

# **TECHNICAL STANDARD No.1 – STORMWATER MANAGEMENT**

## **February 2019**

### **1. INTRODUCTION**

This Technical Standard provides detailed stormwater management requirements and controls to comply with the relevant provisions of Part C5 (Water Management) under the *Willoughby Development Control Plan (WDCP)*.

It is Council's practice to encourage sustainable development for the preservation of the natural environment, as well as protecting private and public land from the increased probability of being flooded due to upstream development. The increase in impervious surfaces due to urban development also puts greater pressure and further costs on Council to maintain and replace its drainage infrastructure. To mitigate these impacts, Council requires most new developments to install on-site detention (OSD) systems to reduce and control the extent of stormwater runoff from a site during storm events.

The requirement for the installation of OSD systems for any new development on a site(s) is addressed as part of the development assessment process. The appropriate method of on-site detention will depend on the type, size and scale of the proposed development.

This Technical Standard is intended to provide information and controls to assist in limiting the peak discharge to predevelopment flow rates for all storm intensities and durations up to and including the 1% Annual Exceedance Probability (AEP) storm event.

### **2. OBJECTIVES**

The objectives of this Technical Standard are to:

- i. regulate development to ensure that it does not contribute to increased flood risk
- ii. manage the change in discharges from development sites by source control
- iii. minimise adverse environmental impacts caused by increased stormwater runoff by reducing the total volume of runoff being discharged from individual properties
- iv. minimise the use of mains supplied water by encouraging water conservation through the reuse of rainwater
- v. provide an effective framework for the installation and ongoing maintenance of OSD systems and rainwater reuse tanks
- vi. ensure compliance with all codes, guidelines and legislation relating to OSD and rainwater reuse tanks
- vii. minimises water pollution from new developments;
- viii. protects the water quality of natural watercourses and receiving waters by preventing further deterioration of the water quality, riparian zones and aquatic ecosystems due to development
- ix. maintain public health and safety

To achieve these objectives and ensure OSD devices operate correctly, the maximum flow rate allowed to discharge from a particular site (Permissible Site Discharge or PSD) is required to be controlled by a restriction such as an orifice plate. In this way, the collective use of OSD systems can reduce the peak discharge to try and match the capacity of the downstream drainage system. This will save the community money by not requiring larger pipe systems. It will also reduce damage to the environment and improve water quality by preventing increased levels of scour, erosion and sedimentation being transported downstream towards the estuaries.

### 3. APPLICATION OF THIS TECHNICAL STANDARD

This Technical Standard applies to all development/building works that require approval under the *Environmental Planning and Assessment Act 1979* or approval under the *Local Government Act 1993*.

In accordance with Part C5 of *WDCP*, 'development' falls into two categories; minor development and major development. The majority of minor developments will only be required to install a rainwater reuse tank to off-set the requirement for OSD.

### 4. GENERAL WATER MANAGEMENT REQUIREMENTS

#### 4.1 Stormwater Design Elements

##### 4.1.1 Standards

Stormwater drainage systems are to be designed and constructed in accordance with the requirements of AS/NZS 3500.3, Australian Rainfall and Runoff, Council's Design Standards (AUS-SPEC) and the National Construction Code.

##### 4.1.2 Surface Inlet Pits and Grated Trench Drains

Surface inlet pits and grated trench drains with flush fitting grates are to be installed where necessary within the site to collect stormwater runoff and direct it to the disposal location. They must be designed to meet the following requirements:

- i. sized to be capable of accepting the design flows
- ii. located to prevent runoff from entering buildings and garages
- iii. located to prevent long term ponding of stormwater
- iv. located so that runoff does not affect pedestrian access to buildings and so that concentrated stormwater does not flow over any public footpath or adjacent properties

All required grated trench drains are to be a minimum width of 200mm. For driveways falling to the street, a grated trench drain is to be provided across the driveway adjacent to the property boundary.

All stormwater junction pits and kerb inlet pits installed in Council's road reserve and public open space must be designed and installed in accordance with Council's Aus-Spec and AS/NZS 3500.3. Pits are to be provided at:

- v. low points
- vi. every change in pipe size, level, direction or grade
- vii. junction points of multiple pipes

##### 4.1.3 Stormwater Pipes

The minimum allowable pipe size across the footway to the street is 100mm diameter sewer grade UPVC pipe with a converter through the kerb consisting of a 75mm high by 125mm wide by 4mm thick galvanised RHS.

When discharging directly to the kerb and gutter, the maximum velocity is 2.5m/s and the maximum flow is 20L/s. Any site with a discharge of greater than 20L/s is required to connect directly into Council's piped stormwater system via a pit and/or pipe.

All pipes within the Council road reserve, other than direct connections to the street kerb and gutter, or public open space must be a minimum of 375mm diameter RCP.

For stormwater pipes in the road reserve or public open space, the minimum pipe grade shall be 1%. Grades on 0.5% will only be acceptable for pipes larger than 225mm diameter, where a grade of 1% is not achievable and the pipe can be shown to be self-cleaning. For pipes within private property, minimum grades shall comply with the requirements of AS/NZS 3500.3.

Pipes with a gradient greater than 20% must have anchor blocks at the top and bottom of the inclined section and at intervals not exceeding 20m.

The depth of cover on all pipelines is to be in accordance with AS/NZS 3500.3 and manufacturer's guidelines.

#### 4.2 Surface Runoff Retention Tanks

Water stored in underground tanks which are designed to capture runoff from paved or other ground surfaces may be used for outdoor irrigation and other non-potable uses.

The system shall:

- i. incorporate suitable treatment measures prior to storage in the tank, such as a first flush and filter system
- ii. be connected to a sub-surface or drip irrigation system rather than a hose tap, unless treatment devices are provided that meet requirements for contact with the water
- iii. not be connected to indoor water features without suitable treatment in accordance with the requirements of Australian Guidelines for Water Recycling Managing Health and Environmental Risks
- iv. have all fixtures connected to the system marked "NOT SUITABLE FOR DRINKING"
- v. have the tank enclosed and all inlets screened to prevent the entry of foreign matter and to prevent mosquito breeding
- vi. have the tank sited in a location where it will not affect the structural integrity of any nearby buildings
- vii. have the overflow connected to the on-site detention system (if required) and to the site drainage system
- viii. be designed by a suitably qualified engineer

#### 4.3 Discharge into Natural Watercourses or Bushland

Approval is required to discharge stormwater, including the overflow from a rainwater reuse tank or OSD system, directly into a natural watercourse, creek or bushland reserve.

Uncontrolled water discharge into natural watercourses and creeks increases embankment erosion and streambed scour. Applicants must ensure that any watercourse or creek bank and bed is protected against erosion and scour at the point of discharge.

Uncontrolled water discharge into bushland increases erosion, weed growth and causes long-term degradation of the bushland. If an applicant has approval to discharge stormwater through bushland, the discharge must be conveyed to the nearest substantial drainage line or watercourse via a natural-looking rock-lined channel or underground pipeline. The

construction of the channel can be incorporated into the existing landscape and/or drainage lines and rock outcrops while protecting existing trees and vegetation.

The system for conveying the stormwater or overflow must incorporate:

- i. energy dissipation structures that reduce the velocity of the stormwater discharge (please refer to Technical Standard No.3 - Sediment and Erosion Control)
- ii. facilities for retention of gross pollutants and sediment. These structures and facilities are to be constructed on private property (please refer to Section 11)

Applicants are responsible for the rehabilitation of any disturbed bushland area as a result of the drainage works being undertaken.

A plan detailing any proposed drainage and remedial works within a natural watercourse, creek or bushland must be prepared by a suitably qualified person and submitted to Council for approval.

#### 4.4 Controls for a Charged System

Charged systems are permitted to connect downpipes to rainwater tank, where it is not possible to provide a gravity drainage system. They are also permitted for minor development where it is not possible to drain the site via gravity and where it is not possible to obtain an easement.

