

# STORMWATER

## DRAFT MANAGEMENT STRATEGY

For the Darwin Harbour Catchment

March 2006

## **MESSAGE FROM THE MINISTER**

Territorians have a long history and ongoing relationship with the rivers and estuaries of the Darwin Harbour and it has become a scenic backdrop for al fresco dining, buzzing nightlife and family get-togethers.

With a breathtaking mix of weathered landscapes, vast plains, rivers, wetlands and coastal and marine estates, the Darwin Harbour Catchment has become an essential feature of the unique lifestyle and character of the Top End of the Northern Territory.

Covering 3227 km<sup>2</sup>, the Darwin Harbour Catchment stretches from the cities of Darwin and Palmerston, extending as far south as Darwin River Dam, to the outskirts of Humpty Doo, the Cox Peninsula and covers the settlements of Belyuen, Mandorah and Wagait Beach. It supports the largest concentration of the Territory's population and holds significant social, economic, environmental and cultural importance within the Top End Community.

With projections of a significant population growth over the next 15 years and resultant urban, commercial and industrial development it is imminent that increasing demands will be placed on our waterways.

For these reasons it is timely that we look at better ways to manage and conserve our waterways – from our creeks, rivers and harbour to the wetlands and sea.

The continued health of the Darwin Harbour Catchment will require on-going cooperative effort from government, industry and the community aimed at managing land use in the catchments, protecting our water resources and improving water quality.

Pollution caused by stormwater has been recognised as a significant contributor to the health of the waterways and improved management of the flow is integral to maintain the ecological balance of the Darwin Harbour Catchment

The development of a Draft Stormwater Management Strategy for the Darwin Harbour Catchment was endorsed by the Darwin Harbour Advisory Committee. The draft strategy forms part of the Darwin Harbour Regional Plan of Management 2003, under the goal 'to maintain a healthy environment'. It will provide direction and focus for a range of stakeholders such as developers, consultants, Federal, Territory and Local Government agencies, environmental groups, industrial and construction associations as well as the community.

This draft Strategy is a result, in no small part, of the cooperation between NT and local governments, environmental organisations and industry, demonstrating the increasing commitment and cooperation between all sectors in conserving our unique and valuable environment.

I encourage all Territorians to comment on the draft during the public exhibition period recognising that commitment and joint ownership by the community, public and private sectors are critical in securing tomorrow's environment.



**Marion Scrymgour**

**Minister for Natural Resources, the Environment and Heritage**

**March 2006**



## PREAMBLE

The development of the Draft Stormwater Management Strategy for the Darwin Harbour Catchment (the Strategy) is one of a number of actions identified in the *Darwin Harbour Regional Plan of Management 2003*. The Environment Protection Agency (EPA) has the key responsibility for the development of the Strategy along with identified partners within the Department of Natural Resources, Environment and the Arts (DNRETA), Department of Planning and Infrastructure (DPI) as well as local government.

The commitment for the development of this Strategy is stated in the *Darwin Harbour Regional Plan of Management 2003* under:

<b>GOAL 1:</b>	<b>TO MAINTAIN A HEALTHY ENVIRONMENT</b>
<b>Outcome 1.2</b>	<b>Protection and enhancement of freshwater, estuarine and marine water quality.</b>
<b>Strategy 1</b>	<b>Manage Stormwater discharge to Darwin Harbour to minimise impacts on water quality</b>
<b>Action 1.1</b>	<b><i>Develop a Stormwater Management Strategy and Implementation Plan.</i></b>

### Preparation of the Draft for Public Comment

The preparation of this Strategy was initiated by the Darwin Harbour Advisory Committee (DHAC) as a commitment under the Darwin Harbour Regional Plan of Management.

This draft Strategy was prepared by the EPA, NRETA under direction of a project Steering Committee. Members of the Steering Committee were:

<b>Name</b>	<b>Title</b>	<b>Department/Organisation</b>
Michael Lawton	Chair	EPA
John Bailey	Chair	H
Merrilyn Barnes	Project Officer	EPA
George Maly	Project Officer	EPA
John Smithson	Project Officer	EPA
Neville Jones	Executive Director	Land Development, DPI
Phill Piper	Planning Consultant	Land Development, DPI
Brian Dobie	Representing the Director	Land Administration, DPI
Ian Lancaster	Representing the Senior Director	Natural Resource Management, DNRETA
Greg Neate	Representing the Senior Director	Road Network, DPI
Luccio Cercarelli	Director Technical Services	Palmerston City Council
Mark Spangler	Design and Development Manager	Darwin City Council
Brendan Dowd,	Technical Services Manager	Darwin City Council
Peter Visentin	Shire Manager	Litchfield Shire Council
Greg Mariager	Senior Director	Road Projects, DPI
Grant Henderson	Construction Division	Road Project, DPI

# DRAFT STORMWATER MANAGEMENT STRATEGY For the Darwin Harbour Catchment

Key information was also provided by various industry, environmental and local government representatives through focus group meetings (see results in Appendix A).

**The proposed goal for the Stormwater Strategy is:**

*Stormwater in the Darwin Harbour Catchment will be managed by comprehensive, catchment based Stormwater Management Plans that optimise the protection of property, sustain ecosystems and ensure public health and safety.*

**The key objectives for the Stormwater Strategy are:**

**Objective 1** Maintain the declared Beneficial Uses and environmental values of the Darwin Harbour through Integrated Catchment Management planning.

**Objective 2** Maintain or improve water quality through improved practice.

**Objective 3** Promote opportunities for, and benefits of, pollution reduction in stormwater.

**Objective 4** Generate knowledge and certainty of stormwater management for all relevant stakeholders in the Darwin Harbour Catchment.

This document will be subject to a public exhibition period of 6 weeks. All community stakeholders are encouraged to provide input and comments in writing to DNRETA. All comments will be replied to and taken into consideration for the final document. The Darwin Harbour Advisory Committee will oversee progress in implementing the Strategy.

Queries and comments regarding this Strategy can be directed to:

**Project Coordinator**

Environment Officer - Stormwater  
Environmental Management - Operations  
Environment Protection Agency  
Department of Natural Resources, Environment and the Arts  
PO Box 496  
Palmerston NT 0831  
Tel: (08) 8924 4046  
Fax: (08) 8924 4053  
[epa.nreta@nt.gov.au](mailto:epa.nreta@nt.gov.au)

