite Stormwater Detention	Section 9.3 – Overland Flow	Section 10.3 – Removal of Private Trees Threatening Council Stormwater Pipes
Increased hard surfaces	Development where the total existing and proposed impervious areas exceeds 40% of the site area						✓		
	Development proposing an increase in impervious area of more than 150m^2				✓				
Near a Council stormwater system	All development containing or adjacent to Council stormwater infrastructure Refer to Council's Stormwater Planning Maps	✓							✓
Groundwater	All development intercepting groundwater			✓					
No Sewer	Any property not connected to the Sydney Water sewerage network or which utilises an onsite wastewater management system		✓						
Flooding or Overland flow	All development located on Flood Prone Land Refer to Section 149 Planning Certificate or Council's Flood Maps:- • High Flood Risk Planning Precinct • Medium Flood Risk Planning Precinct • Low Flood Risk Planning Precinct					✓			
	All development on land affected by overland flows. Refer to Council's Stormwater Planning Maps							✓	

4 General Requirements

4.0 Standard of Design, Construction & Installation

All works are to be designed, constructed and installed in accordance with the following:

- Auspec1 Design Manual
- Minor works specification
- *Local Government Act 1993*
- *Roads Act 1993*
- Plumbing Code of Australia
- Water by Design Technical Guidelines
- Relevant Australian Standards
- Warringah Local Environmental Plan 2000
- Environment & Health Protection Guidelines for Onsite Sewage Management for Single Households
- Interim NSW Guidelines for Management of Private Recycled Water Schemes
- Warringah Local Environmental Plan 2011
- Warringah Development Control Plan 2011
- Technical Specifications where specified
- Water Sensitive Warringah Strategic Plan
- Water Sensitive Warringah Technical Paper

5 Disposal of Stormwater

5.1 General

(a) Stormwater drainage for all properties must be by gravity means. Mechanical methods of stormwater disposal (e.g. pump-out systems) will only be permitted for draining sub-surface flows from underground areas and basement carparks in commercial or residential flat buildings.

(b) Diverting flows from one catchment (or sub-catchment) to another catchment (or sub-catchment) will not be permitted. Properties must drain in the direction of their natural catchment.

(c) Drainage easements obtained through downstream properties for piping flows to a drainage system, at the applicant's expense, are strongly encouraged.

(d) All drainage structures are to be designed to be visually unobtrusive and sympathetic with the proposed development and the surrounding environment.

(e) Piping the property drainage system across a public road is not permitted. Consideration will be given to extending Council's system across the public road to facilitate disposal of stormwater from the property at the applicant's expense.

(f) Stormwater drainage works must be approved by Council under the provisions of the *Roads Act 1993* and *Local Government Act 1993*.

(g) Inability to comply with the requirements of this policy may result in Development Consent not being granted.

5.2 Street & Trunk Drainage

(a) Street and trunk drainage is to be designed and constructed so as to:

i. provide convenience and safety for pedestrians and traffic during storm events,

ii. minimise damage to private and public buildings, and

iii. minimise risks to life and property by overland flow during major storm events.

(b) Street and trunk drainage must comply with the following specifications:

i. Auspec1 Design Manual

ii. Minor works specification

5.3 Discharge to Roads & Maritime Services Drainage System

Where stormwater is to be discharged to the street gutter or underground drainage system of a road that is under the control of the Roads & Maritime Services (RMS), Council will refer the Development Application to the RMS for review.

5.4 Properties Unable to Connect to a Council Stormwater Drainage System or Easement

(a) Any property that is unable to connect to a Council stormwater drainage system, such as land falling naturally away from a Council stormwater drainage system, is required to comply with Council's Stormwater Drainage from Low Level Properties Technical Specification.

(b) Developments proposing to discharge stormwater to a watercourse or open channel must comply with the requirements of section 8.4 - Stormwater Discharge to Watercourse or Open Channel.

(c) Where an inter-allotment drainage easement is to be created, a letter of agreement to the creation of the easement from all the affected property owners shall accompany the development application. This is to demonstrate to Council that a suitable easement/s can be obtained. The letter/s shall be accompanied with a plan of the location of the proposed easement/s also signed by all the affected property owners. The letter/s is/are not to contain any conditions that may preclude the creation of the easement.

5.5 Stormwater Entering Properties from Upstream Lots

(a) Runoff currently entering the site from upstream properties should not be obstructed from flowing onto the site nor redirected so as to increase the quantity or concentration of surface runoff entering adjoining properties.

(b) When a retaining wall is to be constructed across an overland flow path any intercepted flow must be contained within the property where the retaining wall is required and this flow connected to the site drainage system.

(c) Where the overland flow rates are significant, the requirements of section 9.3 – Overland Flow will need to be satisfied.

6 Building Over or Adjacent to Council Drainage Systems and Easements

Council drainage systems may be located within private property. To determine if the property is burdened or is adjacent to a public drainage system, refer to Council's Stormwater Planning Map.

(a) All development on land containing or adjacent to or proposing to reconstruct/relocate a public drainage system, must comply with Council's Building Over or Adjacent to Constructed Council Drainage Systems and Easements technical specifications.

Note:
This does not apply to land with natural (unconstructed) drainage systems and watercourses. In these instances, section 8.4 - Stormwater Discharge to Watercourse or Open Channel and 5.4 - *Properties Unable to Connect to a Council Stormwater Drainage System* and Council's Protection of *Waterways and Riparian Land Policy*.

7 Sustainable Water Management and Onsite Sewage Management Systems

7.1 Water Conservation & Reuse

7.1.1 Water Efficiency

(a) Buildings that are not affected by BASIX that are installing any water use fittings must demonstrate compliance with the minimum standards defined by the Water Efficiency Labelling and Standards (WELS) Scheme. Minimum WELS rated fittings include:

i. 4 star dual-flush toilets
ii. 3 star showerheads
iii. 4 star taps (for all taps other than bath outlets and garden taps)
iv. 3 star urinals
v. 3.5 star washing machines
vi. 4 star dishwashers.

(b) Cooling towers must:

i. Connect a conductivity meter to ensure optimum circulation before discharge.
ii. Include a water meter connected to a building energy and water metering system to monitor water usage
iii. Employ alternative water sources for cooling towers where practical.

7.1.2 Rainwater Tanks

Rainwater tanks which are connected for internal use (toilet flushing & washing machine) and external reuse (garden irrigation) are encouraged for all developments.

(a) Rainwater tanks shall comply with the following:

i. Be fitted with a first-flush device that causes initial rainwater run-off to bypass the tank and must drain to a landscaped area. The first flush device will not be permitted to connect to the stormwater system

ii. Have a sign affixed to the tank stating the contents is rainwater

iii. Be constructed or installed in a manner that prevents mosquitoes breeding, such as the use of mesh to protect inlets and overflows

iv. Have its overflow connected to an existing stormwater drainage system that does not discharge to an adjoining property, or cause a nuisance to adjoining owners

v. Pumping equipment must be housed in a soundproof enclosure

vi. If reticulated water is provided to the lot, the rainwater tank must not be interconnected with any system supplying drinking water to the lot unless it complies with NSW Health requirements.

(b) If OSD is required for residential development, Council may permit the volume of rainwater reuse to be credited against the calculated OSD storage volume as determined by Council's Onsite Stormwater Detention Technical Specification, provided the rainwater tank is connected for internal reuse.

7.2 On-site Sewage Management

Warringah Council is the regulatory authority for on-site sewage management systems under the *Local Government Act 1993*.

All systems must be installed and operated in order to:

(a) Prevent the spread of disease by micro-organisms

(b) Prevent the spread of foul odours

(c) Prevent contamination of water

(d) Prevent degradation of soil and vegetation

(e) Discourage insects and vermin

(f) Encourage the re-use of resources (including nutrients, organic matter and water)

(g) Minimise any adverse impacts on the amenity of the land on which it is installed or constructed and other land in the vicinity of that land

The owners of the property are responsible for the correct operation and functioning of the onsite wastewater management system. Penalty Infringement Notice and Orders can be issued for systems that do not comply with the approval to operate or cause water pollution.

7.2.1 New Systems

(a) An 'Approval to Install an On-site Sewage Management System' must be obtained prior to the installation or modification of any system as required by the *Local Government Act 1993*. The applicant must submit all information as detailed in the application form.

(b) All new domestic on-site sewage systems must possess a certificate of accreditation from the Director-General of the NSW Department of Health. For all non-domestic systems, Council will require the submission of a report prepared by a suitably qualified engineer.

(c) All systems must be designed, installed and operated in accordance with:-

i. *Local Government Act 1993*
ii. Environment & Health Protection Guidelines for Onsite Sewage Management for Single Households
iii. Interim NSW Guidelines for Management of Private Recycled Water Schemes
iv. AS1547
v. Plumbing Code of Australia
vi. The manufacturer's specifications, and
vii. Any conditions of approval from Council.

(d) Water use fittings must demonstrate compliance with the minimum standards defined by the Water Efficiency Labelling and Standards (WELS) Scheme. Minimum WELS rated fittings include:
i. 4 star dual-flush toilets
ii. 3 star showerheads
iii. 4 star taps (for all taps other than bath outlets and garden taps)
iv. 3 star urinals
v. 3.5 star washing machines
vi. 4 star dishwashers.

(e) A certificate from a licenced plumber shall be submitted to the Principal Certifying Authority prior to the release of the Occupation Certificate.

(f) Should 'Approval to Install' be granted, the applicant must then obtain an 'Approval to Operate an On-site Sewage Management System', prior to commissioning of the system. At this time, a risk category will be assigned to the approval which will determine the period of approval.

(g) Council will not generally grant approval for pump-out style systems.

7.2.2 Existing Systems

(a) All onsite systems must hold a current 'Approval to Operate an On-site Sewage Management System', as required by the *Local Government Act 1993.*

(b) An Approval to Operate will be assigned a risk category which will determine the period of approval.

(c) All Aerated Wastewater Treatment Systems (AWTS) must be inspected by an appropriately qualified servicing agent every three months or as specified by the systems NSW Health conditions of accreditation. All costs are at the householders expense. A report must be prepared for each inspection with a copy forwarded to Council. Any faults identified at this inspection must be repaired promptly.

(d) For modifications of an existing system an 'Approval to Install an On-site Sewage Management System' must be obtained in addition to the satisfying the requirements outlined in 7.2.1.

(e) All systems will be subject to Councils routine inspection program with the inspection frequency subject to the risk rating assigned. The inspection will identify any Environmental or Public Health issues and where necessary take action to have these matters rectified.

(f) The destruction, removal or reuse of an on-site sewage management system shall be undertaken in accordance with the NSW Health Advisory Note 3 dated May 2006

"*Destruction, Removal or Reuse Of Septic Tanks, Collection Wells, Aerated Wastewater Treatment Systems and other Sewage Management Facility Vessels*".

8 Protecting Our Environment

This policy aims to protect and improve the health of Warringah's waterways through the appropriate planning, design and operation of stormwater treatments measures for urban development. The outcomes Council seeks include:

i. The integration of water sensitive urban design measures in new developments to address stormwater and floodplain management issues

ii. Improve the quality of stormwater from urban development

iii. Mimic natural stormwater flows by minimising impervious areas, reusing rainwater and stormwater and providing treatment measures that replicate the natural water cycle

iv. Preserve, restore and enhance riparian corridors as natural systems

8.1 Stormwater Quality

Stormwater treatment measures are required to ensure the development does not impact on the receiving waters. The stormwater targets are generally aligned with the catchment classifications as detailed in the Warringah Creek Management Study.

8.1.1 Stormwater Targets

To determine which stormwater targets apply to the site use the table below to identify the land type.

Land Type	Table Which Applies
Undeveloped land[i] within a Group A & B Catchment[ii]	Table 3 – Stormwater Quality Objectives
Land within the riparian buffer of a Coastal Upland Swamp in the Sydney Basin Bioregion Endangered Ecological Community[iii]	
All other land not identified above	Table 4 – General Stormwater Quality Performance Targets

Notes:

i. Refer to the Definition section at the end of this Policy for definitions for "Undeveloped Land".

ii. Catchment Boundaries & Groupings are identified in the Warringah Creek Management Study

iii. To determine if the development is within the riparian buffer of the above noted Endangered Ecological Community, refer to the following: Section 149 Planning Certificate, Protection of *Waterways and Riparian Land Policy*, Waterways and Riparian Map and Threatened and High Conservation Habitat Map.

Table 3 – Stormwater Quality Objectives

Criteria	Objectives
Stormwater Quality	Stormwater quality discharging from the development shall not impact the receiving waters. Reference shall be made to local data if available, including the Warringah Creek Management Study and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC), or other widely accepted guidelines.
Sediment	Disturbance to stream and wetland sediments is to be minimised by regulated discharge of stormwater and dissipation of flows at discharge locations. Runoff from the development must be retained at natural discharge rates and sediments controlled at the source.
Hydrology	Stormwater flow is to mimic natural conditions and ensure a dispersed pattern of flow, avoiding centralised or concentrated discharge points into the wetland or waterway. Natural flow regimes must be retained. The reduction or increase in flows, alteration in seasonality of flows, changes to the frequency, duration, magnitude, timing, predictability and variability of flow events, altering surface and subsurface water levels and changing the rate of rise or fall of water levels must be avoided.

Table 4 – General Stormwater Quality Performance Targets

Pollutant	Performance Target		
	Development located in Group A & B Catchments[i]	**Development located in Group C Catchments**[i]	**Development that discharges directly to the ocean**[iii]
Total Phosphorous	65% reduction in the post development mean annual load[ii]	45% reduction in the post development mean annual load	Not Applicable
Total Nitrogen	45% reduction in the post development mean annual load		Not Applicable
Total Suspended Solids	85% reduction in the post development mean annual load	80% reduction in the post development mean annual load	
Gross Pollutants	90% reduction in the post development mean annual load (for pollutants greater than 5mm in diameter)		
pH	6.5 - 8.5		
Hydrology	The post-development peak discharge must not exceed the pre-development peak discharge for flows up to the 2 year ARI.		Not Applicable

Note:

i. Catchment Boundaries & Groupings are identified in the Warringah Creek Management Study

ii. The percentage reduction in the post development mean annual loads are relative to the loads from the proposed development without treatment applied.

iii. Discharge directly to the ocean means stormwater does not need to pass through a drainage control structure such as a pipe, bridge, culvert, kerb and gutter or natural drainage system.

8.1.2 Standards of Design

(a) All stormwater treatment measures must be designed in accordance with the requirements of this Policy and the Water by Design Technical Guidelines, and modified for local conditions as appropriate.

(b) Stormwater treatment measures must be sited on private land. Council will not accept the ownership or maintenance responsibilities of any stormwater treatment devices.

(c) For alterations and additions and the like, the stormwater quality targets only apply to the new works.

(d) Stormwater treatment measures must not be sited within riparian zones or within remnant vegetation.

(e) Stormwater treatment measures must be kept offline and adequate erosion and sediment controls shall be implemented on site until the site has been fully stabilised. Refer to section 8.3 for further details for erosion and sediment controls.

(f) All stormwater treatment measures must be sited in an area which is easily and safely accessible (e.g. road side) and have wet weather access.

(g) Stormwater treatment measures with a permanent water body must be completely fenced to the standard as required by the *Swimming Pools Act 1992* and associated Australian Standards.

(h) A positive covenant and Restriction As to User must be registered on the title for the stormwater treatment measures to ensure regular maintenance and reliable operation.

8.1.3 Demonstrating Compliance

(a) To demonstrate compliance with the relevant stormwater performance targets, a model preferably through the Model for Urban Stormwater Improvement Conceptualisation (MUSIC), or an equivalent, widely accepted model or methodology must be provided.

Should MUSIC be used, modelling shall be undertaken in accordance with draft NSW Water Sensitive Urban Design Guidelines unless alternative modelling parameters are justified on the basis of local studies. Details of the modelling of those elements, parameters and assumptions used, and all data files must be provided to the Certifying Authority as required by the conditions of consent for the development application.

(b) The applicant is to engage the services of a qualified Civil Engineer, who has membership to the Institution of Engineers Australia, National Professional Engineers Register (NPER-3) to ensure the development complies with the relevant stormwater quality targets outlined above.

8.1.4 Operation and Maintenance Plan

An Operation and Maintenance Plan is to be prepared to ensure proposed stormwater quality measures remain effective. For Community Title developments, the Plan is to be included in the Community Management Statement.

The Plan must contain the following:

a) Maintenance schedule of all stormwater quality treatment devices

b) Maintenance requirements for establishment period

c) Routine maintenance requirements

d) Funding arrangements for the maintenance of all stormwater quality treatment devices

e) Identification of maintenance and management responsibilities

f) Vegetation species list associated with each type of vegetated stormwater treatment device

g) Inspection and maintenance record and reporting

h) Waste management and disposal

i) Traffic control (if required)

j) Maintenance and emergency contact information

k) Renewal, decommissioning and replacement timelines and activities of all stormwater quality treatment devices

l) Work Health and Safety requirements

m) Record keeping

8.2 Groundwater Management

(a) The groundwater regime is to be maintained as close as possible to pre-development conditions and shall not adversely impact on receiving waters and groundwater dependant ecosystems.

(b) Development intercepting the water table is classified as Integrated Development and will require concurrence from the NSW Office of Water under the *Water Management Act 2000.*

(c) Groundwater discharged to the stormwater system shall comply with the requirements of the *Protection of the Environment Operations Act, 1997*.

(d) Groundwater must be discharged to the nearest stormwater pit in accordance with Council's Auspec1 Design Manual. Discharge to the kerb and gutter will not be accepted.

(e) Construction techniques, where possible, shall eliminate the need for dewatering i.e. a tanked construction.

(f) Where below-ground structures are in close proximity to each other (typically less than 3 metres) there shall be no allowance provided for natural flow of groundwater through these narrow corridors, unless adequate justification from a suitably qualified engineer is provided.

(g) Provision must be made for groundwater flows in the design of perimeter or through drainage system.

8.3 Erosion, Sediment and Pollution Controls

(a) Erosion and sediment controls are to be designed, constructed and installed in a accordance with Landcom's Managing Urban Stormwater: Soil and Construction Manual (2004) and maintained until the site is fully stabilised to prevent pollution of the receiving environment.

(b) Council will require the submission of the following plans with the development application:

- An **Erosion and Sediment Control Plan** (ESCP) for all development which involves the disturbance of up to 2500m^2 of land.

- An **Soil and Water Management Plan** (SWMP) for all development which involves the disturbance of more than 2500m^2 of land. A SWMP must be prepared by a suitably qualified Civil Engineer, who has membership to the Institution of Engineers Australia, National Professional Engineers Register (NPER-3).

(c) The design storm event for the stability of erosion, sediment and pollution control structures is to be taken as the 10-year ARI time of concentration storm event, unless as specified by Council.

(d) Water to be discharged must be tested and, if required, treated to ensure it meets the water quality criteria and that pollution of the receiving waters does not occur.

Before water can be discharged to the receiving environment, the following criteria must be met, unless subject to an Environmental Protection Licence or site specific criteria.

Parameter	Criterion	Method	Time Prior to Discharge
Oil and grease	No visible	Visual inspection	<1 hour
pH	6.5- 8.5	Probe/meter	<1 hour
Total Suspended Solids	<50mg/L	Meter/grab sample	<1 hour

(e) Records of all water discharges and monitoring results are to be documented and kept on site. Copies of all records shall be provided to the appropriate regulatory authority upon request.

(f) All chemicals and hazardous substances must be stored and handled in accordance with relevant State and Federal requirements. This includes providing mandatory spillage containment areas (i.e. bunding) to prevent chemicals entering the stormwater system and storage above the Flood Planning Level if located on flood prone land.

8.4 Stormwater Discharge to Watercourse or Open Channel

(a) Direct discharge to a watercourse is to be avoided. Other alternatives should be considered as detailed in Council's Stormwater Drainage from Low Level Properties Technical Specification.

(b) The creation of a discharge point within a watercourse is a Controlled Activity under the Water Management Act 2000 and will require approval from the NSW Office of Water unless exemptions apply (refer to Schedule 5 of the Regulations).

(c) Only a single discharge point to the watercourse or open channel from the development will be permitted.

(a) The outlet structure must comply with Guidelines for Outlet Structures prepared by the NSW Office of Water and Council's Protection of Waterways and Riparian Land Policy for additional requirements.

9 Flood Risk Management

Council is responsible for managing flood risk in the Warringah Local Government Area (LGA). This policy is intended to complement the roles of other Government agencies that provide technical and

financial assistance in the development and implementation of flood risk and management plans as well as emergency response.

The following principles will guide Warringah Council in the management of flood risk in accordance with the process outlined in the NSW Government Floodplain Development Manual (2005).

9.1 Onsite Stormwater Detention

Onsite Stormwater Detention (OSD) collects stormwater and stores it temporarily before releasing it slowly into the drainage system in order to minimise the impacts from flooding.

(a) OSD is required for the following developments:

i. single residential dwellings where the total existing and proposed impervious areas exceed 40% of the total site area (OSD will not be required for alterations and additions or where the total site area is 450m^2 or less)

ii. new residential flat buildings/multi-residential unit dwellings

iii. commercial developments

iv. industrial developments

v. subdivisions resulting in the creation of three (3) lots or more

vi. subdivisions resulting in the creation of two (2) lots or more, OSD will be required where the post developed impervious area of the new lots exceed 40% of the site area of the new lots. This requirement also applies to newly created lots with existing dwellings to be retained

vii. Alterations and additions to existing residential flat buildings/multi-residential unit dwellings, commercial developments and industrial developments, OSD is applicable to the extent of the new works only.

(b) Development requiring OSD must comply with Council's On-site Stormwater Detention Technical Specification.

(c) A positive covenant and Restriction As to User must be registered on the title for the OSD system to ensure regular maintenance and operation.

(d) Council will not permit the use of "Drainage Cell" type products for on-site detention storage as access for maintenance or removal of silt/debris is limited.

(e) Council will allow the volume of rainwater reuse in single residential dwellings to be credited against the calculated OSD storage volume as determined by Council's Onsite Stormwater Detention Technical Specification.

9.2 Identifying Flood Risk

Council will develop and implement a flood program to identify and manage flood risk in the Warringah LGA. Prioritisation of activities within the flood program are based on the potential exposure of an area to flood risk, tying in with strategic priorities, as well as availability and quality of existing studies. Council will identify the extent of inundation and the flood behaviour of lagoons, creeks, estuaries and overland flow paths in Flood Studies.

Flood studies and associated plans will be undertaken in accordance with the NSW Government Floodplain Development Manual 2005 and will be updated as required depending on their current and ongoing suitability for use.

All Flood investigations and management plans undertaken by Council will incorporate appropriate community consultation in accordance with Council's Community Engagement Policy and Framework.

9.2.1 Climate Change

The impact of climate change on flood behaviour will be investigated in all Council flood investigations. Council will consider sea level rise projections and changes in rainfall and storm surge intensity and frequency, in accordance with latest guidelines and best available information for climate change.

9.2.2 Planning Certificates

Council issues Planning Certificates under section 149 of the *Environmental Planning and Assessment Act 1979* which specify such prescribed matters relating to the land as outlined in Schedule 4 of the Regulations, including "Flood related development controls information".

Council has a statutory responsibility to update Planning Certificates as any new or updated flood data becomes available subsequent to the approval from the Council.

The recommendation to Council to update Planning Certificates should be made in the same report as the recommendation to adopt the draft Final Flood Study.

9.2.3 Provision of Data to the Public

a) A Flood Information Report is available from Council (refer Council's fees and charges).

b) Council will provide the 1% AEP, FPL and PMF levels for a specific property where available.

c) Flood level information may be subject to change in the future

d) For large-scale developments, or developments in key flood areas, applicants may be requested to use Council's hydraulic model to assess the impacts. This would be applicable only for a development which is likely to cause a change in the flood regime or requires confirmation that it will create no impact on flooding for neighbouring properties. Hydraulic models are available from Council (refer Council's fees and charges) and recipients will be required to complete the appropriate Data Use Agreement.

9.2.4 Development on Flood Prone Land

a) All development on land identified as being flood prone or subject to overland flows must comply with the requirements of:

- Section 6.3 - Flood Planning of the Warringah Local Environmental Plan 2011, and
- Section E11 – Flood Prone Land of the Development Control Plan 2011
- Clause 47 of the Warringah Local Environmental Plan 2000.

b) A Flood Risk Assessment Report prepared in accordance with Council's Guidelines for Preparing a Flood Risk Assessment Report is required for any development within land identified as 'flood affected land' meaning land below the Flood Planning Level or the Probably Maximum Flood level if vulnerable development is proposed.

9.3 Overland Flow

Overland flow differs from mainstream flooding from creeks or lagoons as they are usually generated from surface run off and overflows from kerbs and smaller pipes, to more serious overland flows involving exceedance in the capacity of major trunk drainage systems.

9.3.1 Identifying Overland Flows

To determine if the subject property is affected by overland flow, a Civil Engineer who is currently registered on the National Professional Engineers Register (NPER), should be engaged to investigate and verify whether the subject property is affected by overland flows during a 1 in 100 ARI event. Council's Stormwater Planning Maps may assist identifying Council drainage in the vicinity of the property.

9.3.2 Development on Land Subject to Overland Flows

a) For development on properties subject to overland flow that has not been identified as being flood affected must comply with flood related development controls, in particular the Warringah Local Environment Plan 2011, Warringah Development Control Plan 2011 or Warringah Local Environmental Plan 2000, as appropriate.

b) Overland flow paths designed to contain a 1 in 100 year ARI storm flow are to be provided over all pipelines that are not designed to cater for this flow. The design of the overland flow path must consider the velocity-depth hazard.

c) Overland flow paths are to be kept free of obstruction and must not be landscaped with loose material that could be removed during a storm event, such as wood chip or pine bark.

9.3.3 Subdivisions on Lots Affected by Overland Flow

Proposed land subdivisions of lots affected by overland flow will not be approved unless the applicant can demonstrate that future development can comply with the requirements of the Warringah Local Environment Plan 2011, Development Control Plan 2011 or Warringah Local Environmental Plan 2000, as appropriate.

9.3.4 Piping Overland Flows

Developments proposing the collection and piping of overland flow through the subject property will generally not be permitted. Where an existing Council pipeline is to be diverted and/or upgraded, the design is to be in accordance with section 6 -
Building Over or Adjacent to Council Drainage Systems and Easements.

10 Compliance

Council will apply the Compliance and Enforcement Policy PL 120 for the investigation of alleged unlawful activity, and any enforcement action required in relation to unlawful activity, within the Warringah local government area for which Council is the appropriate regulatory authority.

10.1 Audit of Water Management Requirements

Council may undertake audits of developments to ensure the requirements of this Policy and the development consent are met at all times. For any non-compliances identified, Council will apply the provisions of the Compliance and Enforcement Policy PL 120.

10.2 Complaints Relating to Private Property

Complaints relating to stormwater from private property are only investigated by Council:

a) after the parties has exhausted reasonable attempts to resolve the matter with each other

b) when there is sufficient evidence that the water has caused, or is likely to cause significant soil erosion or physical damage to a building or land.

Council will not take action, when:

a) water flow problems are caused by natural ground seepage

b) water flows naturally onto the property from a higher property (or properties)

c) water flows from a defective or blocked private inter-allotment drainage easement of which the complainant is a part. Private inter-allotment easements are the responsibility of all property owners who are burdened by and/or benefited by the easement

d) water overflows from a swimming pool due to rainfall.

10.3 Removal of Private Trees Threatening Council Stormwater Pipes

a) To protect Council's stormwater pipes from blockage or structural damage by trees on private land, landowners may be required by Council to remove any tree adjacent to the pipes when it is apparent that the tree's root system has, or is likely to, penetrate the pipeline joints. If the owner refuses to do this after reasonable notification from Council, the owner is to bear the cost of any future maintenance work on the pipeline due to tree root damage.

b) Removal of private trees threatening Council stormwater pipes are to be conducted according to the following principles:

- Identification of tree roots within the pipe system, by means of CCTV or visual inspection
- Removal of root obstruction will be conducted only by the following means:
  i. unobtrusive removal of tree root mass with no physical interference to the pipe
  ii. excavation of the tree root mass at pipe location with minimal site disturbance
  iii. full excavation and replacement of pipe section in accordance with Auspec1 Design Manual.

c) Tree removal will be at owner's expense.

11 Amendments

Nil

12 Authorisation

XX XXX 2015

13 Who is Responsible for Implementing this Policy?

Group Manager Natural Environment

14 Document Owner

Deputy General Manager Environment

15 Related Policies

a) Compliance & Enforcement Policy PL 120
b) Risk Assessment Framework PL 700
c) Protection of Waterways and Riparian Land Policy PL 740

16 G Legislation and References

a) *Conveyancing Act 1919*
b) *Environmental Planning and Assessment Act 1979*
c) *Environmental Planning and Assessment Amendment (Building Sustainability Index: BASIX) Regulation 2004*
d) *Environment Protection and Biodiversity Conservation Act 1999*
e) *Fisheries Management Act 1994*
f) Guidelines for Outlet Structures prepared by the NSW Office of Water.
g) *Local Government Act 1993*
h) *MWH, 2004, Warringah Creek Management Study*
i) *Protection of the Environment Operations Act 1997*
j) *State Environmental Planning Policy 25 Building and Sustainability Index: BASIX 2004*
k) *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*
l) *State Environmental Planning Policy No. 71 - Coastal Protection*
m) *Threatened Species Conservation Act 1995*
n) *Water Management Act 2000*
o) Water by Design Technical Guidelines
p) Warringah Local Environment Plan 2000
q) Warringah Local Environment Plan 2011
r) Warringah Development Control Plan 2011
s) Warringah Council, Waterways and Riparian Map
t) Warringah Council, Protection of *Waterways and Riparian Land Policy*

u) Warringah Council, Building Over or Adjacent to Constructed Council Drainage Systems and Easements Technical Specifications

v) Warringah Council, Stormwater Drainage from Low Level Properties Technical Specification

w) Warringah Council, Onsite Stormwater Detention Technical Specification

x) Warringah Council Compliance and Enforcement Policy PL 120

y) Warringah Council, Water Sensitive Warringah Strategic Plan

z) Warringah Council, Water Sensitive Warringah Technical Paper

17 Definitions

Average Exceedance Probability (AEP) has the same meaning as defined in the Floodplain Development Manual.

Average Recurrence Interval (ARI) means the average or expected value of the period between exceedences of a given rainfall event or discharge.

Catchment means an area of land, bound by hills, mountains and the like from which all runoff water flows to the same low point. A catchment may possess more than one sub-catchment. Catchment Boundaries & Categories are identified in the Warringah Creek Management Study and on Council's Stormwater Planning Maps.

Downstream catchment means the direct sub-catchment a low level property would drain to via gravity.

Development has the same meaning as defined in the *Environmental Planning and Assessment Act 1979.*

Development application has the same meaning as defined in the *Environmental Planning and Assessment Act 1979.*

Drainage has the same meaning as defined in the Plumbing Code of Australia which means any sanitary drainage, liquid trade waste drainage or stormwater drainage system.

Endangered Ecological Communities has the same meaning as defined in the *Threatened Species Conservation Act 1995.*

Exempt and Complying Development means any development undertaken under the State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

Existing development means any development prior to authorisation of this policy.

Flood has the same meaning as defined in the Warringah Development Control Plan 2011.

Floodplain has the same meaning as defined in the Warringah Development Control Plan 2011.

Flood Planning Level (FPL) has the same meaning as defined in the Warringah Development Control Plan 2011.

Flood Prone Land has the same meaning as defined in the Warringah Development Control Plan 2011.

Flood Risk has the same meaning as defined in the Floodplain Development Manual.

Flood Storage has the same meaning as defined in the Floodplain Development Manual.

Habitable Room has the same meaning as defined in the Floodplain Development Manual.

High Hazard has the same meaning as defined in the Floodplain Development Manual.

Impervious area refers to land covered by impervious surfaces such as buildings, paving, asphalt, tiles, and the like, which limits or prevents infiltration of water.

Infrastructure Development means any development undertaken under the State Environmental Planning Policy (Infrastructure) 2007.

Integrated Development has the same meaning as defined in the *Environmental Planning and Assessment Act 1979.*

Inter-allotment drainage easement has the same meaning as an Easement to drain water as referred to in the *Conveyancing Act 1919*. An easement usually identified on the Certificate of Title issued by the NSW Land and Property Information.

Inundation is the experience of getting wet by any source of water including but not limited to fluvial, tidal, oceanic, overland flows, stormwater.

Low Level Properties means a property that has the ground level which is lower than the roadway fronting the property.

New development means any development being designed or constructed after the authorisation of this Policy.

