

WATER SENSITIVE URBAN DESIGN

CONSTRUCTION, ESTABLISHMENT, ASSET HANDOVER AND MAINTENANCE GUIDE

FINAL

Prepared for the Northern Territory Department of Planning and Infrastructure
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1 INTRODUCTION

Urban development in the Darwin Region is occurring without appropriate consideration of its impact on the health of the region's waterways. In order to manage the impacts of new development and redevelopment on Darwin Harbour, the Territory Government is seeking to implement Water Sensitive Urban Design (WSUD) within all new development

To facilitate the adoption of WSUD, the DPI (Department of Planning and Infrastructure) in conjunction with NRETA (Department of Natural Resources, Environment and the Arts) have secured a grant from the Australian Government Coastal Catchments Initiative (CCI) program to develop a WSUD Strategy for Darwin Harbour. The WSUD Strategy will create an enabling environment to ensure commitment to urban water cycle and stormwater management through a WSUD framework for Darwin. The WSUD framework will link policy to locally relevant technical design guidelines, manuals and industry tools.

These *Construction, Establishment, Asset Handover and Maintenance Guidelines* have been prepared for multiple audiences, including design practitioners seeking to implement WSUD in new subdivision development, and local council staff responsible for approvals and asset handover. They include guidance on undertaking construction, establishment, asset handover and ongoing maintenance.

1.1 Purpose of these guidelines

These *Construction, Establishment, Asset Handover and Maintenance Guidelines* have been developed as part of the Darwin Harbour WSUD Strategy, funded by the CCI program. They have been prepared as part of Task 16 (Stage 6) of the Workplan, along with several other guideline documents. The framework of guideline documents is shown in Figure 1.

These guidelines are intended for two main audiences:

- Design practitioners who are designing WSUD solutions, particularly stormwater treatment systems.
- Local council staff responsible for approvals and asset handover.

These *Construction, Establishment, Asset Handover and Maintenance Guidelines* follow on from the *WSUD Technical Design Guidelines*, which described how to undertake design calculations and prepare detailed designs for WSUD elements within a new development. Design practitioners should consider construction, establishment, asset handover and maintenance as part of the design process, therefore the information in these guidelines is relevant at the design stage.

Similar to the *WSUD Technical Design Guidelines*, these *Construction, Establishment, Asset Handover and Maintenance Guidelines* focus on stormwater quality improvement measures (unlike the *WSUD Planning Guide*, which encompassed both potable water conservation and stormwater quality improvement), as it is in this area that the construction, establishment, asset handover and ongoing maintenance process is particularly important.

