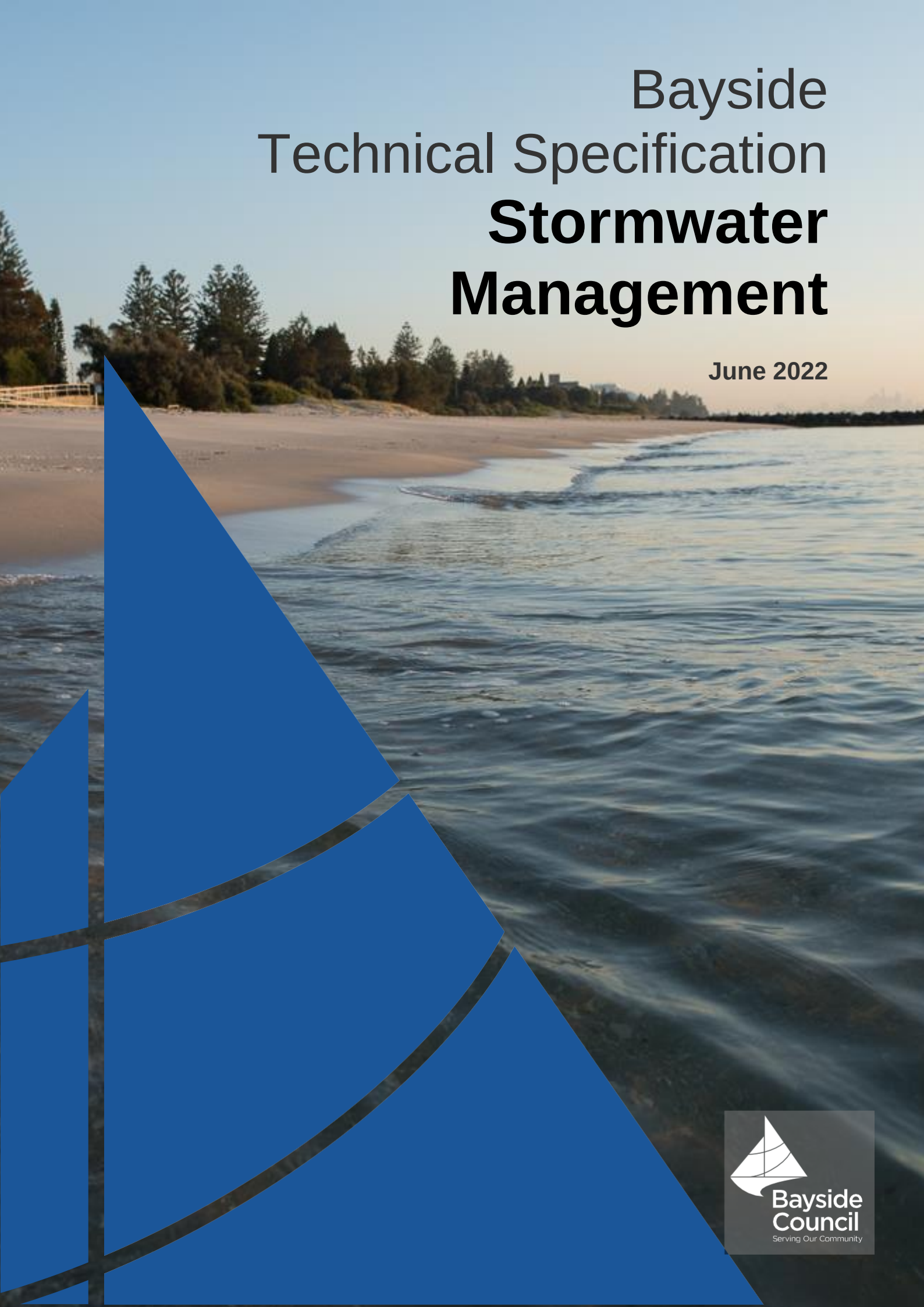


Bayside Technical Specification

Stormwater Management

June 2022

Bayside Council
Serving Our Community

Contents

1 Preliminary

The purpose of this Technical Specification is to provide detailed information in relation to the design and installation of stormwater drainage systems and their connections to the external stormwater network, as well as some other design considerations. This Technical Specification must be read in conjunction with Bayside Development Control Plan, any environmental planning instruments that apply to the land and the relevant Australian Standards.

1.1 Objectives

O1 To outline the technical requirements in relation to the provision, design, and installation of stormwater management systems within the Local Government Area (LGA) of Bayside Council.

O2 To provide clear understanding of the information and documents that must be submitted with the stormwater drainage plans.

O3 To manage the quality and quantity (flow rate and volume) of the stormwater runoff generated from the site into Council's drainage system.

O4 To minimise the impact of flooding to the natural environment and built-up areas.

O5 To contribute to environmental sustainability by encouraging water conservation through the reuse of stormwater runoff from roof areas for non-potable uses and, by incorporating Water Sensitive Urban Design (WSUD) principles into the design of the stormwater drainage system.

O6 To minimise run-off volumes and allow replenishment and recharge of groundwater.

O7 To prevent negative impacts of stormwater on public health and safety.

O8 To protect existing public stormwater drainage assets and provide drainage systems that integrates into Councils existing drainage network with minimal impact on existing users.

O9 To provide drainage systems that are low maintenance and long lasting.

1.2 Application of the Technical Specification and its Requirements

This Technical Specification shall be applied to the design and installation of stormwater drainage systems for development within the Bayside Council LGA. This Technical Specification applies to all development specified in State Environmental Planning Policy (Exempt and Complying Development Codes) 2008.

All developments (including redevelopments) are required to comply with the specification in full, for reference the following shall be followed:

(i) Development on land that falls to the rear (fall away from the street), compliance with section 4 is required.

(ii) Development located in an *absorption area* as per Appendix A, compliance with section 5 is required.

(iii) Development located in a *low absorption area* as per Appendix A, compliance with section 6 is required.

(iv) All development is required to comply with sections 2, 3, 7 and 8.

Except for the following developments which are only required to comply with Section 3 of this specification:

a) Subdivision of existing buildings (including boundary adjustments and consolidations of allotments) where no changes to the buildings or the site are proposed.

b) New swimming pool(s) where the surround and concourse of the pool is graded towards the pool and the pool location does not conflict with an existing stormwater system or Council's stormwater system.

c) Change of use where no physical changes to the outside of the property are proposed.

d) New developments in subdivisions where a stormwater management system (i.e., absorption and/or On-Site Detention System) has already been approved and provided for the entire subdivision.

1.3 Glossary

Absorption Area means an area with typically sandy soils of medium to high permeability that satisfies the nominal absorption rate requirements specified in Section 5. An indication of the Absorption Area is shown on Appendix A.

Absorption System means a device for temporary storage of stormwater, above or below ground, to permit infiltration into the soil, also called a retention/infiltration system.

Charged System means a system consisting of sealed PVC stormwater pipes and down pipes that provides for the discharge of roof water to a termination point (e.g., kerb outlet/water tank inlet) at a level that is higher than the ground level.

External Stormwater Drainage Network has the same meaning as Australian Standard AS/NZS3500.3.

Gravity Fed System means a system consisting of stormwater piping that provides for discharge to a termination at a level that is lower than all preceding inlet pits.

Inter-allotment Drainage System means a stormwater pipes that receives stormwater from two or more *Stormwater Drainage Systems* before connecting to the External *Stormwater Drainage Network*.

Low Absorption Area means an area that does not satisfy the nominal absorption rate requirements specified in Section 5. An indication of the Low Absorption Area is shown on Appendix A.

Low Level Driveway means a driveway that is lower than the front boundary level that leads to either a garage, a carport, or any other trapped low point where the depth of ponding will exceed 200 mm

Low Level Property means a property that is located in a low absorption area that has levels that grade away from the kerb and gutter and there is no Council pipe, inter-allotment drainage scheme or private drainage easement available.

On-Site Detention System has the same meaning as On-site Stormwater Detention from Australian Standard AS/NZS3500.3.

On-site Disposal System (as referenced by various State Environmental Planning Policies) has the same meaning as Absorption System.

Point of Connection has the same meaning as Australian Standard AS/NZS3500.3.

Rainwater Tank means a tank collecting and storing stormwater from non-trafficable roof areas, intended for reuse.

Roof Drainage System means the system for collection of stormwater on a roof and discharge to a surface drainage system, and includes the eaves gutters, box gutters, valley gutters, gutter overflows, and down pipes.

Stormwater Drainage System has the same meaning as Australian Standard AS/NZS3500.3.

Subsoil Drainage System means a trench filled with filter material or enhanced by using slotted pipes for the purpose of conveying subsoil water.

Surface Drainage System means the system for conveyance of stormwater from the roof drainage and stormwater collected from other areas to the discharge point, and includes stormwater drains, channels, inlets and other surfaces that convey overflows.

2 Design Documentation & Submission Requirements

This section sets out the minimum documentation standards for stormwater management plans.

2.1 Plans

Plans are the principal document in the design of stormwater management. There are two types of plans based on two levels of detail that are typically required through a development.

2.1.1 Stormwater Concept Plan

The Stormwater Concept Plan is the plan that supports a Development Application. The purpose of this plan is not to provide all the detailed design, but to identify the drainage constraints and to clearly demonstrate that the drainage system can be integrated into the site's overall water management and proposed layout.

The drainage system is an integral part of the entire development and can be expensive to retrofit once the site layout has been established. To avoid this developers and architects should involve their drainage designer(s) in developing the initial site layout.

a) Objectives of the Stormwater Concept Plan

   (i) Emphasise that the drainage requirements need to be considered, as part of an overall site water management plan, in the initial planning stages of the development.

   (ii) Ensure compliance with BASIX.

   (iii) Simplify the detailed design by identifying adequate areas for the drainage elements in the planning stage.

   (iv) Determine what WSUD components are required.

   (v) Reduce project costs by maximising the use of proposed landscape and architectural features as part of the drainage system.

   (vi) Assure Council that the necessary drainage requirements can be satisfactorily incorporated into the proposed development.

   (vii) Allow the cost of development consent conditions relating to drainage requirements to be determined at the planning stage.

   (viii) Assist in addressing the concerns of residents regarding drainage and flooding issues.

b) Minimum Requirements

   (i) Is drawn at a scale of 1:100, except for sites over 2000 m^2 where a scale of 1:200 or greater is permitted. The various drainage elements are to be drawn at a more detailed scale to assist in understanding.

   (ii) Includes a north point.

   (iii) Includes BASIX and/or rainwater tank requirements together with other WSUD details.

   (iv) Clearly indicates the size and location of the drainage elements including detention, or absorption as applicable.

   (v) Includes an amendment list to keep track of the various versions of the plans.

   (vi) Includes company name, postal address, email address, contact name and phone numbers.

2.1.2 Stormwater Detailed Plan

The stormwater detailed plan is the plan that supports a Construction Certificate or Complying Development Certificate. The purpose of the stormwater detailed plan is to finalise the design of all components of the drainage system, provide a set of plans and details for construction of the system, and detail the maintenance procedures necessary to ensure the long-term effectiveness of the system. This design will also ensure that all components of the drainage system are functional and, include structural certification for components of the drainage system.

2.2 Calculations

Calculations are required to support the information contained on the stormwater concept plan and the stormwater detailed plan. Calculation sheets for the design of on-site infiltration systems are included in Appendix C. Other types of calculation should be based on Australian Rainfall and Runoff (AR&R).

2.3 Certification

All designs for stormwater management are required to be certified for compliance against the standards outlined in this Technical Specification, as follows:

a) The stormwater concept plan must be accompanied by the Stormwater Concept Plan Certification and Stormwater Concept Plan Checklist.

b) The stormwater plan must be accompanied by the Detailed Drainage Design Certification and Detailed Drainage Design Checklist (identifying whether the design relates to a Construction Certificate, Subdivision Certificate or Complying Development Certificate).

Copies of standard forms for certification may be obtained from Council.

2.4 Qualifications and Accreditation

Minimum qualification and accreditation standards apply for the preparation of plans and certification of plans regarding stormwater management.

2.4.2 Additions to Single Dwellings & New Single Dwellings

The following are the minimum acceptable qualification and accreditation standards for the purpose of drainage design and certification for Additions to Single Dwellings & New Single Dwellings:

a) Graduate Membership of the Institution of Engineers Australia.

b) All those eligible under 2.4.3.

2.4.3 All Other Development

The following are the minimum acceptable qualification and accreditation standards for the purpose of drainage design and certification for development other than Additions to Single Dwellings & New Single Dwellings:

a) A Civil Engineer registered on the National Engineering Register (NER).

b) Professional Civil Engineer (MIEAust) (Engineers Australia).

c) Accreditation as an accredited certifier under the Environmental Planning and Assessment Act 1979 in the relevant discipline.

d) An engineer employed by Bayside Council.

2.5 Submission Requirements

Plans and documents as per sections 2.1, 2.2 & 2.3. Calculations can be provided as part of the stormwater plans for small-medium scale development. For large-scale high-density development, a supplementary report demonstrating how the stormwater plans comply with the technical specification is required.

Geotechnical information in accordance with Section 5.1 of this guideline for any on-site infiltration system or nominal absorption rate obtained from council shall be provided.

3 General Drainage Requirements

3.1 Introduction

Much of the Bayside Council local government area is underlain by sand, with soil permeability rates that are suitable for infiltration of stormwater. This enables stormwater to be discharged by absorption systems. As much of these same areas have significant flood problems, Council requires absorption to be used for all developments where practical (section 5). A guide to areas that are a suitable for absorption are shown in Appendix A. Where absorption is not practical other disposal methods are required.

The design and installation of stormwater drainage systems shall be in accordance with the relevant Australian Standards, primarily AS/NZS3500.3, except as varied by this Technical Specification. The variations contained in this Technical Specification are designed to ensure that the objectives of the DCP and LEP in relation to stormwater management are achieved. This section details the design and installation requirements for stormwater drainage systems, comprising roof drainage systems, surface drainage systems, and subsoil drainage systems. The Section also provides further details on the connection at the point of discharge.

3.1.1 General Standards for all Development Types

All development is required to provide a stormwater drainage system, comprising a roof drainage system(s), and a surface drainage system. Subsoil drainage systems shall be provided where advised by a suitably qualified competent person, such as a professional engineer, and be in accordance with the design requirements of this technical specification. A silt/litter arrestor pit is required for all development, except where the stormwater drainage system drains to an absorption system.

3.1.2 General Restrictions for Drainage Systems

The following general restrictions apply to the design of stormwater drainage systems, unless there are specific directions made elsewhere in this Technical Specification:

a. Absorption systems shall not be provided in the low absorption area (except where supported by a geotechnical report confirming a suitable absorption rate for the site) and shall not be provided on contaminated land that has not been remediated.

b. Pumped discharge drainage systems (pump-out systems) shall not be provided, except where specified and approved by Council for low density residential development (single dwelling houses, secondary dwellings, and dual occupancies) and other permissible locations.

c. Existing stormwater systems can be used only if they are functional and are in good working condition. 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/councils drainage system is required before existing stormwater systems can be connected to and re-used.

3.2 Connections

This section details the design and installation of discharge connections from a stormwater drainage system to the point of connection, with reference to Australian Standard AS/NZS3500.3.

3.2.1 Silt/litter arrestor pit

All developments in low absorption areas require a silt/litter arrestor pit fitted with a maximesh screen prior to discharge to the connection (kerb and gutter, Council pipe/pit or interallotment drainage scheme) in accordance with Figure SK001 of Appendix D. The maximesh screen should have an area 40 times the area of the discharge pipe. A silt/litter arrestor is not required where a detention system includes a maximesh screen at orifice control. The minimum size for an individual pit is 350 mm square. As the area draining through the silt/litter arrestor pit increases so does the size of the silt/litter arrestor pit.

3.2.2 Connection Design and Installation

The design and installation of connections shall comply with Australian Standard AS/NZS3500.3 except where specified below in sections 3.2.3 – 3.2.6.

3.2.3 Kerb and Gutter Connections

Connection to the kerb and gutter must be within 15 m of the property boundary and the discharge must be less than 50 l/s for the combined discharge of the entire development site for the 1% AEP storm event. For discharges greater than 50 l/s, the connection must be made to an underground stormwater system. Where multiple conduits are required across the footpath, the conduits shall be separated by a minimum of 150 mm at the kerb and provide a 150 mm gap at each end to ensure an integral concrete unit. The new kerb over the multiple openings shall be strengthened by a 10 or 12 mm galvanised reinforcing bar across the top of the openings centrally located. The discharge line is to be set at an angle of 45° to the kerbline for a minimum of 0.5 m from the kerb. Where the line extends in front of an adjoining property the line is to be within 0.5 m of and parallel to the kerb and access for cleaning (screw cap) provided at any bend greater than 40°. The use of sewer grade PVC is restricted to low density residential developments (single dwelling houses, secondary dwellings, and dual occupancies). Concrete restorations over the conduits in brick or sandstone kerbs are to be coloured to match the adjoining material. Size of conduits is as follows:

a. 150mm High Concrete Kerb and all Brick/Sandstone Kerbs. Drainage conduits across the footpath areas discharging to the kerb shall be:

   (i) sewer grade PVC pipe, maximum diameter 100 mm, The kerb outlet from the 100 mm PVC pipe shall have a plastic Kerb Adaptor Socket, either 150 mm wide by 55 mm high, or 130 mm wide by 60 mm high inserted in the kerb; or

   (ii) galvanised Rectangular Hollow Section (RHS), maximum 75 high, typically 125 x 75 (min 5mm thick).

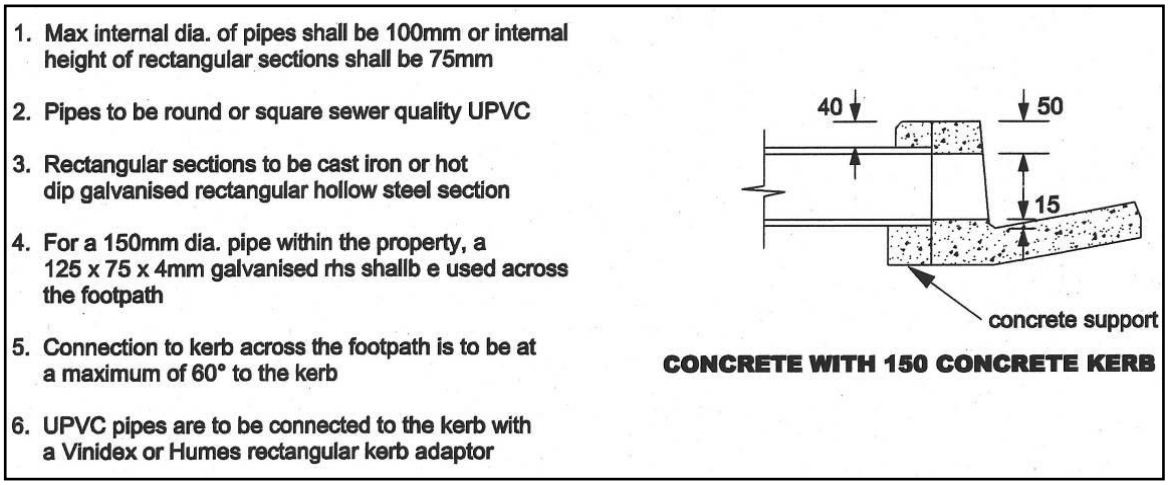


Figure 1 - Kerb and Gutter Connection

b. 200mm High Concrete Kerb. Drainage conduits across the footpath areas discharging to the kerb shall be:

   (i) sewer grade PVC pipe, maximum diameter 100 mm, directly connected to the kerb; or

   (ii) sewer grade PVC pipe, maximum diameter 150 mm. The kerb outlet from the 150 mm PVC pipe shall have a plastic Kerb Adaptor Socket, 150 mm wide by 100 mm high; or

   (iii) galvanised Rectangular Hollow Section (RHS), maximum 100 high (minimum 5 mm thick).

3.2.4 Council Stormwater Pipe Connections

This refers to direct connection to a Council pipe within the property, or a Council pipe in the street, and is referred to in Australian Standard AS/NZS3500.3 as a junction or cut-in. Direct connection into the Council pipe is only permitted where:

a. The diameter of the connecting pipe is 150 mm or less, and

b. Only one connection per property is permitted, and

c. The connection is made in accordance with Figure 2.

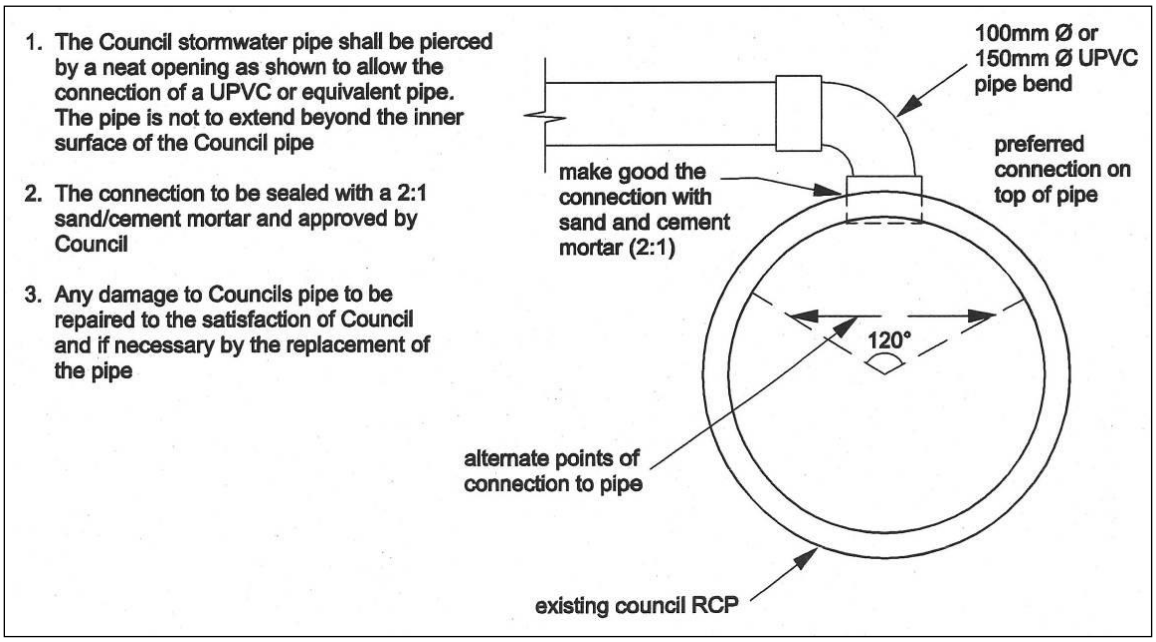


Figure 2 - Council Stormwater Pipe Connection

Where the diameter of the connecting pipe is greater than 150 mm diameter, or the connection cannot be made in accordance with Figure 2, a stormwater pit will be required to be constructed over the existing pipe to facilitate the connection.

3.2.5 Council Stormwater Pit Connections

This refers to connection to a Council pit located within the Council road reserve, or on public land. A Direct Connection to a Council stormwater pit is permitted except where:

a. The Council pit is further than 5 m away from the subject property boundary (1), or

b. The new inflow pipe flow exceeds 1/3 capacity of the existing Council pipe (2), or

Notes:

(1) Where connection to an existing pit greater than 5m away is necessary this requires an extension of the existing Council pipe system to outside the subject property and the construction of a Double Grated Gully Pit and lintel (typically 2.4 m overall, or as directed by Council) to connect the discharge pipe from the development into it.

(2) These connections may still be permitted; however, they require more detailed investigation to determine the impacts, or optimum pipe configuration. In some instances, the solution may require upgrading the Council pipes further downstream.

3.2.6 Inter-allotment Drainage System Connections

Connections to an inter-allotment drainage system require the construction of a junction pit over the inter-allotment drainage system pipe to facilitate the connection.

3.3 Roof Drainage Systems

The design and installation of the roof drainage system shall be in accordance with AS/NZS3500.3.

3.4 Surface Drainage Systems

This section details the design and installation of surface drainage systems. The design and installation of the surface drainage system shall be in accordance with AS/NZS3500.3, except as specified below.

3.4.1 Pits

a. Child proof J-Locks or similar shall be fitted to all pits deeper than 1 m and larger than 600 mm x 600 mm, and locks are encouraged to be fitted to the grates of the smaller size pits as well. Where the pit type does allow the use of J-Locks the grate is to be bolted down with removable elements that still allow reasonable access for maintenance. Step irons (synthetic preferred) are to be provided for pits deeper than 1.2 m.

b. The minimum internal dimensions for stormwater and inlet pits shall comply with Table 1.

Minimum Pit Size (mm)	Allowable Depth for Pit (m)
300 x 300	0.55
450 x 450	0.75
600 x 600	1
600 x 900	1.5
900 x 900	2
1200 x 1200	> 2

Table 1 - Minimum Internal Dimensions for Stormwater and Inlet Pits

c. Blocking factor (b_f) shall be 0.5 for the design of sag pits and 0.3 for the design of on-grade pits.

d. For podium areas exposed to rain the 250 mm x 250 mm Flo-way Gully top is recommended with the allowable minimum being the 150 mm diameter grate. Calculations are required to justify the size and spacing of all inflow grates in podiums allowing for a blocking factor of 0.5.

e. Trench grates shall comply with the following:

(i) Where the site falls to the street a trench grate is to be provided at the boundary across the driveway and any pedestrian paths.

(ii) To provide greater protection to low level garages, carports, or car parks the trench grate is to be a minimum of 300mm wide at the entrance to the structure.

(iii) Additional trench grates are to be provided for long driveways at maximum 20m intervals.

(iv) The trench grate style in areas subject to high pedestrian movements shall be designed to minimise tripping or conflicts with high heels. Where the available inlet area is reduced because of safety requirements the trench grate width is to be increased beyond the minimum to compensate.

(v) Trench grates in major residential, commercial, and industrial applications are to be bolted down and modified as necessary to reduce noise levels.

(vi) Pits located in roadways or on Council pipes shall be in accordance with Section 8.4. Pits located on Inter-allotment Drainage Schemes shall be in accordance with Section 8.5.

(vii) For a driveway with a maximum width of 5 m and a maximum driveway slope of 10%, the trench grate width shall be determined by Table 2. Smaller grate widths may be achievable in some circumstances however more detailed calculations would need to be supplied to account for inflow capacity and capacity of the trench to convey the flows. In addition, this table assumes uniform distribution of flows against the trench. Where driveway slope concentrates the flow at a particular location a larger inlet pit may be required to capture the flow in addition to the trench Grate.

Trench Grate Width (mm)	Maximum Contributing Area per m Length of Trench Grate (m^2)
100	9
150	14
200	21
300	30

Table 2 – Trench Grate Widths

3.4.2 Pipe Drains - General

a. Pipes shall be designed to convey the 5 minute 20 year ARI (5% AEP) design rainfall.

b. The minimum pipe size for single dwellings and residential buildings shall be DN 100. For all other development the minimum pipe size shall be DN 150.

c. Internal drainage system design for sites less than 3,000m^2 can be based on “pipes running full but not under pressure” unless there are backwater issues. Sites greater than 3000m^2 are to use Hydraulic Grade Line Analysis (HGL) for the internal drainage system.

d. The nominal method specified in AS/NZS3500.3 may be used for single dwelling developments but shall not be used for the design of pipe drains for all other developments.

3.4.3 Charged Pipe Systems

Charged pipe systems are a permitted method of stormwater discharge for low density development in areas that fall away from the street and are not suitable for absorption.