Onsite stormwater detention system means is a stormwater drainage device to control the amount of stormwater discharge to a specified rate. The device is to be constructed on the subject property. Refer to Council's Onsite Stormwater Detention Technical Specification and Onsite Stormwater Detention (OSD) checklist for more information.

Onsite Wastewater Management System has the same meaning as Sewage Management Facility as defined in the *Local Government (General) Regulation 2005.*

Overland Flow means inundation by excess rainfall runoff, flowing across land before it enters a principal watercourse. Includes sloping areas where overland flows develop along alternative paths once system capacity is exceeded. Land is considered to be flood affected if flow depth is greater than 0.3m, or in the case of high hazard, if flow depth is greater than 0.15m.

Pollution has the same meaning as defined in the *Protection of the Environment Operations Act 1997.*

Probable Maximum Flood (PMF) has the same meaning as defined in the Warringah Development Control Plan 2011.

Receiving waters means a waterway/s into which water discharges from a development.

Remnant vegetation has the same meaning as defined in the Warringah Development Control Plan 2011.

Residential flat development has the same meaning as defined in the *State Environmental Planning Policy No 65 - Design Quality of Residential Flat Development*.

Riparian land has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Riparian zone has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Sewage has the same meaning as defined in the *Local Government (General) Regulation 2005.*

Single Lot Residential Development means all development

Stormwater is rain water that flows over the surface of the land as run-off, rather than seeping into the soil.

Undeveloped land means land:-

a) that has not been subject to prior development, or
b) is in a state of nature, or
c) with an impervious area of less than 10%.

Vulnerable Development has the same meaning as defined in the Warringah Development Control Plan 2011.

Watercourse has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy.

Waterway has the same meaning as defined in Council's Protection of the Waterways and Riparian Land Policy**.**

Wastewater has the same meaning as Sewage as defined in the *Local Government Act 1993.*

Warringah Council

PAS-PL 130

Building Over or Adjacent to Constructed Council Drainage Systems and Easements Policy

1. The purpose of this policy is

To ensure that Council's costs and liabilities are minimised when constructing, replacing, maintaining or obtaining emergency access to constructed public drainage systems located within private property.

2. Policy statement

This policy does not apply to natural (unconstructed) drainage systems and watercourses.

When a Development application is lodged on land that is burdened by a Council stormwater drainage system and or easement the principles outlined below are implemented.

3. Principles

The policy is to be implemented according to the following guidelines.

3.1 Environmental Considerations

In addition to a technical assessment under this policy, any proposal for building over or adjacent to a constructed drainage system will be subject to an environmental assessment in accordance with Council's Local Environmental Plan of the merits or impacts of the proposal. Compliance with the technical requirements of this policy is not to be taken as implying that Council approval will be issued.

3.2 Easements requirements for Council Drainage Systems

Council will acquire drainage easements over constructed public drainage systems within private property, wherever possible.

When a development application is submitted and the property contains a Council drainage system not burdened by a drainage easement, development consent shall be conditional upon the property owner agreeing to grant Council a drainage easement. All costs including legal and surveying associated with the creation of the easement are to be borne by the applicant.

Where a developer/property owner obtains Council approval to reconstruct and/or relocate any existing constructed public drainage system within the subject site,

the developer/property owner shall create drainage easements in favour of Council, to suit the relocated/reconstructed drainage system.

All costs associated with the reconstruction and / or relocation of Council's drainage system are to be borne by the applicant. This also includes hydrological and hydraulic studies and design plans prepared by a Civil Engineer registered on the National Professionals Engineers Register (NPER).

3.3 Hydraulic Design Requirements

Council's piped or underground drainage system is to cater for all storms up to and including the 1 in 20 year Annual Exceedance Probability (AEP). If the existing drainage system is not designed for the 1 in 20 year AEP then the drainage system will need to be upgraded by the applicant/developer to the 1in 20 year AEP capacity. The upgrading of Council's drainage system will be required prior to commencement of building works or during the building construction. The required upgrading of Council drainage system may be within the site and or along the street frontage(s) located within the road reserve.

An overland flowpath through the property is to be provided for all storms in excess of the 1 in 20 year AEP, up to and including the 1 in 100 year AEP. The width of any drainage easement shall be governed by the extent of the predicted 1 in 100 year AEP flowpath and also minimum easement width requirements listed below. Where an overland flowpath cannot be provided for all storms up to and including the 1 in 100 year AEP through the property, the piped or underground drainage system is to be upgraded to accommodate the 1 in 100 year AEP flows.

Hydraulic design plans and an accompanying report detailing the Council drainage system upgrade are to be prepared by a Civil Engineer registered on the NPER. The Hydraulic design plans are to be submitted with the Development Application. Hydrological and Hydraulic technical guidelines as specified in Council's Engineering Design Specification -AUSPEC ONE are to be used in the preparation of the Hydraulic design plans and report.

Upstream and downstream impacts are to be considered and minimised to prevent increases in hydraulic flows and water surface levels. All habitable floor areas are to have a 500mm freeboard above the 1 in 100 year AEP water surface level. Basement entry levels, garages, ventilation openings and other potential water entry points are to have a minimum of 500mm freeboard above the 1 in 100 year AEP water surface level.

3.4 Minimum Easement Width Requirements

The width of any drainage easement is controlled by the minimum practical width necessary for standard machinery to carry out reconstruction of the public drainage system to current standards and Occupational Health and Safety requirements. For this reason, the minimum width of any drainage easement shall be 3.0 metres.

Warringah Council

PAS-PL 130

For pipes/channels having a width greater than 1.0 meter, the drainage easement shall have a minimum width equal to the external width of the pipe/channel plus 2 metres, rounded to the next 0.1 meter (See Figure 1 below).

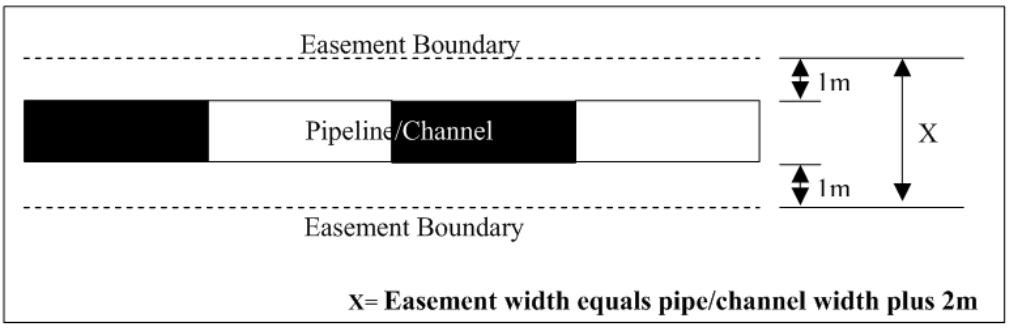


Figure 1 - Drainage Easement Width (Straight)

If bends occur in the Council drainage system then the minimum easement width shall be increased as detailed in Figure 2 below.

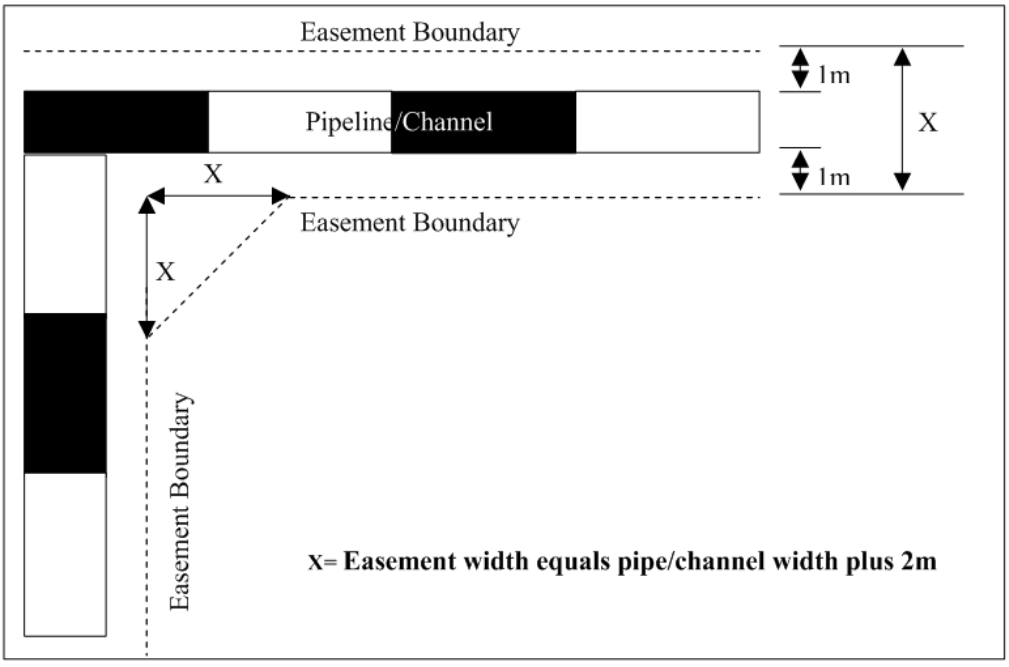


Figure 2 - Drainage Easement Width (Bend)

3.5 Permanent Structures over Council's Drainage system

The construction of buildings or other permanent structures over constructed public drainage systems is not favoured, and will generally not be approved by Council. However, in certain cases consideration may be given to a development proposal which can satisfy the minimum requirements for construction and maintenance access and also comprehensively demonstrate that objectives of this policy will be met. In these cases it will also be necessary to demonstrate that the site cannot be reasonably developed without building over, or by relocating Council's drainage system.

Filling over Council's drainage systems may be permitted, subject to the approval of Council's technical staff with supporting hydraulic studies prepared by a Civil Engineer registered on the NPER.

The hydraulic study is to demonstrate that there are no adverse effects including diversion of overland flow paths and flooding of upstream and downstream properties.

Note:
Construction of buildings or other permanent structures under constructed public drainage systems is not permitted.

Council may permit structures over constructed public drainage systems which are lightweight and easily demountable or removable such as carports and car stand areas. A Positive Covenant in favour of Council will need be created on the title, requiring any costs related to dismantling, removal, and subsequent re-assembling, re-installation, re-instatement of the above structures to be borne by the property owner.

Fences are to be not to be built over Councils drainage system as they impede the overland flow path, unless it can be demonstrated that there are sufficient openings to cater for the overland flow and also prevent the potential for debris blockages. Fences must designed to be able to be readily dismantled. All costs associated with the removal and restatement of the fences is to be borne by the applicant.

3.5.1 Minimum Requirements for Construction and Maintenance Access

Council may give a property owner approval to build a permanent structure over an existing Council drainage system where the structure provides adequate access for Council to reconstruct and maintain the drainage system. Council will not approve a structure over a public drainage system which will result in Council incurring additional costs by having to use specialised equipment or construction techniques.

a) Dimensional Requirements

Council's dimensional requirements for access are governed by the minimum horizontal and vertical clearances necessary for standard machinery to gain access to, and undertake construction and maintenance of public drainage systems. These clearances include:

i) The vertical height from the surface level over the public drainage system to the underside of the overlying structure. This is generally governed by the vertical swept path of backhoes, excavators and cranes and must take into account clearances necessary to load and unload standard trucks. The minimum vertical height shall be 5.0 metres.

ii) The horizontal distance between permanent obstructions along the line of the public drainage system. This is generally governed by turning circles and horizontal swept paths of backhoes, excavators and cranes and must take into account the limited maneuverability capabilities of these standard machines. The horizontal clearance shall be the minimum of 3.0 metres or the pipe /channel diameter plus 2 metres.

The vertical and horizontal clearances through the structure for access to the Council drainage system is governed by the travelling height, width and turning radius of standard construction machinery, and must take into account the size of loaded vehicles required to deliver construction materials or equipment. The minimum vertical clearance shall be 3.5 metres and the horizontal clearance shall be 3.5 metres on straight section with increases provided as necessary on vertical and horizontal curves. A right of carriageway in favour of Council will need to be created over the access way prior to occupation of the building.

Note:
The above dimensional values are minimums only. The required clearances will vary according to the size of the Council drainage system and are subject to the discretion of Council's technical staff.

b) Structural Provisions

The pavement over which Council will obtain access to the public drainage system shall be designed and constructed in accordance with relevant Australian standards so as to sustain the loadings which would be imposed by Council's construction vehicles.

Any pavement constructed on the surface over the Council drainage system shall include construction joints along each longitudinal edge of the easement over the drainage system, in order to facilitate Council's access to the drainage system. Where pavement consists of structurally reinforced concrete, the pavement within the drainage easement shall consist of suitably sized removable panels, designed as simply supported suspended slabs and include lifting eyes.

Warringah Council

PAS-PL 130

Footings of any building located over or adjacent to an easement or constructed public drainage system are to be a minimum of 300mm below the invert of the public drainage system and may rise by 300mm for each 300mm removed there from. (See Figure 3 below)

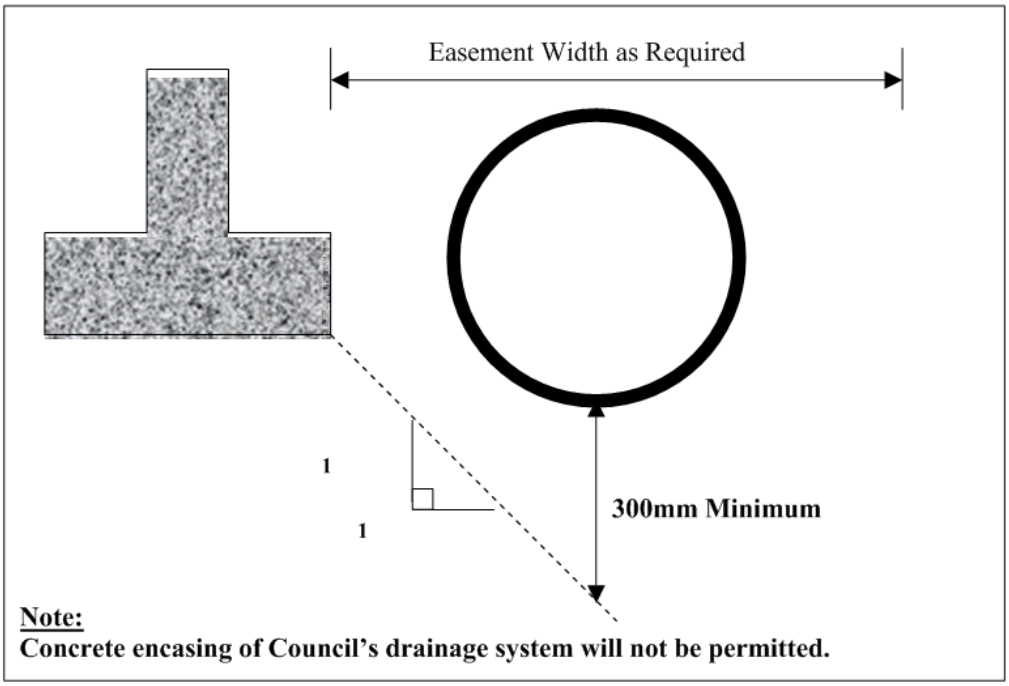


Figure 3 - Footing Placement in Relation to Pipe

c) Right of Access by Council

Provision is to be made to ensure that Council has uninhibited legal right of access through the overlying structure to the Council drainage system.

To ensure that Council has uninhibited access through the overlying structure, for emergency purposes, gates or doors cannot be installed along the path of access, between the public road and the Council drainage system.

To ensure that Council has legal right of access through the overlying structure, a Right of Carriageway is required to be granted to Council over the full length and width of the access, between the public road and the public drainage system. The Right of Carriageway shall be created to facilitate the minimum dimensions required by Paragraph 3.4.1.

4. Amendments

Nil

5. Authorisation

This Policy was authorised by Council on 28 February 2006.

Warringah Council

PAS-PL 130

The Policy is due for review on 28 February 2008.

Warringah Council

PAS-PL 130

6. Who is responsible for implementing this policy?

Team Leader Development Engineering

7. Document owner

Director, Planning and Assessment Services

8. Legislation and references

Council's standard engineering design specification Auspec 1.

Council's Stormwater Drainage Policy ENV-PL 410.

Warringah Council

PAS-PL 100

On-site Stormwater Detention Rainwater Re-use Policy for Alterations and Additions and new Single Residential Dwellings

1. The purpose of this policy is

To allow rainwater re-use to offset the volume of storage required by Council's "On-site Stormwater Detention Technical Specification", without compromising the OSD system's contribution to stormwater management.

2. Policy statement

On-site Stormwater Detention is required for all new houses where the total impervious area exceeds a certain percentage. With the implementation of the SEPP Building and Sustainability Index Basix 2004, which requires water saving commitments for alterations and additions and new single house development applications. It is proposed to credit the use of rainwater storage determined by Basix against the calculated On-site detention volume as calculated by Council's "On-site Stormwater Detention Technical Specification".

Rainwater re-use can be used for non-potable applications such as watering the garden, irrigation, clothes washing and toilet flushing.

3. Principles

3.1 Basix certificate requirements.

BASIX is an on-line web based design tool developed by the Department of Planning and Infrastructure in conjunction with other government agencies and public utility authorities to reduce water and energy consumption for all new housing construction.

On the 1st of July 2004 Basix commitments were required for all new Development Applications for single dwelling homes, reducing water and energy consumption. This was extended to alterations and additions to single residential dwellings in July 2006.
Basix ensures each new dwelling reduces water consumption by 40% compared with the average home.

Compliance with this target is demonstrated through the completion of a BASIX assessment and the issuing of a **BASIX Certificate**.

The BASIX on line assessment requires information about the proposed development, such as dwelling size, floor area, landscaped area and services.

The proposal is scored against the potential to use less mains water (potable water), than an average home. By installing rainwater re-use facilities to be used for flushing of toilets and watering of gardens etc.

To obtain a BASIX certificate, development applications complete an on line assessment using the BASIX tool and enter certain site parameters for the proposed development. A BASIX certificate can be obtained at **www.basix.nsw.gov.au**.

3.2 Rainwater re-use and On-site Stormwater Detention (OSD).
Council encourages the re-use of rainwater and where OSD is required as part of a development, Council will allow the volume of rainwater re-use to be credited against the calculated OSD storage volume as determined by Council's On-site Stormwater Detention Technical Specification.

****REVISED OSD VOLUME = Determined OSD volume (Council Specification) – BASIX certificate storage volume.**

**** Revised OSD Volume to a be a minimum of 50% of determined OSD volume (Council OSD Specification)**

The maximum storage volume as determined by the BASIX tool will be credited against the calculated OSD volume**. Additional storage beyond the determined BASIX volume will not be credited.**

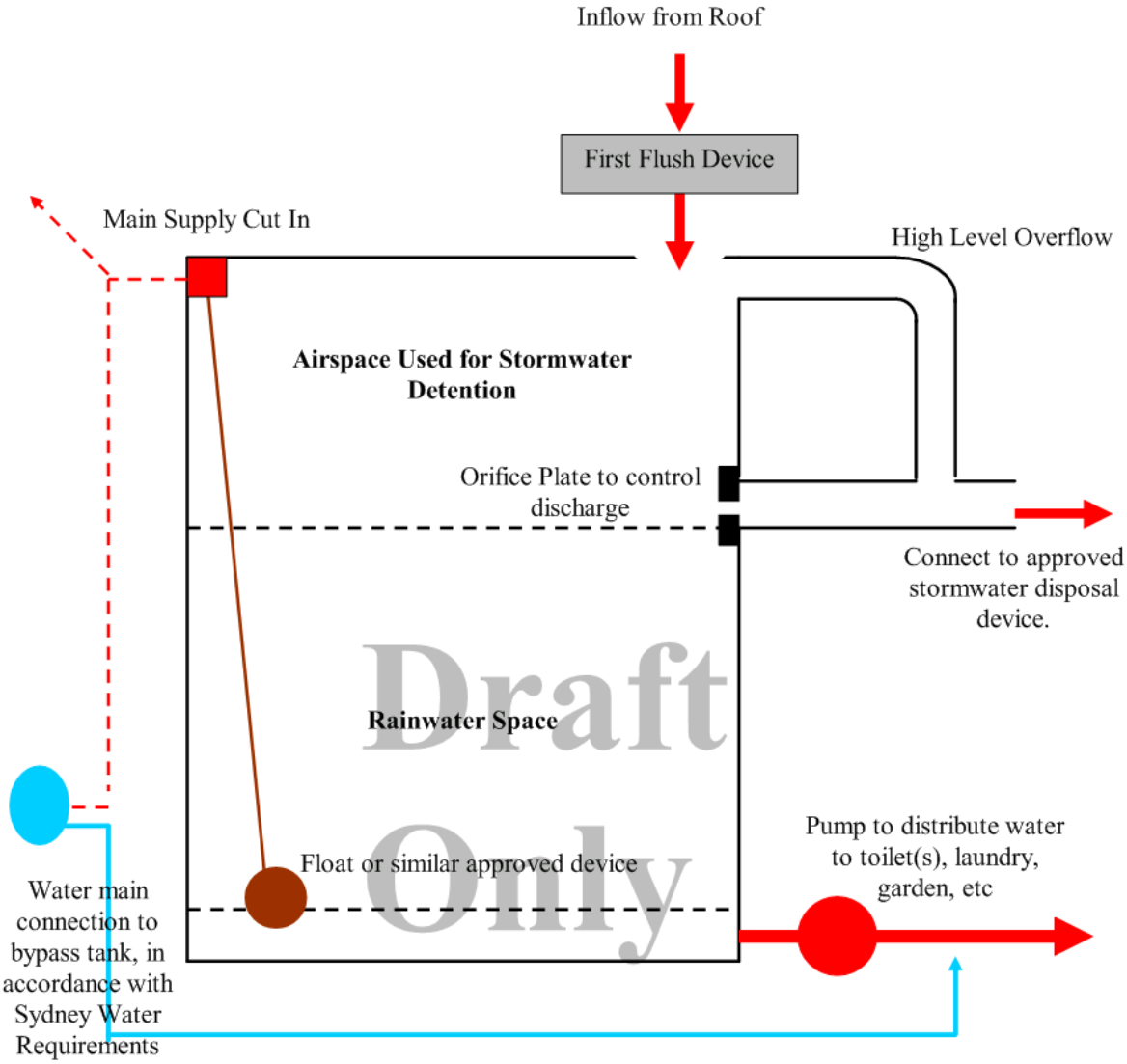
To achieve a full credit against the determined OSD volume rainwater re-use must be used for flushing of toilets as a minimum.

The stored rainwater can be used for non-potable usage such as watering of gardens, toilet flushing, washing cars, clothes washing etc. Combining OSD and rainwater re-use water in one tank is permitted. The tank can either be located above or below the ground, with typically the bottom of the tank being used for re-use whilst the top is used for OSD storage. Engineering details are to be submitted together with the drainage plans at the lodgement of the Development Application. Details are also to include to water re-use system including tank location and hydraulics plan.

A dual purpose OSD / rainwater re-use tank that collects only roof water from the roof may allow the majority of stormwater runoff from the site to be uncontrolled.
The design must ensure at least 50% of the site is routed through the OSD system.

The calculated permissible site discharge (PSD) is not to be adjusted as determined by the OSD Technical specification.

3.3 Typical Combined Rainwater/ On-site Stormwater Detention Tank



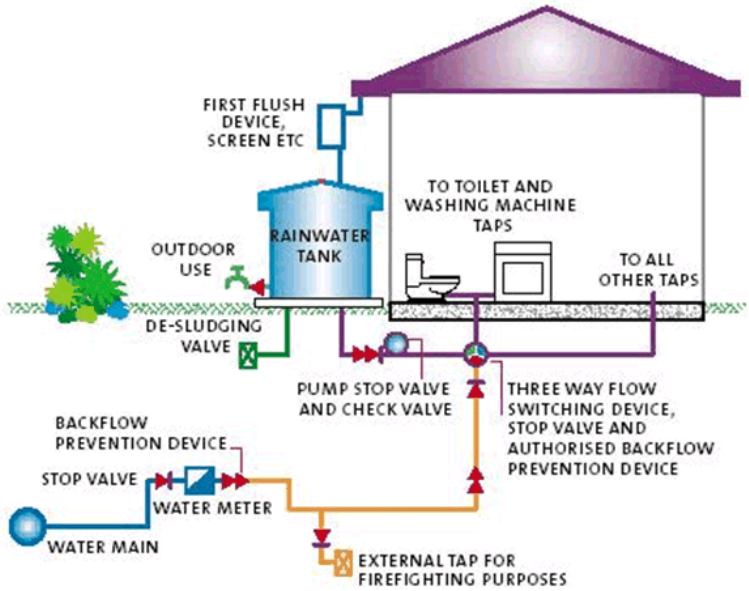


Diagram obtained from brochure 'Installing a Rainwater Tank' by Sydney Water.

3.4 Greywater re-use

In addition to rainwater reuse for non-potable sources re-use of domestic grey water may be considered. Grey water is not to be credited against the calculated OSD volume.

Grey water is by definition wastewater from showers, baths, hand basins laundry tubs and washing machines. It does not include wastewater from toilets, kitchen sinks and dishwashers. This is called **Blackwater.**

3.4.1 Greywater re-use systems

- Greywater diversion devices (GDD)
Diversion devices allow the redirection of household grey water through plumbing fixtures that to sub-surface irrigation systems. The grey water can be directed back to the sewer when not required in the garden or during wet weather. The devices can either be gravity fed or rely on a pump and surge tank set up, which regulates the flows.

A greywater diversion device must be installed in accordance with the most recent edition of **NSW Health's Greywater reuse in sewered single domestic premises**.

- Domestic greywater treatment systems (DGTS)

Domestic grey water treatment systems collect, store and treat greywater to a quality that is acceptable for direct uses onto the surface of the garden. The treatment process involves, the settling of solids, anaerobic digestion, aeration, and chemical treatment.

The DGTS must either by:

1) A greywater system device accredited by NSW Health in accordance with the DGTS Accreditation Guideline,

2) An aerated wastewater treatment system (AWTS) accredited by NSW Health in accordance with the NSW Heaths AWTS guidelines or,

3) A facility that is purpose designed for a particular premise and approved in accordance with the Local Government (Approvals) Regulation 1999.

4. Amendments

Amended march 2007, to add Basix requirements for alterations and additions.

5. Authorisation

This Policy was adopted on 22 November 2005

It was last amended on 27 July 2007.

6. Who is responsible for implementing this policy?

Team Leader Development Engineering

7. Document owner

Director, Planning and Assessment Services

8. File number

EDMS: Policy Register

9. Legislation and references

- Environmental Planning and Assessment Amendment (Building Sustainability Index: BASIX) Regulation 2004
- Environmental Planning and Assessment Act 1979 No 203
- SEPP 25 Building and Sustainability Index Basix 2004

9.1 Definitions

None.

Warringah Council

ENV-PL 415

Removal of private trees threatening Council stormwater pipes

1. The purpose of this policy is

To protect Warringah Council's stormwater pipes from blockage or structural damage by trees on private land.

2. Policy statement

Landowners are to remove any tree adjacent to the pipes when it is apparent that the tree's root system has, or is likely to, penetrate the pipeline joints. If the owner refuses to do this, he/she is to bear the cost of any future maintenance work on the pipeline due to tree root damage.

This policy will be implemented by Warringah Council and in consultation with appropriate service divisions.

3. Principles

Removal of private trees threatening Council stormwater pipes will be conducted according to the following principles:

3.1 Identification of tree roots within the pipe system, by means of videoing or visual inspection.

3.2 Removal of root obstruction will be conducted only by the following means:

a) unobtrusive removal of tree root mass with no physical interference to the pipe
b) excavation of the tree root mass at pipe location with minimal site disturbance
c) full excavation and replacement of pipe section, conducted under Warringah Council's guidelines and recommendations for Stormwater Construction

3.3 Tree removal will be at owner's expense.

4. Amendments

ENV-PL 415 Removal of private trees threatening Council stormwater lines supersedes policy number 4.3.01.
This report was amended on 7 August 2006.

Warringah Council

ENV-PL 415

5. Authorisation

The removal of private trees threatening Council stormwater lines policy was authorised by Council on 14/8/1984.

This policy is due for review on 31 December 2003.

6. Who is responsible for implementing this policy?

Manager Assets

7. Document owner

Director, Customer and Community Services.

8. File number

170.003.002

9. Legislation and references

-

9.1 Definitions

None.

Warringah Council

ENV-PL 410

Stormwater Drainage Policy

1. The purpose of this policy is

to protect life and property during major floods, reduce inconvenience during minor floods, protect the quality of receiving waters and lift public awareness.

2. Policy statement

Council aims to provide protection from stormwater drainage problems by implementing a series of controls as outlined in the principles below.

3. Principles

The Stormwater Drainage policy is to be implemented according to the following guidelines:

3.1 To protect life and property during major floods:

to maintain surface flowpaths on all land to protect the urban environment from the effects of stormwater flows, especially those flows resulting from major (infrequent) storm events.

Surface flow shall be controlled so as to negate (or reduce to an acceptable frequency) the possibility of flooding buildings (houses, factories, shops, hospitals etc) and/or danger to life at any location (pathways, roads, lanes, parks, building forecourts, plazas etc) by utilising:

- natural or existing routes
- road reserves as controlled extreme event floodways
- parkland adjacent to major and minor, intermittent and perennial watercourses as floodways
- parkland for the storage of flood flows where appropriate as flood mitigation basins
- the removal of flood affected development from floodways and the prohibition of further development in floodways
- the creation and maintenance of flood paths within development by careful attention to site levels
- fixing floor levels for all development to reduce the risk of flood damage

- augmenting the pipe/channel network where the other measures cannot be implemented.

3.2 To reduce inconvenience during minor floods

Pipe/channel systems should be used to minimise or negate disruptions and/or danger to both pedestrian and vehicular traffic that may be caused by uncontrolled surface stormwater flows resulting from frequent storm events.

The principal function of the urban pipe/channel drainage system is to maintain the viability of the transport infrastructure and NOT flood control. The pipe/channel drainage system should only be considered as a flood control measure when it is proposed and analysed as part of the surface drainage for major floods detailed in (1).

The pipe/channel drainage system may comprise:

- natural creeks and watercourses
- open earth and concrete lined channels
- underground pipelines and box culverts
- on-site stormwater detention systems.

3.3 To protect the quality of receiving waters:

The quality of receiving waters are to be protected and enhanced by the provision of water quality control devices and public education.

Water quality control devices include:

- mini wetlands
- trash racks
- gross pollutant traps (GPT)
- water quality control ponds.

These devices will be constructed to:

- remove paper
- bottles
- grass
- other trash, silt floatables including oils, deleterious chemicals and excessive nutrients from stormwater flow.

3.4 Public awareness:

The public will be informed of the contents and implications of Council's Stormwater Drainage policy and will be encouraged to protect themselves from flooding.

Guidelines and procedures will be prepared and distributed by Council to ensure as far as possible the objectives of this policy are achieved.

4. Amendments

ENV-PL410 Stormwater Drainage Policy supersedes Policy "Stormwater Drainage' implemented in 1992.

5. Authorisation

This policy was authorised by Council in 1992.

This policy is due for review in 31 December 2003.

6. Who is responsible for implementing this policy?

Service Unit Manager, Environmental Management.

7. Document owner

Environmental Management.

8. File number

9. Legislation and references

9.1 Definitions

None.

Warringah Council

Warringah Council Policy

Policy No. PDS – POL 136

Stormwater Drainage from Low Level Properties

1 Purpose of Policy

To manage overland flow, nuisance flooding and groundwater related damage caused by low level properties to adjacent downstream properties during storm events.

To manage the impact of stormwater runoff on Council's stormwater drainage infrastructure as a result of any Development on a low level property and ensure low level properties drain to their natural downstream catchment.

To provide guidance for owners of properties when submitting a Development Application to determine the appropriate drainage system where the property falls (naturally) away from the street.

The policy applies to all developments and land use.

2 Principles

This policy applies to all types of developments and land uses where these properties fall naturally away from the street. The requirement for stormwater disposal is dependent on the type of proposed development or proposed land use for the property.

For Zone R2 Low Density Residential Dwelling Houses, the property owner or developer is required to manage stormwater drainage according to the sequence of steps as outlined in sections 2.1 and 2.2 of the Policy

For all land use excluding Zone R2 Low Density Residential Dwelling Houses, the property owner or developer is required to manage stormwater drainage in accordance with section 2.3 of the Policy.

Council is to be satisfied that all avenues of the first or preceding step have been exhaustively investigated and considers these avenues to be impractical or unviable, prior to consenting the property owner or developer to progress to the next step.

