



Bayside Council

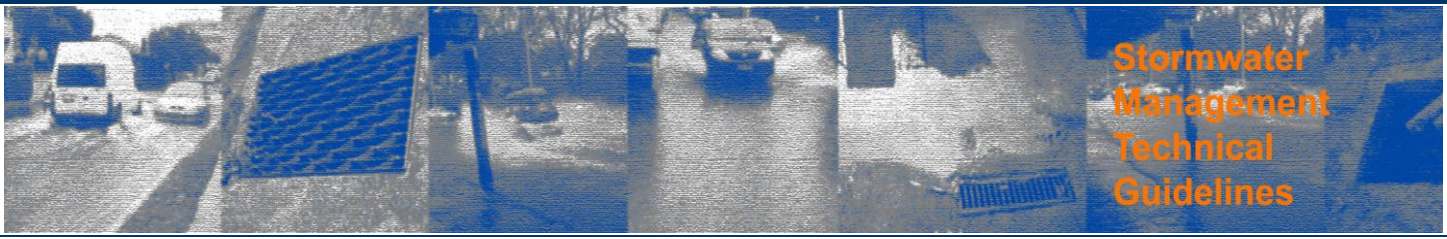
Serving Our Community

Part 10

Stormwater Management Technical Guidelines

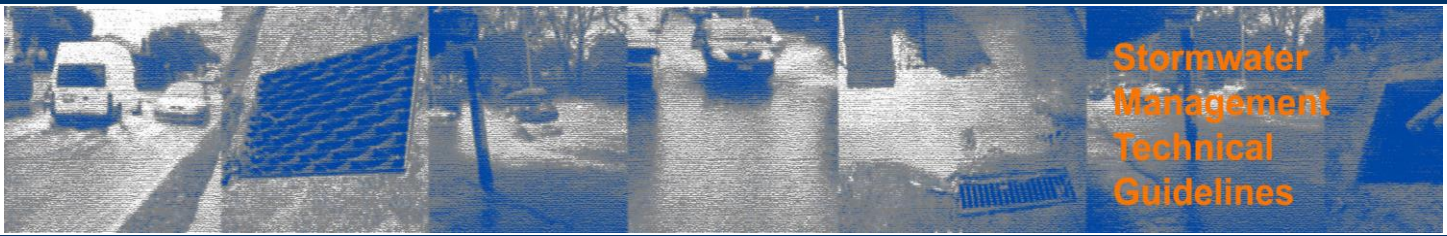
Botany Bay Development Control Plan 2013



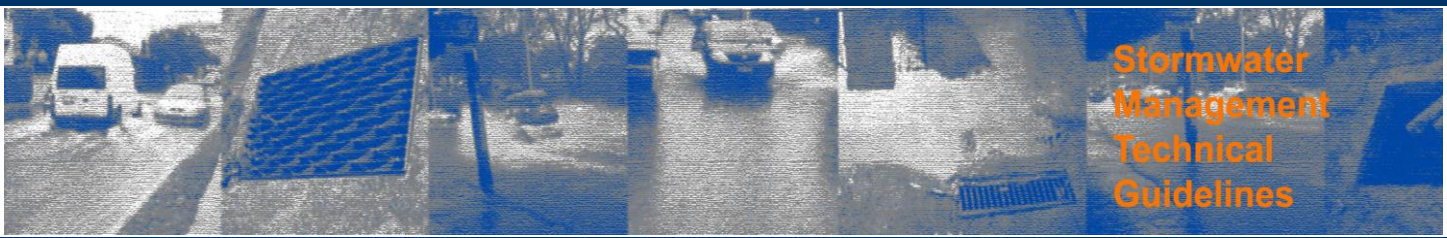


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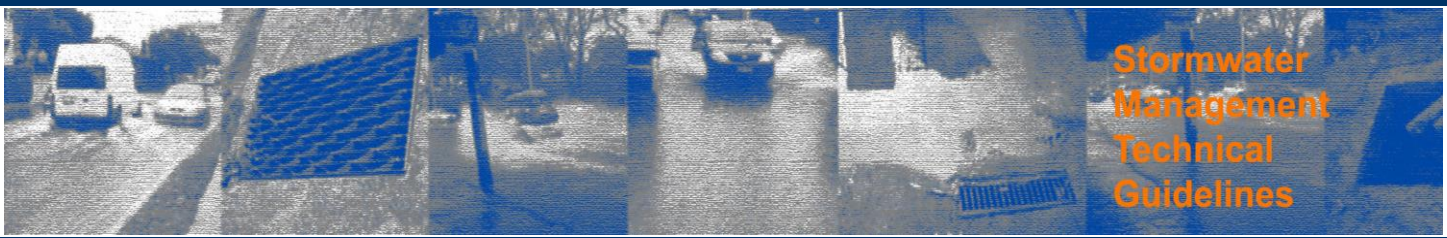


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1. General Objectives

- 01** To outline the technical requirements in relation to the design of stormwater management systems within the Bayside Local Government Area (LGA);
- 02** To ensure an unified approach to the design of on-site stormwater management systems;
- 03** To manage the quality and quantity (flow rate and volume) of the stormwater runoff generated from the site into Council's drainage system;
- 04** To minimise the impact of flooding (mainstream and local) to the natural environment and built up areas;
- 05** To contribute to environmental sustainability by encouraging water conservation through the reuse of stormwater runoff from roof areas;
- 06** To implement and incorporate Water Sensitive Urban Design (WSUD) principles into the design of the stormwater drainage system;
- 07** To allow replenishment and recharge of groundwater;
- 08** To prevent negative impacts of stormwater on public health and safety; and
- 09** To protect existing public stormwater drainage assets.



2. When This Guideline Applies

The following developments are only required to comply with Section 3 of the guidelines:

- (i) Boundary adjustments and consolidations of allotments where no additional lots are created;
- (ii) Subdivision of existing buildings where no changes to the buildings or the site are proposed;
- (iii) One-off minor developments, minor additions and repairs where the proposed development will increase the roof area or impervious area by less than or equal to 30m²;
Note: any subsequent minor developments or additions will require infiltration and/or an On-Site Detention (OSD) system;
- (iv) Carport over the existing paved car parking area, where approved on-site infiltration/on-site detention system has been provided to the site;
- (v) First floor additions over the existing building footprint only;
- (vi) New swimming pools where the surround and concourse of the pool is graded towards the pool;
- (vii) Change of use where no physical changes to the outside of the property are proposed;
- (viii) New developments in subdivisions where stormwater management system (i.e. rainwater re-use, infiltration and/or On-site Detention system) have already been approved and provided for the entire subdivision; and
- (ix) Landscape areas, grassed (not artificial) playing fields, and other grassed and sand areas, which naturally infiltrate water to the aquifer.

All other developments and redevelopments to which this DCP applies require full compliance with this technical guideline.

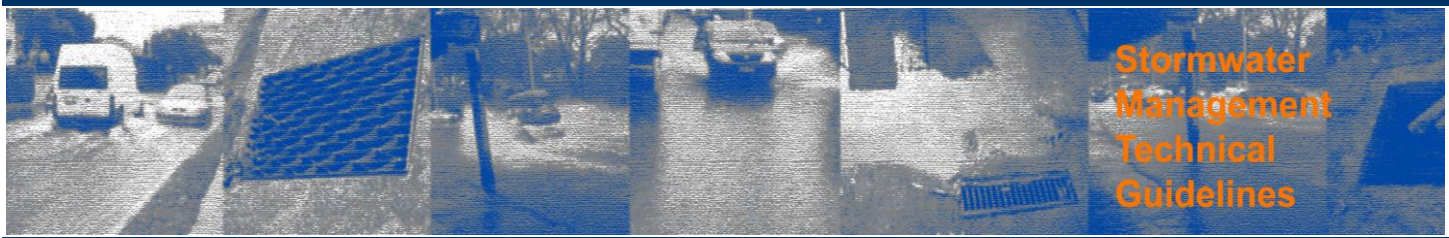
2.1 Submission Requirements

Developments exempted from the full compliance of this technical guideline require the following information to be submitted to Council as part of the Development Application:

- (i) A report from a registered plumber, certifying that the stormwater drainage system (including downpipes) of the existing structure is fully operational and is connected to the on-site stormwater drainage system/ kerb and gutter/ Council's drainage system; and
- (ii) A concept plan showing the connection of the new stormwater drainage system (including roof gutters and downpipes), if any, to the existing site stormwater drainage system in accordance with the current version of AS3500.3.

For all other developments and redevelopments within Bayside Local Government Area the following information is required to be submitted as part of the Development Application:

- (i) A detailed Stormwater Management Plan and design certification which must be prepared by an accredited professional. The following is considered to be acceptable accreditation for the purpose of the stormwater design and certification:
 - Professional Civil Engineer (MIEAust) (Engineers Australia);
 - NPER in Civil Engineering;



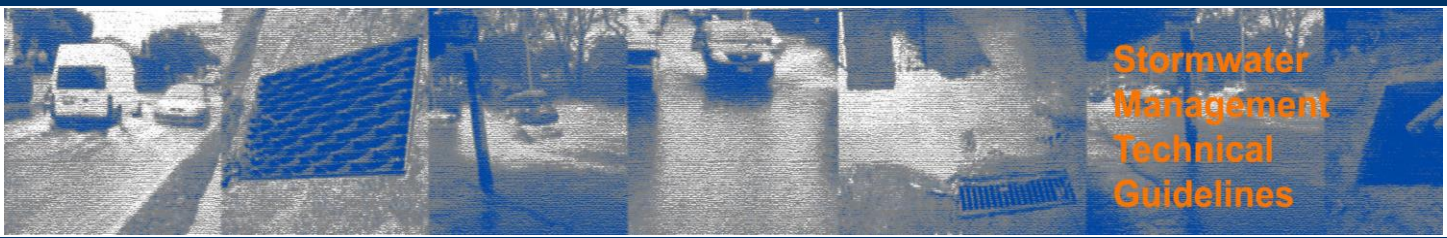
- Surveyors Certificate of Accreditation in On-Site Detention and Drainage Design (Institute of Surveyors NSW and the Association of Consulting Surveyors NSW);
- Stormwater Register (Association of Hydraulic Services Consultants Australia);
- Accreditation as a certifier under the Environmental Planning and Assessment Act 1979 in the relevant discipline.

Note: Except for the above accreditation, Council may accept stormwater management plans for the minor developments (such as alterations and additions) prepared by a qualified stormwater drainage designer, who can demonstrate extensive experience in stormwater drainage design.

- (ii) Geotechnical information in accordance with Section 9.2.1 of this guideline for any on-site infiltration system;
- (iii) Calculations showing the storage volumes and discharge rates of each on-site infiltration and/or on-site detention (OSD) system;
- (iv) Calculations showing capacity of the internal drainage systems; overflow structures and overland flow paths/ floodway (if applicable); Location of any Council's drainage easement and/or drainage system within and adjacent to the site;
- (v) Structural certification of the on-site infiltration and/or OSD systems;
- (vi) Car washing area details – location and where draining to;
- (vii) A flood study when the criteria in Section 15.1 apply to the site (if required); and
- (viii) Design plans and details including:
 - Site layout;
 - Existing site contours and final design levels;
 - Catchment area draining to each on-site infiltration and /or OSD system;
 - Finished floor levels and footprints of the proposed development/ structures;
 - Location and size of the internal and external drainage systems, rainwater re-use system, on-site infiltration and/or OSD systems;
 - Levels and location of discharge points for each infiltration and /or OSD system;
 - Maximum water surface levels in each storage;
 - Overflow structures and surcharge/overflow paths;
 - Locations and details of each discharge control unit (if any);
 - Locations and details of the pump-out system (if any);
 - Location and extent of any overland flow path/ floodway through the site (if any);
 - Location and type of pollution control devices; and
 - Cross-sections details of the rainwater tanks, on-site infiltration and/or OSD systems.

2.2 Rainfall Intensity, Duration & Frequency Curves

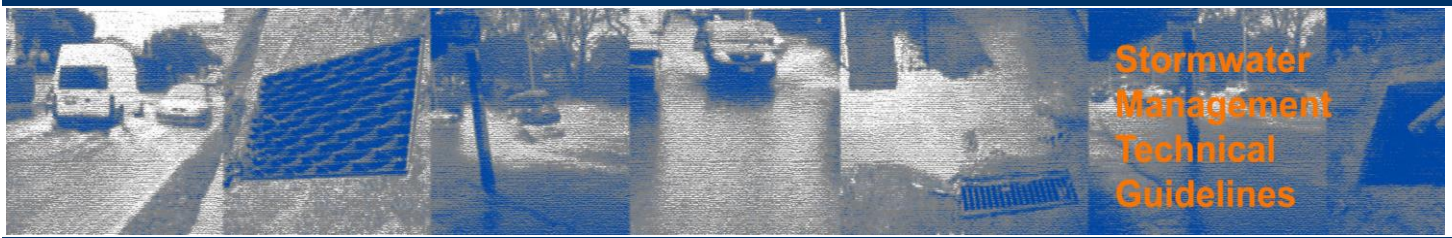
Bayside, in conjunction with the Bureau of Meteorology, has produced a rainfall, intensity, duration and frequency table up to the 1% AEP design storm events for Bayside (refer to **Table 1 and Table 2**). These tables shall be used for the design and computation of discharges. Data for greater than the 1% AEP design storm or 72 hour duration shall be obtained from the station nearest to Botany as depicted in Australian Rainfall and Runoff.



3. GENERAL DRAINAGE DESIGN REQUIREMENTS

The following general drainage design requirements are required:

- (i) All drainage works and floodway / overland flow paths shall be designed in accordance with the requirements detailed in this technical guideline and the current edition of Australian Rainfall and Runoff (AR&R);
- (ii) Impacts from climate change to the stormwater drainage system and floodway / overland flow paths shall be considered in design;
- (iii) All property drainage systems, except for Single Dwelling and Dual Occupancy, shall make provision for surface flow path routes through the site to the street system or through the drainage easement in accordance with the minor/major design concept defined in AR&R. Where OSD is required, the surface flow path route shall be routed through the detention basin in accordance with the relevant clause prior to discharge to the receiving stormwater system;
- (iv) All developments affected by local stormwater inundation or mainstream flooding shall be designed to satisfy the requirements of this technical guideline and subject to assessment and approval from Council;
- (v) All developments that impinge on Sydney Water's and / or Council's stormwater system shall obtain confirmation from Sydney Water and / or Council that the system is suitable for connection prior to lodgement of Development Application;
- (vi) Filling of sites to obtain drainage to the street against the natural fall of the land will require assessment and approval from Council to ensure it will not impact on privacy or result in obstruction to the surface runoff from adjoining properties;
- (vii) Any proposal for filling of the site or redirection of the catchment is required to address the impacts of redirected catchment onto the receiving street gutter, stormwater drainage system and adjoining and downstream properties, as well as the amenity of adjoining properties. Hydraulic analysis of the capacity of the existing stormwater system and its ability to accept additional flows shall be carried out by a qualified and experienced civil engineer and will require assessment and approval by Council;
- (viii) Relocation of an existing Council stormwater pipe may only be approved under exceptional circumstances by Council. The applicant shall demonstrate through full engineering analysis, prepared by a suitably qualified civil engineer experienced in hydraulic design, that there is no adverse effect on Council's stormwater system and adjoining properties; and

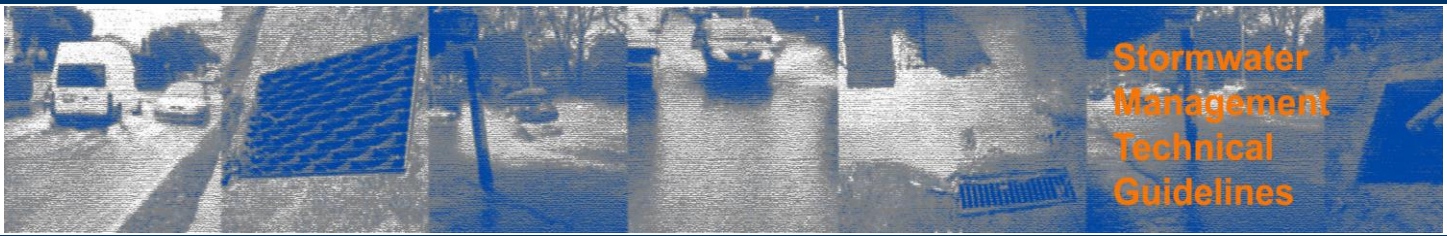


(ix) Applicants / Owners / Developers are responsible to:

- Locate any inter-allotment drainage system, Council's and /or Sydney Water's stormwater system (including floodway and overland flow paths) and verify their size. This information and details shall be prepared by a Registered Surveyor and shall be lodged with the development application ;and
- Investigate the suitability and availability of Council's infrastructure for drainage and access, in accordance with the provisions of this technical guidelines, prior to submitting a Development Application. Where such infrastructure is unavailable, Council does not undertake to provide or assist in the provision of this infrastructure to facilitate any proposed developments.

3.1 Roof and Pipe Drainage Systems

- (i) All roof and pipe drainage system shall be designed and constructed in accordance with AS 3500.3.
- (ii) Minimum cover requirements on pipelines shall comply with the relevant Australian Standards and the manufacturer's specifications.
- (iii) For developments with total catchment area of the drainage system of less than 3000sq.m (0.3ha), pipe sizes can be determined from AS3500.3 or HGL analysis and shall be subject to the following:
 - a) The minimum diameter of any pipeline draining a roofed area shall be 90 mm.
 - b) All uPVC pipes shall be Sewer Extra Heavy Grade and subject to the recommended minimum cover requirements of AS3500.3.
 - c) The minimum diameter of any pipeline draining a paved, grassed or landscaped area shall be 100 mm (catchment area less than 1000 sq m) or 150mm (catchment area greater than 1000 sq m).
 - d) Pipes shall be designed to cater for the likely construction and traffic loads. Allowance should be made for situations where cover during construction may be less than finished cover.
 - e) Pipes contained in drainage easements shall be Rubber Ring Joint (RRJ) Reinforced Concrete Pipes (RCP)/ Fibre Reinforced Concrete (FRC) Pipes where minimum cover of 500mm cannot be provided.
- (iv) For developments with a total catchment area (i.e. site area plus other areas draining to the site) of more than 3000sq.m (0.3ha), a full Hydraulic Grade Line (HGL) analysis of the proposed stormwater system shall be submitted to Council.
- (v) HGL analysis shall also be required for the pipe reaches connecting to a receiving system other than the street kerb. All pit grates shall be minimum 100mm above the HGL.
- (vi) The downstream water level in the HGL analysis shall be assumed either at the top of kerb or 1% AEP downstream water level, whichever is higher.



3.2 Site Drainage Outlet Connection

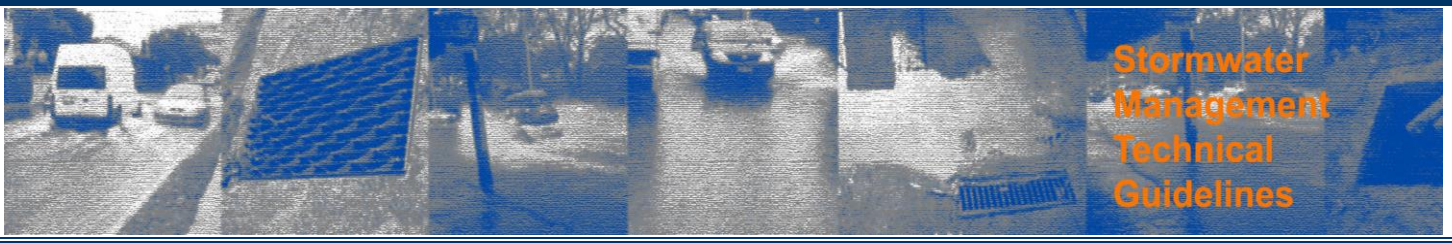
The following is required:

- (i) Grated boundary silt arrestor pit (min. 450mm x 450mm) shall be provided for any stormwater outlet discharging from the site;
- (ii) All stormwater runoff from the development site shall be conveyed under gravity to street kerb or by a single pipeline to Council or Sydney Water stormwater drainage system to which runoff from the site naturally falls. Charged system/s will not be permitted;
- (iii) If a site discharge is greater than 20 L/s, connection shall be made to Council's underground stormwater drainage system;
- (iv) The number of stormwater outlets to kerb and gutter for each development site shall not be more than two and shall have a minimum separation of 15 metres;
- (v) The point of connection for site stormwater runoff to the Council stormwater drainage system will be determined and specified by Council. Any connection to a Sydney Water stormwater system will require specific approval from Sydney Water
- (vi) Connection into Council drainage pipeline shall be by means of a junction pit for any pipes larger than 150mm diameter. The design drawings shall show plan view and longitudinal sections of the pipeline and connection details at a suitable scale
- (vii) Any stormwater drainage pipelines, which required to be laid outside the development site and within Council's drainage easement, road /drainage reserve or parks, shall satisfy the following criteria:
 - Under the footpath area:
 - Minimum 125 x 75 x 6 galvanised Rectangular Hollow Section (RHS)

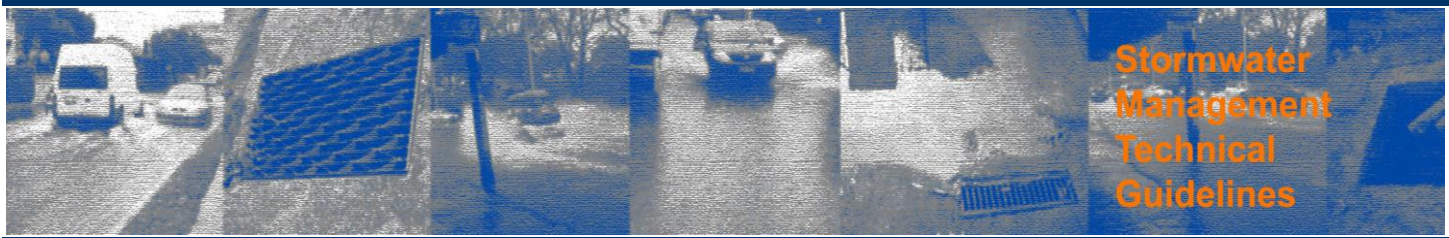
Note: The applicant shall locate all utility services within the footway and show the information on the submitted plans.