General Requirements for Charged Pipe Systems:

a. Where the boundary level is above any kerb within 15 m of the site or a Council pipe is available, the roof water is to drain by gravity from the boundary to the Council system via a silt/litter arrestor pit. Where a gravity discharge to the Council system is not viable the charged pipe may connect directly to the kerb.

b. Flap (reflux) valves are to be installed on the outlet pipes from the charge system that discharge to the silt/litter arrestor pit to minimise mosquito nuisance.

c. The lowest level of the charged system shall drain by gravity to a small inspection pit (350 x 350 mm min) with sump for cleaning. There shall be a minimum of one metre of pipe from the last downpipe to the inspection pit. The connection to the pit is to have a sealed screw cap to allow for periodic cleaning and removal of rubbish. The cap is to have a 5 mm dribble hole to allow trapped water to discharge slowly. See Figure 3.

d. Only sewer grade PVC or pressure pipes are to be used to convey charged flows.

e. All pipes and downpipes are to be sealed to a minimum of 0.5 m above the maximum water level in the system. The system shall be pressure tested prior to backfilling. The use of exposed pipeline shall be minimised.

f. All gutters must have leaf gutter guards installed and undertake regularly cleaning of the downpipes to ensure effectiveness of the system.

Requirements for Charged Pipe Systems for Roof Systems:

g. The eave gutter level shall be a minimum of 0.8 m and preferably 1.5m above the higher of the top of the kerb outlet or the top storage level (e.g., Rainwater Tank). Where the height is between 0.5m and 1.5m an analysis of head losses shall be provided.

Requirements for Charged Pipe Systems for Aboveground Rainwater Tanks:

h. The overflow from the rainwater tank is to be a minimum of 0.5m and preferably 1.5m above the top of the kerb outlet. Where the height is between 0.5m and 1.5m an analysis of head losses shall be provided.

i. The inlet pipes from the roof system to the rainwater tank may enter directly, or through a charge system. Where a charge system is used each line will have a cleanout pit.

j. Flap valves are to be installed on the inlet pipes to the rainwater tank from the charge system to minimise mosquito nuisance.

k. The design and installation shall comply with HB 230 - Rainwater Tank Design and Installation Handbook.

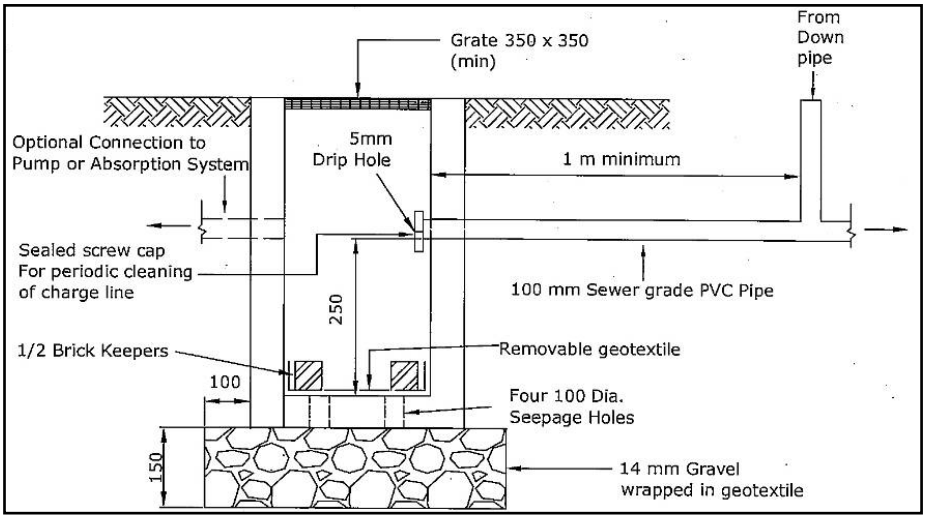


Figure 3 – Charged Pipe Cleanout Pit

3.4.4 Internal Overland Flow

This section applies to flows generated from within the site and does not apply where the site is subject to external overland flows (e.g., flooding). Particular attention is to be directed to 'L' or 'U' shaped developments that may trap surface flows. Though the pipe system is designed to convey the 5 minute 50 year ARI (2% AEP), an overland flow path is required to convey flows in excess of the 2% AEP design standard, or where the pipe drains are blocked. Development is required to comply with the BCA/NCC regarding prevention of stormwater entering a building. To assist in achieving this requirement, all habitable floor levels are to be a minimum of 200 mm above the ground level. Design of flow routes is to ensure that:

a. The route that the flow takes is to be designed to cater for the 1% AEP flow, either through pipes, or as surface flows, or a combination of both. The water level of surface flow routes and ponding at sag pits shall be at least 100 mm below the floor level of any adjacent building.

b. The applicant shall not concentrate or divert overland flow onto, nor increase the hazard on a neighbouring property.

c. Provision shall be made for the harmless escape of overflows from on-site detention and on-site retention (absorption) systems, in the case of malfunction of the system, such as blockage of the outlet, or the exceedance of the design storm rainfall.

d. The design of flow routes and open channels to convey internal overland flows shall be checked for hydraulic capacity using the Equation 1 - Manning Equation.

$Q = 1000 \times (A / n) \times R^{2/3} \times S^{1/2}$

Where A = area of cross section (m^2)
R = Hydraulic radius (m) = A / WP
WP = wetted perimeter (m)
S = gradient (m/m)
n = manning roughness coefficient (1)
Notes:
(1) For the Manning Roughness Coefficient refer to Table 5.4.9 of Australian Standard AS/NZS3500.3:2018.

Equation 1 - Manning Equation

e. Where overland flows are directed towards private property the escape route for overland flow at boundaries shall be over a level weir to provide sheet flow. The length of weir shall be the downstream easement width (if available), or a minimum of 5m where there is no easement.

f. Equation 2 - Weir Equation is to be used to check emergency overflows and overland flow.

$Q = 1.67 \times L \times H^{1.5}$

Where Q = discharge (m^3/sec)
L = length of the weir (m)
H = depth of water flowing over the weir (m)

Equation 2 – Weir Equation

3.4.5 Overland Flow from Rear, or Side Neighbours

This Section applies to minor flows that enter a property from adjoining property. The extent of flow can only be determined by a catchment assessment and contour plan and an inspection of the drainage system on the adjoining properties. The requirements, in addition to the requirements specified in Section 2.4.4, are as follows:

a. Where there are minor surface flows from neighbouring properties these can be accepted into a properly designed internal drainage system and conveyed to the discharge point. It is essential however that these upstream flows are assessed, and the proposed development is protected from them. The storage or PSD requirements of an OSD system do not need to be increased due to minor upstream flows.

b. The habitable floor levels shall be the greater of 200 mm above finished ground level or 100 mm above the water surface level.

3.4.6 Installations near Buildings

This Section applies equally to the installation of pipe drains near / under buildings, and to the construction of buildings near / over existing pipe drain installations. Where the installation is a domestic pipe drain the installation shall comply with Australian Standard AS/NZS3500.3, or as specified by the Building Code of Australia. Where the installation is a Council or inter-allotment stormwater drainage pipe refer to Section 8.

3.5 Underground Structures and Subsoil Drainage Systems

The design and installation of subsoil drainage shall comply with Australian Standard AS/NZS3500.3. Refer to section 7.3 for more detailed groundwater requirements associated with the design of underground structures and subsoil drainage systems.

The provision, design, and installation of pumped systems for sites falling to the rear is subject to the requirements of Section 4.

The design of pumps for Driveways to Basement Garages and Underground Carparks must comply with AS/NZS 3500.3 (including calculation, sizing, and pump design), in any case the basement pump-out tank volume shall be not less than $3m^3$.

Covenants are to be established over the property (in favour of Bayside Council) to ensure the systems continued operation, protect from alteration, and ensure regular maintenance.

3.6 Car Parking Requirements

This section provides design details for car parking areas.

3.6.1 Oil/Sediment

Developments proposing 10 or more car parking spaces shall also incorporate into the drainage system a device capable of removing oil and sediment from the driveway and carpark stormwater run-off. The device shall be manufactured by a Quality Endorsed Company to the requirements of ISO 9001 and shall have a minimum oil storage capacity of 20 litres for every 10 car spaces proposed or part thereof. A cleaning and maintenance schedule is to be supplied with the Construction Certificate.

3.6.2 Carwash Bay Requirements

To reduce the impact of soapy water on receiving waters car wash bays provided as part of developments must be undercover and bunded in accordance with the relevant Australian standards (AS1940 & AS/NZS 4452). Car wash bays are either to directly discharge to the sewer in accordance with Sydney Water requirements or be designed to treat and re-circulate the car wash water with a proprietary treatment system maintained by the owner, or body corporate. Each car wash bay is to be covered, appropriately signposted, have a cold-water tap (typically connected to the rainwater tank) and a waterproof power outlet. Car wash bays are not permitted that discharge directly to the Council stormwater system, or to an absorption system.

3.7 Rainwater Tank Re-Use Systems

See section 7.2 for rainwater tank re-use design requirements including minimum volumes.

3.8 Subdivisions

This section applies to development that is primarily for subdivision under Torrens Title that result in the creation of additional allotments and does not apply to Strata Title Developments.

Absorption Areas:

Stormwater servicing of the new allotments from the subdivision will be adequately catered for by the future residential development on those allotments (using Absorption Systems), and there are no stormwater servicing requirements. Alternatively, an absorption system can be provided for the entire subdivision.

Low Absorption Areas:

Where the site falls to the street the stormwater servicing of the new allotments from the subdivision will be adequately catered for by the future development on those allotments, and there are no stormwater servicing requirements. Where the site is a low-level property, the allotments shall be provided with a private drainage

easement, so that future developments discharge by gravity fed stormwater drainage system. Refer to section 4 for more details on low level properties.

3.9 Other Authorities

This section deals with stormwater requirements in relation to other external authorities to Council.

a) Where a development incorporates a stormwater connection directly to a classified (state) road, the stormwater management requirements of this technical specification prevail.

b) Where a development is proposed to directly discharge to Sydney Water owned stormwater infrastructure (e.g., channel or pipe), the stormwater requirements of Sydney Water prevail, and Sydney Water shall be consulted for approval.

c) Where a development proposes to directly discharge to a rail line, the stormwater management requirements of managing rail authority prevail and the managing authority shall be consulted for approval (e.g., Sydney Trains or ARTC).

3.10 Post Construction Requirements

3.10.1 Construction Tolerance

The tolerance for construction in all development types is listed as follows:

Stormwater Aspect	Construction Tolerance
Pit size	-10% to + no limit
Grate size	-15% to + no limit
Pipe grade	-10% to + no limit
Rainwater tank volume	-5% to + no limit
Stormwater reuse volume	-10% to + no limit
OSD and OSR volume	-10% to + no limit
OSR base area	-10% to + no limit
Orifice diameter	-20% to + 5%
Design orifice depth	-15% to +15%
Freeboard to overland flow path/flooding	-30mm to + no limit, except as required by the BCA

Table 3 – Construction Tolerance

3.10.2 Work-As Executed Plans

Prior to the issue of the Final Occupation Certificate and/or Subdivision Certificate, Work-as-Executed (WAE) plans prepared by a Registered Surveyor shall be submitted to the Principal Certifier and Bayside Council. 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.

<u>On-Site Infiltration System:</u>

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

<u>On-Site Detention System:</u>

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 vale 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

3.10.3 Compliance Certificates

Compliance Certificates shall be submitted to the Principal Certifier and Bayside Council to confirm that the construction of stormwater drainage system, pump-out system, the stormwater re-use system, absorption system and on-site detention system have been completed in accordance with the approved design.

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:

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

3.10.4 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.

a) Type and procedure of maintenance:

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 all aspects of the stormwater system are located (infiltration trenches, pumps, tanks, permeable pavements, GPT's/SQID's and storages etc.) within the development.

- 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.
- What methods and procedures need to be followed to maintain the system.
- List manufacturers details.

b) Responsible parties to carry out maintenance:

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

c) Frequency of maintenance:

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:

- 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 six months.

4 Drainage of Low-Level Properties

Where a property falls away from the street, the flow of stormwater run-off that is generated by the impervious areas of this property may be directed towards a neighbour's property to the side or rear. With continuing development there is considerably more flow off these properties potentially causing increased impacts such as flooding, or damage to the neighbour's property and/or inconvenience. These flows need to be controlled. The objectives of this section are:

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

b) To manage the impact of stormwater runoff on Council's stormwater drainage infrastructure and ensure low level properties drain to their natural downstream catchment.

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

4.1 Application

This section applies to all types of developments and land uses where these properties fall naturally away from the street and cannot connect to a Council drainage system. Compliance with the requirements of other sections of this technical specification is still required for properties that fall away to the street. A number of the procedures outlined in this section may take some time to resolve and are outside Council's control. If these procedures were initiated as part of the development application process, they would cause undesirable delays to applicants and the development application process. Consequently, for all developments Bayside Council will not accept development applications for properties that fall away from the street unless the drainage plans are accompanied by either:

- The completed 'Drainage of Low-Level Property Checklist', where 'yes' has been answered to at least one of the questions on that list, with all attachments, or
- A letter from Bayside Council authorising lodgement.

4.2 Stormwater Discharge Design Procedure

The requirement for stormwater disposal is dependent on the type of proposed development or proposed land use for the property. Bayside Council is to be satisfied that all avenues of the first or preceding step have been exhaustively investigated and considers these avenues to be impractical or unviable, prior to consenting the property owner or developer to progress to the next step.

4.2.1 Low Density Development

This section includes: Single Dwellings, Secondary Dwellings, Outbuildings, Dual Occupancies, Semi-Detached dwellings (and other forms of low density development subject to agreeance with Bayside Council) including alterations and additions to those developments.

The following must be followed and addressed in the design of the stormwater management system for a development on this property:

STEP 1:

Bayside Council's **first preference** is for stormwater run-off to discharge into an on-site absorption system subject to the following:

i. The location of the site and its soil absorption characteristics indicate the on-site absorption system is appropriate for the property (refer to section 5), and

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

iii. The on-site absorption system will require the creation of a Positive Covenant and Restriction on Use of Land for the maintenance of the system.

Where the site is suitable for absorption exit this procedure and undertake the absorption design process detailed in Section 5. An indicative guide to areas suitable for absorption is in Appendix A. If Bayside Council

has advised that the area is unsuitable for absorption or if geotechnical testing results in a poor infiltration rate, subject to agreeance with Bayside Council, proceed to STEP 2.

STEP 2:

Where the means of stormwater discharge in STEP 1 is not available, connection of stormwater to an existing Bayside Council, Sydney Water or inter-allotment stormwater drainage line located within the subject site will be required if present, subject to the drainage line having sufficient capacity. Connection of stormwater to an existing inter-allotment drainage easement and pipeline subject to the property owner demonstrating the inter-allotment pipeline has sufficient capacity and the property owner having a formal drainage easement(s) created over the inter-allotment pipeline within the downstream property(s).

Alternatively, for sites that fall directly to a Bayside Council Park, Reserve, or Bushland, the use of gravity discharge to a level spreader to discharge stormwater into the reserve will be permitted subject to compliance with section 4.5.

If the above matters have been explored and found to be not feasible, proceed to STEP 3.

STEP 3:

The use of a charged line and pump-out system to drain roof and surface runoff to the kerb and gutter system fronting the site will be acceptable provided that the following have been addressed in the design of the stormwater management system for this property:

a) Use all available opportunities to discharge roof water to the street kerb and gutter via a charged system designed as per section 3.4.3.

b) Roof water runoff and surface areas which cannot be directed to the street with a charged system shall be directed to an onsite dual pump-out tank and pumped to the Street kerb in accordance with section 4.4.

c) Provision of an offline groundwater recharge trench from the pump out tank will be beneficial to reduce the pump use in smaller and frequent rain events and shall be included in the design. Overflow from the recharge trench can be directed to landscape areas to further reduce stormwater runoff. Figure 7 provides an example of this.

d) No concentrated flow is to be directed to the downstream properties.

e) All new impervious pathway and surface areas as porous surface to further reduce runoff in frequent rain events.

4.2.2 All Other Development (e.g., Medium to High Density Development).

For all other development for a land use other than stated in section 4.2.1 (i.e., medium & high density, development, multi-unit residential, boarding house/co-living, commercial, industrial, and mixed commercial/industrial/residential) stormwater disposal via a gravity fed pipeline will be required where these properties fall naturally away from the street.

Bayside Council will accept the use of an absorption system as the method of discharge subject to the following:

a) Soil absorption characteristics and other physical constraints indicate the on-site absorption system is appropriate for the property (refer to Section 5), and

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

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

If the site is not suitable for absorption, stormwater disposal from the site must be via a new gravity fed pipeline to either of the following:

I. Gravity discharge to an existing Bayside Council owned (or owned by another authority e.g., Sydney Water) stormwater drainage infrastructure located within the subject site, subject to the drainage line having sufficient capacity.

II. Gravity discharge to an existing Bayside Council owned (or owned by another authority e.g., Sydney Water) stormwater drainage infrastructure located within an adjoining property or within a public road downstream (e.g., kerb and gutter/below ground pipe). This will require the construction of a private drainage pipe and the provision of an easement to drain water over the neighbouring land (in accordance with section 4.3) connecting to the stormwater drainage infrastructure. Noting there may be difficulties obtaining an easement through multiple properties, the property owner is to ascertain which adjoining downstream property(s) it may be feasible and practical to drain stormwater through, and then approach the owner(s) to request an easement be granted for the purpose of draining stormwater through their property. An application under Section 88K of the Conveyancing Act 1919 can be made to allow the Court to consider making an order to impose an easement over land if the easement is reasonably necessary for the effective use or development of other land that will have the benefit of the easement.

III. For sites that fall directly to a Bayside Council Park, Reserve, or Bushland, the use of gravity discharge to a level spreader to discharge stormwater into the reserve will be permitted subject to compliance with section 4.5.

Note: If no other method of stormwater disposal is feasible, development consent will not be granted.

4.3 Private Drainage Easements

Where a site falls away from the street and the site is not suitable for absorption, and there is no Council pipe or interallotment drainage scheme to connect to, or an approved alternative drainage system, then the preferred and best method is for the developer to negotiate for a private drainage easement and construct a private drainage line to allow for gravity discharge.

4.3.1 Requirements for Private Drainage Easements

a) Drainage easements are to be a minimum of 900 mm wide unless the existing building offset is less than this. In this case the absolute minimum easement width is 600 mm immediately adjacent to the building.

b) The easement pipe is to be designed to carry the unrestricted 1% AEP flow (without detention where detention is required) from all properties benefiting from it. This includes any intermediate properties that the pipe travels through.

c) The minimum pipe size is to be a 150 mm diameter PVC pipe. For pipe diameters greater than 225 mm the easement width is to be increased above 900 mm (see Section 8.4.1).

d) The last pit on the developing property before connecting into the private drainage line shall be designed to accept all pipe and surface flows (ignoring any detention if required) from the 1% AEP storm event. Where there is an above ground detention system adjacent to the last pit, the last pit is to be raised so that the grate level matches the storage level, and any weir overflow is set a minimum of 100 mm above this grate level.

e) Where the private drainage easement pipe discharges to the kerb and gutter in the street a grated pit is required just inside the front boundary of the burdened property to provide access for future maintenance and convert the easement pipe to multiple conduits, either 100 mm diameter sewer grade PVC, or 125 x 75 high (minimum 5 mm thick) galvanised RHS. Connection to the kerb is not permitted where the discharge is greater than 50 l/s for a 1% AEP storm event (see Section 3.2.3).

4.4 General Pump Requirements

For pump systems that are approved through section 4.2.1, the design shall be in accordance with AS/NZS 3500.3 except as follows:

a) The pump rate is to be determined by the design engineer for a wide range of storm durations.

b) The minimum clear internal height of the tank is to be 1 m.

c) A minimum of 100% of the required pump storage is to be below ground.

d) The rising main shall connect to a stormwater pit to achieve a gravity feed to the gutter. Where a gravity feed to the gutter is physically impossible the rising main shall connect to the gutter and be angled at 45 degrees to the gutter and the pipe enlarged across the footpath to a 100 mm diameter to minimise velocity and spray.

e) A positive covenant and restriction on use of land is required over the pump system to ensure long term maintenance.

f) The storage in the pump system shall be provided at the minimum rate of 3.6 m^3 per 100 m^2 of site area being drained.

g) The pump tank has sump (200mm to 500mm deep) and low-level outlet to a ground water recharge trench.

h) The impervious area (roof and surface) catchment draining to a pump-out system is to be limited to 200m^2.

i) Submission of a risk assessment in accordance with section 4.4.1.

4.4.1 Risk Assessment

Where pumps are to be used in accordance with section 4.2.1, a risk assessment must be undertaken by a suitably qualified and experienced person. Figure 4 outlines a suggested process for risk management.

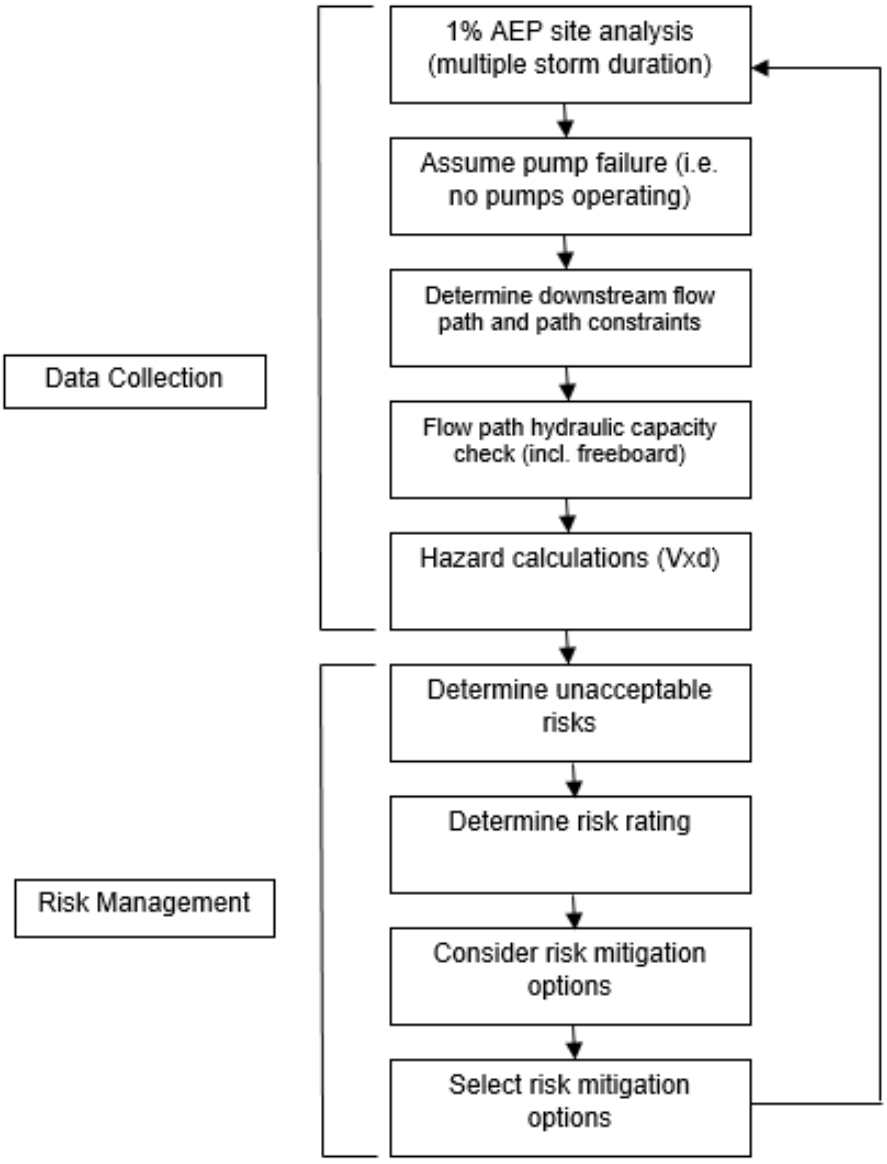


Figure 4 – Risk Management Process

This assessment shall assume pump failure and be based on the 1% AEP event with freeboard. The aim of the assessment is to identify properties that may be particularly vulnerable to even small local surface flows. This could include a lack of downstream escape routes or where natural or man-made features direct flows into dwellings or outbuildings. The applicable standard for risk assessment and management is ISO 31000: Risk Management-Principles and Guidelines. The risk assessment is to be in a report form and must accompany the drainage plans submitted to Council.

4.5 Sites Falling to a Bayside Council Park, Reserve, or Bushland

This section applies to areas falling to a Council Park, Reserve, or Bushland that are not suitable for an absorption system.

a) The stormwater is to discharge evenly to the park/reserve via a trough arrangement. The trough is to be fully contained within the property for future maintenance access and is to be a minimum of 0.2 m wide and 0.15 m deep. The base of the trough shall have 100 mm seepage holes filled with geotextile at 1 m centres connected to a gravel seepage system set below natural ground level that will allow the trough to drain after the storm has finished. The discharge from the upstream drainage system is to first go through a silt/litter arrestor pit and should connect towards the middle of the trough through a 'T' fitting to minimise spill and concentrated overflow. The typical trough arrangement is detailed in Appendix D drawing SK013.

b) A pump may be required where the risk (sensitivity to scour, impact of pollutants, etc.) to the park, bushland or reserve is too great to allow continual discharge through a trough. Pumps (where required) are to have the site discharge directed to a silt litter arrestor pit and then a groundwater recharge trench (see figure 7). Pump storage is to be provided at the minimum rate of 3.0 m3 below ground (or 3.6m3 above ground) per 100m2 of site area that cannot be drained by charged line, or gravity to the street. Higher storage requirements may apply to more intense use developments such as dual occupancies and above. Minimum 40% of the storage is to be below ground. The silt litter arrestor pit is to be located as close to the rear low point to collect as much of the site flow as possible and the pump sized accordingly for the 2% AEP. The level of the access grate to the pumps is to be a minimum of 150 mm below the level of the emergency overflow weir. For general pump requirements see section 4.4.

c) Where pumps are required and where practical, direct the majority of roof water to the street via a gravity, or charged system and if applicable an onsite detention system.

d) A level weir, 100mm above the pump storage / OSD discharge pit grate level, is to be provided across the majority of the property where the cross-slope is relatively level, or a minimum of 6 m long in steeply sloping blocks, to minimise downstream scour.

e) A minimum 50 mm gap is to be provided between the weir overflow and the underside of the rear fence.

4.6 Surface Pavement Requirements

For sites that fall to the rear, the excessive use of impervious surface pavement is not permitted, and deep soil landscaping must be maximised. Any surface pavement used shall be porous (e.g., permeable pavement/pavers) to the satisfaction of council. Porous pavement is detailed further in section 7.4.

5 On-Site Absorption Systems

On-site stormwater absorption (also known as on-site retention and infiltration) shall be used as the **FIRST** stormwater disposal method where possible for all developments (except industrial developments), regardless of whether the site falls to or from a public road. On-site stormwater retention aims to retain stormwater on the site using an absorption/infiltration system and is applicable to sites that have typically sandy soils with acceptable permeability rates. The *Botany Bay Sand Aquifer*, generally identified in Appendix A, is indicative of sand strata through the Council area and is a general guide to locations suitable for absorption systems.

5.1 Establishing the Nominal Absorption Rate

For additions to single dwellings or the construction of new single dwellings, Bayside Council can supply a Nominal Absorption Rate (AR_n). For all other developments, and for sites where Bayside Council does not have any/enough geotechnical data, the Nominal Absorption Rate shall be determined by a geotechnical engineer, and compiled into a report, in accordance with the following;

a. The Nominal Absorption Rate, in the unit's litres/square metre/sec ($L/m^2/s$), shall be determined at each proposed absorption system location with a recognised falling head or constant head test (a double ring infiltrometer is preferred). The sand shall be fully saturated when the test is carried out. The test shall be repeated until there is less than a 5% difference in results. Multiple tests will be required for larger sites at the minimum rate of one test per 900 m^2 of site area or part thereof.

b. A minimum of two (2) borehole logs are required to a minimum depth of 2.0 metres below existing ground level, or to 1.0 m below the proposed absorption pit base (whichever is greater) shall be supplied detailing all soil type's present, the bed rock level, and the water table level. One of the boreholes shall be within the proposed infiltration area/s, with other/s in various locations throughout the site.

c. Absorption may not be practical in some locations due to the physical limitations of the soil, or where the nominal absorption rate is less than 0.05 $l/sec/m^2$. Physical limitations are a high groundwater table, rock close to the surface, or contaminated soils. Clay or silty clay soils are typically unsuitable and give absorption rates below the accepted level.