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	URBAN STORMWATER.....	1
1.2	PURPOSE OF THIS STRATEGY .....	1
1.3	SCOPE OF THIS STRATEGY .....	2
1.4	THE AREA COVERED BY THIS STRATEGY .....	2
<b>2</b>	<b>IMPACTS OF DEVELOPMENT ON THE DARWIN HARBOUR CATCHMENT.....</b>	<b>2</b>
<b>3</b>	<b>STORMWATER MANAGEMENT CONTEXT .....</b>	<b>3</b>
3.1	NATIONAL CONTEXT.....	3
3.1.1	<i>Ecologically Sustainable Development.....</i>	<i>4</i>
3.2	LOCAL CONTEXT.....	4
3.2.1	<i>NT Legislative Framework for Stormwater.....</i>	<i>4</i>
3.2.2	<i>Integrated Catchment Management.....</i>	<i>7</i>
3.2.3	<i>Darwin Harbour Regional Plan of Management.....</i>	<i>7</i>
<b>4</b>	<b>RESPONSIBILITY FOR STORMWATER MANAGEMENT.....</b>	<b>8</b>
<b>5</b>	<b>GOAL FOR STORMWATER MANAGEMENT.....</b>	<b>10</b>
<b>6</b>	<b>PROPOSED OUTCOMES OF THE STRATEGY.....</b>	<b>10</b>
<b>7</b>	<b>KEY OBJECTIVES OF THE STRATEGY.....</b>	<b>11</b>
<b>8</b>	<b>IMPLEMENTATION OF THE STRATEGY.....</b>	<b>14</b>
8.1	GUIDING PRINCIPLES FOR THE IMPLEMENTATION OF THE STRATEGY.....	14
8.2	KEY PERFORMANCE INDICATORS.....	14
<b>9</b>	<b>REVIEW OF THE STRATEGY .....</b>	<b>15</b>
<b>10</b>	<b>STORMWATER MANAGEMENT PLANS.....</b>	<b>20</b>
10.1	OVERVIEW .....	20
10.2	PRINCIPLES OF STORMWATER MANAGEMENT PLANNING .....	20
10.2.1	<i>Water Quality Management Hierarchy.....</i>	<i>21</i>
10.3	THE PROCESS FOR DEVELOPMENT OF A STORMWATER MANAGEMENT PLAN .....	22
<b>11</b>	<b>11 ESSENTIAL ELEMENTS OF A STORMWATER MANAGEMENT PLAN .....</b>	<b>24</b>
11.1	SCOPE AND PURPOSE OF THE STORMWATER MANAGEMENT PLAN <b>ERROR! BOOKMARK NOT DEFINED.</b>	
11.2	IDENTIFY AGENCIES THAT HAVE THE RESPONSIBILITY FOR THE MANAGEMENT OF LOCAL STORMWATER.....	25
11.3	DOCUMENTATION AND MAPPING .....	27
11.4	IDENTIFY ENVIRONMENTAL VALUES AND STORMWATER QUALITY OBJECTIVES.....	28
11.5	IDENTIFY THREATS TO ENVIRONMENTAL VALUES AND STORMWATER QUALITY OBJECTIVES .....	29
11.6	IDENTIFY MANAGEMENT OPTIONS AND ACTIONS .....	29
11.7	PREPARE AND EXHIBIT THE DRAFT STORMWATER MANAGEMENT PLAN.....	30
11.8	PREPARE AND IMPLEMENT THE FINAL STORMWATER MANAGEMENT PLAN .....	31
11.9	PERFORMANCE REVIEW AND MONITORING.....	32
<b>12</b>	<b>APPENDICES .....</b>	<b>33</b>
12.1	APPENDIX A: SUMMARY OF FOCUS GROUP MEETINGS .....	338
12.2	APPENDIX B: METHODOLOGY .....	48
12.3	APPENDIX C: REFERENCES.....	49
12.4	APPENDIX D: GLOSSARY .....	50
12.5	APPENDIX D LIST F ACRONYMS AND ABBREVIATIONS .....	504

**PART 1: STORMWATER MANAGEMENT STRATEGY FOR THE DARWIN HARBOUR CATCHMENT**

## **1 INTRODUCTION**

### ***1.1 Urban Stormwater***

*‘Urban stormwater is runoff from urban areas, including the major flows during and following rain as well as dry weather flows. Dry weather drainage flows generally originate from groundwater, garden watering, wash down, leaking water pipes, and illegal discharges. In most systems, overflows from sewerage systems or septic tanks may also become part of stormwater flows during wet and dry weather.’* (Taken from the Australian Guidelines for Urban Stormwater Management 2000).

The flow of water over land is determined by the topography of the land and by the contributing natural processes. In some areas water will flow over the surface and in others water will infiltrate the ground. On steep slopes and impervious surfaces water can flow fast, whereas on flatter surfaces or areas of poor soil drainage, stormwater flow can be very slow or pond. A catchment is a topographically defined area drained by a stream such that all outflow is directed to a single point. A catchment can contain many sub-catchments.

*Urban stormwater presents a management challenge in terms of **quantity** (flood and drainage management, stormwater reuse), **quality** (litter, nutrients, chemicals, sediments) and **aquatic ecosystem health** (aquatic habitats, riparian vegetation, stream stability and environmental flows).*

(Taken from the Australian Guidelines for Urban Stormwater Management 2000).

Poor management of stormwater can lead to the degradation of natural ecosystems and can allow stormwater to become a conduit for accelerated transport of sediments, pollutants and nutrients to receiving waters. Any area of bare soil such as construction sites, dirt roads or poorly vegetated land will contribute fine particles and contaminants to the stormwater system.

The management of stormwater flow begins on the land where such flows originate. In urban localities, where development is dense and land ownership within natural drainage systems is highly fragmented, the management of stormwater flow becomes an increasingly complex issue in regards to assigning management responsibilities. In urban environments, stormwater must be coordinated by a public utility, often via engineered infrastructure.

### ***1.2 Purpose of this Strategy***

This Strategy will provide the overarching guidelines for the management of stormwater in the Darwin Harbour Catchment. It has taken into account the vision and goals from the Darwin Harbour Regional Plan of Management, as well as stakeholder inputs which were provided during focus group workshops (see Appendix A).

This Strategy outlines:

- impacts of development;
- the stormwater management context;
- ownership and responsibility of stormwater management;
- goal and key management objectives; and
- actions for the implementation of the Strategy.

The Strategy also outlines the key steps for the development of 'Stormwater Management Plans' for individual sub-catchments and regions of Darwin Harbour which will be identified during the implementation of this Strategy. Stormwater Management Plans are the essential tool for the management of stormwater and their implementation will greatly assist the future development of the Darwin Harbour Region in an environmentally sustainable manner.

### ***1.3 Scope of this Strategy***

The Stormwater Management Strategy is a strategic document for the management of stormwater within the Darwin Harbour Catchment. The Strategy provides a framework to address a range of environment protection and water quality issues in a coordinated, integrated and prioritised manner. It is anticipated that further input from industry, local government and the public will be sought to help set priorities, and suggest solutions for management of stormwater at the local level in line with an adaptive management methodology. The implementation plan, in Section 11.0, identifies a number of actions to achieve this aim. It is also anticipated that the scope of the Strategy will be broadened to other catchments within the NT that are, or will be, undergoing development.

### ***1.4 The Area Covered by this Strategy***

This Strategy covers the Darwin Harbour Region including Port Darwin, Shoal Bay and their catchments. This area covers 3227 km<sup>2</sup> and extends from Charles Point to Gunn Point including the estuarine areas and tributaries of Woods Inlet, West Arm, Middle Arm, East Arm, the Howard River and the land that drains into these waterways.

## **2 IMPACTS OF DEVELOPMENT ON THE DARWIN HARBOUR CATCHMENT**

The average annual rainfall in the Darwin Harbour Catchment is approximately 1700 millimetres with most falling between December and March. The intensity of the stormwater flow during this period can be very high and areas of low relief and/or those areas with poorly drained soils can become inundated for extended periods of time. These intense periods of rainfall produce a unique challenge for the management of stormwater.

The continual development of natural areas and the expansion of urbanised areas will increase the environmental impacts on existing natural systems within the Darwin Harbour Catchment. Some identifiable impacts include:

- **Catchment Hydrology** - increased frequency and intensity of runoff and flooding events; higher runoff volumes and peak flows; more rapid peaking of storm flows, and reduced base flows in watercourses. This may lead to an increase in the level of floods during the frequent storm events experienced during the wet season.