For a charged system draining to a rainwater tank, the following requirements are to be met:

- i. hydraulic grade line calculations are to be undertaken by a suitably qualified person demonstrating that the proposed system will have sufficient operating head. A freeboard of at least 500mm is to be allowed between the lowest roof gutter level and the hydraulic grade line at the top of the respective downpipe. Alternatively, the eaves gutter level is to be a minimum of 1.5m above the top water level in the rainwater tank
- ii. the pipe system shall be fully sealed to a minimum of 500mm above the top water level in the pipe
- iii. a grated cleanout pit must be established adjacent to all system low-points and provided with a screw-capped sealed extension of the respective main charged drainage line that connects to an on-site dispersal trench system or stormwater pit
- iv. leaf guards, mosquito mesh and/or an appropriate flap valve must be established over the inlet pipes to the stilling pit in order to minimise mosquito nuisance
- v. exposed aerial drainage will not be approved by Council, except for guttering and vertical downpipes and diagonal lines where they are feeding directly into a rainwater tank

For a charged system within the site that drains to the kerb and gutter, the following requirements are to be met:

- vi. there is a gravity flow across the road reserve from the property boundary to the street gutter to preclude the possibility of street water backflow
- vii. a minimum of 1.5 metres head height must be available from the roof gutter to the invert of the inlet in the stilling pit and a maximum of 1.5 metres head height between the invert level of the inlet in the stilling pit and the base of the downpipe
- viii. hydraulic grade line calculations are to be undertaken by a suitably qualified person demonstrating that the proposed system will have sufficient operating

- head. A freeboard of at least 500mm is to be allowed between the lowest roof gutter level and the hydraulic grade line at the top of the respective downpipe
- ix. the discharge pipe must be fully sealed to a minimum level of 1 metre above the invert level of Council's street gutter or 500mm above the top water level in the system, whichever is greater
  - x. a grated cleanout pit must be established adjacent to all system low-points and provided with a screw-capped sealed extension of the respective main charged drainage line that connects to an on-site dispersal trench system
  - xi. leaf guards, mosquito mesh and/or an appropriate flap valve must be established over the inlet pipes to the stilling pit in order to minimise mosquito nuisance
  - xii. exposed aerial drainage will not be approved by Council, except for guttering and vertical downpipes and diagonal lines where they are feeding directly into a rainwater tank

#### 4.5 Pumps

Generally stormwater drainage from all properties should be by gravity. The use of pumps is generally only permitted for distribution of water from rainwater reuse tanks.

Pumps may be used to drain seepage from underground basements and a minor amount of direct runoff from basement driveway ramps. The pumps are required to be dual submersible pumps and sized and constructed in accordance with Section 9.4 of AS 3500.3.

Wet wells must have a minimum storage capacity equivalent to the runoff volume from a 2 hour 100 year ARI storm event and designed and constructed in accordance with AS/NZ 3500 Part 3.

Direct connection of a pump's rising main to the kerb will not be permitted. The rising main shall be directed to an OSD system, at a level above the top water level, or a stilling pit, prior to discharge.

#### 4.6 Sub-Soil Drainage

Sub-soil drainage systems, which may be necessary in certain types of development, are to be designed and constructed in accordance with AS/NZ 3500.3. Sub-soil drains should generally not be directly connected to the street kerb. Instead they should be connected under gravity to an internal stormwater drainage system via a pit. Water in the system should be disposed of in a manner that will not adversely affect adjacent properties. It is recommended that applicants consult a hydraulic engineer in this regard.

#### 4.7 Overland Flow Paths

Existing overland flow paths, including flows from adjacent allotments, are to be preserved and retained. Naturally diffuse surface waters (sheet flows) are not to be concentrated.

Catchment flood studies or drainage analysis must be carried out for sites where there is a risk or record of flooding from overland flow.

Approval to straighten, widen, line or pipe open channels may be granted in some instances, subject to environmental and hydrological considerations.

No structure or fill is to be placed within the flow path where it could cause a rise in the flow depth; increase the velocity beyond the allowable safety limit as defined by Australian Rainfall & Runoff 2016; or, have an adverse effect on adjacent properties.

Fences within overland flow paths are to be open style that allows the passage of floodwaters.

#### 4.8 On-site Disposal Systems

On-site disposal, including dispersion and infiltration, as a primary method of stormwater disposal is generally not permitted as it can cause inundation of downstream properties in built environments. In addition, dispersion at the rear of properties backing onto bushland could change the moisture content in the bushland area and have an adverse impact on the local flora.

For minor development only, where it is not possible to obtain a downstream easement, on-site disposal may be used where the following controls are met:

- i. it is demonstrated that no drainage easement exists either over adjoining properties or are readily available through negotiation
- ii. it is demonstrated that all other alternatives have been comprehensively examined and demonstrated to be inappropriate and ineffective
- iii. installation of rainwater tank(s) with an effective capacity of 10,000 litres to capture runoff from all roof areas for re-use. The tank shall be connected to supply non-potable use including toilet flushing, laundry devices, car washing, and landscape irrigation etc. Overflow from rainwater tank(s) shall be piped to the on-site dispersion system
- iv. surface runoff from hard paved areas shall be collected via a filtration device prior to discharging into the system to prevent blockage by silt and/or debris

The design of on-site disposal system is to be prepared by a suitably qualified civil or geotechnical engineer. The design must demonstrate that the soil and terrain conditions can accommodate an infiltration or soil absorption system having regard to the soil types, slope of the land, level of the water table, and contamination and hydraulic conductivity of the soils.

The design must comply with the following criteria:

- v. the base of the trench shall be at least 1 metre above the underlying water table or rock stratum
- vi. a maximum of 5% of the total impervious area (i.e. driveways and/or paved areas) of the site may be drained directly to the disposal system, with the remaining impervious area draining via the rainwater tank/s
- vii. the system should be at least 5 metres from downstream property boundaries.
- viii. the system should be at least 3 metres from any buildings
- ix. the system should not be located where it could have an adverse impact on any existing or proposed tree
- x. if the system is being constructed in conjunction with any new structure (including residential buildings) the foundations of the structure are to consist of pier and beam. The piers are to be to a solid stratum
- xi. the system must be at least 1 metre from pavements that are subjected to vehicular traffic
- xii. a debris/silt collection pit is to be constructed immediately upstream of the absorption system

- xiii. the system is to consist of an *Evertrench Jumbo 410* or similar product with 20mm river gravel wrapped with geofabric, with 1 lineal metre of trench for every 10m<sup>2</sup> of impervious area draining to the trench

Any variation to these criteria will require a detailed soil assessment and test report from a qualified geotechnical engineer confirming that the site is suitably permeable. The design details and hydraulic calculations are to be prepared by a suitably qualified civil/hydraulic engineer that demonstrates to Council's satisfaction that such a proposal would have no adverse effect on any building, soil stability, local vegetation, drainage system or watercourse.

The design must include the following details:

- xiv. the system will enable infiltration of up to a 5% AEP storm event for all storm durations without surcharging onto neighbouring properties
- xv. the system can completely drain within 72 hours
- xvi. the infiltration area shall be the area of the base(s) of the trench(s) only
- xvii. a 50% clogging factor is to be added to the trench area
- xviii. the trench aggregate fill to have a minimum of 35% void
- xix. installation to allow access pit(s) for cleaning

#### 4.9 Permeable Paving

Permeable paving may be used as part of a water sensitive urban design (WSUD) system provided for a development, and to meet water quality objectives, particularly on major developments or developments draining to reserves, watercourses, bushland or the harbour.

Permeable paving should not be used in areas which:

- i. comprise impermeable soils with a hydraulic conductivity of less than 0.36mm/hr
- ii. have a surface of rock or shale
- iii. have a slope greater than 5%
- iv. have a high water table
- v. receive high vehicular traffic or regular use by heavy vehicles
- vi. are located downstream of areas likely to contribute significant amounts of silt, sediment, debris or windblown material (due to the potential for such material to result in clogging of permeable paving)

Soil assessment and permeability testing must be undertaken as part of the design process for permeable paving. In the case of shallow soil cover over rock, testing is required to ensure that seepage will not cause negative impacts on downstream properties. Assessment and test results are to be submitted as part of the application for any development that includes permeable paving as part of its stormwater management system.