Darwin Harbour WSUD Strategy Road Map

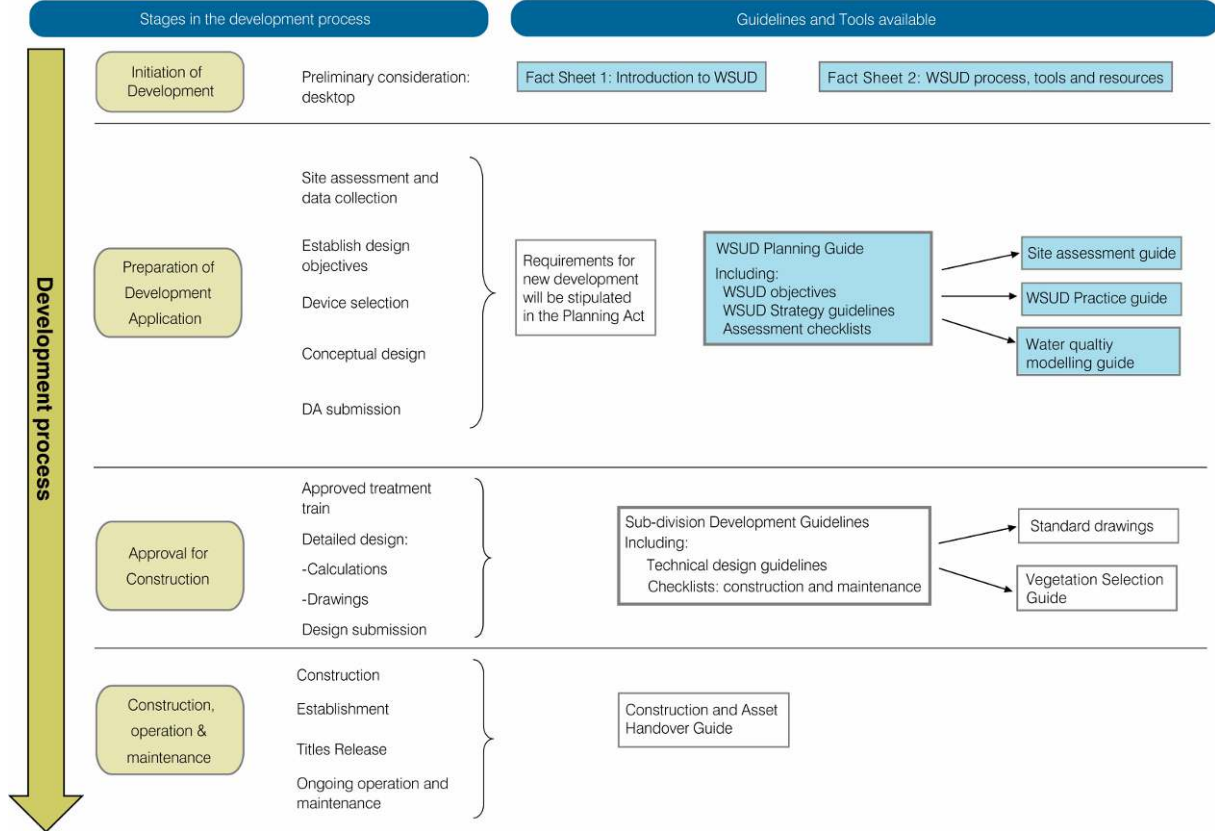


Figure 1: Relationship of the “Construction, establishment, asset handover and maintenance guide” to other guidelines and tools

1.2 Scope of these guidelines

These guidelines describe appropriate methods for construction, establishment, asset handover and ongoing maintenance of WSUD systems in the Darwin Region. It is not the intention of the guidelines to detail every part of the process for every type of treatment measure, but rather to provide general principles which can be applied to a wide range of situations. Design practitioners will need to develop specific strategies for particular treatment systems.

WSUD is a new practice in the Darwin Region and in the wet-dry tropics in general. Knowledge of best practices for construction, establishment and maintenance of WSUD measures in this climatic zone is constantly increasing. These guidelines therefore encourage innovation and the pursuit of alternative approaches to those presented within them. The methods and recommendations given in these guidelines are based on current best practice in southern Australia. Alternative approaches may provide potential improvements.

These guidelines draw to a large extent on information included in the *WSUD Technical Design Guidelines for South East Queensland* (Moreton Bay Waterways and Catchments Partnership, 2006). This document is available online:

<http://www.healthywaterways.org/wsud technical design guidelines.html>

The main reasons for relying on the South-East Queensland Technical Design Guidelines (“SEQ Guidelines”) are as follows:

- In SEQ there is extensive experience with construction, establishment and maintenance of stormwater treatment systems
- The SEQ Guidelines include comprehensive information on construction, establishment and maintenance

2 CONSTRUCTION AND ESTABLISHMENT

Most vegetated stormwater treatment systems (swales, bioretention systems and wetlands) require two growing seasons before vegetation within them has reached maturity, and until this time, the height and density of vegetation will be less than the “design” condition. During this time, vegetated stormwater treatment systems are susceptible to scour and erosion, deposition of high sediment loads and infestation by weeds. If subdivision construction and allotment building is also taking place in the catchment at the same time, then the risks are increased. Therefore a staged construction and establishment approach is recommended.

The construction and establishment approach outlined here is based on that given in the current SEQ Guidelines. SEQ’s Healthy Waterways Partnership is currently working on a new document: “Construction and Establishment of Vegetated Stormwater Management Systems”, due for release in March 2009. Once this document is available, it is recommended that this section be reviewed and updated.

Two distinct phases can be identified in the development of a new area (as described in the SEQ Guidelines):

1. **Subdivision construction:** Involves earthworks, installation of services (roads, water, sewerage, power etc.) followed by the landscape works to create streetscape and open space features. These activities can generate large sediment loads in runoff, which can smother vegetation. Construction traffic and other works can also result in direct damage to stormwater treatment systems. Importantly, all works undertaken during subdivision construction are normally ‘controlled’ through the principal contractor and site manager. This means the risks can be readily managed through appropriate guidance and supervision.
2. **Building phase:** Involves construction of the houses and other buildings. Sediment loads and construction traffic remain significant risks. This phase of development is effectively ‘uncontrolled’ due to the number of building contractors and subcontractors present on any given site. For this reason the building phase represents the greatest risk to the successful establishment of stormwater treatment systems.