- **Water Quality** - elevated levels of suspended solids, nutrients, micro-organisms, heavy metals and organic materials. This may lead to pollution of receiving waters such as natural waterways and the Darwin Harbour marine environment. This may become a health issue for people utilising these areas predominantly for recreation purposes.
- **Waterway Channels** - channel form may be changed by increased erosive force of flows, removal of riparian vegetation and sedimentation. Natural waterways may become deeper and banks unstable. Erosion of waterways will increase sediment loads and deposition of sediment downstream. Sedimentation of stormwater infrastructure such as pipes, open drains and culverts presents an ongoing maintenance issue for the managing authority.
- **Riparian Vegetation** - removal of riparian vegetation and replacement with exotic species can lead to higher water temperatures, loss of aquatic and terrestrial habitats and decreased bank stability. Algal blooms may also increase in these circumstances which can present an aesthetic and public health issue.
- **Aquatic Habitats** - may be lost through changes in the bed material and bed shape of waterways, removal of in-stream objects such as snags and aquatic plants and drainage of wetlands and floodplains. This can lead to loss of biodiversity in unique habitats within the Darwin Harbour Catchment.
- **Watercourse Barriers and Constrictions** - structures such as bridges and culverts may alter flow patterns, fauna movement and sediment transport patterns. The inability to alter or maintain this infrastructure can cause flooding and damage to property and other infrastructure.

### 3 STORMWATER MANAGEMENT CONTEXT

A number of existing principles, guidelines and strategies were considered during the development of this Strategy. These considerations have been divided into national context and local context; the latter includes the Northern Territory legislative framework and local government regulations within the Darwin Harbour Catchment.

#### 3.1 *National Context*

The National Water Quality Management Strategy (NWQMS) was introduced by the Commonwealth, State and Territory Governments in 1992 as a response to growing community concern about the condition of the nation's water resources and the need to manage them in an environmentally sustainable way. In 1994 the NWQMS was included in the Council of Australian Governments (COAG) Water Reform Framework.

The main objective of the NWQMS is:

*'To achieve sustainable use of the nation's water resources by protecting and enhancing their quality while maintaining economic and social development'*

The NWQMS emphasises the importance of the following principles in water quality management:

- Ecologically sustainable development;
- Integrated (or total) catchment management;
- Best management practices, including the use of acceptable modern technology, waste minimisation and utilisation; and
- The role of economic measures, and application of the user pays and polluter pays principles.

The guidelines developed under the NWQMS provide advice on management of issues across the whole of the water cycle, which includes stormwater, ambient and drinking water quality, monitoring, groundwater, rural land uses and water quality, sewerage systems as well as effluent management for specific industries. The NWQMS also provides guidance on many aspects of the water cycle, including urban stormwater, which can be found on the website at <http://www.affa.gov.au/nwqms>. The 'Australian Guidelines for Urban Stormwater Management No 10' have been integral to development of this Strategy.

### 3.1.1 Ecologically Sustainable Development

The principal of Ecologically Sustainable Development (ESD) was adopted by the NT Government via the endorsement of the National Strategy for Ecologically Sustainable Development in 1992. The Commonwealth Government suggested the following definition for ESD in Australia:

*'using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased.'*

Taken from the National Strategy for Ecologically Sustainable Development (1992)

The principles of ESD are:

- (a) The **precautionary principle** namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- (b) **Inter-generational equity** namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.
- (c) Conservation of **biological diversity** and ecological integrity namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration.
- (d) **Improved valuation**, pricing and incentive mechanisms namely, that environmental factors should be included in the valuation of assets and services.

## 3.2 Local Context

Various legislation, policies and plans focused on water quality and the management of Darwin Harbour have been taken into consideration during the development of this Strategy.

### 3.2.1 NT Legislative Framework for Stormwater

The regulatory control of stormwater in the NT is managed under the *Water Act* and the *Waste Management and Pollution Control Act*. The *Waste Management and Pollution Control Act* primarily deals with the water quality aspects or levels of pollutants contained in stormwater. Other relevant legislation includes:

- Planning Act; and
- Local Government Act

## Beneficial Use Declarations under the Water Act

Beneficial Use Declarations are a legislated process that reduces the effects of water pollution and assists in the protection and management of water. The community decides how a particular water body should be used by choosing one or more Beneficial Use categories.

Water quality and stormwater in the Darwin Harbour Catchment needs to be managed to ensure that Beneficial Use Declarations are met.

The following outlines the categories of Beneficial Use Declarations:

Aquatic ecosystem environmental values are values or uses of the environment for which it has been determined that a given area of the environment should be protected. Water quality objectives may be set for surface waters and groundwaters in the Territory by determining which of the following protected environmental values should apply to each body of water.

- a) Agriculture – to provide irrigation water for primary production including related research;
- b) Aquaculture – to provide water for commercial production of aquatic animals including related research;
- c) Public Water Supply – to provide source water for drinking purposes delivered through community water supply systems;
- d) Environment – to provide water to maintain the health of aquatic ecosystems;
- e) Cultural – to provide water to meet aesthetic, recreational and cultural needs;
- f) Industry – to provide water for industry, including secondary industry and mining or petroleum activity, and for other industry; and
- g) Rural stock and domestic.

The NT's water resources are controlled under the *Water Act*. The *Water Act* legislates the extent to which both surface and ground water can be used and for what purpose. Waste discharge to natural waters is prohibited unless licensed under the Act. Waste Discharge Licences are only available in areas where Beneficial Uses have been declared.

Beneficial Use Declarations for Darwin Harbour and most of its Catchment have been made under the *Water Act* which states the following:

**DARWIN HARBOUR AND MARINE REACHES OF RIVERS AND CREEKS DRAINING INTO HARBOUR**

*Aquatic Ecosystem Protection and  
Recreational Water Quality and  
Aesthetics*

Signed 30 August 1996

**Planning Act**

The role of the *NT Planning Act* in the management of stormwater is primarily in the area of new development. The Development Consent Authority (DCA) is able to include conditions on development permits in regards to the management of stormwater. (See also Section 4). Under Section 51 of the *Planning Act*, a number of matters need to be taken into account by the DCA in order to approve a development application including:

*(d) an environment protection objective within the meaning of the Waste Management and Pollution Control Act that is relevant to the land to which the application relates;*

*(m) the public utilities or infrastructure provided in the area in which the land is situated, the requirement for public facilities and services to be connected to the land and the requirement, if any, for those facilities, infrastructure or land to be provided by the developer for that purpose;*

*(s) any beneficial uses, quality standards, criteria, or objectives, that are declared under section 73 of the Water Act.*

**Local Government Act**

Local Government's role in the management of stormwater and maintenance of stormwater infrastructure is legislated under Part 6, Powers and Functions of Councils under the *Local Government Act*. In particular Schedule 2 of the Act outlines the functions of council.

**Waste Management and Pollution Control Act**

The *Waste Management and Pollution Control Act* is based around two key concepts:

1. Environmental Harm; and
2. Due Diligence.

The role this legislation plays for the management of stormwater is primarily in the areas of stormwater quality, that is, the types and levels of pollutants discharging to stormwater. Penalties for offences under the Act are tiered as environmental nuisance, environmental harm and serious environmental harm.

### 3.2.2 *Integrated Catchment Management*

The principle of Integrated Catchment Management (ICM) recognises the catchment-wide relationships between resource use and management. It also addresses the need for community involvement in identifying issues and management solutions. The principles of ICM have been adopted by the Darwin Harbour Advisory Committee (DHAC).