## 5. RAINWATER REUSE TANKS

### 5.1 General

Willoughby City Council promotes and encourages the installation of rainwater reuse tanks in lieu of OSD systems for minor developments. Applicants should refer to Table 1 and the Flow Chart in Part C5 of *WDCP* to determine the required size of the rainwater reuse tank and discharge method of overflow for particular types of minor development.

Sydney's water supply is treated to drinking water standard, however approximately 54% of domestic water usage in an average Sydney household could be supplemented by water stored in rainwater tanks.

NSW Health Department does not recommend the use of rainwater tanks for drinking purposes where reticulated potable water supply is available. For additional information in this regard, please contact NSW Health Department or [www.health.nsw.gov.au](http://www.health.nsw.gov.au)

The following graph shows the percentage of potable water used in an average Sydney household for domestic purposes.

Figure 1 - Typical Household Water Usage  
Sourced from Sydney Water Corporation (2003)

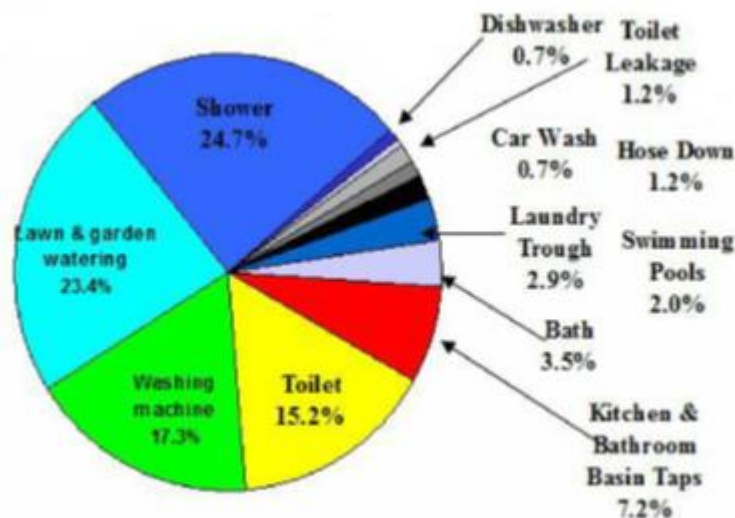
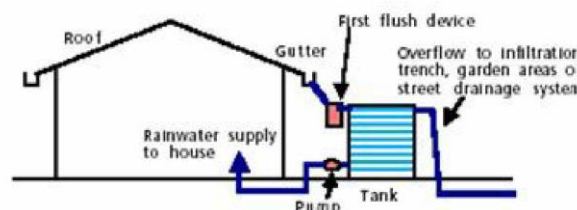


Figure 2 - Key elements of a domestic rainwater system



### 5.2 Exempt Development

Subdivision 32 of the *State Environmental Planning Policy 2008* (Exempt and Complying Development Codes) allows above ground rainwater reuse tanks that comply with certain

criteria to be installed without the need for a Development Application (please see the *SEPP* for further detailed requirements).

It should be noted that if an above ground rainwater reuse tank is constructed or installed on or in a heritage item in accordance with the *SEPP*, the tank must be located in the rear yard.

Installation of Rainwater Tanks which fall under *SEPP 2008* (Exempt and Complying Development Codes) should have regard to the provisions of Part C5 of *WDCP*, and this Technical Standard.

### 5.3 Bush Fire Prone Land

Rainwater tanks installed on bush fire prone land are required to comply with the following requirements:

- i. a gate valve is to be fitted to the water tank (a 38mm Storz coupling will assist the N.S.W. Fire Brigades)
- ii. have an additional gate valve fitted to enable the use of a portable pump
- iii. placement of a SWS (static water supply) symbol in a conspicuous position at the front of the property

**Note:** Bush fire prone land is identified on the Willoughby City Council Bush Fire Prone Land Map.

### 5.4 Tank Construction

- i. a rainwater tank must only collect rainwater from roof gutters and downpipes and from a water supply service main
- ii. underground rainwater tanks are to be fully sealed to prevent runoff from the ground surface and groundwater entering the rainwater tank
- iii. the rainwater tank must be fitted with a first-flush by-pass device. The device is to be designed to cause a minimum of 1 millimetre of the initial run-off from the roof area to bypass the tank thereby acting as a separator to reduce pollutants entering the tank, (it being noted that filters are not permitted)
- iv. the tank must be rigid walled and structurally sound and be prefabricated or constructed from prefabricated materials that are designed and manufactured for use as a rainwater tank. Bladder type tanks are not acceptable
- v. the tank must be assembled and installed in accordance with the instructions of the manufacturer or supplier
- vi. the tank must be placed on a structurally adequate base in accordance with the manufacturer's or engineer's details
- vii. the tank, and any stand, must be installed and maintained in accordance with any requirements of Sydney Water Corporation which has responsibility for the supply of potable mains water to the premises on which the tank is installed
- viii. the tank is not to be fixed to any wall of a building unless certified by a practicing structural engineer
- ix. The tank must be enclosed and any inlet to the tank must be screened to prevent the entry of foreign matter, animals or insects
- x. tanks must be designed for ease of flushing, desludging and general maintenance and, where applicable, comply with Australian/New Zealand Standard 2179.1 "Metal shape or sheet rainwater goods, and metal accessories and fasteners"

- xi. tanks are to be located in a position where they are accessible for maintenance and replacement, and where they are structurally separate from habitable parts of a building. To cater for leakage or bursting of tanks, an overflow path is to be provided to direct water away from habitable areas
- xii. tanks must be in a neutral, non-reflective colour that is compatible with the character of the locality and adjoining buildings

#### 5.5 Interconnected water supply systems and mains top up

To ensure a continuous water supply from the rainwater tank and also to ensure adequate storage availability for rainfall events, an interconnection to the potable water supply or a maximum storage volume (mains top-up zone) is to be set when installing the system.

The interconnection to the potable water supply may be via a three-way flow switching device provided that suitable backflow protection is in place. A three-way flow switching device selects water from the rainwater tank for its intended purpose. When the rainwater tank is low or the pump fails, the device automatically reverts to the potable water supply.

For a mains top up, the maximum level is to be based on the daily household usage expected from the tank and set for one day's usage. Reference should be made to Sydney Water Corporation data when calculating the average daily usage patterns for the household on [www.sydneywater.com.au](http://www.sydneywater.com.au).

Further information regarding plumbing requirements on backflow prevention for rainwater tanks and interconnected systems can be found on [www.sydneywater.com.au](http://www.sydneywater.com.au) in Plumbing Requirements.

#### 5.6 Overflow

Any overflow from the rainwater tank must be drained by gravity directly to an existing Council stormwater system, OSD system, bushland or watercourse.

For underground rainwater tanks, the invert level of the discharge pipe must be above the 1% AEP flood level. There must be no other connections to the overflow pipes, such as surface water inlet pits. This is to prevent foreign matter entering the pipelines and flowing back into the rainwater tank.

#### 5.7 Pumps

Any motorised or electric pump used to draw water from the tank or used to transfer water between tanks:

- i. must comply with NSW Office of Environment and Heritage guidelines
- ii. in the case of a permanent electrical pump, must be installed by a licensed electrician

#### 5.8 Signage

A sign must be affixed to the tank clearly stating that the water in the tank is rainwater.

Taps supplied by water from the tank must be clearly labelled indicating the source of water.

Pipes from the tank are to be labelled rainwater / non-potable water in accordance with current Australian and Sydney Water standards.

## 6. ON-SITE STORMWATER DETENTION

In accordance with Part C5 of *WDCP*, all developments that are not regarded as 'minor' are deemed to be 'major' development. All major developments are required to provide OSD devices and/or other additional water management strategies, such as water sensitive urban design (WSUD) measures. A stormwater management plan, including hydraulic and hydrological concept plans will be required to be prepared by a suitably qualified engineer and submitted for assessment with the development application.

When full or partial redevelopment of a site is proposed, OSD must be provided to cover all the impervious area. No credit will be given for existing impervious areas.

### 6.1 Exemptions

OSD will not be required where discharge of stormwater from a property does not pass through any Council owned drainage infrastructure before reaching the receiving waters of Middle Harbour or Lane Cove River. However, other stormwater management devices are required to maintain water quality and prevent erosion, refer to Sections 10 and 11 of this Technical Standard for further details.