- Under kerb and gutter and road-pavement: -
 - Minimum 375mm diameter RRJ RCP/ FRC pipes
- Within Council's drainage easement: -
 - Minimum 375mm diameter RRJ RCP / FRC pipes
- Within Parks and Reserves: -
 - Minimum 375mm diameter RRJ RCP / FRC pipes

The developer shall construct these pipelines according to Council's standards and at their expense. On satisfactory completion and formal approval from Council, Council will take over ownership and be responsible for all future maintenance.



- (viii) Developments connecting to the existing Council's stormwater system shall demonstrate to Council by hydraulic grade line analysis that the proposed development has no adverse impact on the system; and
- (ix) Developments requiring construction of drainage infrastructure in road reserve or Council's lands require assessment and specific approval from Council. Council reserves the right to approve or reject the proposal on its merits based on criteria, including but not limited to environmental assessment and site conditions.



4. Rainwater Re-Use Systems

4.1 Rainwater Tanks

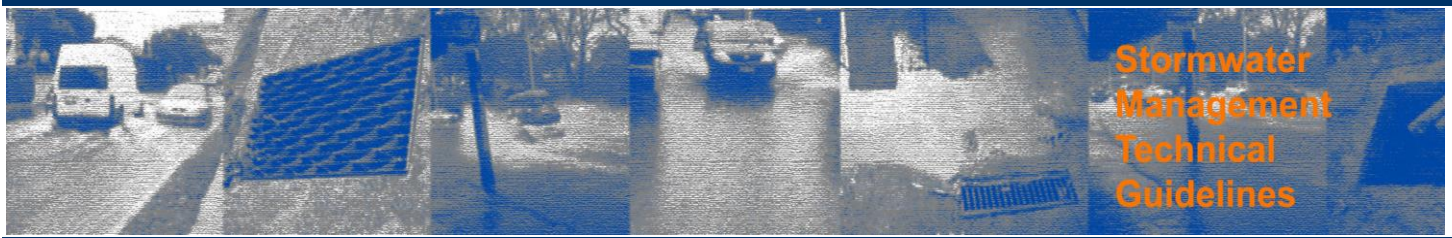
Bayside requires the re-use of stormwater be limited to non-potable uses (watering of gardens, washing of vehicles, outdoor wash down areas, cold water for washing machines, and toilet flushing) for all developments.

With the re-use of stormwater, the following issues shall be considered:

- (i) The rainwater tank shall be used to collect roof water only and the connection to the main water supply will be used as a top up system during extended periods of dry weather.
- (ii) The re-use of stormwater for potable use such as cooking, drinking and hot water systems **shall not be permitted**.
- (iii) Tank water taps shall be marked "Tank Water – Not To Be Used For Human Consumption".
- (iv) Rainwater storage tanks shall be installed in accordance with the manufacturer's specification, Sydney Water's requirements and the relevant Australian Standards.
- (v) The size of the tank and the volume required for re-use must be approximately in balance, e.g. in many large roofed area developments purely using the tank water for landscape irrigation is not a balanced approach, and at least toilet flushing must be added to the re-use.
- (vi) For commercial vehicle washing developments, the vehicle washing water shall be provided predominantly from stormwater re-use and recycling, to minimise use of the potable water. The connection to landscape irrigation system is to be provided whilst the connection for toilet flushing and washing machine is not required.

4.2 Minimum Rainwater Tank Volume

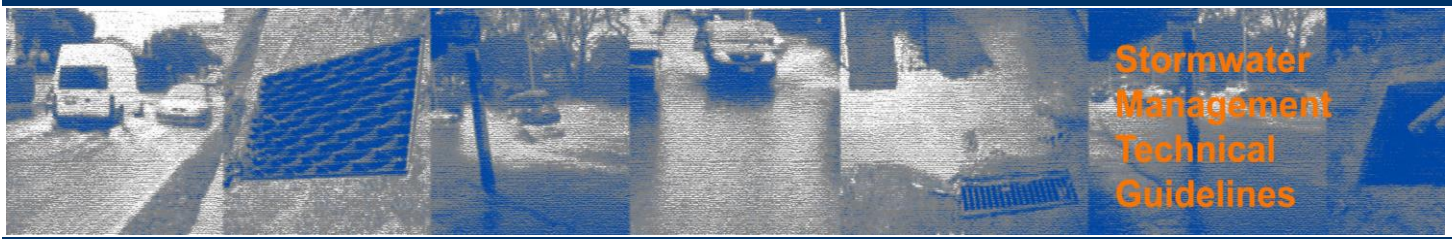
- (i) For a new single dwelling, the minimum capacity of rainwater tank shall be 3,000 litres or that specified in BASIX requirements, whichever is greater. The tank shall service outdoor irrigation, laundry and toilet flushing in accordance with the requirements of Sydney Water and AS3500.3.;
- (ii) For new townhouses, villas, terraces and dual occupancies, each unit shall have minimum 2,000 litres rainwater tank to service outdoor irrigation, laundry and toilet flushing in accordance with the requirements of Sydney Water and AS 3500.3.;
- (iii) For all other new multi-unit developments, minimum 10,000 litres rainwater tank shall provided for the entire development to service outdoor irrigation and/or laundry and toilet flushing in accordance with the requirements of Sydney Water and AS 3500.3.;



- (iv) Any development with roofed areas exceeding 5,000 m², a minimum 10,000 litres rainwater tank(s) shall be provided; and
- (v) For commercial vehicle washing developments, the tank size shall be designed based on a supply/demand management approach.

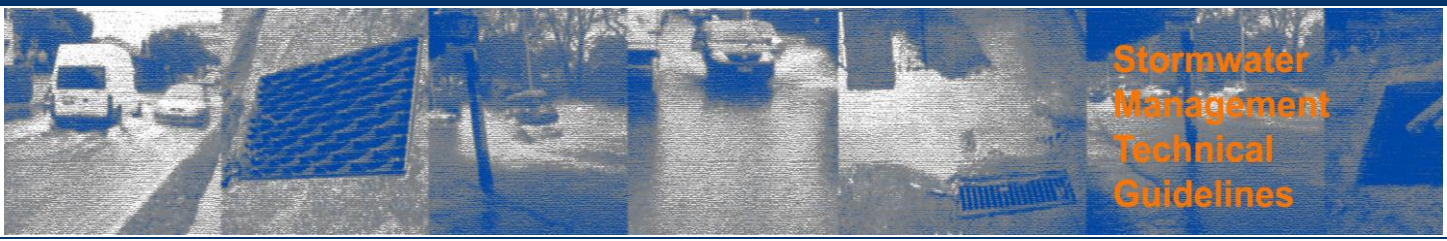
4.3 Rainwater Tank Design Requirements

- (i) All roof water shall be directed to the rainwater tank except for detached elements (e.g. garages, outhouses, sheds, etc);
- (ii) The rainwater tank shall be located to be minimum 500mm from the property boundary and not be seen directly from the street frontage;
- (iii) In order to reduce pollutants entering the tank, a first flush device to divert minimum 1mm initial runoff from the roof area bypassing the tank shall be provided (refer to **Figure 2**);
- (iv) The rainwater tank shall be connected to the mains water supply. These connections will be used as a top up system during extended periods of dry weather. This system shall activate when the volume of water within the rainwater tank reaches 10% of its capacity. The system will then operate until the capacity of the rainwater tank is returned to 20%. A simple example of this arrangement is shown in **Figure 3**;
- (v) The pump shall be appropriately positioned and sound insulated to comply with Council's Noise Criteria, including:
 - (a) The operation of the pump and equipment shall not give rise to an equivalent continuous (L_{Aeq}) sound pressure level at any point on any residential property greater than 5dB(A) above the existing background L_{A90} level (in the absence of the noise under consideration);
 - (b) The operation of the pump and equipment when assessed on any residential property shall not give rise to a sound pressure level that exceeds L_{Aeq} 50dB(A) day time and L_{Aeq} 40dB(A) night time;
 - (c) The operation of the pump and equipment when assessed on any neighbouring commercial/industrial premises shall not give rise to a sound pressure level that exceeds L_{Aeq} 65dB(A) day time/night time; and
 - (d) For assessment purposes, the above L_{Aeq} sound levels shall be assessed over a period of 10-15 minutes and adjusted in accordance with EPA guidelines for tonality, frequency weighting, impulsive characteristics, fluctuations and temporal content where necessary. Further details on noise requirements can be obtained from Council's Assets and Environment Service section;
- (vi) The pump shall provide a minimum pressure output of 150kPa;
- (vii) It is recommended that, all rainwater tanks shall service outdoor irrigation, laundry and toilet flushing where possible. However, where the development proposal does not include a new toilet and/or a washing machine connection, the reuse of rainwater will be limited to outdoor purposes only (e.g. irrigation and wash down).



Stormwater Management Technical Guidelines

- (viii) An overflow pipe from the rainwater storage tank/s shall be connected into the proposed/current on-site infiltration/detention system. Charged system will not be permitted;
- (ix) Appropriate measure/s shall be incorporated into the design of the tank, pipe and gutter system to exclude vermin and prevent the breeding of mosquitoes;
- (x) No outdoor water taps shall be connected to mains water, i.e. water shall be supplied from the tank(s). An appropriate sign shall be installed at each tap stating – “Tank Water - Not To Be Used For Human Consumption”;
- (xi) In order to encourage environmental sustainability and apply Water Sensitive Urban Design (WSUD) principles, consideration can be given to offset the storage requirements of the infiltration and/or OSD system provided that the rainwater tank(s) is connected to irrigation, laundry and toilet flushing for reuse and all downpipes are connected to the rainwater tank. The volume to be offset from the infiltration and/or OSD system is equivalent to 50% of the size of the rainwater tanks. This only applies to residential, commercial and mixed residential/ commercial developments; and
- (xii) Council may allow up to 70% of the volume of rainwater tanks to be used to offset the volume required from the on-site infiltration and/or OSD System provided a Total Water Management Plan has been submitted to Council. The Plan shall include proposed outcomes, efficiencies and ongoing maintenance and monitoring issues of devices installed for water cycle management within the site.



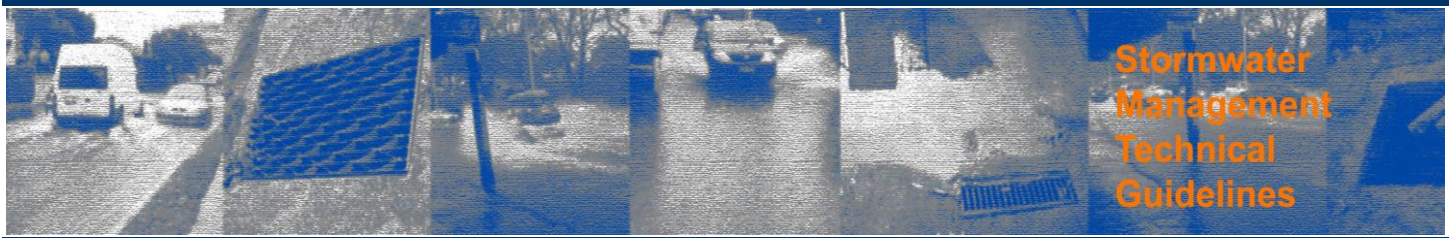
5. On- Site Infiltration Systems

5.1 General

- (i) On-site infiltration shall be used as the FIRST stormwater disposal method (due to the natural Botany Sand soil) for all developments (except industrial developments), regardless of whether the site falls to or from a public road.

To meet the above criteria, the following shall apply to all development sites:

- a) All landscaped areas where the underlying natural soil is sand (over 95% of the Botany Council area) shall have no subsoil drainage systems and shall be dished with no fall to paved surfaces.
- b) It is preferred to have all driveways and parking areas open to weather to be constructed with permeable pavements, utilizing interlocking permeable pavers, using the current CMAA (Concrete Masonry Association of Australia) design method and conforming to Australian Standards.
- c) For commercial and multi-unit residential developments, permeable pavements will not be permitted if any of the following criteria apply to the site:
 - o The measured groundwater levels are within 1000mm of the finished surface levels.
 - o Finished surface slopes exceed or equal 3%.
 - o For developments where there are likely to be silts, sediments and contaminants that would easily and quickly block the permeable infill.
- d) Overland flows that emanate external to the development shall not be blocked, shall not enter the infiltration system, and shall be accommodated via a suitable gravity flow path through the site.
- e) No trees shall be planted over or within 2m of any underground infiltration system.
- f) Underground infiltration system shall not be located within the canopy dripline (or an area stipulated by Council/consultant Arborist) of existing trees.
- g) Underground infiltration system shall be located so as to allow adequate space for planting trees on the property in either the front or rear setbacks. It is recommended that the infiltration system to be located underneath paved areas e.g. driveways, particularly where deep soil landscape area availability is restricted in dimension (small lots); or otherwise located to take up no more than 50% of the landscape area.
- h) Where the system is provided aboveground via a landscaped depression, swale or storage basin, the design volume shall be increased by 20%, and no floatable landscape materials shall be used.
- i) Geotechnical information in accordance with Section 2.1 shall be submitted to Council as part of documentation of development applications, except alterations and additions, and new single dwellings



(except where the site is located within a groundwater exclusion area or is flood affected). For alternations and additions, the geotechnical information shall be ascertained prior to the issue of Construction Certificate.

- j) Infiltration system installed under driveways and concrete slabs shall ensure it is structurally adequate.
- (ii) On-site infiltration system shall not be permitted if any of the following criteria apply to the site:
 - a) The measured groundwater level of the site is within 1.5m below the existing surface levels, or;
 - b) The base of the infiltration system is within 0.5m of the measured groundwater table/ rock level;
 - c) The site is contaminated.
- (iii) No infiltration system shall be permitted within a building footprint
- (iv) If the measured groundwater level of the site is within the range between 1.5m and 2.5m below the existing surface levels, storage of the on-site infiltration system will be preferred to be provided in the aboveground landscaped area.
- (v) The aboveground landscaped storage basin/depression shall be designed to comply with the following:
 - a) The aboveground storage shall be provided within the accessible landscaped area only and shall not diminish the use, function or amenity of the landscape area/open space.
 - b) The underground storage component of the infiltration system shall be designed to have minimum volume to accommodate stormwater runoff generated by all impervious area of the site for 20% AEP design storm events.
 - c) An additional 20% storage volume, in excess of the total design storage of the system, shall be provided for any aboveground landscaped storage basin area.
 - d) Emergency overflow spillway shall be provided to the aboveground landscaped storage basin.
 - e) Any walls forming the storage basin area shall be constructed wholly within the property boundaries and the top of walls should generally be minimum 100mm above the top of water level, excluding the emergency overflow spillway/weir. The walls shall be congruous and harmonious with surrounding landscape finishes, pathways, edges, fences and the like.
 - f) The maximum ponding of all aboveground landscaped storage basin shall not exceed 600mm.
 - g) The finished floor level of the habitable area and garage shall be minimum 300mm and 100mm above the top water level of the aboveground storage basin respectively.
 - h) Any grated trenches and surface inlet pits outside the storage basin area shall be minimum 100mm above the top water level of the storage basin.



- i) Sewer gully pits, electricity outlets, hot water units and air conditioners shall not be located within the storage basin area.
 - j) No floatable landscaped materials shall be used in the storage basin area.
 - k) A permanent warning sign in stainless steel shall be provided to the aboveground storage basin area informing stormwater in the basin area may rise during heavy storm.
- (vi) Except for alterations and additions and new single residential dwellings, restriction on use of land and positive covenant shall be created over the property in favour of the Council prior to the release of Final Occupation Certificate and/or the Subdivision Certificate to guarantee the on-site infiltration systems continued operation, protect from alterations and ensure regular maintenance.

The Restrictions on Use of Land and Positive Covenants can be imposed either by submitting a suitable Request Form to the NSW Land and Property Information under Section 88E (3) of the Conveyancing Act 1919 or in conjunction with the registration of a plan showing the new lots to be created via Section 88B of the Conveyancing Act, 1919.

A sketch plan showing all the components of the system, including above and below ground storages, and a copy of the Maintenance Schedule (refer to **Section 13**) shall be included as attachments to the positive covenant. This will ensure that future owners are aware of their maintenance obligations.

- (vii) Bayside Council shall be the authority empowered to release, vary or modify the restriction and the positive covenant. Documentary evidence of registration of the instrument with the NSW Land and Property Information shall be submitted to Council and the Principal Certifying Authority.
- (viii) Standard wording of the Section 88E (3) / 88B is available in **Appendix A**.
- (ix) For all industrial developments, infiltration system is not permitted. All industrial development will require an on-site detention system to detain 1% AEP peak flows generated by the development.

5.2 Design Requirements of On-site Infiltration System

Geotechnical Information Requirements

- (i) A geotechnical report shall be prepared by a practicing professional geotechnical engineer. The report shall include:
 - a) The proposed on-site infiltration system will have no adverse impact on the adjoining land and buildings;
 - b) The RL (AHD) of the watertable; and
 - c) The infiltration rate (L/m²/sec) of the natural soil within the site to be used for the design of the on-site infiltration system, and permeable pavements.
- (ii) A minimum of two (2) boreholes per site is required. One of the boreholes shall be within the proposed infiltration area/s, with other/s in various locations throughout the site.



For developments with a gross site area (GSA) of greater than or equal to 3000m², an additional borehole is required for every 500m² or part there of over 1000m² (e.g. for a site with GSA of 1450m², four (4) boreholes are required).

The lowest value from this investigation shall be used in the calculation to determine the storage of on-site infiltration system;

The report shall include meteorological details of the test day, the general site condition and the level of the water table for the site.

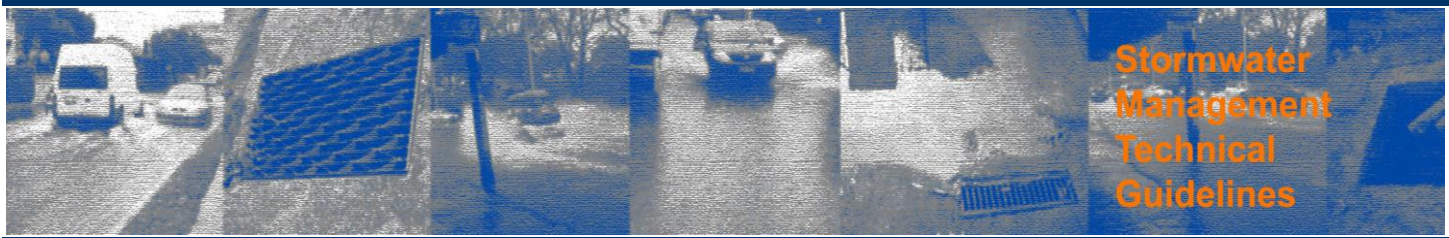
Borehole depth shall be a minimum of 4m below the existing ground level, unless groundwater is encountered. Copies of borehole logs shall be submitted with the Development Application.