*“Integrated Catchment Management is the sustainable and balanced use of all land, water and biological resources in a catchment. It provides a continuous and dynamic process for decision making and fosters cooperation and coordination between landholders, community, government agencies and other natural resource users and managers”* (Taken from the Darwin Harbour Regional Plan of Management (2003).

ICM embraces the following principles:

- A holistic approach to natural resource management within catchments, marine aquifers, with linkages between water resources, vegetation, land use, and other natural resources recognised;
- Integration of social, economic and environmental issues,
- Coordination of all the agencies, levels of government and interest groups within the catchment; and
- Community consultation and participation (a ‘bottom up’ approach).

ICM is increasingly becoming the ‘umbrella’ for sustainable resource management.

### 3.2.3 *Darwin Harbour Regional Plan of Management.*

The development of a Stormwater Strategy is an identified action under the Darwin Harbour Regional Plan of Management. Therefore it is important to take into consideration the Darwin Harbour Regional Plan of Management Strategic directions, including:

#### **Vision for Darwin Harbour Region:**

*“A biologically rich and diverse marine and terrestrial environment for our use and enjoyment today, and for our children tomorrow...”*

The five goals of the Darwin Harbour Regional Plan of Management are:

- Goal 1** *To maintain a healthy environment*
- Goal 2** *To support recreational use and enjoyment of the environment*
- Goal 3** *To encourage ecologically and economically sustainable development*
- Goal 4** *To protect cultural values and heritage*
- Goal 5** *To foster community ownership and participation in management.*

## 4 RESPONSIBILITY FOR STORMWATER MANAGEMENT

There is a range of financial, technical, institutional and regulatory challenges that stormwater managers need to address. Stormwater management is rarely the responsibility of one organisation within a sub-catchment. The preparation of Stormwater Management Plans for sub-catchments on a cooperative basis will help to achieve a common vision for all stormwater managers.

The following section discusses the roles and responsibilities of the various agencies and authorities that are responsible for the planning, management and maintenance of stormwater infrastructure.

### Local Government

Six local governments are located within the Darwin Harbour region. These are the Darwin City Council, Palmerston City Council, Litchfield Shire Council, Cox Peninsula Community Government Council, Belyuen Community Government Council and the Coomalie Community Government Council.

Within its municipal boundaries, local government in the Darwin Harbour Catchment is the primary authority responsible for the control and management of stormwater, except on private land and those lands owned or managed by the NT Government.

### NT Government Agencies

Lands owned or managed by the NT Government may include road corridors and Crown lands. On these lands, stormwater is managed by several operational units of DPI, namely:

- Land Administration – a part of the Lands Division, which manages Crown Estate directly or through leases of Crown land;
- Land Development – also part of the Lands Division, which releases or develops Crown land for urban, industrial and rural purposes and provides:
  - project management services through the capital works, minor new works and repairs and maintenance programs; and
  - technical advisory services for the development of rural land for commerce, residences, horticulture, agriculture, aquaculture and other uses;
- Road Network – a part of the Transport Division, which manages and oversees the development and maintenance of the NT Government owned or managed road network; and
- Infrastructure Projects – a part of the Construction Division which is responsible for the management and delivery of capital works and repairs and maintenance programs for public infrastructure throughout the NT for NT Government client agencies.

The DNRETA has a broader task of managing land and water resources in the NT. DNRETA has responsibilities in the area of sediment and erosion control and environmental protection and pollution control, which are important considerations in stormwater management.

The design of stormwater drainage on private land will usually be undertaken by an engineering consultant employed by the owner/developer of the land. This design is to the connection

specification of a local government authority or, in the case of larger scale developments, to the specifications of the NT Government. Design of stormwater infrastructure on public land is typically undertaken by the NT or Local Government whilst the construction is often carried out by a private contractor selected via a tender process.

### **Development Consent Authorities**

In regards to new development, the DCA and the Minister for Lands and Planning are responsible for decisions regarding stormwater management under the *Planning Act*. The DCA is able to include 'conditions of approval' on any development permit granted, which may include the orderly collections and appropriate disposal of stormwater. The DCA will take into consideration advice provided by the local service authority, such as the relevant local government or other local service authorities.

### **Darwin Harbour Advisory Committee**

DHAC is responsible for overseeing the implementation of the actions identified under Darwin Harbour Regional Plan of Management.

The relevant actions pertaining to stormwater management in the Darwin Harbour Regional Plan of Management are:

- *Strategy 1*      *Manage Stormwater discharge to Darwin Harbour to minimise impacts on water quality*
- *Action 1.1*      *Develop a Stormwater Management Strategy and Implementation Plan*

### **Stormwater Management Planning Groups**

Stormwater Management Planning Groups (SMPGs) comprise of the identified existing local stormwater management agencies and other key stakeholders that have the responsibility for managing stormwater and the maintenance of sub-networks in sub-catchments. The key tasks for the SMPG will be to develop and implement Stormwater Management Plans. (See Section 10 and 11). In most cases the SMPG will be a combination of representatives from existing agencies and will most likely include local government and NT Government. In some cases representatives from road authorities, land or property developers or even the private sector may be included on the SMPG.

## 5 GOAL FOR STORMWATER MANAGEMENT

A long term strategic goal has been developed as a result of consultation with local stormwater management agencies and focus group meetings, for the management of stormwater in the Darwin Harbour Catchment.

*Stormwater in the Darwin Harbour Catchment will be managed by comprehensive, catchment based, Stormwater Management Plans that optimise the protection of property, sustain ecosystems and ensure public health and safety.*

## 6 PROPOSED OUTCOMES OF THE STRATEGY

The Stormwater Strategy seeks to achieve the following outcomes:

- Implementation of actions identified under the Darwin Harbour Regional Plan of Management, in particular:

### **GOAL 1: TO MAINTAIN A HEALTHY ENVIRONMENT**

Outcome 1.2 Protection and enhancement of freshwater, estuarine and marine water quality.

Strategy 1 Manage stormwater discharge to Darwin Harbour to minimise impacts on water quality

Action 1.1 *Develop a Stormwater Management Strategy and Implementation Plan.*

- Provision of a strategic framework and focus for action on stormwater management in the Darwin Harbour Catchment.
- The protection of the identified Beneficial Use Declarations and Environmental Values made under the NT *Water Act*.
- Implementation of an Integrated Catchment Management approach across NT Government, local government, relevant agencies and the community.
- Implementation of strategic long term planning and management and maintenance of stormwater infrastructure.
- Increase in community awareness of information and education programs in regards to best practice management of stormwater.
- Coordination of Federal, Territory and Local Government stormwater management programs.
- Ensure that programs, funding and resources are targeted at stormwater quality management issues.
- The development of strategic partnerships between local stormwater management agencies, key stakeholders and community interest groups.
- The ongoing monitoring and review of effective stormwater management.

## 7 KEY OBJECTIVES OF THE STRATEGY

The following key objectives have been selected as a result of consultation with relevant local stormwater management agencies and focus group meetings, as a means of achieving the Strategy's goal and outcomes:

- |                    |   |
|--------------------|---|
| <b>Objective 1</b> | <b>Maintain the declared Beneficial Uses and Environmental Values of the Darwin Harbour through Integrated Catchment Management planning.</b> |
| <b>Objective 2</b> | <b>Maintain water quality through improved practice.</b>  |
| <b>Objective 3</b> | <b>Promote opportunities for, and benefits of, pollution reduction in stormwater.</b>   |
| <b>Objective 4</b> | <b>Generate knowledge and certainty of stormwater management, for all relevant stakeholders, in the Darwin Harbour Catchment.</b>             |

The following provides a discussion in regards to the intention of the identified key objectives for this strategy.