### 6.2 Design Requirements

OSD systems shall be designed in accordance with Council's policy as follows:

- i. the volume of storage or the site storage requirement (SSR) for a site must be in accordance with Table 1

**TABLE 1 - Site storage required per impervious area**

See On-Site Detention Drainage Zone Map (Appendix 1) for the required zone.

Zone	Volume of Storage Required m <sup>3</sup> /Ha	Volume of Storage Required m <sup>3</sup> /100m <sup>2</sup>
1	327	3.27
2	360	3.6
3	380	3.8
4	315	3.15

- ii. the Permissible Site Discharge (PSD) for a site must be in accordance with Table 2

**TABLE 2 - Permissible site discharge (PSD) per impervious area**

See On-Site Detention Drainage Zone Map (Appendix 1) for the required zone.

Zone	Permissible Site Discharge L/s/Ha	Permissible Site Discharge L/s/100m <sup>2</sup>
1	225	2.25
2	170	1.7
3	180	1.8
4	136	1.36

- iii. where flow from impervious area bypasses the detention system, the PSD from the system is to be reduced by a rate equal to the flow from the bypass area in the 1% AEP storm event. Where the area bypassing the system is over 5% of the total

- impervious area, then a DRAINS model is to be prepared, to confirm that PSD is achieved and confirm the required storage volume for the reduced outflow
- iv. if the PSD is to be reduced to 20L/s to allow discharge to the kerb and gutter, then a DRAINS model is to be prepared to confirm the required storage volume
  - v. a spillway with an overland flow route is to be provided in the event that a storm higher than the design storm occurs, or the OSD device malfunctions. The flow route must be capable of carrying the flows for a 1% AEP storm, assuming that the outlet to the OSD device is fully blocked. Finished ground levels of the route must be shown on the plan
  - vi. all roof and impervious areas shall drain through the OSD system for all storms up to an including the 1%AEP storm event. Should the internal major flow path not drain to the system, then the pipe network, including gutters and downpipes, shall be designed for the 1%AEP storm event
  - vii. all habitable floor levels adjacent to the OSD storage, or the overland flow path/spillway from the OSD storage, are to be a minimum of 300 mm above the maximum design storage water surface level
  - viii. maximum above ground storage ponding depths are to be as follows:
    - a) 200mm deep in areas such as driveways and car parking areas
    - b) 300mm deep in other storage areas such as landscaping or gardens. Floatable landscaping material, e.g. tree bark chips, is not permitted in above ground storage ponding areas. Depth may be increased to 1000mm, provided the storage area is fully fenced with pool fencing, it is possible to “walk out” of the ponding area (maximum 1:8 batters) and warning signs provided to indicate sudden rise in water levels
  - ix. volumes of storage in landscaped areas to be increased by 20%, to allow for vegetation growth
  - x. a minimum of 0.36m<sup>3</sup> of the storage must be provided in the form of below ground storage such as a pit, which is to form the outlet of the OSD device. For storage on car parks, a minimum 25% of the SSR shall be stored underground
  - xi. all below ground OSD tanks must be accessible for maintenance purposes, with the access pit as near to the outlet as possible. Attention is drawn to the provisions of AS 2865 - "Safe Working in Confined Spaces"
    - a) step irons are required at the outlet access grate of below ground storage tanks with a depth of 900mm or greater
    - b) OSD storage outlet discharge flows of 20 l/s or more shall be connected directly to Council's underground drainage system or an extension of the system
    - c) below ground tanks shall be a minimum of 500mm deep
    - d) all below ground OSD tanks are to have an additional access grate diagonally opposite the outlet for ventilation and cleaning purposes. The minimum size of any access grate is to be 600mm x 900mm
    - e) the below ground tanks and pits are required to drain completely dry at the cessation of any storm and therefore do not require sediment traps at the outlet point
    - f) tanks are not to be located beneath habitable floors

- xii. orifice plates used to restrict the outflow must be machined to the exact dimension as calculated from minimum 3mm thick stainless steel, or 3mm thick steel galvanised after machining. The minimum diameter of any orifice shall be 65mm. They must be bolted to the pit walls or permanently fixed in the pit by some approved method so that they cannot be easily removed. A pipe outlet is not recommended for discharge control
- xiii. a stainless steel or galvanised mesh screen with a minimum area of 75 times the orifice area shall be latched over the orifice plate. To this end, Maxi Mesh (rh3030) is desirable. A handle attached to the screen is desirable
- xiv. all storage outlets must have inverts above the 1 in 100 year floodway level of any nearby creeks or overland flow routes, or be designed with hydraulic grade line analysis in the case of connection to Council's underground system
- xv. for all OSD systems, a Positive Covenant and Restriction on Use of Land will be required to be placed on the Title in favour of Council. These instruments shall be created under Section 88B for newly created lots or under Section 88E(3) of the *Conveyancing Act 1919* where no new lot is created. The purpose of this is to ensure that the registered proprietor has care, control and maintenance obligations of the OSD system
- xvi. a plaque measuring no less than 400mm x 200mm and of a material acceptable to Council will be in some way permanently attached and prominently displayed within the immediate vicinity of the OSD device. This plaque will advise occupiers of the property of the existence of the OSD device and also that the device is not in any way to be changed without prior written consent of Willoughby City Council

Required wording for the plaque is:

*This is an on-site detention device. It must not be altered in any way without written consent from Willoughby City Council. The owner shall regularly clean the system.*

If the depth of the OSD Tank is greater than 900mm, a 'Danger sign' no less than 450 mm x 300 mm is to be displayed at the entrance of the tank advising that only persons with confined space training should enter that tank.

Suggested wording for the Danger sign is:

*DANGER  
 CONFINED SPACE  
 No entry without Confined Space Training.*

- xvii. the constructed OSD installation must be certified by a suitably qualified and competent professional engineer, (generally CP Eng qualification) and state that it complies with Council's specifications (AUSPEC), all relevant codes and technical standards and also that it is in accordance with the approved plans

### 6.3 Submission requirements

All plans, calculations and details submitted must include the following information:

- i. total impervious area in m<sup>2</sup>. Separately show the total roof area and total paved area including all driveways, carports and pathways. Swimming pools will be considered impervious where the high-level overflow is not connected to the sewer. Details of the

proposed high-level overflow system are to be included in the submission when seeking exemption from the impervious area calculation

- ii. floor levels of all existing and proposed buildings and structures on the site
- iii. existing and proposed surface levels and contours. These contours shall extend 5 metres outside the property
- iv. location of all existing and proposed trees
- v. the volume of storage being provided, with dimensions and level shown so that the storage volume can be easily calculated. This volume must be in accordance with the figures provided in Table 1
- vi. demonstrate that stormwater flows up to the 1%AEP storm event from all impervious areas (including roofs) are conveyed to the OSD system, either via a major flow path or by an appropriately sized pipe network
- vii. should the permissible site discharge be reduced or throttled calculations showing the outflow versus storage relationship will be required for the critical storm calculations of the size of the orifice plate or other approved outlet control device will be required
- viii. show adequate details of an overflow spillway and overland flow path. To this end Council may require calculations to show that the flow path can cope with the 1% AEP storm event
- ix. all levels are to be given to Australian Height Datum (AHD). Bench Mark information is available from the Survey Control Branch of the Department of Lands (Land & Property Information Section) and from Sydney Water
- x. show the invert level of the proposed discharge outlet point at the street kerb or Council trunk drainage system, and that all connections from OSD systems are above the 1%AEP water surface level
- xi. the OSD Checklist (see Appendix 5) shall be completed and signed and included in the submitted documentation

The standard of presentation required for ease of checking the plan should indicate a north point, reduction ratios, existing and finished floor levels, construction dimensions, details and cross-sections.

#### 6.4 Post-development Documentation

- i. The construction of the OSD installation must be supervised and certified by a suitably qualified Engineer, which must state that it complies with Council's OSD policy, all relevant codes, standards and also that it is in accordance with the approved plans. Appendix 2 contains a draft Certificate of Hydraulic/Hydrological Compliance.
- ii. On completion of the OSD system, a Registered Surveyor must verify critical levels and storage volumes. A suitably qualified Engineer will be required to prepare the Works-As-Executed Plan with any changes shown in red, and complete the attached OSD Record of Installation.