Minimum Design Criteria

- (iii) All proposed impervious areas (including internal roadways) and the non-absorbed flow from the permeable pavement areas shall be used to calculate the required infiltration area. The impervious area shall include proposed and existing non-public roads, i.e. no private road drainage shall be directly discharged to a Council system.
- (iv) The on-site infiltration system shall be designed to detain and absorb all runoff generated by the development for all storm events up to and including the 1% Annual Exceedance Probability (AEP) design storm events, and for all durations from 6 minutes to 72 hours inclusive.
- (v) “Mass Curve Technique” shown in Australian Rainfall and Runoff (ARR) shall be used to determine the size and storage volume of the infiltration system. The outflow rate of the system shall be based on the infiltration rate of the soil.
- (vi) The maximum infiltration rate used in designing the on-site infiltration system shall not exceed 1.0 L/m²/sec.
- (vii) The base of the infiltration system shall be a minimum 0.5m above groundwater level determined in the geotechnical report.
- (viii) For sites that fall to the rear, additional 20% storage volume in excess of the total design storage of the system shall be provided.
- (ix) For sites, which fall to the public streets, overflow from the on-site infiltration system shall be discharged to Council’s drainage system / kerb and gutter on public roads via a grated boundary pit (min. 450mm x 450mm) and a 125 x 75 x 6 galvanised Rectangular Hollow Section (RHS). The grade of RHS shall be a minimum of 0.5%.
- (x) Council’s preferred methods of infiltration are:
 - Infiltration trench system
 - Infiltration trench system with aboveground storage
 - Open bottom tank system
 - Drainage cells



- (xi) The on-site infiltration system shall have minimum one (1) metre clearance from the boundaries fronting public roads/reserve and two (2) metres clearance from all other boundaries, building/structure footings, and/or underground car parking structures. Council may allow the system to be located less than two (2) metres clearance from building/structure footings, and/or underground car parking structures subject to certification from a qualified structural engineer.
- (xii) Minimum two (2) grated pits (600mm x 600mm) located at each end of the infiltration system shall be provided to enable access for cleaning to the infiltration units. (Note: These pits can also be used as boundary pits if the edge of the pit is located within 0.5m from the boundary line).
- (xiii) Lysaght Maximesh RH3030 trash screens and 300mm silt sump shall be provided to the pits.
- (xiv) Minimum 200mm thick layer of 14mm crushed aggregate wrapped in a geotextile fabric shall be provided at the base of the infiltration system.
- (xv) The emergency overflow from the infiltration system, due to blockage or a rainfall event larger than the design event, shall be via the grate on the pit(s) (except the aboveground storage basin). The grate(s) shall be a minimum of 100mm below any adjacent floor levels.
- (xvi) All flows from within the development and relevant to the infiltration system, either via a piped system, surcharge from the gutter/piped systems, or overland flow, shall be directed by gravity flow to the infiltration system. The conduits shall be designed for a minimum of a 5% AEP event and flow paths for the 1% AEP event.

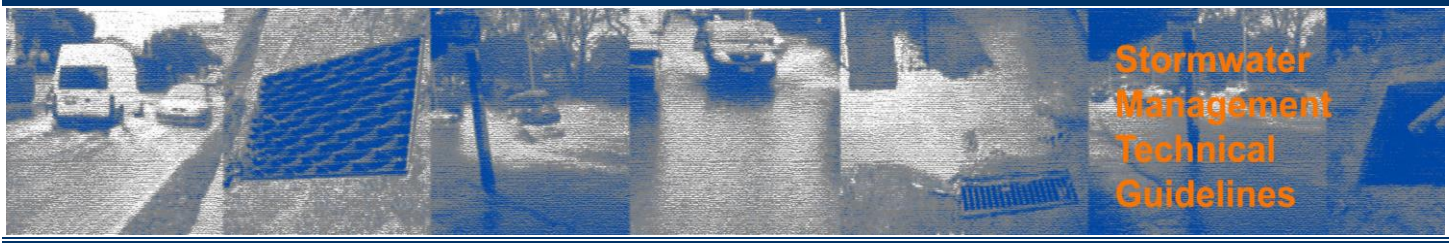


6. On-Site Detention (OSD) Systems

6.1 General

OSD systems shall be provided for all industrial developments and developments, which infiltration system is not permitted or feasible. The OSD system shall be designed on the following basis:

- (i) All runoff generated from the development and relevant to the OSD system (either via a piped system, surcharge from the gutter/piped systems, or overland flow) shall be directed by gravity flow to the OSD storage. All pipes shall be minimum 100mm diameter and designed for a minimum of 5% AEP design storm event. Overland flow paths shall be designed for the 1% AEP event.
- (ii) Detain the stormwater runoff generated by the development for all storm durations up to and including 1% AEP events. The permissible site discharge (PSD) from the site shall be designed to restrict the discharge to 20% AEP event peak flow under the "State of Nature" condition of the site (i.e. the site is totally grassed/turfed) for all storm events.
- (iii) Computer modeling, such as DRAINS/ILSAX can be used to design the OSD system. The design details of the system shall be submitted to Council for assessment.
- (iv) Runoff times of concentration for pervious areas are preferably calculated using the kinematic wave equation recommended in Australian Rainfall & Runoff. A minimum time of concentration of 5 minutes is acceptable for paved / impervious areas.
- (v) The OSD storage volume shall be provided such that the piped outflow of OSD system and bypass flow from the development site does not exceed the maximum permissible discharge allowed for the site.
- (vi) Where it is not possible to discharge flows from some of the impervious area into the OSD system, the storage of OSD system shall be enlarged and the outlet control shall be revised to ensure total runoff from the development not exceeding PSD of the entire development site. The maximum site area bypasses the OSD system shall not exceed 15% of the total site area of the development.
- (vii) Overland flows into the site from the external catchments upstream of the development shall not be blocked or enter the OSD system. These flows shall be collected separately and conveyed around the site via a suitable gravity flow path without detention.
- (viii) The finished floor levels of any non-habitable and habitable buildings/structures shall be minimum 100mm and 300mm above the maximum top water level of the OSD system.
- (ix) For sites with multiple owners/tenants, the discharge control pit and the storage area shall be contained in the communal areas rather than on private lots. This will reduce the complication for inspections and maintenance and remain the responsibility of the joint owners rather than an individual.
- (x) Except for residential alternations and additions and a new single dwelling, restriction on use of land and positive covenant shall be created over the property in favour of the Council prior to the release of Final Occupation Certificate and/or the Subdivision Certificate to guarantee the on-site infiltration systems continued operation, protect from alteration and ensure regularly maintenance.



The Restrictions on Use of Land and Positive Covenants can be imposed either by submitting a suitable Request Form to the NSW Land and Property Information under Section 88E (3) of the Conveyancing Act 1919 or in conjunction with the registration of a plan showing the new lots to be created via Section 88B of the Conveyancing Act, 1919.

A sketch plan showing all the components of the system, including above and below ground storages, and a copy of the Maintenance Schedule (refer to **Section 13**) shall be included as attachments to the positive covenant. This will ensure that future owners are aware of their maintenance obligations.

Bayside shall be the authority empowered to release, vary or modify the restriction and the positive covenant. Documentary evidence of registration of the instrument with the NSW Land and Property Information shall be submitted to Council and the Principal Certifying Authority.

Standard wordings of the Section 88E (3) / 88B is available in **Appendix B**.

(xi) Prior to the release of Final Occupation Certificate and/or the Subdivision Certificate, Work-As-Executed (WAE) plans and a maintenance schedule of internal drainage systems, rainwater tanks, OSD systems shall be submitted to Council. The maintenance schedule shall show:

- Type of maintenance;
- Procedure of maintenance;
- Responsible parties to carry out maintenance; and
- Frequency of maintenance.

6.2 Discharge Control Pit

The Discharge Control Pit shall comply with the following:

(i) The discharge control pit shall:

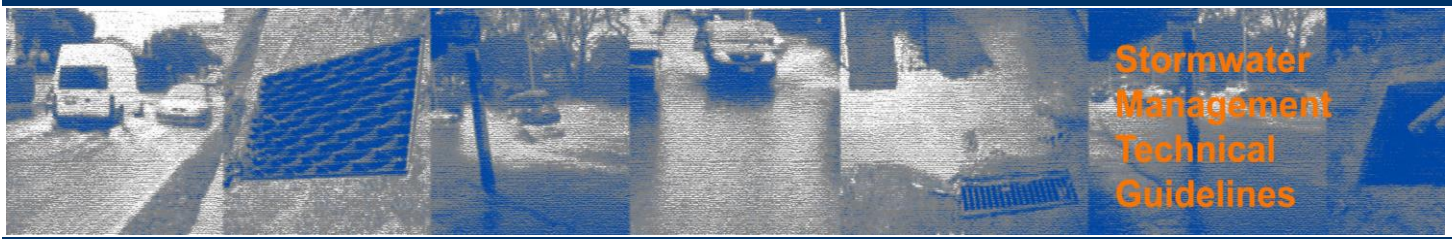
- Minimise the risk of becoming blocked by debris;
- Be locate in a suitable position;
- Be readily inspected;
- Be accessed readily for cleaning; and
- Have a minimal risk of being tampered with.

(ii) The minimum size of the discharge control pit shall be:

- 600 x 600mm for pits up to 900mm depth.
- 900 x 900mm for pits greater than 1200mm depth.

(iii) The discharge control pit shall be a separate compartment to the storage volume.

(iv) No discharge control pit is to be located within the canopy dripline of existing trees.



- (v) The grates shall be fitted with a childproof J-lock or similar.
- (vi) Pit covers should be capable of being opened by one person.
- (vii) Step irons are required for pits greater than 900mm depth. The step irons shall be placed in a wall clear of the flow.
- (viii) All discharge control pits shall be fitted with orifice plates. Orifice plates shall be:
 - Manufactured from a corrosion resistant stainless steel plate with a minimum thickness of 3mm (5mm where the orifice diameter exceeds 150mm), with a central circular hole machined to 0.5mm accuracy;
 - Machined hole shall retain a sharp edge ;
 - Permanently fixed to the pit wall and be epoxy sealed to prevent the entrance of water around the edges; and
 - Engraved with the orifice diameter and an identifying mark.
- (ix) The orifice diameter shall not be less than 25mm.
- (x) The invert of the orifice shall be at least 300mm above the gutter/ top of the grated pit level at the point of connection to the public stormwater system. This is to prevent surcharge into the OSD storage as the public system often can only cater for storm frequencies of less than 20% AEP event.

Where this cannot be achieved, submerged outlet condition shall be considered to determine the OSD storage requirements. The downstream water level in this instance shall be based on 1% AEP water level or assumed to be the top of kerb if the downstream water level is unknown.

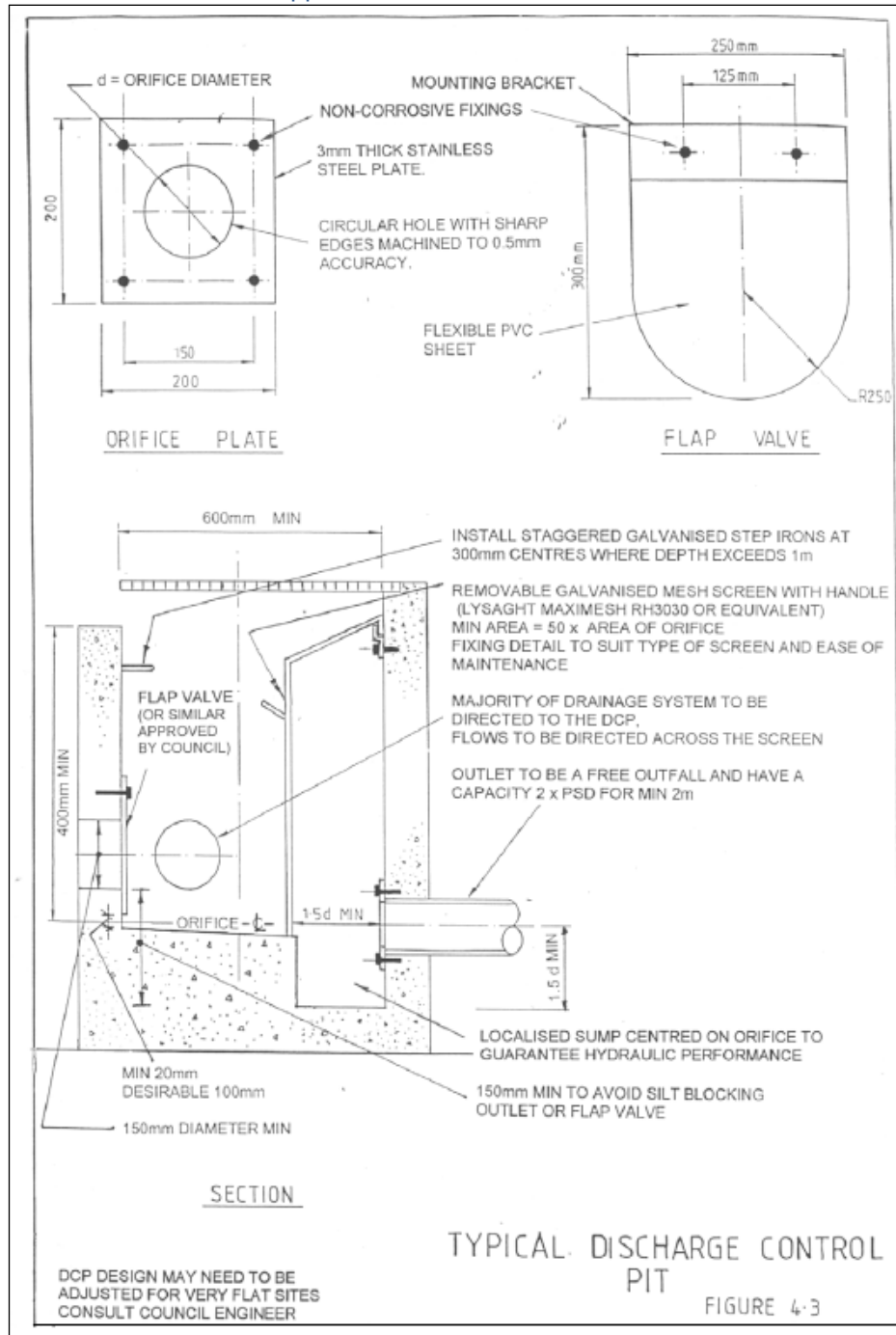
- (xi) All discharge control pits shall be fitted with an internal trash screen which shall:
 - Be manufactured from galvanised Lysaght RH3030 Maxi-mesh (or approved equivalent) with galvanised angle steel frame;
 - Screen all pit inflows to the orifice;
 - Have screen area 50 times the orifice area;
 - Include handle(s) for easy removal;
 - Be located to a minimum distance of 150mm from the outlet orifice; and
 - Be positioned as close to vertical as possible.

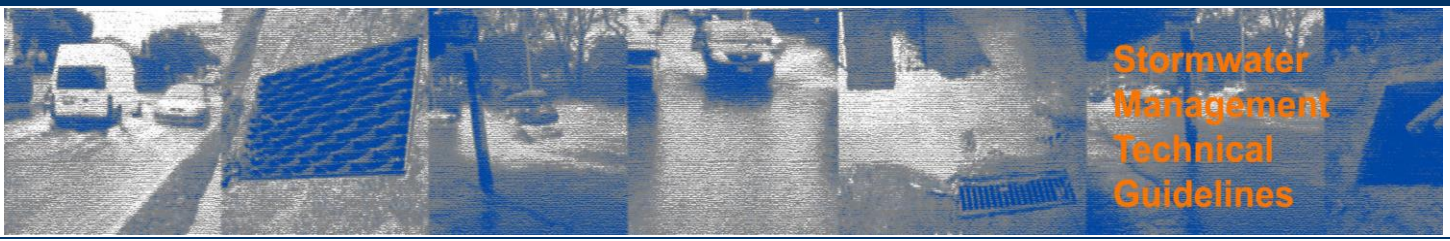
Note: Pits up to 600mm deep should have screens no flatter than 45 degrees. In pits over 600mm deep or remote positions, this should be increased to 60 degrees.



Figure 1 -Typical Discharge Control Pit

Source: Upper Parramatta River Catchment Trust





6.3 High Early Discharge

High Early Discharge (HED) shall be considered in the design of the OSD system to minimise the storage volume required. In order to achieve HED, the following shall be complied with:

- (i) The discharge to the storage shall commence at a minimum of 75% of the PSD as calculated for the various storm frequencies.
- (ii) The overflow structure from the discharge control pit to the storage (weir, pipe, grate, etc) shall convey the maximum 1% AEP flow to the discharge control pit less the initial HED through the orifice.
- (iii) The majority of the site drainage system shall be connected to the discharge control pit.
- (iv) The volume of the discharge control pit shall be small in comparison to the volume of the storage.

6.4 OSD Storage Requirements

The OSD storage shall be designed to comply with the following:

- (i) The on-site detention storage shall be located separate from any natural watercourses and overland flow paths, and shall not be inundated by any events up to and including a 1% AEP design storm event
- (ii) Where roof storage is proposed for the OSD system, the freeboard requirements are not applicable.
- (iii) For aboveground landscaped storages, the design volume shall be increased by 20% to allow for construction irregularities and vegetation. No floatable landscape materials shall be used.
- (iv) The surface of the landscaped area where detention storage is proposed shall be grass surface / stone gravels. The location of the OSD shall be consistent with the landscape plan and clear of areas containing landscaping mulch garden beds.
- (v) Above ground storage in landscaped areas shall be defined by separate watertight dwarf walls in masonry construction.



(vi) In the interests of safety and amenity, ponding of water of the storage area shall be designed in a manner, which minimises inconvenience and nuisance. The following requirements shall also be complied with:

Storage Area	Desirable Max.	Absolute Max.
Pedestrian Areas	0 mm	50 mm
Parking & Driveways	100 mm	200 mm
Accessible Landscaped Area	300 mm	600 mm
Covered/Fenced Storage	600 mm	1200 mm
Roof Area	As required by structural integrity	
Underground with sealed access	No limit	

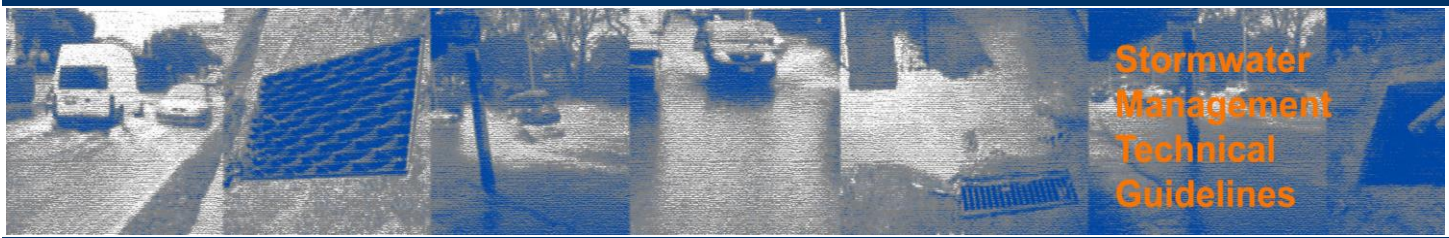
(vii) Where the ponding depth exceeds 300mm, a warning sign shall be erected in each such storage area – refer to **Figure 6**.

(viii) To ensure the continued function, maintenance and amenity of developments, OSD storage areas shall not be located within privately controlled residential areas (eg. private courtyards) for multiple occupancy sites.

(ix) The underground OSD storage shall be located within the building structure or underneath approved pavements such as service, manoeuvring or parking areas.

(x) No underground OSD storage shall be located:

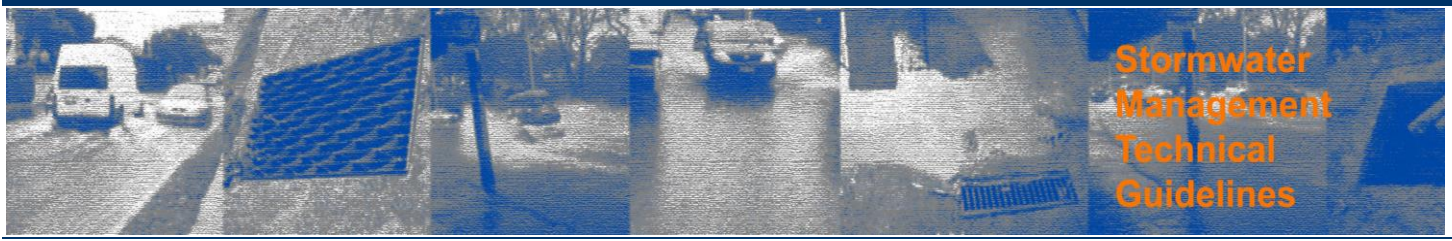
- In the areas dedicated as landscape areas or in open spaces, unless there are no other alternative; and
- Within the canopy dripline of existing trees or to any other dimension or radius measured from the tree trunk specified by an Arborists' Report or Council specification, except when it is located underneath approved pavements.