### **Objective 1 Maintain the declared Beneficial Uses and Environmental Values of the Darwin Harbour through Integrated Catchment Management planning.**

This objective seeks to establish a process of Integrated Catchment Management. It also seeks to ensure a more effective management of stormwater hydrology and its impact on ecosystems, water quality and other natural land values. Planning and management of stormwater will be undertaken on a sub-catchment basis.

Once the practical boundaries of stormwater management areas or sub-catchments are identified, significant ecosystems that can be preserved will need to be identified. Links with existing, water quality monitoring processes, will need to be established to provide data to inform further evaluation and decision-making processes.

Information collated on each sub-catchment will guide the development of Stormwater Management Plans. The Stormwater Management Plans will need to be developed by the local stormwater management agencies with funding from a range of sources (potentially including the local rate base, territory funding and national government initiatives). Stormwater Management Plans are intended to be the primary drivers for further infrastructure planning particularly in providing opportunities to integrate the ownership, coordination and management of stormwater to the relevant service agency.

Once completed, Stormwater Management Plans may also be incorporated into the relevant development controls of the Planning Scheme or as Developer Contribution Plans in accordance with Part 6 of the *Planning Act*.

## **Objective 2 Maintain or improve water quality through improved practice.**

This objective seeks to deal with stormwater quality by addressing a number of pollution related issues such as on-site handling and management of pollutants and sediment and erosion control. This objective will be achieved through the development and implementation of guiding documents listing best practice in regards to the management of stormwater and waste water. The guiding documents will be released as draft codes of practice. They will be phased in over the first term of the Strategy to allow sufficient time for consultation, evaluation and uptake by industry. The Strategy's first review can then be used to determine final codes of practice containing the most appropriate mix of guidance and regulation.

## **Objective 3 Promote opportunities for, and benefits of, pollution reduction in stormwater.**

This objective seeks to provide information and educational materials on how to reduce pollution in stormwater. The information and education materials will be targeted at various groups including industry, government, developers and the general community.

## **Objective 4 Generate knowledge and certainty of stormwater management, for all relevant stakeholders, in the Darwin Harbour Catchment.**

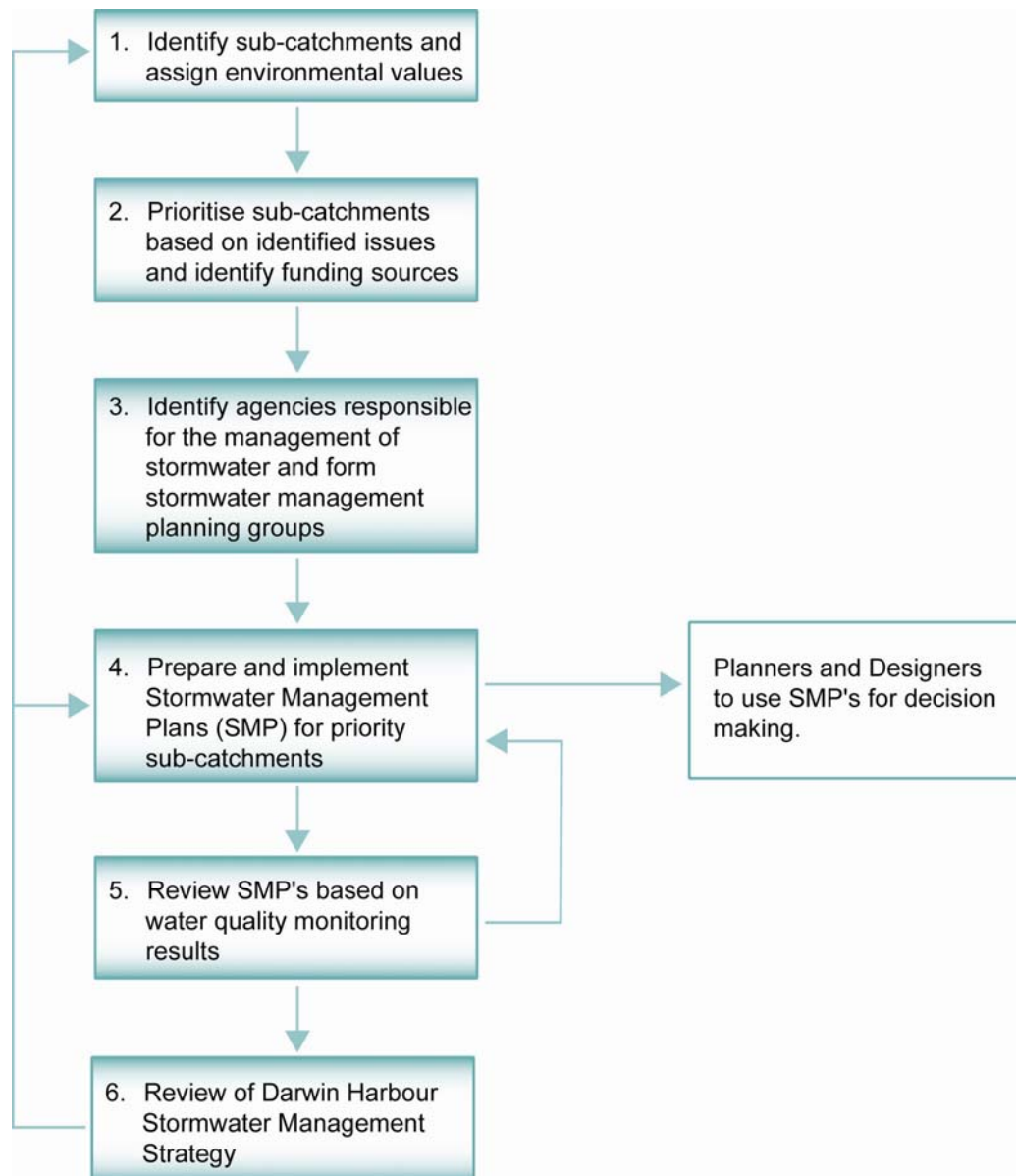
This objective ensures that the Strategy undergoes effective evaluation and review of the actions identified in the implementation plan (see Section 8). It was developed to ensure that appropriate monitoring mechanisms such as key performance indicators, are developed to guide the Strategy's implementation.

This Strategy is to be considered a 'living document' and should be reviewed in light of ongoing changes such as regulation, new technology, and changes to the Darwin Harbour Regional Plan of Management. Pollution, particularly from dispersed origins such as streets, car parks and other public areas will require ongoing attention.

It is proposed that the Strategy be reviewed every three years in order to take advantage of new approaches and innovations and to enable the strengthening of links with new initiatives and plans. Periodic review will also provide for evaluation of the success and failure of the various actions recommended and allow for an opportunity to evaluate timeframes and milestones as the need arises.

In most instances the key performance indicators, such as expenditure and frequency of maintenance works, are already being used in the business plans of participating agencies and can be readily extracted for the purposes of the Strategy's review.