2.1 Zone R2 Low Density Residential Dwelling House (for alteration and additions to existing dwelling houses) where an onsite stormwater detention is not required

A Development Application for a Zone R2 Low Density Residential Dwelling House where an On-site stormwater detention system is not required for the low level property, will require stormwater disposal from the site in accordance with the following steps:

STEP 1

Connection of stormwater to the existing stormwater disposal system will be permitted under the following circumstances:

i. Connection into an inter-allotment stormwater pipeline or Council's stormwater pipeline subject to the drainage pipeline having sufficient capacity

and the property owner having formal drainage easement(s) created over the above pipeline within the downstream property(s) or,

ii. Existing drainage system was previously approved by Council and,

iii. There are no valid objections of overland flow and groundwater related damage and the associated inconvenience from downstream property owners.

STEP 2

Where the means of disposal in Step 1 are not available, the use of an on-site absorption system will be permitted subject to the following:

i. The on site absorption system is designed by a suitably experienced and qualified civil engineer and,

ii. The on site absorption system will not have an adverse impact upon adjoining and/or downstream properties by the direction or concentration of stormwater on those properties and,

iii. Soil absorption characteristics and other physical constraints indicate the on site absorption system is appropriate for the property (see Attachment 2 – On site Absorption Design Guidelines)

iv. The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

STEP 3

Where the means of disposal in Steps 1 and 2 are not available, stormwater disposal from the site shall be via a gravity fed pipeline. This will require an easement to drain stormwater to Council's drainage infrastructure through the downstream property(s).

The property owner is to approach the adjoining downstream property owner(s) to request an easement be granted for the purpose of draining stormwater to Council's drainage system (See sample letter, Attachment 1). If the property owner is unable to attain any written responses from the adjacent downstream property owner, the property owner is to then enclose a Statutory Declaration stating that the above.

STEP 4

Where the means of disposal in Steps 1, 2 and 3 are not available, the use of level spreader will be permitted subject to the following circumstances:

i. The level spreader will have minimal impact on the upon adjoining bushland reserves and parks by the direction and flow of stormwater on the above reserves and park and,

ii. Soil absorption characteristics and other physical constraints indicate the on site absorption system is not appropriate for the property (see Attachment 2 – On site Absorption Design Guidelines) and,

iii. Compliance with any requirements of the affected downstream property owners, and

iv. The level spreader shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

STEP 5

Council may, at its discretion, consider other methods of stormwater disposal only if all of the abovementioned methods have been exhaustively investigated and were considered not appropriate for this development.

Note : If no other method of stormwater disposal is feasible, the Development Consent may be refused.

2.2 Zone R2 Low Density Residential Dwelling House (for all new dwelling houses or alteration and additions to existing dwelling houses) where on - site stormwater detention is required

A Development Application for a Zone R2 Low Density Residential Dwelling House where an On-site stormwater detention System is required will require stormwater disposal from the site to be in accordance with the following steps:

STEP 1

Option 1 – Connection of stormwater to an existing Council stormwater drainage line located within the subject site, subject to the drainage line having sufficient capacity.

OR

Option 2 – Connection of stormwater to an existing inter-allotment drainage easement and pipeline subject to the property owner demonstrating the inter-allotment pipeline has sufficient capacity and the property owner having a formal drainage easement(s) created over the inter-allotment pipeline within the downstream property(s).

STEP 2

Where the means of disposal in Step 1 is not available, Option 1 – Stormwater disposal from the site is to be via a new gravity fed pipeline. This will require an easement to drain stormwater to Council's drainage infrastructure through the downstream property(s).

The property owner is to approach the adjoining downstream property owner(s) to request an easement be granted for the purpose of draining stormwater to Council's drainage system (See sample letter, Attachment 1). If the property owner is unable to attain any written responses from the adjacent downstream property owner, the property owner is to then enclose a Statutory Declaration stating the above.

OR

Where the means of disposal in Step 1 is not available, Option 2 – Council will accept the use of an on-site absorption system subject to the following:

i. The on-site absorption system will not have an adverse impact upon adjoining and/or downstream properties by the direction or concentration of stormwater on those properties and,
ii. Soil absorption characteristics and other physical constraints indicate the on site absorption system is appropriate for the property (see Attachment 2 – On-site Absorption Design Guidelines), and
iii. The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

STEP 3

Where the means of disposal in Steps 1 and 2 are not available, Option 1 – The use of a charged line to drain roof runoff to the kerb and gutter system fronting the site will be acceptable provided:

i. Stormwater is discharged into the same catchment (or sub-catchment), in comparison to stormwater being discharged to follow the natural fall of the land to the rear of the subject site, and
ii. The property owner demonstrating that the kerb and gutter system including any low level driveways fronting the street has sufficient capacity to cater for the 1 in 100 year ARI storm event from roof runoffs from all applicable properties fronting the same road, and
iii. On-site absorption system will be required to collect stormwater from impervious areas of the development that cannot drain by gravity to the kerb and gutter system (see Attachment 2 – On site Absorption Design Guidelines), and
iv. The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

OR

Option 2 – The use of a level spreader to discharge stormwater will be acceptable to Council subject to the following :

Stormwater flows from the whole site are to be restricted to the 1 in 5 year ARI "state of nature" storm event, for all storm events up to and including the 1 in 100 year ARI storm event. This system will require the provision of an on-site stormwater detention system.

Council may, at its discretion, consider other methods of stormwater disposal only if all of the abovementioned methods have been exhaustively investigated and were considered not appropriate for this development.

Note : If no other method of stormwater disposal is feasible, the Development Consent may be refused.

2.3 All Land use excluding Zone R2 Low Density Residential Dwelling Houses

A Development Application for land use other than Zone R2 Low Density Residential Dwelling Houses, i.e., Subdivision Developments, Commercial Developments, Industrial Development and Mixed Commercial/Industrial/Residential will require stormwater disposal via a gravity fed pipeline where these properties fall naturally away from the street.

This will require an easement to drain stormwater to Council's drainage infrastructure through the downstream property.

An application under Section 88K of the Conveyancing Act 1919 can be made to allow the Court to consider making an order to impose an easement over land if the easement is reasonably necessary for the effective use or development of other land that will have the benefit of the easement.

Council may, at its discretion, consider other methods of stormwater disposal only if all of the abovementioned methods have been exhaustively investigated and were considered not appropriate for this development.

Note : If no other method of stormwater disposal is feasible, the Development Consent may be refused.

2.4 Pump-out systems

Council will only permit pump-out systems for draining sub-surface seepage flows from under-ground areas, such as basement garages where the seepage flows are minor and intermittent. The pump-out discharge line is only to be connected to a Council stormwater gully pit and not to the kerb and gutter.

The use of sump and pump-out systems for the disposal of stormwater flows are only to be used for the drainage of surface flows from basement vehicle entry driveways.

Council will not accept stormwater disposal to the public road fronting the low level property by employing pump-out systems because of the following reasons:

i. Potential failure of the pump-out system and consequent stormwater related damage to property and adjacent properties, and
ii. Diverting flows from one catchment (or sub-catchment) to another catchment (or sub-catchment) burdened that catchment (or sub-catchment) with additional stormwater flows that may cause nuisance flooding or exasperate existing flooding problems.

The public road drainage system fronting the low level property was not designed to adequately cope with the additional stormwater flows from these pump-out systems or charged drainage lines.

3 Authorisation

This Policy was adopted by Council on 27 October 2009.

It is effective from 27 October 2009.

It is due for review 27 October 2014.

4 Amendments

N/A.

5 Who is responsible for implementing this Policy?

Team Leader - Development Engineering

6 Document owner

Director - Planning and Development Services

7 Related Council Policies

Stormwater Drainage Policy ENV – PL410

8 Legislation and references

a) Local Government Act 1993, Section 124 Order Number 12

b) Sydney Coastal Councils Group groundwater management handbook

c) Conveyancing Act 1919-Section 88K.

9 Definitions

Policy No.

a) Zone R2 Low Density Residential Dwelling Houses – land use as referred to in the Draft Warringah Local Environment Plan 2009

b) Low Level Property – a property that has the ground level which is lower than the roadway fronting the property.

c) Level spreader – a device that allows for the even distribution of flows across the land.

d) Downstream catchment – the direct sub-catchment a low level property would drain to via gravity.

e) State of nature – the undeveloped condition of a property, that is, the property is grassed or turfed

f) On-site stormwater detention system – a stormwater drainage device to control the amount of stormwater discharge to a specified rate. The device is to be constructed on the subject property. Refer to Council's On-site Stormwater Detention Technical Specification and On-site Stormwater Detention (OSD) checklist for more information.

Policy No.

Attachment 1

Dear . . . .

I/we . . . .
are proposing to redevelop our property at . . . .

Before we can proceed with this proposal Council has advised us that we have two options for the drainage of stormwater, the first, which is Council's preferred method, is to obtain a drainage easement to convey the stormwater runoff from our property to the nearest public stormwater drainage infrastructure or Council approved discharge point,
being . . . .

This will require you to grant me/us a drainage easement through your property with all legal and survey costs for the creation of the easement being borne by us, together with any consideration for the use of your property as determined by an independent valuation or agreement. (Attach independent valuation or agreement to this form)

The other alternative is to install an underground absorption system or level spreader (if appropriate for this site) to spread and disperse the stormwater flow. As the runoff and seepage from this system may flow towards your property because of the slope of the land, the best solution would be to have a drainage system that will convey our stormwater via an inter-allotment drainage pipe to . . . .

You are advised that if Council determines that the only way for the drainage of stormwater is via an easement through your property, I/we may have to use Section 88K of the Conveyancing Act 1919 to request the Supreme Court to grant me/us the drainage easement. This will probably result in legal expenses and time spent for both you and I/us.

Could you please indicate your position regarding this matter so that we can advise Council to enable our application to progress.

YES I/we are willing to grant you a drainage easement.

. . . .

Name   Address

NO I/we are not willing to grant you a drainage easement.

. . . .

Name   Address

Policy No.

Attachment 2

WARRINGAH COUNCIL STORMWATER ON-SITE ABSORPTION DESIGN GUIDELINE

1. A consulting geotechnical engineer must submit a geotechnical report providing the following details (where applicable) for the proposed location of the absorption/dispersal trench:
   - Depth to rock
   - Depth to the water table
   - Measured infiltration rate (in litres/square metres/second)
   - Infiltration rate that can be maintained in the long term
   - Minimum distance any infiltration system should be located clear of property boundaries
   - Whether the use of infiltration is likely to cause seepage problems to the proposed structure or to any adjoining properties
   - The use of any waterproofing to protect underground areas
   - Any special requirements for the design of walls or footings on the site

   The above information must be submitted to Council to determine whether any absorption system is permitted for the site.

2. The absorption pit is to be designed for an Average Recurrence Interval (ARI) storm of 50 years using DRAINS computer software based on the infiltration rate that can be maintained in the long term. An overflow mechanism in the form of a level spreader must be provided for all storms greater than the 50 year ARI storm, up to and including the 100 year ARI storm. The overflow mechanism is required to minimise overland flow disturbance to the lower property.

3. The roof guttering and downpipe system should be designed to collect the 50 year ARI design rainfall and pipe it to the absorption system, or alternatively provide for surface collection of guttering overflows into the absorption system.

4. A site plan showing the location of absorption pit(s) relative to fences and to the buildings on-site and on neighbouring properties must be provided. The pipe layout with sizes and grades is also to be shown. Drainage calculations must be submitted with the plans.

5. Where a high water table is encountered and a gravel filled trench design is proposed, the base of the trench should be at least 500mm above the water table to accommodate fluctuations of the groundwater.

6. When considering available storage volumes for the storage design methods, a maximum of 20% voids in the base aggregate may be used. Volumes in the end pits and the Everglas Trench systems may also be used.

7. The absorption pit should not be located within three metres of the side or rear boundary, or three metres from any on-site building or neighbouring buildings.

Policy No.

Attachment 3

WARRINGAH COUNCIL STORMWATER LEVEL SPREADER DESIGN GUIDELINE

1. Level spreader is to be designed by a suitably qualified and experienced Civil Engineer, who has Membership to the Institution of Engineers Australia.

2. Stormwater flows from the whole site are to be restricted for all storm events up to and including the 1 in 100 year ARI storm event. This system will require the provision of an on-site stormwater detention system.

3. Total discharge including bypass flows and controlled flows through the level spreader must not exceed the 1 in 5 year ARI state of nature storm event.

4. The level spreader should not be located within three metres of the side or rear boundary, or three metres from any on-site building or neighbouring buildings.

5. The level spreader ideally is to be located as far as possible from the downstream boundary.

6. Level spreader must not directly or indirectly, result in the concentration and increase of surface flows downstream of the property.

Warringah Council

STR-PL 820

Water Sensitive Urban Design

1. The purpose of this policy is

- To establish Council's commitment to sustainable water management and demonstrable Council's Corporate Commitments to sustainable development.
- To improve the ecological condition of urban streams, catchments and receiving waters by addressing water as a resource and managing the total water cycle in a more sustainable manner.
- To improve the way development is carried out in Warringah by promoting more sustainable, economic and practical management of the total water cycle.

2. Policy statement

Stormwater management has historically focussed on directing water away from properties and managing pollution, flooding and erosion problems within the drainage system. It is now widely recognised that rainwater should be used within buildings and delivered to the environment in a more sustainable fashion, replicating natural water cycles. The advantages of sustainable water management extend beyond the environmental benefits of improved receiving water quality, reduced quantity of storm flows and reduced demand on the reticulated water supply. Development, construction and maintenance costs can be reduced with an integrated series of water management techniques that utilise water as an asset rather than a nuisance. A combination of recreational, habitat and flood mitigation benefits can be gained from the same piece of land while improving the amenity of the land to the community. The practice of sustainable water management is usually referred to as water sensitive urban design or integrated water cycle management.

3. Principles

- Council will actively develop and implement planning controls and guidlines that support integrated water cycle management for Council's operations and for the community consistent with the principles of ecologically sustainable development

- Council will employ the principles of integrated water cycle management in the development and management of Council and community assets

- Council will actively promote the benefits of integrated water cycle management

- Council will work in partnership with agencies and organisations in the pursuit of integrated water cycle management

Warringah Council

STR-PL 820

4. Amendments

This Policy is to be reviewed during the 2006 – 2007 Management Plan cycle.

5. Authorisation

6. Who is responsible for implementing this policy?

The responsibility for implementing this policy is with the General Manager. People who have responsibilities under this policy are:

Executive Team
Service Unit Managers

7. Document owner

Manager Policy and Planning

8. Dataworks Registration Link

Water Sensitive Urban Design
Water Conservation
Policy Register for Council

9. Legislation and References

9.1 Definitions

Water Sensitive Urban Design: Water sensitive urban design (WSUD) or integrated water cycle management, seeks to ensure that development is carefully designed, constructed and maintained so as to minimise impacts on the natural water cycle. It is part of the contemporary trend towards more 'sustainable' solutions that protect the environment. Water sensitive urban design can help counteract many of the negative impacts of urban development on the natural water cycle. By utilising appropriate measures in the design and operation of development, it is possible to:

- maintain and restore natural water balance
- reduce flood risk in urban areas
- reduce erosion of waterways, slopes and banks
- improve water quality in streams and groundwater
- make more efficient use of water resources
- reduce the cost of providing and maintaining water infrastructure
- protect and restore aquatic and riparian ecosystems and habitats

- protect the scenic, landscape and recreational values of streams and beaches.

Further information on WSUD can be found within the Data Works subjects listed in the File reference.

9.2 Legislation

- Local Government Act – Section 7 (e) and Section 89 (1) (c)

9.3 References

1. Water Sensitive Urban Design in the Sydney Region (2002) *'Model Draft Council Report'* unpublished.
2. May, C.W and Hornet, R.R (undated) *'The Limitations of Mitigation-Based Stormwater Management in the Pacific Northwest and the Potential of a Conservation Strategy based on Low-Impact Development Principals'*. As presented in Water Sensitive Urban Design in the Sydney Region Seminar November 21 2002.
3. Boubli, D (2002) *'A Case Study in Delivering Water Sensitive Urban Design'*. As presented in Water Sensitive Urban Design in the Sydney Region Seminar November 21 2002.
4. Water Sensitive Urban Design in Warringah: Summary Report (2002) prepared by Montgomery Watson Harza. Unpublished.
5. Water Sensitive Resource Kit for the Sydney Region (2003). Published by the Upper Parramatta River Catchment Management Trust on behalf of the WSUD in the Sydney Region Project.

WARRINGAH COUNCIL

On-site Stormwater Detention Technical Specification

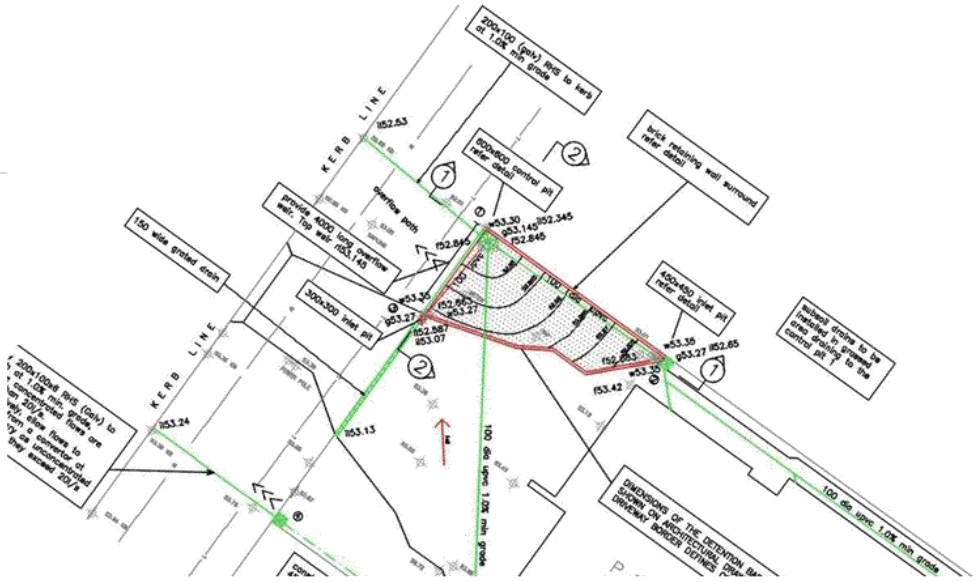


Table of Contents

LIST OF TABLES

LIST OF FIGURES

1 General

This Specification supports and compliments the requirements of the Warringah Development Control Plan and Water Management Policy.

Variations to the requirements of this Specification will only be considered on merit following submission of documentation to allow adequate assessment.

Sites which cannot drain directly to a public stormwater drainage system shall require disposal of collected stormwater in such a manner which will not adversely affect downstream land (Refer to Section 2.4 for further details).

If the site is part of a new subdivision and drains into a community detention basin which was constructed as part of that subdivision, On-site Stormwater Detention (OSD) may still be required for developments on the individual allotments, where the design parameters of the community system do not fully compensate for the development. Council staff should be consulted in these cases.

This Specification is intended to apply to Development Applications (DA's) and Construction Certificates (CC's) as from the 1st July 1998, under the provisions of the *Environmental Planning and Assessment Amendment* Act (EP&AA Act 1997).

For stormwater drainage and engineering related matters other than for OSD design, reference is to be made to Council's AUSPEC1 Construction Specification Document and Development Engineering Minor Works Specification.

2 Planning and Design

2.1 Applications

Generally OSD is required for all developments in Warringah where the total existing and proposed impervious areas exceed 40% of the total site area.

The above criterion does not apply to residential flat buildings (RFB's), commercial and industrial developments and subdivisions resulting in the creation of three (3) lots or more, as these will require OSD in all cases.

Where subdivisions result in the creation of two (2) lots, OSD will be required where the total post developed impervious area of the new lots exceed 40% of the total site area. This requirement also applies to newly created lots with existing dwellings to be retained.

All development applications for single residential dwellings where the total site area is 450m^2 or less will not require OSD.

All development applications for alterations and additions for single residential dwellings will not require OSD.

To assist Council in determining whether OSD will be required, an *OSD Checklist,* which can be obtained from the Planning and Assessment Services Counter, is to be filled out and submitted with the Development Application (DA). A copy of this form is attached in APPENDIX 8 of this Specification or Council's internet site http://www.warringah.nsw.gov.au/sites/default/files/documents/pdf-forms/onsite-stormwater-detention-checklist/4osdchecklist000.pdf

Refer to Section 4 for design guidelines.

2.2 Pre-Lodgement Meeting

Council offers a pre-lodgement meeting service which is strongly encouraged for large-scale, complex or controversial development applications, however is available for all development types. A fee is payable for this service with further details provided on the website link below.

Following the meeting, you will receive written advice that lists the information required for the application to be processed. It also indicates whether or not the application is likely to be accepted.

Further information can be found at http://www.warringah.nsw.gov.au/planning-and-development/application-process/submit-your-application

2.3 Rainwater Re-use for Single Residential Development

Council may permit the volume of rainwater reuse to be credited against the calculated OSD storage volume as determined by this Specification for single residential dwellings only.

Please note the rainwater reuse system shall be designed in accordance with the AS/NZS 3500 Plumbing and Drainage Part 3 Stormwater.
The maximum storage volume as determined by the BASIX tool will be credited against the calculated OSD volume. Additional storage beyond the determined BASIX volume will not be credited.

The following calculation may be used to determine the revised OSD volume:

****REVISED OSD VOLUME = Determined OSD volume (Council Specification) – BASIX certificate storage volume.**

**** Revised OSD Volume to a be a minimum of 50% of determined OSD volume (Council OSD Specification)**

To achieve a full credit against the determined OSD volume rainwater reuse must be used for flushing of toilets as a minimum, however rainwater can be used for non-potable usage such as watering of gardens, washing cars, clothes washing etc. Combining OSD and rainwater reuse water in one tank is permitted.

The design must ensure at least 50% of the site is routed through the OSD system.

The calculated Permissible Site Discharge (PSD) is not to be adjusted as determined by Council's On-site Stormwater Detention (OSD) Technical Specification.

2.4 Gravity Drainage and Easements

Stormwater drainage for all properties must be by gravity means. Mechanical methods of stormwater disposal (e.g. pump-out systems), other than for draining sub-surface flows from under-ground areas, such as in a basement carpark in a commercial or residential flat building, will not be permitted. Charged drainage systems (part of the system is below the outlet level and permanently hold water) are not acceptable. All stormwater drainage lines must be free draining.

Diverting flows from one catchment (or sub-catchment) to another catchment (or sub-catchment) will not be permitted. Properties must be drained in their natural direction. Where necessary, drainage easements must be obtained through downstream properties for piping flows to the downstream drainage system at the applicant's

expense. The site's existing discharge point into the public drainage system cannot be altered.

Inability to provide a gravity stormwater drainage system and drainage easement(s) may result in Development Consent not being granted.

Note: Where a stormwater drainage easement(s) is required, evidence in the form of a legal agreement, in regards to obtaining the easement(s), is to be provided to Council with the submission of the Development Application (DA).

The acquisition of a drainage easement(s) must be completed prior to the issue of the Development Consent. Council staff should be consulted for guidelines regarding minimum easement widths and other requirements pertaining to the development.

In exceptional circumstances, where it can be adequately demonstrated that it is not possible to drain to a downstream drainage system due to physical constraints and that there are no existing or reported downstream drainage problems, Council may give some consideration for alternative methods of stormwater disposal. In such cases, the Applicant must submit detailed hydrologic and hydraulic calculations to prove that the alternative method of disposal will not adversely affect downstream land or reduce the capacity of the receiving drainage system or cause nuisance drainage problems.

A geotechnical report must also be submitted where an absorption system is to be used and providing the absorption rate of the soil in litres per square meter per second ($l/m^2/s$). The approval of such a system will be dependent on the soil's ability to absorb water and the availability of land for effective absorption. In some cases, a combination of detention and absorption may be required to satisfy Council's drainage requirements. Refer to Council's Water Management Policy and Stormwater Drainage from Low Level Properties Technical Specification for on-site absorption design guidelines.

Although undesirable, Council may grant approval for a property to be gravity drained to a location outside its natural catchment or natural drainage path. This would be subject to the Applicant demonstrating to Council, beyond any reasonable doubt, that such discharge would, in no way, adversely affect any land, drainage system or receiving watercourse.

Information for determining catchment boundaries and for drainage analysis can be obtained from Council. Copies of scaled 1:2000 maps showing the existing public stormwater drainage system, is available on request.

2.5 Stormwater Drainage Plan (SDP)

A DA must include an SDP demonstrating the feasibility and functionality of the proposed drainage system(s) within the site, and the connection to the public drainage system. Full details must be provided in accordance with Section 3 of this Specification. Details shown on the SDP must be compatible with Council's planning controls (e.g. landscaping requirements and height restrictions). Early coordination between Engineers and Architects is recommended so as to reduce possible conflicts in the final plans.

The SDP is to show:

- the complete stormwater drainage layout for the site including the location and the type of OSD storage to be provided,
- all piped and surface flow paths within the site and through downstream properties, including easements where required,

- all information or computations necessary to support the Application and assist in Council's assessment, and
- that it is compatible with the landscaping drawing(s).

2.6 Visual Impact

All drainage structures are to be designed to be visually unobtrusive and sympathetic with the proposed development and the surrounding environment. This requirement is necessary to integrate drainage structures into the development thereby minimising the likelihood of future occupants removing these facilities for aesthetic or other reasons.

2.7 Flood Prone Land

OSD will not be required where the site of the development is located within a Council established 1 in 100 year ARI flood plain, and that it can be demonstrated that lesser storm events will also flood the site. Otherwise it will be necessary to provide OSD to control the runoff for the minor storm events.

2.8 Hydraulic Grade Line Analysis

If the rate of discharge from the outlet of the OSD system is affected by tailwater conditions from the receiving drainage system, for example, where the invert level of the orifice is lower than the surface level at the point of connection into the existing drainage system, then full hydraulic calculations, will be required. These hydraulic calculations shall include the determination of water surface profiles using hydraulic grade line analysis and/or backwater calculations. The preferred hydrologic model to be used in the analysis, to obtain flowrates, is the ILSAX or DRAINS program. Hydraulic analysis can be performed using hand calculations. However for more complex analysis in the determination of water surface profiles in creeks or rivers, the use of the Hec-Ras computer program is preferred.

Full hydraulic calculations will be required for all public and major piped systems, or where Council believes that it is necessary to determine the feasibility of the proposal. Full hydraulic calculations shall be required in conjunction with a detailed engineering longsection.

Calculations must be in accordance with current design practices and principles outlined in Australian Rainfall and Runoff (1987 or later editions) and Guidelines, and must be prepared by a suitably qualified and experienced civil engineer.

2.9 Legal Requirements

All OSD systems shall require the creation of a Positive Covenant and Restriction on the Use of Land in favour of Warringah Council on the Title, under Section 88E of the *Conveyancing Act 1919* for newly created lots. For existing Titles, a Positive Covenant is to be created by an application to the NSW Department of Lands using Form 13PC. The Restriction on the Use of Land is to be created using Form 13RPA.

The purpose of the Covenant is to ensure that the registered proprietor takes care, control and maintenance obligations for the OSD system. The Restriction on the Use of Land is to ensure that the system is not altered in any manner, shape or form.

The terms of the instrument must be approved by Council. However, standard terms to be included in the Positive Covenant and the Restriction on the Use of Land are given in APPENDIX 3.

All drainage easements are to be acquired prior to the issue of the Development Consent and Positive Covenants and Restriction on the Use of Land are to be finalised prior to the issue of the Occupation Certificate.

3 Information to be Lodged with the Development Application

3.1 Minimum Information required for all Single Residential Dwellings

- An estimate of the volume of OSD Site Storage Required (SSR) in accordance with the Table 1 in Section 4.2.1 - Streamlined Method.
- An estimate of the Permissible Site Discharge of OSD required in accordance with the Table 1 in Section 4.2.1 - Streamlined Method.
- Details of Council's drainage infrastructure burdening the site together with any calculations of the maximum 1 in 100 year ARI flow rate for flowpaths and floodways where applicable; (please refer to Council's Water Management Policy and *Building over or adjacent to constructed Council Systems and Easements* technical specification)
- Details of the OSD facility which must be located clear of any 1 in 100 year ARI flow path where applicable;
- Copies of certificates of title showing the creation of easements to drain water, where applicable
- Details of all paved and roof surface areas which must be collected and discharged into the OSD system
- A Stormwater Concept Plan including the following:
    1. the development/site boundaries and area
    2. contours and spot levels (which reflect the site gradings and extending into adjoining properties)
    3. the extent and area of any upstream catchment for external flows entering the site
    4. the location and extent of detention storages
    5. the location and levels of discharge points for the storages
    6. the layout of the site, including location of all buildings, roadways and landscaped areas
    7. the location and approximate extent of any floodways or flowpaths through the site
    8. the location and area of any portion of landscaped area of the site unable to drain to the detention storages.
    9. Location and levels/invert levels of all surface drainage pits.
    10. Location of stormwater drainage lines detailing sizes and grades.

3.2 Minimum additional information required when lodging a Construction Certificate for single residential dwellings

1. Structural Details of the OSD tank or any proposed retaining wall for above ground systems as designed by a suitably qualified engineer.
2. All other details are to be in accordance with the sample drawings in appendix 9 of this specification.

3.3 Minimum Information required for all Developments Except Single Residential Dwelling Developments

At the lodgement of the DA, an SDP showing the general layout of the proposed stormwater drainage system including the location(s) and dimensions of the OSD system(s) must be submitted. The minimum information to be lodged with the DA is to include the following:

- engineering drawings showing all of the existing and proposed stormwater drainage system, including pipe diameters, existing or proposed pits, open drains and points of discharge(s), detention basin(s) (where applicable), control pit(s) and surface flow path(s)
- where a connection is to be made through an easement, a longitudinal section of the pipe through the easement and details at the connection, are to be provided
- dimensions and areas of the site including all existing and proposed roof and paved areas are to be included on the stormwater drainage plan(s)
- copies of certificates of title showing the creation of easements to drain water, where applicable
- dimensions (mm) and volume(s) (m^3) of the proposed OSD system(s) or retention system(s) (where applicable)
- size (mm) and shape of the orifice and outlet device at the control pit
- finished floor levels of all existing and proposed structures, and existing surface levels, to Australian Height Datum (AHD), are to be shown on the drainage plan(s)
- plans, elevations and sections of the OSD system(s) in relation to all existing and proposed buildings and site conditions, finished surface levels and invert levels of all stormwater drainage pipes and structures, centre line level of the outlet pipe and orifice, the maximum design water level in the OSD system, and flood levels (where applicable) of the receiving water
- longitudinal section of all pipe(s) from the OSD basin to the discharge point showing calculated flows, velocities, pipe sizes, type and class, grades, and invert levels of all pipes, all utility services crossings and a hydraulic grade line (where required)

  Note: It is the responsibility of the Applicant to provide full details of all relevant services that may conflict with the proposed OSD system(s) and stormwater lines. The exact locations of any crossings or connections are to be shown.

- the depth of ponding for the 3month, 1yr, 5yr, 20yr and 100yr ARI storm events, for all above ground storage systems, are to be shown on the drawing(s)
- details of surcharge facilities and overland flow paths are to be shown on the drawing(s)
- details of Council's drainage infrastructure burdening the site together with any calculations of the maximum 1 in 100 year ARI flow rate for flowpaths and floodways where applicable;
- details of the OSD facility which must be located clear of any 1 in 100 year ARI flow path where applicable;
- details of access and maintenance facilities
- structural details of all tanks and pits, and manufacturers' specifications for proprietary items, and for above ground OSD systems, the type of surface finish to be used, are to be referenced or shown on the drawing(s)
- all supporting hydrologic and hydraulic computations are to be submitted
- calculations of the times of concentration (T_c minutes) of the existing and developed site are to be submitted
- calculations showing how the 5, 20 and 100 year ARI runoff (in litres per second) were determined for the existing and developed (with and without OSD) site, and the storm duration(s) that corresponds to these values

- all designs and calculations submitted to Council for approval must include a copy of all input and output files on CD-ROM. Please note that $3^1/2$" and $5^1/4$" computer discs will not be accepted
- summary information regarding the design of the OSD and associated stormwater drainage system in similar format as shown on drawing no. A1 9070 – 1, as given in Appendix 9, is to be shown on the drawing

3.4 Drawings

Stormwater drainage drawings are to be submitted at the lodgement of the DA. These drawings are to show all relevant details of the OSD system and associated works as outlined above in Section 3 and are to be signed and certified by a suitably qualified and experienced Civil Engineer, who has membership to the Institution of Engineers Australia and National Professional Engineers Register (NPER).

Where an underground tank is to be used, the standard drawing detail as given in Appendix 9 of this Specification can be used.

Where an above ground OSD system is to be used, dimensions and levels of the basin must be provided. Sample drawings are given in Appendix 9 of this Specification.

4 Detailed Design

4.1 General

An experienced and competent designer would need to be engaged to ensure compliance with all of the requirements of this Specification. The general requirement of Council's OSD Specification is to ensure that the site's stormwater runoff after any development does not exceed the runoff prior to the development (refer to Section 4.3).