Upon lodgement of a development application that requires an absorption stormwater system, a copy of the nominal absorption rate provided by Bayside Council or a copy of the geotechnical report confirming the infiltration rate for the site shall be provided at lodgement. The infiltration rate used in designing the on-site infiltration system shall not exceed 1.0 L/m2/sec.

5.2 Absorption System Design Requirements

a. Absorption systems are not permitted if any of the following criteria apply to the site

   (i) The measured groundwater table level of the site is within 1.5m of existing surface levels,

   (ii) The site is contaminated,

   (iii) The base of the absorption system is within 0.5 metres of the measured groundwater table/rock level.

   (iv) The site is used for an industrial purpose.

   Where an absorption system is not permitted or cannot be provided, compliance with section 6 of this technical specification is required instead.

b. The absorption system shall be designed to accept all the flows off the impervious areas for a 2% AEP storm event (Average Recurrence Interval (ARI) storm of 50 years).

c. All impervious areas shall be accounted for including roofs, paving, driveways, and paths. The surface area of any pool is considered as impervious except where overflows are permitted by Sydney Water to directly connect to the sewer. Landscaping/turfing that is constructed over basement car park areas, or over concrete podiums shall be considered fully impervious. The total calculated impervious area shall be increased by a minimum of 30 m^2 or 20%, whichever is greater (but not so that the actual site area is exceeded), to account for future increases in impervious surfaces.

d. Where the absorption system is located on a property that falls away from the street and no emergency overflow can be provided for, the storage volume shall be increased by 20%.

e. The design of absorption system shall be in accordance with the standard designs in Appendix D. Alternative designs will only be considered provided they match or exceed the performance and ease of maintenance requirements of the standard designs. Absorption systems must be maintainable, and each design has its strengths and weaknesses. Council's assessment of various designs based on long-term maintenance from easiest to hardest is:

Easiest	1. Open Single Style Absorption Pit (Drawing SK010)
	2. Tank Type Absorption Pit (Drawing SK006 & SK007)
	3. Maintainable Trench Type Absorption Pit (Drawing SK004 & SK005)
	4. Covered Void Type Absorption Pit (Drawing SK002 & SK003)
Hardest	5. Drainage Cells (or similar)

Where alternate systems are possible Council's preference is for installations that are easier to maintain.

f. The location of the absorption systems must not be located within, or conflict with, the required deep soil area or landscape planting as required by the landscape design. Trees shall not be planted over or within 2 metres of any underground infiltration system. The underground infiltration system shall be located to allow for adequate space for planting trees on the property, so it is recommended that the infiltration system be located below paved areas.

g. The on-site absorption system shall not be located within 2.0 metres of the side, or rear boundary, nor 3 metres from any existing building or structure however, absorption systems are permitted within 3 metres of proposed buildings and structures where special provisions are made in the footing design (typically piers) by the structural engineer. The absorption system is permitted up to 0.5 m from the front boundary.

h. Any driveway over an absorption system shall be either constructed on a pier and beam foundation with piers extending no less than 300mm below the bottom of the trench base or constructed structurally so that no load is transferred to the system.

i. When calculating the available storage volume allow for a maximum of 20% voids in the base aggregate. The standard pipe network shall not be considered as storage volume. Rainwater tanks offsets may contribute to the available storage volume.

j. In the covered void type of absorption systems Council will allow the gravel bed to be replaced with a drainage cell minimum 52 mm thick. Allow for a design void content of 80% of the cell volume.

k. Where absorption systems (gravel beds) are located within 5 m of any retaining walls the base level of the gravel bed of the absorption system located on the high side of the wall is to be constructed a minimum of 300 mm lower than the surface level at the bottom of the retaining wall. Special provisions in the footing design (typically piers) are required by the structural engineer for systems closer than 2.5 m to the footing. On the low side of the retaining wall the absorption system is to be no closer than 2.5 m from the front of the retaining wall footing unless special provisions are made in the footing design (typically piers) by the structural engineer.

l. If multiple plastic trenches, box culverts or pipes are used as part of a single absorption trench system they shall each have full access from an end pit to facilitate cleaning and be interconnected at the end pits to provide an even distribution of flows.

m. Basement garages shall not be permitted to drain/pump to an absorption system that has no emergency overflow provision.

n. A minimum of 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. Lysaght Maximesh RH3030 trash screens and 300mm silt sump shall be provided to the pits.

o. Where drainage cells (or similar) are used for storage, all discharge to the cells is to go firstly through the manufacturers recommended and correctly sized filtration unit before being piped directly into the drainage cells. Allow for a design void content of 90% of the cell volume. Where a conventional pit is proposed after the special filtration unit, but adjacent to the sides of the cells, the side of the pit is to be left open. A removable geotextile flap is to be hung over the opening to filter any material prior to water entry to the drainage cells. Permanent geotextile that surrounds the cells is still required.

5.3 Method of Sizing Absorption Systems

5.3.1 Design Absorption Rate (AR_D)

The Design Absorption Rate (AR_D) is determined by the application of a Reduction Factor (F_R) to the Nominal Absorption Rate (AR_N) to account for clogging of filters, variability of sands and likelihood of multiple storms, in accordance with Equation 3.

$AR_D = AR_N \times F_R$

Where F_R is determined in accordance with the following:

Nominal Absorption Rate (AR_N)	Reduction Factor (F_R)
$0.1 \leq AR_N \leq 1.0$	0.75

Equation 3 – Design Absorption Rate (AR_D)

The maximum nominal absorption rate accepted by Council is 1.0 litre/square metre/second.

5.3.2 Storage Method with Average Rainfall Intensity

The method requires the designer to decide on some preliminary dimensions and proceed through a process of trial and error.

Base Area (BA) = Width * Length.

Calculate the rate of discharge to the sand using AR_D * BA in litres per second.

Then calculate the required storage for several storms by calculating the difference between the runoff volume and the absorbed volume. Compare the required storage to the available storage in the proposed system. Where the available storage is greater than the required storage for all time steps the proposed system is viable. To design the most economical solution it is suggested that the designer create a spread sheet so multiple sizes and configurations can be tested. A design spreadsheet is available from Bayside Council, which utilises this method. Appendix C

5.3.3 Storage Method with Temporal Effects

This method uses temporal patterns from ARR 2019 and guidance from Book 9 Chapter Section 4.5.6 and 4.5.7. This is similar to the above but uses mass curve techniques to determine the inflow from the site.

5.4 Above Ground Storage

Absorption systems may utilise above ground storage provided the design and installation is in accordance with the following:

a. The design and installation of the above ground storage must comply with the criteria under Section 6.6.3, as if the above ground storages were for an On-Site Detention System.

b. The design and installation must also make provision for an overflow in accordance with Section 6.5, as if the above ground storages were for an On-Site Detention System.

c. All driveway grates and surface inlet pits not within the storage area shall be a minimum of 50mm above the design water surface level.

d. The location of all onsite above ground storage systems shall be marked by the permanent fixing of a marker plate of minimum size 200 mm by 150 mm to the nearest permanent surface. The plate shall be non-corrosive metal, or 4 mm thick laminated plastic that contains the following wording: "This is an onsite stormwater absorption system that will pond water during heavy storms. The owner is to clear the absorption pit regularly."

e. Retaining walls shall be able to withstand all hydrostatic loads generated by the 1% AEP event. This is the depth of maximum storage plus the depth of flow overtopping the weir.

f. All gas meters, sewer vents, electricity outlets and other services shall be located outside or above the limits of the storage and overflow weir.

g. Bark chips and other loose floatable landscaping materials shall not be used in the above ground storage area.

h. Above ground storages are prohibited for Child Care Centre development.

5.5 Absorption Exemptions and offsets

Absorption system offsets are available as per section 7.2.2.

The requirement to provide absorption systems is exempted for one-off minor developments, minor additions, and repairs where the proposed development will increase the sites impervious area by less than or equal to 60m2. (except where required by section 4). This exemption can be applied only once.

5.6 Covenant for Absorption/Infiltration Systems

The Absorption System is intended to control site discharges over the entire life of the development. To guarantee the system's continued operation, it needs to be protected from alteration and regularly maintained. For all developments other than alterations, additions and new single dwellings, the Absorption System shall be protected by a positive covenant and restriction on use of land in favour of Bayside Council. The covenant is to be in the form of an Instrument under the Conveyancing Act, and use standard wording as set out in Appendix B. Bayside Council shall be the authority empowered to release, vary, or modify the restriction and the positive covenant. Prior to the endorsement of the instruments, satisfactory Work-As-Executed (WAE) plans and a maintenance schedule of the construction drainage system shall be submitted to Bayside Council in accordance with section 3.10. A sketch plan showing all the components of the system, including above and below ground storages, and a copy of the Maintenance Schedule shall be included as attachments to the positive covenant. This will ensure that future owners are aware of their maintenance obligations.

6 On-Site Detention (OSD) Systems

On-site stormwater detention (OSD) systems shall be provided for all industrial development and development, which infiltration system is not permitted or feasible (e.g., low absorption areas or where other physical limitations prevent effective absorption). The OSD Policy aims to ensure that developments will not increase the risk of flooding at any downstream properties, in all flood events up to and including the 1% AEP storm event. Some development is exempted from OSD and this is detailed in section 6.9.

6.1 Principal Design Requirements

The OSD system shall be designed on the following basis:

a) The pre-developed flow is defined as the site being 100% pervious (e.g., grassed/turfed) and **not** the sites existing impervious/pervious composition.

b) The Permissible Site Discharge (PSD) from the site shall be designed to restrict the discharge to the predeveloped runoff in the "state of nature/greenfield" condition (Predeveloped site must be assumed as 100% pervious (i.e. the site is totally grassed/turfed) for the 20%, 10%, 5%, 2%, and 1% AEP storm events for all typical durations from 10 minutes to 2 hours. The OSD storage volume (SSR) shall be designed to ensure this achieved.

c) Post developed flow shall be checked for all storm events (20%, 10%, 5%, 2%, and 1%) verifying that the post developed flow from the development site during each storm event does not exceed the PSD for each storm event, and that this has been achieved in the design of the OSD system.

d) Where overflow would pass through a downstream property via an easement, the depth of the overland flow must not be greater than 150mm in a 1% AEP storm event.

e) Emergency overflow from the OSD system shall be zero up to the 2% AEP storm event

f) 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. The time of concentration used in the OSD modelling is to be justified to the satisfaction of Bayside Council.

g) Kerb & gutter connections are only permitted when the 1% AEP post developed flow from the site is less than 50L/s. If permitted, a maximum of one outlet (to the kerb and gutter) is permitted per street frontage. A stormwater discharge connection to Council kerb & gutter is not permitted if the discharge is equal to or greater than 50 L/s for the entire development site, and therefore, the connection will need to be made to underground stormwater infrastructure pit/pipe system. If existing drainage infrastructure is not readily available, the infrastructure will need to be constructed to service the development designed as per Bayside Council specifications at the cost of the developer.

h) 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 PSD allowed for the site in all storm events.

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. Overland flow paths shall be designed for the 1% AEP event.

6.2 Computer modelling requirements:

Bayside Councils preference is to utilise DRAINS software in designing the OSD system. Where the DRAINS (ILSAX) model is used in the design to calculate the required design volume, the following design parameters are to be adopted:

- soil type = 3
- antecedent moisture content, AMC = 3
- depression storage - paved area = 1 mm, supplementary area = 1mm, grassed area = 5 mm
- Rainfall and temporal patterns, as per Australian Rainfall and Runoff (current edition)

Where the DRAINS (IL-CL) model is used in the design to calculate the required design volume, initial and continuing loss assumption need to be in accordance with the Australian Rainfall and Runoff (AR&R) data hub

data and latest AR&R guidelines. A soft copy of the drains modelling will need to be provided to council for review along with a detailed breakdown/output of the modelling data within a supplementary report.

6.3 Discharge Control

The discharge from the OSD system is to be via an orifice plate or choke pipe protected from blocking by a maximesh screen and silt trap. High early discharge systems are not permitted. The maximesh screen shall typically have an area 50 times greater than the orifice. A typical layout is shown in Appendix D DWG No. SK011. For orifices larger than 150 mm, a grid mesh such as Weldlok A40/203 may be used providing a proprietary GPT is installed prior to discharge to the Council system to collect litter and rubbish. The Weldlok grid should have an area 20 times the orifice area. The discharge is considered to be a free discharge. If this is not the case and the orifice is drowned refer to section 6.3.3.

6.3.1 Orifice Control

The orifice plate is to be stainless steel, a minimum of 3 mm thick for orifices up to 150 mm and a minimum of 5 mm thick for orifices over 150 mm. The orifice plate is to be fixed to the pit wall with epoxy glue and stainless steel dynabolts or epoxy/chemical anchors. The plate is to be sealed around the perimeter after fixing. The minimum orifice diameter is 25mm. The connecting discharge pipe is to a capacity in excess of the design discharge assuming the pipe is flowing full, but not under pressure.

$Q = 2.123 \times D^2 \times h^{1/2}$ or $D^2 = 0.471 \times Q / h^{1/2}$

Where Q = discharge (m^3/sec)
h = depth of water above the centre of the orifice (m).
D = orifice diameter (m)
Note: This formula assumes a coefficient of discharge of 0.61.

Equation 4 – Orifice Discharge Equation

6.3.2 Choke Pipe Control

The choke pipe is to be a minimum of 1 m in length, unless connecting to an adjacent pit. The determined choke pipe diameter is to be within 2 mm of a standard pipe size, or the invert varied to adjust the height over the orifice ‘h’ to match. The downstream discharge pipe is to have a capacity more than the design discharge assuming the pipe is flowing full, but not under pressure.

$Q = 2.786 \times D^2 \times h^{1/2}$ or $D^2 = 0.359 \times Q / h^{1/2}$

Where Q = discharge (m^3/sec)
h = depth of water above the centre of the orifice (m).
D = choke pipe diameter (m)
Note: This formula assumes a coefficient of discharge of 0.8.

Equation 5 – Choke Pipe Discharge Equation

6.3.3 Drowned Orifices and Free Discharge

Council’s aim wherever possible is for the discharge from the OSD system to be a free discharge such that the invert of the orifice is a minimum of 100 mm above the Hydraulic Grade Line (HGL) of the receiving system for the 1% AEP event. In the absence of more detailed information the HGL could be considered as the top of kerb, the grate level of a pit, or 300 mm above the obvert level of a pipe. To allow a free discharge, above ground rather than below ground detention may be required. For some sites a free discharge may be difficult to achieve, and the following guide will assist where an orifice is restricted or drowned by the downstream water (HGL) level. Consider “h” as the depth of storage over the orifice centreline in metres. Note for a tank this shall be the underside of the tank roof rather than the grate level. Consider “h_o” as the height of the downstream HGL level over the orifice centreline in metres within 15 m of the orifice. Expressing h_o / h as a percentage gives a measure of how much the orifice is restricted. In the absence of more detailed information Table 4 gives a guide as to how much the SSR detention volumes must be increased to compensate for the restricted outlet assuming a static downstream water level.

Percentage Restriction (h_o / h *100)	Additional Detention Volumes (%)
10	5
20	15
40	35
60	60
75	90

Table 4 – Drowned Orifice Adjustment

A flood flap, reflux valve, or backflow prevention device is required downstream of the orifice control. Alternative assessment using an appropriate computer program is permitted provided the orifice size is not to be increased above what is required to achieve the PSD assuming a free discharge and all discharge through the orifice. Where $h_o/h > 75\%$, a computer program assessment is required to determine the adjustment to storage volume.

6.4 Areas Not Directed to the OSD Storages (Bypass)

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. Where possible, the roof and surface system shall be designed to direct runoff from the entire site to the OSD system. Where it is not possible to discharge all flows from 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 does not exceed the 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. Though this bypass area does not drain to the OSD system, this flow still must be collected and discharged in an appropriate and safe manner that does not impact on adjoining properties.

6.5 Overflow

Provision needs to be made when designing a storage for storms more severe than the design storm or for blockages in the system. With most storages it is relatively easy to provide a weir capable of passing the entire discharge from a very large storm event with only a few centimetres depth of water over the weir. See also Section 3.4.4.

6.5.1 Design process

The following design method should be used to check the adequacy of overflow structures, such as weirs or spillways, and freeboards to finished floor levels. Overflow and weir flow calculations must be included in the detailed design information submitted to the consent authority:

a. Assume the outlet is blocked and the storage full.

b. Calculate the approximate maximum 1% AEP discharge to the storage (Equation 6 – Rational Method).

c. Calculate the maximum depth over the spillway/weir assuming the entire 1% AEP discharge passes over the spillway/weir (See Equation 2 – Weir Equation).

d. Check the floor levels of any buildings upstream of the storage to ensure that these buildings are not inundated for suitable freeboards.

e. Overflows should be directed to a flowpath through the development so that buildings are not inundated nor are flows concentrated on an adjoining property.

f. 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.

g. The invert of overflow pipe invert or surface level of the grate of the OSD should be a minimum of 300mm above the gutter or natural surface RL at the point of connection.

h. The finished floor levels of any non-habitable and habitable buildings/structures adjacent to the overflow structure and overland flow path shall be minimum 150mm and 300mm above the maximum depth of water over the emergency overflow structures respectively.

6.6 Detailed Detention Requirements

6.6.1 General

a. The design of OSD shall comply with the general criteria from Australian Standard AS/NZS3500.3, except as follows:

   (i) Ponding levels shall be not less than 300 mm below any adjacent habitable floor levels, not less than 150 mm below any adjacent non-habitable floor levels. Ponding levels shall also be not less than 50 mm below surface level of pits and grates within the surface drainage system.

b. Additional requirements are as follows:

   (i) The discharge from the OSD must be via gravity discharge

   (ii) Developments that are to be subdivided under Torrens Title are to have separate OSD systems. Multi dwelling housing developments, residential flat buildings, mixed use premises and other buildings that may be subdivided under strata are permitted to have a combined OSD system. The OSD system must be located wholly within common property on the strata plan.

6.6.2 Below Ground Storage Design Requirements

The design and installation of the below ground (enclosed) storage shall be as follows:

(i) The grade of the floor of the tank shall be a minimum of 1%.

(ii) When preparing a design for, designers shall be aware of the provisions of AS/NZS 2865 and shall identify any entry to an enclosed space with a plate. The plate shall be non-corrosive metal, or 4 mm thick laminated plastic that contains the following wording: “Warning Enclosed Space. entry prohibited without workcover approved procedure”

(iii) The storage shall be able to be inspected from the surface without having to remove heavy access covers. All openings shall be 600 mm x 900 mm. Access grates shall be clear of the driveway where possible. Openings shall be positioned to allow flow through ventilation. All grates are to be fitted with child proof “J - Locks”. A minimum of two openings shall be provided for pits longer than 3 m and pits longer than 9 m shall have additional openings at maximum 5m spacing. The minimum internal pit depth for safe accessibility is 1.0 m.

(iv) The storage shall have a sump adjacent to the orifice with a minimum depth of 250 mm below the orifice centreline. The sump volume shall not be considered in storage calculations.

(v) Bondek may only be used as permanent formwork and not as a structural component i.e. bottom reinforcing is still required. Extra trimmer rods and top reinforcement may also be required for an appropriate structural design.

(vi) All openings to the below ground storage should be grated unless there are exceptional circumstances as determined by Council. Such circumstances may include tanks incorporated into balconies where the second access point could be covered with a gatic lid providing an alternative ventilation point is provided. The main access point over the orifice must remain grated however a finer mesh could be used to improve pedestrian safety.

(vii) Internal supporting walls for pits will not be permitted unless the pit is wider than 3m. If supporting walls used 0.9 m by 0.9 m minimum openings at 1.8 m centres shall be provided within the supporting wall to allow free access.

(viii) The storage shall be designed to be structurally sound allowing for all loads including earth, traffic and hydrostatic loads generated by a full storage. The storage shall be designed to prevent floatation particularly during the construction phase.

(ix) Limits of excavation shall not fall within the influence lines of any footings or structures unless allowance for piering has been made in the relevant footing design.

(x) Pipes are permitted to provide underground storage however the principles of accessibility and good maintenance apply. Maximum pipe length is 10 m between pit access points with a preferable minimum pipe slope of 1% and absolute minimum slope of 0.35%. Access pits (typically 600 mm by 600 mm)

with minimum 250 mm deep silt traps are to be provided at each end. Where multiple pipes are to be used, the pit size is to be increased to enable full access to each pipe end or multiple pits provided.

(xi) Corrosion resistant (preferably synthetic) step irons are to be provided for pits deeper than 1.2 m in a staggered pattern at 300 mm centres.

(xii) The location of the on-site detention tank must not be located within, or conflict with, the required deep soil area or landscape planting as required by the landscape design.

(xiii) Enclosed detention storage systems may be permitted within a basement or under a driveway, ground floor car-parking area, garage, or patio. Under these circumstances, unobstructed external access to the OSD system(s) must be always provided. A safe overflow route from the OSD system must also be provided.

6.6.3 Above Ground Storage design requirements

The design and installation of the above ground storage must comply with Australian Standard AS/NZS3500.3 except as follows:

(i) The maximum depth of ponded water that shall be permitted is:

Parking & driveways	200 mm
Courtyards, grass & landscaped	600 mm
Covered or restricted access	no limit

(ii) Protection of entry to ponded areas shall be in accordance with the Building Code of Australia.

(iii) The location of all onsite above ground storage systems shall be marked by the permanent fixing of a marker plate of minimum size 200 mm by 150 mm to the nearest permanent surface. The plate shall be non-corrosive metal, or 4 mm thick laminated plastic that contains the following wording: “This onsite stormwater detention system will pond after heavy rain. The outlet pit must be cleared of debris regularly.”

(iv) Retaining walls shall be able to withstand all hydrostatic loads generated by the 1% AEP event. This is the depth of maximum storage plus the depth of flow overtopping the weir.

(v) All gas meters, sewer vents, electricity outlets and other services shall be located outside or above the limits of the storage and overflow weir.

(vi) Bark chips and other loose floatable landscaping materials shall not be used in the above ground storage area.

(vii) Above ground storages are prohibited for Child Care Centre development.

6.7 Surface Flow Paths

Runoff from the developed site must not cause a detrimental effect on any property. This may require the retention of existing surface flow paths and maintaining the same or reduced quantity and water depths in these flow paths. Surface flow paths may include the provision of an emergency overflow weir or spillway for unexpected blockages which may occur to the system, or for flows in excess of the 1% AEP Storm event. The flow route must be capable of carrying stormwater up to and including the 1% AEP storm event to account for 100% blockage to the piped system. A minimum freeboard of 300 mm must also be provided between habitable floor levels and the maximum water level on the developed site. Any uncontrolled flows or overflows that are directed to the street will require calculations to show velocity-depth characteristics for sheet flows to the kerb as per scouring and safety criteria stated in the Australian Rainfall & Runoff manual. The maximum allowable depth of sheet flow is 150mm and the maximum velocity x depth product of 0.4 m^2/s is permitted.

6.8 Stormwater Runoff from Upstream Catchment(s)

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

6.9 OSD Offsets and Exemptions

The following OSD offsets are available for certain development:

a) OSD system offsets are available as per section 7.2.2.

b) For new secondary dwelling and ancillary outbuilding development, the required provision of OSD can be entirely offset with the provision of a minimum capacity 2000L rainwater tank connected for non-potable stormwater re-use as per section 7.2.3

c) For Single Dwelling, Dual Occupancy and Semi-Detached Dwellings, the required provision of OSD can be entirely offset with the provision of a minimum capacity 9500 litres rainwater tank for each dwelling. The rainwater tanks are to have a catchment of at least 75% of the main roof area and shall be connected for non-potable stormwater re-use as per section 7.2.3.

The above full offsets in b) and c) are not permitted on sites that are suitable for the provision of an absorption/infiltration system designed in accordance with section 5.

The following exemptions are available:

d) The provision of an OSD system is exempted for one-off minor developments, minor additions, and repairs where the proposed development will increase the sites impervious area by less than or equal to 60m2. This exemption can be applied only once.

e) On-site detention is exempted for subdivisions of existing buildings where no changes to the buildings or site are proposed. This includes boundary adjustments and consolidations of allotments where no additional lots are created and consolidation of lots without any building works.

f) On-site detention may be exempted where the sites stormwater discharges directly into an open waterway on a case-by-case basis. Where possible, avoid making new drainage connections to waterways, where none currently exist (concurrence from other authorities may be required).

g) OSD is exempted within the Wolli Creek Suburb and instead, the following shall be complied with:

   i. A minimum 20000L rainwater tank shall be provided per 1000m^2 of site area (or part thereof), with an absolute minimum capacity of 20000L for sites smaller than 1000m^2. The rainwater tank(s) must be connected for non-potable stormwater re-use as per section 7.2.3

   ii. The internal pipe drainage system (typically provided on a podium) is to be designed to collect and discharge the flows from the 1% AEP storm, or be designed to collect and discharge the flows from the 5% AEP storm with provision for the difference in flow between the 5% and 1% AEP storms for the site to be carried as overland flow across the podium with a minimum of 200 mm freeboard between this flow level and any habitable areas.

   iii. Much of the new drainage infrastructure is subject to flood levels and this will require minimum weir levels for overflow from the rainwater tank and/or discharge treatment pit.

   iv. The pipe connection to the Council system shall have sufficient capacity to convey the peak 5% AEP flow (assuming any rainwater or stormwater tank is already full). Provision needs to be made for the safe escape to the street of flows more than the 5% AEP flow.

6.10 Covenant for Detention Systems

OSD Systems are intended to control site discharges over the entire life of the development. To guarantee the system's continued operation, it needs to be protected from alteration and regularly maintained. For all developments the on-site detention system shall be protected by a positive covenant and restriction on use of land in favour of Bayside Council. The covenant is to be in the form of an appropriate Instrument under the Conveyancing Act. Bayside Council shall be the authority empowered to release, vary, or modify the restriction and the positive covenant. See Appendix B for the standard wording. If the proposed development has provided a complete offset to the detention requirement via a rainwater tank system, the covenant is not required. Prior to the endorsement of the instruments, satisfactory Work-As-Executed (WAE) plans and a maintenance schedule of the constructed drainage system shall be submitted to Bayside Council in accordance with section 3.10. A sketch plan showing all the components of the system, including above and below ground storages, and a copy of the Maintenance Schedule shall be included as attachments to the positive covenant. This will ensure that future owners are aware of their maintenance obligations.

7 Water Sensitive Urban Design Requirements

Bayside Council requires new urban development to address the issue of creating a more sustainable urban environment. Global warming and climate change are issues to be addressed in the present, not just the future. Droughts and dry land salinity have highlighted the need to review our national approach to water usage, while the increasing population in major cities has increased attention on the supply of potable water and the disposal of wastewater. Water supply authorities are reviewing the appropriateness and cost implications of using treated, potable water for domestic or industrial uses that are predominantly non-potable.

As the driest continent in the world, Australia must conserve water, which is one of its most precious resources, if the country is to prosper in the long term. As well as conserving the quantity of water we must also protect the quality of water. Action now will give future generations an opportunity to enjoy the quality of life we currently enjoy. Failure to act will create enormous problems within the next generation. This general approach is called Water Sensitive Urban Design (WSUD), consequently Council recognises the need for all development to:

a. Protect and enhance of natural water systems (creeks, rivers, wetlands, estuaries, lagoons, groundwater systems) and water quality by improving the quality of stormwater runoff;

b. Minimise harmful impacts of urban development upon water balance and groundwater flow regimes;

c. Conserve water by using stormwater as a resource to reduce demand on the potable water supply;

d. Integrate stormwater treatment into the landscape design; and

e. Reduce runoff and peak flows.