## STORMWATER MANGEMENT PROCESS FOR THE DARWIN HARBOUR CATCHMENT



**Figure 1. The process to develop Stormwater Management Plans for selected sub-catchments in Darwin Harbour.**

## 8 IMPLEMENTATION OF THE STRATEGY

In order to achieve the Strategy goal, “*Stormwater in the Darwin Harbour Catchment will be managed by comprehensive catchment based Stormwater Management Plans which will optimise the protection of property, sustain ecosystems and to ensure public health and safety*”, it will be necessary to implement the actions identified at the Focus Group and Steering Committee meetings. The actions for the implementation of this Strategy can be found in *Table 2: Detailed Implementation Guidelines for Stormwater Management Strategy* and a summary of actions can be found in Table 1.

### 8.1 Guiding Principles for the Implementation of the Strategy

The identified actions found in the implementation tables have been guided by the following principles:

1. Retain and restore existing valuable elements of the natural drainage system, including waterway, wetland and groundwater features.
2. Implement non-structural source controls - organisational and behavioural techniques to minimise the amount of pollution entering the drainage system, principally achievable via education and in case of poor performance regulatory mechanisms.
3. Install structural controls at, or near the source. Promote the provision of appropriate infrastructure prior to off-site disposal to minimise pollutant inputs and the volume of stormwater runoff. Identify, assist and provide guidance for activities which have a significant potential to pollute by stipulating appropriate infrastructure.
4. Infiltrate or reuse rainfall as high in the catchment as possible. Promote the use of ‘in-system’ management measures such as swales and riparian zones, and structural quality improvement devices such as gross pollutant traps based on Water Sensitive Urban Design (WSUD) principles. Promote the use of water retention structures capable of minimising or storing runoff.
5. Prioritise decision making and management systems on the basis of major threats or risks and allocate suitable funds for priority actions.
6. Where urban land use is the major land use across the catchment, the development of the Stormwater Management Plan will be required to address day to day decision-making at the local level.

### 8.2 Key Performance Indicators

Key Performance Indicators (KPIs) have been identified in the implementation guidelines (Table 2). Where possible KPIs should reflect the relevant agency or organisations goals and objectives should be incorporated into their business plans.

Performance may be then measured by indicators related to:

- frequency and cost of servicing infrastructure;
- frequency of pollution incidents related to stormwater;
- extent of compliance with erosion and sediment control guidelines, land grants and civil works contracts;
- audit and performance reporting;
- proportion of capital works funding diverted to upgrading stormwater infrastructure;
- attendance of stormwater pollution related incidents; and
- records of complaints, remedial actions and related information.

## 9 REVIEW OF THE STRATEGY

A three year review cycle of this Strategy will allow sufficient time for information gathering and for the uptake of new ideas and approaches. A review of this Strategy should include:

- updating information on each sub-catchment to inform future development of stormwater management plans;
- providing information and recommendations on an appropriate water quality and/or pollution level monitoring schedule;
- evaluating timeframes for actions; and
- observing and contributing to the development of common terms of reference which are to be used across all sub-catchments.

The review of the Stormwater Strategy should be conducted by DNRETA in partnership with DHAC. The review of the Strategy must include key stakeholders and any agencies responsible for the management of stormwater. A list of other relevant key stakeholders can be found in Appendix A.

# DRAFT STORMWATER MANAGEMENT STRATEGY

## For the Darwin Harbour Catchment

**Table 1 Summary of Actions to Implement the Stormwater Management Strategy**

ACTION No:	ACTIONS	TIME	KPI	KEY RESPONSIBILITY	PARTNERS
<b>Objective 1: Maintain the Declared Beneficial Uses and environmental values of the Darwin Harbour through Integrated Catchment Management Planning.</b>					
Action 1	Delineate the Darwin Harbour Catchment into sub-catchments or stormwater management regions.	Early 2006	A public document consisting of a map of Darwin Harbour catchment showing sub-catchments, or water management regions accompanied by relevant data on environmental values in each sub-catchment.	DNRETA, SWSC	DHAC
Action 2	Prioritise sub-catchments on the basis of relative risk.	Six months after the completion of Action 1, then every three years.	A publicly available status report outlining the information on catchments selected for priority action and the basis for their selection.	DNRETA, SWSC	DHAC
Action 3	Develop a SMP for each priority sub-catchment.	This action is reliant on the completion of action 2.	Development and implementation of comprehensive and integrated SMPs for prioritised sub-catchments.	SMPG	DPI (Land Development Division) LG
Action 4	Establish and promote links with ecosystem and water quality monitoring processes.	Ongoing	A public report on the summary of activities.	SMPG, DNRETA	EMG (DHAC)
<b>Objective 2 Maintain or improve water quality through improved practice.</b>					
Action 5	Develop and implement guidelines for erosion and sediment control.	Mid 2006	Guidelines produced, distributed and implemented through Development Assessment Services, Local Government etc	DNRETA, DPI (DAS)	SWSC, LG
Action 6	Develop guidance materials/codes of practice outlining methods of minimising pollution to stormwater.	Early 2006	Guidelines completed and distributed.	DNRETA	LG, Chamber of Commerce NT, DPI (DAS)
Action 7	Update and implement relevant sewage overflow plans in accordance with environmental values, risk assessment and risk management strategies.	Ongoing	Sewage overflow plan completed.	DNRETA , PowerWater	SMPG, LG
<b>Objective 3: Promote opportunities for, and benefits of, pollution reduction in stormwater.</b>					
Action 8	Develop, implement and maintain public awareness of best practice in stormwater management.	Prior to the Strategy's first review.	Guidelines and draft codes of practice developed and released.	DNRETA	LG, DHAC, DEET, Chamber of Commerce NT
<b>Objective 4: Generate knowledge and certainty of stormwater management for all relevant stakeholders in the Darwin Harbour Catchment.</b>					
Action 9	Develop effective key performance indicators and conduct regular evaluation of the Strategy's implementation.	Strategy's first review in 2008 and then every three years.	A public report and review of Strategy's performance based on KPIs, key outcomes and monitoring programs.	DNRETA, SWSC	DHAC
Action 10	Identify and secure funding for implementation of SMPs.	Ongoing	Successful access to funding for implementation of SMPs and on-ground works.	SWSC	DNRETA, DHAC