Where possible, the OSD system must be designed to capture stormwater runoff from the entire existing and proposed roof and paved areas of the site and any other areas which can be physically directed to the system. Where this is not possible, then the majority of hardstand surfaces of the site must be directed to the OSD system. In this regard, only 20% of the hardstand area will be allowed to bypass the OSD system, that is, a minimum of 80% of the total hardstand must be directed through the OSD system. If there are more than one OSD system(s), then a minimum of 80% of that proportion of the hardstand area must be directed through each OSD system.

Where partial or staged development of a large site is likely, consideration should be given in locating the OSD system in an area where the entire development can drain to it. The system could be modified as additional development occurs and may be more practical than having numerous smaller systems scattered throughout the site.

4.2 Design Methods

Design of the OSD system shall be undertaken in accordance with one of the following methods:

1. "Streamlined Method" for Single Residential Dwellings as set out in Section 4.2.1
2. "Simplified Method" for All Development Except Single Residential Development as set out in Section 4.2.2
3. "Full Computation Method" for All Development Except Single Residential Development as set out in Section 4.2.3

4.2.1 Streamlined Method

The Streamlined Method involves the use of a table to size the OSD system and determine the Permissible Site Discharge. This method is to be used for all single residential dwelling developments.

Table 1: Minimum Site Storage Required and Maximum Permissible Site Discharge

Types of stormwater disposal	Minimum Site Storage Required (SSR)	Maximum Permissible Site Discharge (PSD) for all storms up to and including 1 in 100 year ARI design storm
All gravity fed drainage systems connected to Council's drainage system	200 m^3 per Ha	400 L/s per Ha
All drainage systems that require a level spreader	In accordance with Council's "Stormwater Drainage from Low Level Properties" policy	In accordance with Council's "Stormwater Drainage from Low Level Properties" policy

Note: All single residential dwellings will be assessed on the above SSR and PSD requirements.

4.2.2 Simplified Method

The Simplified Method as given in APPENDIX 1 – Simplified Method involves the use of tables to size the OSD system. The whole of the site area must be considered in the calculation of the Site Storage Requirement (SSR) and the Permissible Site Discharge (PSD), as predetermined by Council.

It is recommended that the Simplified Method be used only where the site conditions have similar parameters to those given in APPENDIX 1 – Simplified Method, in the derivation of the tables.

The Simplified Method can only be used for developments other than single residential developments when the whole of the site can be collected by the OSD system. That is, all runoff from the site is routed through the OSD system prior to discharging to the receiving external drainage system. A maximum of 30 m^2 of the site area, which cannot be physically drained to the OSD system, is permitted to bypass. However, where more than 30 m^2 of the site cannot be collected by the OSD system, then the Full Computation Method must be used.

Where there is more than one OSD system on the site, it is possible to calculate the required volume and discharge rate from each OSD system by determining the percentage of the site area draining to each OSD unit and then distributing the total calculated SSR and PSD (calculated from the total site area) to each OSD system.

The Simplified Method cannot be used for sites where its area exceeds 1200 m^2 in size. The derived tables were not intended for extrapolation.

4.2.3 Full Computation Method

Where the site conditions vary from those given in the Simplified Method (see also APPENDIX 1 – Simplified Method) and/or more than 30m^2 of the site cannot physically drain to the OSD system then the Full Computation Method must be used.

The Full Computation Method can only be used for developments other than single residential developments as set out in Appendix 2. An experienced and competent designer would need to be engaged to ensure compliance with all of the requirements of this Specification. In many cases, this method of analysis may produce the most economical design. The Full Computation Method involves the use of computer models

to simulate rainfall and runoff from the site. Refer to Section 4.4 for the types of models that can be used.

4.3 Pre and Post Development Runoff for Full Computation Method

The total site runoff for the 5 year ARI and the 100 year ARI storm event under existing site conditions (pre-development) must be determined. For the Simplified Method, these values are read from Tables 2a or 2b given in Appendix 6. In the Full Computation Method, these values are calculated. A check of the 20 year ARI storm event must also be made when using the Full Computation Method.

The direction of runoff from the site, which has to fall in the same direction of the catchment, must be maintained.

The pre-development stormwater runoff or Permissible Site Discharge (PSD), both piped and overland from the total site, must be calculated in the Full Computation Method. For all developments, the runoff from the site after development is not to exceed the runoff from the total site prior to the development, for all storm durations for the 5 year, 20 year and the 100 year ARI storm event.

For all developments except single residential dwelling developments the PSD is to be calculated on the maximum allowable impervious fraction of 0%. That is, discharge off the site is to be restricted to the “state of nature” condition.

Where alterations and additions are proposed, the PSD is to be calculated on the maximum allowable impervious fraction of 0% for the areas considered for the proposed alterations and additions only. Stormwater detention will be required for the extent of the proposed alterations and additions only.

For all subdivision developments that result in the creation of three (3) lots or more, the OSD system is to be designed for a minimum impervious fraction of 60% for each newly created lot.

The overland flow from the site is not to be concentrated at any single point, where necessary, flows are to be spread evenly across the entire site as unconcentrated overland flow.

The post-development runoff is to be determined based on the post-development impervious area for all storm durations for the 5 year, 20 year, and 100 year ARI storm events. The OSD system(s) must be designed to restrict these flows to the calculated pre-development discharge rates. Hence the 5 year ARI post-development runoff must not exceed the 5 year ARI pre-development discharge, the 20 year ARI post-development runoff must not exceed the 20 year ARI pre-development discharge, and the 100 year ARI post-development runoff must not exceed the 100 year ARI pre-development discharge.

The total piped flow from the site must not exceed the maximum 5 year ARI pre-development runoff. The total piped and overland flows from the site must not exceed the 100 year ARI pre-development discharge. Where surcharging out of the OSD system(s) is not permitted or possible, for example where the overflows would pass through a downstream property via an easement and where there is no safe overland flowpath available, the OSD system(s) must be designed not to overflow. In this circumstance, the outlet pipe is to be designed for the 100 year ARI storm event even though the OSD outflow is to be restricted to the 5 year ARI storm event. This is to account for any blockages in the pipe which may cause runoff to overflow out of the OSD system.

4.4 Computer Modelling

4.4.1 General

The Full Computation Method requires computer modelling to determine the volume or Site Storage Requirement (SSR) and the PSD.

The preferred model for analysis is ILSAX or DRAINS. Council has chosen the ILSAX model because it is public domain and requires minimal data entry, and is consistent with Council's drainage database.

Note: Computation methods based on the approximate triangular method or the rational method is not acceptable.

4.4.2 Design Parameters to be used in the Model

Where the Full Computation Method is to be applied, and the ILSAX or DRAINS model is used in the design, the following design parameters are to be adopted:

- soil type = 2.5
- antecedent moisture content, AMC = 3
- infiltration rates:

  initial paved = 1 mm, grassed = 5 mm

- storms, as per Australian Rainfall and Runoff (AR&R 1987). All design storm duration for the 5, 20 and 100 year ARI, must be checked. Stacked rainfall patterns to be used in the ILSAX program are given in Figures 1 to 3 in Appendix 7
- the time of concentration (T_c) can be calculated using the kinematic wave formula from AR&R (1987) p 300, or read from Tables 4 and 5 in Appendix 6

  Where:

  1. The flow path length, L is the distance from the furthest point of the site to the exit to Council's stormwater drainage system. This length may be modified by the development either by piping, paving or redirecting
  2. The surface roughness coefficient, n* is per AR&R (1987) p 300. For non-paved areas the minimum value of n* to be used is 0.33
  3. The area to be considered in the calculations is the total area of the catchment affected and not just the development site

- stored bypass or surcharge is not to be used. That is, type "0" inlets are not to be used
- supplementary areas are not to be used
- orifice size can be estimated using Table 3 in Appendix 1, or calculated from the formula: $Q = CA\sqrt{2gh}$

  Note: The tables are based on a '*C*' value of 0.6 for a circular shaped, square edge cut in a flat plate

- all areas likely to be paved after completion of the development (e.g. driveways, and courtyards), will be considered as part of the impervious area and included as such in the calculations

- the determination of the SSR is to be undertaken by trial and error, using the above constraints.

4.5 Surface Flow Paths

Runoff from the developed site must not cause a detrimental effect on any property. This may require the retention of existing surface flow paths and maintaining the same or reduced quantity and water depths in these flow paths.

Surface flow paths may include the provision of an emergency overflow weir or spillway for unexpected blockages which may occur to the system, or for flows in excess of the 100 year ARI storm event. The flow route must be capable of carrying stormwater up to and including the 100 year ARI storm event to account for 100% blockage to the piped system. A minimum freeboard of 300 mm must also be provided between habitable floor levels and the maximum water level on the developed site and any other adjoining properties so affected.

Any uncontrolled flows or overflows that are directed to the street will require calculations to show velocity-depth characteristics for sheet flows to the kerb as per scouring and safety criteria stated in the Australian Rainfall & Runoff manual. The maximum allowable depth of sheet flow is 200mm and the maximum velocity x depth product of 0.4 m^2/s is permitted.

4.6 Stormwater Runoff from Upstream Catchment(s)

Stormwater from upstream catchment(s) must not enter into the OSD system(s). The design of suitable channels, open drains, pits and pipes, mounding, landscaping or walls may be necessary to divert stormwater from adjacent properties away from the system(s). However, care must be exercised to ensure that the provision of such diversions within the site does not result in the concentration of stormwater onto adjoining properties. If this cannot be achieved, then the OSD system(s) must be designed to cater for the additional stormwater inflow.

4.7 Floor and Ground Levels

All office, storage and habitable floor levels are to be set at a minimum of 300 mm above the maximum design storage water surface or surcharge flow path level, whichever is higher. All factory warehouse and garage floor levels are to be set at a minimum of 150 mm above the maximum design storage water surface and surcharge flow path levels.

Council will not approve detention systems directly under habitable floors. In special circumstances, where approval is granted for enclosed systems, the control/inspection pit must be able to be accessed externally to the building.

The definition of *habitable floors* includes all living areas, commercial office space, store rooms and show rooms where there is likely damage by water inundation (or condensation) to stored goods and materials.

Enclosed detention storage systems may be permitted under a basement or ground floor carparking area, garage or patio. Under these circumstances, unobstructed external access to the OSD system(s) must be provided at all times. A safe overflow route from the OSD system must also be provided. Access to the OSD system(s) via enclosed structures will not be acceptable.

4.8 Site Discharge and Connection to Public Drainage System

Where possible, the PSD is to be piped to the nearest downstream formed or natural public drainage system. Piped discharge from the total site may be connected to the kerb and gutter, provided that the PSD does not exceed 20 litres per second per outlet per 15m run of kerb and gutter for storms up to and including the 100 year ARI.

The outlet pipe leaving the site, must exit at an acute angle of less than 45 degrees from the boundary.

Council will require that all concentrated stormwater runoff to be piped to the nearest public drain, or natural watercourse, with a minimum 375 mm diameter pipe, and to Council's specifications, if:

(i) concentrated discharge from the site to the street gutter cannot be restricted to 20 l/s at 15 m apart, and

(ii) a direct connection to the public drainage system outside the subject property is not available.

Pipe junctions are to be orientated to minimise hydraulic losses. Pits are to be located at changes of direction, at property boundaries, and connection to the public drainage system. Where pits cannot be used, suitable transition structures may be accepted at Council's discretion.

Where an outlet pipe is to be connected through a standard 150 mm high kerb and gutter, and is greater than 100 mm in diameter (or there is less than 50 mm cover over the pipe), the following structures will be required:

(i) minimum 450 x 450 grated converter pit to be constructed inside the boundary of the property, and

(ii) between the converter pit and the kerb and gutter, laying galvanised steel rolled hollow rectangular sections to the following equivalent dimensions:

- 100 dia outlet pipe - use 1 x 100 mm x 100 mm x 6 mm thick RHS
- 150 dia outlet pipe - use 1 x 200 mm x 100 mm x 6 mm thick RHS
- 225 dia outlet pipe - use 2 x 200 mm x 100 mm x 6 mm thick RHS.

Note: No other allowance will be considered, especially for twin 150 mm pipes into a 200 mm high kerb and gutter, or multiple outlets of more than three pipes.

The absolute minimum pipe grade on all outlets is to be:

- 1.5 % for pipes less than 225 mm diameter, or
- 1.0 % for pipes greater than 225 mm.

Note: Minimum pipe grades and design requirements for public drainage systems are given in Council's Standard Specification for engineering works.

4.9 Discharge Control Devices

4.9.1 General

The type of control device which is acceptable to Council is a flat plate with a square edge cut to form the orifice hole. This device is to be mounted in front of an oversized outlet pipe. Other forms of control devices may be acceptable to Council provided

adequate supporting calculations can be submitted to demonstrate that it will perform as intended to the requirements of this Specification.

All hydraulic control devices are to be non-removable.

High early discharge or normal discharge control devices can be used.

It is desirable that these control devices operate under *inlet control*, that is, a "free outlet" condition exists. However, in exceptional cases where inlet control cannot be achieved, Council, at its discretion, may allow the system to operate under *outlet control*. Systems which are to operate under outlet control or downstream control will require supporting calculations for determining flows and water levels in the external drainage system for which the OSD system will be connected to. A full range of storm recurrence intervals will need to be considered.

Note: All discharge control devices and pits are to be located externally to all structures and buildings so that 24 hour access to the OSD system is possible and that overflows from the system can be safely directed away.

4.9.2 Orifice Plates

Orifice plates are to be made of a flat sheet of stainless steel plate with minimum dimensions of 200 mm x 200 mm x 3 mm thick. Galvanised steel plates will not be acceptable. The orifice hole is to be cut to the exact dimension as calculated and to be of a uniform circular shape with sharp (not rounded) edges. The centre of the plate is to be cast into the wall or epoxied and securely fixed over the centre of the outlet pipe by the use of at least 4 "Dyna" bolts or similar, one at each corner.

Generally, to minimise blockages, orifice diameters smaller than 50 mm will not be accepted.

The invert of the orifice must be at least 50 mm lower than the base of the main tank. Ideally, the level at the base of the tank should match the level of the centre of the orifice. This is to ensure that the tank will not hold water during dry weather.

4.10 Trash Screens

A stainless steel or galvanised mesh screen (Maxi-mesh RH3030 or equivalent) with a minimum of 50 times the orifice area shall be provided between the orifice and all inlets. This screen is to protect the orifice from blockages.

For orifices greater than 150 mm in diameter, the area of the screen can be reduced to 20 times the orifice area, if a grid mesh is installed. The screen is to be located at a distance of 1.5 x the diameter of the orifice or 200 mm away from the orifice, whichever is the greater. Where possible, the incoming line is to flow across the face of the mesh.

The screen is to be placed diagonally against the face of the tank wall with a dividing wall on the inside of the tank to shield the end of the screen. Preferably, the screen should completely protect the orifice without the need for a dividing wall by having side panels on both ends of the screen. This could be achieved by welding triangular mesh side panels to the screen.

A lifting handle welded to the top of the mesh would also be required to allow for easy removal of the screen for cleaning purposes. The screen must not be bolted securely to the wall but should also not be easily removed.

4.11 Underground Storage Systems

Underground storage systems are accepted as OSD. However they should not be used where surface storage can be provided. Underground systems should be located in areas where they can be readily accessed for inspections and maintenance.

These systems can be constructed from reinforced concrete, prefabricated units or proprietary systems provided they can operate to the requirements of this Specification, can be readily cleaned, and must perform hydraulically as required. The structural adequacy of the system must be checked and certified by a suitably qualified Engineer.

These systems must be watertight if there is the potential for water seepage which may cause damage to adjacent properties or structures.

For safety, all maintenance access to underground storage systems must conform to the current Work Health and Safety Bill 2011, Work Health and Safety Regulations 2011 and Australian Standard AS 2865-2009 “Confined spaces”.

Venting must be provided where gas build up is likely. A hydrostatic valve must be provided where necessary.

Step irons are to be installed where the depth of the tank is greater than 1200 mm.

A high level outlet or grate shall be provided at the discharge control pit to cater for surcharge during major storm events. Access to the discharge control pit must be provided for inspections and maintenance of the silt trap and trash screen.

Underground storage tanks should be located externally to all buildings and structures.

The access opening to the pit must be a minimum of 600 mm x 600 mm in dimension and fitted with a removable galvanised steel grate. The grate is to be placed above the outlet and silt trap.

Additional access openings will be required for larger underground storage tanks and high early discharge structures. Underground tanks which exceed 1500mm in length must have a second access point (300 mm x 300 mm minimum dimension) at the extreme corner of the tank to allow regular inspections, flushing of the system and ventilation, where necessary.

Essentially, the system shall be designed to maximise ease of maintenance and ensure safety for the proprietor.

To avoid unpleasant odours and health risks, maintenance of the OSD structure must be carried out on a regular basis. For this reason Council will require a Positive Covenant to be placed on the title of the subject land to emphasise the proprietor's maintenance responsibilities (refer to section 2.9).

4.12 Surface Storage Systems

Surface storage can be provided in either in landscaped and/or driveways and carpark areas. Surface storage areas must be located externally to all buildings and structures.

Where the depth of storage exceeds 300 mm, a Council approved fence must be provided around the perimeter of the storage area.

Surface storage in driveways must not exceed 200 mm. Reference is made to Section 4.12.2.

4.12.1 Storage in Landscaped areas

The ponding depths in landscaped areas for all residential developments must not exceed 300 mm under design conditions. The maximum depth of ponding in all other developments must not exceed 1200 mm. Pool fences must be installed around the landscaped area where the depth of ponding exceeds 300mm. Pool fences must be designed and constructed in accordance with the requirements of the *Swimming Pools Act 1992.*

Storage which is to be provided in landscaped areas shall include an allowance of an additional 20% volume to compensate for loss of volume due to vegetation growth and construction inaccuracies. The 20% additional volume is to be gained by increasing the surface area of the ponded surface. Increasing the depth of the basin to gain the additional storage will not be approved, as this will alter the designed stage-storage-discharge relationship of the model.

The maximum slope of batters in grassed areas is to be 1 in 4.

The minimum surface slope is 1.5%, with the absolute minimum being 1.0%.

Sub-soil drainage must be provided around the outlet to prevent the ground becoming saturated during prolonged wet weather.

Where the storage is to be located in an area where frequent ponding could create maintenance problems or personal inconvenience to property owners, the first 5% of the storage volume must be provided in a pit. The next 15% must be provided in an area able to tolerate frequent inundation, for example, a small underground tank in conjunction with a paved outdoor entertainment area. A check using the ILSAX model to confirm that the 3 month design storm will occupy the first 5% of storage volume and the 1 year ARI design storm will occupy the first 20% of the storage, will be sufficient. Generally all grassed/landscaped areas would require the first 5% of the storage to be contained within the pit and the next 15% storage to be in a tolerable, frequently wettable zone. This is to be assessed at the discretion of Council.

The structural adequacy of any retaining walls, including any hydrostatic loads caused by full storage must be checked. The retaining walls are to be constructed as waterproof masonry walls.

4.12.2 Storage in Driveways and Carparks

Carparks and driveways used as storage areas must be located externally to all buildings and structures.

To avoid damage to vehicles, depths of ponding on driveways and carparks are not to exceed 200 mm under design conditions.

Transverse paving slopes within storage areas must not be less than 0.7%.

If the storage is to be provided in a commonly used area where ponding will cause inconvenience (e.g. carparks), this area should not, on average, flood more than once every three months. This will require approximately the first 5% of the storage to be provided in a non-visual area, e.g. an underground pit.

5 Constructed Works

5.1 Compliance

If Council issues the Construction Certificate for the OSD system then, on completion of the Works, the system must be certified by a suitably qualified and experienced Civil Engineer, who has membership to the Institution of Engineers Australia and National Professional Engineers Register (NPER), with Works-as-Executed drawings supplied to Council in respect of:

1. Compliance with the DA.
2. Intended purpose of the storage structure, that is, the structure has been designed to comply with all relevant Australian Standards and Codes.
3. The Works have been constructed in accordance with the approved drawings. Where 'approved drawings' are those that bear Council's approval stamp. The Certification shall read "I have carried out all inspections necessary to declare that the work nominated in drawing No.*******, have been carried out in accordance with the approved plans and specifications, and the conditions of development consent". Such certification shall be signed and dated.
4. The Works-as-Executed drawings are to be prepared by a Registered Surveyor and submitted to Council, to include all relevant levels, reduced to Australian Height Datum and locations including:

    - invert levels,
    - surface or pavement levels,
    - floor levels including adjacent property floor levels, if required,
    - maximum water surface level for 100 year ARI storm,
    - dimensions of basin(s), tank(s), pit(s), etc.,
    - locations of basins and distances from building and boundaries,
    - storage volume(s) provided
    - Size of the Orifice.

If the Applicant chooses to have an Accredited Certifier prepare the Construction Certificate, then certification of the Works must be provided by the Accredited Certifier including the submission of Works-as-Executed drawings in respect of the above points 1 to 4.

A copy of the Works-as-Executed drawings must be lodged for Council's records.

5.2 Plaque

At Council's discretion, identification of the OSD system(s) may be required. Identification in the form of a plaque attached near the system and clearly displayed, will be required. This would generally be necessary for large basins.

If required, a plaque measuring no less than 400 mm x 200 mm shall be attached permanently and prominently displayed within the vicinity of the OSD system(s). This plaque shall advise the occupants of the property of the existence of the OSD system(s) and that the controlling device must not be tampered with, changed or modified in any manner without prior written consent from Council.

APPENDIX 1 – Simplified Method

The Simplified Method uses Tables 2a or 2b (Appendix 6) for the design of the OSD system.

Table 2a should be used if the following site conditions apply:

1. The entire site drains to the front or to the rear of the property and the whole of the site was considered in all of the computations.
2. The average slope of the site does not exceed 5%.
3. The width of the site does not exceed 18m.
4. The existing site impervious area is to be 0% of the total site area.
5. The post-development impervious area is assumed to be equal to or less than 60% of the site area.
6. The estimation of the time of concentration for the pre-developed site is to be assumed as grassed for the entire site - refer to Tables 4 & 5.
7. Discharge from the OSD system must not be affected by any downstream tailwater levels from the receiving drainage system. That is, it must have a 'free outlet'.
8. The volume of the tank was designed so that:
    - The maximum discharge through the orifice is equal to the 5 year ARI (or 20 litres per second where concentrated discharge is to the kerb), and
    - The basin surcharged at a rate equal to the difference between the 100 year and the 5 year ARI (or 20 litres per second where concentrated discharge is to the kerb).
9. Stormwater runoff for the total site prior to the development during the 100 year ARI design stacked storm pattern is equal to the estimated flow after the development.
10. The two design stacked rainfall patterns were used to determine the 5 year and 100 year ARI flows. These rainfall patterns are shown in Figure 1.

Note: Where the site constraints vary from the above parameters, it is recommended that the Full Computation Method be used.

Table 2b should be used if the following site conditions apply:

1. The entire site drains to the front or to the rear of the property and the whole of the site was considered in all of the computations.
2. The average slope of the site does not exceed 5%.
3. The width of the site does not exceed 18m.
4. The existing site impervious area is to be 0% of the total site area.
5. The post-development impervious area is assumed to be between 60% and 100%.
6. The estimation of the time of concentration for the pre-developed site is to be assumed as grassed for the entire site - refer to Tables 4 & 5.
7. Discharge from the OSD system must not be affected by any downstream tailwater levels from the receiving drainage system. That is, it must have a 'free outlet'.
8. The volume of the tank was designed so that:
    - The maximum discharge through the orifice is equal to the 5 year ARI (or 20 litres per second where concentrated discharge is to the kerb), and
    - The basin surcharged at a rate equal to the difference between the 100 year and the 5 year ARI (or 20 litres per second where concentrated discharge is to the kerb).
9. Stormwater runoff for the total site prior to the development during the 100 year ARI design stacked storm pattern is equal to the estimated flow after the development.
10. The two design stacked rainfall patterns were used to determine the 5 year and 100 year ARI flows. These rainfall patterns are shown in Figure 1.

Note: Where the site constraints vary from the above parameters, it is recommended that the Full Computation Method be used.

The Simplified Method approach is set out below:

1. The minimum Site Storage Requirement (SSR) and the maximum Permissible Site Discharge (PSD) values are read from Tables 2a or 2b.

   Example: Site area = 600 m^2 and the total post-development impervious percentage is 80%, therefore from Table 2b gives PSD = 18 litres per second and SSR = 19.0 m^3.

2. The size of the outlet and orifice is read from Table 3.

   The top line of the table refers to the maximum depth that the water will pond above the centre of the orifice. Knowing the PSD and depth of ponding, the size of the orifice and the size of the minimum outlet pipe can be obtained.

   Example: PSD = 18 litres per second and the design maximum depth of ponding is 0.5 m, gives orifice size of 110 mm diameter with a 225 mm diameter outlet pipe. Outlet pipe size based on the greater of the minimum grade of 1% or 3 times the orifice outlet.

3. Detention storage volume will be achieved by the use of a properly designed and constructed above ground storage or below ground tank.

   The dimensions of an underground tank will be dependent upon the maximum depth of ponding that the site will allow.

   The dimensions of the tank, depth (D) x width (W) x length (L) should be equal to the minimum SSR determined.

   Example: SSR = 19.0 m^3 and depth = 0.5 m,

   Therefore W x L x 0.5 = 19.0 m^3 or W x L = 38.0 m^2

   Values of W and L are independent. However, as the width approaches 3 m or more, the covering slab may become expensive to construct on site and pre-cast commercial tanks may be more economical. A suitably qualified professional Engineer will be required to design the covering slab.

4. The minimum information required, as set out in Section 3, is to be supplied with the Application to Council.

5. Table 2a and 2b applies only to the total area of the site. Dividing the original site area into smaller allotments and then using the above Tables, is not acceptable. PSD and SSR values shall be determined on the original lot size, which can be proportioned down to the new allotment size.

APPENDIX 2 – Full Computation Method

The Full Computation Method shall be used when the Simplified Method is not appropriate. The analysis shall be undertaken by a suitably qualified professional Civil Engineer to determine the PSD and SSR in accordance with the following:

1. Computations shall be carried out using the "ILSAX" or "DRAINS" program. The estimation of the time of concentration for the pre-developed site is to be assumed as grassed for the entire site - refer to Tables 4 & 5.
2. Where the outlet from the basin cannot be classed as a "free outlet" full hydraulic calculations will be required.

   For simple external Catchment analysis, assume that the HGL level of the next downstream pit is at top of kerb level at street pits or ground level for other pits.
3. Refer to 4 - Detailed Design for Storage and Discharge Requirements.
4. The maximum allowable pre-development impervious fraction, to be used in the determination of the PSD, for all commercial or industrial developments, residential flat buildings and subdivisions resulting in the creation of three (3) lots or more is to be 0% of the total site area.
5. Generally stormwater runoff (both piped and overland) from the total site after development, is not to exceed the runoff from the total site prior to the development. These values must include all storm intensities up to and including the 100 year ARI event.
6. The stacked rainfall patterns used to determine the maximum discharge from the existing site for the 5 year ARI storm event is given in Figure 1 (Appendix 7). The maximum value obtained from the output files will be the (piped) PSD.

   The peak discharge from the total developed site during a 5 year ARI storm, is not to exceed the existing 5 year ARI runoff, or 20 litres per second if discharging to the kerb, whichever is the lower value.
7. The stacked rainfall patterns used to determine the maximum discharge from the site for the 100 year ARI storm event, is given in Figure 1. The maximum 100 year ARI runoff obtained from the output file is the total maximum allowable runoff (both piped and overland) from the total site during the 100 year ARI event. That is, the total non-concentrated discharge (including overflow from the basin) from the site is not to exceed the difference between the 100 year and 5 year ARI stormwater runoff.

   Maximum concentrated discharge to the kerb during a 100 year ARI storm is not to exceed 20 litres per second per 15m run of kerb and gutter.
8. The calculation of the OSD storage volume (SSR) is to be undertaken by trial and error, using the above constraints.

   For the purpose of these computations:

   - The site is to be examined for all typical duration from 10 minutes to 3 hours during the 5, and 100 year ARI storm events, to check the performance of the proposed OSD system. Refer to Figure 1 for stacked rainfalls
   - The total impervious area of the proposed development will be used as the impervious area for the post development site. This will include all existing and proposed roof and other paved areas.
   - All new and existing impervious areas of the site must be directed through the detention storage system(s). Only a minimum of 50% of the total site area can be allowed to bypass the OSD system(s). Where practical, this minimum area is to consist of all the paved and impervious surfaces, plus grassed areas to make up the 50% requirement.

9. The minimum information, as set out in Section 3, is to be supplied with the Application to Council.
10. A check must be made to ensure that the 20 year ARI discharge from the developed site is no greater than the 20 year ARI from the same site prior to development. Refer Figure 3 for the 20 year ARI storm patterns.
11. Where above-ground storage is to be provided, the 3 month and 1 year ARI storm events must also be checked to ensure that the 5% and 15% storage volume requirement has been met.

APPENDIX 3 – Terms of Positive Covenant and Restriction on the Use of Land

Where there is no subdivision of land, that is, no Section 88B instrument required, then the following wording for the "Terms of Restriction on the Use of Land" and "Terms of Positive Covenant" shall be attached to the NSW Department of Lands standard forms 13RPA & 13PC respectively.

Terms of Restriction on the Use of Land

The registered proprietors covenant with the Warringah Council (Council) that they will not:

I. Do any act, matter or thing which would prevent the structure and works from operating in an efficient manner.

II. Make any alterations or additions to the structure and works or allow any development within the meaning of the Environmental Planning and Assessment Act 1979 to encroach upon the structure and works without the express written consent of the authority.

III. This covenant shall bind all persons who claim under the registered proprietors as stipulated in section 88E(5) of the Act.

For the purposes of this covenant:

Structure and Works shall mean the on-site stormwater detention system constructed on the land as set out in the plan annexed hereto and marked with the letter "A" (or alternatively as detailed on the plans approved by Council No: {INSERT DA NUMBER}) including all gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins, rainwater tanks (if an airspace "credit" is claimed against the storage volumes) and surfaces designed to temporarily detain stormwater on the land.

The Act means the *Conveyancing Act 1919*.

Terms of Positive Covenant

The registered proprietors covenant with the Warringah Council (Council) that they will maintain and repair the structure and works on the land in accordance with the following terms and conditions:

I. The registered proprietor will:

   i. keep the structure and works clean and free from silt, rubbish and debris

   ii. maintain and repair at the sole expense of the registered proprietors the whole of the structure and works so that it functions in a safe and efficient manner.

II. For the purpose of ensuring observance of the covenant the Council may by its servants or agents at any reasonable time of the day and upon giving to the person against whom the covenant is enforceable not less than two days notice (but at any time without notice in the case of an emergency) enter the land and view the condition of the land and the state of construction maintenance or repair of the structure and works on the land.

III. The registered proprietors shall indemnify the Council and any adjoining land owners against any claims for damages arising from the failure of any component of the OSD, or failure to clean, maintain and repair the OSD.

IV. By written notice the Council may require the registered proprietors to attend to any matter and to carry out such work within such time as the Council may require to ensure the proper and efficient performance of the structure and works and to that extent section 88F(2) (a) of the Act is hereby agreed to be amended accordingly.

V. Pursuant to section 88F(3) of the Act the authority shall have the following additional powers pursuant to this covenant:

   i. In the event that the registered proprietor fails to comply with the terms of any written notice issued by the Council as set out above the Council or its authorised agents may enter the land with all necessary equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in III hereof.

   ii. The Council may recover from the registered proprietor in a Court of competent jurisdiction:

      (a) Any expense reasonably incurred by it in exercising its powers under sub-paragraph i hereof. Such expense shall include reasonable wages for the Council's own employees engaged in effecting the said work, supervising the said work and administering the said work together with costs, reasonably estimated by the Council, for the use of machinery, tools and equipment in conjunction with the said work.

      (b) Legal costs on an indemnity basis for issue of the said notices and recovery of the said costs and expenses together with the costs and expenses of registration of a covenant charge pursuant to section 88F of the Act or providing any certificate required pursuant to section 88G of the Act or obtaining any injunction pursuant to section 88H of the Act.

VI. This covenant shall bind all persons who claim under the registered proprietors as stipulated in section 88E(5) of the Act.

For the purposes of this covenant:

Structure and Works shall mean the on-site stormwater detention system constructed on the land as set out in the plan annexed hereto and marked with the letter "A" (or alternatively as detailed on the plans approved by Council No: {INSERT DA NUMBER}) including all gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins, rainwater tanks (if an airspace "credit" is claimed against the storage volumes) and surfaces designed to temporarily detain stormwater on the land.