7.1 Stormwater Treatment

Bayside Council contains a significant catchment to Botany Bay consisting of several major waterways: Georges and Cooks Rivers, Alexandra Canal, Wolli Creek and Botany Wetlands (including the Botany Dams, Mill Stream, Mill Pond and Engine Pond). There are also minor waterways such as Scarborough Ponds, Bonnie Doon, Eve Street wetlands, Springvale and Floodvale drains, Birds Gully, Spring Street catchments and the Muddy, Bardwell, Goomun, Bado-Berong and Waradiel Creeks as well as substantial foreshore areas to the Bay itself. To reduce the stormwater pollution loads entering the Botany Bay catchment, all development must meet or exceed the stormwater pollution reduction and WSUD requirements as outlined in the Botany Bay & Catchment Water Quality Improvement Plan prepared by the Sydney Metropolitan CMA.

All developments will be required to implement the principles of WSUD. The stormwater treatment design shall be innovative and consider the development type, individual site, its landform, natural patterns/environments, heritage/cultural contexts, and site constraints. Whilst WSUD elements will be most effective when vegetation is used in its design to reduce runoff, improve aesthetics, and capture nutrients, factors such as the need for water to be transported across paved areas, land availability and topography will require piped components to be incorporated into a broader WSUD system. Permeable hard surfaces shall also be included in the design to reduce runoff intensity whilst providing a level of durability. WSUD elements should be integrated into landscaped areas to fit seamlessly into a development and be located to maximise the impervious area treated.

7.1.1 Stormwater Quality Design Requirements

For all medium and high-density development, including re-development, the conformance to the targets for stormwater pollution reduction must be justified by an analysis using MUSIC (Model for Urban Stormwater Improvement Conceptualisation). The MUSIC model must be prepared in line with the NSW MUSIC Modelling Guidelines. Table 5 outlines the stormwater pollution reduction targets for development and redevelopment.

Stormwater Pollutant	Pollutant Reduction
Gross pollutants	90%
Total suspended solids (TSS)	85%
Total phosphorous (TP)	60%
Total nitrogen (TN)	45%

Table 5 - Stormwater Pollution Reduction Targets

In situations where a higher treatment standard is needed to satisfy other authority's requirements or other water quality legislation, the higher standard shall prevail.

7.1.2 Stormwater Quality Improvement Devices and WSUD infrastructure

Stormwater Quality Improvement Devices (SQID) shall be provided to all development where possible. The water quality improvement system shall be designed to capture and treat at least 85% of stormwater runoff generated from the development site. Where an absorption system is proposed, the location of stormwater quality improvement devices shall be installed prior to the discharge into the absorption system. The treatment measure(s) shall include one or more of the following methods or any other as appropriate:

i. Bioretention Systems/Raingardens/Vegetated Swales;
ii. Constructed Wetlands;
iii. Buffer Strips and Vegetated Filter Strips;
iv. Riparian Revegetation;
v. Proprietary Treatment Devices (Filtration Cartridges/Oil Separators/Gross Pollutant Traps);
vi. Sediment Traps/Basins;
vii. Media Filtration Devices;
viii. Tree Pit Filters (Tree Filter Boxes or Street Tree Wells);
ix. Hydrodynamic Separators;
x. Silt/litter Arrestor Pits and Traps; and
xi. Gully Pit Baskets, Nets & Trash Racks.

Additionally, the stormwater treatment device shall 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. 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 EPA and WorkCover Authority.

7.2 Rainwater Tank Re-Use Systems

7.2.1 Minimum Rainwater Tank Volume Requirements

Bayside Council requires the re-use of stormwater be limited to non-potable uses and for rainwater tanks to be provided in development at the following rates detailed below:

a) For all new low and medium density residential development (secondary dwellings, single dwellings, dual occupancy, semi-detached, multi dwelling housing etc.), a rainwater tank system must be provided for each dwelling with a minimum capacity of 3000 litres or the capacity specified in BASIX requirements, whichever is greater. The rainwater tank(s) must be designed to be connected for non-potable stormwater re-use as per section 7.2.3. At least 75% of the roof area is to connect to the rainwater tank;

b) For all boarding house/co-living development, a rainwater tank(s) system must be provided with a minimum capacity of $0.5m^3$ for each room or the capacity specified in the BASIX certificate, whichever is greater. For development that exceeds 20 rooms, a minimum rainwater tank capacity of $10m^3$ will suffice. The rainwater tank(s) must be designed to be connected for non-potable stormwater re-use as per section 7.2.3. At least 75% of the roof area is to connect to the rainwater tank;

c) For all new high density development (e.g., residential flat building/shop top housing/build-to-rent housing/seniors housing/office/hotel/serviced apartment etc.), a minimum 10,000 litres rainwater tank shall be provided. The rainwater tank(s) must be designed to be connected for non-potable stormwater re-use as per section 7.2.3. At least 75% of the roof area is to connect to the rainwater tank;

d) For all industrial, commercial vehicle washing and concrete batching plant development, a rainwater tank system is required to be provided. The volume shall be determined based on a supply/demand management approach to maximise non-potable stormwater re-use on site (min 10000L). The rainwater tank(s) must be designed to be connected for non-potable stormwater re-use as per section 7.2.3.

e) For all development with roofed areas exceeding 2,500 m², a minimum 10,000 litres rainwater tank(s) shall be provided. This is cumulative for every additional 2,500m^2 of roofed area. The rainwater tank must be connected as per section 7.2.3 where available.

Note: Under the Environmental Planning and Assessment Act 1979 and accompanying Regulations most residential development involving dwellings must include a BASIX certificate. The BASIX certificate may include the provision of a rainwater tank volume to reduce potable water demand. Where possible the BASIX certificate is to be prepared to reflect the above technical specification requirements.

7.2.2 Rainwater Tank Offsets for Primary Drainage Systems

A rainwater tank volume provided in accordance with Section 7.2.1 may be used for offsets against drainage volumes required for OSD and absorption systems. This offset is only provided where the required non-potable stormwater re-use requirements are achieved and at least 75% of the roof area is directed to the rainwater tank.

a) On-Site Detention System Offsets:

Council will allow an offset of 1 m^3 from the OSD volume for every 3 m^3 of rainwater tank, providing the final OSD volume does not fall below 50% of the original design volume. Furthermore, rainwater tanks with a capacity greater than 15 m^3 are permitted but no further offset against the OSD is available.

b) Absorption System Offsets:

Council will allow an offset of 1 m^3 from the design storage of the absorption system for every 3 m^3 of Rainwater Tank providing that a minimum storage of 3.0 m^3 is maintained in the absorption system itself. This minimum storage is based on a site area of 1000 m^2 or less. For larger sites the minimum storage volume of 3.0 m^3 is to be proportionally increased (e.g., for a site area of 1500 m^2 the minimum absorption system storage volume is 3.0 x 1500 / 1000 = 4.5 m^3) before rainwater tank offsets will be available. Furthermore, Rainwater tanks with a capacity greater than 10 m^3 are permitted, but no further offset against the absorption system volume is available.

7.2.3 Rainwater Tank Non-Potable Stormwater Re-use

The rainwater must be connected for non-potable stormwater re-use as per the following:

a) All toilet flushing in the development (for high density development this only needs to be all toilet flushing on the ground floor), and

b) The cold-water supply to all clothes washing machine in the development (for high density development this only needs to all clothes washing machines on the ground floor), and

c) The landscape irrigation system, including connection to most external taps, and

d) For developments that require car/truck washing bays, supply water for car washing, unless the car wash water is recycled through a proprietary system.

7.2.4 Rainwater Tank Design and Installation

The design and installation requirements for rainwater tanks are as follows.

a) The tank shall meet all current Sydney Water and Plumbing Code of Australia requirements and be constructed to satisfy HB230 and NSW Code of Practice: Plumbing and Drainage.

b) All rainwater tank water taps, and connections shall be marked “Tank Water – Not to Be Used for Human Consumption”.

c) Rainwater shall be screened prior to entering the tank and/or a first flush device fitted.

i. Screening devices positioned between the roof surfaces and the rainwater tank assist to separate this debris from the rainwater. Combinations of coarse and fine mesh screens can be provided to remove different size debris and prevent tank access by mosquitoes, frogs, rodents and other animals. Coarse and fine mesh screens are usually provided in the roof of the rainwater tank to filter rainwater at inlets. Finer screens are provided over outlets from the tank to prevent mosquito access. Screens are typically provided at breaks in downpipes.

ii. First flush devices should be sized to divert the first flush of rainwater from the roof which typically contains the highest concentration of pollutants (e.g., 1mm of initial run-off from the

roof area). A first flush diverter should be provided prior to a rainwater tank inlet and after a screening device.

d) Roof gutters should have leaf guards or similar fitted to minimise entry of debris to the tank. Fit flaps on all inlet pipes. No openings are permitted on the rainwater tank that could allow insects to enter. It shall be constructed/installed in a manner that prevents mosquitoes breeding.

e) Tanks shall have a suitable pump fitted (dual pumps are not required) to ensure adequate pressure, except where the tank is less than 1200 litres and only used for garden watering.

f) The offtake to the pump shall be a minimum of 100 mm above the base of the tank to avoid uptake of any settled material. Alternatively, a floatable offtake could also be used.

g) Where the development is to be subdivided under Torrens Title each dwelling shall have its own tank and pump. For Strata Developments a single tank and pump is permitted.

h) Pumping equipment must be housed in a soundproof enclosure

i) Rainwater tanks provided as part of a charged system are to comply with Section 3.4.3.

j) To maintain the integrity of the stored rainwater, any discharge from a driveway, carpark, or trafficable area (even if treated) shall discharge downstream of the rainwater storage.

k) The overflow from the rainwater tank shall be directed to the internal drainage system.

l) Where the rainwater tank is interconnected to a reticulated water supply, it must be installed in accordance with backflow/cross connection prevention requirements.

m) Rainwater tanks can be located above or below ground. A single above ground rainwater tank may not be achievable as it will be generally impossible to direct the bulk of the roof water to it unless the downpipes connect through a charged system. Where multiple above ground tanks are used, they shall be connected by underground pipes to allow stored water to be fully utilised.

n) Below ground tanks installed within the zone of influence of an existing building shall adequately support the building's footings to prevent movement during construction.

o) A buoyancy check needs to be undertaken to ensure that any inground tank will not pop out of the ground if the tank is empty and there is a high-water table or low permeability ground (e.g., clay, silty sand). Care needs to be taken during construction if the tank is left in the open hole while fitting the pipes and the hole could fill up with surface water from rain on the site prior to backfilling.

p) The re-use of stormwater for potable uses such as cooking, drinking and hot water systems are not permitted.

7.3 Groundwater

Groundwater, in a broad sense, is all water that occurs below the land surface. It is an integral part of the water/hydrologic cycle and interacts directly with surface water. It provides significant contributions to rivers and other water bodies and maintains the dynamics of the estuarine and near-shore marine water bodies, contributing inflows of fresh water to otherwise saline environments. It is an invaluable resource. A significant proportion of the bayside local government area is impacted by shallow groundwater flows and sandy soils.

Evidence from historical projects shows that groundwater dewatering can critically impact nearby buildings, structures, and infrastructure when the magnitude and duration of induced drawdown exceeds natural occurrences. There is the potential to induce the compaction of unconsolidated layers beneath neighbouring land particularly in areas of sandy soils, this may result in damage to other properties.

Constructing buildings with basements that require excavation is aquifer interference activity. Therefore, it is subject to the Water Management Act 2000, relevant water sharing plans and the NSW Aquifer Interference Policy. These apply even if the excavation is unlikely to intersect groundwater at the time of construction.

The assessment of groundwater impacts during development assessment is shared responsibility of council and the state government agency administering the Water Act 1912, Water Management Act 2000, relevant water sharing plans and the NSW Aquifer Interference Policy. The management of groundwater is further detailed in the Sydney Coastal Councils Group Groundwater Management Handbook.

7.3.1 Groundwater Management

The majority of the Bayside Council LGA lies in an area of a relatively shallow groundwater table, or aquifer. The Construction within 1m of the groundwater table level is prone to groundwater seepage. The impacts to the groundwater regime resulting from development must be minimised to protect the aquifer and surrounding property/infrastructure, as follows:

a) All developments with a below ground structure (e.g., basement) are required to establish the actual water table level to Australian Height Datum (AHD). This will require the submission of a geotechnical assessment report for the site with the Development Application that includes accurate confirmation, over multiple groundwater monitoring events, the groundwater levels for the site. Where the development intercepts (or is within 1m of) the groundwater table, the geotechnical assessment must address, but not limited to, the following matters:

   i. The existing groundwater table levels,
   ii. The method of dewatering,
   iii. The amount the local water table is proposed to be lowered,
   iv. An estimate of the volume of groundwater to be pumped from the site, the maximum pump rate and duration of dewatering,
   v. An assessment of impacts on surrounding structures,
   vi. A plan showing the extent and depth of all excavations,
   vii. An assessment on the quality of groundwater, and how it will be treated prior to discharge.
   viii. Environmental site assessment report identifying the contamination status of the property and the general quality characteristics of the groundwater beneath the site.
   ix. Architectural plans illustrating accurate design dimensions of the proposed basement and sections (oriented approximately at right angles) illustrating the design depth of the proposed basement(s).
   x. Acid sulfate soils assessment and management report identifying the nature, extent, and management of acid sulfate soils (where present).

   Further requirements for geotechnical investigation reports are detailed in the following documents:

   - *Minimum requirements for building site groundwater investigations and reporting* published by the NSW Department of Planning, Industry and Environment (DPIE) in January 2021
   - *Fact Sheet Geotechnical Investigation Reports Minimum Requirements* published by Water NSW or their most recent versions.

b) All development that requires dewatering (either temporary or otherwise) or intrudes into the water table (e.g., basements) requires, in addition to development consent, parallel approval by the NSW State Government agency administering the Water Act 1912 and the Water Management Act 2000 (Integrated Development). Developments that intercept the groundwater table are generally considered "integrated development" and referral for assessment and concurrence will be sent to the relevant NSW government agency during DA assessment.

c) Proposals that require permanent or semi-permanent pumping of groundwater (after completion of the development) are not permitted. In these locations, the construction of the below ground structure will require a waterproof retention system (i.e., a full structural tanking and waterproofing) with an adequate provision for future fluctuations of the water table level. Cut-off walls down to bedrock may be necessary in certain soil and groundwater conditions. Subsoil drainage, if provided, shall be designed to allow the free movement of groundwater around and beneath any proposed structure, but must not to be connected to the internal drainage system. The pump-out system shall not be used to drain seepage from the basement due to the elevated water table level, the pump-out system can only be utilized to dispose stormwater runoff that may enter the basement carpark from the driveway access.

d) Despite the requirements of part c), the NSW State Government agency administering the Water Act 1912 and the Water Management Act 2000 may assess and approve a drained basement (permanent

dewatering) in certain circumstances where there are lower impact factors such as: site specific ground conditions; potentially low inflows; lesser risk of impacts to neighbouring users; low potential for ground surface settlement. This will only occur after hydrogeological modelling and assessment has been undertaken to the satisfaction of the state government agency. The applicant must prove to both council and the state government agency that a drained basement is acceptable in lieu of a fully tanked and waterproofed basement. If a drained basement intercepting groundwater is approved by the state government agency for the development (resulting in groundwater being collected, pumped, and discharged to the council stormwater system) the following requirements apply:

i. It must be assessed, demonstrated, and certified through appropriate geotechnical/hydrogeological modelling that the pumping of groundwater will not induce settlement and damage to surrounding properties.

ii. Groundwater discharge must be directed into the underground stormwater system (no discharge of groundwater to the kerb and gutter is permitted). If existing drainage infrastructure is not readily available, the infrastructure will need to be constructed to service the development designed as per Bayside Council specifications at the cost of the developer.

iii. The groundwater collected and pumped out of the basement will need to be permanently monitored and treated on-site to ensure compliance with the applicable water quality standards (i.e., ANZG, formerly known as ANZECC, water quality guidelines for fresh & marine water quality).

iv. A permanent dewatering management plan is to be prepared by a geotechnical engineer.

v. Obtain a Water Access Licence (WAL) and required groundwater share allocation (if required).

e) Some requirements (e.g., soil/groundwater contamination) can have impacts upon the proposal, such that the project may need to be modified to include tanking and waterproofing.

7.3.2 General requirements

a) All structures that are fully or significantly below ground must be fully tanked (structural tanking) and waterproofed to the finished ground level so that, after construction is completed no groundwater seepage is discharged from the site. A drained basement (permanent dewatering) will not be permitted unless approved by the applicable state government agency administering the Water Act 1912 and the Water Management Act 2000.

b) All subsurface structures on sites that are currently contaminated or are formerly contaminated should be fully tanked and waterproofed.

c) Subsoil drainage, if provided, shall be designed to allow the free movement of groundwater around and beneath any proposed structure, but must not to be connected to the internal drainage system.

d) All subsurface structures are required to be designed with consideration of uplift due to water pressure and “flotation” (buoyancy) effects.

e) The design of subsurface structures, tanking and waterproofing, and subsoil drainage must be undertaken and certified by engineer(s) registered with the National Engineering Register (NER).

7.3.3 Dewatering and Discharge of Groundwater to Council Systems

Council will allow temporary dewatering during construction. Council requires a permit to be obtained prior to discharging any groundwater from temporary dewatering, or pumping out of flooded sites, into Council's Stormwater Drainage network. A geotechnical engineering report, dewatering management plan & water quality plan is to be submitted as part of the permit process. Any such permit will include strict conditions for water quality standards (i.e., ANZG water quality guidelines for fresh & marine water quality) and water quality monitoring that must be met during dewatering, any breach of the conditions will be prosecuted in accordance with environmental protection legislation. Ponded water, particularly in clay areas, may require significant treatment prior to discharge from the site. The pipe work associated with the temporary de-watering process shall not be permitted to cross Council’s road reserve without the appropriate pedestrian protection.

The developer needs to liaise with the applicable state government agency(s) administering the Water Act 1912 and the Water Management Act 2000 regarding construction stage groundwater management and monitoring requirements. Certain approvals are necessary after development consent has been granted.

7.3.4 Groundwater Recharge Trench

To reduce the impact of continued urbanisation and increased imperviousness for areas not generally suitable for absorption, development needs to allow for some form of stormwater infiltration, particularly for small storms. This is achieved through a Groundwater Recharge Trench. This trench consists of a minimum 800 mm wide by 200 mm high section of 14, or 20 mm gravel wrapped in geotextile filter fabric with a slotted PVC pipe (minimum diameter 100 mm) running through the middle. This trench would be located downstream of the silt/litter arrestor pit on private property, but prior to discharge to the street, pipe, or pump system. The trench is to be a minimum of 1.0 m long for each 100 m^2 of impervious site area draining to the system. Where ground levels and slopes make positioning the Groundwater Recharge Trench downstream of the typical silt/litter arrestor pit location it is permissible to place the Groundwater Recharge Trench along a major pipe section providing an additional silt/litter arrestor pit is provided upstream of the Trench and the Trench is not located within 1.5 m of a neighbour's boundary, or 0.25 m to the front boundary. A section through the Groundwater Recharge Trench is shown in Figure 5. Typical layouts are shown in Figures 6 (fall to the street) and Figure 7 (fall to a pump at the rear). This trench is not required for Alterations and Additions to Single Dwellings. Alternative designs may be used subject to meeting the intended objective.

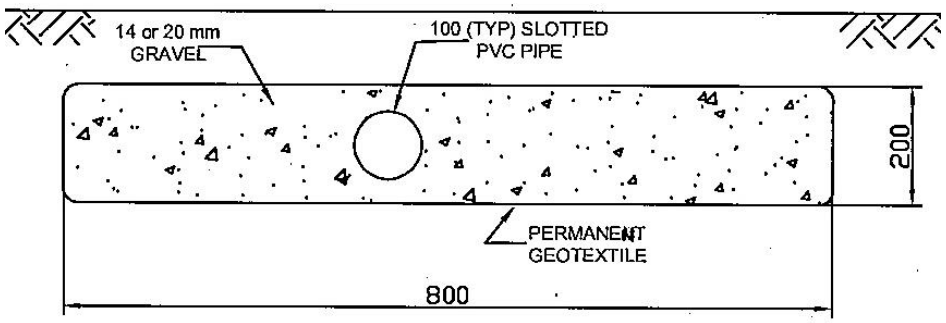


Figure 5 – Groundwater Recharge Trench, Section

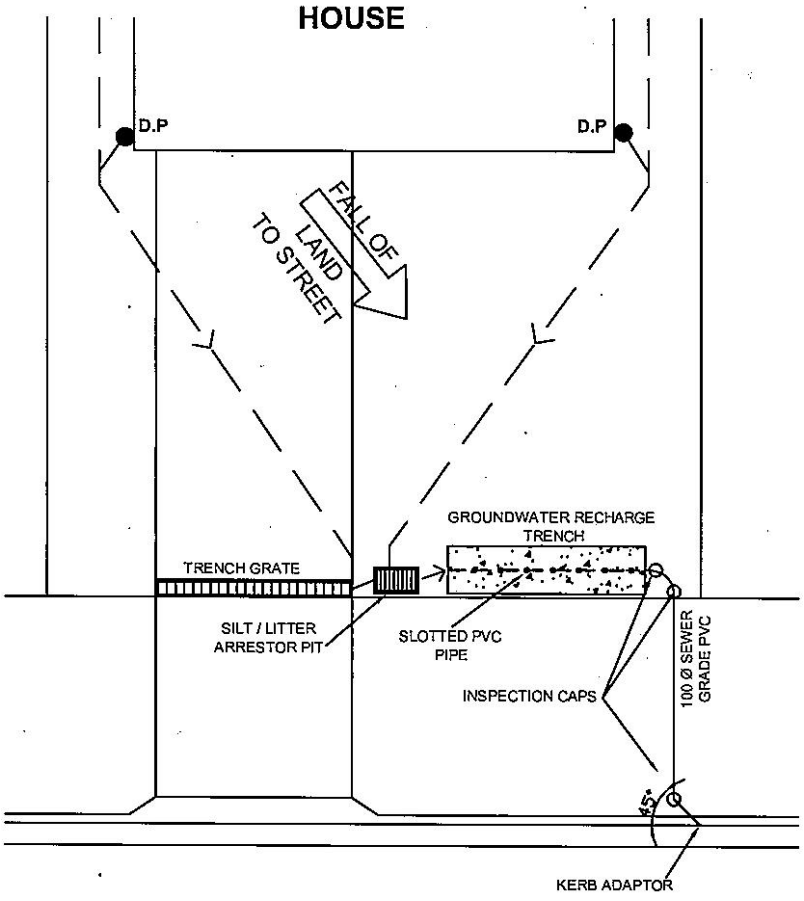


Figure 6 – Example Groundwater Recharge Trench Layout - Fall to Street

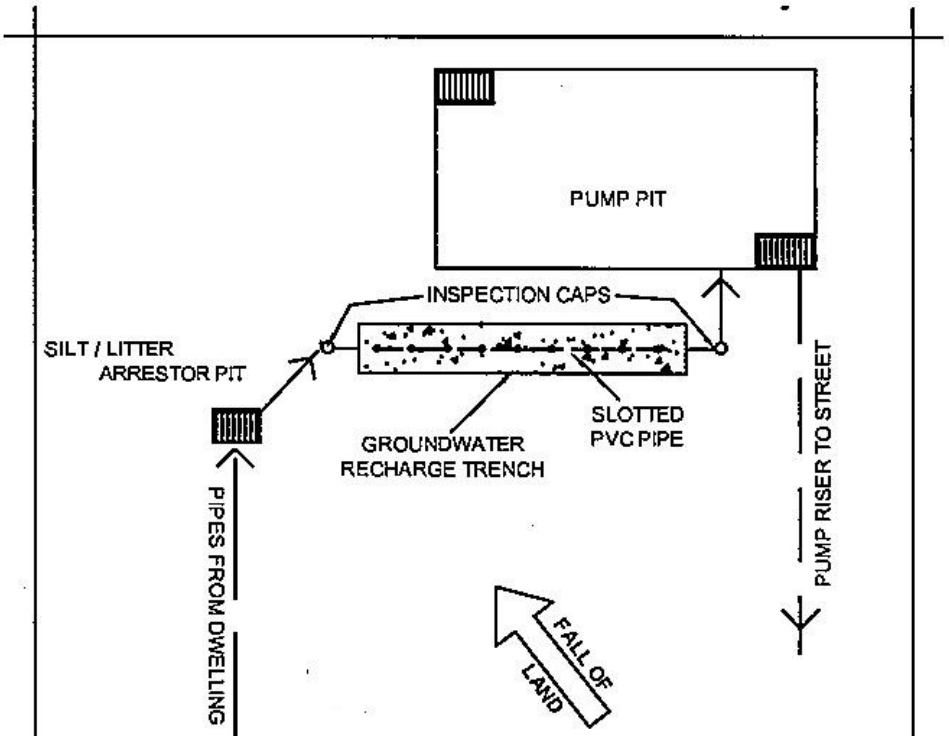


Figure 7. – Example Groundwater Recharge Trench Layout - Fall to a Pump at the Rear

7.4 Porous Paving

In urban environments, paved surfaces such as driveways and courtyards cover a significant area of a typical house block. These “impervious” areas do not allow rainfall to soak through them to the underlying soil and as a result more stormwater enters our creeks and rivers and at a faster rate than would otherwise naturally occur. These stormwater flows carry pollution and contribute to creek bank erosion and habitat removal.

To protect our streams from this occurring, we need to reduce the amount of impervious surface in our urban areas so that less water and pollutants are washed off and delivered quickly to the creek. Installation of porous pavements instead of traditional concrete pavements reduces the amount of runoff by allowing water to soak through the surface and into the underlying soil. Porous paving is highly effective when first installed however its performance will deteriorate over time as foreign material is washed into joints and/or paving openings creating a barrier. Ongoing maintenance is required to keep joints and openings clear of debris.

Porous paving can be used subject to the following guidelines.

a) Council considers pervious pavement to be, on average, 50 % impervious and will allow a reduction of 50 % in the long term design impervious area of any area paved with porous paving over deep soil.

b) Council preferred porous paving is constructed from precast porous paving units supplied by a quality assured company. Hot laid porous asphalt paving (open graded) is not considered pervious due to it high probability of clogging. Council experience with individual asphalt porous paving units indicated that they are unsuitable as porous paving in the long term.

c) All porous paving shall be installed in accordance with the manufacturer’s recommendations.

d) To protect local structures such as a garage from the variability of the porous paving performance, surface drainage systems collecting the runoff from the porous paving (such as a trench grate) shall be designed to cater for the 5 min 2% AEP design rainfall assuming the paving to be fully impervious.

e) Porous paving shall not be positioned in areas liable to receive high sediment loads.

f) Porous paving shall not be used on slopes greater than 5% in grade.

7.5 Landscaping

A variety of landscape measures can be used to manage stormwater flows, utilise stormwater within the site, and minimise supplementary watering of landscaping. The careful design and placement of landscape measures has many benefits for the water cycle, including reduced peak stormwater discharges, increased groundwater recharge, reduced erosion and sedimentation, increased retention of soil moisture and lower water costs. This is in addition to aesthetic & ecological benefits.

7.5.1 Raingardens

Raingardens are a specific landscaping features that may be designed for stormwater quality treatment without foregoing aesthetic or ornamental values. Stormwater runoff can be filtered, typically, through a sand/organic mulch medium, which subsequently drains to a conventional stormwater conveyance pipe. Raingardens can also provide some detention and/or retardation of stormwater flows reducing the risk of flooding, while providing an aesthetic water/pond/landscape feature. Raingardens can be designed with any soil type and are typically planted with native vegetation. Plants for raingardens should have the following qualities:

a) Tolerate short periods of inundation followed by longer dry periods,

b) Have spreading rather than clumped growth forms,

c) Are perennial rather than annual,

d) Have deep fibrous root systems.