# DRAFT STORMWATER MANAGEMENT STRATEGY

## For the Darwin Harbour Catchment

**Table 2 Detailed Implementation Actions for the Stormwater Management Strategy**

ACTIONS	RATIONALE	GUIDING INFORMATION	TIME	KPI'S	KEY RESPONSIBILITY	PARTNERS
<b>Objective 1: Maintain the Declared Beneficial Uses and environmental values of the Darwin Harbour through Integrated Catchment Management Planning.</b>						
<b>Action 1</b> <b>Delineate the Darwin Harbour Catchment into sub-catchments or stormwater management regions.</b>	Subdividing Darwin Harbour Catchment into sub-catchments will assist in prioritising actions and ensure a more effective management of stormwater quality and hydrology and its impact on receiving waters and ecosystems.	<ul style="list-style-type: none"> <li>➤ The selection of sub-catchment boundaries should be located around rather than across similar land uses to provide spatial context for SMPs.</li> <li>➤ Maps and associated data of sub-catchments must include information on environmental values that will need to be sustained.</li> <li>➤ Common terminology and assessment criteria must be applied to all sub-catchments for comparative purposes and. to ensure consistency</li> </ul>	Early 2006	A public document consisting of a map of Darwin Harbour catchment showing sub-catchments, or water management regions accompanied by relevant data on environmental values in each sub-catchment.	DNRETA, SWSC	DHAC
<b>Action 2</b> <b>Prioritise sub-catchments on the basis of relative risk.</b>	Resources should be directed towards those sub-catchments identified as having the highest relative risk for the degradation of water quality and ecosystem  Catchment wide and a risk based approach to stormwater management will ensure that prioritisation is appropriately considered and justified.	The assessment of present and intended land uses, catchment characteristics, declared Beneficial Uses and environmental values of the receiving waters and any local stormwater management issues in need of urgent attention. Information required includes: <ul style="list-style-type: none"> <li>➤ potential risks in each sub-catchment; and</li> <li>➤ estimates of the likely timeframe and cost of priority actions such as the preparation of SMPs and establish appropriate framework for achievement of timely outcomes.</li> </ul>	Six months after the completion of Action 1 and every three years thereafter.	A publicly available status report outlining the information on catchments selected for priority action and the basis for their selection.	DNRETA, SWSC	DHAC
<b>Action 3</b> <b>Develop a SMP for each priority sub-catchments.</b>	The SMPs will be used as a decision making tool to provide a common focus and certainty for all stakeholders, by identifying and addressing stormwater management issues at the local level.  To ensure that resources are targeted at priority sub-catchments.	SMPs are to be developed in accordance with the NWQMS Guidelines for Urban Stormwater Volume 10 and Sections 11 and 12 of this Strategy. They are to be: <ul style="list-style-type: none"> <li>➤ consistent with EPA stormwater quality standards;</li> <li>➤ identify areas suitable for appropriate in-system management;</li> <li>➤ seek to implement guidelines/provisions for the management of stormwater on single residential allotments;</li> <li>➤ identify and implement non-structural or preventive stormwater management measures to address dispersed pollution sources (eg. mechanical and suction sweeping of roads, parking areas or other large impervious surfaces);</li> <li>➤ identify sub-standard infrastructure be consistent with PowerWater's sewerage overflow plan and other waste management and pollution prevention initiatives; and</li> <li>➤ incorporated into planning controls or as developer contribution plans.</li> </ul>	This action is reliant on the completion of action 2.	Development and implementation of comprehensive and integrated SMPs for prioritised sub-catchments.	SMPG	DPI (Land Development Division), LG
<b>Action 4</b> <b>Establish and promote links with ecosystem and water quality monitoring processes.</b>	Monitoring will provide baseline data for decision-making and assist and inform the Strategy's evaluation and monitoring process.	Establish and link with monitoring mechanisms in order to: <ul style="list-style-type: none"> <li>➤ inform the sub-catchment prioritisation process;</li> <li>➤ determine hot spots in the Darwin Harbour Catchment;</li> <li>➤ assist in the development of performance criteria to assess pollution or risk levels in priority areas; and</li> <li>➤ observe and contribute to the development of common terms of reference which are to be used across all catchments.</li> </ul>	Ongoing	A public report on the summary of activities, baseline data and information collected at the review period which is relevant to this Strategy.	SMPG, DNRETA	EMG (DHAC)

# DRAFT STORMWATER MANAGEMENT STRATEGY

## For the Darwin Harbour Catchment

<b>Objective 2 Maintain or improve water quality through improved practice.</b>						
<b>Action 5</b>  <b>Develop and implement Guidelines for erosion and sediment control.</b>	An effective erosion and sediment control plan will provide a more comprehensive approach to the control of erosion and pollution of water by sediment.	The guidelines will be distributed by divisions within DPI and DNRETA as part of their land management and land development activities. The guidelines will need to provide a comprehensive approach to managing erosion and sedimentation for all works including: <ul style="list-style-type: none"> <li>➤ during and after land subdivision works;</li> <li>➤ during and after the construction phase of development including the construction of single dwelling; and</li> <li>➤ land clearing.</li> </ul>	Mid 2006	Guidelines produced, distributed and implemented through Development Assessment Services, councils etc.	DNRETA, DPI (DAS)	SWSC, LG
<b>Action 6</b>  <b>Develop guidance materials/codes of practice outlining methods of minimising pollution to stormwater.</b>	To guide and inform the public, government and industry on best practice approaches to undertaking activities that have the propensity to cause pollution.	Separate guidelines should be provided to different sectors such as industry, government and domestic activities. The guidelines must: <ul style="list-style-type: none"> <li>➤ emphasise the need to manage for pollution resulting from frequent low flows events;</li> <li>➤ set water quality criteria for discharges to stormwater; and</li> <li>➤ observe and promote common terminology across all sub-catchments to ensure consistency.</li> </ul> The guidelines should provide information on: <ul style="list-style-type: none"> <li>➤ options for an appropriate disposal of waste in non-sewered areas;</li> <li>➤ on types and availability of waste collection services or other appropriate means of waste disposal; and</li> <li>➤ basic maintenance of relevant infrastructure.</li> </ul>	early 2006	Guidelines completed and distributed.	DNRETA	LG, Chamber of Commerce NT, DPI (DAS)
<b>Action 7</b>  <b>Update and implement relevant sewage overflow plans in accordance with environmental values, risk assessment and risk management strategies.</b>	Sewage overflows occur due to a range of factors for which appropriate management must be provided.	Development of the sewerage overflow plan should be consistent with: <ul style="list-style-type: none"> <li>➤ the SMPs in each catchment;</li> <li>➤ environmental and cultural values; and</li> <li>➤ must specify the period of its application and review.</li> </ul>	Ongoing.	Sewage overflow plans completed.	DNRETA, PowerWater	LG, SMPG

# DRAFT STORMWATER MANAGEMENT STRATEGY

## For the Darwin Harbour Catchment

<b>Objective 3: Promote opportunities for, and benefits of, pollution reduction in stormwater.</b>						
<b>Action 8</b>  <b>Develop, implement and maintain public awareness of best practice in stormwater management.</b>	To address and maintain consistency with the Darwin Harbour Regional Plan of Management and to ensure ongoing and effective performance of the Strategy's communication and education component.	A comprehensive education campaign will include: <ul style="list-style-type: none"> <li>➤ the development and distribution of appropriate guidelines or codes of practice;</li> <li>➤ dissemination of the guidelines via DNRETA and DPI websites, development and environmental assessment process and the pollution response line;</li> <li>➤ the provision of educational material to schools, as part of the Sustainable Schools NT Program;</li> <li>➤ integration of stormwater management principles with related initiatives such as the Litter Abatement Strategy;</li> <li>➤ maintaining ongoing dialog between relevant stakeholders;</li> <li>➤ maintaining ongoing information flow to related documents such as the annual reporting on the Darwin Regional Plan of Management; and</li> <li>➤ involving stakeholder and interest groups in the development of stormwater codes of practice.</li> </ul> Requires the development of a communications and marketing plan.	Prior to the Strategy's first review	Guidelines and draft codes of practice developed and released	DNRETA	DHAC, DEET, Chamber of Commerce NT, LG.
<b>Objective 4: Generate knowledge and certainty of stormwater management for all relevant stakeholders in the Darwin Harbour Catchment.</b>						
<b>Action 9</b>  <b>Develop effective key performance indicators and conduct regular evaluation of the Strategy's implementation</b>	Effective monitoring mechanisms and information will be required to determine the Strategy's performance.  A regular evaluation will ensure relevance and accommodate new initiatives and understanding	➤ Key Performance Indicators (KPIs) will assist with: <ul style="list-style-type: none"> <li>➤ evaluation of performance and uptake of recommended best management practices (guidelines);</li> <li>➤ monitoring the success of non-structural programs such as street sweeping; and</li> <li>➤ decision making and identification of options for the development of regulatory regime under existing legislation.</li> </ul> KPIs should be adapted from existing reporting practices, such as business plans and audits.  A three year review cycle will allow sufficient time for information gathering and for the uptake of new ideas and approaches.	Strategy's first review in 2008 and then every three years;	A public report and review of the Strategy's performance based on KPIs, key outcomes and monitoring programs.	DNRETA, SWSC	DHAC
<b>Action 10</b>  <b>Identify and secure funding for implementation of SMPs.</b>	Funding from various sources should be sought, in order to assist implementation of on-ground works identified in the SMPs.	Potential funding sources should be considered cooperatively by the SMPGs. On-ground works prioritised in completed SMPs will become the basis for funding applications.	Ongoing	Successful access to funding for the implementation of SMPs and on-ground works.	SWSC	DNRETA, DHAC