- (xi) Any underground storage shall be designed to enable the property owner/contractor to carry out routine maintenance. The following shall be incorporated in the design:
- a. Residents/owners must be able to inspect critical parts of the storage from the surface without having to remove heavy access covers. Concrete covers shall be avoided for this reason.
 - b. A continuous fall on the floor of the storage of at least 1% must be provided to the storage outlet to minimize ponding in the storage.
 - c. To provide suitable maintenance access to the underground storage tank, the access grate openings of the tank shall be minimum 900 mm x 900 mm and at no more than 6m spacing from another access grate. At least one (1) access grate shall be provided over the outlet pipe.
 - d. For all grated pits that connected to the OSD system (except overflow pits), the surface level of the pit shall be minimum 100mm above the top water level in the underground storage tank.
 - e. The minimum clearance height for underground tank shall be 900mm. If this cannot be achieved due to level or other constraints, Council may consider to accept the internal heights of the tank absolutely not less than:
 - Commercial/industrial developments: 750mm
 - Residential developments: 600mm

In addition, the following shall be complied with:

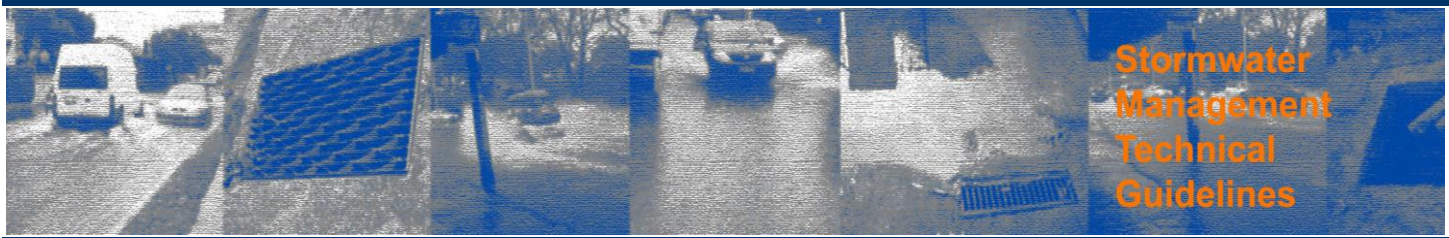
- Maximum lifting weight of 20kg for the access grates;
 - Access grates shall be placed at no more than 3m spacing from another access grate;
 - The base of the tank shall be shaped with a 1% crossfall to a V drain and with a 2% longitudinal slope along the V drain;
 - Tanks less than 750mm high shall be precast to avoid difficulties with removing formwork; and
 - Step irons shall be provided to the tank, which the depth exceeds 900mm.
- (xii) To minimize the risk of silt and debris blocking the storage outlet the floor of the discharge control pit shall be a minimum of 150mm below the return pipe to the storage, and the return pipe to the storage shall be at least 150mm in diameter.
- (xiii) Underground storage for total storage volumes shall be avoided where at all possible.
- (xiv) Where all the storage is provided in an underground structure, the storage shall be designed to overflow and pond in a very visible part of the property so that the ponding will be noticed and the outlet blockage cleared before another storm event.
- (xv) The build-up of noxious odour in storages without a grated access can create problems. If the storage is sealed, vents shall be provided.



6.5 Overflow Requirements

Provision needs to be made in the OSD design to accommodate stormwater runoff generated by the storm event more severe than the design storms or if the outlet of the OSD system is blocked. Emergency overflow structure and distinct overland flow path of the OSD system shall be created (free from obstruction, such as fences, buildings, structures etc) and maintained. In order to check the adequacy of the emergency overflow structures, such as weirs or spillways, and freeboards to finished floor levels, the following shall be complied with:

- (i) The emergency overflow structures (including weirs, spillways, pipes) shall be designed to convey peak flow from 1% AEP event that discharges to the storage.
- (ii) Emergency overflow via pipe system is not preferred and will only be accepted under exceptional circumstances. A minimum blockage factor of 50% shall be applied to the flow in calculating the size of the overflow pipes.
- (iii) The finished floor levels of garage and any habitable buildings/structures adjacent to the overflow structure and overland flow path shall be minimum 100mm and 300mm above the maximum depth of water over the emergency overflow structures respectively.
- (iv) Overflows shall be directed to a flow path through the development so that buildings are not inundated nor are flows concentrated on an adjoining property.
- (v) Where an emergency overflow would flow over private property external to the site, a piped overflow system with 1% AEP capacity shall be provided within a suitable drainage easement.
- (vi) The invert of overflow pipe invert or surface level of the grate of the OSD shall be a minimum of 300mm above the gutter or natural surface RL at the point of connection to the Council stormwater system.



7. Underground Structures

7.1 Groundwater Seepage

Construction within 0.5m of the groundwater table level is prone to groundwater seepage. Therefore, the following conditions will apply:

- (i) The design shall ensure the integrity of the underground structure is maintained at all times (e.g. tanking or water proofing). Details of the water proofing method shall be submitted with the development application.
- (ii) No subsoil drainage systems shall be installed where sand is the natural soil in and around the infiltration system, in the garden areas, behind basements walls, and behind retaining walls.

7.2 De-watering of Underground Structures

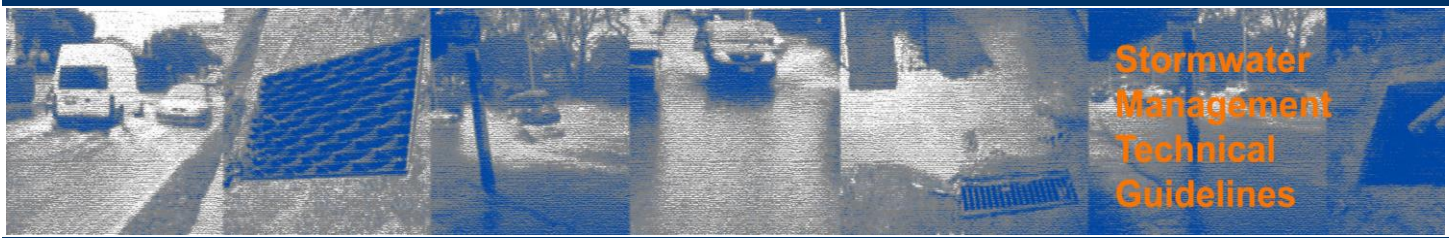
It is normal practice with the construction for underground structures, that de-watering will be required. Contact should be made with NSW Office of Water to determine if a licence is required under the Water Management Act 2000, for temporary dewatering.

Note: Permanent dewatering is not allowed in the Botany Sand Aquifer.

If a licence is required, then the Development Application becomes Integrated Development and Council's Development Assessment Planner must be consulted.

Council requires a report from an appropriately qualified professional that includes, but not limited to, the following information. A report listing the following must be submitted with the Development Application:

- (i) The number of pumps and the discharge location/s of these pumps from the site;
- (ii) Type of de-watering works – bore/s, spearpoints or excavation;
- (iii) An estimation of volume of water to be extracted, pumping rate and duration;
- (iv) The extent of the water table will be lowered and the radius of influence;
- (v) Estimation of the likely impact (settlement) on existing neighbouring structures due to groundwater drawdown;
- (vi) An estimate of the likely increase in water table level post-development due to the proposed structures;
- (vii) Consideration be given to the likely impact of heave due to the derivation of groundwater beneath the perimeter walls;



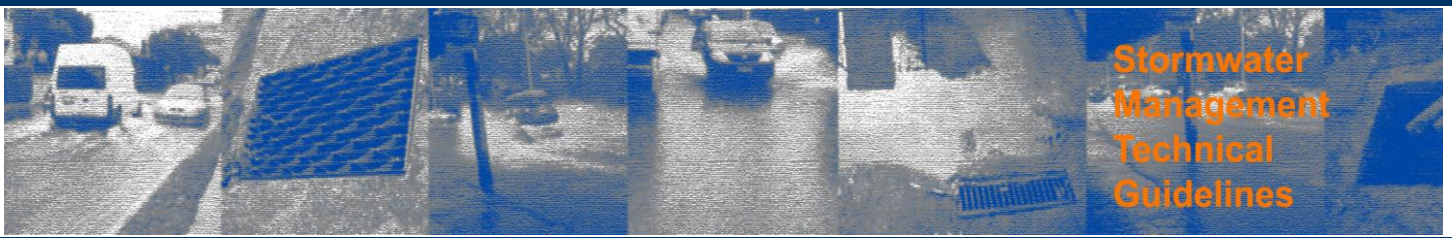
- (viii) Flows from the de-watering process shall be tested, to ensure compliance with *Protection of the Environment Operations Act 1997* and ANZECC 2000 Guidelines for Fresh and Marine Water Quality – Marine Ecosystem 95% trigger criteria; and
- (ix) The pipe work associated with the de-watering process shall not be permitted to cross Council's road reserve without the appropriate pedestrian protection and separate approval.

7.3 Basement Drainage

The basement drainage system shall be designed to suit the following criteria:

- (i) No subsoil drainage system shall be provided where the natural soil is sand and/or area below the ground water table.
- (ii) The pump-out tank shall be designed to comply with the following requirements:
 - (a) The pump-out system shall be designed in accordance with AS/NZS 3500.3.
 - (b) The pump-out system shall comprise of two (2) submersible type pumps. The two pumps shall be designed to work on an alternative basis to ensure both pumps receive equal use and neither remains continuously idle.
 - (c) Each pump shall have a minimum capacity of 10L/s or shall be based on the flow rate generated from a 1% AEP 5-minutes duration storm event of the area of the ramp that draining into the system, whichever is greater.
 - (d) An alarm warning device (including signage and flashing strobe light) shall be provided for the pump-out system to advise the occupant of pump failure. The location of the signage and flashing strobe light shall be shown on the stormwater management plans.
 - (e) The volume of the pump-out tank shall be designed with a minimum storage capacity equivalent to the runoff volume generated from of the area of the ramp that draining into the tank for a 1% AEP 2-hours duration storm event.
 - (f) Backflow prevention devices/ measures shall be provided to the outlet of the pump-out system to minimise or eliminate the risk of backflows into the basement.
- (iii) Prior to the release of the Occupation Certificate and/or the Subdivision Certificate, restriction on use of land and positive covenant is to be established over the property (in favour of the Council) to ensure the systems continued operation, protect from alteration and ensure regularly maintenance.

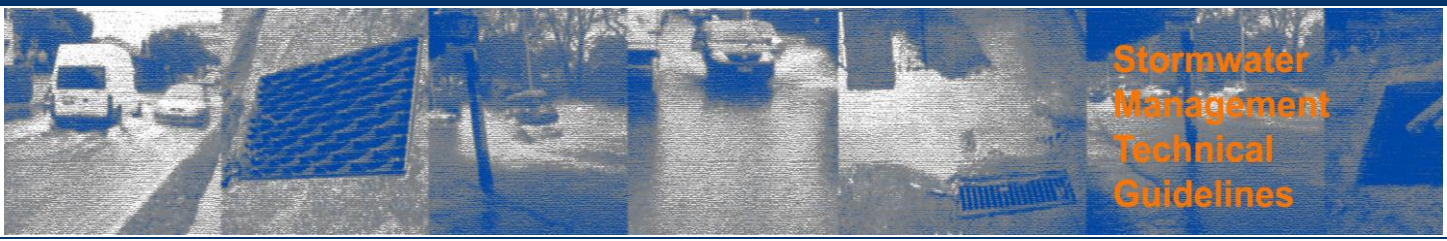
The Restrictions on Use of Land and Positive Covenants can be imposed either by submitting a suitable Request Form to the NSW Land and Property Information under Section 88E (3) of the Conveyancing Act



1919 or in conjunction with the registration of a plan showing the new lots to be created via Section 88B of the Conveyancing Act, 1919.

A sketch plan showing all the components of the system, including above and below ground storages, and a copy of the Maintenance Schedule (refer to **Section 13**) shall be included as attachments to the positive covenant. This will ensure that future owners are aware of their maintenance obligations.

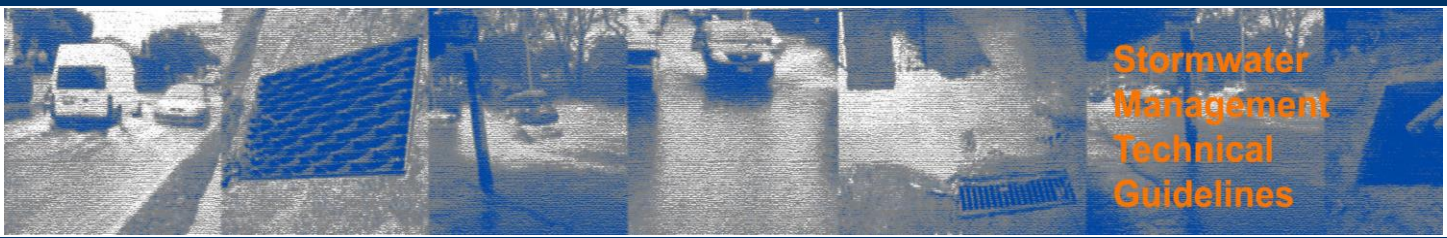
- (iv) Bayside Council shall be the authority empowered to release, vary or modify the restriction and the positive covenant. Documentary evidence of registration of the instrument with the NSW Lands and Property Information shall be submitted to Council and the Principal Certifying Authority.
- (v) Standard wordings of the Section 88E (3) / 88B is available in **Appendix C**.



8. Finished Floor Levels

All new developments shall have finished floor levels complying with the following minimum criteria:

- (i) For a site within Council's identified flood area or within the vicinity of Council or Sydney Water drainage easement/reserve or stormwater drainage system (including open/covered channel, watercourse and underground drainage pipes/culverts), the finished floor levels shall be minimum 500mm (habitable buildings/structures) and 300mm (non-habitable buildings/structures, such as garages, ramps to the basement car parking area) above the estimated 1% AEP flood level.
- (ii) For developments associated only with extension of a single dwelling where this requirement may create a major problem, Council will consider lowering the criteria, depending on the size of the proposed extension and its proposed use.
- (iii) For a site falls toward the streets and not affected by overland flow path and flooding, the finished floor level of the habitable area shall be minimum 300mm above the top of kerb fronting the site.
- (iv) For site falls to the rear and not affected by overland flow path and flooding, the finished floor level of the habitable area shall be minimum 300mm above the highest natural surface RL directly adjoining the proposed floor.
- (v) For site with belowground basement, the crest levels of ramps and steps at the entry points shall be minimum of 300mm above the following:
 - 1% AEP flood level where such is known; or
 - top of kerb adjacent to the layback; or
 - overflow RL from any on-site stormwater systems; and
- (vi) The raising of floor levels, or any site levels, shall not create or exacerbate flooding on any other private or public properties, including public roads and open space.



9. Maintenance Schedule

Prior to the release of Final Occupation Certificate and/or Subdivision Certificate, a maintenance schedule shall be prepared and submitted to Council. The maintenance schedule is a simple set of operating instructions for future property owners and occupiers. It should be clearly and simply set out and should be accompanied by a simplified plan showing the total layout of the stormwater system. The designer's consent to release of this plan to subsequent owners/occupiers should be provided to facilitate long-term maintenance of the facility.

What must be done?

The maintenance schedule needs to set out simply and clearly the routine maintenance necessary to keep the stormwater system working. Some of the issues that will need to be addressed are:

- Where the infiltration trenches, permeable pavements, GPT's and storages are located.
- Which parts of the system need to be accessed for cleaning and how access is obtained.
- A description of any equipment needed (such as keys and lifting devices) and where they can be obtained.
- The location of screens and how they can be removed for cleaning.

Who should do the maintenance?

Where a large proportion of the storage is located above ground, it should be maintained by property owners, residents or handymen. For underground structure, particularly those with limited access and/or substantial depth, the owner may require to engage commercial cleaning companies with specialized equipment, particularly the GPT(s). Appropriate notes on the hazards of confined space entry shall be included.

How often should it be done?

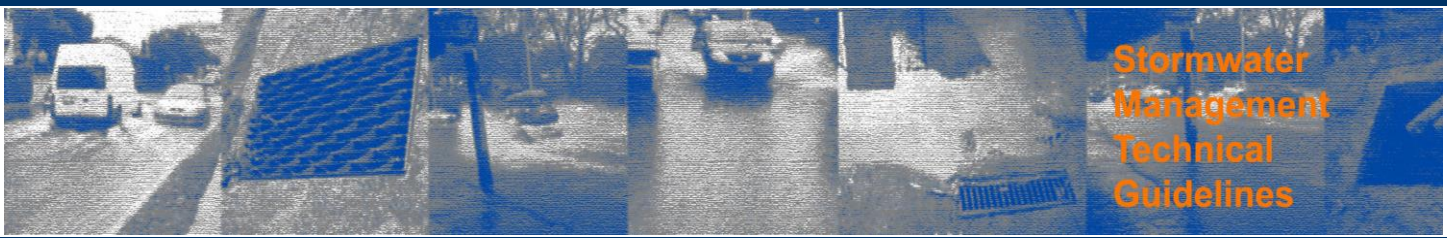
The owner should be provided with advice on how frequently the system needs to be inspected and approximately how often it will require cleaning. The frequencies of both inspections and maintenance will be highly dependent on the nature of the development, location of the storage and the occurrence of major storms. Council suggests the following frequencies:

Residential

- Inspect the system for damage or blockage every six months and after heavy rainfall;
- Clean the system by removing sediment, debris and blockage as required, generally at least once a year; and
- Suction sweep permeable pavements at least once every six months.

Commercial/Industrial/Others

- Inspect the system for damage or blockage every three months and after heavy rainfall;
- Clean the system by removing sediment, debris and blockage as required, generally at least once every six months; and
- Suction sweep permeable pavements at least once every three months.



10. Work-As Executed Plans & Compliance Certificates

Prior to the issue of Final Occupancy Certificate and/or Subdivision Certificate, the following information shall be provided to Principal Certifying Authority and a copy to Council:

For alternations and additions and construction of a single dwelling

Documentation, prepared by a practicing civil engineer or qualified and experienced person in stormwater drainage design shall be submitted to Council. The documents shall certify that the stormwater drainage system (including stormwater re-use, on-site infiltration and on-site detention system) has been constructed in accordance with the approved stormwater drainage design and accepted practice.

For all other developments and redevelopments (including multi-unit residential, commercial, industrial and mixed use developments):

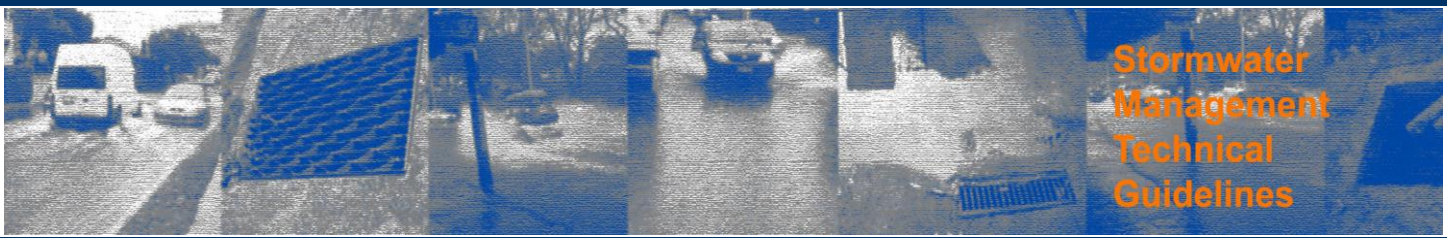
10.1 Work-as-Executed (WAE) Plans

Work-as-Executed (WAE) plans prepared by a Registered Surveyor shall be submitted. A general set of guidelines for preparation of WAE plans is provided below. However, in some projects there will be site-specific features that will require additional details. The designer should therefore be consulted before preparing these plans. The WAE plans shall provide sufficient information to the designer to certify the as-constructed system will function in accordance with the approved design.

Note: Any changes to the top water level in the storage or depth of storage may alter the required orifice diameter. Calculations shall be submitted to show that the orifice diameter is correct if the approved design water level has been changed.

On-Site Infiltration System

- Location of permeable pavements and the on-site infiltration system(s), especially clearance distance from property boundary and building/structure footings;
- Location and size of the access pits;
- Dimension in plain view of permeable pavements and on-site infiltration systems;
- Storage capacity of the on-site infiltration system; and
- Location and size of any overflow pipe from the infiltration systems.



On-Site Detention System

Discharge Control Pit

- Location of the pit;
- Internal pit dimensions;
- Surface and invert level of the pit;
- Internal diameter and invert level of the outlet pipe;
- Internal diameter and invert level of the return pipe;
- The diameter of the orifice and verification that it has been fitted correctly;
- Details of the overflow weir (including level and dimension) from the discharge control pit to the storage; and
- Verification that a non-return flap valve and a trash screen have been fitted.

Storage

- Type of storage - roof, aboveground, belowground or combination;
- Extent of the storage;
- Sufficient levels and dimensions to verify storage volumes – as a minimum, WAE plans shall give the constructed level of all design levels shown on approved plans;
- Detailed calculations of the actual volume achieved for each storage; and
- Level and location of any overflow structures (e.g. spillways, weirs). Any changes to storage depth or top water level and whether the orifice size is affected.

Freeboard

- The finished floor levels of adjacent buildings structures of the OSD system and overland flow paths.

Stormwater Quality Improvement Device (SQID)

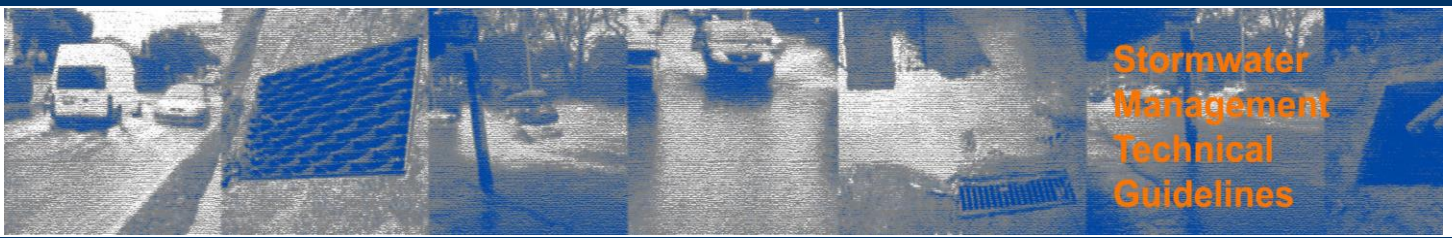
- Location of the SQID; and
- Type and size of the SQID

10.2 Compliance Certificates

For all new commercial, industrial, mixed use and multi-unit residential developments, Compliance Certificates, issued under Part 4A of Environmental Planning and Assessment (EP&A) Act, shall be submitted to Principal Certifying Authority and Council to confirm that the construction of stormwater drainage system, pump-out system, the stormwater re-use system, on-site infiltration and on-site detention have been completed and generally carried out in accordance with the approved design.

