Design Guide – Infiltration/Absorption System Concept Design

This Design Guide summarises the general requirements for the design of an infiltration/absorption system where the system is applicable and suitable for a development. This is a technical document intended to assist developers and engineers.

Revision	Summary	Date
A	Design Requirements for Infiltration/Absorption Trench	December 2021

Application

For developments such as alterations and/or single dwellings on a site that drains to the rear (and/or over adjacent properties), infiltration/absorption systems may be considered. The system can be also used for minor paved surface areas sloping away from the street. To understand the requirements of an infiltration/absorption system, the type of required system is to be identified as follow:

1. **Minor Systems** are required for:
   i. An alteration or minor addition to an existing dwelling;
   ii. Granny flats/secondary dwellings; and
   iii. Single dwellings that the entire or majority of the roof can be drained to the street via a charged system (refer to Charged System Design Guide for further information).

2. **Major Systems** are required for:
   i. Single dwellings that the site drains to the rear (and/or over adjacent properties) where it can be justified that other stormwater disposal methods have been reviewed and are not possible or practical i.e. the minimum head for a charged line that drains the majority of the roof cannot be achieved. It is to be noted that Council preference for this type of developments is a drainage easement over the downstream property(ies). However, if it can be justified that a drainage easement over downstream properties is not available or a charged system for the roof area will not be practical, Council will accept an infiltration/absorption system as an alternative stormwater management measure. This type of system is considered a major system and has different design criteria from the minor system.

The use of an infiltration/absorption system will be permitted under the mentioned circumstances provided that:

i. It can be shown that other stormwater disposal methods have been reviewed and are not possible or practical;
ii. The subject site is suitable for the system i.e. the soil type and permeability allows for having an infiltration/absorption system;
iii. There is no restriction on the site or over the adjoining properties that would restrict the use of an infiltration/absorption system; and
iv. The system is designed and sized in accordance with the criteria outlined in this design guide.

Summary

Infiltration systems are designed to detain and retain runoff to provide an opportunity for infiltration of stored water to the surrounding soils. The aim is to reduce runoff volume by retaining and infiltrating the treated water into the soil and the local groundwater.

The primary purpose of infiltration system is runoff reduction and not to treat stormwater. However, the system will reduce pollution in urban waterways by minimising the polluted runoff reaching receiving environments and by providing a primarily filtration which improves the quality of water leaving the system.

Infiltration/absorption trenches and infiltration basins are the two types of infiltration systems that can be used as a method of stormwater disposal for eligible residential dwellings. Infiltration trenches are best suited for small residential developments while infiltration basins in the form of raingardens are more complex systems and suitable for specific conditions.

Infiltration trenches typically hold runoff within a subsurface trench prior to infiltrating into the surrounding soils. They usually comprise of a shallow, excavated trench filled with reservoir storage aggregate. Infiltration trenches are similar in concept to infiltration basins; however, trenches store runoff water below ground within a pit and tank system, whereas basins utilise above-ground storage (DPLG, 2009).

Design Process

Step 1 – Site Suitability

Infiltration systems are suitable for sites with good infiltrative soil capacity. The site is not suitable for infiltration system if:

i. The site soil type is Loose Sands;
ii. The site soil type is Heavy Clays;
iii. The site has shallow soil over rock or shale and the depth to rock is less than 1.2m;
iv. The site has steep terrain with slopes more than 10%;
v. There is a shallow groundwater table where groundwater depth is less than 1m below natural or final ground surface (whichever is lower); and
vi. The site is contaminated.

Site suitability should be defined by the applicant's stormwater engineer.

Step 2 – Sizing and Arrangement

This design guide provides an overview of the key design issues that should be considered when conceptualising and designing an infiltration system. A typical infiltration strategy is illustrated in **Figure 1.**

The infiltration trench should be designed by a competent hydraulic/stormwater engineer. The engineer shall define if the site is suitable for such a system and to design the system to allow full infiltration into the aggregate layer beneath. The following points are be considered in the design:

- The system should be designed on the basis of, 2.5 m^3 storage being provided per 100 m^2 of the roof and impervious area(s) connected to the system.
- The system should be located parallel to the proposed or existing site contours.