The Act means the *Conveyancing Act 1919*.

Where a subdivision has been lodged and a Section 88B instrument created, then the following wording for the "Terms of Restriction on the Use of Land" and "Terms of Positive Covenant" is to be included:

Terms of Restriction on the Use of Land referred to in the above-mentioned Plan

The registered proprietor covenant with the Warringah Council (Council) in respect to the structure erected on the land described as "on-site stormwater detention system" (which expression includes all ancillary gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins and surfaces designed to temporarily detain stormwater) shown on plans approved by the Council No. {INSERT DA NUMBER} (hereinafter called "the system").

The registered proprietors covenant with the Warringah Council (Council) that they will not:

I. Do any act, matter or thing which would prevent the structure and works from operating in an efficient manner.

II. Make any alterations or additions to the structure and works or allow any development within the meaning of the Environmental Planning and Assessment Act 1979 to encroach upon the structure and works without the express written consent of the authority.

III. This covenant shall bind all persons who claim under the registered proprietors as stipulated in section 88E(5) of the Act.

For the purposes of this covenant:

Structure and Works shall mean the on-site stormwater detention system constructed on the land as set out in the plan annexed hereto and marked with the letter "A" (or alternatively as detailed on the plans approved by Council No: {INSERT DA NUMBER}) including all gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins, rainwater tanks (if an airspace "credit" is claimed against the storage volumes) and surfaces designed to temporarily detain stormwater on the land.

The Act shall mean the *Conveyancing Act 1919*.

Terms of Positive Covenant referred to in the above-mentioned Plan

The registered proprietors covenant with the Warringah Council (Council) that they will maintain and repair the structure and works on the land in accordance with the following terms and conditions:

I. The registered proprietor will:
   i. keep the structure and works clean and free from silt, rubbish and debris
   ii. maintain and repair at the sole expense of the registered proprietors the whole of the structure and works so that it functions in a safe and efficient manner.

II. For the purpose of ensuring observance of the covenant the Council may by its servants or agents at any reasonable time of the day and upon giving to the person against whom the covenant is enforceable not less than two days notice (but at any time without notice in the case of an emergency) enter the land and view the condition of the land and the state of construction maintenance or repair of the structure and works on the land.

III. The registered proprietors shall indemnify the Council and any adjoining land owners against any claims for damages arising from the failure of any component of the OSD, or failure to clean, maintain and repair the OSD.

IV. By written notice the Council may require the registered proprietors to attend to any matter and to carry out such work within such time as the Council may require to ensure the proper and efficient performance of the structure and works and to that extent section 88F(2) (a) of the Act is hereby agreed to be amended accordingly.

V. Pursuant to section 88F(3) of the Act the authority shall have the following additional powers pursuant to this covenant:
   i. In the event that the registered proprietor fails to comply with the terms of any written notice issued by the Council as set out above the Council or its authorised agents may enter the land with all necessary equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in I hereof.
   ii. The Council may recover from the registered proprietor in a Court of competent jurisdiction :
      (a) Any expense reasonably incurred by it in exercising its powers under sub-paragraph i hereof. Such expense shall include reasonable wages for the Council's own employees engaged in effecting the said work, supervising the said work and administering the said work together with costs, reasonably estimated by the Council, for the use of machinery, tools and equipment in conjunction with the said work.

(b) Legal costs on an indemnity basis for issue of the said notices and recovery of the said costs and expenses together with the costs and expenses of registration of a covenant charge pursuant to section 88F of the Act or providing any certificate required pursuant to section 88G of the Act or obtaining any injunction pursuant to section 88H of the Act.

VI. This covenant shall bind all persons who claim under the registered proprietors as stipulated in section 88E(5) of the Act.

For the purposes of this covenant:

Structure and Works shall mean the on-site stormwater detention system constructed on the land as set out in the plan annexed hereto and marked with the letter "A" (or alternatively as detailed on the plans approved by Council No: {INSERT DA NUMBER}) including all gutters, pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins, rainwater tanks (if an airspace "credit" is claimed against the storage volumes) and surfaces designed to temporarily detain stormwater on the land.

The Act means the *Conveyancing Act 1919.*

APPENDIX 4 – Examples of ILSAX models with various applications

1. Underground tank - Normal Discharge Control

Original lot size = 800m^2, existing slope = 1%, width of block = 18m. For a vacant lot assume that the maximum existing impervious percentage = 0%, (refer to Section 4.3).

Calculate the existing Q5 (piped PSD) and Q100 (max PSD) for the existing site using the ILSAX program or read from Tables 2a or 2b. Assuming that the grassed flowpath length = paved flowpath length, gives the PSD for Q5 = 23 l/s and Q100 = 45 l/s with overflow = Q100 - Q5 = 22 l/s

For the developed site, calculate impervious percentage and grassed percentage. Also, use Tables 4 and 5 to calculate times of concentration.

Assume that the tank is to be 1.0m deep with 150mm topsoil cover and the walls and roof of the tank is to be 150mm thick.

The post-development paved imp = 80%, grassed imp = 20%, T_c paved = 5 minutes and T_c grassed = 8 minutes.

Orifice size (calculated or read from Table 3) would be 98mm at 1.3m deep for the piped PSD = 23 l/s.

Assuming that the tank will capture all the flows from the site with trial volume = 27.60m^3, then the post-development ILSAX model would be:

```
800sqm SITE AT No.1 SAMPLE STREET, WARRINGAH
AAA  001  -1  -1
10  4  1.0  1.00  225  2
AAA  002  0
13
0.000    0.00  0.0000  0.0
0.100    2.75  0.0064  0.0
0.200    5.50  0.0090  0.0
0.300    8.25  0.0110  0.0
0.400  11.00  0.0128  0.0
0.500  13.75  0.0143  0.0
0.600  16.50  0.0156  0.0
0.700  19.25  0.0169  0.0
0.800  22.00  0.0180  0.0
0.900  24.75  0.0191  0.0
1.000  27.50  0.0202  0.0
1.300  27.60  0.0230  0.0
1.400  27.60  0.0230  0.1
0
0.08  80  5  0  20  8  0

AAA  002  -1  -1
0  1  1.0  1.00  225  -1
10  0  0  0  0
0.00  0  0  0  0  0  0

END
```

2. Multi-underground tanks - Normal Discharge Control with some areas not directed to the tank

Same criteria as before, except with two tanks and not all of the flows will be directed to the detention systems. Note that the PSD for the Q5 (piped) is set at 30 l/s when both tanks are full in this example. Tank 1 has a depth of 1.0m and trial volume of 11.0m^3. Tank 2 has a depth of 1.0m and trial volume of 9.60m^3 and 50m^2 of the site is uncontrolled.

The designer has the flexibility to adjust the volumes of the tanks to achieve the required discharge.

```
800sqm SITE AT No.1 SAMPLE STREET,
      *WARRINGAH
AAA  001  -1  -1
10  4  1.0  1.00  150  2
AAA  002  0
13
0.000   0.00  0.0000  0.0
0.100   1.09  0.0044  0.0
0.200   2.18  0.0063  0.0
0.300   3.27  0.0077  0.0
0.400   4.36  0.0089  0.0
0.500   5.45  0.0099  0.0
0.600   6.54  0.0108  0.0
0.700   7.63  0.0117  0.0
0.800   8.72  0.0125  0.0
0.900   9.81  0.0133  0.0
1.000  10.90  0.0140  0.0
1.300  11.00  0.0160  0.0
1.400  11.00  0.0166  0.1
0
0.04  80  5  0  20  8  0

AAA  002  -1  -1
0  2  20.0  1.00  150  -1
10  0  0  0  0
AAA  003  1
0.00  0  0  0  0  0  0

AAB  001  -1  -1
10  4  1.0  1.00  150  2
AAB  002  0
13
0.000  0.00  0.0000  0.0
0.100  0.95  0.0038  0.0
0.200  1.90  0.0054  0.0
0.300  2.85  0.0066  0.0
0.400  3.80  0.0076  0.0
0.500  4.75  0.0085  0.0
0.600  5.70  0.0093  0.0
0.700  6.65  0.0100  0.0
0.800  7.60  0.0107  0.0
0.900  8.55  0.0114  0.0
1.000  9.50  0.0120  0.0
1.300  9.60  0.0137  0.0
1.400  9.60  0.0142  0.1
0
0.035  80  5  0  20  8  0

AAB  002  -1  -1
0  2  5.0  1.00  150  -1
10  0  0  0  0
AAA  003  .2
0.00  0  0  0  0  0  0

ADD  AAB  TO  AAA

AAA  003  -1  -1
0  1  1.0  1.00  225  -1
10  0  0  0  0
0.005  80  5  0  20  8  0

END
```

3. Above Ground Storage - Normal Discharge Control

Original lot size = 800m^2, existing slope = 1%, width of block = 18m. For a vacant lot assume that the maximum existing impervious percentage = 0% (refer to Section 4.3).

Calculate the existing Q5 (piped PSD) and Q100 (max PSD) for the existing site using the ILSAX program or read from Tables 2a or 2b. Assuming that the grassed flowpath length = paved flowpath length, gives the PSD for Q5 = 23 l/s and Q100 = 45 l/s with overflow = Q100 - Q5 = 22 l/s.

For the developed site, calculate the impervious percentage and grassed percentage. Also, use Tables 4 and 5 to calculate times of concentration.

For this design assume that the maximum depth of ponding in the basin = 300 mm deep. Tank depth = 0.8m and the storage in courtyard area = 12.5m x 5m with 1% crossfall. Allow minimum of 20% volume in the control pit = 5m x 2.25m, and the walls and roof of the tank is 150 mm thick with access manhole 0.6m x 0.6m.

The post-development paved imp = 80%, grassed imp = 20%, T_c paved = 5 minutes and T_c grassed = 8 minutes.

Orifice size (calculated or read from Table 3) would be 108mm at 0.9m deep for the piped PSD = 23 l/s.

Assuming that the tank will capture all the flows from the site with trial volume = 18.85m^3, then the post-development ILSAX model would be:

```
800sqm SITE AT No.1 SAMPLE
      *STREET, WARRINGAH
AAA  001  -1  -1
10  4  1.0  1.00  225  2
AAA  002  0
19
0.000   0.00  0.0000  0.0
0.100   1.13  0.0081  0.0
0.200   2.25  0.0115  0.0
0.300   3.38  0.0141  0.0
0.400   3.96  0.0163  0.0
0.500   4.00  0.0182  0.0
0.525   4.16  0.0186  0.0
0.550   4.63  0.0191  0.0
0.575   5.41  0.0195  0.0
0.600   6.50  0.0199  0.0
0.625   7.91  0.0203  0.0
0.650   9.47  0.0207  0.0
0.675  11.04  0.0211  0.0
0.700  12.60  0.0215  0.0
0.725  14.16  0.0219  0.0
0.750  15.72  0.0223  0.0
0.775  17.29  0.0226  0.0
0.800  18.85  0.0230  0.0
0.900  18.85  0.0230  0.1
0
0.08  80  5  0  20  8  0

AAA  002  -1  -1
0  1  1.0  1.00  225  -1
10  0  0  0  0
0.00  0  0  0  0  0  0

END
```

4. High Early Discharge Tank

IMPORTANT NOTE: The ILSAX program will not accurately model the total outflow from high early discharge (HED) storage systems. The outflow from the HED storage closely follows the above ground storage until the tank is full, then as the level in the tank recedes, the outflow follows the normal tank discharge.

Original lot size = 800m^2, existing slope = 1%, width of block = 18m.

For a vacant block, the maximum existing impervious percentage = 0%.

Calculate the existing Q5 (piped PSD) and Q100 (max PSD) for the existing site using the ILSAX program or read from Tables 2a or 2b. Assuming that the grassed flowpath length = paved flowpath length, gives the PSD for Q5 = 23 l/s and Q100 = 45 l/s with overflow = Q100 - Q5 = 22 l/s.

For the developed site, calculate the impervious percentage and grassed percentage. Also, use Tables 4 and 5 to calculate times of concentration.

Assume that the tank is to be 1.0m deep with 150mm topsoil cover and the walls and roof of the tank is to be 150mm thick. The post-development paved imp = 80%, grassed imp = 20%, T_c paved = 5 minutes and T_c grassed = 8 minutes.

Orifice size (calculated or read from Table 3) would be 98mm at 1.3m deep for the piped PSD = 23 l/s.

Assuming that the tank will capture all the flows from the site with trial volume = 18.70m^3, then the post-development ILSAX model would be:

```
800sqm SITE AT No.1 SAMPLE STREET, WARRINGAH
AAA  001  -1  -1
10  4  1.0  1.00  225  2
AAA  002  0
14
0.000   0.00  0.0000  0.0
0.100   0.04  0.0064  0.0
0.200   0.07  0.0090  0.0
0.300   0.11  0.0110  0.0
0.400   0.14  0.0128  0.0
0.500   0.18  0.0143  0.0
0.600   0.22  0.0156  0.0
0.700   0.25  0.0169  0.0
0.800   0.29  0.0180  0.0
0.801 15.50  0.0181  0.0
0.900 17.05  0.0191  0.0
1.000 18.60  0.0202  0.0
1.300 18.70  0.0230  0.0
1.400 18.70  0.0230  0.1
0
0.08  80  5  0  20  8  0

AAA  002  -1  -1
0  1  1.0  1.00  225  -1
10  0  0  0  0
0.00  0  0  0  0  0  0
END
```

APPENDIX 5 – ILSAX Model Instabilities

In all cases, the total area of the site in the model must equal the original site area. The model must include all the site area(s):

- directed to one or more OSD system, and
- not directed to any OSD system, in one (1) hydrological model to allow a direct comparison between the pre and post development surface outflows.

If the error message

WARNING - TIME STEP X. seconds IS MORE THAN TWICE THE MINIMUM RATIO OF

STORAGE DIFFERENCE vs OUTFLOW DIFFERENCE IN THE HEIGHT-STORAGE-OUTFLOW TABLE

\- Y. seconds.

THIS MAY CAUSE INSTABILITIES IN BASIN CALCULATIONS.

YOU NEED TO CHECK RESULTS, AND POSSIBLY USE A SHORTER TIME STEP,

OR TO MODIFY THE TABLE.

appears in the large output file after the stage-storage-outflow table, modifications may be necessary to the rainfall and/or the ILSAX model file(s).

Additional stage-storage-discharge values will be required in the model. In the previous examples, 100 mm stage increments are shown. To remove this instability, the stage increments could be reduced to 50 or even as low as 10 mm. Also, additional increments for the high level discharge will help. Remember, 30 sets of values is the maximum limit for the ILSAX program.

Alternatively, a reduction in the time computation step may remove this instability. Figure 1 shows the rainfall files. Lines 6, 12, 18, 24, 30, 36, 42, 48, 54 and 60, the fourth number in each line represents the computation time interval. Reducing the value of this number will improve the accuracy of the flood routing through the basin. Also, it will increase the total time to do the analysis and may produce more than 360 rainfall ordinates. Any ordinates greater than 360 will be ignored and lost. This may occur for the longer duration storms greater than 60 minutes.

Extreme care must be taken to ensure that a least the first 70% of any storm passes through the basin. Usually, in small basins, once the basin has been filled, the remaining 30% of the storm will have a minimal effect upon the storage. The rainfall intensities at the end of a storm will be significantly lower than the first part of the storm. The inflow into a basin will be less than the outflow, hence its water level should be receding. It is the maximum volume of storage that is important, not the time to drain the basin.

In some cases, both types of modification will be necessary to produce a satisfactory result.

If the error message cannot be eliminated, especially for the very small basins, and there is no overflow from the structure, then the error message can be ignored. If the “Y” value is 0 or less, nothing can be done to improve the accuracy or remove the instabilities in the basin calculations.

However, if there is surcharge from the basin, fluctuating values will be produced from the overflow hydrograph in the output files. Simply average the immediate high and low values from the overflow hydrographs to obtain the more appropriate surcharge flow. The maximum modified value must then be added to the basin's maximum discharge from the orifice to obtain the total discharge exiting the site. Also, the designer must add the maximum discharge values from any areas not draining through the basin. This total value must be equal to or less than the pre-development discharges for the 5 year and 100 year ARI storm events.

APPENDIX 6 – SSR and PSD Tables

Table 2a: SSR and PSD for various site areas with equal to or less than 60% impervious

total area of site	min. size of basin (SSR)	max. Q5 from existing site (PSD from basin)	max. Q100 from existing site	Max. overflow from basin
m^2	m^3	l/s	l/s	l/s
200	5.0	7	13	6
250	6.1	9	16	7
300	7.4	11	19	8
350	8.5	12	22	10
400	9.8	14	25	11
450	11.6	15	28	13
500	13.5	16	30	14
550	15.2	17	33	15
600	17.0	18	36	18
650	18.9	20	39	19
700	20.9	21	41	20
750	22.8	22	43	21
800	24.7	23	45	22
850	26.1	24	47	23
900	28.6	25	49	24
950	29.1	26	51	25
1000	30.5	27	53	26
1050	32.0	29	56	27
1100	33.5	30	58	28
1150	35.1	32	61	29
1200	36.6	33	63	30

Note: Maximum concentrated discharge to kerb and gutter is 20 l/s

650	18.9	20	39	19
700	22.9	20	41	21
750	25.8	20	43	23
800	28.6	20	45	25
850	31.7	20	47	27
900	34.7	20	49	29
950	37.8	20	51	31
1000	40.8	20	53	33
1050	44.2	20	56	36
1100	47.6	20	58	38
1150	50.9	20	61	41
1200	54.3	20	63	43

Table 2b: SSR and PSD for various site areas with between 60 and 100% impervious

total area of site	min. size of basin (SSR)	max. Q5 from existing site (PSD from basin)	max. Q100 from existing site	Max. overflow from basin
M^2	m^3	l/s	l/s	l/s
200	5.5	7	13	6
250	6.8	9	16	7
300	8.2	11	19	8
350	9.5	12	22	10
400	10.9	14	25	11
450	12.9	15	28	13
500	15.0	16	30	14
550	17.0	17	33	15
600	19.0	18	36	18
650	21.1	20	39	19
700	23.3	21	41	20
750	25.4	22	43	21
800	27.5	23	45	22
850	29.1	24	47	23
900	30.8	25	49	24
950	32.4	26	51	25
1000	34.0	27	53	26
1050	35.7	29	56	27
1100	37.4	30	58	28
1150	39.1	32	61	29
1200	40.8	33	63	30

Note: Maximum concentrated discharge to kerb and gutter is 20 l/s

650	21.1	20	39	19
700	25.1	20	41	21
750	28.0	20	43	23
800	30.8	20	45	25
850	33.9	20	47	27
900	36.9	20	49	29
950	40.0	20	51	31
1000	43.0	20	53	33
1050	46.4	20	56	36
1100	49.8	20	58	38
1150	53.1	20	61	41
1200	56.5	20	63	43

Table 3: Orifice sized according to depth of ponding and PSD

PSD	Depth of tank above centreline of orifice																				
l/s	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	
2	55	46	42	39	37	35	34	33	32	31	30	30	29	28	28	28	27	27	26	26	
3	67	57	51	48	45	43	41	40	39	38	37	36	36	35	34	34	33	33	32	32	Min.
4	78	65	59	55	52	50	48	46	45	44	43	42	41	40	40	39	38	38	37	37	100 mm
5	87	73	66	62	58	56	54	52	50	49	48	47	46	45	44	44	43	42	42	41	diameter
6	95	80	72	67	64	61	59	57	55	54	52	51	50	49	48	48	47	46	46	45	outlet
7	103	87	78	73	69	66	63	61	59	58	57	55	54	53	52	51	51	50	49	49	pipe
8	110	93	84	78	74	70	68	65	64	62	60	59	58	57	56	55	54	53	53	52	
9	117	98	89	83	78	75	72	69	67	66	64	63	61	60	59	58	58	57	56	55	
10	123	104	94	87	82	79	76	73	71	69	68	66	65	64	63	62	61	60	59	58	
11	129	109	98	91	86	82	79	77	75	73	71	69	68	67	66	65	64	63	62	61	
12	135	113	102	95	90	86	83	80	78	76	74	72	71	70	69	67	66	65	65	64	
13	140	118	107	99	94	90	86	83	81	79	77	75	74	73	71	70	69	68	67	66	
14	146	122	111	103	97	93	90	87	84	82	80	78	77	75	74	73	72	71	70	69	Min.
15	151	127	115	107	101	96	93	90	87	85	83	81	79	78	77	75	74	73	72	71	150 mm
16	156	131	118	110	104	99	96	93	90	88	85	84	82	80	79	78	77	76	75	74	diameter
17	160	135	122	113	107	103	99	95	93	90	88	86	85	83	82	80	79	78	77	76	outlet
18	165	139	125	117	110	106	102	98	95	93	91	89	87	85	84	83	81	80	79	78	pipe
19	170	143	129	120	113	108	104	101	98	95	93	91	89	88	86	85	84	82	81	80	
20	174	146	132	123	116	111	107	104	100	98	96	94	92	90	88	87	86	85	83	82	
21	178	150	136	126	119	114	110	106	103	100	98	96	94	92	91	89	88	87	85	84	
22	183	154	139	129	122	117	112	109	105	103	100	98	96	94	93	91	90	89	87	86	
23	187	157	142	132	125	119	115	111	108	105	102	100	98	97	95	93	92	91	89	88	
24	191	160	145	135	128	122	117	113	110	107	105	102	100	99	97	95	94	93	91	90	
25	195	164	148	138	130	124	120	116	112	109	107	105	102	101	99	97	96	94	93	92	
26	198	167	151	140	133	127	122	118	115	112	109	107	105	103	101	99	98	96	95	94	
27		170	154	143	135	129	124	120	117	114	111	109	107	105	103	101	100	98	97	96	
28		173	156	146	138	132	127	122	119	116	113	111	108	106	105	103	101	100	99	97	
29		176	159	148	140	134	129	125	121	118	115	113	110	108	107	105	103	102	100	99	
30		179	162	151	143	136	131	127	123	120	117	115	112	110	108	107	105	104	102	101	
31		182	165	153	145	138	133	129	125	122	119	116	114	112	110	108	107	105	104	102	
32		185	167	156	147	141	135	131	127	124	121	118	116	114	112	110	108	107	105	104	
33		188	170	158	150	143	137	133	129	126	123	120	118	116	114	112	110	109	107	106	
34		191	172	160	152	145	140	135	131	128	125	122	120	117	115	113	112	110	109	107	Min.
35		194	175	163	154	147	142	137	133	129	126	124	121	119	117	115	113	112	110	109	225 mm
36		196	177	165	156	149	144	139	135	131	128	125	123	121	119	117	115	113	112	110	diameter
37		199	180	167	158	151	146	141	137	133	130	127	125	122	120	118	117	115	113	112	outlet
38		202	182	170	160	153	148	143	139	135	132	129	126	124	122	120	118	116	115	113	pipe
39		204	185	172	163	155	149	145	140	137	133	131	128	126	124	122	120	118	116	115	
40		207	187	174	165	157	151	146	142	138	135	132	130	127	125	123	121	120	118	116	
41		210	189	176	167	159	153	148	144	140	137	134	131	129	127	125	123	121	119	118	
42		212	192	178	169	161	155	150	146	142	139	136	133	130	128	126	124	122	121	119	
43		215	194	180	171	163	157	152	147	144	140	137	134	132	130	128	126	124	122	121	
44		217	196	183	173	165	159	154	149	145	142	139	136	133	131	129	127	125	124	122	
45		220	198	185	175	167	161	155	151	147	143	140	138	135	133	131	129	127	125	123	
46		222	201	187	177	169	162	157	152	148	145	142	139	136	134	132	130	128	126	125	
47		224	203	189	178	170	164	159	154	150	147	143	141	138	136	133	131	130	128	126	
48		227	205	191	180	172	166	160	156	152	148	145	142	139	137	135	133	131	129	128	
49		229	207	193	182	174	168	162	157	153	150	146	143	141	138	136	134	132	131	129	
50		231	209	195	184	176	169	164	159	155	151	148	145	142	140	138	136	134	132	130	

Min. 375 mm diameter outlet pipe

Min. 300 mm diameter outlet pipe

For orifice diameters less than 50 mm, a 90 mm diameter plastic pipe may be used as the outlet pipe from the basin.
Discharge allowed to kerb is not to exceed 20 l/s

Flow through the orifice is based on the equation

$Q = C A \sqrt{(2 g H)} \times 10^3$

$d = \sqrt{(4 A / \pi)} \times 10^3$

Q = the flowrate in litres per second

Where

C = 0.6 for a circular, square cut edged orifice
H = the depth of ponding from the centreline of the orifice to the upper water surface level in metres
A = the area of the orifice in square metres
g = 9.81 metres per second per second (gravity)
π = 3.1416
d = the diameter of the orifice in millimetres

Table 4: Time of concentration for 5 year ARI design storm

(i) grassed times of flow

n* = 0.33

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	6	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10	10	8	6	5	5	5	5	5	5	5	5	5	5	5	5	5
15	13	10	8	7	6	6	6	5	5	5	5	5	5	5	5	5
20	16	13	10	9	8	7	7	6	6	5	5	5	5	5	5	5
25	19	15	12	10	9	8	8	7	7	6	6	6	6	5	5	5
30	22	17	13	11	10	10	9	8	7	7	6	6	6	6	5	5
35	25	19	15	13	12	11	10	9	8	8	7	7	7	7	6	6
40	27	21	16	14	13	12	11	10	9	9	8	8	8	7	7	6
45	30	23	18	15	14	13	12	11	10	9	9	8	8	8	7	7
50	32	25	19	17	15	14	13	12	11	10	9	9	9	8	8	7
55	35	27	21	18	16	15	14	12	12	11	10	10	9	9	8	8
60	37	28	22	19	17	16	15	13	12	12	11	10	10	10	9	9
65	39	30	23	20	18	17	16	14	13	12	12	11	11	10	10	9

(ii) Concentrated times of flow over driveways, pathways, through pipes, etc. for the remainder of the site.

n* = 0.012

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
45	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
50	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1
55	3	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1
60	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1
65	4	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1

Table 5: Time of concentration for 100 year ARI design storm

(i) grassed times of flow

n* = 0.33

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10	7	6	6	5	5	5	5	5	5	5	5	5	5	5	5	5
15	10	8	7	6	5	5	5	5	5	5	5	5	5	5	5	5
20	13	10	8	7	6	6	5	5	5	5	5	5	5	5	5	5
25	15	12	9	8	8	7	6	6	5	5	5	5	5	5	5	5
30	17	13	10	9	8	8	7	6	6	5	5	5	5	5	5	5
35	19	15	12	10	9	9	8	7	7	6	6	6	5	5	5	5
40	21	16	13	11	10	9	9	8	7	7	6	6	6	6	5	5
45	23	18	14	12	11	10	9	9	8	7	7	7	6	6	6	5
50	25	19	15	13	12	11	10	9	9	8	8	7	7	7	6	6
55	26	21	16	14	13	11	11	10	9	8	8	7	7	7	6	6
60	28	22	17	15	13	12	12	11	10	9	9	8	8	8	7	7
65	30	23	18	16	14	13	12	11	10	9	9	8	8	8	7	7

(ii) Concentrated times of flow over driveways, pathways, through pipes, etc. for the remainder of the site.

n* = 0.012

slope % / length (m)	.5	1	2	3	4	5	6	8	10	12	14	16	18	20	25	30
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
45	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
50	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
55	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
60	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1
65	3	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1

APPENDIX 7 – ILSAX Rainfall Files

Figure 1: ILSAX rainfall files for 5 and 100 year ARI storms

```
3 2 10
5 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 -100 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2 1
1 5 130
0
5 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2 1
1 5 110
0
5 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 .2 1
1 5 97
0
5 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 .2 1
1 5 87
0
5 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 .2 1
1 5 80
0
5 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 .2 1
1 5 65
0
5 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 .3 1
1 5 55
0
5 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 .3 1
1 5 44.0
0
5 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 .3 1
1 5 37.0
0
5 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 .3 1
1 5 29.1
0
```

```
3 2 10
100 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 -100 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2* 1
1 100 213
0
100 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2* 1
1 100 184
0
100 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 .2* 1
1 100 163
0
100 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 .2* 1
1 100 149
0
100 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 .2* 1
1 100 135
0
100 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 .2* 1
1 100 112
0
100 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 .3* 1
1 100 96
0
100 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 .3* 1
1 100 77
0
100 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 .5* 1
1 100 65
0
100 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 .5* 1
1 100 52
0
```

***Note: For larger site areas use increments of '1' or '2' to avoid program from 'crashing'.**

Figure 2: ILSAX rainfall files for 3 month and 1 year ARI storms

```
3 2 10
3 MONTH, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2 1
1 1 30.5
0
3 MONTH, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2 1
1 1 24.0
0
3 MONTH, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 .2 1
1 1 20.0
0
3 MONTH, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 .2 1
1 1 17.4
0
3 MONTH, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 .2 1
1 1 15.3
0
3 MONTH, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 .2 1
1 1 10.8
0
3 MONTH, 1 HOUR ARI
-1 0 3.0
1
5 60 5 .2 1
1 1 7.8
0
3 MONTH, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 .2 1
1 1 7.0
0
3 MONTH, 2 HOUR ARI
-1 0 3.0
1
5 120 5 .2 1
1 1 5.5
0
3 MONTH, 3 HOUR ARI
-1 0 3.0
1
5 180 15 .2 1
1 1 4.5
0
```

```
3 2 10
1 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 .2 1
1 1 80
0
1 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 .2 1
1 1 67
0
1 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 1 1
1 1 58
0
1 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 1 1
1 1 52
0
1 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 1 1
1 1 47.4
0
1 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 1 1
1 1 38.0
0
1 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 1 1
1 1 32.4
0
1 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 2 1
1 1 25.7
0
1 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 2 1
1 1 21.6
0
1 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 2 1
1 1 17.0
0
```

Figure 3: ILSAX rainfall files for 20 and 50 year ARI storms

```
3 2 10
20 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 1 1
1 20 166
0
20 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 1 1
1 20 142
0
20 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 1 1
1 20 125
0
20 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 1 1
1 20 112
0
20 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 1 1
1 20 104
0
20 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 1 1
1 20 85
0
20 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 1 1
1 20 73
0
20 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 2 1
1 20 58
0
20 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 2 1
1 20 49.2
0
20 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 2 1
1 20 38.7
0
```

```
3 2 10
50 YEAR, 10 MINUTE ARI
1 2 -1 0 -0.3 0 375 0.3
1 5 2.5 3.0 1 1 0
1
5 10 5 1 1
1 50 193
0
50 YEAR, 15 MINUTE ARI
-1 0 3.0
1
5 15 5 1 1
1 50 168
0
50 YEAR, 20 MINUTE ARI
-1 0 3.0
1
5 20 5 1 1
1 50 147
0
50 YEAR, 25 MINUTE ARI
-1 0 3.0
1
5 25 5 1 1
1 50 132
0
50 YEAR, 30 MINUTE ARI
-1 0 3.0
1
5 30 5 1 1
1 50 122
0
50 YEAR, 45 MINUTE ARI
-1 0 3.0
1
5 45 5 1 1
1 50 100
0
50 YEAR, 1 HOUR ARI
-1 0 3.0
1
5 60 5 1 1
1 50 86
0
50 YEAR, 1.5 HOUR ARI
-1 0 3.0
1
5 90 5 2 1
1 50 69
0
50 YEAR, 2 HOUR ARI
-1 0 3.0
1
5 120 5 2 1
1 50 58
0
50 YEAR, 3 HOUR ARI
-1 0 3.0
1
5 180 15 2 1
1 50 46.1
0
```

APPENDIX 8 – OSD Checklist

Warringah Council

On-site Stormwater Detention (OSD) Checklist

For Single Dwelling Residential Developments

This form is to be used to determine if OSD will be required for demolition and reconstruction, or construction of new single dwelling residential developments and **must be completed and included with the submission of any development application for these works**. Please read both sides of this form carefully for its applications, guidelines and definitions.

For assistance and support, please contact Council's Customer Service Centre on (02) 9942 2111.

Address of Proposed Development	
Address of proposed development	Lot ☐ DP (if applicable) ☐ No. ☐ Street ☐ Suburb ☐
PART 1	**Exemption for properties that drain naturally away from the street**
Tick one only	Does the site fall naturally away from the street? Yes ☐ No ☐ If yes, stormwater drainage must be in accordance with Council's Policy No. PDS-POL 136 'Stormwater Drainage from Low Level Properties'. If no, proceed to the next part.
PART 2	**Is the site area less than 450m^2**
Tick one only	Yes ☐ No ☐ If yes, OSD is not required. If no, proceed to next part.
PART 3	**Exemption for Direct Discharge to Ocean**
Tick one only	Does the site of the development drain directly to the ocean without the need to pass through a drainage control structure such as a pipe, bridge, culvert, kerb and gutter or natural drainage system? Yes ☐ No ☐ If yes, OSD is not required. If no, proceed to the next part.