The certificates shall be obtained from the following categories of Accredited Certifier:

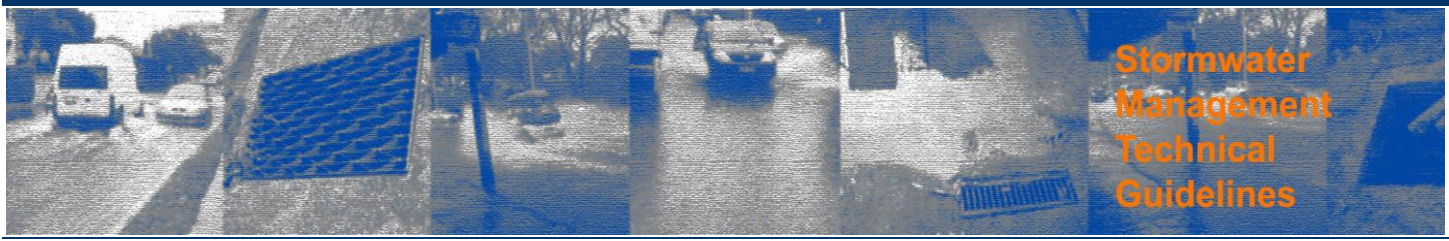
- Accredited Certifier (stormwater management facilities construction compliance); and
- Accredited Certifier (stormwater compliance).



To avoid delays in obtaining compliance certificates, developers and builders are encouraged to have the designer supervising the construction of these systems. Defects are expensive to repair once the development is completed.

A separate structural certification will be required for any structural elements. The Compliance Certificate needs to:

- State that the system will function in accordance with the approved designs, subject to satisfactory maintenance;
- Identify any variations from the approved design; and
- State that these variations will not impair the performance of the site stormwater system.



11. Flood Study or Overland Flowpath Assessment

11.1 Sites requiring a Flood Study/Overland Flowpath Assessment

A flood study/overland flow path assessment shall be carried out by the developer and submitted to Council as part of the DA documentation when the following is applicable to the site:

- (i) Council's (or Sydney Water's) drainage easement/drainage reserve and/or stormwater drainage system (including open/covered channel, watercourse and underground drainage pipes/culverts) is located within /adjacent to the site';
- (ii) The site is within or directly adjoins the Council's identified major overland flow path or flood area;
- (iii) The site is located at/ adjacent to the sag point of the catchment; and
- (iv) Any part of the site has nature ground level below 4m AHD.

For developments associated only with extension of a single dwelling where this requirement may create a major problem, Council will consider lowering the criteria, depending on the size of the proposed extension and its intended use.

11.2 Submission Requirements

Overland Flow Path Assessment

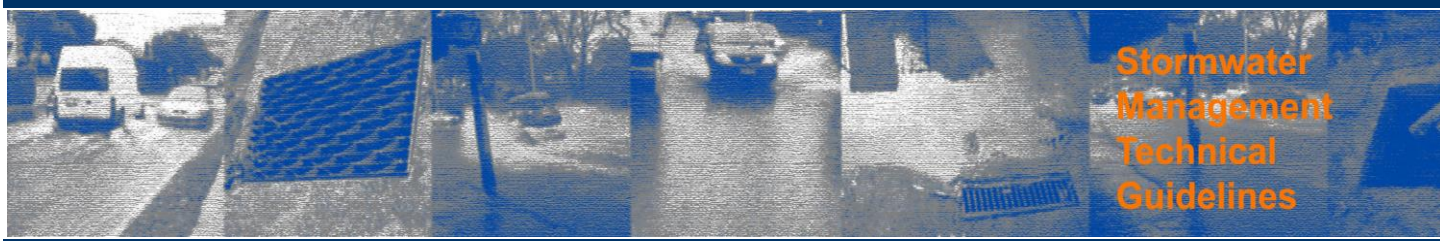
For site with upstream catchments less than or equal to 5 Ha, a detailed overland flow path assessment in accordance with the current version of Australian Rainfall and Runoff (AR&R) and the NSW Floodplain Development Manual shall be submitted to Council to determine the critical flow characteristics (e.g. potential extent) of the overland flow path and its impact to and by the proposed development.

The assessment shall be prepared by a qualified civil engineer experienced in the preparation of flood study. The flood study shall include the following information:

- (i) Catchment plan highlighting the full upstream catchment area that generates the overland flow;
- (ii) A pre-construction (existing conditions) & post-construction (proposed development) detailed hydraulic analysis based on the 1 % AEP for the upstream catchment area;

Note: A 50% blockage factor shall always apply to the hydraulic analysis of the underground drainage system.

- (iii) A scaled plan view showing the existing 1% AEP overland flow path extent and levels on the subject property;
- (iv) A **longitudinal section** (at the vertical scale 1:50, horizontal scale to that of plan view) of the drainage system showing existing and proposed surface levels, 1% Annual Exceedance Probability (AEP) floodwater levels, hydraulic data and all changes in grade;

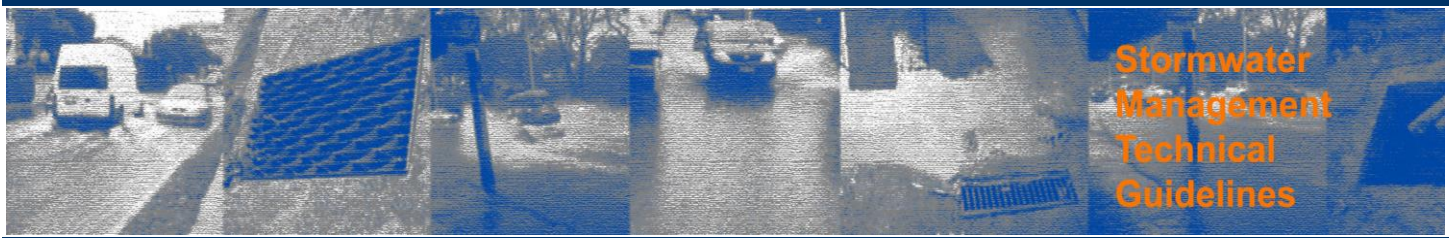


- (v) Scale 1:50 cross-section details taken at the right angle to the overland flow path with a maximum spacing of every 5m. It shall at least include the following locations:
- Immediately at the upstream property boundary;
 - Where the existing and proposed development /structure is closest to the flow path;
 - Immediately at the downstream property boundary; and
 - Other cross-sections as required where the flow path and/or drainage system being affected.

Note: Cross-sections must show the existing and proposed ground levels, pre- and post development top water levels, hydraulic data and flood extents.

In addition, the following issues shall also be complied with:

- (i) Impact to the frequency and intensity of the storms from Climate Change in accordance with NSW Sea Level Rise Policy Statement shall be considered;
- (ii) All levels shown on assessment drawings and details shall be to the Australian Height Datum (AHD);
- (iii) The overland flow path assessment must demonstrate that the proposed development will not impede the passage of overland flow to cause a rise (afflux) in the water level upstream and/or increase the downstream velocities of flow;
- (iv) No structures and/or fillings are permitted over the 1% AEP overland flow path unless suitable flood mitigation measures are to be implemented. These measures will require assessment and approval from Council;
- (v) The proposed finished floor levels of habitable buildings/structures and non-habitable buildings/structures (including garage, ramps to the basement car parking area etc.) shall be minimum 300mm and 100mm above the 1% AEP floodwater levels respectively;
- (vi) If the velocity - depth product of the overland flow path exceeds $0.4\text{m}^2/\text{s}$, suitable open type fencing or other appropriate measures shall be used to restrict access to such areas affected by hazardous overland flows;
- (vii) The boundary fence over the estimated extent of the overland flow path must be replaced with open type fencing to allow unimpeded passage of overland floodwater; and
- (viii) The overland flow path assessment must be signed by an engineer declaring that the study has been undertaken in accordance with Australian Rainfall and Runoff and the NSW Floodplain Development Manual.

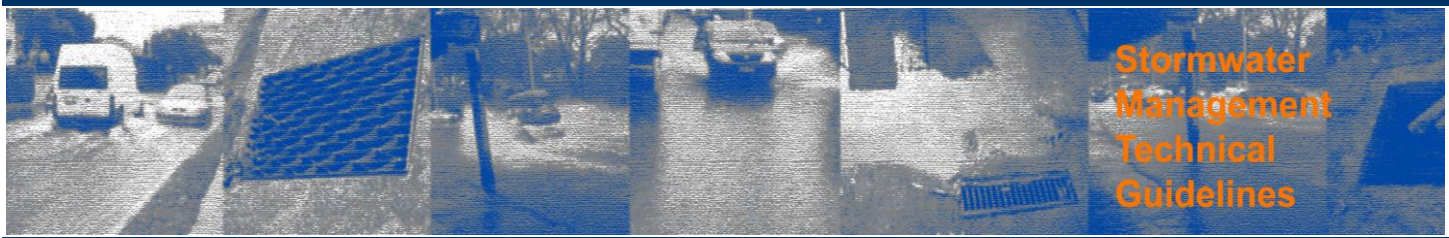


Flood Study

For site with upstream catchments greater than 5 Ha, a detailed flood study in accordance with the current version of Australian Rainfall and Runoff (AR&R) and the NSW Floodplain Development Manual shall be submitted to Council.

The assessment shall be prepared by a qualified civil engineer experienced in preparation of flood modelling and shall address and comply with the following:

- (i) The flood study which shall include:
 - Flood model of the 1% Annual Exceedance Probability (AEP) design storm events and Probable Maximum Flood (PMF) with the predicated impacts of Climate Change;
 - Two-dimensional (2D) flood modelling (such as TUFLOW) shall be used for the development site with upstream catchments greater than 20 Ha.
 - Scaled maps, including 0.2 m contour lines that showing full upstream catchment area;
 - Scaled maps showing the flood extent, flood contour, flood depth and velocity of pre-development and post-development 1% AEP and PMF flood; and
 - Detailed scaled plan view showing the pre-development and post-development 1% AEP and PMF flood extent and levels on the subject property.
- (ii) A 50% blockage factor shall always apply to the underground drainage system in flood modelling.
- (iii) A sensitivity analysis on flooding impact when the stormwater drainage system is 100% blocked shall be considered in the modelling.
- (iv) All levels shown on flood study shall be to the Australian Height Datum (AHD).
- (v) The flood study shall demonstrate that the proposed development will not impede the passage of floodwater to cause a rise (afflux) in the flood level upstream and/or increase the downstream velocities of flow of the flood standard.
- (vi) The proposed finished floor levels of habitable buildings/structures and non-habitable buildings/structures (including garage, ramps to the basement car parking area etc.) shall be minimum 300mm and 100mm above the 1% AEP floodwater level respectively.
- (vii) Flood storage within the site shall be maintained before and after the development.
- (viii) Structures/filling shall not be placed within the flood extent unless suitably and adequate mitigation measures have been proposed and implemented. These measures will require approval from Council.
- (ix) The boundary fence over the estimated flood extent must be replaced with open type fencing to allow unimpeded passage of overland floodwater.
- (x) Flood Evacuation Plan in PMF storm events shall be submitted for assessment.



- (xi) If the velocity - depth product of the overland flow path exceeds $0.4\text{m}^2/\text{s}$, suitable open type fencing or other appropriate measures shall be used to restrict access to such areas affected by hazardous overland flows.
- (xii) The flood study must be signed by an engineer declaring that the study has been undertaken in accordance with Australian Rainfall and Runoff and the *NSW Floodplain Development Manual*.

Positive Covenants and Restrictions on Use of Land

Prior to the release of the Occupation Certificate and/or the Subdivision Certificate, Restrictions on Use of Land and Positive Covenants shall be created on the title of the subject site that is affected by flooding, overland flow path and / or flood storage in order to ensure unimpeded passage of 1% AEP overland floodwater and / or maintain the capacity of the flood storage in the catchment.

The Restrictions on Use of Land and Positive Covenants can be imposed either by submitting a suitable Request Form to the NSW Lands and Property Information under Section 88E (3) of the Conveyancing Act 1919 or in conjunction with the registration of a plan showing the new lots to be created via Section 88B of the Conveyancing Act 1919.

The extent of the identified overland flood path and /or compensatory flood storage within the subject site shall be shown on a scale sketch, attached as an annexure to the Positive Covenant. This will ensure that future owners are aware of their maintenance obligations.

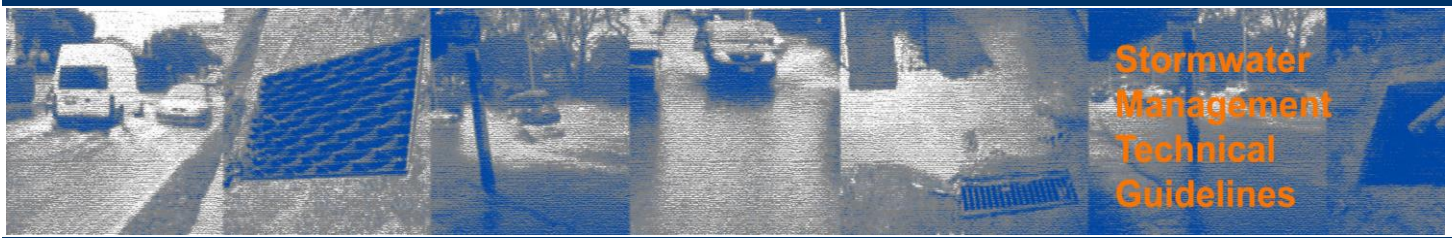
Bayside Council shall be the authority empowered to release, vary or modify the restriction and the positive covenant. Documentary evidence of registration of the instrument with the NSW Land and Property Information shall be submitted to Council and the Principal Certifying Authority.

Standard wordings of the Section 88E (3) / 88B is available in **Appendix D**.

Engineering Certification

Prior to the release of the Occupation Certificate and/or the Subdivision Certificate, certification from a qualified civil engineer, shall be submitted to Council certifying the follows:

- (i) All flood management measures identified in the submitted flood study/overland flow path assessment have been constructed and completed;
- (ii) The required compensatory flood storage has been provided in accordance with the flood study/ overland flow path assessment;
- (iii) All fencing within the flood extent and overland flood path must not cause any detrimental increase in floodwaters on surrounding lands and is to be constructed to withstand the forces of floodwaters; and
- (iv) Work-as-Executed details showing the flood affected area / overland flow path / compensatory flood storage are in accordance with the details shown on the submitted flood study/overland flow path assessment.



12. Buildings/Structures Over Council Stormwater Lines & Easements

Council does not permit the construction of any structural features of the development to be built over Council's drainage lines or easements.

If there are site constraints whilst other alternatives have been investigated, Council may permit light and demountable structures (such as carport) over the easements subject to:

- (i) Approval has been granted by Council's Asset Section;
- (ii) The structure will not obstruct the 1% AEP flood/overland flow path;
- (iii) Deed of Indemnity shall be prepared and entered into between Council and the owner of the subject property for the light and demountable structure erected within the existing Council stormwater drainage easement. The deed shall fully indemnify Council and their representative from all claims, demands and liability, which may arise in respect of the removal of structures and any necessary works associated with the structures that erected within the existing Council stormwater drainage easement and the owner shall bear all costs associated with these removal works; and
- (iv) The structure foundations shall extend to at least 1m below the invert of the existing stormwater line.

Under **no circumstances** shall any permanent structures or habitable areas, such as bedroom and living areas be erected over Council's easements or drainage lines.

12.1 CCTV Survey of Council Drainage Systems (2.48)

For the site contains and/or is adjacent to Council drainage easement/reserve or stormwater drainage system (including open/covered channel, watercourse and underground drainage pipes/culverts), closed circuit television (CCTV) inspection survey shall be carried out prior to commencement of any site work and prior to issue of any Occupation Certificate. This is to protect Council's infrastructure during the course of construction of the development. The CCTV inspection survey shall comply with the following:

A qualified practitioner, with a certificate of attainment in NWP331A Perform Conduit Evaluation, shall undertake a closed circuit television (CCTV) inspection and report on the condition of the Council drainage pipeline before the development and after the completion of all development works. The camera and its operation shall comply with the following:

- (i) The internal surface of the drainage pipe shall be viewed and recorded in a clear and concise manner;
- (ii) The CCTV camera used shall be capable to pan, tilt and turning at right angles to the pipe axis over an entire vertical circle to view the conduit joints;
- (iii) Distance from the manholes shall be accurately measured; and
- (iv) The inspection survey shall be conducted from manhole to manhole.



The written report, together with a copy of the digital video footage of the pipeline shall be submitted to Council. A written acknowledgment shall be obtained from Council (attesting to this condition being appropriately satisfied) and submitted to the Principal Certifying Authority.

Any damage to Council's infrastructure during the course of the construction works shall be restored at the applicant's cost.

12.2 Drainage Easements

For sites where the conveyance of stormwater involves the provision of a stormwater system across lands owned by others, then easements to drain stormwater shall be created over the downstream properties, in favour of the lot(s) being developed.

Where a downstream drainage easement is required, written agreement to the easement from the affected owner(s) shall be submitted with the Development Application.

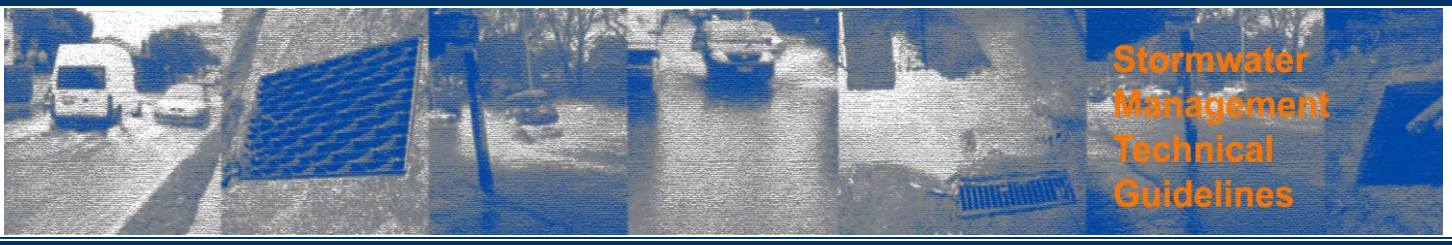
Documents relative to the creation of downstream easement(s) shall be lodged with NSW Land and Property Information for registration prior to issue of the Construction Certificate. Final registration shall be in effect prior to the issue of Occupancy Certificate or occupation of the site. All costs shall be borne by the developer.

All Council and inter-allotment drainage easements shall be able to accommodate overland flow from the upstream catchment up to 1% AEP design storm event.

Drainage Easement benefiting Council shall have the width as follow:

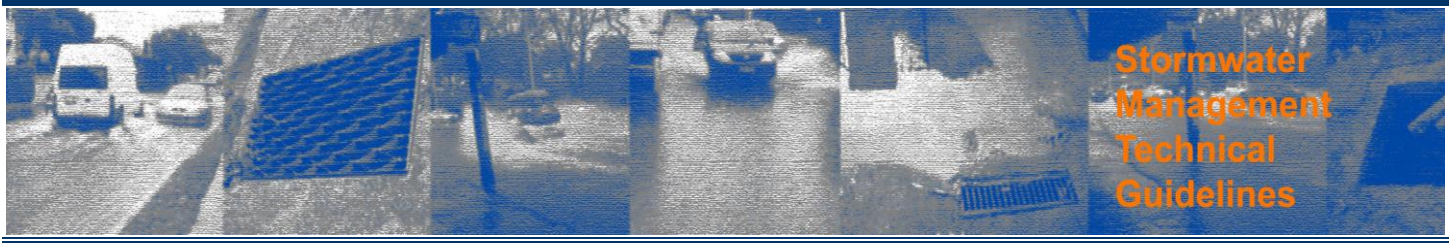
- For pipe diameter \leq 900mm,
- 3 m
- For pipe diameter $>$ 900mm,
- width of the drainage structures plus one (1) metre on each side of the structure

All Council drainage easements shall be provided with an unobstructed floodway of adequate capacity over the surface. No structures shall be erected or placed over the Council drainage easement except to those structures stated in Section 16 of this technical guideline.