- A silt arrestor and trash screen should be placed in the drainage system immediately upstream of the infiltration trench.
- The system should be outside of the Tree Protection Zone (TPZ) of any existing tree within the subject site and the adjoining properties.

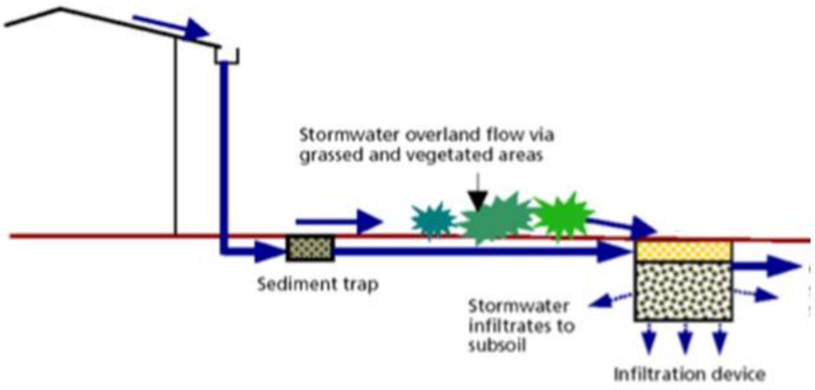

Figure 1 Typical Infiltration Trench (adopted from DPLG, 2009)

Step 3 – Location and Setback

The design of infiltration systems must take into consideration of their proximity to existing structures and boundaries and in-ground infrastructure. There should be also enough space within the subject site where the system can be located with adequate buffer distances from foundations, neighbouring properties and existing in-ground infrastructure. **Figure 2** illustrates a typical arrangement of charged line and infiltration systems and **Figure 3** illustrates typical details of an Infiltration Trench sediment control and level spreader.

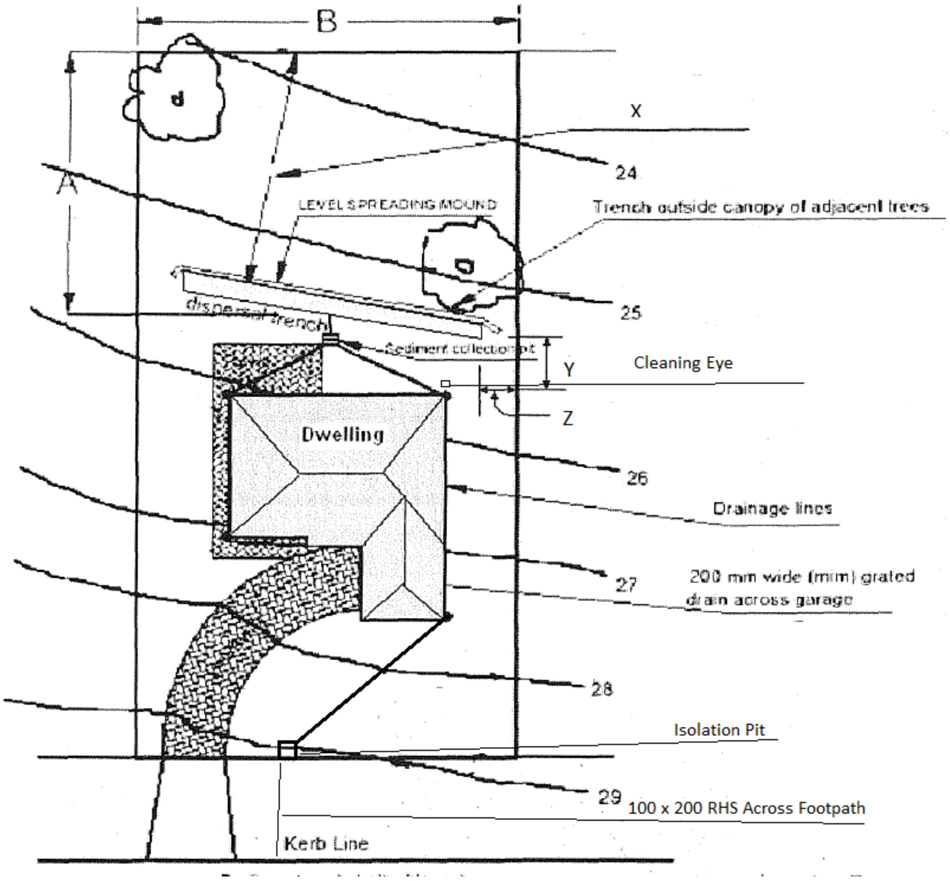

Figure 2 Typical arrangement of charged line and infiltration systems– Refer to Table 2 and Table 3 for specifying the X, Y and Z values