Corresponding to these stages, a construction and establishment approach for stormwater treatment systems has been proposed in the SEQ Guidelines, and is also recommended in Darwin. The approach is outlined in Figure 2 and includes three stages:

1. **Functional installation** occurs during the final period of subdivision construction, at the same time that the landscape works are underway. Functional installation involves completion of earthworks and installation of inlets, outlets, etc. The surface is then stabilised ahead of the building phase.
2. **Sediment and erosion control** occurs during the building phase. Protection of stormwater treatment systems during the building phase is important as uncontrolled building site runoff can carry excessive sediment loads, as well as weeds and litter.
3. **Operational establishment** occurs immediately after the completion of the building phase and involves removing temporary stabilisation measures, as well as accumulated sediment and debris, and planting out the stormwater treatment systems.

These stages are described in more detail in the following sections.

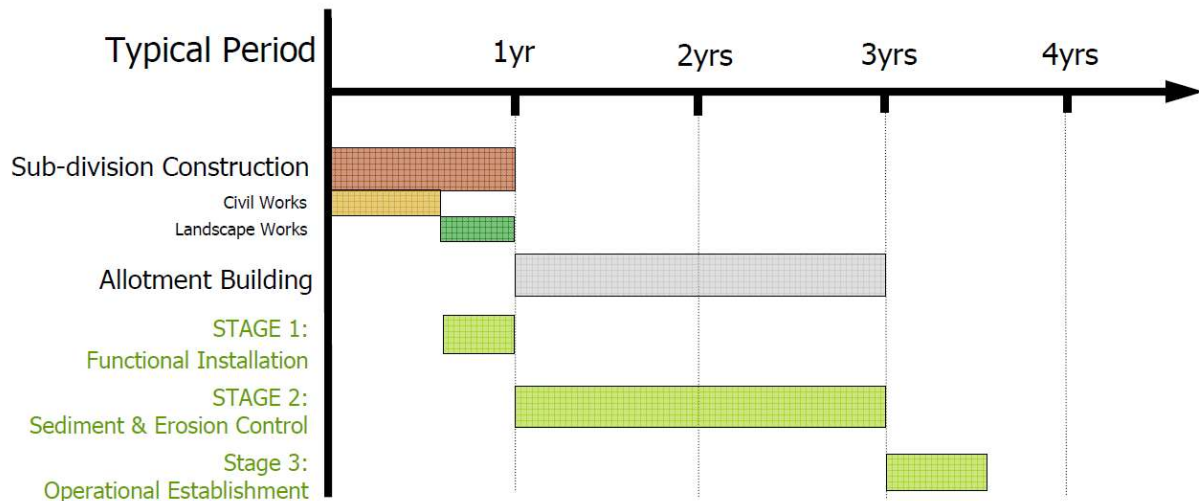


Figure 2: Staged construction and establishment method, recommended in SEQ Guidelines

2.1 Functional Installation

Functional installation involves completing the earthworks for stormwater treatment systems, and installing inlets, outlets and other components of the drainage system. In bioretention systems, the drainage layer, transition layer and filter media may be placed at this stage, provided they can be effectively protected from clogging during the remainder of the construction process.

The surface is then stabilised so that treatment systems can remain as-is during the building phase. The SEQ Guidelines recommend using geofabric, shallow topsoil and instant turf for stabilisation. Instant turf is not likely to be practical in the Darwin Region, where it would not survive the dry season, however other stabilisation methods may be appropriate.

Barriers are also recommended, particularly for streetscape stormwater treatment systems, to ensure that they are protected from construction traffic.

2.2 Sediment and erosion control

During the building phase, erosion and sediment controls should be in place across the site, and should protect stormwater treatment systems from high sediment loads. However at this stage, some stormwater treatment measures may also be able to play a role in site sediment and erosion control. For example sedimentation basins and bioretention basins can be configured to operate temporarily as construction-stage sedimentation basins.

If stormwater treatment systems can be effectively taken offline during the building phase, then operational establishment may be able to commence at this stage, with planting occurring according to the design planting schedule. For example wetlands can often be effectively taken offline by disconnecting them from the upstream sedimentation basin. During plant establishment, water levels need to be controlled in the wetland to encourage vigorous plant growth. Flows can exit the sedimentation basin via the high flow bypass spillway. However if there is a risk of sediment smothering treatment systems, then operational establishment should be delayed until the end of building construction.

2.3 Operational establishment

At the completion of the building phase the temporary stabilisation measures and sediment controls should be removed with all accumulated sediment and stormwater treatment systems re-profiled and planted in accordance with the proposed design planting schedule. Establishment of the vegetation to design condition can require more than two growing seasons, depending on the vegetation types, during which additional maintenance will be required.

