Stormwater Design Guidelines for

Residential Developments

June 2011

Contents

Table Index

1 Introduction

1.1 General

This document has been prepared to assist developers meet the expectations of the City of Karratha (the Shire) in drainage of any development in a residential area.

The City is the authority responsible for the future care, control and management of the road and stormwater drainage infrastructure. All designs submitted will be checked against these guidelines and the reserves the right to request revisions or further details if they are not satisfied with the information supplied.

1.2 Background

Typically the drainage network in the developed areas of the City operate by capturing flows within developed residential area and conveying the water to topographic low points and discharging through open drainage channels. The channels vary in size and shape, depending on the volumes of water they convey.

The current drainage network within the City has proven to be an effective system that performs its function well. Any proposed modifications will undergo close scrutiny as it may impact on the hydraulic capacities of drainage control points such as road crossings. It is important that new developments are designed to ensure post development flows do not exceed pre development flows so additional pressures are not placed on these drainage points within the network.

1.3 Developer Responsibilities

Any developer subdividing or developing land for residential purposes is required to undertake stormwater drainage design. Although the extent of the design will vary in accordance with the size of the development, in a basic context it will involve examination of the total drainage catchment area to ensure any upstream drainage may pass through the development is included in the design and the drainage system developed is capable of carrying the ultimate design flow from the upstream catchment as well as the developed land. The drainage system shall be designed to cater for two different storm events: 1. The initial storm

2. The major storm

1.3.1 Shared Drainage Systems

Developers whose land shares a common drainage catchment have a responsibility for ensuring that the whole of the catchment, including major roads are drained.

Larger developments which may have a staged development process will be required to demonstrate an overall drainage plan for the entire catchment prior to obtaining approval for any individual stages.

1.3.2 Existing Drainage Systems

If, during the design phase it is determined that existing drains do not meet the requirements of the new development then the developer must arrange appropriate approvals for altering the existing infrastructure prior to undertaking any works. Under no circumstances will any alteration to existing drain be permitted without authorisation.

1.3.3 Outfall to Private Property

In instances where stormwater is to be discharged into private land downstream of a development, the developer must ensure that an easement is provided over the route of the drain in addition to constructing and/or improving the drainage outlet. The easement shall be in favour of the City of Karratha

1.3.4 Preliminary Drainage Proposal

A preliminary drainage proposal and investigation will be required which defines the drainage requirements for initial and major storms, identifies types and location for Water Sensitive Urban Design (WSUD) strategies, considers upstream and downstream catchments, identified necessary flood ways and any upgrades required to existing infrastructure. Results of this investigation shall be included on a master plan for drainage which shall be provided to the City for approval prior to commencing any development.

1.3.5 General Design Parameters

The developer in consultation with the drainage designer will be responsible for determining suitable runoff coefficients and characteristics for a drainage system based on the ultimate development of all allotments for the relevant land zoning. Storm events shall be in accordance with table 1 below

Table 1 Design Storm Events

Catchment Zoning	Initial Storm	Major Storm
All open spaces	2 year	100 year
All other Zones	5 Year	100 year

1.4 Development within Drainage Reserves

Any proposed development that impinges on drainage reserves will require detailed investigation. The Local Government Guidelines for Subdivision Development 2009 – Edition 2 (IPWEA 2009) illustrate a floodplain development strategy and identify a flood fringe that can be utilised if necessary. The minimum requirement for this type of impingement will include a hydrologic and hydraulic assessment to demonstrate:

- Minimum habitable floor level of 0.5 m above the 100 year ARI flood level.
- Total development within the flood fringe does not raise the 100 year ARI flood level by more than 0.15 m

Environmental considerations are also major design requirements for all drainage infrastructure and subdivision designs must be undertaken in consultation with relevant agencies. In particular, soil erosion and sediment control will be necessary both during construction and maintenance periods.

To avoid mosquito breeding and associated issues, all drainage systems and associate structures should be designed in consultation with the Department of Health.

1.5 Water Sensitive Urban Design (WSUD)

The City supports the principles of WSUD and recommends they be adopted to suit the climatic and ground condition of the region. All developers are to maintain surface and groundwater quality at predevelopment levels (winter concentrations) and improve the quality of water leaving the developed area, if possible. All runoff contained in the drainage infrastructure network needs to receive treatment prior to discharge into the environment consistent with

the *Stormwater management manual* (DoW, 2004-2007). The following elements can be considered as part of the design:

Combining drainage reserves and recreation reserves with appropriate landscaping. This should include an assessment of irrigation water demands to determine whether the water supply network has adequate capacity. Landscaping should not impact on the hydraulic function of the drainage system.

WSUD at the source of stormwater generation by encouraging landscaping to reduce peak flows to open drains.

Use of v-notched weirs or drop structures within open drains to provide detention and treatment of low flows with the aim of reducing flow velocities to limit erosion and reduce downstream sedimentation.

1.6 Innovation

The City supports innovation in stormwater design, however good supportive evidence must be supplied with any proposal.

1.7 Other texts

The City acknowledges that the Local Government Guidelines for Subdivisional Development by the Institute of Public Works Engineers Australia (Guidelines for Subdivision) are considered as the minimum standard for subdivision development and are to be read in conjunction with this document and other policies and legislations relevant to Agencies associated with subdivisional approvals.