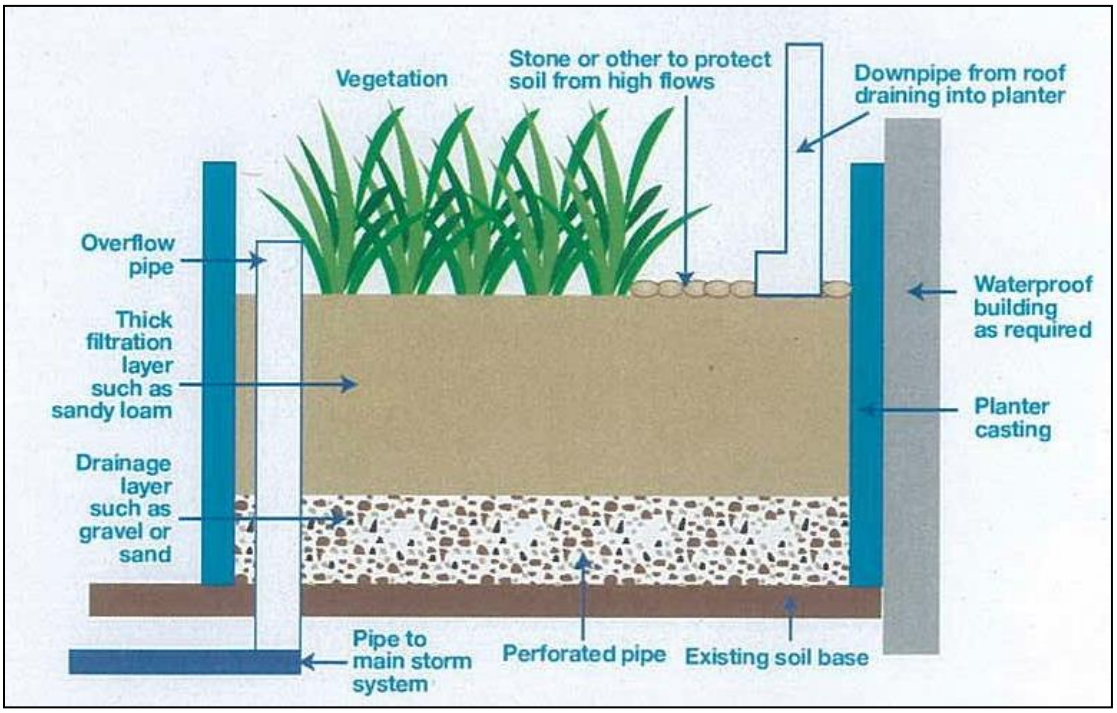


Figure 8 – Typical Raingarden layout

Raingardens may be applicable for downpipes from isolated outbuildings, downpipes that are not connected to rainwater tanks, or for the overflow from a rainwater tank. Raingardens are not suitable for the downpipes directly connected to a rainwater tank due to the risk of contamination. Downpipes into rainwater gardens should discharge a minimum of 2.5 m from most structures unless specific waterproofing techniques are used to prevent water ponding against the structure and overflows are directed clear of the adjacent footings. Above-ground rain gardens can be adopted, in the form of planter boxes, to treat runoff from roof areas not draining to a rainwater tank. These typically require less space than an in-ground system.

8 External Stormwater Drainage Network

8.1 Introduction

Bayside Council is an older urban Council area that had much of its stormwater infrastructure constructed more than 100 years ago. At that time the residential grid subdivision pattern was popular, with lots developed on mainly right angles. This rigid pattern did not recognise natural topographical features such as natural streams and water courses which crossed these grids at various angles. The early pipe designs were based on a very limited understanding of rainfall behaviour and an aim of conveying relatively small frequent storms from the low density development of the day. The historical development patterns and pipe design have resulted in reasonably frequent overland flows at low spots. Given that many houses are built over, or directly adjacent to the existing stormwater network, considerable damage has and may still occur. Flood modelling and stormwater volume calculations are now more sophisticated. The concept of on-site stormwater detention, which is designed to retain a proportion of the flow higher up in the catchment for longer periods, has been introduced relatively recently and only accounts for proportionately few properties. It cannot be used to overcome the increased stormwater flows from past development over several generations. Consequently, Council endeavours to augment priority and stormwater problems within a very limited budget. When a property is due for redevelopment and a pipe runs under, or near to the building a value judgement is required as to what action Council and the Developer should take. It shall also be noted that a portion of stormwater assets in Bayside Council are owned by Sydney Water, who shall be consulted in those cases.

8.2 Protection for low level driveways from street flows

A low-level driveway is a driveway that is lower than the front boundary level that leads to either a garage, a carport, or any other trapped low point where the depth of ponding will exceed 200 mm. When a layback is constructed in association with a driveway, the layback height can allow for stormwater flows in the kerb and gutter to escape down the driveway. Council requires the 1% AEP street flows to be prevented from flowing down the driveway and entering these areas. This procedure determines minimum driveway crest levels to contain these flows in the street. Though protection is not specifically required for carports or at-grade car spaces (other than for the above ponding depth) or the property generally, it is encouraged. Each owner, engineer or developer should undertake their own assessment as to whether their carport or car space or property should be protected from such flows. To provide protection to the whole property a solid masonry front fence needs to be provided and driveways and pedestrian accesses raised to the required protection level.

8.2.1 Calculating flows and depths for low level driveways:

For properties that are not identified as affected by the 1% AEP flood event, the following shall be adhered to:

a) The driveway crest level is to be a min. of 200 mm above the 1% AEP gutter flow level. The driveway shall also be protected from lateral flows and flows from other sources by incorporating side returns.

b) The flow discharge is to be determined using the Equation 6.1 and assuming the Council drainage pipes (if present) are flowing at 50% capacity. When calculating the contributing area, in addition to all the area that naturally drains to the street, include in the catchment all the properties on the low side assuming they have redirected their stormwater via pumps or charge lines. The travel time (time of concentration) is to be assessed allowing for a combination of surface flow using kinematic wave equation and faster gutter flow travel time. If alternative route times available use the lower travel time.

$Q = (C \times I \times A) / 360$

Where Q = Runoff (m^3/s)
C = Runoff Coefficient (refer to Table 6)
I = Rainfall Intensity (mm/hr) based on time of concentration
A = Catchment Area (Ha)

Equation 6 – Rational Method

Land Use	General Urban	Villas, Town-house	RFB, Commercial & Industrial	Roads	Parks	Schools
% Impervious	65	75	100	96	15	60
C100	0.93	0.97	1	1	0.73	0.91

Table 6 Runoff Coefficients for 1% AEP Storm (1)

Note: (1) The percentage impervious in Table 6 is based on generalised information. Where a higher percentage is known, use the runoff coefficient based on that higher figure.

c) The depth of flow in the street is to be estimated using Equation 1 - Manning Equation, HEC-RAS or other suitable software. Particular care needs to be taken where there is a low level footpath as the street capacity may be limited to the level of the laybacks (typically 100 mm high or less) and overflows travel along the footpath. For small developments, a crest level of 200mm above the boundary level will be sufficient to protect the low level driveway from inundation.

8.3 Flooding and Major Overland Flow

Major overland flows are those flows previously identified by Council or identified as part of the design of certain sites, that are significant and generally arise from a considerable catchment area. These flows are generally stormwater flows that are unable to enter the pipe network as it is already at capacity. The usual design standard is the 1% AEP flood level though it is important that flows in excess of this up to the PMF flood level are considered and have a viable escape route. All considerations and controls for flood affected sites are detailed in the Bayside DCP Flood Prone Land. All development on flood prone land is to comply with the controls outlined in that section. A flood advice letter is required to be obtained from Bayside Council for all development on sites that are affected by the 1% AEP flood event.

Some key aspects for consideration are:

- All development shall not reduce flood storage and not concentrate, or divert overland flow onto, nor increase the hazard on a neighbouring property. Two-dimensional (2D) flood modelling is required to assess the impacts of the development on the floodplain or flow path.
- An easement will be required over the extent of the overland flow path in favour of Bayside Council.
- All flood affected sites shall utilise flow through fencing. Details of approved types of fencing can be found in Appendix D drawings SK015 and SK016. Where the fence is between properties that have or may have a dog on one side and young children on the other, ‘arrowhead’ (^) louvres must be used to provide better protection.
- All required minimum flood planning levels are to be adhered to on flood affected sites.

8.4 Design and construction of Council pit and pipe drainage systems

New Council stormwater drainage lines are generally designed for the 5% AEP (20 year ARI) design standard and a Hydraulic Grade Line analysis undertaken. The minimum Council pipe size is a 375 mm diameter RRJ concrete pipe, unless there are special circumstances. All construction shall be in accordance with AUS-SPEC. Other standards are set out in AS3500 except where varied by this DCP or AUS-SPEC.

All pits are to be Double Grated Gully Pit and with a minimum 1.8m overall length lintel (preferably 2.4m), or as required for inflow capacity. For new pipe systems in the road, new kerb inlet pits shall be provided at intervals of every 60m. All Council drainage pipelines shall be reinforced concrete (RCP) or rubber ring joint (RRJ), and shall be of the appropriate class (minimum Class 3). The design shall consider final and construction traffic loads. 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%. All pipes shall be backfilled in accordance with the relevant Australian Standards. The final design details will need to be made in liaison and approval by Bayside Council. Hydrologic and hydraulic design of the drainage system shall be based on a recognized, current stormwater model and the present Australian Rainfall & Runoff.

For trunk stormwater systems, the design frequency storm event shall depend on the following:

- The capacity of the existing upstream and downstream system;

- The size of the catchment;
- Capacity and location of the overland flow path; and
- The type of adjoining development.

On completion of the construction, CCTV survey and report shall be submitted to Bayside Council to ascertain if any damage has occurred to the newly laid stormwater pits and conduits. Any damage shall be repaired by the applicant to Bayside Council's requirements and satisfaction. Once any damage has been repaired to Bayside Council requirements, a further CCTV survey and report shall be submitted to Bayside 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. Furthermore, work-as-executed plans prepared by a registered surveyor shall be submitted to Bayside Council for consideration. These plans shall indicate the as-constructed pit and conduit sizes and conduit invert RL's at each pit. The information shall be provided in Bayside Councils required format. The below points are an example of the following asset details for stormwater infrastructure that are required to be submitted to Bayside Council (for further details on requirements see Bayside Councils Works as Executed Records Manual and Contributed Asset Procedure).

8.4.1 Nominal Drainage Easement Widths

Many of the Council pipes do not have drainage easements over them. Where there is no existing easement the zone of influence for any pier and footing design is to be undertaken from the outside of the Nominal Drainage Easement Widths detailed below. Where the pipeline runs parallel to the side boundary the nominal easement width may include part of the adjoining property. Generally, the nominal easement will be located equally both sides of the pipe centreline.

Nominal Pipe Diameter	Nominal Easement Width (minimum)
≤ 225mm	900 mm
> 225mm and ≤ 375mm	1200 mm
> 375mm and ≤ 525mm	1500 mm
> 525mm and ≤ 825mm	2000 mm
> 825mm	Width of the drainage structures plus 1000 mm on each side of the structure

Table 7 - Nominal Minimum Drainage Easement Widths

The nominal easement width must also include the width of the overland flow path that traverses over the pipe. Where the width of overland flow is greater than the nominal easement width, the easement width shall be increased to match the overland flow path width. A positive covenant will also be required for overland flow paths.

8.5 Interallotment Drainage Schemes

Interallotment drainage schemes provide a connection point for stormwater where the property would otherwise be a low-level property. These schemes allow several properties to drain through a common drainage line.

8.5.1 Design and Installation of new Interallotment Drainage Schemes

The design and installation of new private interallotment drainage schemes shall be in accordance with AUS-SPEC.

8.5.2 Connection to Interallotment Drainage Schemes

The last pit on the property before connecting into the interallotment drainage line shall be designed to accept all pipe and surface flows from the 1% AEP storm event. Where there is an above ground detention system adjacent to the last pit, the last pit is to be raised so that the grate level matches the storage level and any weir overflow is set a minimum of 100 mm above this grate level. Where above ground detention is required, the storage is not permitted over the easement along the line of the interallotment pipe where such storage interferes with the natural overland flow path.

8.5.3 Council Interallotment Drainage Schemes

Council has a number of interallotment drainage schemes that have been constructed or approved for construction. Council's Customer Service Centre can provide details of any interallotment drainage schemes

applicable to the site. For sites that have a Council approved interallotment scheme, but the interallotment pipe has not reached the property as yet and it is not economically viable for Council to extend the scheme at that time (following discussions with Council's Project Management and Design Section) a pump system is required as a temporary measure.

The temporary pump system is required to meet the minimum pump requirements in Section 2.13.3. Where connection to the interallotment scheme is expected within the foreseeable future (typically less than 2 years) there is no specific minimum storage requirements. Where connection to the interallotment scheme is not expected until after 2 years the pump pit shall be sized at 3.0 m^3 per 100 m^2 of area being drained. Where onsite detention (OSD) is required the pump storage volume can be used to offset any required storage. The developer is required to pay the scheme contribution and the future owners are required to disconnect the pumps and connect to the scheme when the interallotment pipe reaches them. For developments that do not require OSD the temporary pump pit can be designed to be converted to a stormwater reuse system once the outlet is connected to the interallotment pipe.

8.6 Construction near Council Stormwater and Inter-allotment Pipes

This Section is applicable to properties where the proposed construction is in close proximity to the stormwater pipe, drainage easement, or drainage reserve, but not in direct conflict. The stormwater pipe, or drainage easement may either be on the adjoining property, or alternatively on the subject property, but not in direct conflict with the construction. The proposed construction may be close enough to require protection through piering if the adjacent stormwater pipe, drainage easement, or drainage reserve is excavated for reconstruction of stormwater pipes, or for maintenance.

8.6.1 Stormwater Pipe to be Located

It is necessary for the owner/developer to arrange for the stormwater pipe to be physically located on site, including the depth of the pipe. Council has some drainage plans which give the approximate location of the stormwater pipe which are available for a small fee, or there may be an easement over it which will assist in locating it. Unfortunately, not all stormwater pipes have easements over them and even where there are easements the stormwater pipes are not always fully located within the easement. The stormwater pipe needs to be found and exposed. A registered surveyor needs to accurately peg the easement (including pipe) and prepare accurate pipe location plans. The location plans are to be supplemented with accurate photographic evidence of the pipe. This will determine the proximity of the proposed development to the stormwater pipe and/or drainage easement. Where the pipe is located on an adjacent private property this stormwater pipe may not be able to be physically located and the best conservative estimate can be used based on available information.

8.6.2 Angle of Repose

The angle of repose of soil should be advised by a recognised geotechnical consultant, or as specified by the BCA.

8.6.3 Footing and Pier Design and Construction

Footings and piers including all foundations for buildings, walls, retaining walls, the underside of pools and slabs located adjacent to enclosed drainage systems, shall be designed and located outside the zone of influence so that no load is applied onto the drainage pipe, or channel and the footing support is not compromised by reconstruction of the stormwater pipe.

Footings, or piers shall be located outside the easement, beginning 500 mm (minimum) below the invert of the pipeline at the easement boundary and continuing upwards to the surface at the angle of repose of the soil. The area above the angle of repose is considered as the zone of influence.

General guidelines for footing design and construction are:

a) The natural surface within the easement boundaries shall not be filled, or excavated without Council approval.

b) Where footings are proposed within the zone of influence these are to be supported fully on piers that extend below the zone of influence.

c) At the time of footing inspection, the edge of the easement (including nominal easement) is to be pegged and the pipe exposed adjacent to each end of the proposed construction and at any change of grade, or direction.

d) Where footings are proposed to be founded on rock, the soundness and depth shall be proved by excavation adjacent to the pipe and through an engineer's certificate.

e) The standard angle of repose detailed above is based on dry soil conditions. Where the water table is located higher than 500 mm below the pipe invert generally the angle of repose will decrease, adopt V = 1 and H = 4 for sand unless more specialised technical advice is obtained. The use of the flatter zone of influence is still required for the design of footings even where dewatering techniques (including spear points) are used to assist construction.

8.6.4 CCTV Pre and Post Construction for Development near Council Stormwater Assets

For a development site that contains and/or is adjacent to a Bayside Council drainage stormwater drainage system (including open/covered channel, watercourse and underground drainage pipes/culverts/pits), 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 Bayside Council's infrastructure during the course of construction of the development. The CCTV inspection survey shall comply with the following:

A qualified practitioner shall undertake a closed-circuit television (CCTV) inspection and report on the condition of the Bayside Council drainage pipeline before the development and after the completion of all development works. The camera and its operation shall comply with the following at minimum:

(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 prior to commencing any works in the vicinity of the pipe and after completing the works, written acknowledgement from council is to be obtained at each stage. Any damage to Council's infrastructure during the course of the construction works shall be restored at the applicant's cost prior to occupation.

8.7 Permanent Excavation Adjacent to Stormwater Pipes

This Section applies where there is permanent excavation proposed adjacent to the stormwater pipe such as a basement garage or low-level driveway. The structural design of the supporting wall shall be designed as a tanked structure and shall include the worst case from a range of scenarios including all soil loads together with free water to the surface due to escape of stormwater from the pipe and all soil and construction vehicle loadings allowing for pipe reconstruction. Bayside Council will not accept any liability for seepage flows. Such excavation within the zone of influence is only permitted with Bayside Council approval. A submission to Bayside Council to obtain such approval must detail whether the developer will either:

a) Reconstruct the pipe at the end of the project with a new pipe (without concrete encasement) to a standard advised by Bayside Council (typically 5% AEP) while making reasonable provision for the continued operation of the pipe during the construction period, or

b) Retain the existing pipe (unless advised otherwise by Bayside Council) and undertake the following:

(i) A CCTV camera recording and condition report of the pipe is to be provided to Council prior to release of the construction certificate.

(ii) Details of how the pipe and surrounding soil is to be protected and supported during excavation is to be provided to Council prior to release of the construction certificate.

(iii) Concrete encasement of the stormwater pipe prior to excavation for the wall.

(iv) A CCTV camera recording and condition report of the pipe after construction of the wall is to be provided to Council prior to occupation. Should the pipe be damaged it is to be repaired at the developer's cost.

8.8 Construction Over Council Stormwater Pipes and Inter-allotment Drainage Pipes

This Section is applicable to properties where the proposed construction is directly over the stormwater pipe, or drainage easement.

8.8.1 Stormwater Pipe to be Located

This Section applies where the proposed construction is over, or in conflict with the drainage easement either actual (existing), or nominal. It is necessary for the owner /developer to arrange for the stormwater pipe to be physically located on site. Council has some drainage plans which give the approximate location of the stormwater pipe which are available for a small fee, or there may be an easement over it which will assist in locating it. Unfortunately, not all stormwater pipes have easements over them and even where there are easements the stormwater pipes sometimes stray from them. The stormwater pipe needs to be found and exposed. A registered surveyor needs to peg the easement (actual, or nominal from 8.4.1) including the pipe and prepare accurate location plans. The location plans are to be supplemented with accurate photographic evidence of the pipe. This will determine the proximity of the proposed development to the stormwater pipe and/or drainage easement. The depth, size and accurate location of the pipe must be detailed to the satisfaction of Bayside Council.

8.8.2 Minimisation of Conflict

Concrete stormwater pipes are assets that in general have a very long service life (minimum of 80 years). The existing stormwater pipes have usually been located in the easiest and the most direct route. In addition once the stormwater pipes are built they are very expensive to move, or alter. Consequently, Council's preference is that the existing stormwater pipe remain in it's current position and the proposed construction be modified to be completely clear of the easement, or the alteration to be minimal.

Bayside Council will consider allowing the stormwater pipe to be relocated where the owner/developer can demonstrate there is a substantial benefit. This will not be agreed to where in Bayside Council's view, relatively simple modifications to the construction would reduce the impact on the pipe.

Where Bayside Council agrees that the construction cannot be simply modified, an assessment will be made by Bayside Council Officers to determine whether the pipe can be effectively routed around the proposed development. In rare instances where the pipe cannot be relocated Bayside Council may approve building over the pipe in certain special circumstances, see section 8.8.3.

8.8.3 Development Over Council Pipes and Drainage Easements

Council's aim is to provide continuous access to the Council pipe system for maintenance requirements and will generally not permit new building work over Bayside Council pipes (other than detailed below).

a) General Allowable Minor Construction:

Providing that existing ground levels are not raised, Council will generally permit the construction over Bayside Council pipes and easements of:

(i) Most types of lawns and landscaping, except where raised planter beds are used,

(ii) Planting of trees, except for large trees (> 4 m in height), or invasive trees,

(iii) Paving of driveways and paths, however for villas and more intense development the driveway is to be supported on piers for pipes with less than 1 m of cover,

(iv) Fences and gates (but not masonry fences) providing louvres or pool fencing is constructed at the bottom of the fence, or gate to a minimum of 0.1 m above the depth of the 1% AEP flow.

b) Additions to Single Dwellings:

Providing the building work has no adverse overland flow impacts, Bayside Council may approve the building over a Bayside Council pipe where:

(i) The work only involves a steel/timber framed and skillion steel/fibreglass roofed pergola providing the footings are outside the easement (or not within 0.5 m of the pipe), there are no solid elements that restrict surface flows and the structure is bolted together in sections not exceeding 2 m by 3 m that weigh less than 80 kg,

(ii) The work only involves a steel/timber framed decks providing the footings are outside the easement (or not within 0.5 m of the pipe), the overland flow is not significant and there are no solid elements that restrict surface flows and the structure is bolted together in sections not exceeding 2 m by 3 m that weigh less than 80 kg,

(iii) The work only involves a steel/timber framed and skillion steel/fibreglass roofed carports over existing driveways providing the footings are outside the easement (or not within 0.5 m of the pipe), there are no solid elements that restrict surface flows and the structure is bolted together in sections not exceeding 2 m by 3 m. (Note new carports on new driveways will not normally be permitted because of the impact of overland flows.),

(iv) There are major practical construction problems in routing the pipe around the proposed additions to single dwelling and the redesign of the additions to avoid the pipe is considered by Bayside Council to be unworkable; or,

(v) The dwelling is already built over the pipe and the impact of extending the building further over the pipe is not considered significant by Bayside Council.

In cases (iv) and (v) above an assessment is made by Bayside Council's Asset Management Team of the condition of the existing pipe. There may be a fee for this assessment process and this will require the submission of a thorough condition assessment report to the satisfaction of Bayside Council. Where the pipe condition is good, but no upgrade planned Bayside Council may allow the existing pipe to be retained and built over with conditions, or where the pipe is in poor condition the existing pipe replaced with a similar sized pipe. All new construction adjacent to the pipe is to be piered to protect it.

c) New Single Unit Dwellings:

Providing the building work has no adverse overland flow impacts, Bayside Council may approve the building over a Bayside Council pipe where there are major practical construction/hydraulic problems in routing the pipe around the proposed new single dwelling and the redesign of the dwelling to avoid the pipe is considered by Bayside Council to be unworkable. In this instance an assessment is made by Bayside Council's Asset Management Team of the condition of the existing pipe and whether it is intended to replace/upgrade the pipe within the next twenty years. There may be a fee for this assessment process, and this will require the submission of a thorough condition assessment report to the satisfaction of Bayside Council. Where the pipe condition is good, but no upgrade planned, Bayside Council may allow the existing pipe to be retained and built over with conditions, but an additional pipe must be laid parallel to the existing pipe with sufficient capacity to carry the 5% AEP flow between the two pipes. Where the pipe is in poor condition the existing pipe is to be replaced either as a two-pipe system as above, or as a single 5% AEP standard. All construction adjacent to the pipe is to be piered to protect it and an easement provided in Bayside Council's favour if none currently exists or needs to be adjusted.

d) Commercial and Industrial Development:

Providing the building work has no adverse overland flow impacts, Council may approve the building over a Council pipe where:

(i) There are major practical construction/hydraulic problems in routing the pipe around the proposed development and the redesign of the development to avoid the pipe is considered by Bayside Council to be unworkable.

(ii) The nature of the development allows future access for Bayside Council plant and equipment. For pipes up to 1050 mm in diameter and up to 1.7 m deep a minimum clear access 3.5 m wide and 4.0 m high is required along the full length of the pipe. Larger areas are required for bigger diameter and deeper pipes, or if the pipe has bends. An assessment is made by Bayside Council's Asset Management Team of the condition of the existing pipe and whether it is intended to replace/upgrade the pipe. There may be a fee for this assessment process, and this will require the submission of a thorough condition assessment report to the satisfaction of Bayside Council.

Bayside Council may require the pipe to be upgraded to the 5% AEP standard as part of the development approval.

(iii) The existing commercial, or industrial building is already built over the pipe and the impact of a small extension over the pipe is not considered significant by Bayside Council. An assessment is then made by Bayside Council's Asset Management Team of the condition of the existing pipe. There may be a fee for this assessment process, and this will require the submission of a thorough condition assessment report to the satisfaction of Bayside Council. Where the pipe condition is good, but no upgrade planned, Bayside Council may allow the existing pipe to be retained and built over with conditions, or where the pipe is in poor condition the existing pipe replaced with a similar sized pipe. All new construction adjacent to the pipe is to be piered to protect it and an easement provided in Bayside Council's favour if none currently exists or needs to be adjusted.

In any of the above cases, a CCTV survey is required to be undertaken (see section 8.6.4).