The following minimum width of the inter-allotment drainage easement shall apply:

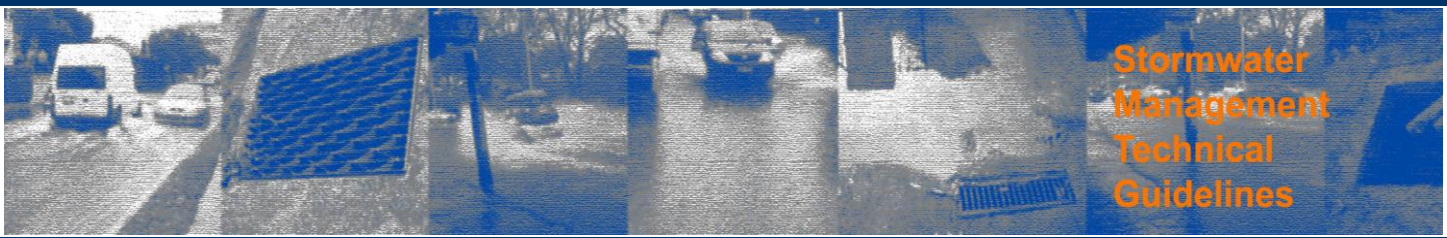
Pipe Diameter	Minimum Easement Width
$\leq 300\text{mm}$	1 m
$> 300\text{mm}$ and $\leq 750\text{mm}$	2.5 m
$> 750\text{mm}$ and $\leq 1200\text{mm}$	3 m
$> 1200\text{mm}$	Width of the drainage structures plus one (1) metre on each side of the structure



13. Design & Construction of Council Stormwater Drainage Systems

The design and construction of Council's stormwater drainage system shall comply with the following:

- (i) Infrastructure performance bond shall be lodged with Council to safe guard against defective public civil works undertaken by the main contractor for a period of twelve (12) months from the date of completion as agreed by Council. The bond shall be lodged in the form of a cash deposit, cheque or unconditional bank guarantee, which will be refundable (with no interest) subject to the approval of Council's engineers at the end of the maintenance period. In this period, the contractor is liable for any part of the work, which fails to achieve the design specifications. Council shall be given full authority to make use of the bond for such restoration works within the maintenance period as deemed necessary.
- (ii) All Council drainage pipelines shall be reinforced concrete (RCP) or fibre reinforced concrete (FRC), rubber ring joint (RRJ), and shall be of the appropriate class (minimum Class 3). The design shall consider final and construction traffic loads.
- (iii) Design capacity shall be based on at least a 5% AEP design storm event. Larger capacities will be required for trunk stormwater systems where overland flow paths are limited, but the minimum size shall be 375mm diameter and minimum grade of 0.5%.
- (iv) For trunk stormwater systems, the design frequency storm event shall depend on the following:
 - The capacity of the existing upstream and downstream system (existing and proposed);
 - The size of the catchment;
 - Capacity and location of the overland flow path; and
 - The type of adjoining development.
- (v) The final design details will need to be made in liaison and agreement with Council's Engineers. Approval of the design shall be sought from Council prior to commencement of any works on-site.
- (vi) Hydrologic and hydraulic design of the drainage system shall be based on a recognized, current stormwater model (subject to Council's approval) and the present Australian Rainfall & Runoff.
- (vii) Pits shall be in accordance with Council's standard plans and for kerb inlets; the minimum opening shall be 1.8m and a maximum 4.8m.
- (viii) All pipes shall be backfilled in accordance with the relevant Australian Standards.
- (ix) In newly created roads where a low point occurs, an overflow path shall be provided to carry that flow to a public road or stormwater system, and designed for the 1% AEP design storm event (i.e. as though the pipe system did not exist). The overland flow path shall be within a public pathway, public open space, or an area over which exists a relevant covenant or stormwater easement.



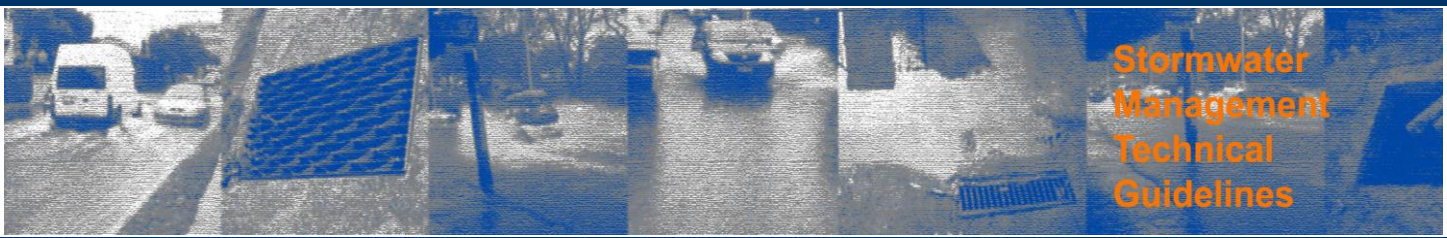
- (x) On completion of the development construction and prior to the issue of the Subdivision Certificate/Occupation Certificate, CCTV survey and report shall be submitted to Council in accordance with **Section 17** of this technical guideline to ascertain if any damage has occurred to the newly laid stormwater conduits. Any damage shall be repaired by the applicant to Council's requirements and satisfaction. Once any damage has been repaired to Council requirements, a further CCTV survey and report shall be submitted to Council for further consideration. The CCTV survey and report shall also be used to view any rubbish and sediment in the conduits for cleaning by the applicant.
- (xi) On completion of the development construction and prior to the issue of the Subdivision Certificate/Occupation Certificate, work-as-executed plans shall be submitted to Council for consideration. These plans shall be prepared by a registered surveyor and shall indicate the as-constructed pit and conduit sizes and conduit invert RL's at each pit. The information shall be indicated in red on the approved construction plans and shall be lodged in PDF format. The Registered Surveyor shall sign and date each plan.
- (xii) On completion of the development construction and prior to the issue of the Subdivision Certificate/Occupation Certificate, the following asset details shall be submitted to Council for consideration, in Excel format:

For each pit

- Pit code as per the work-as-executed plan.
- Pit type and lintel size.
- Total value to the nearest \$1,000.
- Construction date – month and year.
- Built by (contractor's name).
- Street name where applicable.
- Grate RL (AHD).
- Invert RL (AHD).

For each conduit

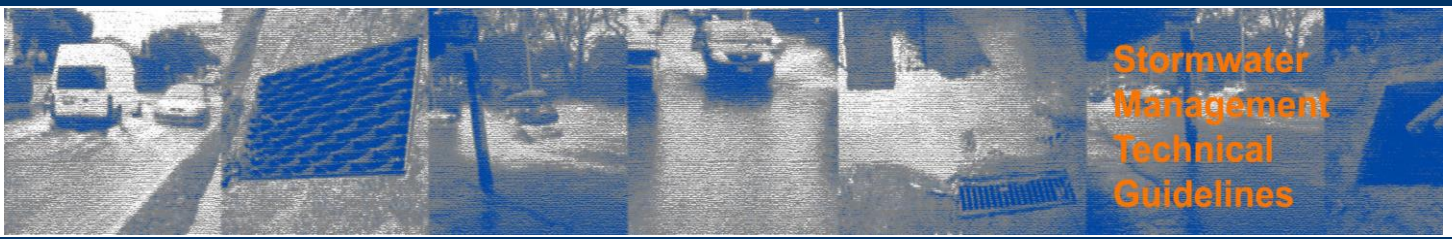
- Line code as per the work-as-executed plan.
- Description – type, eg RCP, FRC, RRJ, box culvert, open channel, etc.\
- Size (mm).
- Length (m).
- Total value to the nearest \$1,000.
- Construction date – month and year.
- Built by (contractor's name).
- Street name where applicable.



14. Design & Construction of Inter-Allotment Stormwater Drainage System

The inter-allotment drainage system shall be designed and constructed in accordance with the following:

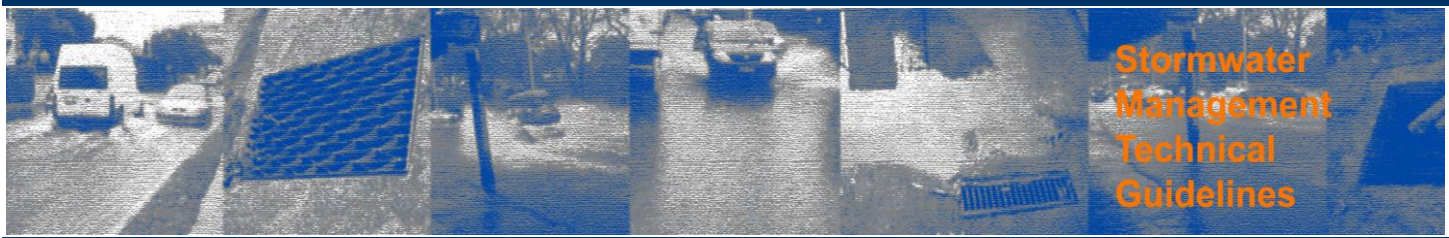
- (i) A written agreement to the creation of the easement and the construction of the inter-allotment drainage line from all affected property owners shall be submitted as part of the documentation of development application.
- (ii) The inter-allotment drainage system shall accommodate runoff generated from all roof areas of the development based on a 1% AEP design storm events (to allow for box gutter design storm frequency in accordance with AS/NZS 3500.3 Table 3.1).
- (iii) The pipeline shall be minimum of 150mm diameter, and UPVC – sewer grade.
- (iv) Provide a 600mm x 600mm concrete pit (precast or cast in-situ) at each bend of 90° or greater, and at the road alignment (within the property) prior to entering the Council system. The pits shall have a concrete lid (not grated, unless the system has been designed for overland flow). If the pit is >1.0m deep, corrosion resistant step-irons shall be provided.
- (v) For a bend < 90°, provide a UPVC bend with a screw capped cleaning eye to the finished surface on the downstream side of the bend.
- (vi) The cover of the pipe shall be in accordance with AS3500.3
- (vii) On completion of the development construction and prior to the issue of the Subdivision Certificate/Occupation Certificate, work-as-executed plans and compliance certificate shall be submitted to Council. The requirements shall be in accordance with Section 14 of this guideline.
- (viii) On completion of the development construction and prior to the issue of the Subdivision Certificate/Occupation Certificate, a CCTV survey and report shall be submitted to Council to ascertain if any damage has occurred to the newly laid stormwater conduits.



15. Car Wash Requirements

For multi-unit residential developments, carwash bays shall be designed to comply with the following:

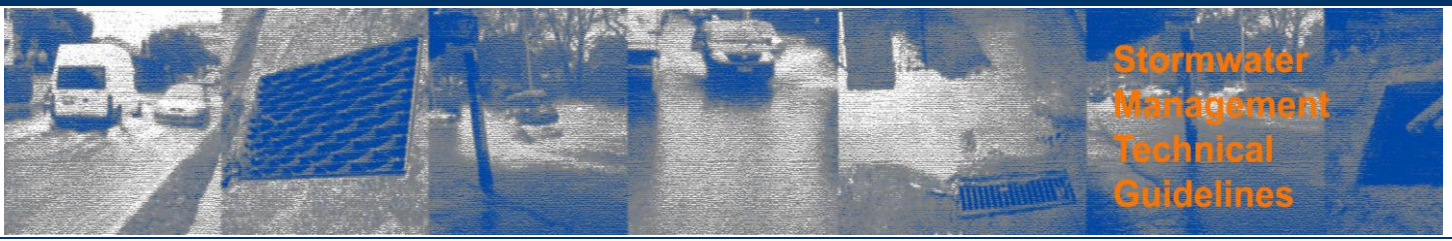
- (i) The car wash bay shall be situated so that the runoff from this area does not enter the site's stormwater system and
- (ii) The car wash bay area shall be bunded and undercover with a direct discharge to the sewer in accordance with Sydney Water requirements.



16. Stormwater Quality Improvement Devices (SQID)

Stormwater Quality Improvement Devices (SQID) shall be provided to all developments, except for alterations and additions and residential developments with less than 20 dwellings. The stormwater quality improvement devices shall address the following:

- (i) Prior to stormwater discharge from the site into the public drainage system, all stormwater runoff generated from the site shall pass through Stormwater Quality Improvement Devices (SQID) (e.g. Gross Pollutant Trap (GPT)) capable of removing litter and sediment and meeting the stormwater pollution reduction targets stated in “Botany Bay & Catchment Water Quality Improvement Plan (BBWQIP)” (2011), by Sydney Metropolitan Catchment Management Authority (CMA Sydney Metropolitan).
- (ii) Model for Urban Stormwater Improvement Conceptualisation (MUSIC) shall be used to demonstrate the stormwater pollution reduction targets stated in BBWQIP has been met. The MUSIC modelling shall be prepared in accordance with “Draft NSW MUSIC Modelling Guidelines”, dated Aug 2010 from CMA Sydney Metropolitan and its subsequent final version.
- (iii) Where on-site infiltration system is proposed, the location of Stormwater Quality Improvement Devices (SQID) shall be installed prior to the discharge into the infiltration system.
- (iv) Prior to the release of the Occupation Certificate and/or the Subdivision Certificate, restriction on use of land and positive covenant is to be established over the property (in favour of the Council) to ensure the SQID continued operation, protect from alteration and ensure regularly maintenance.
- (v) The Restrictions on Use of Land and Positive Covenants can be imposed either by submitting a suitable Request Form to the NSW Lands and Property Information under Section 88E (3) of the *Conveyancing Act 1919* or in conjunction with the registration of a plan showing the new lots to be created via Section 88B of the *Conveyancing Act, 1919*.
- (vi) Bayside Council shall be the authority empowered to release, vary or modify the restriction and the positive covenant. Standard wordings of the Section 88E (3) / 88B is available in **Appendix E**. Documentary evidence of registration of the instrument with the NSW Land and Property Information shall be submitted to Council and the Principal Certifying Authority.

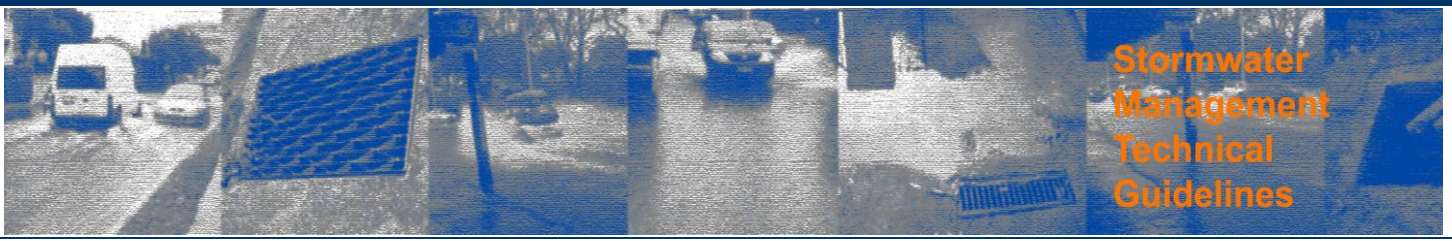


17. Developments Planning to Store Bulk Chemicals

The stormwater treatment device shall also have the ability to capture and contain any spills of bulk chemical liquids to ensure that polluted stormwater does not enter the site's stormwater system or absorption area/s.

All areas used for the storage and handling of bulk chemical liquids, automotive parts or any other materials which may potentially pollute stormwater shall be isolated from the site's stormwater system, located undercover, and bunded. Bunding shall be in accordance with the latest NSW Government guidelines.

The storage of hazardous and chemical liquids shall meet the latest requirements of the NSW Environmental Protection Authority and WorkCover Authority of New South Wales.



18. Special Site Constraints

Council has the right to vary the requirement on any particular site if it is deemed that the application of the Guideline is inappropriate.



