New WAter Ways

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Introducing water sensitive urban design

Tree pits

Summary

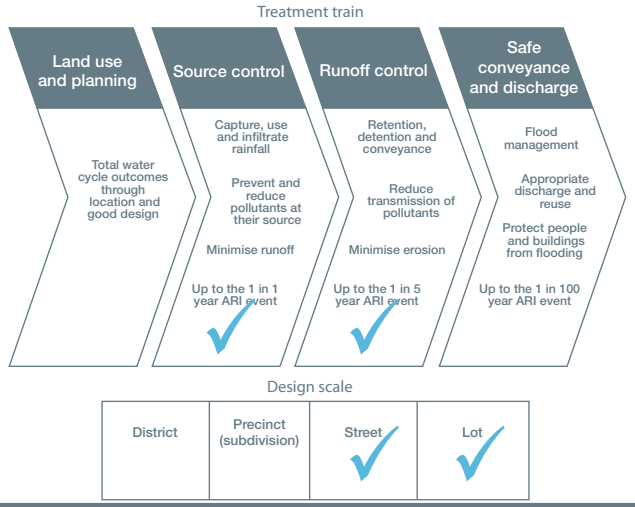
Tree pits are biofilters generally built into the side of roads that receive stormwater runoff from roads. Tree pits can be used in place of conventional street tree/side entry pit systems. The stormwater runoff provides a valuable water source for maintaining street trees in a drying climate.

Tree pits treat runoff from small rainfall events, through filtration, extended detention and some biological uptake of nutrients. Overflow from larger rainfall events may bypass the tree pit and flow along the street into the downstream stormwater management system. Detention cells at the base of the pit may be connected to conventional stormwater pipes to manage overflows from larger events where necessary.

Main benefits

- Reduce stormwater runoff volumes
- Increase groundwater recharge
- Reduce pollutant levels and improve the quality of receiving water bodies
- Provide some local flood control
- Improve street appeal and amenity
- Provide shade and reduce urban heat island effects
- Provide wildlife habitat
- Require limited space
- Easy to install and maintain
- Available in many sizes

Where they can be used in the water sensitive urban design process



Tree Pits
City of Gosnells

Design factors

- The surface of the growing media of a tree pit must be lower than the surrounding ground to allow for water ponding.
- Non-floating mulch should be used.
- Groundcover vegetation at the base of trees helps maintain high porosity in the soil and improves nutrient uptake. Absence of vegetation generally increases maintenance due to increased need for clearance of litter and sediment free for effectiveness.
- Consider any tripping hazards in the design, particularly in high foot traffic areas and provide protection to the tree in high vehicle traffic areas including on-street parking. This may include bollards or seating.
- Grills should be designed to allow easy access for maintenance such as litter and sediment removal.
- Where larger catchments feed into the tree pit, appropriate connections should be made to allow the stormwater to effectively move through the system and be discharged back into the conventional stormwater drainage system. Stormwater in excess of the tree pit capacity can travel further down the kerb and be collected through side entry pits. Discharge and overflow pipes may also be installed with clean-out and inspection points.
- Trees used in tree pits should be selected for their ability to grow in the conditions provided by local rainfall patterns and the hydraulic conductivity of the soil used in the tree pit. Consider the use of a liner and/or watering in areas where there are lengthy periods in between rainfall events.
- Tree guards may need to be used for protection of young saplings and should be structures that can be removed easily to accommodate tree growth.
- Root barriers can be effectively used to train roots away from kerb and road structures. Root barriers are not fail proof and soil volume and suitability should be considered carefully.
- Where sealed pits are installed, careful consideration of soil volume should be made. A medium sized tree requires at least 30m^3 of soil.
- Discuss the design with local government maintenance staff to ensure support for maintenance requirements.
- Observation wells may be installed to monitor water depth and drainage rates in pit. This is usually similar to a capped riser.

Target pollutants

- Phytoremediation. Along with water, trees take up trace amounts of harmful chemicals, including metals, organic compounds, fuels, and solvents from the soil.
- Root growth and decomposition increase soil infiltration capacity and rate.

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Tree pit elements

Plants are usually one large shrub or tree to help filter runoff, and should look attractive, alleviate heat island effects by providing shade and withstand extreme wet and dry periods.

Groundcovers or non-floatable mulch (such as stone mulch) to help keep topsoil moist and free of weeds.