## **7. MAINTENANCE OF STORMWATER MANAGEMENT SYSTEMS**

### **7.1 Maintenance**

Regular maintenance of stormwater management systems, including rainwater tanks and OSD systems, are to be undertaken to ensure they are working effectively.

Rainwater tanks are to be checked for sludge every two to three years. Gutters, leaf screens or guards are to be inspected and cleaned on a regular basis. Discharge control pits and the associated trash rack of OSD systems are to be inspected and cleaned on a regular basis, not exceeding 6monthly intervals.

### **7.2 Legal Requirements**

To ensure the continued effectiveness of stormwater water management devices, the applicant will be required to place a restriction on the property title in favour of Council in the form of a Positive Covenant and/or Restriction on Use of Land under the *Conveyancing Act 1919* for on-site detention systems. Examples of Section 88B and 88E Instruments for the legal protection of stormwater management systems are provided in Appendix 1.

## **8. CONTROLS FOR DISCHARGE FROM A PROPERTY INTO COUNCIL'S DRAINAGE SYSTEM**

### **8.1 General**

All surface water, roof water not connected to a rainwater tank, and the overflow from a rainwater tank must be conveyed by gravity to the Council drainage system, a watercourse or the harbour. All methods of discharge into or through public open space require the approval of Council. (Public open space includes road reserves, drainage reserves, public car parks, public parks, public reserves and bushland), Work, including new connections, may not be carried out on the Council drainage system without approval from Council, and the work may only be carried out in accordance with current Australian Standards, Council's approval and Aus-Spec specifications. Council must be given a minimum of two (2) working days notice prior to undertaking any works carried out in public roadways or involving Council owned or operated structures, including new pipe systems.

Development site(s) that discharge less than 20 litres per second will be permitted to discharge directly to the street kerb using 125x75x4 galvanised rectangular hollow section (RHS). Only one (1) discharge line will be permitted across the nature strip from each property.

The pipe discharging to the street kerb should be located within the frontage of the subject property at an angle no less than 60° to the kerb-line. If drainage is beyond the subject property frontage, Council's street drainage system is to be extended using a minimum 375mm diameter Reinforced Concrete Pipe (RCP) with a kerb inlet pit to a point near the frontage of the subject property.

In exceptional circumstances and only for minor developments, Council may consider the extension of property drainage line for a maximum of 20 metres or the frontage of one property. The drainage line shall cross the nature strip perpendicular to the kerb with two 45° bends to turn the pipe running directly behind, and parallel to the street kerb.

For any stormwater pipeline proposed to discharge directly into a Council-owned stormwater drainage system such as a pipeline, channel or kerb inlet pit, the applicant may be required

to submit hydrological and hydraulic analyses confirming that there will be no surcharges due to backwater effects from the system.

For any connection to a Council pit, pipe, channel etc, the pipe connection must be flush with the pit / pipe wall, and not extend into the pipe / pit.

When connecting to a Council pipe, pit or drainage channel, a minimum of two working days notice must be given to Council prior to commencing the work, to allow for an inspection of the works when the connection is made.

## 8.2 Construction of a Public Pipeline

The proposed stormwater management system may include a public pipeline or other stormwater infrastructure built by the developer in Council's road reserve or public open space as a condition of approval. Usually such infrastructure should be designed for all storm events up to and including a 5% AEP storm event, with a minimum pipe size of 375mm and a minimum grade of 1%. However, where the existing road may be unable to carry excess flows in larger storm events and where there may be danger to persons or risk of property damage, Council may require a larger storm event as a basis for the design. Additional information on public stormwater drainage infrastructure design requirements is available in Councils AUS-SPEC.

Plans for any proposed public pipeline are to be submitted to Council for approval under the *Road Act 1993*. Specific conditions for construction, including inspection requirements and work-as-executed drawings will be provided as part of the approval of any plans.

## 8.3 Discharge to Roads or Lands Controlled by other Statutory Authorities (Integrated Development)

An applicant who proposes connecting the site discharge to a stormwater drainage system that is under the control of another statutory authority must have the authority's written approval for the work. The approval must be submitted to Council prior to an application for a Construction Certificate.

# 9. **CONTROLS FOR DISCHARGE INTO A NEW INTER-ALLOTMENT DRAINAGE EASEMENT AND INTO AN EXISTING DRAINAGE EASEMENT OR DRAINAGE RESERVE**

## 9.1 New Inter-Allotment Drainage Easements

The acquisition of downstream easement(s) may be necessary if the site is unable to discharge into Council's stormwater drainage system by gravity. Documentary evidence of the registration of the drainage easement(s) must be provided to Council prior to issue of a Construction Certificate. Any easements required for a development must be shown on the Linen Plan for any subdivision.

The proposed pipeline in the inter-allotment drainage easement must have adequate capacity to convey the 1:100 year ARI uncontrolled runoff from the development site(s). This pipeline must be constructed prior to commencement of any other works. At completion, the applicant must submit to Council certification from a suitably qualified engineer and works-as-executed drawings from a registered surveyor that the installation of the pipeline has been completed and complies with the approved drawings, the current Australian Standards and Council's AUS-SPEC. The registered surveyor must also certify that all drainage structures are constructed wholly within the drainage easement(s).

If the downstream property owner does not grant the necessary easement, the developer may be required to apply to the Supreme Court under Section 88K of the *Conveyancing Act 1919* for the matter to be adjudicated.

## 9.2 Existing Inter-Allotment Drainage Easement

An applicant may propose discharging runoff through an existing pipeline across an adjoining property. In this case the applicant must submit evidence that the property being developed has the right to use the inter-allotment drainage easement.

The applicant may be required to submit a hydrologic and hydraulic assessment indicating that the existing pipeline has adequate capacity to carry the 1:100 year ARI uncontrolled runoff from the development site.

If the pipeline is unable to convey the additional discharge from the development, the applicant will have to upgrade the pipeline. In this case, the applicant will have to submit the following documents to Council for approval:

- i. evidence in the form of a legal agreement showing that the property has the right to drain via the existing easement
- ii. design details of the proposed upgraded stormwater pipeline

The applicant will be required to construct the approved upgraded pipeline in the easement prior to the commencement of any works. At completion, the applicant must submit to Council certification from a suitably qualified engineer and works-as-executed drawings from a registered surveyor that the installation of the pipeline has been completed in accordance with the approved drawings, the current Australian Standards and Council's AUS-SPEC. The registered surveyor shall also certify that all drainage structures are constructed wholly within the drainage easement(s).

## 9.3 Connection to a Council Drainage Easement or Drainage Reserve

For any proposed stormwater pipeline discharging directly into a Council-owned stormwater drainage system such as a pipeline, channel, inlet pit or discharge onto a vegetated drainage reserve, the applicant may be required to submit hydrological and hydraulic analyses confirming that there will be no surcharges due to backwater effects within the system or adverse impacts to neighbouring property.

## 9.4 Drainage Easement Widths

The following easement widths are required for inter-allotment (or private) drainage pipelines:

<u>Pipe (mm dia.)</u>	<u>Drainage Easement Width (m)</u>
<300	1.25
300	1.50
375, 475	2.00
525, 600,675	2.50
750, 825, 900, 1050	3.50
1200, 1350, 1500	4.00
1650, 1800	4.50

It should be noted that an inter-allotment drainage pipeline is to be contained within an easement of not less than a 900mm width.

The following easement widths are required for Council pipelines:

<u>Pipe (mm dia.)</u>	<u>Drainage Easement Width (m)</u>
<300	2.50
300	2.50
375, 475	2.50
525, 600,675	2.50
750, 825, 900, 1050	3.50
1200, 1350, 1500	4.00
1650, 1800	4.50

When installing pits in a drainage easement, the easement boundaries must be a minimum of 300mm clear of the pit. This also applies to any other drainage structure.

In exceptional circumstances and subject to Council approval, e.g. where the existing width between a house and fence is limited, drainage easements may be of variable width.