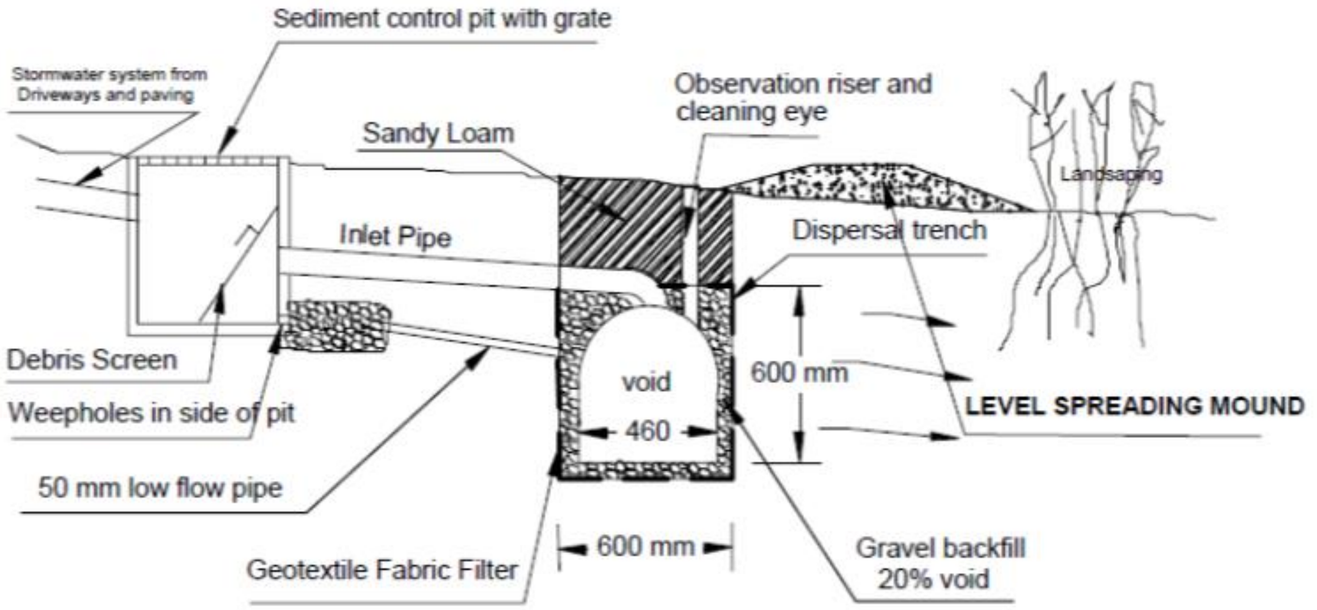

Figure 3 Typical details of Infiltration Trench sediment control and level spreader

Major systems

For single dwellings that the site drains to the rear (and/or over adjacent properties), Council preference is to obtain a drainage easement over the downstream property(ies) or have a charged system for the roof area and an infiltration system to manage minor runoff from paved surface area.

However, if it can be justified that other stormwater disposal methods have been reviewed and are not possible or practical i.e. a drainage easement over downstream properties is not available or a charged line for majority of the roof cannot be achieved, Council will accept an infiltration system as an alternative stormwater management measure. These type of systems are considered major and setback criterias for such a system are designed as summarises in **Table 1**.

Table 1 Required setback for Infiltration trenches for major systems

<table>
<tr><th>Design parameter</th><th>Description</th></tr>
<tr><td>Minimum space with service trenches</td><td>A minimum clear spacing of 1 metre between the sides of the retention device and any service trench is required.