PART 4	**Exemption for Flood Affected Areas**
Tick one only	Is the site of the development located within an established Flood Prone Land as referred to in the Warringah Local Environmental Plan? Refer to section 2.6 of Council's OSD Technical Specification. Yes ☐ No ☐ If yes, OSD is not required. If no, proceed to the next part.
PART 5	**Determination of OSD Requirements**
3.1 Calculations Please view below examples	(a) Site area _____ m^2 x 0.40 = _____ m^2 (b) Proposed and remaining impervious area _____ m^2 **OSD will not be required when (a) is greater than (b)** Is OSD required for this development (tick one only) Yes ☐ No ☐ If yes, then a design in accordance with the Streamlined Method in Council's OSD Technical Specification is to be provided with the Development Application (refer to Clause 3.1.1) If no, OSD is not required.
3.2 Example	If the proposed combined impervious area is greater than 40% of the site area, then OSD is required. *Example 1*: Site Area = 600m^2 Total proposed & remaining impervious area = 290m^2 600 x 0.4 = 240m^2 (290 > 240) OSD required *Example 2*: Site Area = 800m^2 Total proposed & remaining impervious area = 290m^2 800 x 0.4 = 320m^2 (290 < 320) OSD is **not** required
DEFINITIONS	
Designed to help you fill out this application	**Site area:** This refers to the area of the land bounded by its existing or proposed boundaries. **Impervious areas:** This refers to driveways, pathways, paved areas, hardstand areas, roofed areas, garages and outbuildings that are proposed and to be retained. Where an existing structure is to be demolished to make way for a new dwelling, only the proposed impervious areas and remaining impervious areas are to be used in the calculations. No credit is given for existing impervious areas that are not retained.
NOTES	
Please read before filling out this form	1. Other works, ancillary buildings, commercial, industrial, subdivisions and multiple occupancy developments are to comply with Council's **OSD Technical Specification**. 2. A reduction in the OSD volume required may be permitted. Refer to Council's "OSD Rainwater Re-use Policy for Single Residential Dwellings". If OSD is required, then a design for OSD in accordance with Council's "OSD Technical Specifications" is to be provided with the development application.

APPENDIX 9 – Sample Drawings

Figure 4: Typical OSD Underground Tank Detail

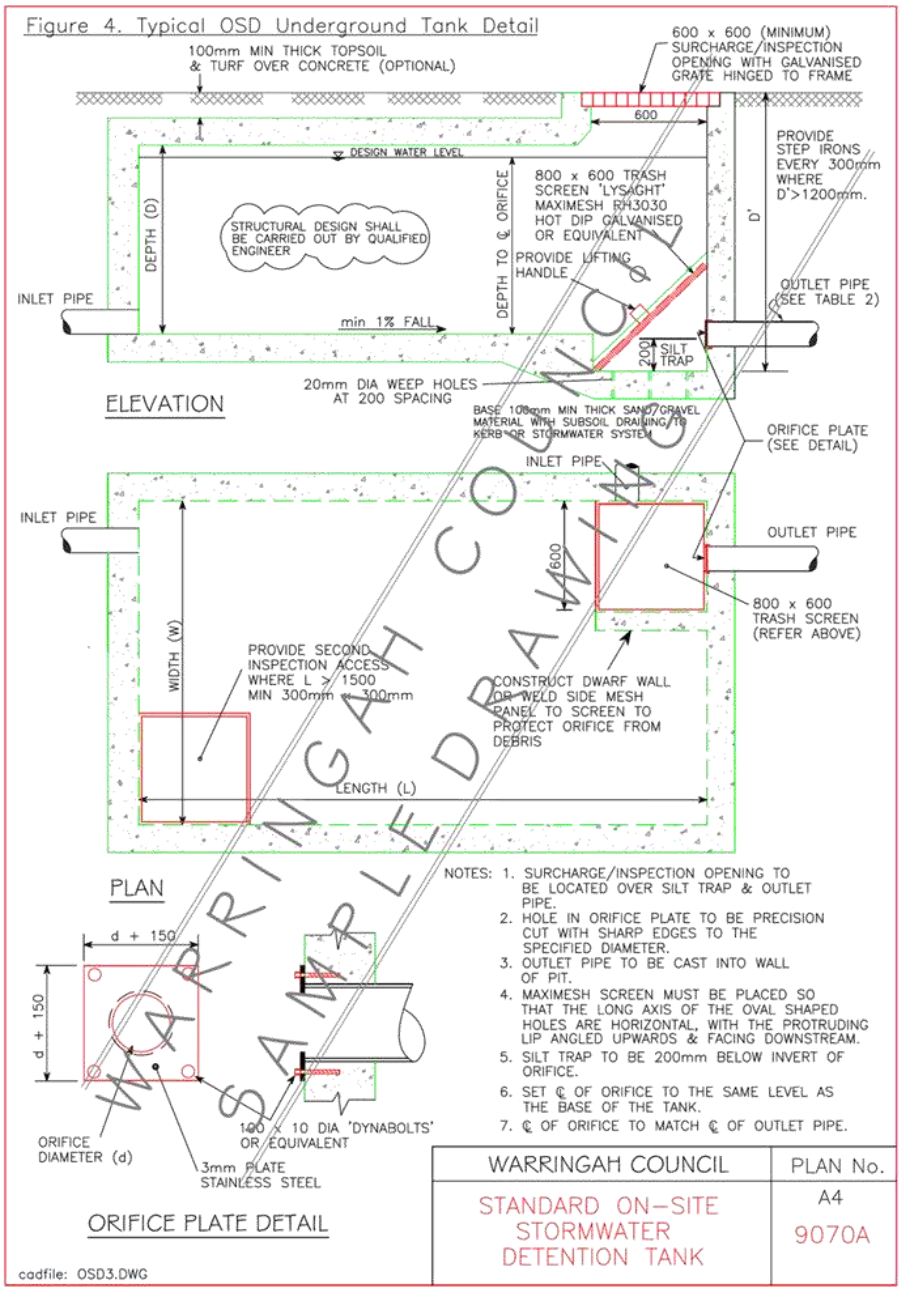
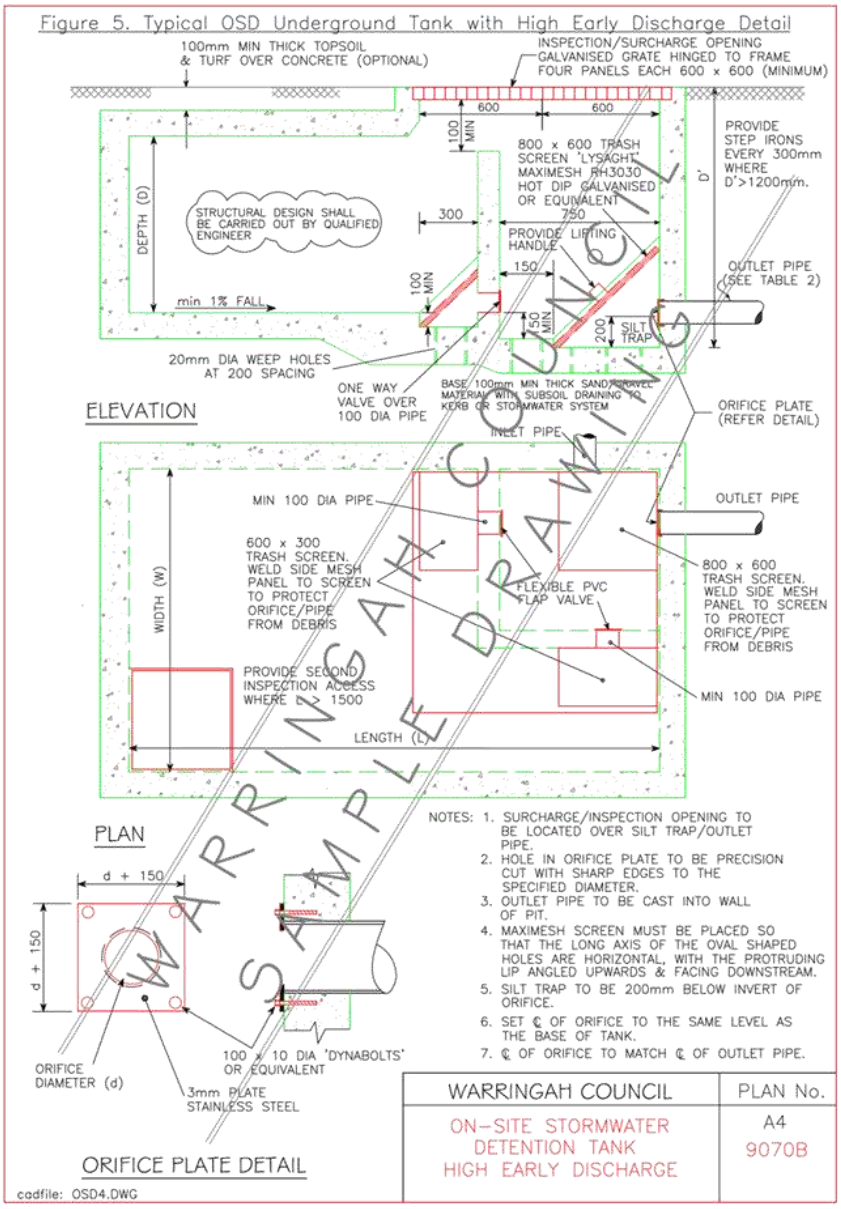


Figure 5: Typical OSD Underground Tank with HED Control Detail



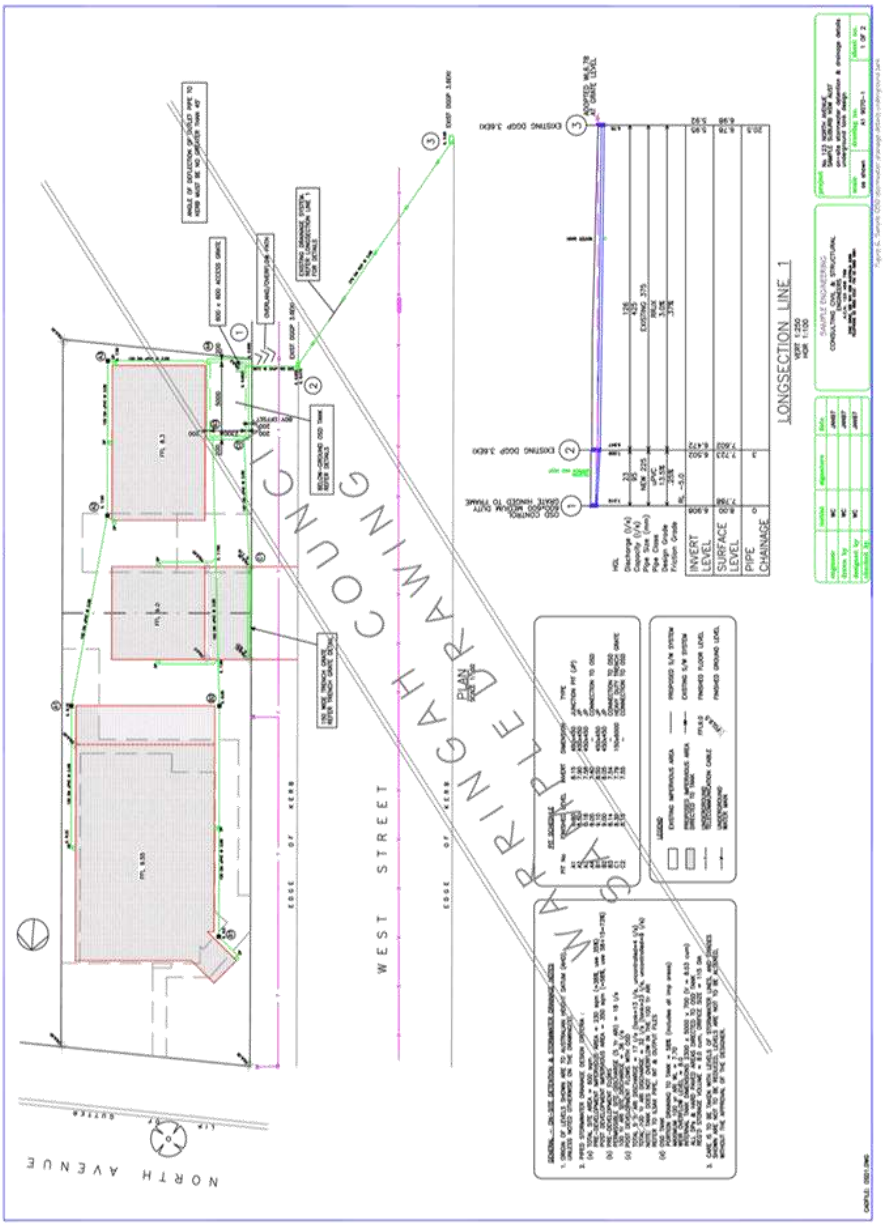


Figure 6: Sample OSD stormwater drainage details underground tank

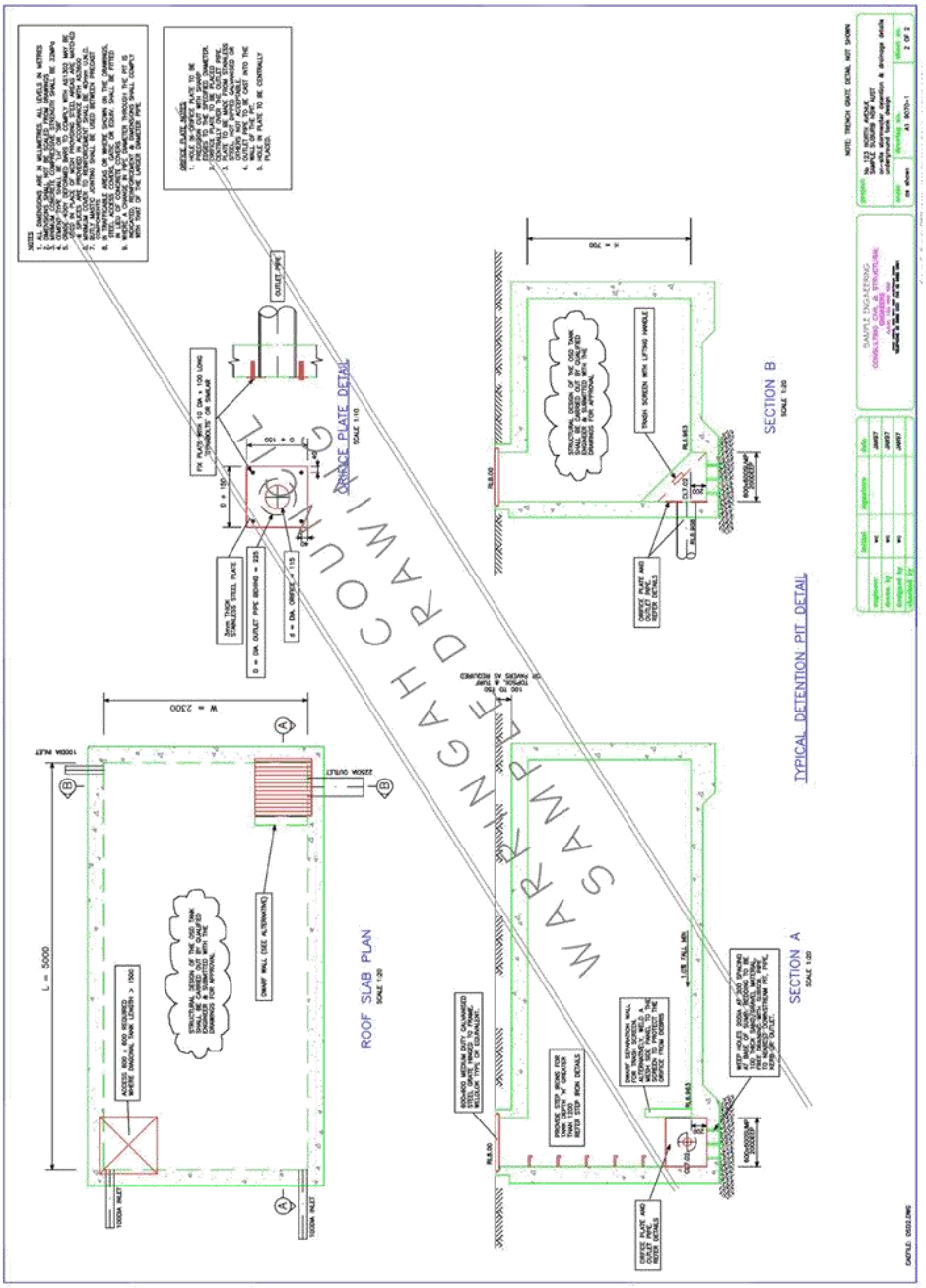
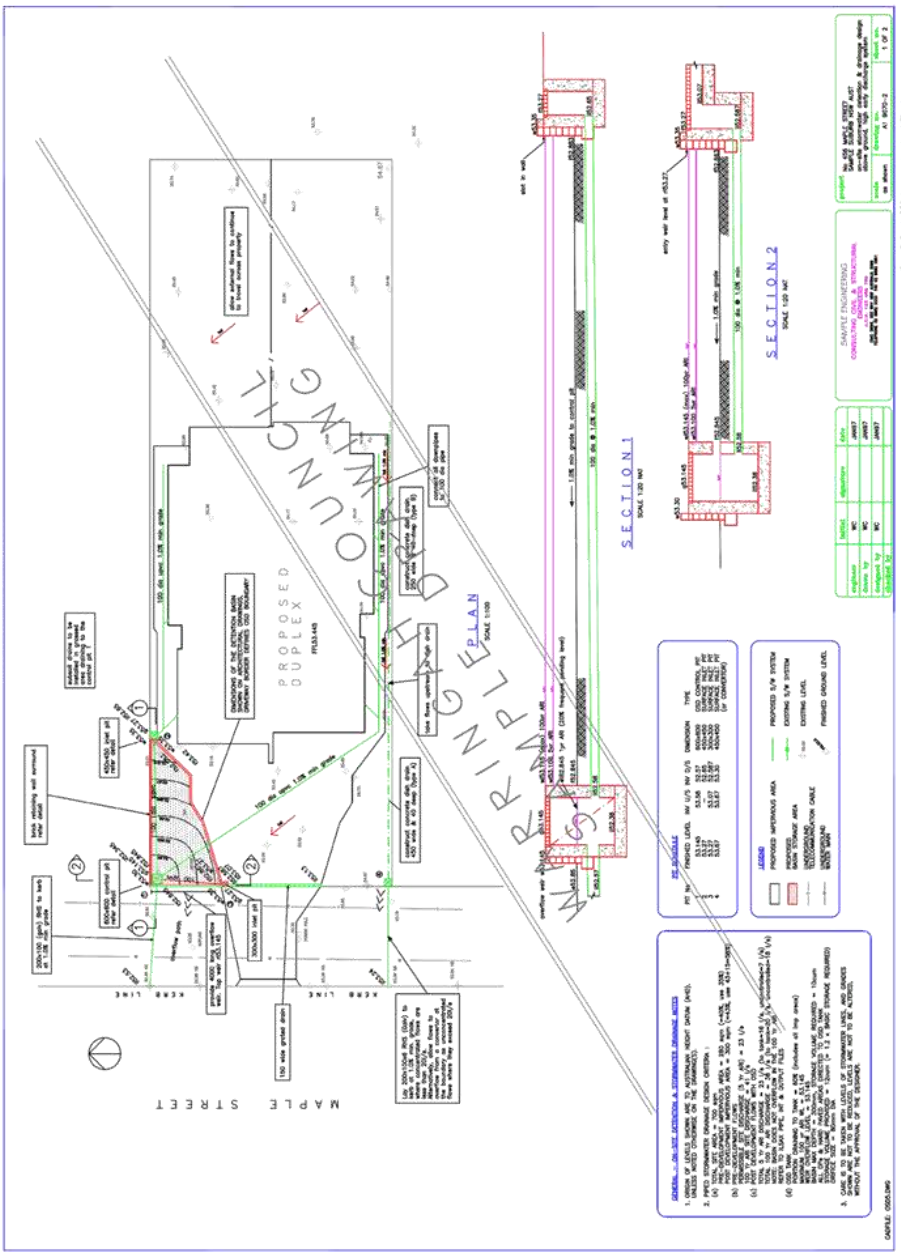
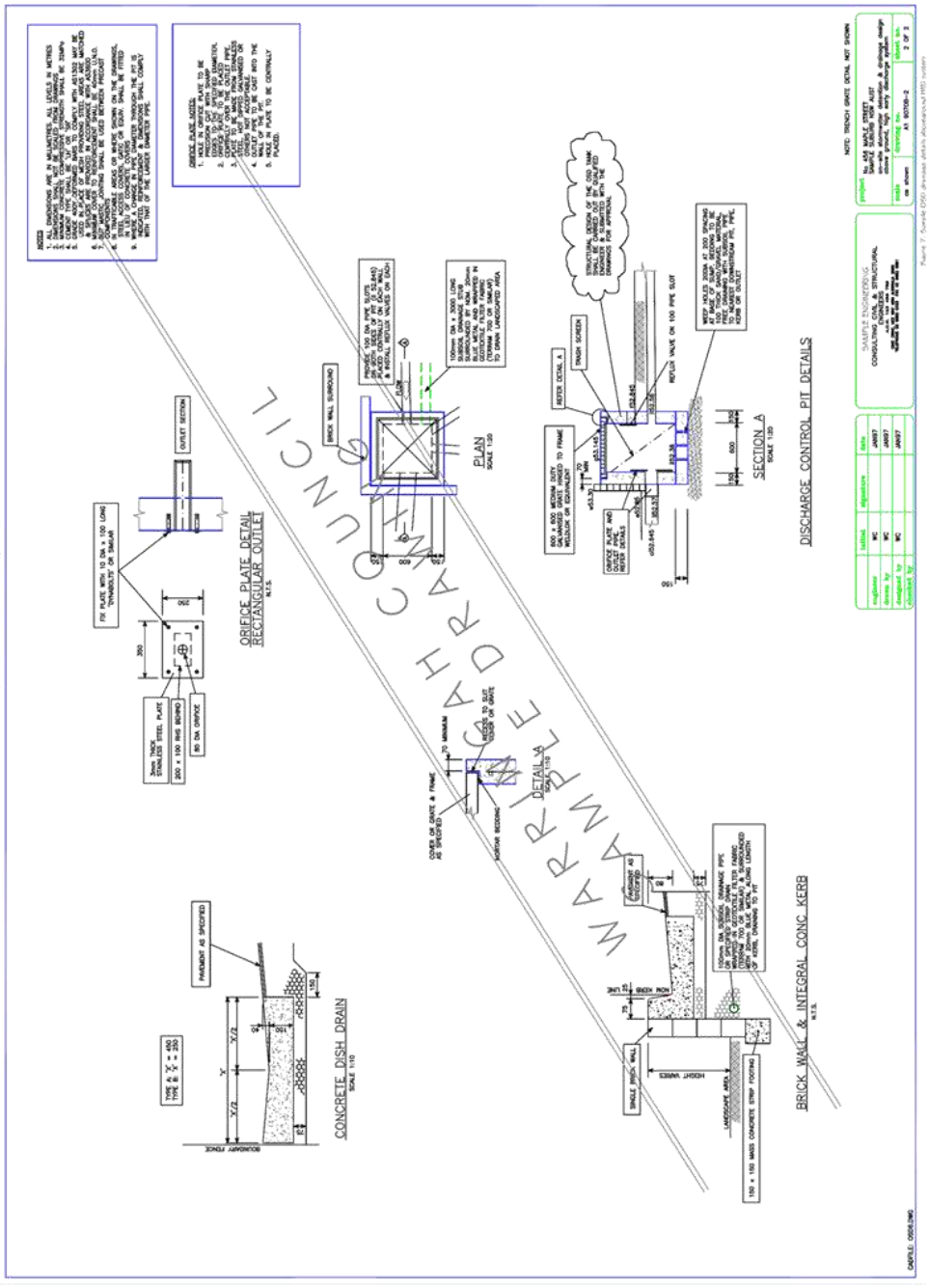

WARRINGAH COUNCIL
SAMPLE DRAWING
ROOF SLAB PLAN
SECTION A
SECTION B
TYPICAL DETENTION PIT DETAIL
ORIFICE PLATE DETAIL

Figure 7: Sample OSD drainage details above ground HED system



On-site Stormwater Detention Technical Specification



Building Over or Adjacent to Constructed Council Drainage Systems and Easements Technical Specification

Table of Contents

1 General

When a Development application or application for a Complying Development Certificate is lodged on land that is burdened by or adjacent to a Council stormwater drainage system and/or easement, the requirements outlined below are to be implemented.

This is to ensure that Council's drainage infrastructure is not damaged and that costs and liabilities are minimised when constructing, replacing, maintaining or obtaining emergency access to constructed public drainage systems located within private property.

Where the drainage system is a natural (unconstructed) drainage system or watercourse, refer to Council's Water Management Policy and Protection of Waterways and Riparian Lands Policy for further detail.

2 Easements Requirements for Council Drainage Systems

Council will acquire drainage easements over constructed public drainage systems within private property, wherever possible.

When a development application is submitted and the property contains a Council drainage system not burdened by a drainage easement, development consent shall be conditional upon the property owner agreeing to grant Council a drainage easement in accordance with Council's standard terms. All costs including legal and surveying associated with the creation of the easement are to be borne by the applicant.

3 Reconstruction/Relocation of Public Drainage System

Where a developer/property owner obtains Council approval to reconstruct and/or relocate any existing constructed public drainage system within the subject site, the developer/property owner shall create drainage easements in favour of Council, to suit the relocated/reconstructed drainage system.

All costs associated with the reconstruction and/or relocation of Council's drainage system are to be borne by the applicant. Hydrological and hydraulic studies and design plans are to be prepared by a Civil Engineer registered on the National Professionals Engineers Register (NPER).

4 Hydraulic Design Requirements

Council's piped or underground drainage system is to cater for all storms up to and including the 1 in 20 year Annual Exceedance Probability (AEP). If the existing drainage system is not designed for the 1 in 20 year AEP then the drainage system will need to be upgraded by the applicant/developer to the 1 in 20 year AEP capacity. The upgrading of Council's drainage system will be required prior to commencement of building works or during the building construction. The required upgrading of Council drainage system may be within the site and or along the street frontage(s) located within the road reserve.

An overland flowpath through the property is to be provided for all storms in excess of the 1 in 20 year AEP, up to and including the 1 in 100 year AEP. The width of any drainage easement shall be governed by the extent of the predicted 1 in 100 year AEP flowpath and also minimum easement width requirements listed below.

Hydraulic design plans and an accompanying report detailing the Council drainage system upgrade are to be prepared by a Civil Engineer registered on the NPER. The Hydraulic design plans are to be submitted with the Development Application. Hydrological and Hydraulic technical guidelines as specified in Council's Engineering Design Specification - AUSPEC ONE are to be used in the preparation of the Hydraulic design plans and report.

Upstream and downstream impacts are to be addressed to prevent increases in hydraulic flows and water surface levels. All habitable floor areas are to have a 500mm freeboard above the 1 in 100 year AEP water surface level. Basement entry levels, garages, ventilation openings and other potential water entry points are to have a minimum of 500mm freeboard above the 1 in 100 year AEP water surface level.

5 Minimum Easement Width Requirements

The width of any drainage easement is controlled by the minimum practical width necessary for standard machinery to carry out reconstruction of the public drainage system to current standards and Work Health and Safety requirements. For this reason, the minimum width of any drainage easement must be 3.0 metres.
For pipes/channels having a width greater than 1.0 metre, the drainage easement must have a minimum width equal to the external width of the pipe/channel plus 2 metres, rounded to the next 0.1 metre (See Figure 1 below).

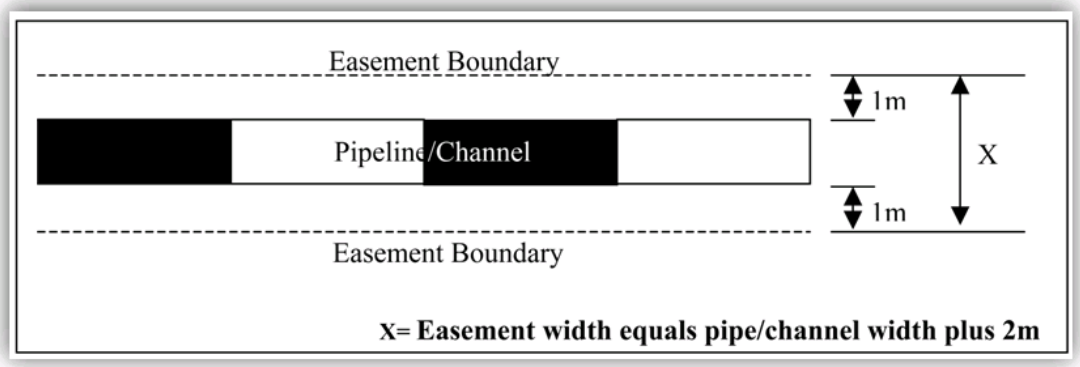


Figure 1 - Drainage Easement Width (Straight)

If bends occur in the Council drainage system then the minimum easement width shall be increased as detailed in Figure 2 below.

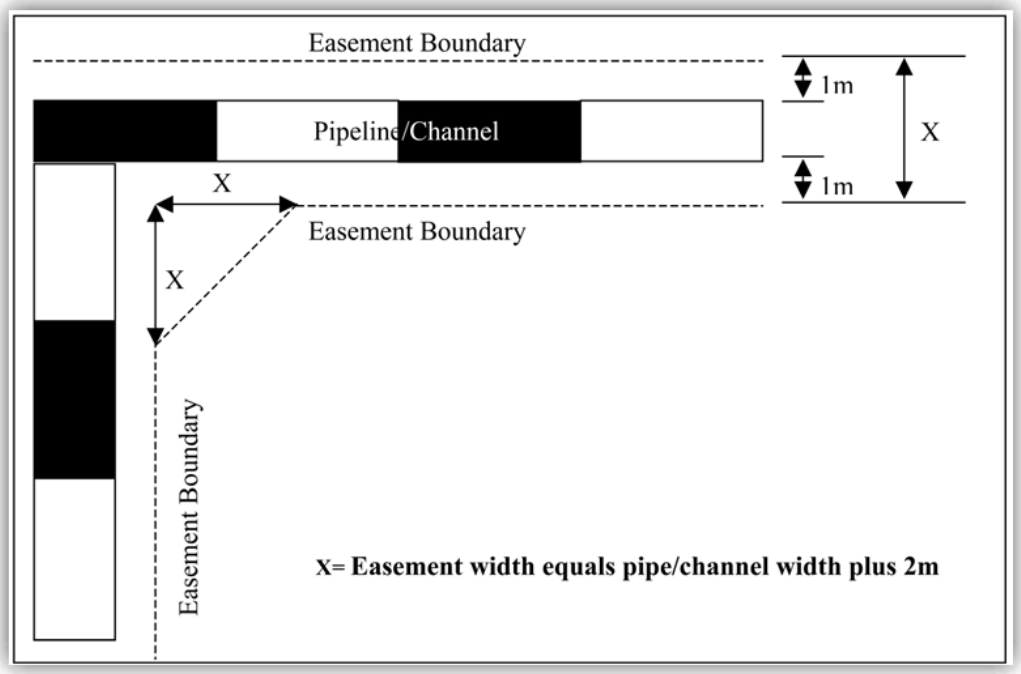


Figure 2 - Drainage Easement Width (Bend)

6 Permanent Structures over Council's Drainage system

The construction of buildings or other permanent structures over constructed public drainage systems is not favoured, and will generally not be approved by Council. However, in certain cases consideration may be given to a development proposal which can satisfy the minimum requirements for construction and maintenance access and also comprehensively demonstrate that objectives of this policy will be met. In these cases it will also be necessary to demonstrate that the site cannot be reasonably developed without building over, or by relocating Council's drainage system.

Filling over Council's drainage systems may be permitted, subject to the approval of Council's technical staff with supporting hydraulic studies prepared by a Civil Engineer registered on the NPER.

The hydraulic study is to demonstrate that there are no adverse effects including diversion of overland flow paths and flooding of upstream and downstream properties.

Note:
Construction of buildings or other permanent structures under constructed public drainage systems is not permitted.

Council may permit structures over constructed public drainage systems which are lightweight and easily demountable or removable such as carports and car stand areas. A Positive Covenant in favour of Council will need be created on the title, requiring any costs related to dismantling, removal, and subsequent re-assembling, re-installation, re-instatement of the above structures to be borne by the property owner.