Figure 2 - Typical Rainwater Tank Arrangement

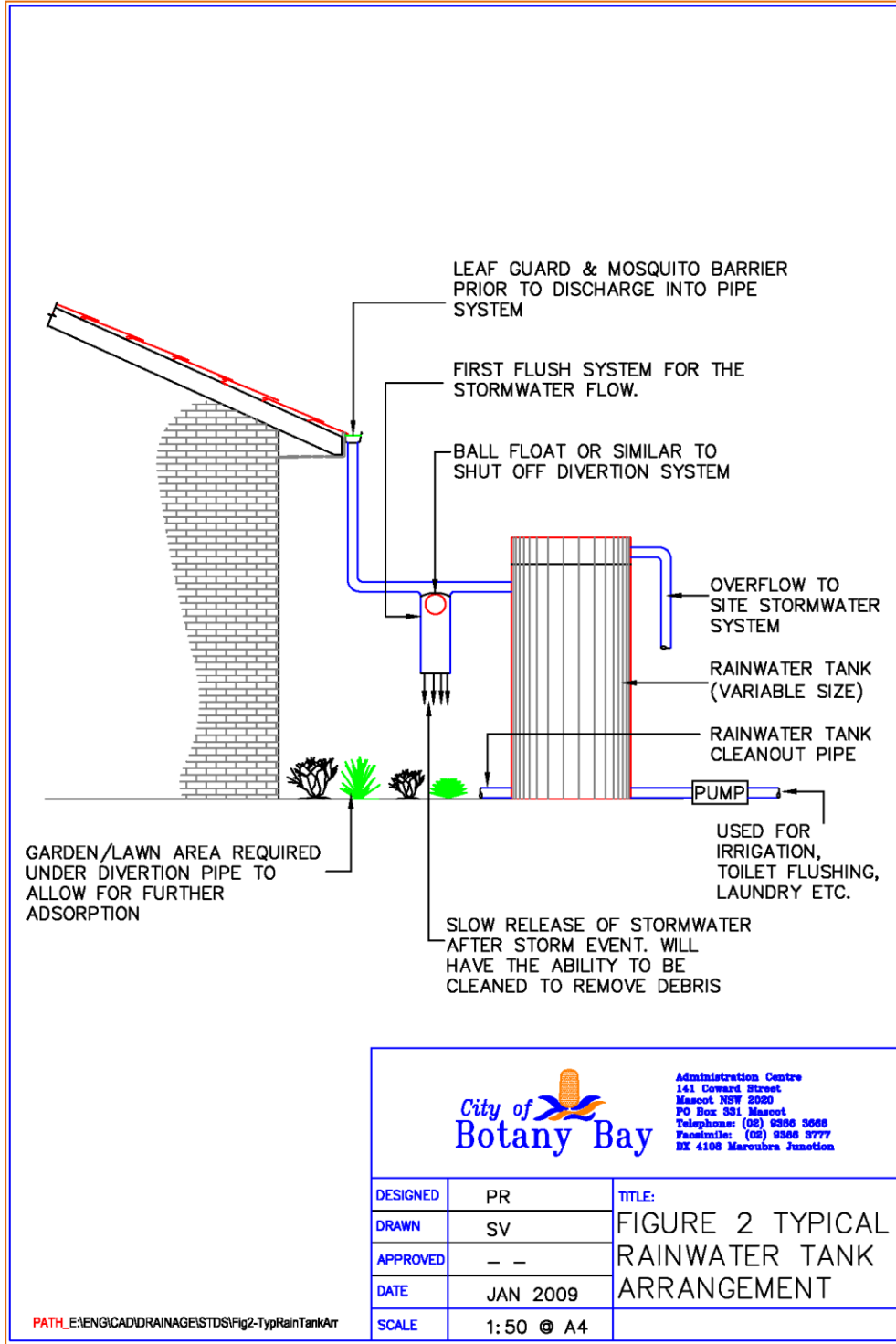




Figure 3 - Rainwater Tank Mains Water Top Up Arrangement

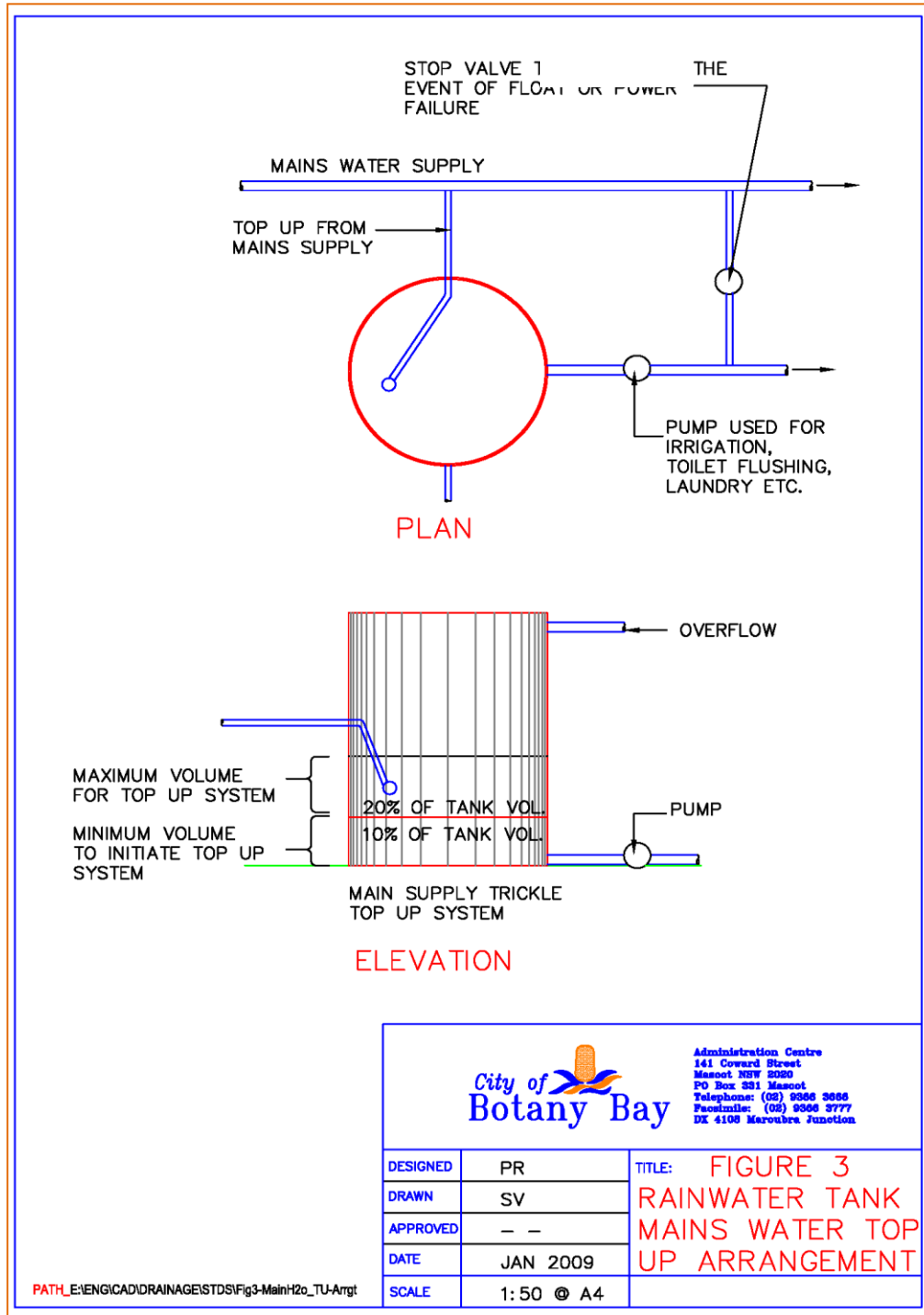
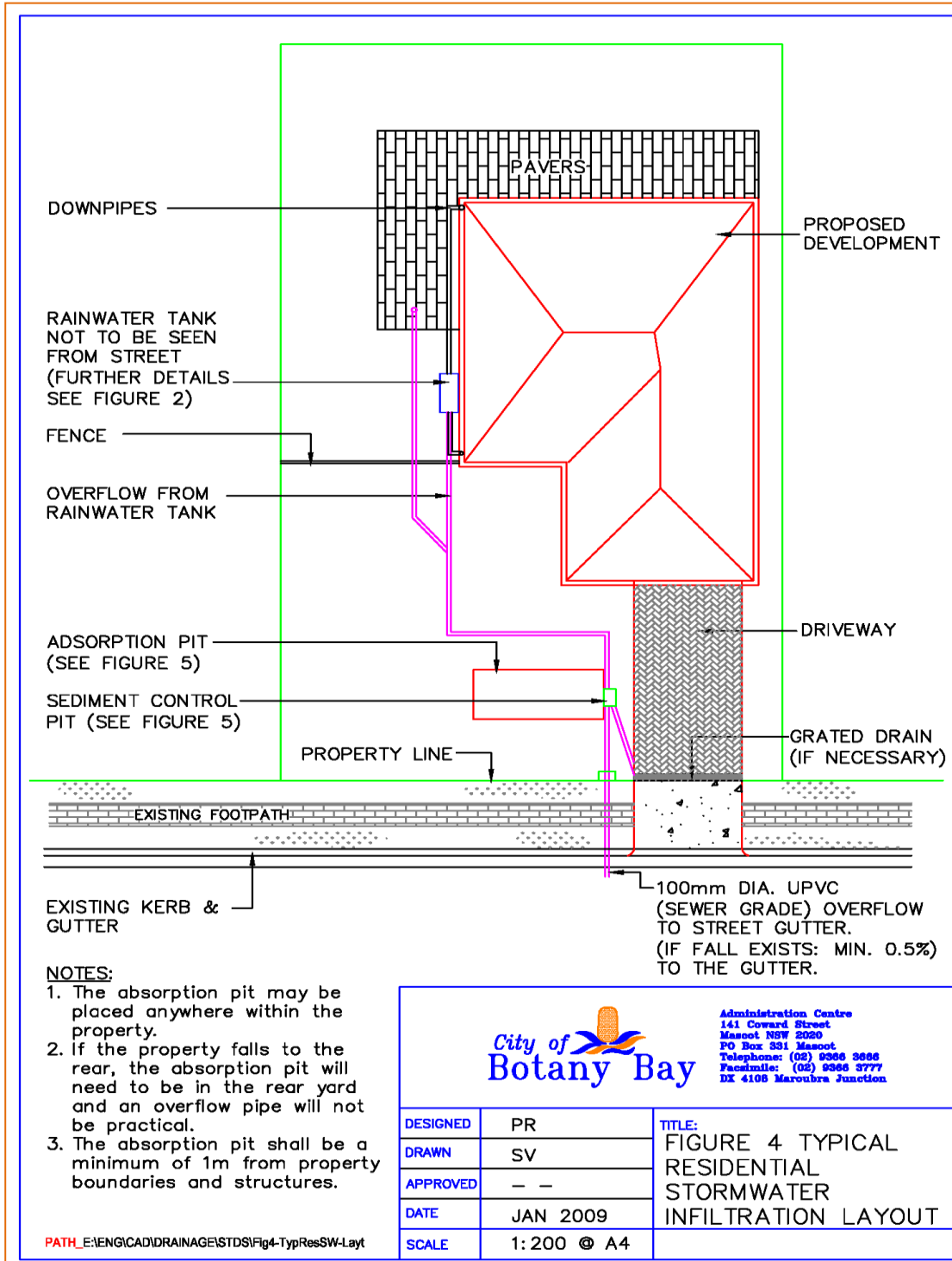




Figure 4 - Typical Residential Stormwater Infiltration Layout



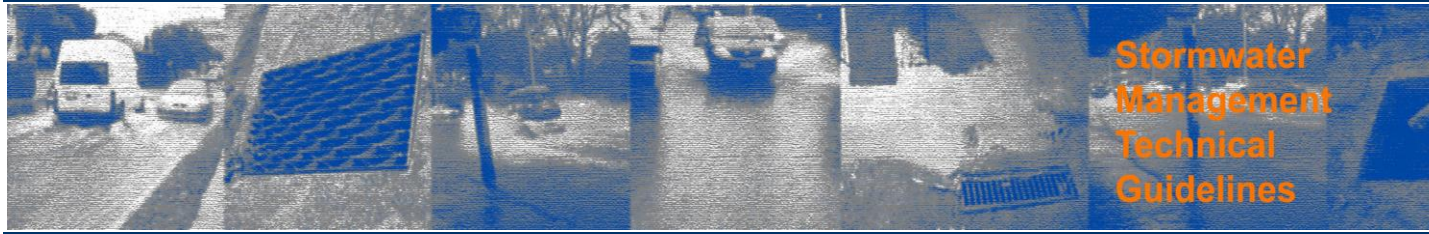
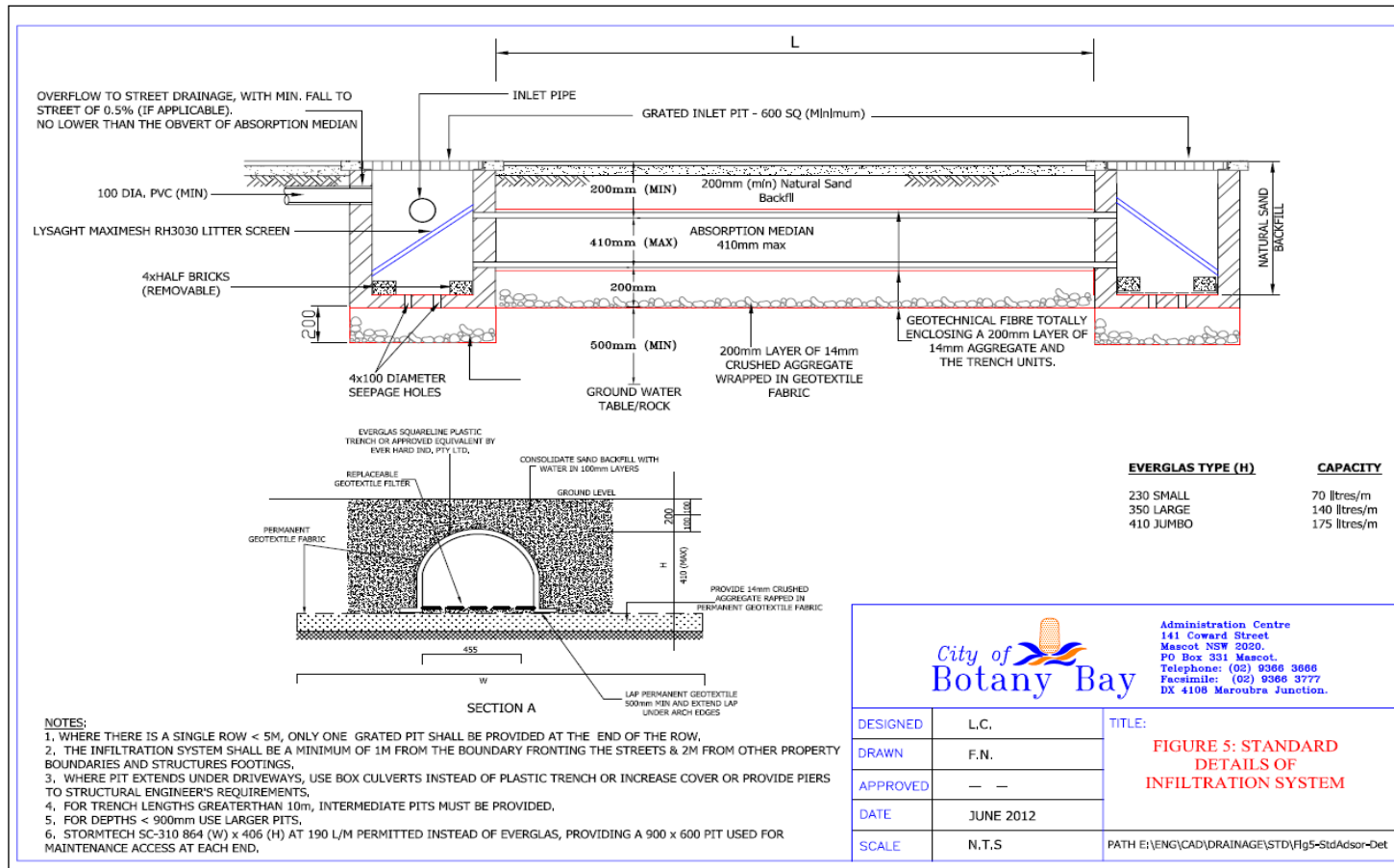


Figure 5 - Standard Detail of On-Site Infiltration System



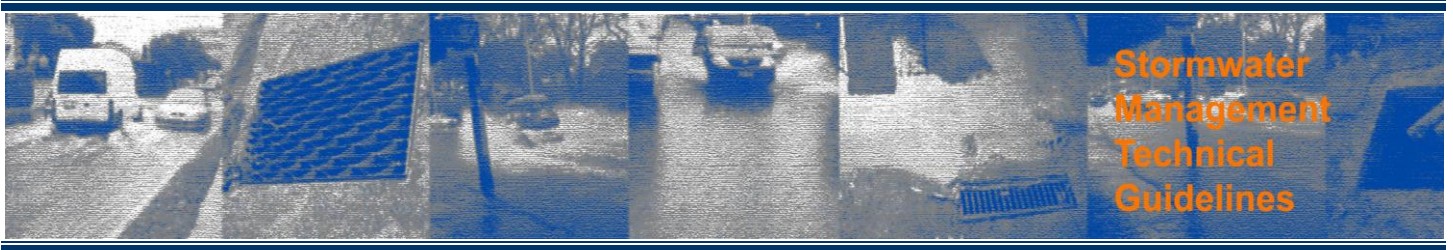


Figure 6 - Stormwater Storage Area Warning Sign



COLOURS:

- Water drops = BLUE
- Triangle and "WARNING" text = RED
- Figure (person + flood water) and remaining text .. = BLACK

141 Coward Street Mascot, NSW 2020 Tel: (02) 9366 3666 Fax: (02) 9366 3777		F I G U R E 6		
		Title: Stormwater Storage Area Warning Sign Scale: Not to Scale Date: 16 January 2009	Revision: A	Page: 1 of 1

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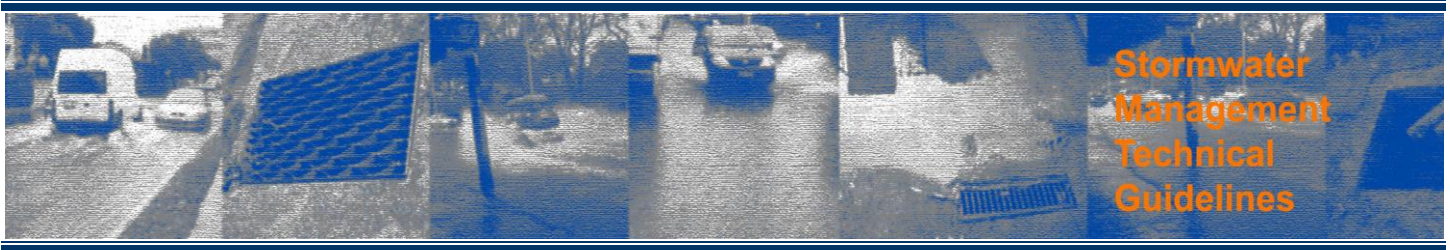


Table 1
Polynomial Coefficient for Bayside

LIST OF COEFFICIENTS TO EQUATIONS OF THE FORM

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

T = TIME IN HOURS (hr); I = INTENSITY IN MILLIMETRES PER HOUR (mm/hr)

LOCATION: BOTANY
33.950 S 151.200 E

ARI (years)	Coefficients						
	a	b	c	d	e	f	g
1	3.450829	-0.60147	-0.047551	0.0075509	0.0022228	-0.00018735	-0.00006682
2	3.711189	-0.5989	-0.050412	0.0077629	0.0024249	-0.00023127	-0.000064782
5	3.98348	-0.59183	-0.058185	0.0078707	0.0030706	-0.00028854	-0.000072136
10	4.115316	-0.58813	-0.06226	0.0079201	0.0034169	-0.0003156	-0.00007703
20	4.26477	-0.58499	-0.065882	0.0079189	0.0037526	-0.00033394	-0.000083778
50	4.43276	-0.58197	-0.069732	0.0082565	0.0040378	-0.0003935	-0.000081496
100	4.544805	-0.5797	-0.072266	0.0082876	0.0042588	-0.0004087	-0.000085394

N.B. For storms that are greater than the 1% AEP storm, or longer than 72 hour duration, data shall be obtained from the station nearest to Botany as depicted in the Australian Rainfall & Runoff.

(Compiled by the former City of Botany Bay Council and the Bureau of Meteorology)

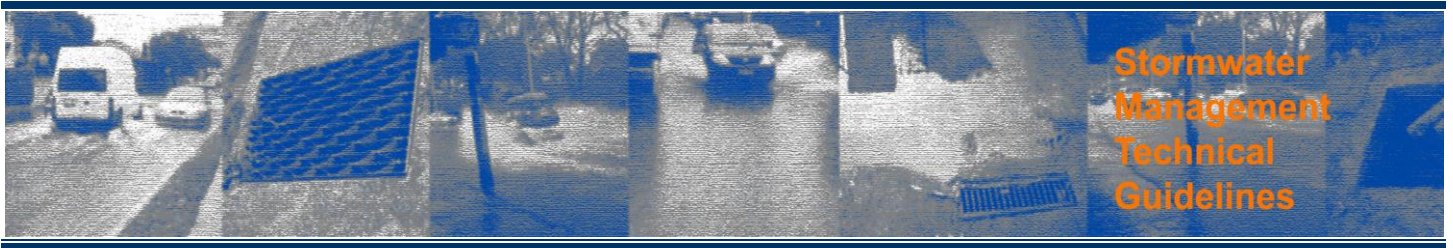
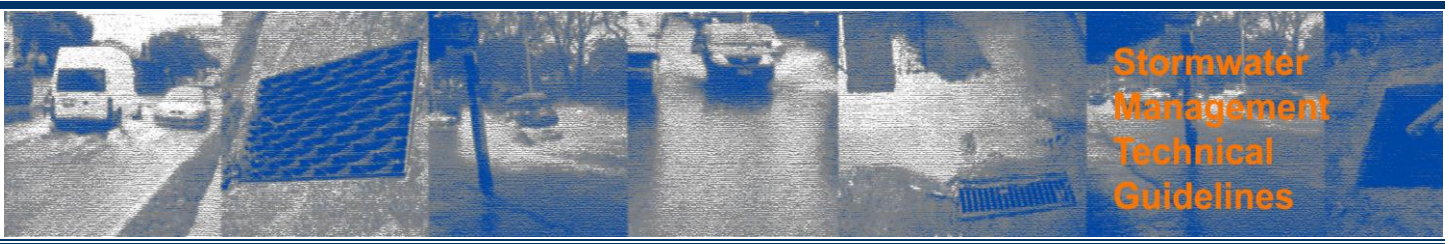


Table 2

Rainfall intensity in mm/hr for various durations and return periods

Duration	Average Recurrence Interval						
	1	2	5	10	20	50	100
5 (min)	101.8	130.1	164.3	183.6	209.6	243.2	268.5
6	95.2	121.7	153.8	172.0	196.4	227.9	251.8
7	89.8	114.9	145.5	162.8	186.0	216.0	238.8
8	85.3	109.2	138.5	155.2	177.4	206.2	228.1
9	81.4	104.3	132.5	148.6	170.1	197.9	219.0
10	78.0	100.0	127.3	142.9	163.7	190.6	211.1
12	72.2	92.7	118.5	133.3	152.9	178.4	197.9
15	65.5	84.2	108.1	121.9	140.2	164.0	182.1
20	57.3	73.8	95.4	107.9	124.4	146.0	162.4
25	51.3	66.2	85.9	97.4	112.6	132.4	147.5
30	46.7	60.3	78.6	89.2	103.2	121.6	135.7
35	43.0	55.6	72.6	82.5	95.6	112.8	125.9
40	39.9	51.7	67.6	76.9	89.2	105.3	117.6
45	37.3	48.4	63.4	72.2	83.7	98.9	110.5
50	35.1	45.5	59.7	68.1	79.0	93.4	104.4
55	33.2	43.1	56.5	64.5	74.8	88.5	99.0
60	31.5	40.9	53.7	61.3	71.1	84.2	94.1
1.5 (hr)	24.5	31.8	41.9	47.8	55.6	65.8	73.6
2	20.4	26.4	34.8	39.7	46.1	54.6	61.1
3	15.6	20.2	26.5	30.2	35.1	41.5	46.4
4	12.8	16.6	21.8	24.8	28.8	34.0	38.0
6	9.8	12.7	16.5	18.8	21.8	25.7	28.7
9	7.5	9.7	12.6	14.3	16.5	19.5	21.7
12	6.2	8.1	10.5	11.9	13.7	16.1	18.0
18	4.8	6.2	8.1	9.2	10.6	12.5	13.9
24	4.0	5.2	6.8	7.7	8.9	10.4	11.6
36	3.1	4.1	5.3	6.0	6.9	8.1	9.0
48	2.6	3.4	4.4	4.9	5.7	6.7	7.5
60	2.2	2.9	3.7	4.2	4.9	5.7	6.4
72	1.9	2.5	3.2	3.7	4.2	5.0	5.5



APPENDIX A

Restriction on Use of Land for On-Site Infiltration System

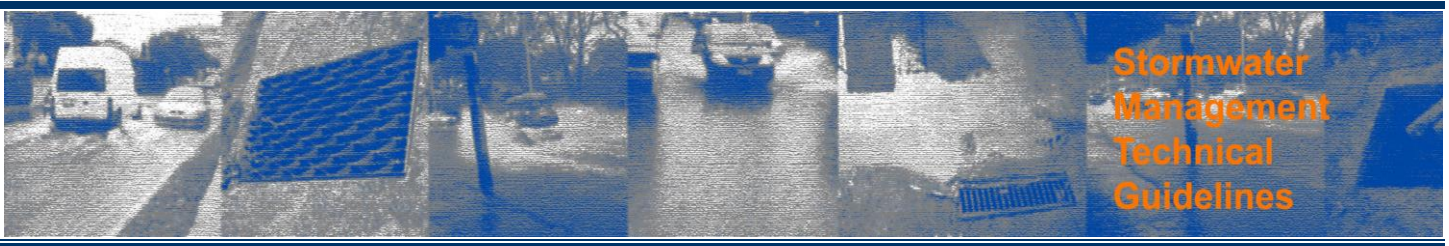
The registered proprietor(s) shall not make or permit or suffer the making of any alterations to any on-site infiltration system, which is, or shall be, constructed on the lot(s) burdened without the prior consent in writing of Bayside Council.

The expression “on-site stormwater infiltration system” shall include all infiltration units, ancillary gutters, pipes, drains, trash screens, pits, grates, tanks, chambers, basins, rainwater tanks (if an airspace “credit” is claimed against the storage volumes) and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to the temporary storage.