The minimum space to each in-ground infrastructure/utility should be set in accordance with the asset owner requirements. For example, if there is a Sydney Water pipe within the subject site, the minimum clear space from the existing pipe to be set in accordance with the Sydney Water requirements.</td></tr>
<tr><td>Setback where no geotechnical investigation is undertaken</td><td>The system shall be generally located a minimum of 5 meters from any property boundary, dwelling, garage or structure to limit the effects of soil expansion/shrinkage in clay type soils as a result of the constant swelling and shrinkage cycles caused by wetting and drying.</td></tr>
<tr><td>Reduced setback where a geotechnical investigation is undertaken</td><td>A reduced setback will only be considered when:
a supporting geotechnical report is provided; or
the adjacent foundations have been designed accordingly and certified as such by a structural engineer.
Section 1.3.4 of Argue (Ed. 2009) report provides recommendations on the required setback for different soil types that can be used as a guide by the design engineer to define the reduced setback.

As a general guide, the following measures can be used; however, the design engineer must ensure that the soil type is suitable for the reduced setback*:

<table><tr><th>Soil Type</th><th>Hydraulic Conductivity (mm/hr)</th><th>Reduced Setback (m)</th></tr><tr><td>Sand</td><td>Kh >= 180</td><td>1m</td></tr><tr><td>Sandy Clay</td><td>36 =< Kh < 180</td><td>2m</td></tr><tr><td>Medium Clay</td><td>3.6 =< Kh < 36</td><td>4m</td></tr><tr><td>Other suitable soil type</td><td>0.036 =< Kh < 3.6</td><td>5m</td></tr></table>* Adopted from Argue (Ed. 2009) and summarised</td></tr>
</table>

Minor systems

The infiltration system is considered a minor system if the development is an alteration or minor addition to an existing dwelling; Granny flat/secondary dwelling; or single dwellings that the entire or majority of the roof can be drained to the street via a charged system. Setback criteria for minor systems to be designed as detailed in **Table 2**.

Table 2 Required setback for Infiltration trenches for minor systems

<table>
<tr><th>Design parameter</th><th>Description</th></tr>
<tr><td>Minimum space with service trenches</td><td>A minimum clear spacing of 1 metre between the sides of the retention device and any service trench is required.

The minimum space to each in-ground infrastructure/utility should be set in accordance with the asset owner requirements. For example, if there is a Sydney Water pipe within the subject site, the minimum clear space from the existing pipe to be set in accordance with the Sydney Water requirements.</td></tr>
<tr><td>Setback where no geotechnical investigation is undertaken</td><td>To limit the effects of soil expansion/shrinkage in clay type soils as a result of the constant wetting and drying cycles, the system shall be generally located:
a minimum of 5 meters from any foundation, dwelling and major structures/buildings; and
a minimum of 3 m away from the property boundary, garage or minor structures.</td></tr>
<tr><td>Reduced setback where a geotechnical investigation is undertaken</td><td>A reduced setback will only be considered when:
a supporting geotechnical report is provided; or
the adjacent foundations have been designed accordingly and certified as such by a structural engineer.
Section 1.3.4 of Argue (Ed. 2009) report provides recommendations on the required setback for different soil types that can be used as a guide by the design engineer to define the reduced setback.

As a general guide, the following measures can be used; however, the design engineer must ensure that the soil type is suitable for the reduced setback*:

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References

1. Department of Planning and Local Government, 2009, *Water Sensitive Urban Design Technical Manual for the Greater Adelaide Region,* Government of South Australia, Adelaide
2. Argue, J. R, Ed, 2009, *WSUD: basic procedures for 'source control' of stormwater - a Handbook for Australian practice.* Editor: Argue, J.R., Authors: Argue, J.R., Allen, M.D., Geiger, W.F., Johnston, L.D., Pezzaniti, D., Scott, P., Centre for Water Management and Reuse, University of South Australia, 5th Printing, February 2009, ISBN 1-920927- 18-2, Adelaide
3. Upper Parramatta River Catchment Trust, 2003, *Water Sensitive Urban Design Technical Guidelines for Western Sydney* , Draft prepared by URS, 7 November 2003