Fences are to be not to be built over Councils drainage system as they impede the overland flow path, unless it can be demonstrated that there are sufficient openings to cater for the overland flow and also prevent the potential for debris blockages. Fences must designed to be able to be readily dismantled. All costs associated with the removal and restatement of the fences is to be borne by the applicant.

6.1 Minimum Requirements for Construction and Maintenance Access

Council may give a property owner approval to build a permanent structure over an existing Council drainage system where the structure provides adequate access for Council to reconstruct and maintain the drainage system. Council will not approve a structure over a public drainage system which will result in Council incurring additional costs by having to use specialised equipment or construction techniques.

6.1.1 Dimensional Requirements

Council's dimensional requirements for access are governed by the minimum horizontal and vertical clearances necessary for standard machinery to gain access to, and undertake construction and maintenance of public drainage systems. These clearances include:

i. The vertical height from the surface level over the public drainage system to the underside of the overlying structure. This is generally governed by the vertical swept path of backhoes, excavators and cranes and must take into account clearances necessary to load and unload standard trucks. The minimum vertical height shall be 5.0 metres.

ii. The horizontal distance between permanent obstructions along the line of the public drainage system. This is generally governed by turning circles and horizontal swept paths of backhoes, excavators and cranes and must take into account the limited maneuverability capabilities of these standard machines. The horizontal clearance shall be the minimum of 3.0 metres or the pipe /channel diameter plus 2 metres.

The vertical and horizontal clearances through the structure for access to the Council drainage system is governed by the travelling height, width and turning radius of standard construction machinery, and must take into account the size of loaded vehicles required to deliver construction materials or equipment. The minimum vertical clearance shall be 3.5 metres and the horizontal clearance shall be 3.5 metres on straight section with increases provided as necessary on vertical and horizontal curves. A right of carriageway in favour of Council will need to be created over the access way prior to occupation of the building.

Note:
The above dimensional values are minimums only. The required clearances will vary according to the size of the Council drainage system and are subject to the discretion of Council's technical staff.

6.1.2 Structural Provisions

The pavement over which Council will obtain access to the public drainage system shall be designed and constructed in accordance with relevant Australian standards so as to sustain the loadings which would be imposed by Council's construction vehicles. Any pavement constructed on the surface over the Council drainage system shall include construction joints along each longitudinal edge of the easement over the drainage system, in order to facilitate Council's access to the drainage system.

Minimum cover over Council's pipelines / culverts to be 600mm. Where this cannot be achieved a proposal to modify this will need to be submitted to Council's technical staff for approval.

Footings of any building located adjacent to an easement or constructed public drainage system are to be a minimum of 300mm below the invert of the public drainage system and may rise at 1:1 from the edge of the easement or from 1.0m horizontal clearance if no easement is in place (refer Figure 3 below). A minimum horizontal clearance of 1.5 metres between the footings and the constructed drainage system is also required.

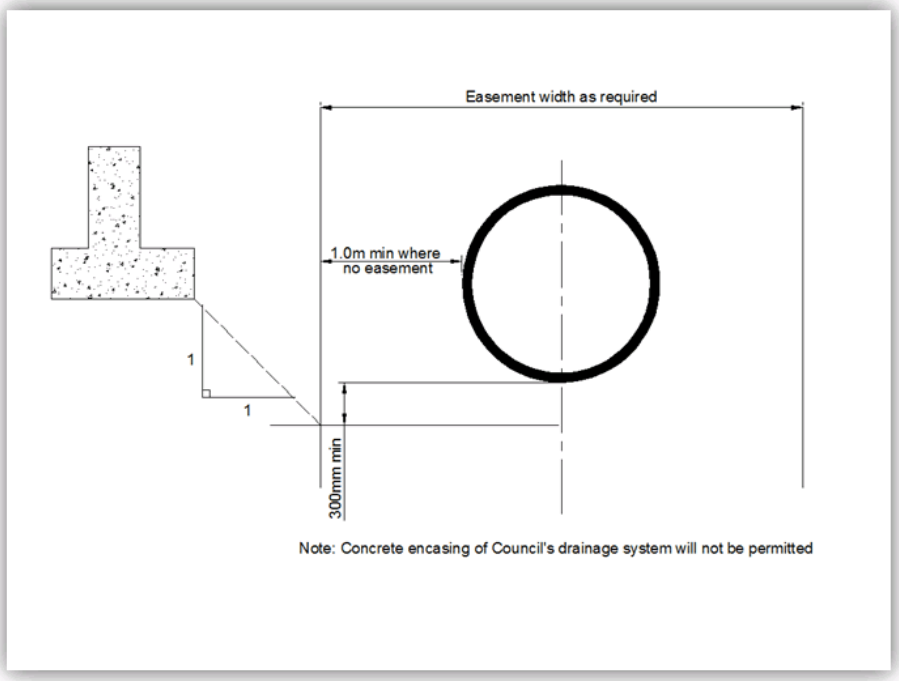


Figure 3 - Footing Placement in Relation to Pipe

7 Right of Access by Council

Provision is to be made to ensure that Council has uninhibited legal right of access through the overlying structure to the Council drainage system.
To ensure that Council has uninhibited access through the overlying structure, for emergency purposes, gates or doors cannot be installed along the path of access, between the public road and the Council drainage system.

To ensure that Council has legal right of access through the overlying structure, a Right of Carriageway is required to be granted to Council over the full length and width of the access, between the public road and the public drainage system. The Right of Carriageway shall be created to facilitate the minimum dimensions required by sections 5 and 6.1.

8 Submission of Information

To demonstrate compliance with this technical specification and the Water Management Policy, the following information may be required to be submitted at the following stages of the development application process:

8.1 Submission with Development Application

8.1.1 Location and Dimension Details

Accurately locate, confirm dimensions including depth and plot to scale Council's stormwater pipelines and associated infrastructure on the DA site plans that outline the proposal. This should be carried out by a service locating contractor and registered surveyor. (Evidence of methodology used for locating stormwater system should be provided). It is recommended that a Closed Circuit Television Pre construction Dilapidation Survey be undertaken at the same time. Refer to section 9.2 for further information.

8.1.2 Hydraulic Design & Construction Plans

Where the reconstruction or relocation of Public Drainage System is proposed, hydraulic design, construction plans and an accompanying report detailing the Council drainage system upgrade are to be prepared by a Civil Engineer registered on the NPER. Hydrological and Hydraulic technical guidelines as specified in Council's Engineering Design Specification – Auspec 1 are to be used in the preparation of the Hydraulic design plans and report.

8.2 Submission as Required by Conditions of Consent

The following information may be required to be submitted as part of the conditions of the consent:-

8.2.1 Closed Circuit Television (CCTV) Survey and Report

A CCTV Survey and Report for Council's Stormwater Asset prepared in accordance with Guidelines for CCTV Investigations of Council Stormwater Assets (refer Appendix A) is required for:

i. Any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent; and

ii. Any new stormwater infrastructure that has been constructed as part of a development and will be handed over to Council's care and control.

8.2.2 Dilapidation Survey

A Dilapidation Survey for Council Stormwater Assets prepared in accordance with Council's Guideline for Preparing a Dilapidation Survey of Council Stormwater Assets (refer Appendix 2) is required for:

i. Any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent.

ii. Any development where a bond amount has been lodged for:

   a) security against any damage to Council's existing stormwater assets or

   b) failure to complete the construction of stormwater drainage works to be handed over to Council's care and control.

This bond will be released based on a review and approval of the pre and post construction dilapidation surveys, engineering certification and Works As Executed data.

8.2.3 Works as Executed Data

Works as Executed Data for Council Stormwater Assets prepared in accordance with Council's Guideline for Preparing Works as Executed Data for Council Stormwater Assets (refer Appendix 3) is required following for:

i. Development works which modify Council's stormwater assets or create new stormwater assets that will be handed over to Council's care and control. Generally this is imposed as a condition of development consent.

8.2.4 Structural Details

All structures are to be located clear of any Warringah Council pipeline or easement. Footings of any structure adjacent to an easement or pipeline are to be designed in accordance with this technical specification. Structural details prepared by a suitably qualified Civil Engineer demonstrating compliance with this technical specification are to be submitted.

Appendix 1 - Guidelines for CCTV Investigations of Council Stormwater Assets

This guideline is intended to provide advice to applicants on Closed Circuit Television (CCTV) Investigation of Council Stormwater Assets.

What is a CCTV Report for a Council Stormwater Asset?

A Closed Circuit Television (CCTV) Report for a Council Stormwater Asset consists of internal video footage of the infrastructure (provided on a DVD) and a hard copy report which is prepared to enable Council to assess the impacts of development upon Council Stormwater Assets, such as stormwater drainage pipelines. Council uses a CCTV Report for Council's Stormwater Assets to adequately assess potential damage that may have occurred to Council owned and maintained stormwater infrastructure and to assess the construction / condition of any new stormwater infrastructure that will be handed over to Council's care and control as part of a development.

When is a CCTV Report for Council Stormwater Asset Required?

A CCTV Report for Council Stormwater Asset is required for:

1. Any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent. Generally, a CCTV report is required for stormwater lines longer that 10m in length and
2. Any new stormwater infrastructure that has been constructed as part of a development and will be handed over to Council's care and control.

Technical Requirements of a CCTV Report for Council Stormwater Asset

CCTV reports are to be as follows:

- The survey is to be undertaken using a suitably sized tractor mounted CCTV camera for the pipe size to ensure the camera is close to the centre of the pipe.
- 360 degree panning is required at every pipe joint with inspections also required at lifting holes
- The video footage is to be in focus.
- Each pipe reach report is to have a cover page outlining the "from pit" and "to pit" numbers, pipe diameter, direction of survey, location, and date (Pit numbers to be obtained from Council's Natural Environment Unit or available on Council's webpage – Stormwater Maps)
- A new survey is required for each pipe reach
- File format to be **mpeg**
- DVD disk to have DVD number & date shown
- DVD disk cover to contain a clearly labelled index of surveys on disk including pit numbers to and from and job location.
- The Electronic file name for each pipe reach report should be labelled using the following naming convention:
  - 'Pit number' to 'Pit number'_Date.

Example: A survey from Pit no. SPP00001 to SPP00002 carried out on 1 August 2009

Should be named as follows: SPP00001_SPP00002_010809.mpg

NOTE: Warringah Council has its own pit numbering system. Pits labelled A or B etc. will not be accepted. Pit numbers to be obtain from Council prior to undertaking works.

- A paper copy of the report is also required.

Other General Requirements of Reporting

All reports are to meet the following standards:

- Be professionally prepared
- Provide details of author

For further information contact Natural Environment Unit on 9942 2111 or via email council@warringah.nsw.gov.au

Appendix 2 - Guideline for Preparing a Dilapidation Survey of Council Stormwater Assets

This guideline is intended to provide advice to applicants on preparing a Dilapidation Survey for Council Stormwater Assets.

What is a Dilapidation Survey for Council Stormwater Assets?

A Dilapidation Survey for Council Stormwater Assets is a document which is to be prepared to determine the condition of Council's Stormwater Asset both before and after construction. A Closed Circuit Television (CCTV) inspection maybe required to determine this condition. This allows Council to determine if there is any damage to Council's stormwater infrastructure caused by development works.

When is a Dilapidation Survey for Council Stormwater Assets Required?

A Dilapidation Survey for Council Stormwater Assets is required for any development works located within the vicinity of a Council Stormwater Asset on public or private land and may be required as a condition of development consent.

The pre-construction Dilapidation Survey of Council's Stormwater Asset must be submitted to Council prior to Construction, or as required by conditions of consent for any stormwater infrastructure that may be impacted upon during construction. This is to clearly identify to Council any existing damage to Council stormwater infrastructure before commencement of the development.

Copies of pre-construction Dilapidation Surveys are to be available on site for inspection until practical completion is reached.

Final post-construction Dilapidation Surveys are to be submitted to Council prior to the release of any bonds. All costs incurred in achieving compliance with these requirements shall be borne by the person entitled to act on a development consent.

Requirements of a Dilapidation Survey for Council Stormwater Assets

Dilapidation Surveys for Council Stormwater Assets are to include the following:

- Photographs and written records identifying any damage to Councils stormwater infrastructure prior to construction
- Photographs and written records identifying any damage to Councils stormwater infrastructure post construction
- Closed Circuit Television (CCTV) footage - DVD and hard copy report (pre and post construction) in accordance with Council's guidelines for CCTV requirements.

Other General Requirements of Reporting

All reports are to must meet the following standards:

- Include an executive summary
- Be professionally prepared
- Provide details of author

For further information contact Natural Environment Unit on 9942 2111 or via email council@warringah.nsw.gov.au

Appendix 3 - Guideline for Preparing Works as Executed Data for Council Stormwater Assets

This guideline is intended to provide advice to applicants on Preparing Works As Executed Data for Council Stormwater Assets.

What are Works As Executed Data for Council Stormwater Assets?

Works As Executed Data Requirements for Council Stormwater Assets consists of a Works As Executed (WAE) plan (dwg file), a spreadsheet and a Closed Circuit Television (CCTV) Report (refer to Guideline for CCTV investigations of Council stormwater assets) which is to be prepared to enable Council to update records and note variations to Council Stormwater Assets.

When is Works As Executed Data for Council Stormwater Assets Required?

Works As Executed Data for Council Stormwater Assets is required following development works which modify Council's stormwater assets or create new stormwater assets that will be handed over to Council's care and control. Generally this is imposed as a condition of development consent.

Technical Requirements for Works As Executed Data for Council Stormwater Assets

The Works As Executed Data is to be provided by a Registered Surveyor and should comply with the following:

1. **Level of accuracy:**
   - X, Y coordinates (Easting; Northing) shall be +/- 0.05m
   - X, Y (Easting; Northing) to GDA 94 Map Grid of Australia Zone 56 (MGA94)
   - reduced level heights shall be +/- 0.01m
   - reduced levels shall be in terms of Australian Height Datum (AHD)

2. **Appropriate formats:**
   - Spreadsheet (.XLS);
   - WAE electronic plan – Drawing **(.DWG AutoCAD 2009 or earlier version**)
   - CCTV Report / footage DVD – (.MPEG)

3. **Deliverables:**

   One (1) soft copy of both the spreadsheet and plan on CD, one (1) scaled A1 paper copy plan of the Drawing, one (1) soft copy of the CCTV footage on DVD and one (1) paper copy of the CCTV report is to be provided to Council.

   The detailed information required within these formats is detailed below:

Spreadsheet Schedule

An Excel Spreadsheet template with drop down menus to enter all the drainage asset information under the following headings is available from Council's Natural Environment section or Council's webpage. This is to be completed and returned to Council.

Pits

- Council Pit Numbers
- Y Coordinate (Northing)
- X Coordinate (Easting)
- Installation Date
- Pit Type
- Pit Material
- Grate RL
- Pit Depth
- Lintel
- Pit Inflow Type

Pipes

- From (upstream) Pit No.
- To (downstream) Pit No.
- Upstream Invert Level
- Downstream Invert Level
- Installation Date
- Pipe Type
- Pipe Material
- Pipe Length
- Pipe Diameter
- Construction Type
- Joint Type
- Length

WAE Plan

A Registered Surveyor is to electronically amend and sign the approved 'design plan' to reflect the 'Works As Executed' information. In this respect the electronic copy of the Drawing file should contain the 'Works As Executed' information on a separate drawing layer in RED.

The WAE plan is to provide the following information:

- The reduced levels (AHD) of all pit and pipe attributes should be listed in the following order:
  - Pit lid level (Road gully pit levels to be taken at centre of grate in the gutter, Junction pits in centre of lid).
  - Reduced level of the invert of the outlet pipe
  - Thereafter each inlet pipe invert in a clockwise direction from the outlet.
  - Longsection(s) outlining any changes to the approved plans
- Co-ordinates of all surface features and changes of horizontal alignment (bends) must be shown (refer Datum heading for co-ordinate system).
- All pipe sizes, classes, material and grades.

In relation to formalised Overland flow paths

- The position (coordinates for start and finish points and changes in direction) of formalised Overland flow paths;
- The reduced levels at appropriate intervals over the length of any formalised Overland flow paths including top and bottom of any retaining structures.

Other General Requirements of Reporting

All reports are to meet the following standards:

- Include an executive summary;

- Be professionally prepared;
- Provide details of author.

For further information contact Natural Environment Unit on 9942 2111 or via email **council@warringah.nsw.gov.au**

WARRINGAH COUNCIL

Stormwater Drainage from Low Level Properties Technical Specification

Table of Contents

1 General

To manage overland flow, nuisance flooding and groundwater related damage caused by low level properties to adjacent downstream properties during storm events.

To manage the impact of stormwater runoff on Council's stormwater drainage infrastructure as a result of any Development on a low level property and ensure low level properties drain to their natural downstream catchment.

To provide guidance for owners of properties when submitting a Development Application to determine the appropriate drainage system where the property falls (naturally) away from the street.

2 Requirements

This Specification applies to all types of developments and land uses where these properties fall naturally away from the street and cannot connect to a Council drainage system. The requirement for stormwater disposal is dependent on the type of proposed development or proposed land use for the property.

For Zone R2 Low Density Residential Dwelling Houses, the property owner or developer is required to manage stormwater drainage according to the sequence of steps as outlined in sections 2.1 and 2.2 of this Specification.

For all land use excluding Zone R2 Low Density Residential Dwelling Houses, the property owner or developer is required to manage stormwater drainage in accordance with section 2.3 of this Specification.

Council is to be satisfied that all avenues of the first or preceding step have been exhaustively investigated and considers these avenues to be impractical or unviable, prior to consenting the property owner or developer to progress to the next step.

2.1 Zone R2 Low Density Residential Dwelling House (for alteration and additions to existing dwelling houses) where an onsite stormwater detention is not required

A Development Application for a Zone R2 Low Density Residential Dwelling House where an on-site stormwater detention system is not required for the low level property, will require stormwater disposal from the site in accordance with the following steps:

STEP 1

Connection of stormwater to the existing stormwater disposal system will be permitted under the following circumstances:

i. Connection into an inter-allotment stormwater pipeline or Council's stormwater pipeline subject to the drainage pipeline having sufficient capacity and the property owner having formal drainage easement(s) created over the above pipeline within the downstream property(s) or,

ii. Existing drainage system was previously approved by Council and,

iii. There are no valid objections of overland flow and groundwater related damage and the associated inconvenience from downstream property owners.

STEP 2

Where the means of disposal in Step 1 are not available, the use of an on-site absorption system will be permitted subject to the following:

i. The on-site absorption system is designed by a suitably experienced and qualified civil engineer and,

ii. The on-site absorption system will not have an adverse impact upon adjoining and/or downstream properties by the direction or concentration of stormwater on those properties and,

iii. Soil absorption characteristics and other physical constraints indicate the on-site absorption system is appropriate for the property (refer Attachment 2 – On-site Absorption Design Guidelines)

iv. The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

STEP 3

Where the means of disposal in Steps 1 and 2 are not available, stormwater disposal from the site shall be via a gravity fed pipeline. This will require an easement to drain stormwater to Council's drainage infrastructure through the downstream property(s).

Noting there may be difficulties obtaining an easement through multiple properties, the property owner is ascertain which adjoining downstream property(s) it may be feasible and practical to drain stormwater through, and then approach the owner(s) to request an easement be granted for the purpose of draining stormwater to Council's drainage system (refer Attachment 1 - Sample Letter). If the property owner is unable to attain any written approval from the adjacent downstream property owner(s), the property owner is to then enclose a Statutory Declaration stating the above.

STEP 4

Where the means of disposal in Steps 1, 2 and 3 are not available, the use of level spreader will be permitted subject to the following circumstances:

i. The level spreader will have minimal impact on the upon adjoining property, including public reserves and parks, by the direction and flow of stormwater and,

ii. Soil absorption characteristics and other physical constraints indicate the on-site absorption system is not appropriate for the property (refer Attachment 2 – On-site Absorption Design Guidelines) and,

iii. Compliance with any requirements of the affected downstream property owners, and

iv. The level spreader shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

STEP 5

Council may, at its discretion, consider other methods of stormwater disposal only if all of the abovementioned methods have been exhaustively investigated and were considered not appropriate for this development.

Note : If no other method of stormwater disposal is feasible, the Development Consent may be refused.

2.2 Zone R2 Low Density Residential Dwelling House (for all new dwelling houses or alteration and additions to existing dwelling houses) where on-site stormwater detention is required

A Development Application for a Zone R2 Low Density Residential Dwelling House where an on-site stormwater detention system is required will require stormwater disposal from the site to be in accordance with the following steps:

STEP 1

i. Connection of stormwater to an existing Council stormwater drainage line located within the subject site, subject to the drainage line having sufficient capacity.

OR

ii. Connection of stormwater to an existing inter-allotment drainage easement and pipeline subject to the property owner demonstrating the inter-allotment pipeline has sufficient capacity and the property owner having a formal drainage easement(s) created over the inter-allotment pipeline within the downstream property(s).

STEP 2

Where the means of disposal in Step 1(i) is not available – stormwater disposal from the site is to be via a new gravity fed pipeline. This will require an easement to drain stormwater to Council's drainage infrastructure through the downstream property(s).

Noting there may be difficulties obtaining an easement through multiple properties, the property owner is ascertain which adjoining downstream property(s) it may be feasible and practical to drain stormwater through, and then approach the owner(s) to request an easement be granted for the purpose of draining stormwater to Council's drainage system (refer Attachment 1 - Sample Letter). If the property owner is unable to attain any written approval from the adjacent downstream property owner(s), the property owner is to then enclose a Statutory Declaration stating the above.

OR

Where the means of disposal in Step 1(ii) is not available – Council will accept the use of an on-site absorption system subject to the following:

i. The on-site absorption system will not have an adverse impact upon adjoining and/or downstream properties by the direction or concentration of stormwater on those properties and,

ii. Soil absorption characteristics and other physical constraints indicate the on-site absorption system is appropriate for the property (refer Attachment 2 – On-site Absorption Design Guidelines), and

iii. The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

STEP 3

Where the means of disposal in Steps 1 and 2 are not available, the use of a charged line to drain roof runoff to the kerb and gutter system fronting the site will be acceptable provided:

i. Stormwater is discharged into the same catchment (or sub-catchment), in comparison to stormwater being discharged to follow the natural fall of the land to the rear of the subject site, and

ii. The property owner demonstrating that the kerb and gutter system including any low level driveways fronting the street has sufficient capacity to cater for the 1 in 100 year ARI storm event from roof runoffs from all applicable properties fronting the same road, and

iii. On-site absorption system will be required to collect stormwater from impervious areas of the development that cannot drain by gravity to the kerb and gutter system (refer Attachment 2 – On-site Absorption Design Guidelines), and

iv. The on-site absorption system shall require the creation of a Positive Covenant and Restriction on Use of Land over the system.

OR

The use of a level spreader to discharge stormwater will be acceptable to Council subject to the following:

Stormwater flows from the whole site are to be restricted to the 1 in 5 year ARI "state of nature" storm event, for all storm events up to and including the 1 in 100 year ARI storm event. This system will require the provision of an on-site stormwater detention system.

Council may, at its discretion, consider other methods of stormwater disposal only if all of the methods outlined above have been exhaustively investigated and were considered not appropriate for this development.

Note : If no other method of stormwater disposal is feasible, the Development Consent may be refused.

2.3 All Land use excluding Zone R2 Low Density Residential Dwelling Houses

A Development Application for land use other than Zone R2 Low Density Residential Dwelling Houses i.e. subdivision developments, commercial developments, industrial development and mixed commercial/industrial/residential will require stormwater disposal via a gravity fed pipeline where these properties fall naturally away from the street.

This will require an easement to drain stormwater to Council's drainage infrastructure through the downstream property.

An application under Section 88K of the *Conveyancing Act 1919* can be made to allow the Court to consider making an order to impose an easement over land if the easement is reasonably necessary for the effective use or development of other land that will have the benefit of the easement.

Council may, at its discretion, consider other methods of stormwater disposal only if all methods outlined above have been exhaustively investigated and were considered not appropriate for this development.

Note : If no other method of stormwater disposal is feasible, the Development Consent may be refused.

2.4 Pump-out systems

Council will only permit pump-out systems for draining sub-surface seepage flows from under-ground areas, such as basement garages where the seepage flows are minor and intermittent.

The pump-out discharge line is only to be connected to a Council stormwater gully pit and not to the kerb and gutter.

The use of sump and pump-out systems for the disposal of stormwater flows are only to be used for the drainage of surface flows from basement vehicle entry driveways.

Council will not accept stormwater disposal to the public road fronting the low level property by employing pump-out systems because of the following reasons:

- Potential failure of the pump-out system and consequent stormwater related damage to property and adjacent properties.
- Diverting flows from one catchment (or sub-catchment) to another catchment (or sub-catchment) burdened that catchment (or sub-catchment) with additional stormwater flows that may cause nuisance flooding or exasperate existing flooding problems.
- The public road drainage system fronting the low level property was not designed to adequately cope with the additional stormwater flows from these pump-out systems or charged drainage lines.

3 Definitions

Zone R2 Low Density Residential Dwelling Houses – land use as referred to in the Warringah Local Environment Plan 2009

Low Level Property – a property that has the ground level which is lower than the roadway fronting the property.

Level spreader – a device that allows for the even distribution of flows across the land.

Downstream catchment – the direct sub-catchment a low level property would drain to via gravity.

State of nature – the undeveloped condition of a property, that is, the property is grassed or turfed

On-site stormwater detention system – a stormwater drainage device to control the amount of stormwater discharge to a specified rate. The device is to be constructed on the subject property. Refer to Council's On-site Stormwater Detention Technical Specification and On-site Stormwater Detention (OSD) checklist for more information.

Attachment 1 – Sample Letter

Dear . . . .

I/we . . . .
are proposing to redevelop our property at . . . .

Before we can proceed with this proposal Council has advised us that we have two options for the drainage of stormwater, the first, which is Council's preferred method, is to obtain a drainage easement to convey the stormwater runoff from our property to the nearest public stormwater drainage infrastructure or Council approved discharge point,
being . . . .

This will require you to grant me/us a drainage easement through your property with all legal and survey costs for the creation of the easement being borne by us, together with any consideration for the use of your property as determined by an independent valuation or agreement. (Attach independent valuation or agreement to this form)

The other alternative is to install an underground absorption system or level spreader (if appropriate for this site) to spread and disperse the stormwater flow. As the runoff and seepage from this system may flow towards your property because of the slope of the land, the best solution would be to have a drainage system that will convey our stormwater via an inter-allotment drainage pipe to . . . .

You are advised that if Council determines that the only way for the drainage of stormwater is via an easement through your property, I/we may have to use Section 88K of the Conveyancing Act 1919 to request the Supreme Court to grant me/us the drainage easement. This will probably result in legal expenses and time spent for both you and I/us.

Could you please indicate your position regarding this matter so that we can advise Council to enable our application to progress.

YES I/we are willing to grant you a drainage easement.

. . . .

Name   Address

NO I/we are not willing to grant you a drainage easement.

. . . .

Name   Address

Attachment 2 – On-site Absorption Design Guideline

1. A consulting geotechnical engineer must submit a geotechnical report providing the following details (where applicable) for the proposed location of the absorption/dispersal trench:
   - Depth to rock
   - Depth to the water table
   - Measured infiltration rate (in litres/square metres/second)
   - Infiltration rate that can be maintained in the long term
   - Minimum distance any infiltration system should be located clear of property boundaries
   - Whether the use of infiltration is likely to cause seepage problems to the proposed structure or to any adjoining properties
   - The use of any waterproofing to protect underground areas
   - Any special requirements for the design of walls or footings on the site

   The above information must be submitted to Council to determine whether any absorption system is permitted for the site.

2. The absorption pit is to be designed for an Average Recurrence Interval (ARI) storm of 50 years using DRAINS computer software based on the infiltration rate that can be maintained in the long term. An overflow mechanism in the form of a level spreader must be provided for all storms greater than the 50 year ARI storm, up to and including the 100 year ARI storm. The overflow mechanism is required to minimise overland flow disturbance to the lower property.

3. The roof guttering and downpipe system should be designed to collect the 50 year ARI design rainfall and pipe it to the absorption system, or alternatively provide for surface collection of guttering overflows into the absorption system.

4. A site plan showing the location of absorption pit(s) relative to fences and to the buildings on-site and on neighbouring properties must be provided. The pipe layout with sizes and grades is also to be shown. Drainage calculations must be submitted with the plans.

5. Where a high water table is encountered and a gravel filled trench design is proposed, the base of the trench should be at least 500mm above the water table to accommodate fluctuations of the groundwater.

6. When considering available storage volumes for the storage design methods, a maximum of 20% voids in the base aggregate may be used. Volumes in the end pits and the Everglas Trench systems may also be used.

7. The absorption pit should not be located within three metres of the side or rear boundary, or three metres from any on-site building or neighbouring buildings.

Attachment 3 – Level Spreader Design Guideline

1. Level spreader is to be designed by a suitably qualified and experienced Civil Engineer, who has Membership to the Institution of Engineers Australia.

2. Stormwater flows from the whole site are to be restricted for all storm events up to and including the 1 in 100 year ARI storm event. This system will require the provision of an on-site stormwater detention system.

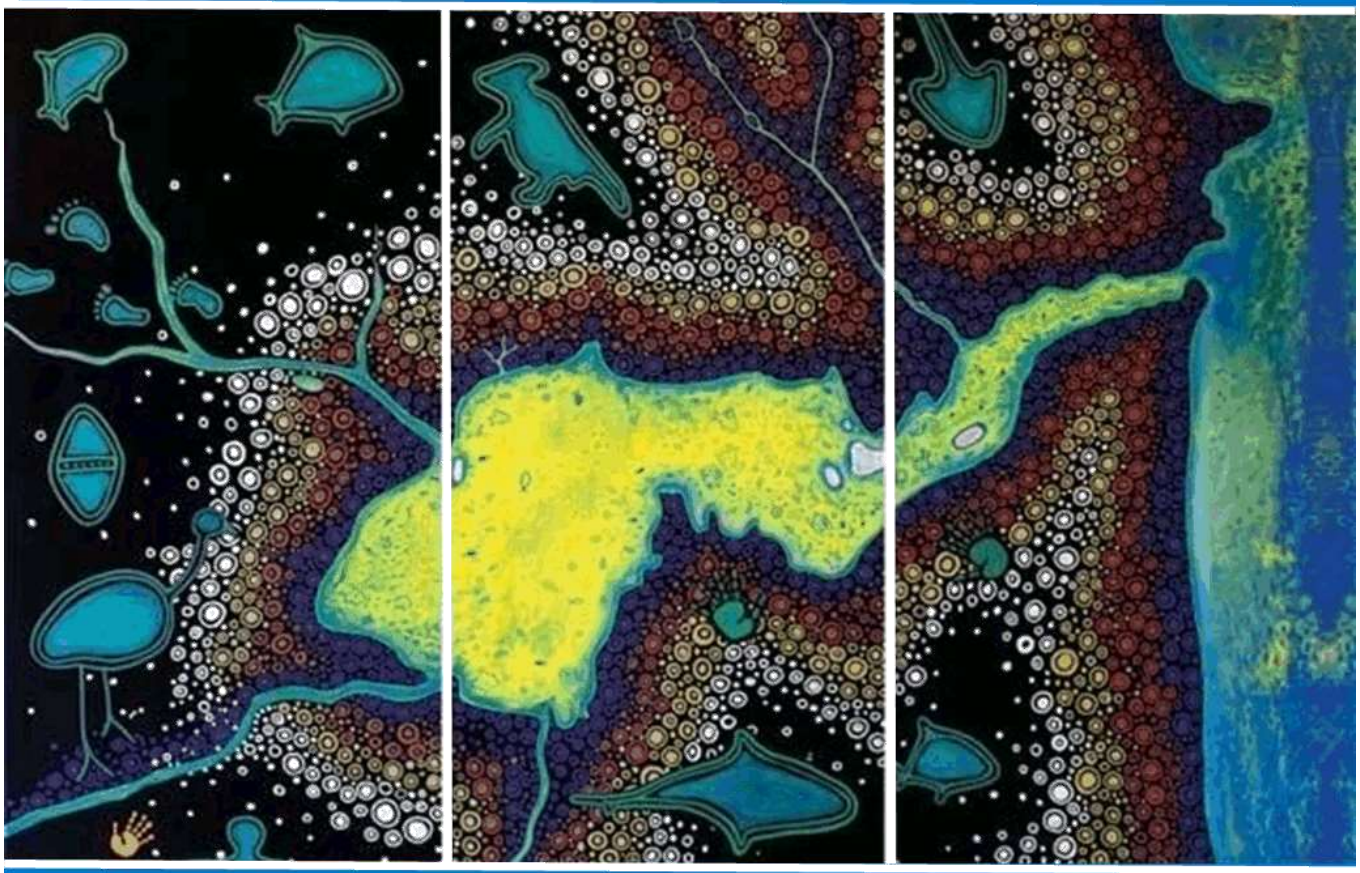
3. Total discharge including bypass flows and controlled flows through the level spreader must not exceed the 1 in 5 year ARI state of nature storm event.