Observation wells (optional) are used to monitor water depths and drainage rates in pit. Fitted with an inspection opening.

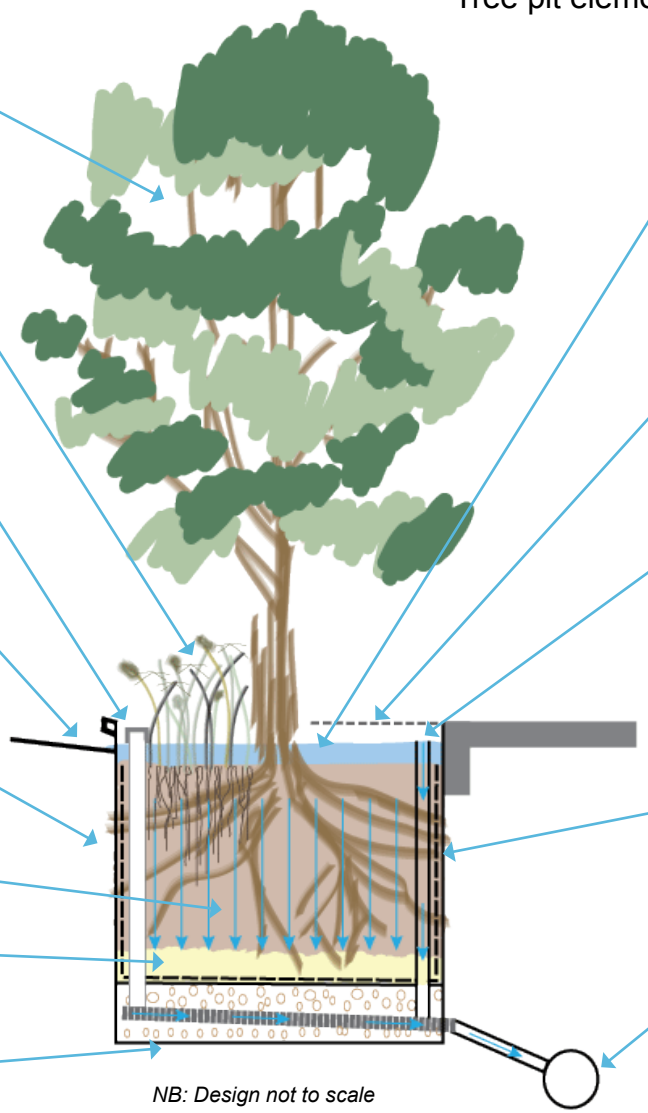
Kerb and channel direct stormwater flows from road or surrounding hardsurface to tree pit. Can be a large opening in the walled kerbing or a side entry pit built into the footpath.

Waterproof lining (if included) is used to avoid saturating tree pits in areas of poor draining soils and also assists in retaining moisture in extended dry periods.

Loamy sand filter media.

Sandy transition layer.

Gravel drainage layer containing **perforated pipe**.



NB: Design not to scale

Extended detention - area around the tree is set lower than the surrounding ground where **stormwater ponds** before filtering through the soil.

A **grate** (optional) at the base of the tree to protect the roots and allow pedestrian movement.

Overflow pit (optional) - large flows bypass directly to conventional drainage system. These may also have clean-out and inspection points, usually capped.

Root barrier (optional) - specially manufactured free-draining geotextile fabric used to line tree pit, preventing roots growing outside area and causing damage to utility services, building foundations and roadways.

Stormwater drainage network.

(Adapted from: *Tree Pit: Construction Guide*, Auckland Council)

Required reading

Street tree design guidelines, 2008, Landcom, New South Wales

Tree pit design principles, 2012, Clearwater, Victoria

Langtree Mall Tree Pits: Case Study, 2012, Clearwater, Victoria

Stormwater Tree Pit, 2008, Charles River Watershed Association (CRWA), Portland Oregon, USA

City of Sydney Street Tree Master Plan: Part D, Technical Guidelines, 2011, City of Sydney, New South Wales

Raingarden and Bioretention Tree Pits: Maintenance Plan, 2008, Facility for Advancing Water Biofiltration (FAWB)

Tree Pits: Construction Guide, not dated, Auckland Council, New Zealand

Tree Pits: Operation & Maintenance Guide, not dated, Auckland Council, New Zealand

Stormwater to Street Trees: Engineering Urban Forests for Stormwater Management, 2013, U.S. Environmental Protection Agency, Washington DC, USA

Australian Government

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