8.8.4 Covering of Open Channels and Culverts

Council will not permit the covering of open channels as it:

a) Restricts entry of flood flows during major events;

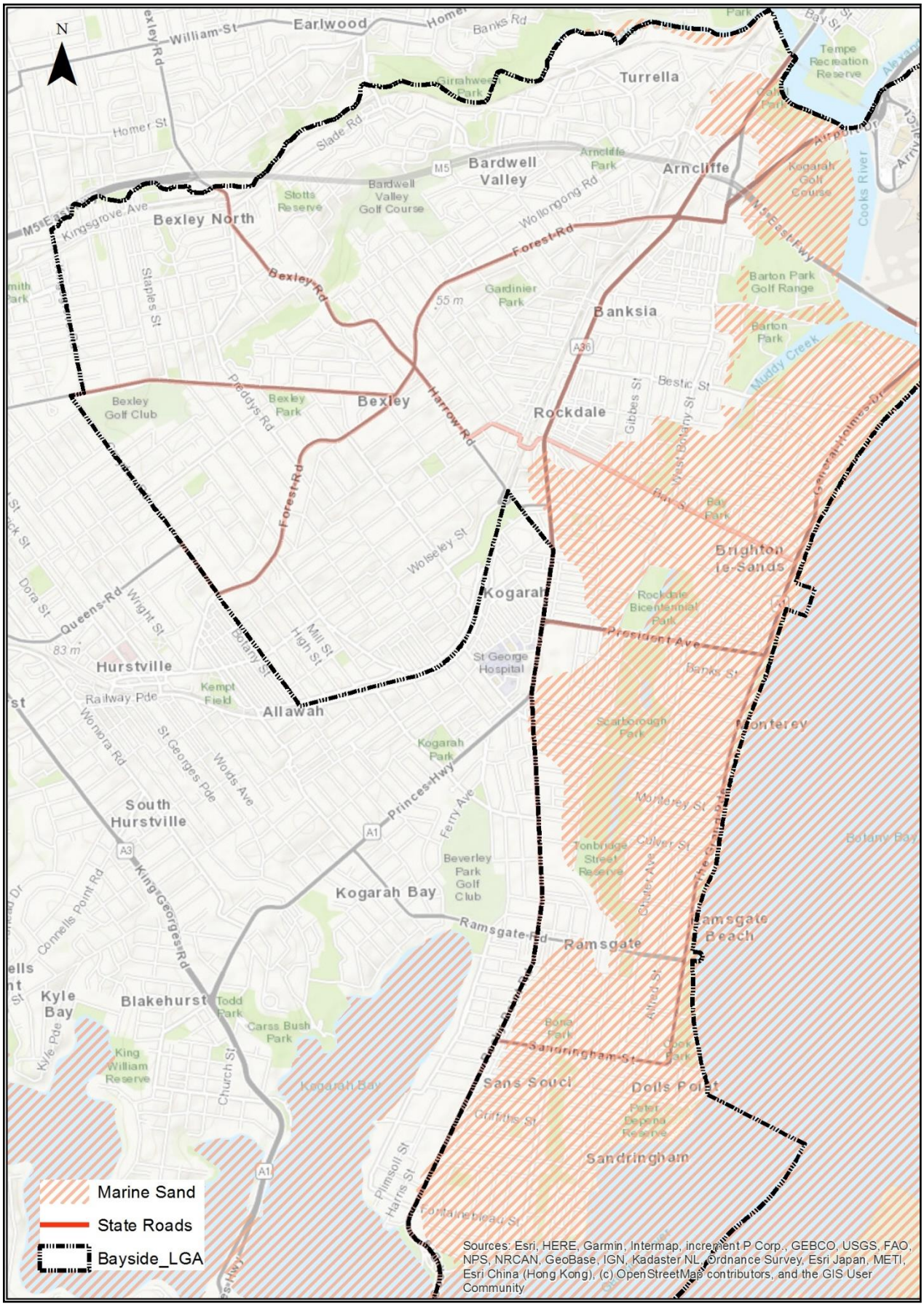
b) Limits access for inspection with significantly greater risk to personnel leading to higher costs to satisfy OH&S obligations with less effective assessment;

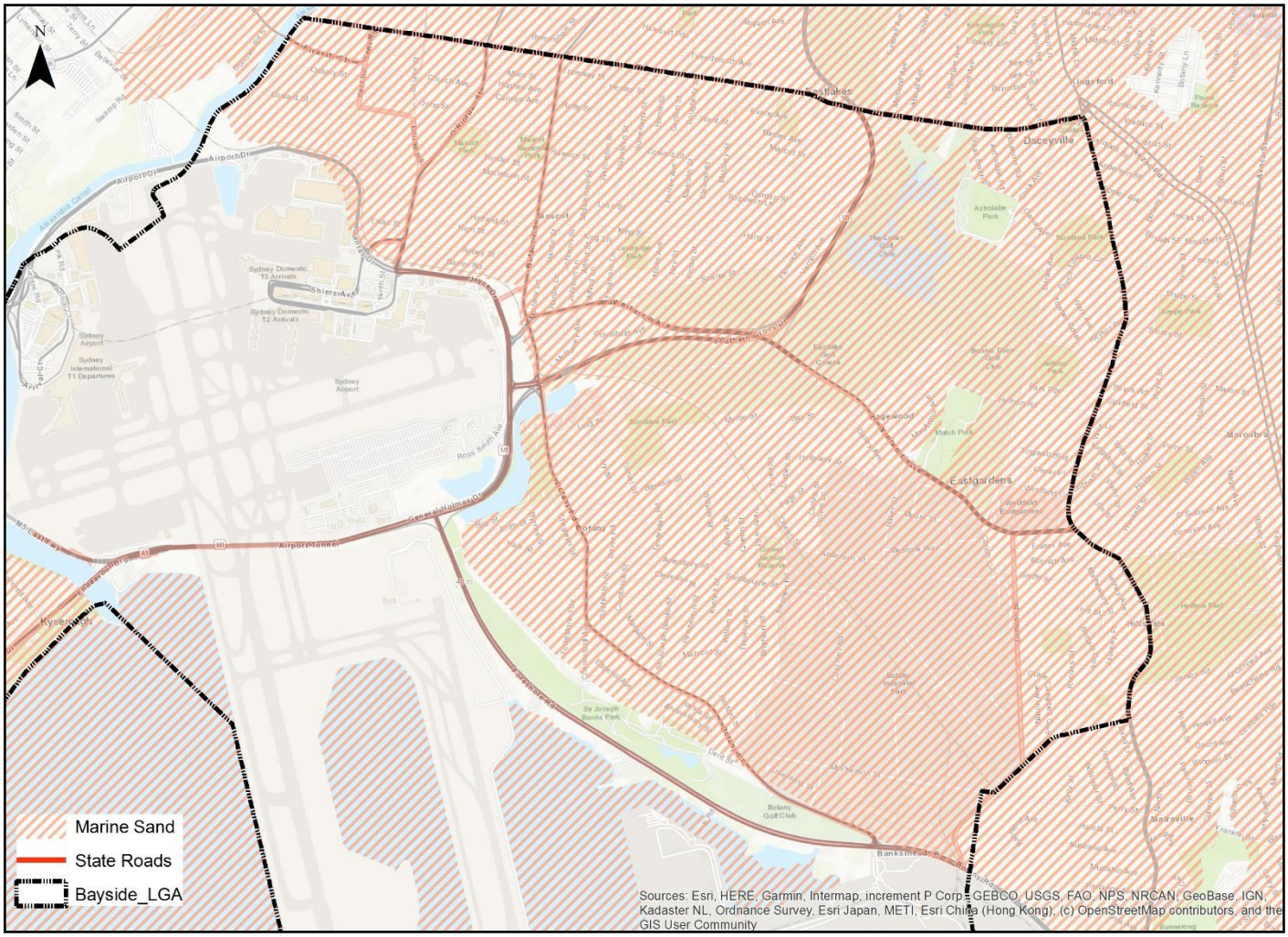
c) Increases Council's maintenance costs for cleaning the channel due to restricted and difficult access;

d) Increases Council's long term maintenance costs due to the additional cost of maintaining the new concrete cover slab as well as restricted access to the channel walls and base. This is particularly true in tidal flow areas that are subject to salt attack. These increased costs may also include the reinstatement of surface finishes that would otherwise not exist;

e) Leads to lower environmental outcomes through reduced biodiversity and possible environmental sterilisation.

APPENDIX A – Botany Bay Sand Aquifer





The shaded areas of Marine sand indicatively depict the location of *Absorption Areas*, with the remainder unshaded areas being *Low Absorption Areas*. This mapping can be viewed in further detail on the public mapping software in Bayside Council's website.

Notes:

- *The above data is based upon the Sydney geological series as an indicative guide of areas with soil profiles suitable for absorption. Further investigation may still be required based on the requirements of this technical specification (i.e., groundwater level).*

APPENDIX B – INSTRUMENTS

POSITIVE COVENANT FOR ON-SITE STORMWATER MANAGEMENT SYSTEM

The registered proprietor covenants as follows with the Council in respect to the structure erected on the land described as "on site stormwater management system" (which expression includes all infiltration units, ancillary gutters, pipes, drains, trash screens, pits, grates, tanks, chambers, basins, rainwater tanks, pumps, walls, kerbs, chambers, basins, orifice plates and surfaces designed to manage stormwater quantity and quality, including the temporary detention or permanent retention of stormwater storages) shown on plans approved by the Council (hereinafter called 'the system').

1. The Registered Proprietor will

a) permit stormwater to be managed by the system;

b) keep the system clean and free of silt, rubbish and debris;

c) maintain, renew and repair the whole or parts of the system so that it functions in a safe and efficient manner;

d) carry out the matters referred to in paragraphs (b) and (c) at the proprietor's expense;

e) not make any alterations to the system or elements thereof without prior consent in writing of the Council;

f) permit the Council or its authorised agents from time to time upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land for compliance with the requirements of this clause;

g) comply with the terms of any written notice issued by the Council in respect to the requirements of this clause within the time stated in the notice.

2 In the event of the registered proprietor failing to comply with the terms of any written notice served in respect of the matters in Clause 1 the Council or its authorised agents may enter with all necessary equipment and carry out any work required to ensure the safe and efficient operation of the system and recover from the registered proprietor the cost of liaison with the proprietor and the cost of carrying out the work, and if necessary, recover the amount due by legal proceedings (including legal costs and fees) and entry of a covenant charge on the land under Section 88F of the Conveyancing Act 1919. In carrying out any work under this clause, the Council shall take reasonable precautions to ensure that the land is disturbed as little as possible.

Name of Authority Empowered to Release, Vary or Modify the Covenant is Bayside Council.

RESTRICTION ON USE OF LAND FOR ON-SITE STORMWATER MANAGEMENT SYSTEM

The registered proprietor(s) shall not make or permit or suffer the making of any alterations to any on-site stormwater management 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 management system” shall include all infiltration units, ancillary gutters, pipes, drains, trash screens, pits, grates, tanks, chambers, basins, rainwater tanks, pumps, walls, kerbs, chambers, basins, orifice plates and surfaces designed to manage stormwater quantity and quality, including the temporary detention or permanent retention of stormwater storages.

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

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

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

POSITIVE COVENANT FOR PUMP-OUT SYSTEMS

The registered proprietor covenants as follows with the Council in respect to the structure erected on the land described as "onsite stormwater pump system" (which expression includes all ancillary gutters, pipes, drains, pumps, walls, kerbs, pits, grates, tanks, rainwater tanks, chambers, basins and surfaces designed to collect and temporarily detain stormwater) shown on plans approved by the Council (hereinafter called 'the system').

1. The Registered Proprietor will

a) permit stormwater to be temporarily detained by the system;

b) keep the system clean and free of silt, rubbish and debris;

c) arrange for regular inspections and maintenance of the pump system, at not more than 6 monthly intervals, by a recognised pump maintenance specialist to ensure the pump(s), associated alarms and system generally is working effectively. The pump maintenance specialist is to prepare a written report detailing whether the pump system is working effectively and if not what actions need to be undertaken to ensure it is working effectively;

d) undertake the rectification works as specified by the pump maintenance specialist's report as soon as practical, but within 14 days of the report being prepared. Obtain a follow-up report to detail that the pump system is now working effectively;

e) maintain written records of all reports and make available to Council such records where requested including details of any rectification works;

f) maintain, renew and repair the whole or parts of the system so that it functions in a safe and efficient manner;

g) carry out the matters referred to in paragraphs (b), (c), (d), (e) and (f) at the proprietor's expense;

h) not make any alterations to the system or elements thereof without prior consent in writing of the Council;

i) permit the Council or its authorised agents from time to time upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land and review the records for compliance with the requirements of this clause;

j) comply with the terms of any written notice issued by the Council in respect to the requirements of this clause within the time stated in the notice.

2 In the event of the registered proprietor failing to comply with the terms of any written notice served in respect of the matters in Clause 1 the Council or its authorised agents may enter with all necessary equipment and carry out any work required to ensure the safe and efficient operation of the system and recover from the registered proprietor the cost of liaison with the proprietor and the cost of carrying out the work, and if necessary, recover the amount due by legal proceedings (including legal costs and fees) and entry of a covenant charge on the land under Section 88F of the Conveyancing Act 1919. In carrying out any work under this clause, the Council shall take reasonable precautions to ensure that the land is disturbed as little as possible.

Name of Authority Empowered to Release, Vary or Modify Covenant is Bayside Council

RESTRICTION ON USE OF LAND FOR PUMP-OUT SYSTEMS

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 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 COVENANT FOR OVERLAND FLOW PATHS

The registered proprietor covenants as follows with the Council in respect to the "overland flow path and flow through fencing" (which expression includes all fences, openings, steps, lawns, gardens, paving and Council approved structures along the overland flow route) shown on plans approved by the Council (hereinafter called 'the system'). Flow through fencing includes fences and gates that have pool fencing and/or louvres from the base (ground) up to the 1% AEP flow depth to allow flood flows through.

1. The Registered Proprietor will

a) permit stormwater to be temporarily conveyed across the land and through the system;

b) keep the system clean and free of silt, rubbish and debris;

c) maintain, renew and repair the whole or parts of the system so that it functions in a safe and efficient manner;

d) not place or store items within the system, temporary or otherwise, that would block or partly block the system;

e) not erect, or construct a fence or gate (that is not flow through fencing), raised planter garden or any other structure within the flowpath that would block or restrict the system;

f) carry out the matters referred to in paragraphs (b), (c), (d) and (e) at the proprietor's expense;

g) not make any alterations to the system or elements thereof without prior consent in writing of the Council;

h) permit the Council or its authorised agents from time to time upon giving reasonable notice (but at any time and without notice in the case of an emergency) to enter and inspect the land and review the records for compliance with the requirements of this clause;

i) comply with the terms of any written notice issued by the Council in respect to the requirements of this clause within the time stated in the notice.

2 In the event of the registered proprietor failing to comply with the terms of any written notice served in respect of the matters in Clause 1 the Council or its authorised agents may enter with all necessary equipment and carry out any work required to ensure the safe and efficient operation of the system and recover from the registered proprietor the cost of liaison with the proprietor and the cost of carrying out the work, and if necessary, recover the amount due by legal proceedings (including legal costs and fees) and entry of a covenant charge on the land under Section 88F of the Conveyancing Act 1919. In carrying out any work under this clause, the Council shall take reasonable precautions to ensure that the land is disturbed as little as possible.

Name of Authority Empowered to Release, Vary or Modify Covenant is Bayside Council

RESTRICTION ON USE OF LAND FOR OVERLAND FLOW PATHS

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 COVENANT FOR COMPENSATORY FLOOD STORAGE

The registered proprietor covenants as follows with the Council in respect to the "overland flow path and flow through fencing" (which expression includes all fences, openings, steps, lawns, gardens, paving and Council approved structures along the overland flow route) shown on plans approved by the Council (hereinafter called 'the system'). Flow through fencing includes fences and gates that have pool fencing and/or louvres from the base (ground) up to the 1% AEP flow depth to allow flood flows through.

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 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.

APPENDIX C – DESIGN CALCULATION SHEET

EXAMPLE ABSORPTION PIT DESIGN CALCULATION SHEET (WITH WORKED EXAMPLE)

Site Details

Address	Example Site	
Site Area	550	m^2
Impervious Area	300	m^2
Nominal Absorption Rate (AR_N)	0.5	$l/m^2/sec$
Reduction Factor (F_R)	0.75	

Design Details

Design Impervious Area (DA)	(see Clause 5.3.10)	360	m^2
Design Absorption Rate (AR_d)	= AR_N x F_R =	0.375	$l/m^2/sec$
Base Area of Absorption Pit (BA)		32.4	m^2

Required Absorption System Volume Calculation for 50 Year ARI Storm

Time (min) T	Rainfall Intensity (mm/hr) I	Runoff (l/s) R = I x DA / 3600	Runoff Volume (m^3) RV = R x T x 60 / 1000	Infiltration Vol (m^3) IV = BA x AR_d x T x 60 / 1000	Required Absorption System Volume (m^3) RV-IV
5	238	23.80	7.14	3.65	3.50
6	223	22.30	8.03	4.37	3.65
7	211	21.10	8.86	5.10	3.76
8	202	20.20	9.70	5.83	3.86
9	194	19.40	10.48	6.56	3.92
10	186	18.60	11.16	7.29	3.87
11	180	18.00	11.88	8.02	3.86
12	174	17.40	12.53	8.75	3.78
13	169	16.90	13.18	9.48	3.71
14	164	16.40	13.78	10.21	3.57
15	160	16.00	14.40	10.94	3.47
20	142	14.20	17.04	14.58	2.46
25	129	12.90	19.35	18.23	1.13
30	118	11.80	21.24	21.87	-0.63
40	102	10.20	24.48	29.16	-4.68
45	96	9.60	25.92	32.81	-6.88
50	90.6	9.06	27.18	36.45	-9.27
55	85.8	8.58	28.31	40.10	-11.78
60	81.7	8.17	29.41	43.74	-14.33
Maximum Required Absorption System Volume (MRASV)(m^3)					3.92

Proposed Absorption System Volume Calculation Sheet

Total Volume of pits (above top of base level)(m^3)	0.4
Volume of half round pipes (m3)(Evergals Jumbo Trench 410 - Voume 175 litres/m)	1.6
Gravel Void Volume (20% of gravel volume)(m^3)	1.3
Above Ground Storage (m^3)	0
Other Volume (details)(m^3).....	0
Subtotal Proposed Absorption System Volume (m3)	3.3
Allowable Rainwater Tank Offset (1m^3 offset for 4m^3 of rainwater tank) where subtotal system volume is greater than 3m^3 **and the minimum volumes and uses of rainwater are in accordance with section 7.2 (m^3)**	1
Total Proposed Absorption System Volume (TPASV)(m^3)	4.3
TPASV must be greater than MRASV	Satisfactory

An electronic version of this calculation sheet may be obtained from Bayside Council's website.

The worked example considers a site, area 550 m^2, where a dwelling is proposed to be constructed with a roof and surrounding paved impervious area of 300 m^2.

Council advised the nominal absorption rate of 0.5 l/m^2/sec.

The proposed absorption system has dimensions as follows:

Gravel base

Length	9 m
Width	3.6 m
Thickness	0.2 m

Void Type

Everglas 410 “Jumbo” 0.175 l/m

End Pits

600 mm x 600 mm, 800 mm deep, with 200mm silt trap.

Rainwater tank

4,000 litres

The proposed system volume (TPASV = 4.30 m^3) is greater than the required volume (MRASV = 3.92 m^3) so the design is acceptable providing the rainwater tank is connected to the appropriate uses. Further refinement could produce a more economical design.

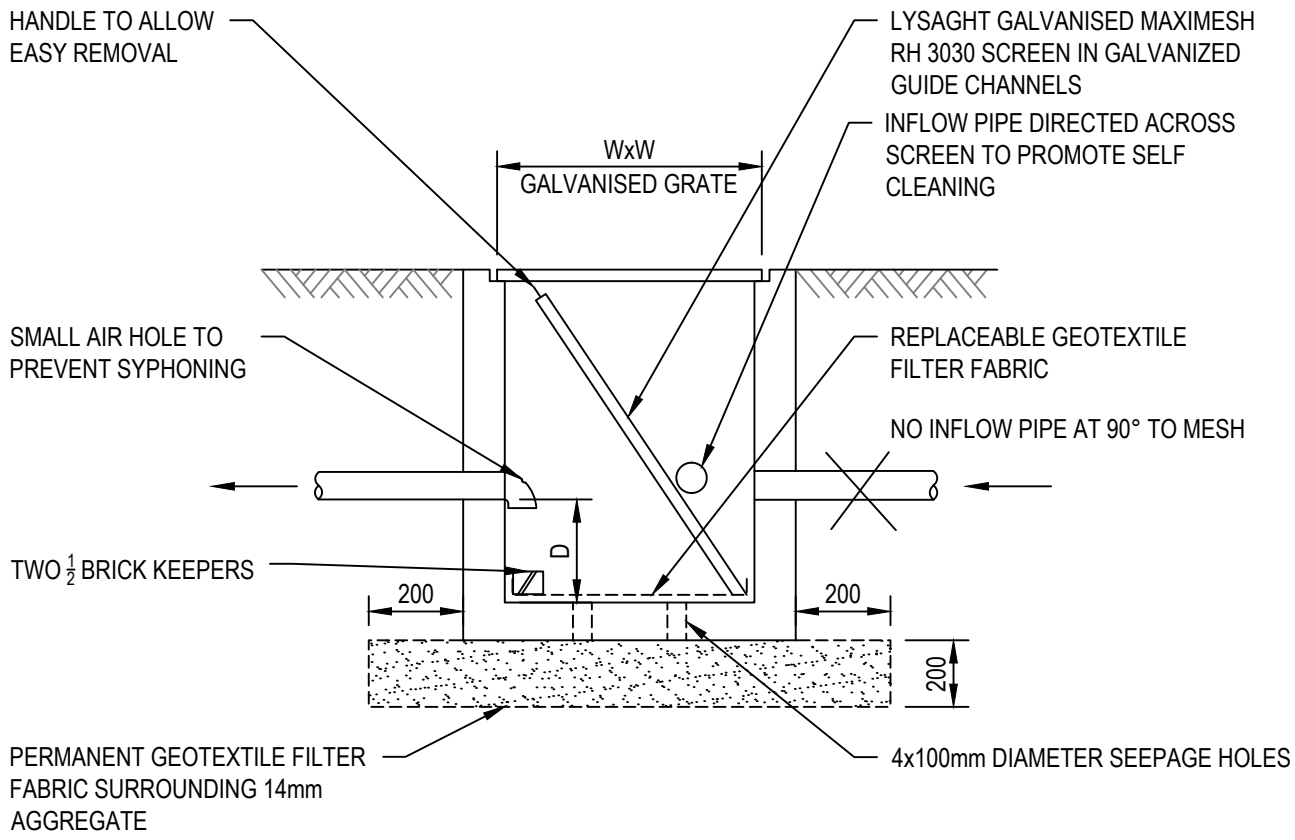
Notes:

1. Using the absorption pit types in drawings SK002, SK003, SK004, SK005 & SK010 will result in the critical storm usually being fairly short, between 5 and 20 minutes, due to the limited storage available in this type of design (except where additional above ground storage is used).

2. When using pit configurations as Drawing C.4 with increased storage, the critical storm duration will generally increase.

3. The designer can adjust the relative capacity of the storage and absorption area by trialing different configurations. If the 5 minute storm is critical there may be an opportunity to reduce the size of the absorption system.

APPENDIX D – STANDARD DRAWINGS



MINIMUM PIT DIMENSIONS

SITE AREA DRAINING (m^2)	WIDTH (W) (mm)	DEPTH(D) (mm)
AREA < 400	450	200
400 < AREA < 800	600	250
800 < AREA < 1200	900	300
1200 < AREA < 1800	1200	350

NOTES:

1. AREAS IN EXCESS OF 1600 m^2 SHOULD HAVE THE FLOWS SPLIT AND ADDITIONAL PITS PROVIDED OR AN ALTERNATIVE DESIGN SUBMITTED
2. PITS MAY BE CONSTRUCTED OF BRICK OR CONCRETE (PRECAST OR CAST IN-SITU) OR CONCRETE BLOCKS OR PLASTIC IF NOT SUBJECT TO VEHICLE LOADS
3. IN SOLID ROCK THE WIDTH OF THE AGGREGATE BASE MAY BE REDUCED TO THE WIDTH OF THE PIT AND DEPTH(D) REDUCED TO 100mm FOR ALL PIT SIZES
4. FOR PITS WITH W GRATER THAN 900mm
   A. THE GRATES ARE TO BE CONSTRUCTED IN COMPONENTS NOT EXCEEDING 600x600 FOR EASY LIFTING AND PREFERABLY LIGHT DUTY WHERE POSSIBLE
   B. THE MAXIMESH SCREEN IS TO BE SUPPORTED ON ITS OWN FRAME
   C. INCREASE THE NUMBER OF SEEPAGE HOLES
5. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM

SILT/LITTER ARRESTOR PIT

NTS

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SILT/LITTER ARRESTOR PIT

DWG NO.
SK001

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

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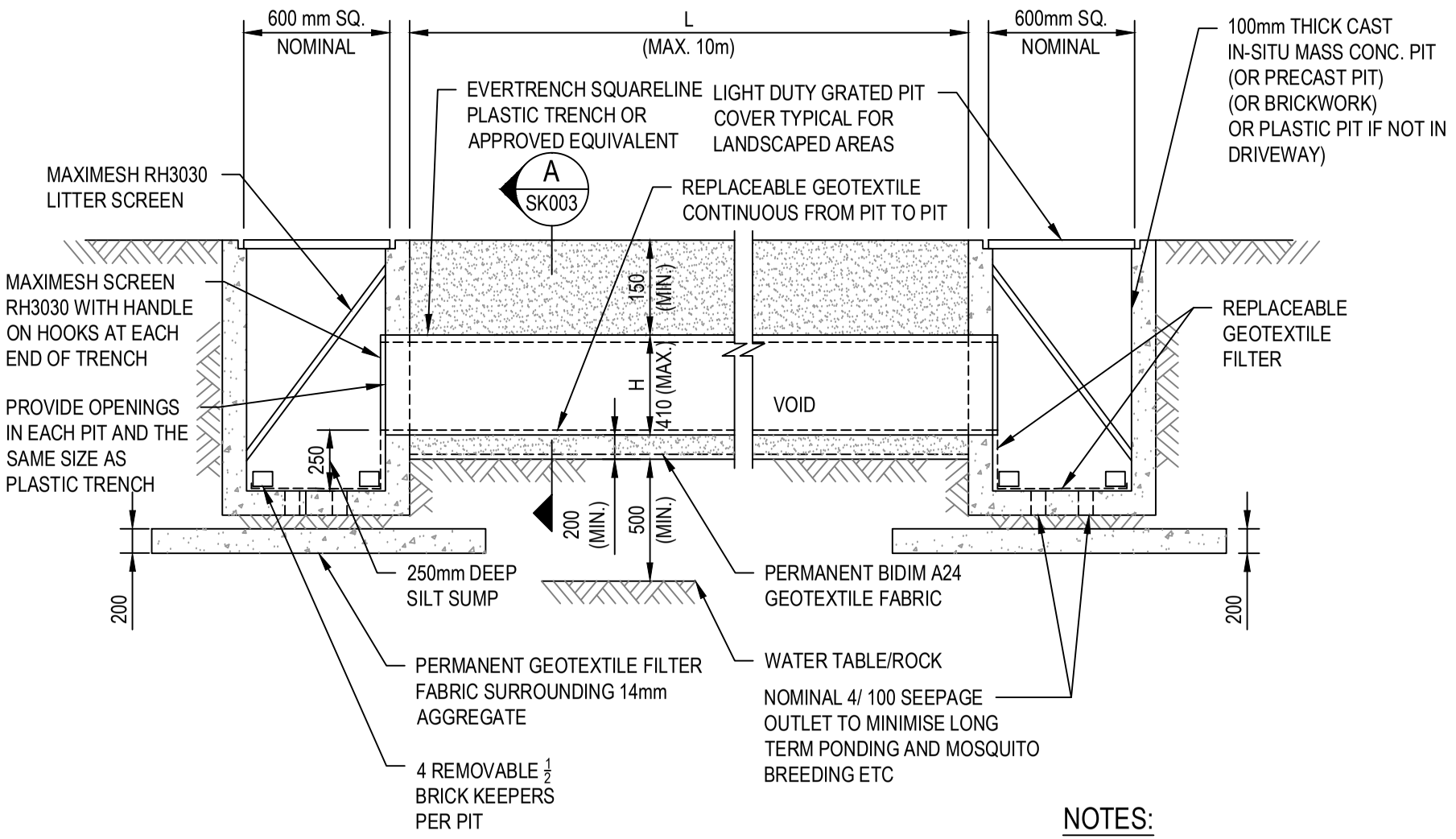
COVERED VOID TYPE ABSORBTION PIT

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

DWG NO.
SK002

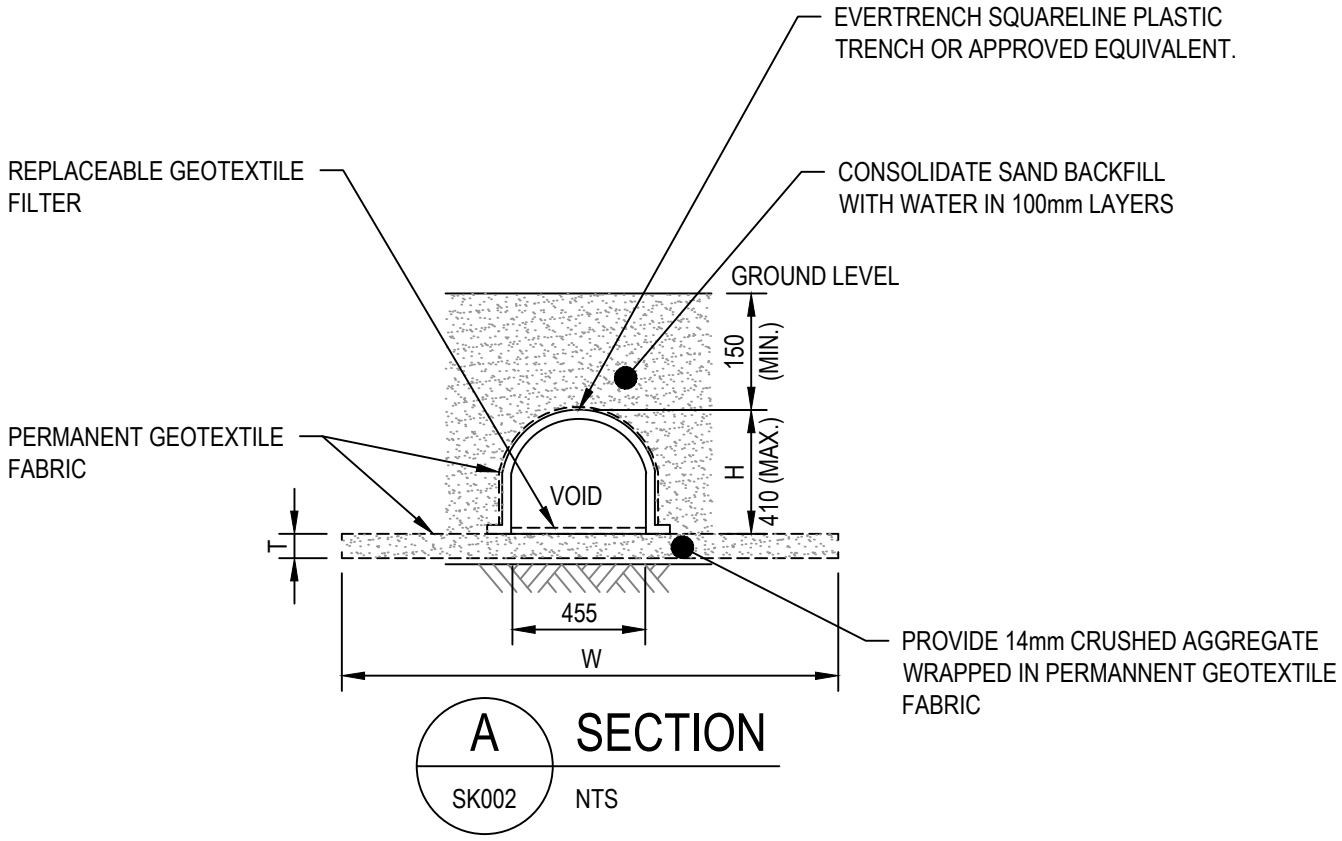


COVERED VOID TYPE ABSORBTION PIT

NTS

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
2. THIS DRAWING MUST BE READ IN CONJUNCTION WITH SK003 - SECTION A.