4. The level spreader should not be located within three metres of the side or rear boundary, or three metres from any on-site building or neighbouring buildings.

5. The level spreader ideally is to be located as far as possible from the downstream boundary.

6. Level spreader must not directly or indirectly, result in the concentration and increase of surface flows downstream of the property.

Water Sensitive Warringah Strategic Plan



WARRINGAH COUNCIL

Authorship & Acknowledgements

The Water Sensitive Warringah Strategic Plan was authored by Adrian Turnbull and Ben Fallowfield of the Natural Environment Unit, Warringah Council.

Warringah Council has benefited from active participation in the Cities as Water Supply Catchments and the CRC for Water Sensitive Cities research programs, as well as membership of the Regional Water Cycle Management Working Group, and the Sydney Coastal Councils Group.

Additional acknowledgement is made for support and contributions by Warringah Council staff including (but not limited to) Todd Dickinson, Gareth Curtis, Jodie Crawford, Jason Ruszczyk, Jacqui Grove, David Bell, James Brisebois, Sue Jacobs, Jean Thuez, Scot Hedge, Dominic Chung, Dean McNatty, Leonie Netting, Ciaran Murphy and Michelle Johnston.

Purpose: This Strategy is an internal document to guide Council's approach to water management across Warringah and should be read in conjunction with the Water Sensitive Warringah Technical Paper.

Cover Image - Narrabeen Lagoon, Jessica Birk, courtesy of the Coastal Environment Centre.

Content

The Vision of a Water Sensitive Warringah

Our goal is to harness the potential of alternative water sources, increase resilience in times of drought, improve waterway health and amenity, reduce urban temperatures, and promote the "liveability" of Warringah's urban areas.

Objectives

The Water Sensitive Warringah Strategic Plan seeks to:

- Improve water security through conservation, demand management and alternative water sources
- Maintain and enhance waterway function and indigenous biodiversity
- Minimise flood risk and damage
- Reduce urban heat island effects
- Enable adaptive, integrated and sustainable management of the total water cycle
- Improve amenity and "liveability" of Warringah's urban areas
- Engage, inspire and motivate the community to protect and conserve our environment.

Focus Areas

This plan focuses on a number of key areas in order to realise the objectives:

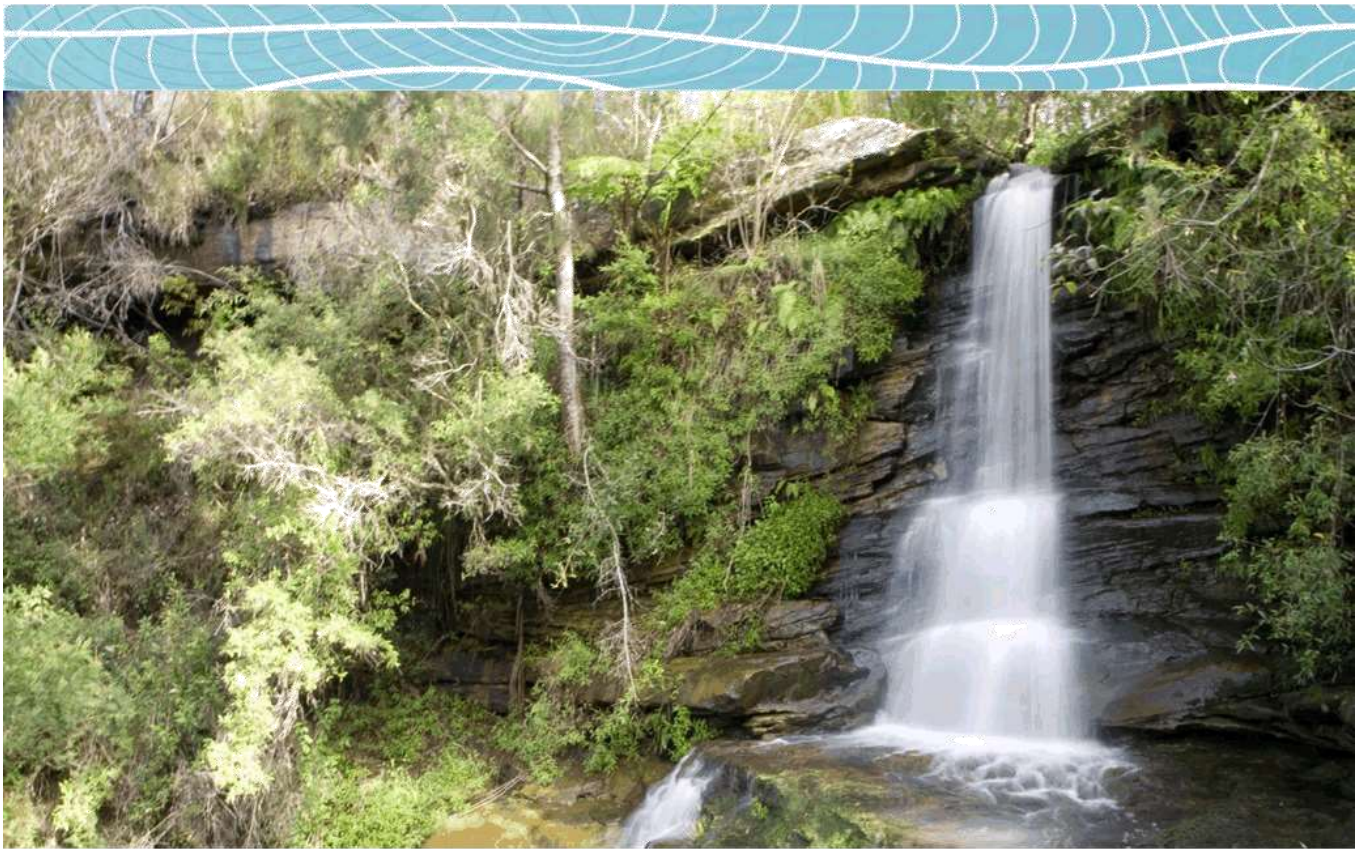
- Strengthened Policy and governance frameworks
- Effective community engagement to enable change
- Support robust research and industry partnerships
- Capacity building to develop skills, knowledge and resilience
- Promotion of sustainable water management practices
- Advancement of "green" infrastructure.

Introduction

The way we manage urban water influences almost every aspect of our environment and quality of life. Water is an essential element of placemaking: it provides cultural and spiritual connection, defines the identity of a locality, provides significant economic value, improves community health and wellbeing while supporting vital habitat for native plants and animals.

The traditional owners of the land acknowledged, respected and highly valued the water resources of the area, a sentiment the Warringah community continue to hold close to this day. Our coastline and beaches are rated as the best part of the local environment, and water quality is considered the most important environmental issue for Warringah residents[1]. Management of our waterways and lagoons is a key service area that only just meets community satisfaction levels[2].

The impacts of future population growth and climate change are a significant challenge that we need to start addressing now. This Plan is fundamentally about strengthening Council's policies and decision making processes in order to realise the outcomes and aspirations of our community, maintaining Warringah as a healthy, vibrant and desirable location. The path to becoming a Water Sensitive Warringah may be challenging but absolutely necessary to maintain our quality of life.



Future Challenges

Building resilience to the impacts of climate change, and in particular ensuring secure water supplies, the safe conveyance of flood waters and the ecological protection of water environments, is an emerging challenge as we seek to minimise the impact of Warringah's growing urban communities on already stressed water resources.

Population Growth

Warringah's projected population is expected to grow by 31,000 people to an estimated 179,000 by 2031 – a 21% increase.

As the population grows there will be increased stress on existing urban zones, and our remaining natural areas will come under more pressure to be developed for housing. Impacts on our natural environment include:

- Decline in catchment water quality and resultant flow on effects on aquatic and terrestrial ecology, receiving waters and recreational assets
- Increased erosion of private and public lands due to the changes in catchment hydrology
- Increased risk of flooding as a result of amplified levels and velocities of stormwater
- Elevated urban heat island effects, particularly in areas containing vulnerable populations
- Loss of native vegetation and increased weed infestation

Climate Change

Climate change, although a global issue, will impact on our community particularly due to our coastal location with significant low lying areas that are prone to flooding and inundation. Extreme weather events pose risks such as flooding and bushfires that directly impact on the wellbeing of our community, as well as more insidious changes to Warringah's ecology from prolonged fluctuations in temperature and rainfall.

Many of the impacts of climate change are shared with population growth, therefore solutions have the potential to address both causes.

The fundamental impacts of climate change that this plan seeks to address include:

- Water supply and security - Ensure the security of water supplies and the social equity issues related to the increased cost and availability of water
- Urban heat - manage the health and wellbeing risks associated with rising temperatures and urban heat retention
- Storm events - flood risk and property damage including erosion of private and public lands due to increased intensity and frequency of storms
- Rising sea levels – changes to the shape and ecology of Warringah's lagoons, increased influence on the water table including groundwater reserves

Legacy Issues

While seeking to manage these future impacts, we are still dealing with the consequences of past decision making. Contamination from earlier activities is an all too common issue, and it is often our lagoons and waterways that feel the worst effects. Inappropriate land filling practices, legal (and illegal) dumping of waste, contaminating land uses ranging from dry cleaners, heavy industry, petrol stations, automotive repair stations and chemical producers continue to impact on our local environment, and may even contaminate our groundwater.

Council is a large user of groundwater to irrigate our parks, ovals and reserves. Should our groundwater resources become either compromised due to contamination or unviable due to unavailability, there is a direct financial impact to supplement this supply with potable water. These costs are expected to increase substantially into the future when water availability becomes further strained during drought conditions, and as demand increases due to population growth. Council and the community must look to invest in alternative supply options to offset these ongoing costs and supply issues.

Moving Forward

In order to maintain our high quality of life into the future, it is essential that we embrace a 'Water Sensitive Warringah' mindset which maximises the integration of urban planning with the management, protection and conservation of our water resources. This will involve moving beyond the traditional water supply approach, and establishes diverse, safe and reliable water resources, incorporating effective stormwater and groundwater management, and protecting the unique waterways and lifestyle of Warringah.

"The vision and concepts of the Water Sensitive City are emerging directly in city-shaping policies"[3]

What is a Water Sensitive City?

Urban communities are a highly complex web of socio-physical systems that are continually evolving. The strength of any community is determined by its ability to balance the needs of the built, economic, social and natural environments. Effective water management is a foundation for each of these factors, and a key influence on the quality of life of the community.

The idea of a Water Sensitive City was first coined by the Australian Government's National Water Initiative and further refined by the Cooperative Research Centre (CRC) for Water Sensitive Cities as the framework to drive "liveability" through intelligent management of water. A Water Sensitive City connects the urban water cycle in ways that: provide water security through efficient use of diverse water resources; enhance and protect the health of watercourses and wetlands; mitigate flood risk and damage; reduce urban heat island effects and create public spaces that harvest, clean and recycle water.

The CRC for Water Sensitive Cities, of which Warringah Council is a foundation partner, explores the various water management states in which cities can exist (Figure 1). These states are directly influenced by drivers starting with basic rights of access to and security of water supply, expanding to public health and flood protection, and evolving to address intergenerational equity and resilience to climate change.

Technical solutions and community willpower are often the limiting factors in the transition to higher states. Significant commitment, research and investment from the community and all levels of government is required to overcome these challenges, in order to preserve and enhance our lifestyles and environment into the future.

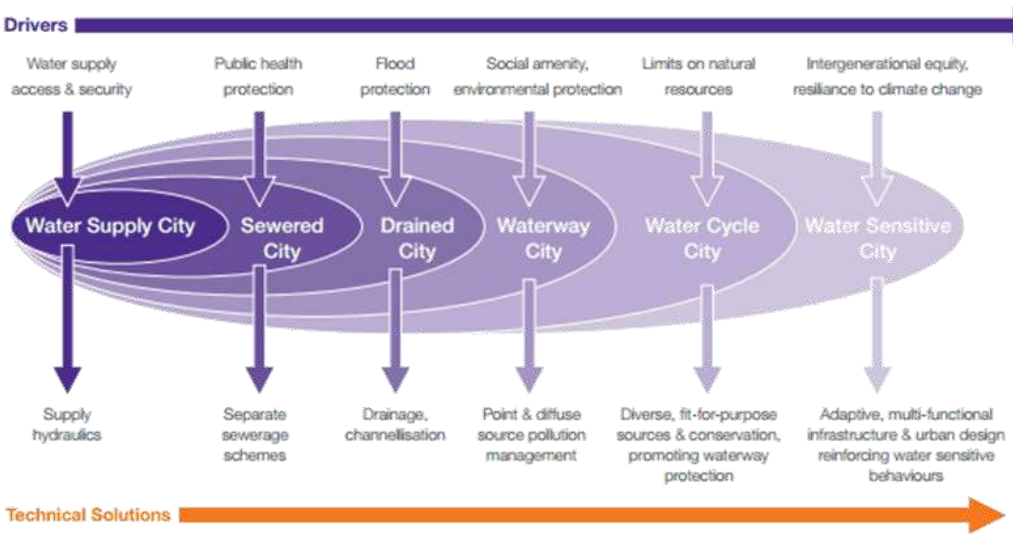


Figure 1: Relationship between city States and Societal Urban Water Needs (adapted from Brown et al, 2008[4])

Three key principles set the foundations for this vision of a Water Sensitive City[5]:

Cities as Water Supply Catchments

- Infrastructure is a mix of centralised systems (potable mains water from outside the catchment), and decentralised and distributed systems (often referred to as Integrated Water Cycle Management). Water quality matches the intended water use; e.g., rainwater is used for flushing toilets, and stormwater for irrigating ovals etc.
- Water sources include rainwater, stormwater, wastewater, desalinated water, and groundwater.

Cities Providing Ecosystem Services

- The built environment functions to complement and support the function of the natural environment through Water Sensitive Urban Design.
- Stormwater is harvested, treated for use, and cleaned before entering waterways, e.g. by rain gardens and wetlands.
- Infrastructure is designed for more infiltration and evaporation, improving microclimates, helping reduce effects of local flooding, e.g. vegetated roofs and permeable paving.
- The movement, distribution, and quality of water are managed so it mimics the natural water cycle.
- Urban waterways are rehabilitated to support local biodiversity and influence microclimate.

Cities Comprising Water Sensitive Communities

- The community is actively involved in the decision making process and is self-motivated to undertake sustainable water actions.
- Citizens, businesses, community and government organisations promote and maintain an ecologically sustainable lifestyle.
- Water planners and managers of public and private land are skilled at managing urban water sustainably.
- Local, state and national government policies strengthen inter-government collaboration and public/ private engagement.

The delivery mechanisms of a Water Sensitive City encompass both Integrated Water Cycle Management (IWCM) and Water Sensitive Urban Design (WSUD).

Integrated Water Cycle Management

IWCM refers to the collective management of all water sources in the urban environment including water supply, sewerage, groundwater and stormwater. This is a whole-of-lifecycle approach empowers government and the community to effectively manage valuable and sometimes scarce water resources.

Figure 2 shows the complex relationships and interactions of a range of alternative water sources available in the urban environment. Within the Sydney metropolitan area, the function of potable water supply and sewerage infrastructure is provided by Sydney Water, while waterways and groundwater are generally governed by the Office of Water. Warringah Council is not proposing to change these responsibilities, but seeks to facilitate future planning that enables long term water security and healthy ecosystems by supporting alternative water supply and management options.

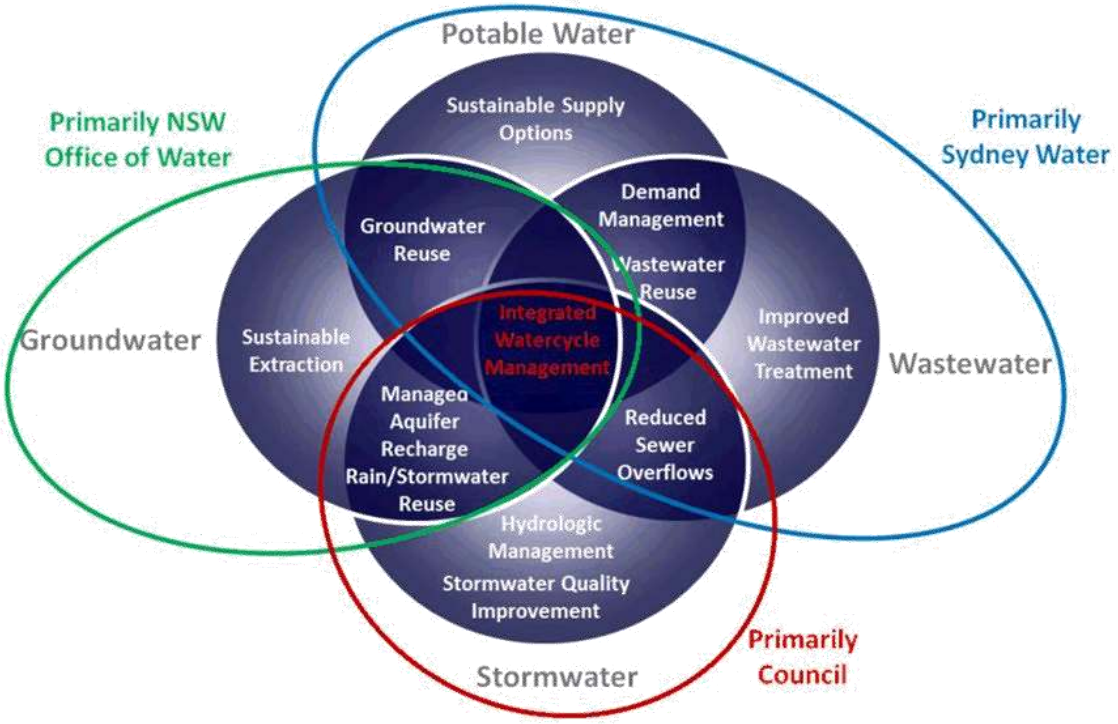


Figure 2: Integrated Water Cycle Management (adapted from Hoban & Wong, 2006[6])

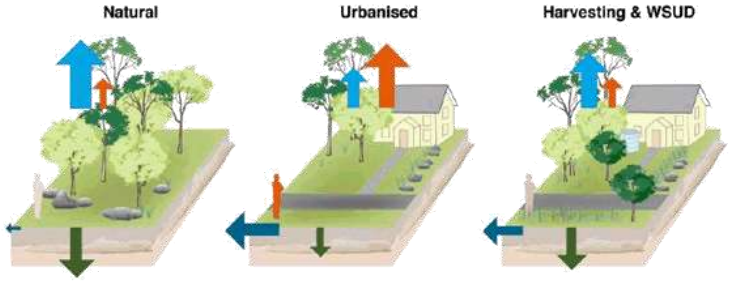
Water Sensitive Urban Design

WSUD is a holistic approach to the planning and design of urban development which aims to minimise the impacts on the natural water cycle and protect the health of aquatic ecosystems.

Water sensitive urban design provides a proven approach to ameliorate the impact of urbanisation on the water cycle, and is underpinned by the following principles:

- protecting and enhancing the natural aspects of Warringah's receiving environments
- treating urban stormwater to best practice standards for reuse and/or discharge to receiving waters
- reducing potable water demand through water efficiency, stormwater harvesting and wastewater reuse
- minimising wastewater generation and treating wastewater so it can be reused
- integrating vegetated stormwater treatment and harvesting systems into the landscape, so as to provide increased biodiversity, amenity and micro-climate benefits which can reduce the heat island effect, and
- providing green infrastructure and green links.[7]

Figure 3 represents how the urban environment has changed the landscape, atmosphere and hydrology, and how stormwater harvesting and water sensitive urban design can help restore a more natural and comfortable environment.



	Natural	Urbanised	Harvesting & WSUD
Stream channel form and biodiversity			
Groundwater recharge	High	Low	Moderate
Evapotranspiration	High	Low	Moderate
Atmospheric heating and heat storage in buildings	Natural	Hotter	Closer to natural
Human thermal comfort	Neutral	Hot	Slightly warm
Surface runoff	Low and infrequent	High and frequent	Infrequent and moderate
Stream hydrology	Natural	'Peaky'	Moderated (both high flows and low flows)
Riparian vegetation	Intact	Degraded	Restored
Channel form	Natural	Severely degraded	Uncertain (may need intervention)

Figure 3: Urban impacts and the benefits of water management[8].

The fundamental principle of water sensitive urban design is its integration with the urban environment. Figure 4 illustrates some easily implemented measures available within the urban environment to treat and reuse stormwater, which provide improved amenity and built urban form through functional landscapes – "liveable" communities.

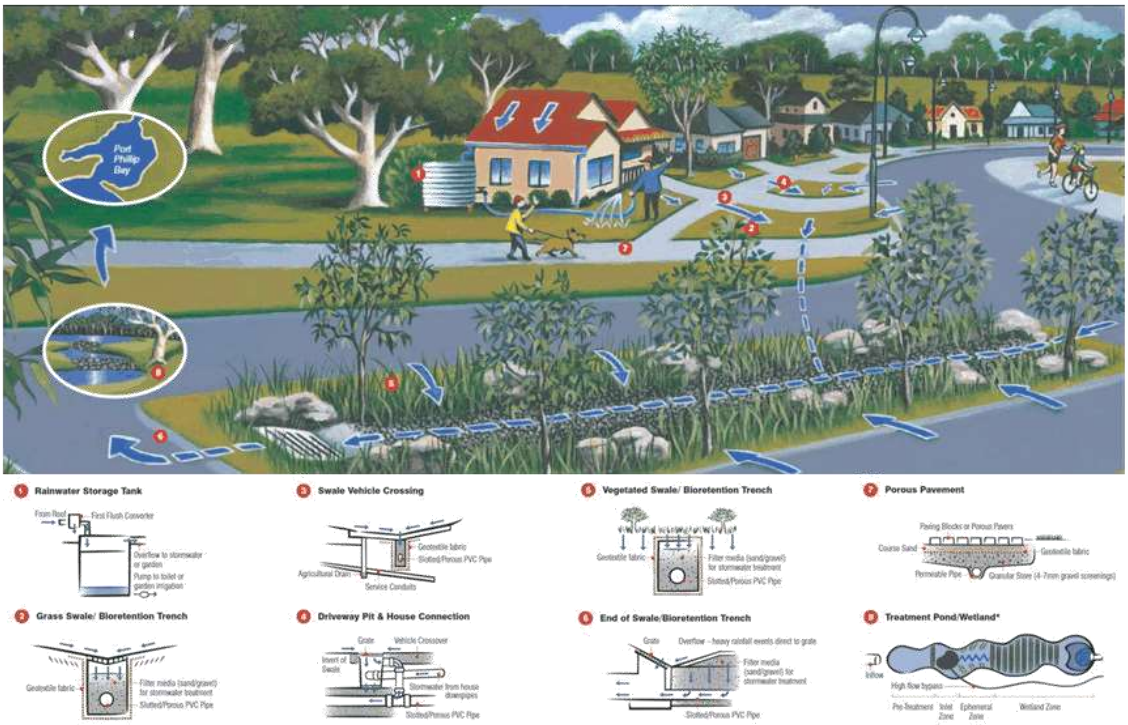


Figure 4: WSUD in the Urban Landscape (Source: Melbourne Water)

Changes in the movement of water through the landscape and into the atmosphere underlie many of the impacts of urbanisation, and can be restored through stormwater harvesting to support ecosystem services" [9]

Pathway to a Water Sensitive Warringah

The delivery this vision must be underpinned by a water cycle aware community and organisation. This Plan is founded on developing a culture of ownership, knowledge, awareness, appreciation and innovation, while instilling a sense of responsibility within all levels of the organisation and community.

Figure 5 illustrates the how the Water Sensitive Warringah Strategic Plan is aligned with Council's guiding documents including the Warringah Community Strategic Plan, Environmental Sustainability Strategy, Asset Management Plans and Policies.

Figure 5: Relationship of this plan to Council's guiding governance structures

Community Strategic Plan 2023 – Our Vision

"A vibrant, caring community, thriving in a unique beach and bush environment, supporting a balance of lifestyle, business and recreation."

Recognising and addressing strong community sentiments, the Community Strategic Plan 2023[10] sets out the long term aspirations for Warringah and our residents. It reflects where we want to be in eight years, and is the key reference point for decision making during this period. The plan was prepared by Council on behalf of Warringah's residents, business and land owners, Councillors and community groups, and with regard to State and Regional policy direction.

Key Community Outcomes relevant to the Water Sensitive Warringah Strategic Plan include:

A Healthy Environment:

3.1 We value the health of our beaches, foreshores and waterways as natural habitats and for our enjoyment

3.2 We protect and sustain our diverse bushland as valuable habitats, and provide for a variety of wildlife to thrive and migrate

3.3 We strive to live and work more sustainably to reduce our environmental footprint

3.4 We effectively plan for and respond to natural hazards and climate change in a sustainable way

Lifestyle and Recreation

2.2 We have access to attractive parks and natural areas that encourage and support a safe healthy lifestyle

2.3 We have inviting public spaces that are clean, green and well designed

A Vibrant Community

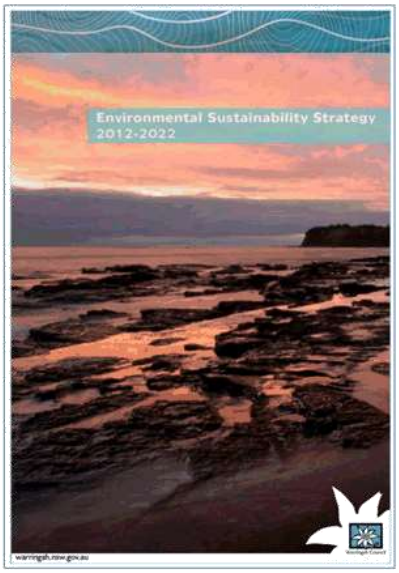
1.1 We have the services to promote and deliver health and wellbeing

Liveable Neighbourhoods

5.1 We have attractive and functional urban and commercial centres that adapt to the needs of residents and business

5.3 We offer a variety of housing choices that meet the needs of our community and complements local neighbourhoods and the Warringah lifestyle

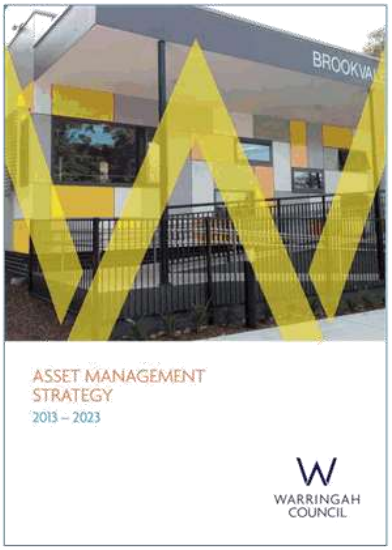
Environmental Sustainability Strategy



The intent of the Community Strategic Plan is further supported by Warringah's Environmental Sustainability Strategy[11], which sets a long-term direction for how best to balance growth with the environmental, economic and social values of the Warringah community. The Strategy aspires to "*maintain and enhance waterway function* and *maintain* and *enhance locally indigenous biodiversity*".

This Plan responds to the Environmental Sustainability Strategy by providing a clear pathway to realise the desired outcomes and aspirations.

Asset Management Strategy 2013 - 2023



The Warringah Asset Management Strategy articulates how Council will manage its assets now and into the future by providing objectives, actions for improvement, timeframes and responsibilities. This holistic approach to asset management provides greater certainty and limits Council's exposure to financial risk and asset failure by planning for the future.

The actions outlined in the Water Sensitive Warringah Strategic Plan will link into Asset Management Plans that are prepared for specific service areas including Roads, Parks and Reserves, Buildings, Stormwater and Natural Areas.

Implementation

The following actions have been identified in order to realise the objectives of the Strategic Plan to continue the transition to a Water Sensitive Warringah:

Policy and Governance

- Embed and improve sustainable water management outcomes into Council's planning controls.
- Establish planning controls that enable sustainable water management outcomes and innovation.
- Embed the responsibility of water management with all asset owners.
- Integrate the outcomes of this plan within the natural and stormwater asset management plans.

Community Engagement

- Run an incentives/outreach program for existing developments to increase the uptake of sustainable water actions.
- Utilise the Community-Based Education & Involvement (CBEI) framework in Council's environmental education initiatives.
- Involvement in Council's environmental education initiatives such as Hilltop to Headland and other Green Events and external initiatives such as World Water Day, World Wetlands Day etc.

- Provide technical assistance to residential and business sector to improve water management practices.
- Regularly undertake the Environmental Perception Survey to identify community sentiment towards water management themes.

Research and Partnerships

- Develop effective partnerships with education and research bodies to improve understanding of aquatic ecosystems and water cycle management.
- Apply and adapt research outcomes to ensure local context and applicability. Embed these findings within Council's core functions and guiding documents.
- Enhance understanding of aquatic biodiversity, birds, pest species and recreational usage of waterways and integrate ecological monitoring with other condition monitoring programs, such as water quality.
- Evaluate climate risks, adaptive capacity and mitigation opportunities for waterways.

Capacity Building

- Continue to support capacity building frameworks in order to create resilience and commitment within the organisation.
- Support learning of Council officers involved in the assessment, design, construction and maintenance of WSUD elements.
- Establish a mentoring program of Council design staff/project managers from concept design to detailed design of WSUD projects. This mentoring would involve consultants and other local government practitioners to ensure best management practices are being achieved.
- Provide training to Council staff in order to ensure adequacy of designs and compliance with Council's development controls.

Demand and Conservation Management

- Facilitate the implementation of water saving actions across Council.
- Investigate the feasibility of implementing a real-time water use monitoring system across Council's highest water using facilities.
- Embed the responsibility of water use with all asset owners.

Groundwater Management

- Improve Council's understanding of groundwater characterisation, and allow detection of impacts from groundwater use.
- Implement planning controls that aim to protect groundwater systems and improve surface water interactions.
- Seek opportunities to supplant groundwater usage with stormwater harvesting schemes, particularly at Council's open spaces.

Stormwater Management

- Ensure the feasibility of WSUD is considered in all Council's open space projects in accordance with the Warringah Design Guidelines.
- Ensure Council's development controls are periodically updated to reflect best practice management.
- Conduct periodic audits of stormwater quality devices to ensure assets are performing to standard.
- Seek opportunities to implement stormwater harvesting schemes, particularly at Council's open spaces.

Rainwater

- Run an incentives/outreach program for existing developments to increase the uptake of rainwater tanks.
- Educate existing rainwater users to ensure their systems are operating efficiently and effectively.
- Ensure rainwater tanks are considered for Council's building upgrades/replacement.
- Run an education program to inform the community on the multiple benefits of using rainwater.

Wastewater Management

- Investigate the feasibility of utilising alternative sources including wastewater through sewer mining activities.
- Support Council's Onsite Wastewater Strategy to ensure the management of wastewater systems on environmentally sensitive land.
- Support Sydney Water's Sewerfix Program to reduce sewer overflows in our catchments particularly during wet weather.

References

[1] *Warringah Environmental Perception Survey, 2014*

[2] Warringah Council *Community Survey, (2013), Available at* *http://www.warringah.nsw.gov.au/sites/default/files/documents/general-information/annual-community-surveys/final-report-web-version-community-satisfaction-survey-2013.pdf*

[3] *Stormwater Management in a Water Sensitive City; Cities as Water Supply Catchments; March 2012, p5*

[4] *Brown, R. R., 2008, Local Institutional Development and Organizational Change for Advancing Sustainable Urban Water Futures, Environmental Management, vol 41, issue 2, pp. 221-233.*

[5] *Wong, T.H.F. and Brown, R.R. (2009) The Water Sensitive City: Principles for Practice, Water Science and Technology, 60(3):673-682.*

[6] *Hoban, A., and Wong, T.H.F., (2006) "WSUD resilience to Climate Change", 1st international Hydropolis Conference, Perth WA, October 2006*

[7] *Warringah Integrated Water Cycle Management Framework 2010, Equatica, Sydney, December 2010, p4*

[8] *Stormwater Management in a Water Sensitive City; Cities as Water Supply Catchments; March 2012, p38*

[9] *Stormwater Management in a Water Sensitive City; Cities as Water Supply Catchments; March 2012, p37*

[10] *Warringah Community Strategic Plan 2023. Available at* *https://eservices1.warringah.nsw.gov.au/ePlanning/live/Public/XC.Community/Default.aspx*

[11] *Warringah Environmental Sustainability Strategy (2012). Available at* *http://www.warringah.nsw.gov.au/sites/default/files/documents/general-information/environmental-sustainability-strategy/environmentalsustainabilitystrategy2012.pdf*