#### 9.5 Structures within Easements

Council will not approve the construction of any permanent structure or the placing of fill over a drainage easement if the structure or fill will prevent or hinder overland flows, construction, reconstruction, maintenance, cleaning or access to the pipeline or easement. Permanent structures include habitable dwellings, eaves, balconies, garages, impervious fences, swimming pools and retaining walls.

Paving and demountable carports over a drainage line or easement may be approved subject to Council assessment. Structures adjacent to pipelines must be sufficiently clear of easement boundaries or independently supported to avoid placing any load within the zone of influence of pipeline elements. Footings must be extended to a minimum of 100mm below the invert of the pipe or to solid rock.

### **10. CONTROLS FOR DISCHARGE FROM A PROPERTY INTO NATURAL WATERCOURSES, BUSHLAND OR THE HARBOUR**

Stormwater systems on properties draining to natural watercourses, bushland or the harbour must include:

- i. water quality improvement devices. See Section 11 Water Quality for further details
- ii. energy dissipation devices

For properties draining to a watercourse over natural bushland, a rock lined channel is to be provided from the site to the watercourse.

For major developments draining to bushland or natural watercourses, a rainwater reuse tank or appropriate WSUD measures are to be incorporated in the stormwater management system, to reduce water velocities and minimise erosion.

For minor developments draining to bushland or natural watercourses, a 5kL rainwater tank is to be provided.

Permission is required from Council to discharge stormwater directly into a natural watercourse, creek or bushland reserve. A plan detailing any proposed drainage and remedial works on Council land must be submitted to Council for approval.

## 11. WATER QUALITY

All major developments are required to address water quality during and after construction. Under *the Protection of the Environment Operations (POEO) Act 1997*, allowing pollutants to enter any watercourse is an offence.

### 11.1 Water Quality during Construction

Construction sites have the potential to significantly affect water quality and contribute to the degradation of the natural environment through poor management of soil, water and materials on the site.

Good management practices on a construction site for the control of water quality includes erosion and sediment control as well as other construction materials such as chemicals and waste.

Reference should be made to Council's *Technical Standard No.3 – Sediment and Erosion Control* and, for larger sites to *Managing Urban Stormwater, Soils and Construction – Landcom 2004* for further information with regards to managing sediment and erosion during the construction phase.

### 11.2 Permanent Post Development Water Quality Controls

For all major developments and for minor development draining to bushland, creeks or the harbour, stormwater runoff is to be treated prior to leaving the site.

#### 11.2.1 General controls

- i. all stormwater flows from regular rainfall events up to and including the 1:2 yr ARI are to be captured and treated prior to discharge to Council's stormwater drainage system
- ii. the treatment measure may include one or more of the following:
  - a) retention - pond, wetland or basin
  - b) retention and filtration – bioretention system, sand filter, rain garden
  - c) retention and volume loss –rainwater tank, surface runoff retention tank, infiltration system
  - d) filtering and conveyance –*grassed swale, filtration system*
  - e) Gross Pollutant Trap (GPT) –off-line diversion device. in-line diversion device, trash rack, centrifugal displacement systems, pit basket
  - f) any device that is capable of capturing and retaining the specified pollutant load
  - g) any other appropriate technique suitable to the needs of the site
- iii. the treatment measure is to be placed as close as possible to the pollution source within the development site
- iv. the pollution retention efficiency must be maintained up to the design discharge and should not decrease with the build-up of materials
- v. in storm events greater than that of the design discharge or if the storage capacity of captured material is exceeded, the storage device must not allow any release of the previously captured material

- vi. the device must be designed to be able to bypass flows in excess of the design discharge without blocking or overtopping
- vii. the device must be designed to meet appropriate public health and safety standards
- viii. the design should ensure that there is minimal risk of mosquito breeding within the device

### 11.2.2 Performance objectives and criteria

Objectives:

Issue	Objectives
Runoff volumes and flow rates Stormwater quality	Impervious areas connected to the stormwater drainage system are minimised without causing uncontrolled property runoff
	Reuse of roofwater for non-potable uses maximised
	Use of vegetated flow paths maximised
	Use of stormwater pollutant traps “at source” where appropriate
Riparian vegetation and aquatic habitat	Protect and maintain natural wetlands, watercourses and riparian corridors
	All natural (or modified) drainage channels within the site that possess either baseflow, defined bed and/or banks, or locally occurring native riparian vegetation are to be protected and maintained.
Flow	Alterations to natural flow paths, discharge points and runoff volumes from the site are to be negligible. Generally no increase in the 50% and 1% AEP storm event peak flows
	The frequency of bank full flows should not increase as a result of development
Natural bushland	Minimise the impact of stormwater discharge on bushland areas

**TABLE 3 – Water quality requirements**

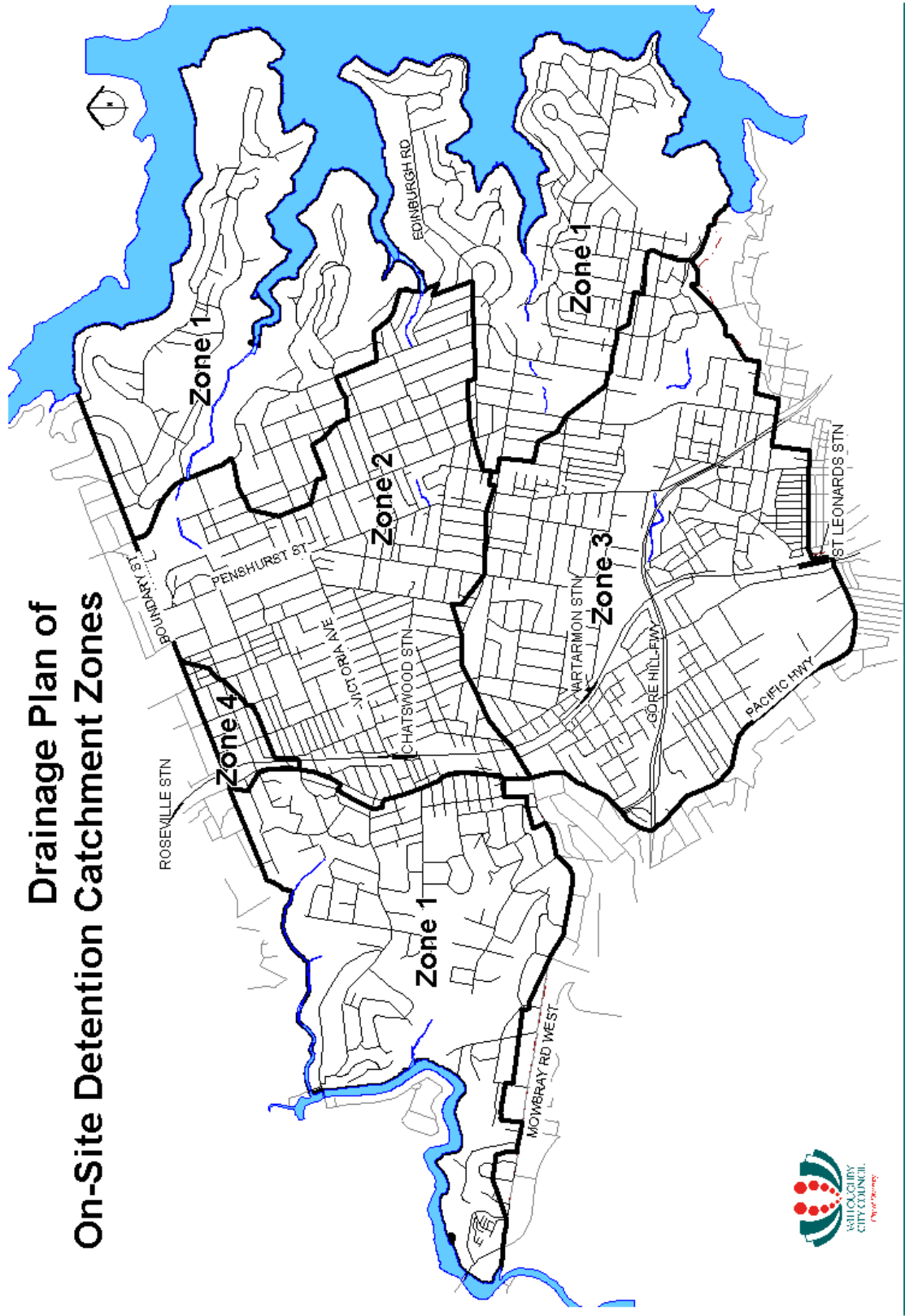
Requirements:

Pollutant	Average annual pollutant load reduction (%)
Gross Pollutants	90%
Total Suspended Solids (TSS)	85%
Total Phosphorus (TP)	60%
Total Nitrogen (TN)	45%
Hydrocarbons	See below

Determination of water quality targets are to be achieved in accordance with Sydney Water guidelines or utilising a MUSIC model. If MUSIC is utilised, parameters are to be in accordance with the parameters detailed in Sydney Catchment Authority’s document *Using MUSIC in Sydney’s Drinking Water Catchment*.