Better Urban Water Management (WAPC 2008) was developed to facilitate better urban water management of our urban water resources by ensuring an appropriate level of consideration is given to the total water cycle at each stage of the planning system and should also be considered in association with Local Government Guidelines for Subdivisional Development during the development process within the Shire.

2 Design Parameters for Small Developments

2.1 General

Small developments are classed as developments on less than five lots. This includes any development of enhancement of a pre-existing developed lot. Typically they will not incorporate any provision for public roads or servicing and stormwater disposal requirements will be local in nature.

In general the drainage system and all associated structures should be designed as follows:

- Maximum flow velocities in open channels shall not exceed 2 m/s in open channels without suitable erosion protection (can be arrested by the inclusion of drop structures);
- Mortared stone pitching shall be provided in open drains at all outlet structures, junctions and bends greater than 22.5^{o}
- Detention storage areas may be provided at suitable locations (can be in line) to reduce peak flow rates to the capacity of downstream facilities
- The minimum habitable floor level shall be 500 mm above the 100 year ARI flood level.
- Drainage channels should be constructed with minimum 1:4 side slopes and vegetated where possible to limit erosion of drain sides
- Appropriate safety measures shall be provided to protect the public from being trapped within a drain during flash flooding

2.2 Flood Events

Storm recurrence intervals for the two defined storm events shall be in accordance with the following:

2.2.1 Minor Events

The roof of any building shall not contain downpipes and will discharge directly to the lot.

Lots should be landscaped to prevent direct runoff from impervious surfaces to the drainage network (roads or arterial drains) and to prevent erosion.

Open drains provided as part of the development will be designed to convey the 5 yr ARI event flows,

2.2.2 Major Events

Any additional capacity within drainage reserves will be designed to convey 100 yr ARI flows

3 Design Parameters for Large Developments

3.1 General

Large developments are classed as developments of five lots or greater and will typically include public services like roads, parks and utilities. Stormwater disposal requirements will primarily be catchment focussed.

The ideal drainage network in this case is represented by utilising kerbed roads as the initial conveyor of stormwater, with kerb breaks located at topographic low points discharging to large open channels that direct the stormwater away from the urban zone.

In general the drainage system and all associated structures should be designed as follows:

- The top water level for the design of open channels shall be greater than 300 mm below the level of the road shoulder for the 5-year ARI event
- Maximum flow velocities in open channels shall not exceed 2 m/s in open channels (can be arrested by the inclusion of drop structures)
- Mortared stone pitching shall be provided in open drains at all outlet structures, junctions and bends greater than 22.5^{o}
- Detention storage areas may be provided at suitable locations to reduce peak flow rates to the capacity of downstream facilities
- The minimum habitable floor level shall be 500 mm above the 100 year ARI flood level
- Drainage channels should be constructed with minimum 1:4 side slopes and vegetated where possible to limit erosion of drain sides

3.2 Flood Events

Flood events should be catered for as follows:

3.2.1 Minor Events

The roof of any building shall not contain downpipes and will discharge directly to the lot.

Lots should be landscaped to prevent direct runoff from impervious surfaces to the drainage network (roads or arterial drains) and to prevent erosion.

The road network will be used as the primary conveyor of stormwater, designed with kerbs to contain all flows within the 5 Yr ARI event.

Kerb breaks will be provided at appropriate low points throughout the road network to discharge stormwater to drainage reserves and vegetated open channels in a controlled manner.

The main channel in open drains will be designed to contain the 5 year ARI event and where appropriate Water Sensitive Urban Design (WSUD) principles in the form of sedimentation basins, gabions, V notch weir structures incorporated to maintain low flow velocities and allow settling of suspended solids

Mortared stone pitching or other suitable scour protection shall be provided in open drains at all outlet structures kerb breaks, kerb returns, open drain junctions and bends greater than 22.5^{o}

3.2.2 Major Events

Flow generated in excess of the 5 Yr ARI event will form overland flow paths by flooding of the road reserve directing stormwater to drainage reserves.

The drainage reserves will be designed to contain all 100 yr ARI flows.

Developments will need to demonstrate that the 100-year flood level in downstream drainage reserves does not increase by more than 0.15 m as a result of the development.

Weir structures or other drop structures shall be provided in arterial drains to limit downstream sedimentation and ensure velocities do not exceed 2 m/s.

3.3 Maintenance

The drainage system shall take into consideration requirements of future maintenance activities including the provision for safe plant access for cleaning, silt removal and maintenance of vegetation.

4 Vegetation

4.1 General

Maintaining a level of vegetation cover in constructed features such as drainage reserves is important for increasing soil stabilisation and reducing erosion. Vegetation can act to inhibit stormwater flows and potentially lead to flooding in serious cases; however a balance of vegetation cover is required to ensure the optimal drainage system performance.

Drainage channels should be vegetated with native grasses whilst trees should occupy drainage reserves. It is preferred that shrubs not be used in drainage reserves due to the additional maintenance requirements. Species should be selected to reduce water requirements with watering to assist in establishment and reduced to zero by handover. Table 2 below has examples of species that are considered suitable however this is not an exhaustive list and other species approved by the City can be considered

Table 2 **Recommended species for establishment in new drainage reserves**

Category	Species	Habitat
Trees	*Eucalyptus victrix* (Western Coolibah); 1 – 12 m	Floodplains and flats
	Terminalia canescens (Joolal); 1 – 10 m	Variety of habitats
Grasses	*Cymbopogan ambiguus* (scent grass)	Variety of habitats
	Themeda triandra	Variety of habitats