EVERTRENCH TYPE (H) (mm)	CAPACITY (litres/m)	AGGREGATE BASE THICKNESS BASE WIDTH (W) (mm)	T (mm)(MIN.)
230 SMALL	70	<1700	200
350 LARGE	140	<2550	200
410 JUMBO	145	<3400 (MAX)	200

NOTES:

1. WHERE PITS EXTENDS UNDER DRIVEWAYS, USE BOX CULVERTS INSTEAD OF PLASTIC TRENCH, OR INCREASE COVER OR PROVIDE PIERS TO STRUCTURAL ENGINEER'S REQUIREMENTS.
2. FOR TRENCH LENGTHS GREATER THAN 10m, INTERMEDIATE PITS MUST BE PROVIDED.
3. FOR DEPTHS > 900mm DEEP USE LARGER PITS
   FOR PITS < 600mm DEEP (eg WITH 230 SMALL) MAY USE 450 x 450 PIT.
4. STORMTRENCH SC-310 864 (W) x 406 (H) AT 190 L/M PERMITTED INSTEAD OF EVERGLAS, PROVIDING A 900x600 PIT. USED FOR MAINTENANCE ACCESS AT EACH END.
5. DRAINAGE CELL MINIMUM 52mm THICK MAY BE PROVIDED INSTEAD OF GRAVEL BASE.
6. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN DIAGRAM.
7. THIS DRAWING MUST BE READ IN CONJUNCTION WITH SK002.

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COVERED VOID TYPE ABSORBTION PIT
SECTION A

DWG NO.
SK003

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

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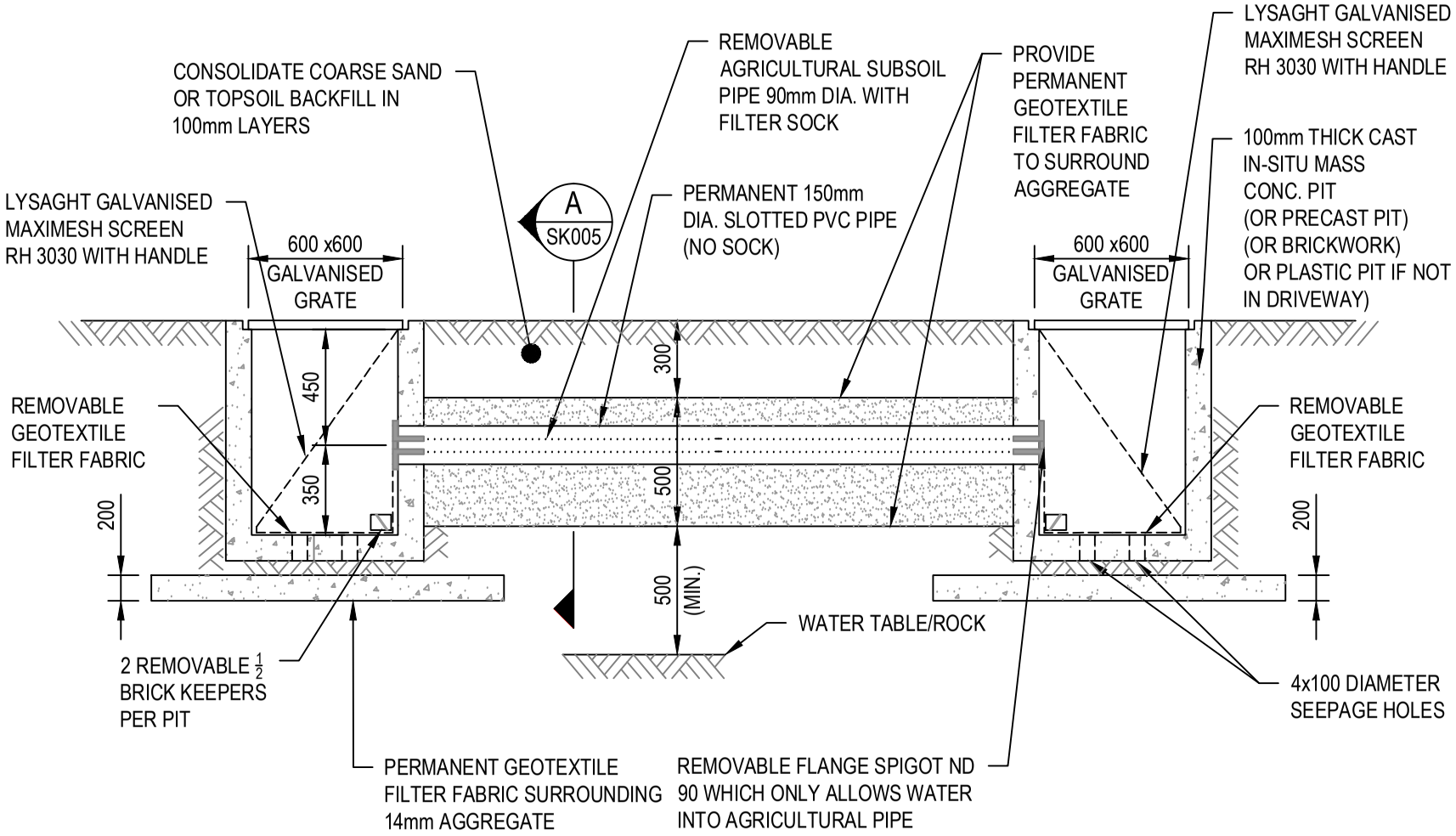
MAINTAINABLE TRENCH TYPE ABSORPTION PIT

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

DWG NO. SK004

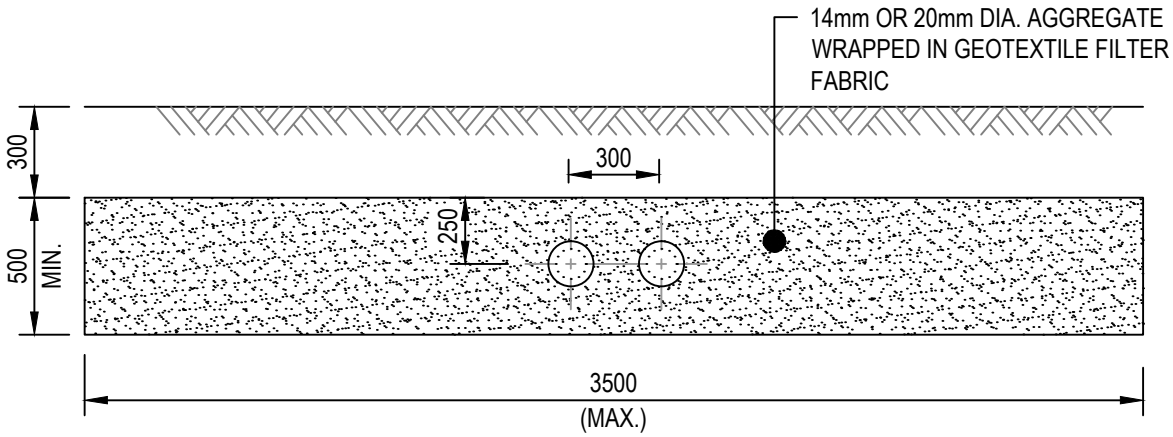


MAINTAINABLE TRENCH TYPE ABSORPTION PIT

NTS

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
2. THIS DRAWING MUIST BE READ IN CONJUNCTION WITH SK005.



A SECTION

SK004 NTS

NOTES:

1. 10m MAXIMUM BETWEEN PITS.
2. FOR WIDTHS GREATER THAN 3.5m USE ADDITIONAL SUBSOIL DRAINS AND PITS.
3. WHERE THIS STYLE OF PIT IS TO BE USED IN DRIVEWAYS, OR SUBJECT TO LOADING, THE ENGINEER IS TO CERTIFY THAT DESIGN IS SUITABLE FOR THIS PURPOSE.
4. PLASTIC PITS MAY ONLY BE USED IN LANDSCAPED AREAS.
5. FOR INFLOWS GREATER THAN 15 l/sec IN EACH PIT, ADDITIONAL SUBSOIL DRAINS ARE TO BE PROVIDED.
6. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
7. THIS DRAWING MUST BE READ IN CONJUNCTION WITH SK004.

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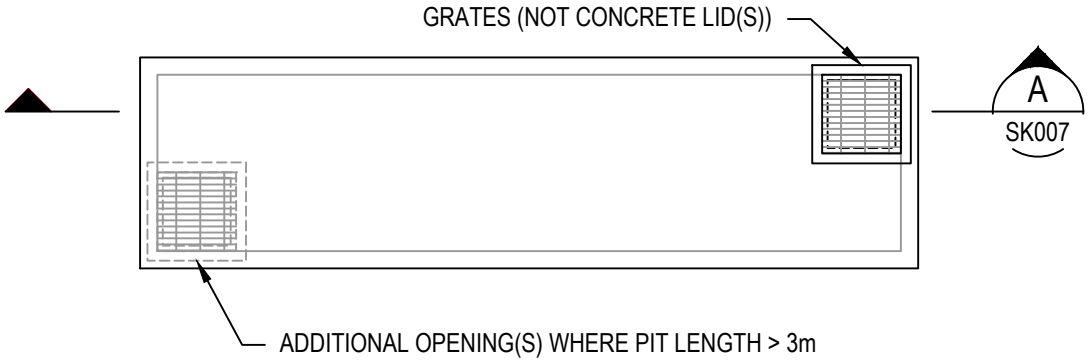
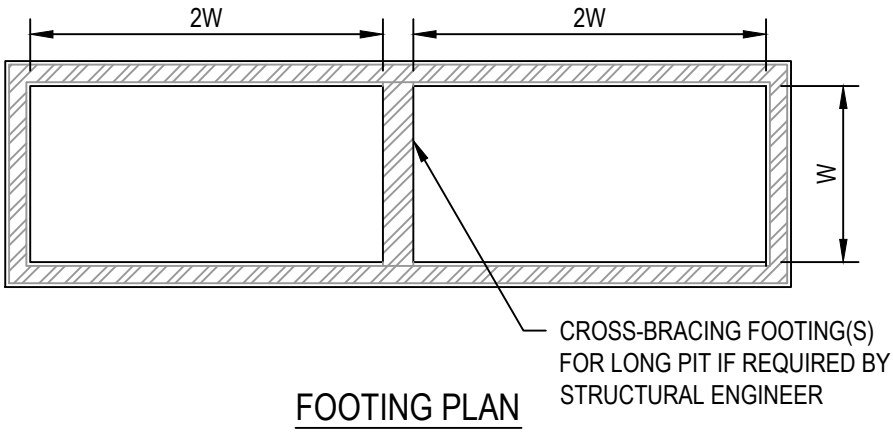
MAINTAINABLE TRENCH TYPE ABSORPTION PIT - SECTION A

DWG NO.
SK005

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020



PLAN



FOOTING PLAN

NOTES:

1. THIS PIT TYPE SUITABLE FOR LARGE SITES OR SMALLER SITES WITH MEDIUM TO POOR ABSORPTION RATES.
2. STRUCTURAL DETAILS TO BE SUPPLIED WITH CC.
3. LOCATE INLET PIPES WHERE POSSIBLE ADJACENT TO INSPECTION OPENINGS.
4. INSTEAD OF BONDEK MAY USE COMPRESSED FRC SHEETING WITH TEMPORARY PROPS.
5. ALL GRATES MUST BE 600x900. ALL GRATES TO BE FITTED WITTH CHILDPROOF 'J-LOCKS'.
6. FOR DEPTHS GREATER THAN 1200mm PROVIDE STEP IRONS.
7. BASE OF ABSORPTION TANK MUST BE LEVEL.
8. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

COVERED TANK TYPE ABSORPTION PIT

NTS

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COVERED TANK TYPE ABSORPTION PIT

DWG NO.
SK006

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

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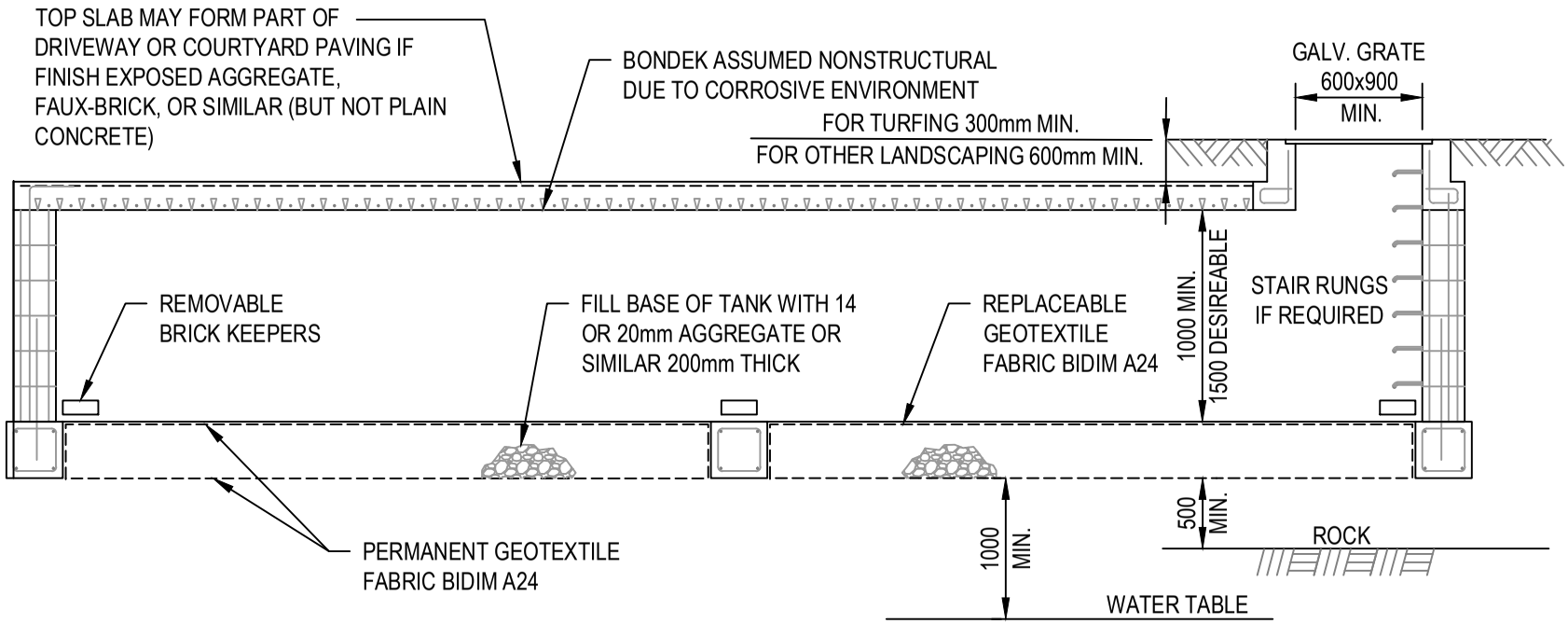
COVERED TANK TYPE ABSORPTION PIT - SECTION A



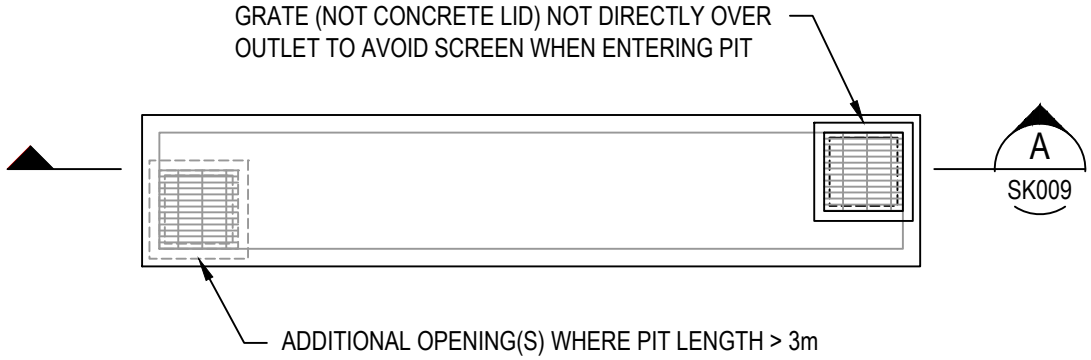
A SECTION
SK006 NTS

NOTES:

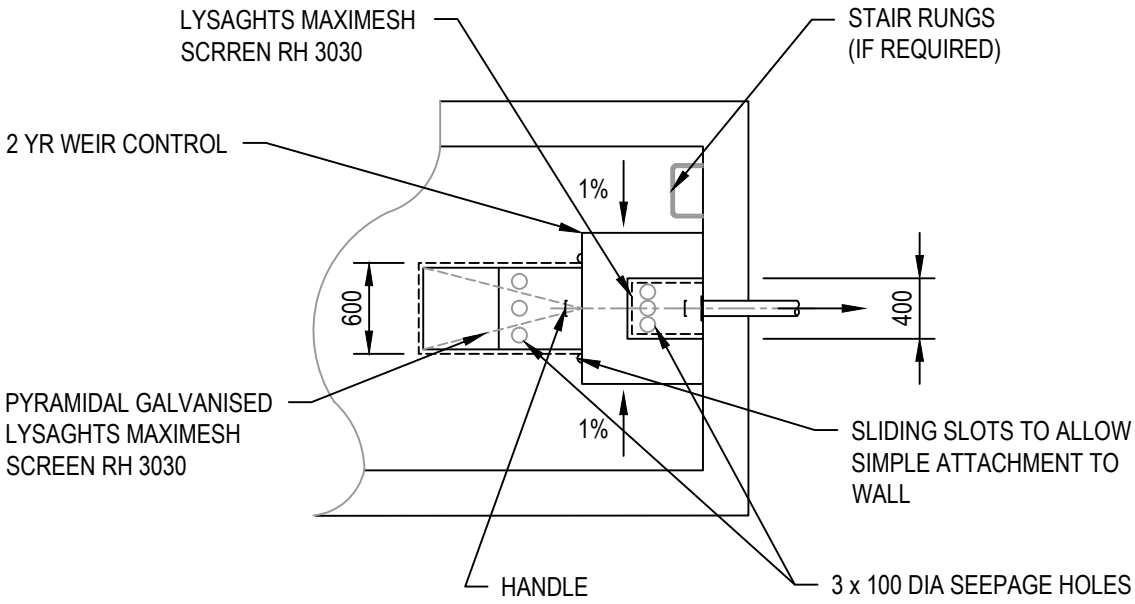
1. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
2. STRUCTURAL ENGINEER TO PREPARE DETAIL FOR THE TANK WALL, TOP SLAB AND FOOTINGS ETC. TANK TO BE CAST IN SITU AND DESIGNED STRUCTURALLY TO WITHSTAND LOADS AS APPROPRIATE DEPENDING ON LOCATION
3. THIS DRAWING MUST BE READ IN CONJUNCTION WITH SK007

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

DWG NO. SK007



PLAN



B SECTION
SK009 NTS

NOTES:

1. STRUCTURAL DETAILS TO BE SUPPLIED WITH CC.
2. LOCATE INLET PIPES WHERE POSSIBLE ADJACENT TO INSPECTION OPENINGS.
3. INSTEAD OF BONDEX MAY USE COMPRESSED FRC SHEETING WITH TEMPORARY PROPS
4. ALL GRATES MUST BE 900mmx600mm AND FITTED WITH CHILDPROOF 'J-LOCKS'.
5. FOR DEPTHS GREATER THANK 1200mm PROVIDE STEP IRONS.
6. ALL DIMENSIONS ARE IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
7. SEEPAGE HOLES ARE ONLY APPROPRIATE WHEN OSD IS LOCATED DIRECTLY ABOVE DEEP SOIL (UNLIMITED IN DEPTH).
8. THIS DRAWING MUST BE READ IN CONJUNCTION WITH SK009.

COVERED TANK TYPE DETENTION PIT

NTS

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COVERED TANK TYPE DETENTION PIT

DWG NO.
SK008

REV	DESCRIPTION	SCALE	APP'D	DATE
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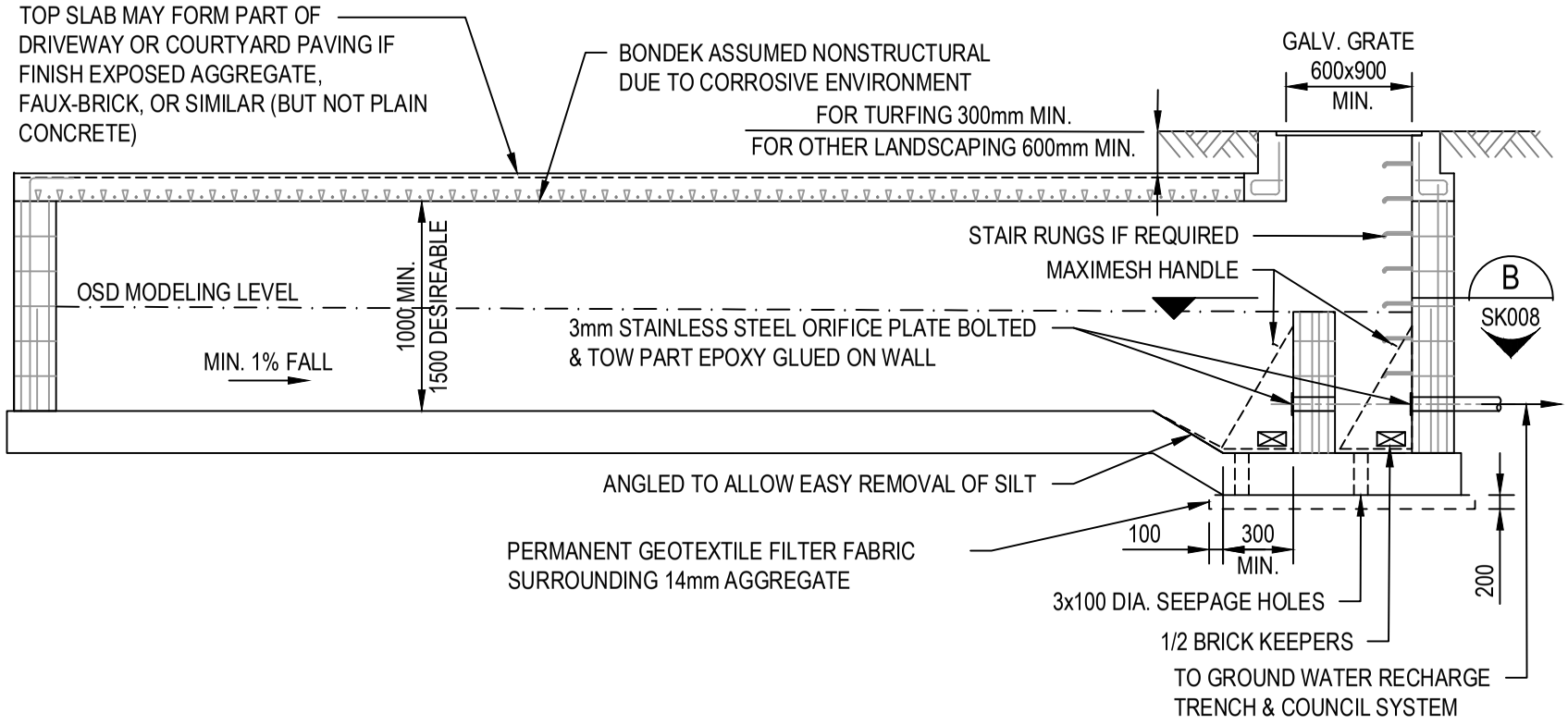
COVERED TANK TYPE DETENTION PIT - SECTION A



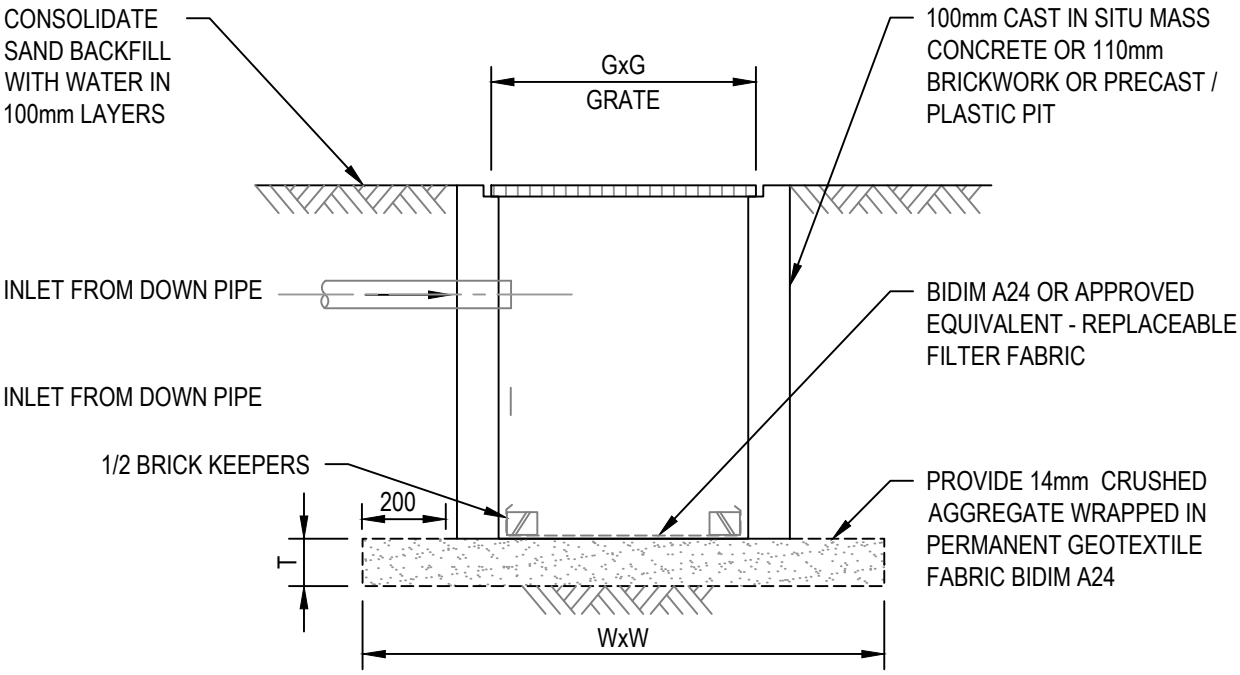
A SECTION
SK009 NTS

NOTES:

1. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
2. STRUCTURAL ENGINEER TO PREPARE DETAIL FOR THE TANK WALL, BASE, TOP SLAB AND FOOTINGS ETC. TANK TO BE CAST IN SITU AND DESIGNED STRUCTURALLY TO WITHSTAND LOADS AS APPROPRIATE DEPENDING ON LOCATION.
3. THIS DRAWING MUST BE READ IN CONJUNCTION WITH SK008.