Developments with more than 5 parking spaces and commercial and industrial development are to provide a treatment device that specifically targets hydrocarbons or incorporates a raingarden / bio-retention basin. Runoff from all parking areas, driveways or access roads is required to drain to the treatment device or raingarden / bio-retention basin.

APPENDIX 1  
On-Site Detention Catchment Zones



**APPENDIX 2**

**ON-SITE DETENTION RECORD OF INSTALLATION AND CERTIFICATE OF HYDRAULIC/HYDROLOGICAL COMPLIANCE**

RECORD OF INSTALLATION OF ON-SITE STORMWATER DETENTION

JOB NO: \_\_\_\_\_  
 DA NO: \_\_\_\_\_  
 Drawing No: \_\_\_\_\_

PROJECT AT: \_\_\_\_\_

Attributes	Designed Parameters	Constructed Parameters
Tank Dimensions (LxWxH) (m)		
Orifice Size (mm)		
Orifice Plate Type		
Hydraulic head (m)		
Storage Volume (m <sup>3</sup> )		
Permissible Site Discharge (L/s)		
Debris Screen Type		
Debris Screen Area (m <sup>2</sup> )		
Overland Flow Provided		
No. of Access Grates		
Plaque(s) attached to wall		
Step irons provided (over 0.9m grate-invert)		
Plumber's Certificate No. for rainwater tank installation		

Comments

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**CERTIFICATE OF HYDRAULIC/HYDROLOGICAL COMPLIANCE**

I \_\_\_\_\_ of \_\_\_\_\_ (a professional engineer being competent to practice in the field of stormwater drainage design) have inspected the above completed on-site stormwater detention system, including verification of the generally + or - 10% acceptable limits and tolerances of the system of this policy, and I certify that the works have been constructed in accordance with the approved design details for the above mentioned project, except for the variations highlighted in the Works-As-Executed drawings which do not affect the performance of the system, subject to satisfactory maintenance.

Signature:

Qualifications:

Position:

Membership No:

Telephone:

### **APPENDIX 3**

#### **Samples of draft terms for Positive Covenant and Restriction on Use of Land**

##### **DETENTION SYSTEM**

(To be used with a Deposited Plan is being registered)

###### **Terms of Positive Covenant \_\_\_\_\_ referred to in the abovementioned plan**

The registered proprietor of the land hereby burdened (herein called the "proprietor") in respect of the on-site stormwater detention system (herein called the "System") constructed on the land to:

- (a) clean, maintain and repair all pits, basins, tanks, pipelines, orifice plates, trench barriers, walls, earth banks and other structure, gutters, leaf gutter guards, down pipes, pipe connections and any associated devices relevant to the System, and
- (b) regularly keep the System clean and free from grass clippings, silt, debris and the like to ensure the efficient operation from time to time and at all times of the System, PROVIDED HOWEVER that Willoughby City Council (herein called the "Council") shall have the right to enter upon the burdened lot with all necessary materials and equipment at all reasonable times and on reasonable notice (but at any time and without notice in the case of an emergency):
  - i. to view the state of repair of the System;
  - ii. to ascertain whether or not there has been any breach of the terms of this covenant; and
  - iii. to execute any work required to remedy a breach of the terms of this covenant if the proprietor has not within fourteen (14) days of the date of receipt by the proprietor of written notice from the Council requiring remedy of a breach of the terms of this covenant taken steps to remedy the breach and without prejudice to the Council's other remedies the Council may recover as a liquidated debt the cost of such remedial work from the proprietor forthwith upon demand.

NAME OF AUTHORITY EMPOWERED TO RELEASE, VARY OR MODIFY THE POSITIVE COVENANTS REFERRED TO: **WILLOUGHBY CITY COUNCIL**

##### **TERMS OF SECTION 88B INSTRUMENT FOR THE LEGAL PROTECTION OF ON-SITE STORMWATER**

(To be used with a Deposited Plan is being registered)

###### **Terms of Restriction on the Use of land \_\_\_\_\_ referred to in the abovementioned plan**

The registered proprietor of the land hereby burdened (herein called the "proprietor") covenant with the Willoughby City Council (herein called the "Council") in respect of the on-site stormwater detention system (herein called the "System") constructed on the land:

- (a) Not to erect or suffer to permit any building, structure or erection on the whole or erection on the part of the land hereby burdened except:
  - i. dividing fences;
  - ii. such buildings, structures and erections as from time to time form part of or are associated with the carrying out by the proprietor of the land hereby burdened of his obligations under the Positive Covenant as are approved by the Council, and
  - iii. such other structures as are approved by the Council.
- (b) Not to carry out any alterations to the System including, but not limited to, detention levels, controlled outflows, grates, pipes, orifice plate, mesh screen, gutters, leaf gutter guards, downpipes, pipe connections and any associated devices of the System without consent in writing previously obtained from the Council.

NAME OF AUTHORITY EMPOWERED TO RELEASE, VARY OR MODIFY THE RESTRICTION ON THE USE OF LAND REFERRED TO: **WILLOUGHBY CITY COUNCIL**

**TERMS OF SECTION 88E(3) INSTRUMENT FOR THE LEGAL PROTECTION OF ON-SITE STORMWATER DETENTION SYSTEM**

(To be used with Form 13PC from the Department of Lands)

**Terms of Positive Covenant**

The registered proprietor of the land hereby burdened (herein called the "proprietor") in respect of the on-site stormwater detention system (herein called the "System") constructed on the land to:

- (a) clean, maintain and repair all pits, basins, tanks, pipelines, orifice plates, trench barriers, walls, earth banks and other structure, gutters, leaf gutter guards, down pipes, pipe connections and any associated devices relevant to the System, and
- (b) regularly keep the System clean and free from grass clippings, silt, debris and the like to ensure the efficient operation from time to time and at all times of the System, PROVIDED HOWEVER that Willoughby City Council (herein called the "Council") shall have the right to enter upon the burdened lot with all necessary materials and equipment at all reasonable times and on reasonable notice (but at any time and without notice in the case of an emergency):
  - i. to view the state of repair of the System;
  - ii. to ascertain whether or not there has been any breach of the terms of this covenant; and
  - iii. to execute any work required to remedy a breach of the terms of this covenant if the proprietor has not within fourteen (14) days of the date of receipt by the proprietor of written notice from the Council requiring remedy of a breach of the terms of this covenant taken steps to remedy the breach and without prejudice to the Council's other remedies the Council may recover as a liquidated debt the cost of such remedial work from the proprietor forthwith upon demand.

NAME OF AUTHORITY EMPOWERED TO RELEASE, VARY OR MODIFY THE POSITIVE COVENANTS REFERRED TO: **WILLOUGHBY CITY COUNCIL**

**TERMS OF SECTION 88B INSTRUMENT FOR THE LEGAL PROTECTION OF ON-SITE STORMWATER DETENTION SYSTEM**

(To be used with Form 13RPA from the Department of Lands)

**Terms of Restriction on the Use of Land**

The registered proprietor of the land hereby burdened (herein called the "proprietor") covenant with the Willoughby City Council (herein called the "Council") in respect of the on-site stormwater detention system (herein called the "System") constructed on the land:

- (a) Not to erect or suffer to permit any building, structure or erection on the whole or erection on the part of the land hereby burdened except:
  - i. dividing fences;
  - ii. such buildings, structures and erections as from time to time form part of or are associated with the carrying out by the proprietor of the land hereby burdened of his obligations under the Positive Covenant as are approved by the Council, and
  - iii. such other structures as are approved by the Council.
- (b) Not to carry out any alterations to the System including, but not limited to, detention levels, controlled outflows, grates, pipes, orifice plate, mesh screen, gutters, leaf gutter guards, downpipes, pipe connections and any associated devices of the System without consent in writing previously obtained from the Council.