During establishment of vegetation, weed control and watering are key considerations. Stormwater treatment systems should not be mulched with conventional organic mulches, as these are often buoyant and will wash away. Biodegradable erosion control matting is a suitable alternative. Hydro-mulch may also be used prior to planting, to maintain stable surfaces. Note that erosion control matting and hydro-mulch should not be used on the filter media surface of bioretention systems (but may be used on the batters).

High planting densities will help avoid weed establishment, and follow-up weeding will help ensure that weeds do not take over.

If planting is undertaken at the start of the wet season, plants will have a period of several months of good rainfall in which to establish. However during the first dry season, some irrigation may still be required.

Construction checklists are available in the SEQ Guidelines for each stormwater treatment measure included in that document. For ease of reference, these are reproduced in Appendix A.

3 ASSET HANDOVER

After completion of subdivision construction, there are a number of stages which follow, as outlined in Darwin and Palmerston Councils' subdivision guidelines:

1. **On Maintenance:** at the completion of development, the developer applies to the local council to go "on maintenance". Construction documents, fees and maintenance and security bonds are lodged with the council.
2. **Maintenance period** (defects liability period): the developer is solely responsible for the maintenance of works (including stormwater treatment systems) during this period. The local council may conduct inspections as necessary to ensure that an acceptable level of maintenance is being achieved. The local council may use the maintenance/security bonds during this time to rectify defects.
3. **Off Maintenance:** at the end of the maintenance period, the developer applies to the local council to come off maintenance. Off maintenance will be granted once the council is satisfied that all the works (including stormwater treatment systems) have been satisfactorily maintained and no further defects have been identified. Relevant maintenance and security bonds are returned once off maintenance is granted.

After coming off maintenance, assets are handed over to the local council for ongoing operation and maintenance. The asset handover process is important for stormwater treatment systems, as some potential issues may not be apparent immediately after construction, but may emerge after the first wet season.

Key considerations at the asset handover stage are:

- That the stormwater treatment systems have been constructed and are operating as designed
- That the vegetation has successfully established
- That all relevant plans and other documentation are provided
- That the requirements for ongoing maintenance are clear

Example asset handover checklists are available in the SEQ Guidelines for each stormwater treatment measure included in that document. For ease of reference, these are reproduced in Appendix B. These may be tailored by each local council to suit their needs.

4 ONGOING OPERATION AND MAINTENANCE

Stormwater treatment systems require regular inspections and maintenance to ensure that the vegetation remains healthy, accumulated sediment and debris does not smother the treatment system, inlets and outlets remain free of blockage and that scour and erosion and other damage is identified and rectified early.

Typical maintenance activities are relatively simple and involve:

- Inspection for scour, erosion, traffic and other damage, and repairing damage where required
- Inspection for excessive sediment deposition, build up of debris and blockage, and clearing where required
- Inspection to identify issues which may increase the risk of mosquito breeding, such as isolated pools, and corrective action where required
- Inspection and testing of irrigation systems (where installed)
- Weed removal
- Mowing, slashing or pruning to remove unwanted vegetation and stimulate new growth
- Occasional replanting when vegetation dies
- Pest monitoring and control

It is recommended that wet weather inspections should be undertaken to help identify any potential issues, particularly during the first few wet seasons of operation. Some potential issues which are obvious during wet weather operation may not be apparent in dry weather. Otherwise most of the maintenance activities can be undertaken in the dry season, when it will be easier to access inlets and outlets and manage unwanted vegetation.

As set out in the SEQ Guidelines, a maintenance plan for a stormwater treatment system should include:

- inspection frequency
- maintenance frequency
- data collection/ storage requirements (i.e. during inspections)
- detailed cleanout procedures (main element of the plans) including:
 - equipment needs
 - maintenance techniques
 - occupational health and safety
 - public safety
 - environmental management considerations
 - disposal requirements (of material removed)
 - access issues
 - stakeholder notification requirements
 - data collection requirements (if any)

- design details

Maintenance plans should generally be developed as part of the design process, but may be modified during the establishment phase as certain maintenance issues become better understood.

Example maintenance checklists are available in the SEQ Guidelines for each stormwater treatment measure included in that document. For ease of reference, these are reproduced in Appendix C. These should be tailored for each treatment system when preparing a maintenance plan.

5 REFERENCES

City of Palmerston 2007 *Palmerston Subdivisional Guidelines* Revision 1, August 2007.

Darwin City Council 2005 *Subdivision and Development Guidelines* September 2005.

Moreton Bay Waterways and Catchments Partnership, 2006 *WSUD Technical Design Guidelines for South East Queensland*.

Appendix A Construction Checklists

Appendix B Asset Handover Checklists

Appendix C Maintenance Checklists