The on-site infiltration system is detailed on the plans approved by as Construction Certificate No., issued on under Development Consent No.

Any on-site infiltration system constructed on the lot(s) burdened is hereafter referred to as “the on-site infiltration system”.

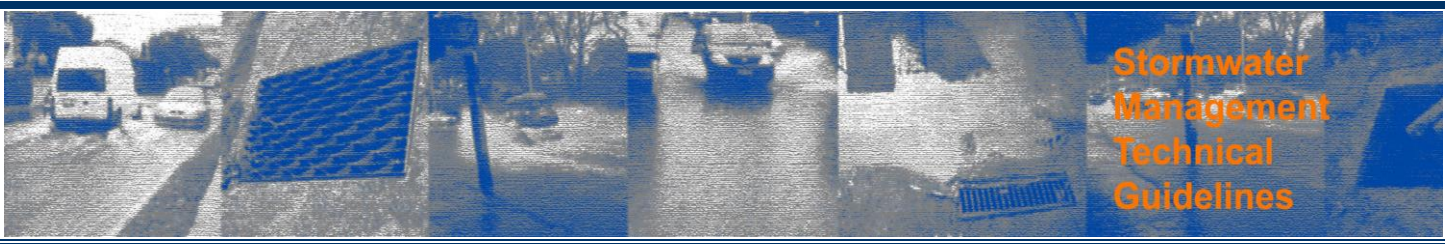
Name of Authority having the power to release, vary or modify the Restriction on Use of Land referred to is Bayside Council.



Positive Covenants for On-Site Infiltration System

1. The registered proprietor of the lot(s) hereby burdened will in respect of the on-site infiltration system:
 - a) keep the on-site infiltration system clean and free from silt, rubbish and debris;
 - b) maintain and repair the whole of the on-site infiltration system at the sole expense of the registered proprietors so that it functions in a safe and efficient manner;
 - c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
 - d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.
 - e) refer to the maintenance schedule as an appendix to items (a) and (b) mentioned above.
2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
 - a) 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 materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above; and
 - b) the Council may recover from the registered proprietor in a Court of competent jurisdiction:
 - (i) any expense reasonably incurred by it in exercising its powers under sub-paragraph (a) hereof. Such expense shall include reasonable wages for the Council's employees engaged in effecting the work referred to in (a) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
 - (ii) 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.

Name of the Authority having the power to release, vary or modify the Positive Covenant referred to is Bayside Council.



APPENDIX B

Restriction on Use of Land for On-Site Detention System

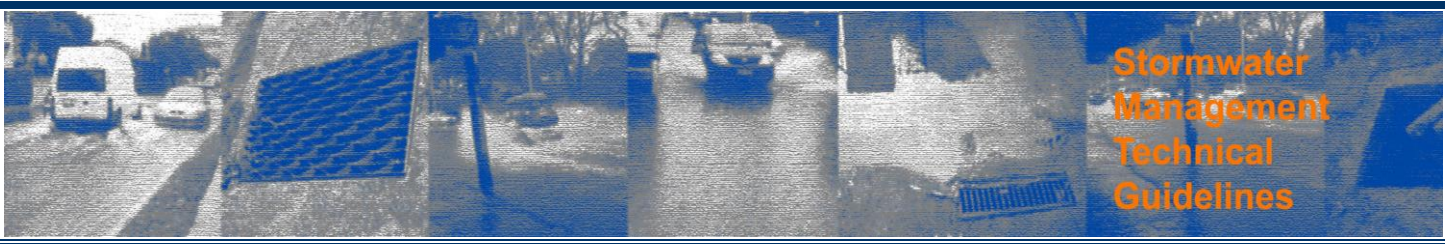
The registered proprietor(s) shall not make or permit or suffer the making of any alterations to any on-site detention system, which is, or shall be, constructed on the lot(s) burdened without the prior consent in writing of Bayside Council.

The expression “on-site stormwater detention system” shall include all ancillary gutters, pipes, drains, orifice plate, 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 as well as all surfaces graded to direct stormwater to the temporary storage.

The on-site detention system is detailed on the plans approved by as Construction Certificate No., issued on under Development Consent No.

Any on-site detention system constructed on the lot(s) burdened is hereafter referred to as “the on-site detention system”.

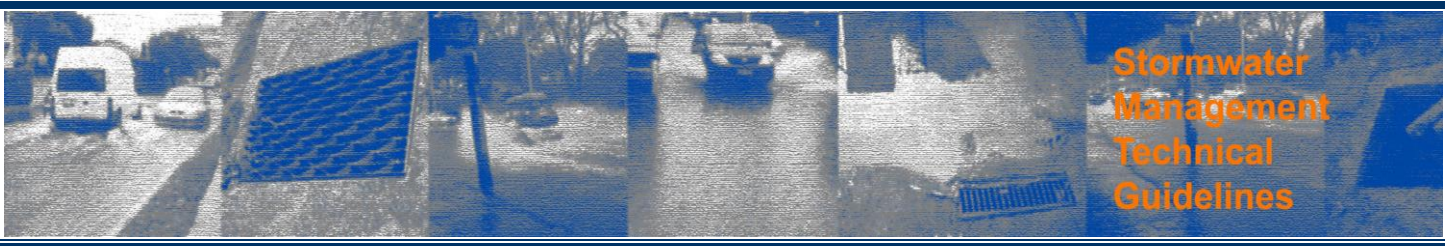
Name of Authority having the power to release, vary or modify the Restriction on Use of Land referred to is Bayside Council.



Positive Covenants for On-Site Detention System

1. The registered proprietor of the lot(s) hereby burdened will in respect of the on-site detention system:
 - a) keep the on-site detention system clean and free from silt, rubbish and debris;
 - b) maintain and repair the whole of the on-site detention system at the sole expense of the registered proprietors so that it functions in a safe and efficient manner;
 - c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
 - d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.
 - e) refer to the maintenance schedule as an appendix to items (a) and (b) mentioned above.
2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
 - a) 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 materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above; and
 - b) the Council may recover from the registered proprietor in a Court of competent jurisdiction:
 - (i) any expense reasonably incurred by it in exercising its powers under sub-paragraph (a) hereof. Such expense shall include reasonable wages for the Council's employees engaged in effecting the work referred to in (a) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
 - (ii) 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.

Name of Authority having the power to release, vary or modify the Positive Covenant referred to Bayside **Council**.



APPENDIX C

Restriction on Use of Land for Pump-out System

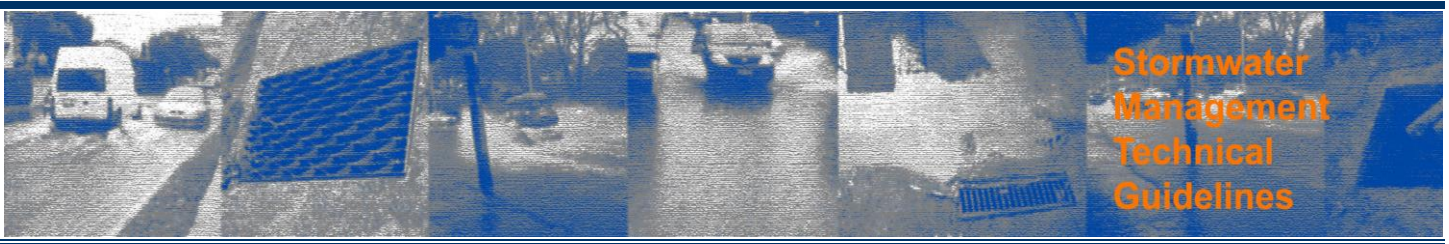
The registered proprietor(s) shall not make or permit or suffer the making of any alterations to any pump-out system, which is, or shall be, constructed on the lot(s) burdened without the prior consent in writing of Bayside Council.

The expression “pump-out system” shall include all ancillary pipes, drains, kerbs, pits, grates, tanks, chambers, and surfaces designed to temporarily detain stormwater as well as all surfaces graded to direct stormwater to the temporary storage.

The pump-out system is detailed on the plans approved by as Construction Certificate No., issued on under Development Consent No.

Any pump-out system constructed on the lot(s) burdened is hereafter referred to as “the pump-out system”.

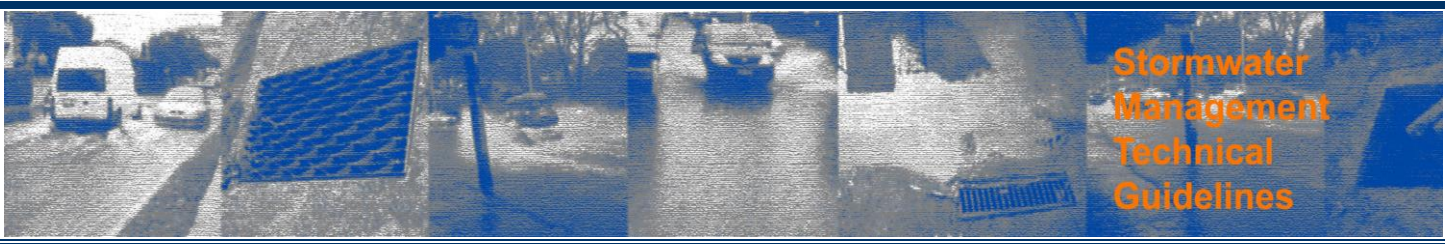
Name of Authority having the power to release, vary or modify the Restriction on Use of Land referred to is Bayside Council.



Positive Covenants for Pump-out System

1. The registered proprietor of the lot(s) hereby burdened will in respect of the pump-out system:
 - a) keep the pump-out system clean and free from silt, rubbish and debris;
 - b) maintain and repair the whole of the pump-out system at the sole expense of the registered proprietors so that it functions in a safe and efficient manner;
 - c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
 - d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.
 - e) refer to the maintenance schedule as an appendix to items (a) and (b) mentioned above.
2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
 - a) 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 materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above; and
 - b) the Council may recover from the registered proprietor in a Court of competent jurisdiction:
 - (i) any expense reasonably incurred by it in exercising its powers under sub-paragraph (a) hereof. Such expense shall include reasonable wages for the Council's employees engaged in effecting the work referred to in (a) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
 - (ii) 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.

Name of Authority having the power to release, vary or modify the Positive Covenant referred to is Bayside Council.



APPENDIX D

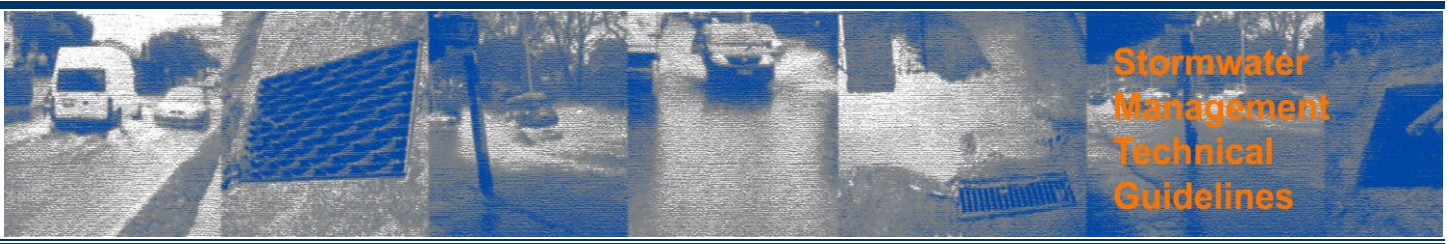
Restriction on Use of Land for Compensatory Flood Storage

The registered proprietor shall not make or permit or suffer the making of any alterations to any compensatory flood storage which is, or shall be, constructed on the lot(s) burdened without the prior consent in writing of Bayside Council.

The expression “compensatory flood storage” shall include all ancillary pipes, drains, walls, kerbs, pits, grates, tanks, chambers, basins, and surfaces designed to temporarily detain floodwater as well as all surfaces graded to direct floodwater to the temporary storage. The compensatory flood storage is detailed on the plans approved by as Construction Certificate No., issued on under Development Consent No.

Any compensatory flood storage constructed on the lot(s) burdened is hereafter referred to as “the flood storage”.

Name of Authority having the power to release, vary or modify the Restriction on Use of Land referred to is Bayside Council.

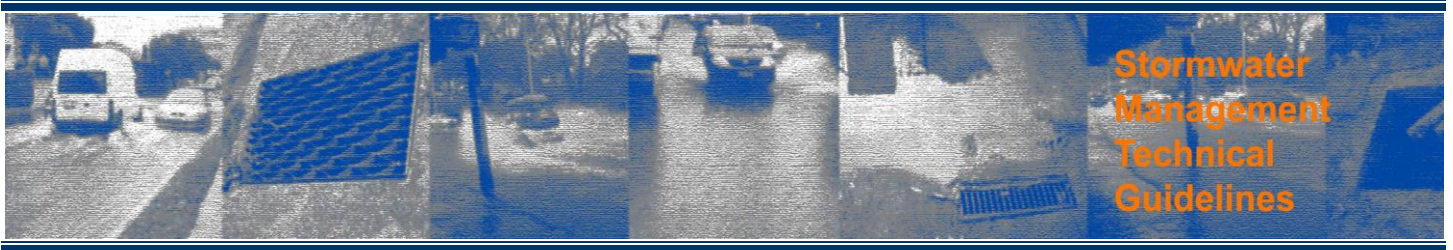


Positive Covenants for Compensatory Flood Storage

1. The registered proprietor of the lot(s) hereby burdened will in respect of the flood storage:
 - a) keep the flood storage clean and free from silt, rubbish and debris;
 - b) maintain the flood storage volume at the sole expense of the registered proprietors so that it functions in a safe and efficient manner;
 - c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
 - d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.

2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
 - a) 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 materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above; and
 - b) the Council may recover from the registered proprietor in a Court of competent jurisdiction:
 - (i) any expense reasonably incurred by it in exercising its powers under sub-paragraph (a) hereof. Such expense shall include reasonable wages for the Council's employees engaged in effecting the work referred to in (a) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
 - (ii) 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.

Name of Authority having the power to release, vary or modify the Positive Covenant referred to is Bayside Council.



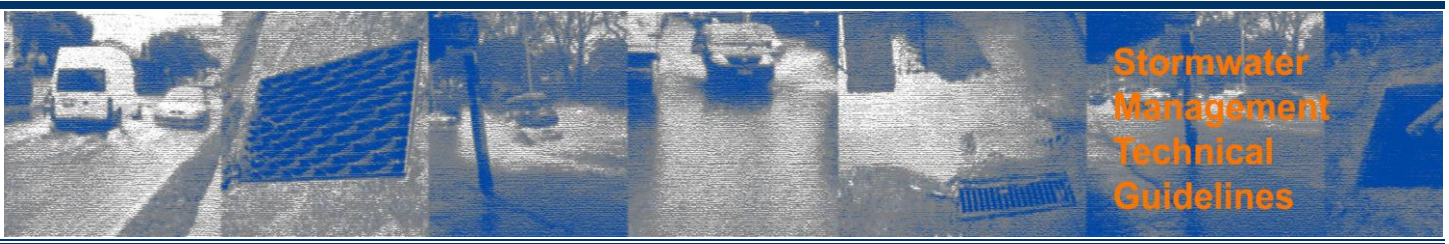
Restriction on Use of Land for Overland Flow Path

The registered proprietor(s) shall not make or permit or suffer the making of any alterations to the overland flow path, which is on the lot(s) burdened and identified in the report, prepared and certified by, Reference No., dated and approved under Development Consent No., without the prior consent in writing of Bayside Council.

The expression “overland flow path” shall include all ancillary pipes, drains, walls, kerbs, pits, grates and surfaces designed to convey the overland flow path through the site.

Any overland flow path on the lot(s) burdened is hereafter referred to as “the overland flow path”.

Name of Authority having the power to release, vary or modify the Restriction on Use of Land referred to is Bayside Council.

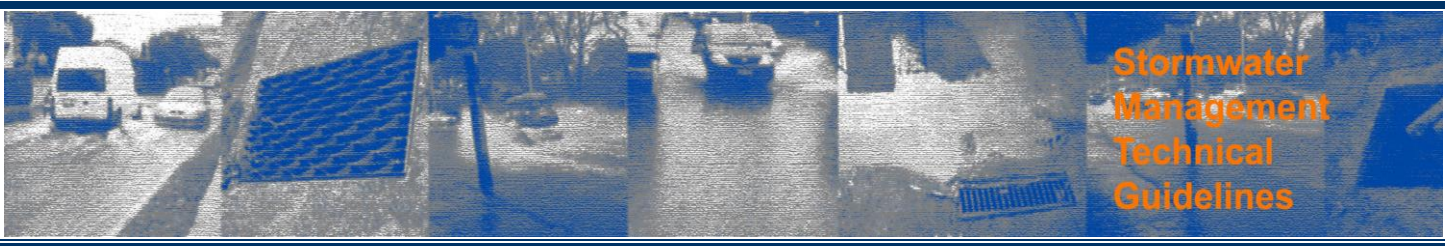


Positive Covenants for Overland Flow Path

1. The registered proprietor of the lot(s) hereby burdened will in respect of the overland flow path:
 - a) keep the overland flow path free from rubbish and debris;
 - b) maintain the overland flow path clear from any obstructions at the sole expense of the registered proprietors so that it functions in a safe and efficient manner;
 - c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
 - d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.

2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
 - a) 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 materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above; and
 - b) the Council may recover from the registered proprietor in a Court of competent jurisdiction:
 - (i) any expense reasonably incurred by it in exercising its powers under sub-paragraph (a) hereof. Such expense shall include reasonable wages for the Council's employees engaged in effecting the work referred to in (a) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
 - (ii) 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.

Name of Authority having the power to release, vary or modify the Positive Covenant referred to is Bayside Council.



APPENDIX E

Restriction on Use of Land for Stormwater Quality Improvement Device (SQID)

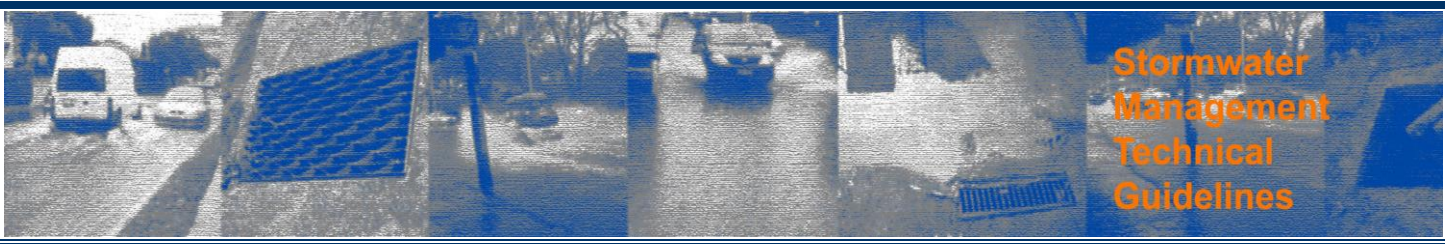
The registered proprietor(s) shall not make or permit or suffer the making of any alterations to any Stormwater Quality Improvement Device (SQID), which is, or shall be, constructed/installed on the lot(s) burdened without the prior consent in writing of Bayside Council.

The expression "Stormwater Quality Improvement Device (SQID)" shall include all devices and mediums that designed to treat stormwater as well as all ancillary pipes, drains, kerbs, pits, grates, chambers, basins and surfaces that direct stormwater to the Stormwater Quality Improvement Device (SQID).

The Stormwater Quality Improvement Device (SQID) is detailed on the plans approved by
as Construction Certificate No., issued on under Development Consent No.
.....

Any Stormwater Quality Improvement Device (SQID) constructed on the lot(s) burdened is hereafter referred to as "the device".

Name of Authority having the power to release, vary or modify the Restriction on Use of Land referred to is Bayside Council.



Positive Covenants for Stormwater Quality Improvement Device (SQID)

1. The registered proprietor of the lot(s) hereby burdened will in respect of the device:
 - a) keep the device clean and free from silt, rubbish and debris;
 - b) maintain and repair the whole of the device at the sole expense of the registered proprietors so that it functions in a safe and efficient manner;
 - c) permit the Council or its authorised agents from time to time and upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for the compliance with the requirements of this covenant; and
 - d) comply with the terms of any written notice issued by the Council in respect of the requirements of this covenant within the time stated in the notice.
 - e) refer to the maintenance schedule as an appendix to items (a) and (b) mentioned above.
2. Pursuant to Section 88F(3) of the Conveyancing Act 1919 the Council shall have the following additional powers:
 - a) 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 materials and equipment and carry out any work which the Council in its discretion considers reasonable to comply with the said notice referred to in part 1(d) above; and
 - b) the Council may recover from the registered proprietor in a Court of competent jurisdiction:
 - (i) any expense reasonably incurred by it in exercising its powers under sub-paragraph (a) hereof. Such expense shall include reasonable wages for the Council's employees engaged in effecting the work referred to in (a) above, supervising and administering the said work together with costs, reasonably estimated by the Council, for the use of materials, machinery, tools and equipment in conjunction with the said work.
 - (ii) 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.

Name of Authority having the power to release, vary or modify the Positive Covenant referred to is Bayside Council.