NAME OF AUTHORITY EMPOWERED TO RELEASE, VARY OR MODIFY THE RESTRICTION ON THE USE OF LAND REFERRED TO: **WILLOUGHBY CITY COUNCIL**

**APPENDIX 4**

**RAINFALL INTENSITY IN mm/Hr  
FOR VARIOUS DURATIONS AND RETURN PERIODS**

Duration (hours)	RETURN PERIOD						
	1yr	2yrs	5yrs	10yrs	20yrs	50yrs	100yrs
0.083	97.9	125.	159.	178	204.	237.	262.
0.100	91.8	118.	149.	167.	192.	223.	247.
0.167	75.2	96.7	124.	139.	159.	186.	206.
0.333	54.9	70.9	91.7	104.	120.	141.	156.
0.500	44.7	57.9	75.3	85.6	99.0	117.	130.
1.000	30.5	39.6	52.0	59.4	69.1	81.8	91.5
2.000	20.2	26.2	34.8	39.9	46.5	55.3	62.0
3.000	15.7	20.5	27.2	31.3	36.5	43.5	48.8
6.000	10.2	13.4	17.9	20.6	24.1	28.7	32.3
12.000	6.72	8.79	11.8	13.6	16.0	19.1	21.5
24.000	4.45	5.82	7.86	9.10	10.7	12.8	14.5
48.000	2.90	3.80	5.16	6.00	7.07	8.48	9.59
72.000	2.19	2.88	3.92	4.56	5.38	6.47	7.32

**LIST OF COEFFICIENTS TO EQUATIONS OF THE FORM:-**

$$\ln(I) = a + b(\ln(T)) + c(\ln(T))^2 + d(\ln(T))^3 + e(\ln(T))^4 + f(\ln(T))^5 + g(\ln(T))^6$$

Where I = Intensity in millimetres per hour;  
And T = Time in Hours

Years	RETURN PERIOD						
	a	b	c	d	e	f	g
1	3.4171	-0.5782	-0.0314	0.00714	0.000801	-0.0001313	-0.0000369
2	3.6781	-0.5738	-0.0320	0.00726	0.000784	-0.0001541	-0.0000311
5	3.9521	-0.5605	-0.0350	0.00702	0.001072	-0.0001620	-0.0000370
10	4.0849	-0.5537	-0.0365	0.00708	0.001194	-0.0001887	-0.0000353
20	4.2350	-0.5485	-0.0378	0.00720	0.001314	-0.0002139	-0.0000347
50	4.4041	-0.5427	-0.0392	0.00746	0.001396	-0.0002625	-0.0000286
100	4.5167	-0.5382	-0.0400	0.00733	0.001460	-0.0002589	-0.0000302

**RAINFALL DURATION INTENSITY IN MIN. MM/HR**

**Values of (t.I<sup>0.4</sup>)**

Where I = Intensity in millimetres per hour;

## RETURN PERIOD

DUR (hr)	DUR (min)	1YR	2YRS	5YRS	10YRS	20YRS	50YRS	100YRS
0.083	5	31.16	34.36	37.83	39.57	41.79	44.37	46.19
0.100	6	36.58	40.45	44.40	46.48	49.14	52.18	54.35
0.167	10	56.41	62.38	68.90	72.12	76.11	81.04	84.41
0.333	20	99.18	109.86	121.77	128.06	135.60	144.64	150.61
0.500	30	137.17	152.12	168.98	177.87	188.53	201.56	210.23
1.000	60	235.44	261.35	291.44	307.37	326.54	349.34	365.36
2.000	120	399.32	443.10	496.38	524.29	557.39	597.41	625.37
3.000	180	541.54	602.52	674.68	713.66	758.91	814.08	852.39
6.000	360	911.47	1016.59	1141.42	1207.40	1285.61	1378.65	1445.38
12.000	720	1542.70	1717.62	1932.35	2045.26	2182.63	2342.86	2456.45
24.000	1440	2616.41	2912.94	3284.97	3483.21	3716.34	3992.51	4196.72
48.000	2880	4409.12	4912.54	5552.04	5897.30	6297.39	6772.53	7114.10
72.000	4320	5911.01	6595.39	7461.02	7926.28	8468.31	9116.86	9578.29

NOTE:  
FOR USE WITH "KINEMATIC WAVE" EQUATION

## APPENDIX 5

### OSD DESIGN CHECKLIST

1.	Has a spillway with an overland flow route been provided?	Yes / No
2.	Has the minimum freeboard been provided between habitable floor levels and the 1:100yr flood level? Refer to Section 10 of Council's Floodplain Management- Technical Standard No. 3 for information regarding freeboard requirements.	Yes / No
3.	Has a minimum of 300mm freeboard been provided between the habitable floor levels and the OSD design storage topwater level?	Yes / No
4.	For above ground storage maximum depths <ul style="list-style-type: none"> <li>• over driveways and carparking</li> <li>• over landscaping or garden areas</li> <li>• minimum below ground storage</li> </ul>	.....mm .....mm .....m <sup>3</sup>
5.	Below ground OSD tanks must be accessible for maintenance purposes in accordance with AS 286,5 - Safe Working in Confined Spaces. <ul style="list-style-type: none"> <li>• Have step irons been provided for tanks deeper than 900mm?</li> <li>• Have 2 x600mm x 900mm access grates been provided?</li> </ul>	Yes / No Yes / No
6.	Total impervious area including driveways, carports, pathways and swimming pools not incorporating high-level overflow system_	.....m <sup>2</sup>
7.	Existing, and proposed surface levels and contours have been provided (contours extend 5m beyond property boundary)	Yes / No
8.	Location of all trees has been provided	Yes / No
9.	Calculated volume of storage according to Table 1	.....m <sup>3</sup>
10.	Calculated permissible site discharge according to Table 2.	.....l/s
11.	Calculated orifice diameter (65mm minimum)	.....mm
12.	Type of mesh screen provided?	
13.	Does the major overland flow path within the site for runoff from all impervious areas drain to the OSD system or has the pipe network been designed for the 1%AEP storm event?	Yes / No
14.	Direct connections to Council's drainage system have been checked against backwater effect and drowned orifice?	Yes / No
15.	Is the base of the OSD tank graded flush with the orifice invert level?	Yes / No
16.	Has a minimum 1125mm x 75mm x 4 RHS been provide for a discharge through the street kerb?	Yes / No
17.	All levels have been given to Australian Height Datum (AHD)	Yes / No
Design Engineer		
Qualifications:		

**APPENDIX 6**

**STANDARD EASEMENT REQUEST LETTER**

...../...../.....

.....  
.....  
..... NSW .....

Dear .....

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

Before we can proceed with this proposal the Willoughby Council has advised us that we have two options for the drainage of stormwater, the first, which is the preferred method, is to obtain a drainage easement to convey the stormwater runoff from our property to

.....  
This would require you to grant us a drainage easement through you property with all costs for the creation of the easement being born by us, together with any consideration for the use of your property as may be determined by an independent valuation or later agreement. Alternatively we are prepared to offer you \$### \* ..... as compensation for the right to drain our stormwater under your property.

The alternative is an on-site disposal system which will discharge stormwater into an underground trench and absorption of the stormwater flow into the ground, with overflow over the ground surface.

As the runoff and seepage from this system may flow towards your property and possibly cause some dampness because of the slope of the land the best solution would be to have a drainage system that will convey our stormwater under your property via a pipe to

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

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

.....  
Name Address Signature

NO I/we understand that our property will be subject to some overland flow and that we do not want to accept any compensation for a drainage easement as we are not willing to grant you a drainage easement:

.....  
Name Address Signature

\* compensation amount offered to be in line with market value for easements, and not a nominal amount.