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020

DWG NO. SK009

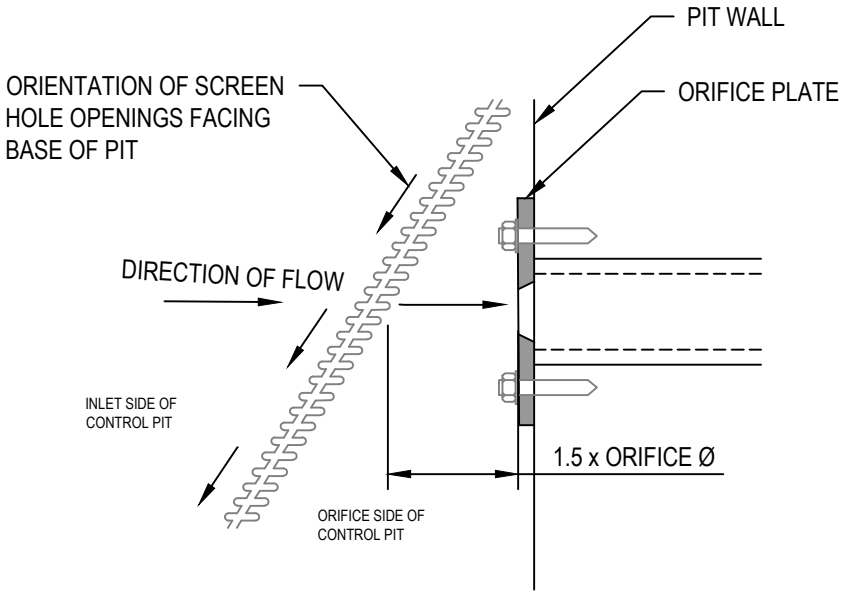


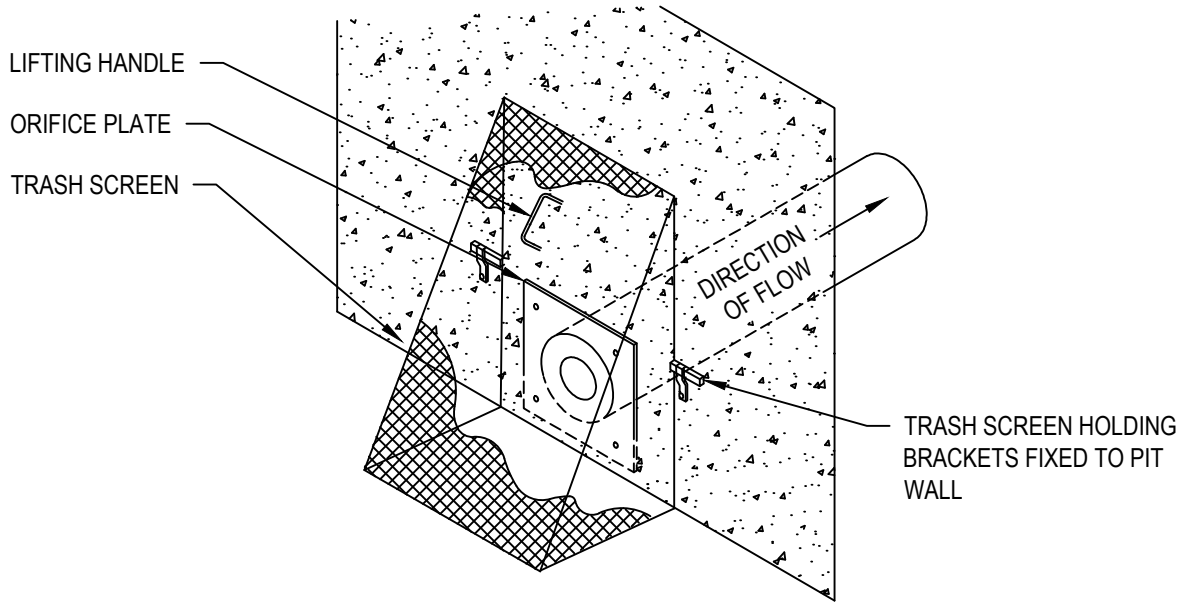
NOTES:

1. SUITABLE FOR SMALL AREAS, COURTYARDS, ETC. IN HIGHLY PERMEABLE SOILS OR IN CONJUNCTION WITH ABOVE GROUND DETENTION.
2. PLASTIC PIT MUST NOT BE USED IN DRIVEWAY OR PARKING AREAS.
   FOR W LESS THAN 3000, G = 600mm AND T = 200mm
   FOR W GREATER THAN 3000 AND LESS THAN 3600 (MAX.), G = 1200mm AND T = 200mm
3. IT IS POSSIBLE TO COMBINE A SERIES OF SINGLE ABSORPTION PITS INTO A LARGER ABSORPTION SYSTEM LINKED WITH CONNECTING PIPES.
4. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

OPEN SINGLE ABSORPTION PIT

NTS





NOTE:

1. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

ORIFICE PLATE & TRASH SCREEN

NTS

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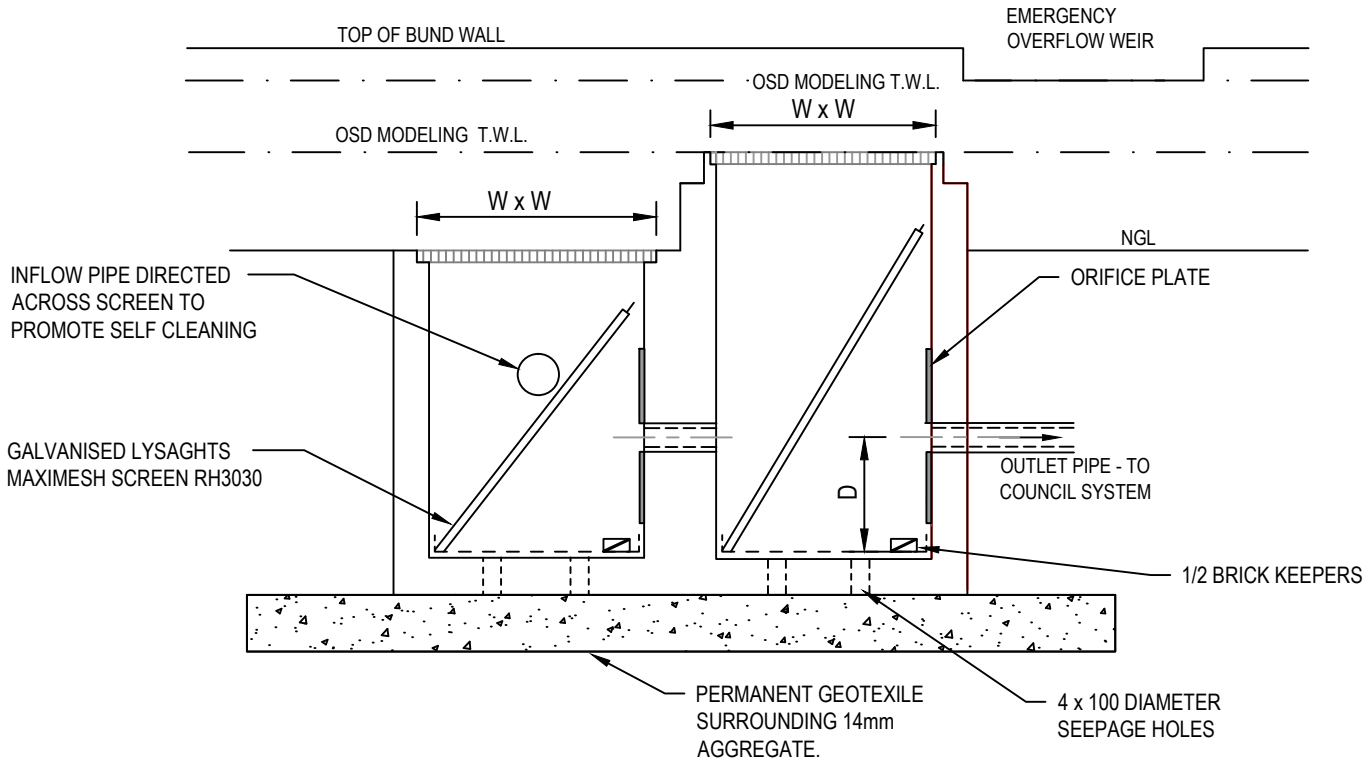
ORIFICE PLATE & TRASH SCREEN

DWG NO.
SK011

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020



EXAMPLE CONFIGURATION OF AN OSD DISCHARGE CONTROL PIT

NTS

NOTES:

1. PIT TYPE FOR USE IN ABOVE GROUND SYSTEM
2. FOR LANSCAPED/TURFED AREAS PROVIDE 20% EXTRA STORGAE
3. CONTOL PITS TO BE CONSTRUCTED OF CONCRTET (PRECAST OR CAST-INSITU)
4. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.
5. H TO BE A MINIMUM OF 1% AEP DEPTH OF OVERFLOW OVER WEIR.
6. FOR VARIABLES W & D REFER TO SK001.

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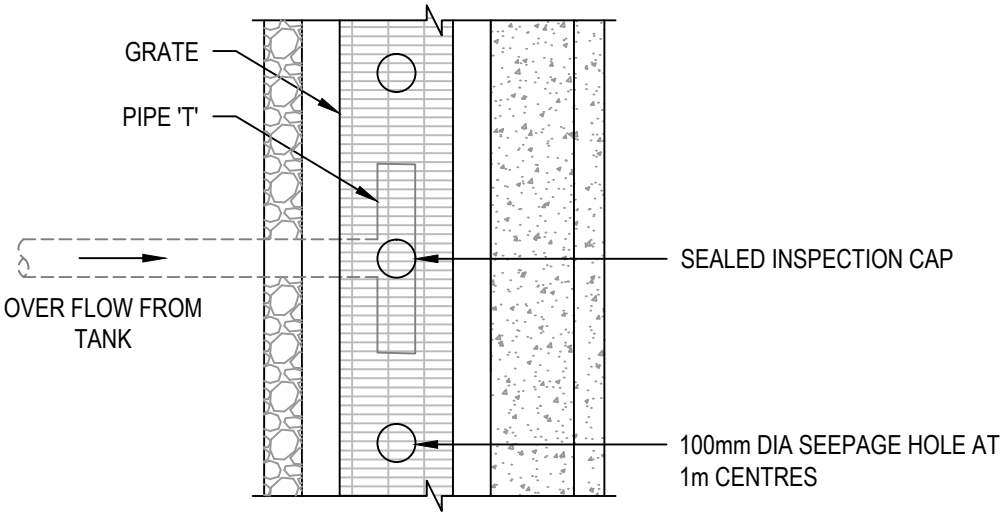
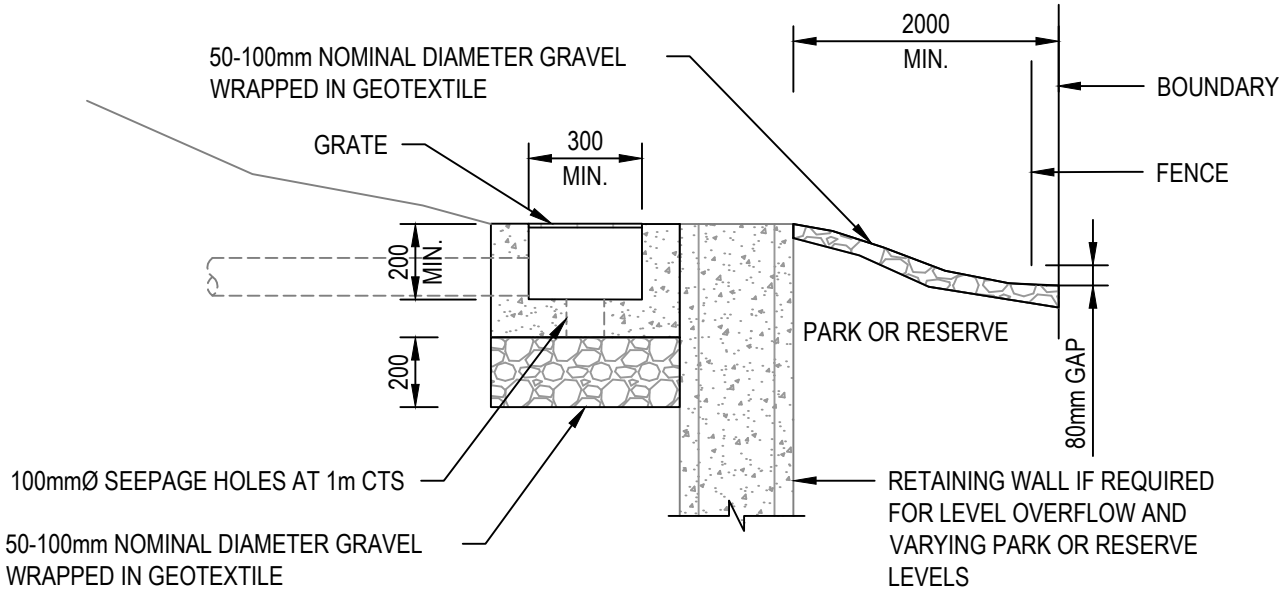
EXAMPLE CONFIGURATION OF AN OSD DISCHARGE CONTROL PIT

DWG NO.
SK012

REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020



PLAN VIEW



ELEVATION VIEW

TYPICAL TROUGH

NTS

NOTE:

1. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

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TYPICAL TROUGH

DWG NO.
SK013

REV	DESCRIPTION	SCALE	APP'D	DATE
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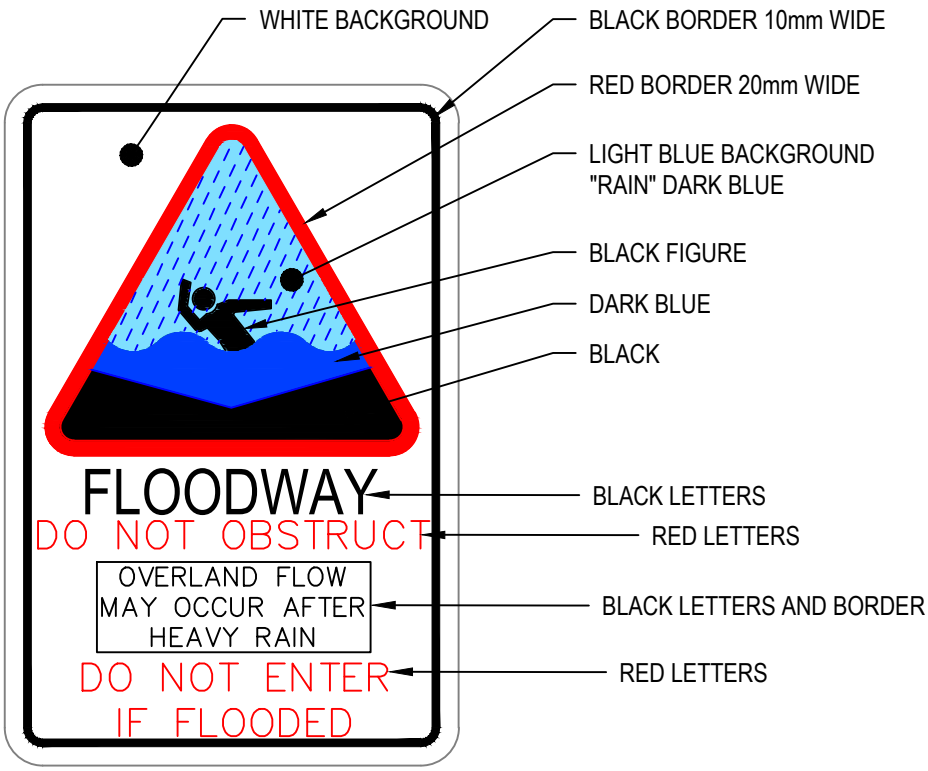

SIZE: A, 300mm x 450mm
B, 450mm x 600mm
C, 600mm x 900mm

FLOOD ADVISORY SIGN

NTS

NOTES:

1. SIGN BLANKS SHALL BE 1.6mm THICK ALUMINIUM STEEL ALLOY OF TYPE 5251 OR TYPE 5052 AND TEMPER H38 OR TEMPER H36 IN ACCORDANCE WITH AS 1734.
2. SIGN BLANKS SHALL BE FREE OF CRACKS, TEARS AND OTHER SURFACE BLEMISHES AND THE EDGES SHALL BE TRUE AND SMOOTH. THE DIMENSIONS OF THE SIGN BLANK SHALL BE WITHIN PLUS OR MINUS 1.5mm OF THE DIMENSIONS SPECIFIED AND THE FINISHED SIGN SHALL BE FLAT WITHIN A MAXIMUM ALLOWABLE BOW OF 0.5 PERCENT OF MAXIMUM DIMENSIONS OF THE CHEMICALLY CLEANED AND ETCHED OR MECHANICALLY ABRADED.
3. THE FACE OF EACH SIGN BLANK SHALL BE CHEMICALLY CLEANED AND ETCHED OR MECHANICALLY ABRADED.
4. THE BACK OF EACH SIGN SHALL BE UNCOATED AND THE SURFACE FINISH SHALL BE RENDERED DULL AND NON-REFLECTIVE EITHER BY MECHANICAL OR CHEMICAL MEANS AND SHALL BE FREE OF SCRATCHES AND BLEMISHES.
5. BACKGROUND PAINT SHALL BE AN APPROVED LONG-LIFE INDUSTRIAL QUALITY, TWO COMPOUND POLYURETHANE PAINT. LEGEND SCREENING INK SHALL BE A HIGH QUALITY DURABLE, FULL GLOSS, NON-FADE, NON-BLEED AND SCRATCH RESISTANT TYPE OF INK COMPATIBLE WITH THE MATERIAL TO WHICH IT IS APPLIED.
6. FOR ASSEMBLY AND ERECTION OF SIGNS REFER AUS-SPEC ANS AS1742 (ALL PARTS), AS1743 AND AS1744.
7. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

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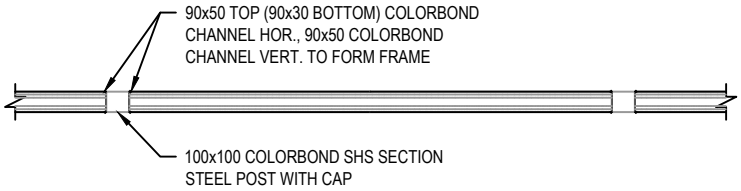
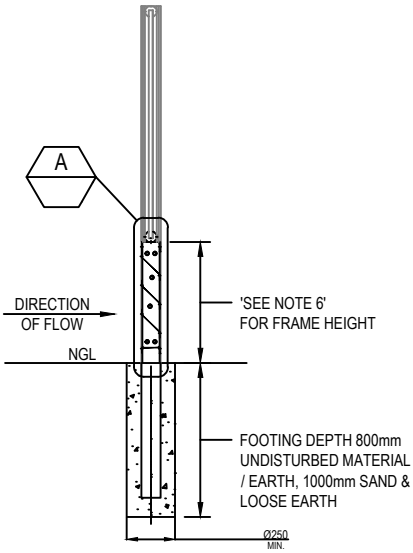
FLOOD ADVISORY SIGN

DWG NO.
SK014

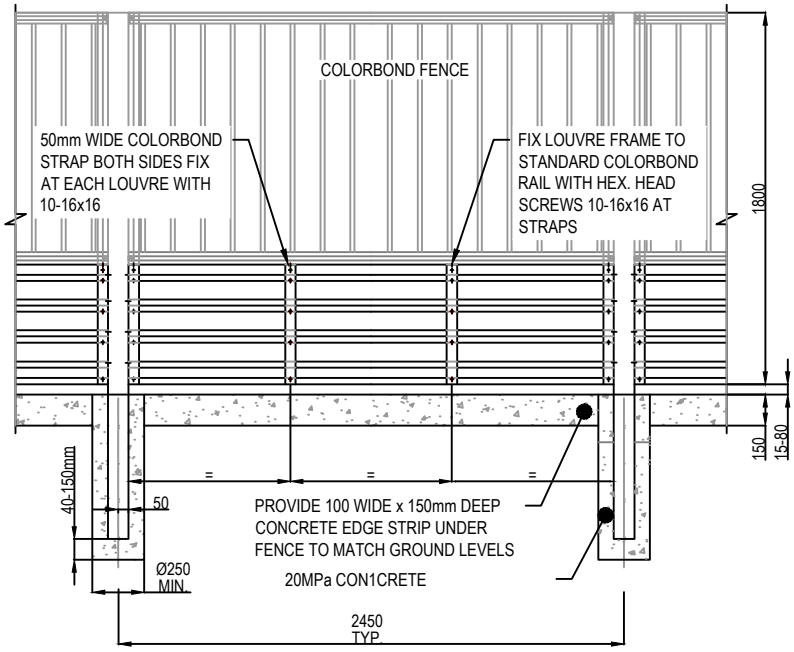
REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020



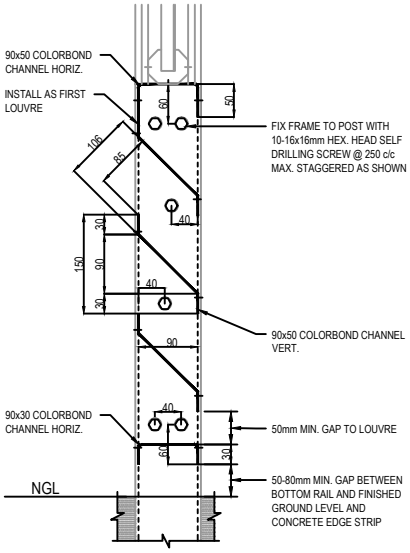
PLAN



SECTION



ELEVATION



DETAIL A

NOTES

1. ALL SHARP EDGES AND CORNERS TO BE REMOVED.
2. USE LYSAGHT INTEGRITY 820 COLORBOND STEEL WITH BMT (BASE METAL THICKNESS) 0.48mm TO FORM LOUVRES AND FRAME.
3. SELF DRILLING & SELF TAPPING SCREWS WITH HEX. WASHER HEAD TO CONFORM TO AS3566 CLASS 3.
4. FIX SCREWS MINIMUM OF 25mm FROM EDGES.
5. ALL LOOSE MATERIAL AROUND FOOTINGS IS TO BE RAMMED AND COMPACTED.
6. FRAME HEIGHT = 130+(N x 150)mm WHERE N = NUMBER OF LOUVRES AND FRAME HEIGHT MUST BE GREATER THAN OPENING HEIGHT APPROVED BY COUNCIL.
7. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

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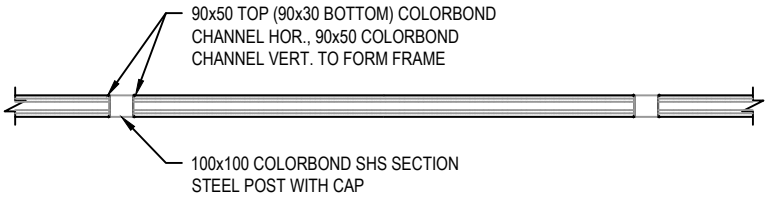
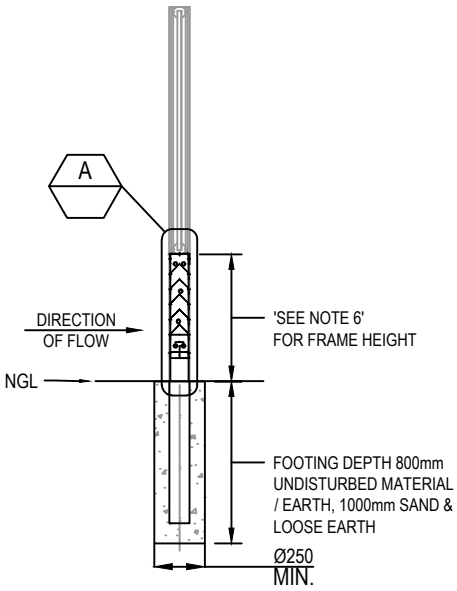
LOUVRE FLOODWAY FENCE
INSERT: TYPE A

DWG NO.
SK015

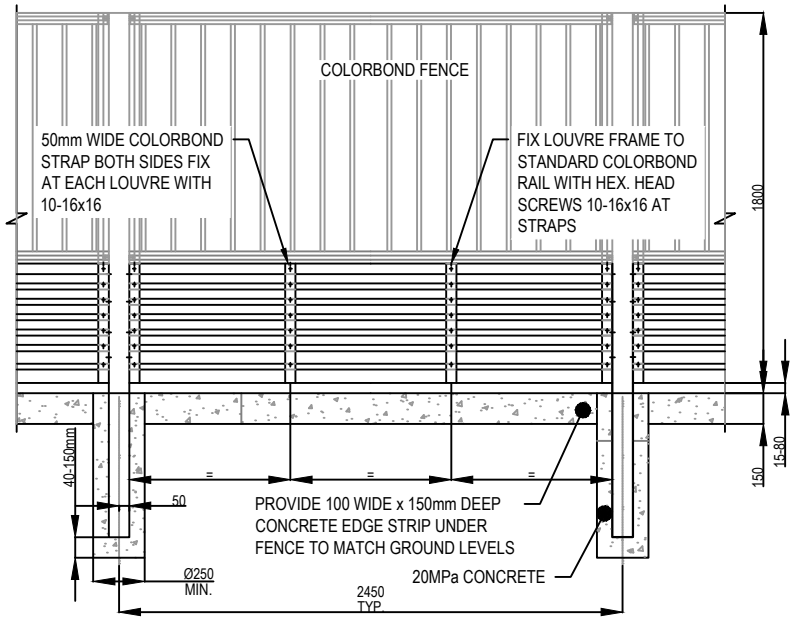
REV	DESCRIPTION	SCALE	APP'D	DATE
A	ISSUE FOR DCP 2020	NTS	K ELAZAR	22/09/2020



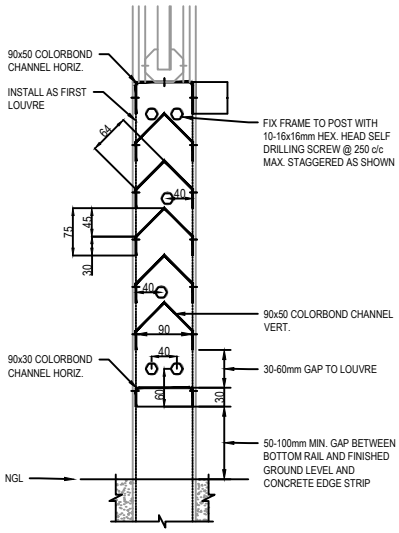
PLAN



SECTION



ELEVATION



DETAIL A

NOTES:

1. ALL SHARP EDGES AND CORNERS TO BE REMOVED.
2. USE LYSAGHT INTEGRITY 820 COLORBOND STEEL WITH BMT (BASE METAL THICKNESS) 0.48mm TO FORM LOUVRES AND FRAME.
3. SELF DRILLING & SELF TAPPING SCREWS WITH HEX. WASHER HEAD TO CONFORM TO AS3566 CLASS 3.
4. FIX SCREWS MINIMUM OF 25mm FROM EDGES.
5. ALL LOOSE MATERIAL AROUND FOOTINGS IS TO BE RAMMED AND COMPACTED.
6. TYPE B LOUVRE IS FOR USE WHERE HIGHER SECURITY IS REQUIRED.
7. ALL DIMENSIONS ARE SHOWN IN mm UNLESS SPECIFIED OTHERWISE IN THE DIAGRAM.

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LOUVRE FLOODWAY FENCE
INSERT TYPE B

DWG NO.
SK016

REV	DESCRIPTION	SCALE	APP'D	DATE
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