### KEY TO ABBREVIATIONS

DAS	Development Assessment Services (DPI)	EMG	Ecosystem Monitoring Group (DHAC)
DEET	Department of Education, Employment and Training	LG	Local Government
DHAC	Darwin Harbour Advisory Committee	SWSC	Stormwater Steering Committee
DNRETA	Department of Natural Resources, Environment and The Arts	SMPG	Stormwater Management Planning Groups (which include NT Government, Local Government and other relevant authorities)
DPI	Department of Planning and Infrastructure		

PART 2 GUIDELINES FOR THE DEVELOPMENT OF STORMWATER MANAGEMENT PLANS FOR DARWIN HARBOUR CATCHMENT

## 10 STORMWATER MANAGEMENT PLANS

The following section describes the process for the development of a Stormwater Management Plan (SMP). These guidelines have been adapted from the *National Water Quality Management System, Australian Guidelines for Urban Stormwater Management*. It is essential that all SMPs are developed in a consistent manner across the Darwin Harbour Catchment in order to integrate the management of stormwater in a best practice and cost effective manner.

### 10.1 Overview

**'The primary purpose of Stormwater Management Plans is to identify actions that will improve the environmental management of urban stormwater and protect the environmental values of receiving waters.'** (Taken from *NWQMS Guidelines for Urban Stormwater Management*).

The development of SMPs is a way of helping local government and other local stormwater management agencies recognise the impacts of activities within their boundaries and to develop management strategies and programs to mitigate these impacts.

The process of developing SMPs will identify the responsible local stormwater management agencies for each sub-catchment or region within the Darwin Harbour Catchment. The implementation of a SMP will be the key tool to achieve best practice stormwater management for Darwin Harbour. The achievement of best practice stormwater management will ensure that:

- (a) *decisions in relation to new development (including redevelopment) are made with the implications for stormwater impacts on receiving waters taken into account, and*
- (b) *remedial measures (both structural and non-structural) are undertaken in a cost-effective, integrated and co-ordinated manner.*

### 10.2 Principles of Stormwater Management Planning

1. **Retain and restore valuable ecosystems:** retaining or restoring (if degraded) existing valuable elements of the stormwater system, such as natural channels, wetlands and riparian vegetation.
2. **Source control: non-structural measures:** non-structural techniques for limiting changes to the quantity and quality of stormwater at the source. (For example, retention of vegetation, community education, best practice guidelines, land use planning and drain maintenance programs).
3. **Source control: structural measures:** constructed management techniques installed at, or near, the source to manage stormwater quantity and quality. (For example, detention basins, sediment control fencing, oil separators, tanks.)

4. **In-system management measures:** constructed management techniques installed within stormwater systems to manage stormwater quantity and quality prior to discharge into receiving waters. (For example, trash racks and energy dissipaters, fish migration structures).

Best practice encourages an integrated approach incorporating these principles. Source controls can ideally prevent many of the pollutants from reaching the stormwater system. However, in practice a combination of source and structural controls are usually required to achieve an improvement in stormwater quality.

### 10.2.1 Water Quality Management Hierarchy

The management of stormwater quality in the Northern Territory should be in accordance with the waste management hierarchy principles (refer Figure 2) with the following order of preference:

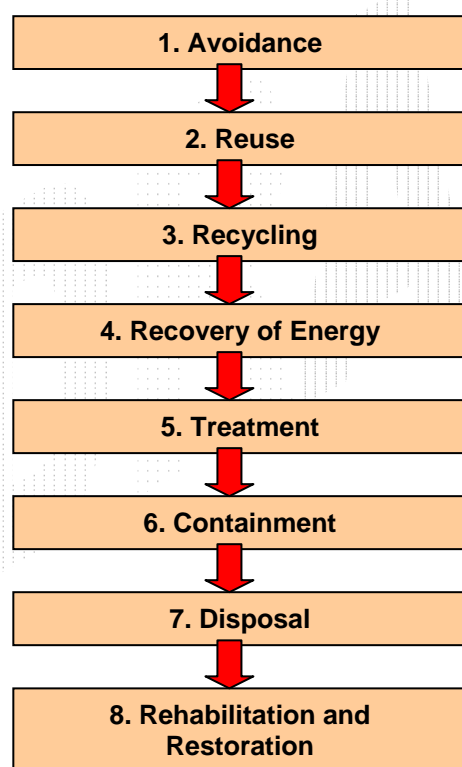


Figure 2 Water Quality Management Hierarchy

The pollution of stormwater is regulated under the *Waste Management and Pollution Control Act* (refer Section 3.3.1). It is important to incorporate the principles of the water quality management hierarchy into SMPs.

### 10.3 The Process for Development of a Stormwater Management Plan

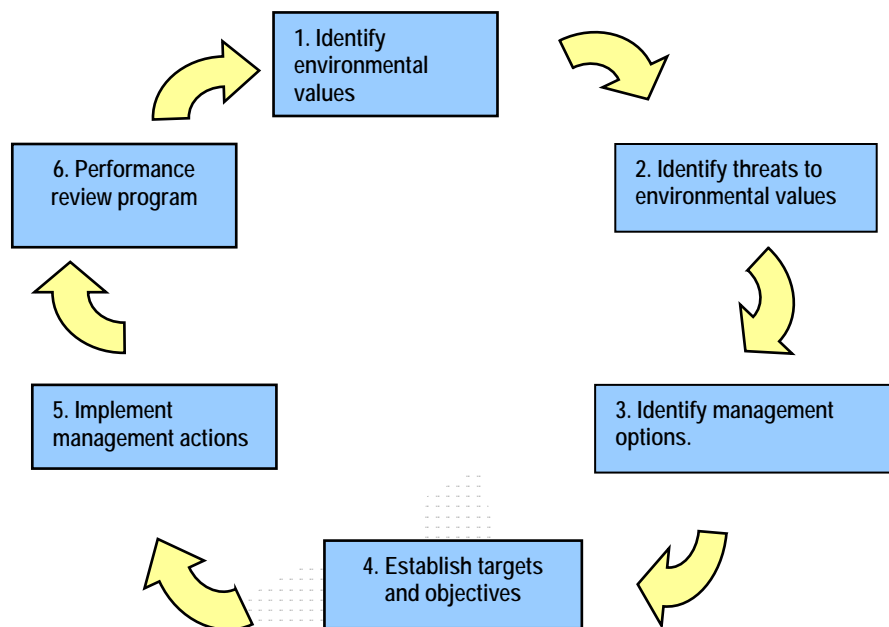


Figure 3 Steps in Natural Resource Management

Stormwater management planning should be based on the general model of natural resource management planning (refer Figure 3), which includes the following:

1. Identify Declared Beneficial Uses and any environmental values and Water Quality Objectives to be protected or restored.
2. Identify threats to these identified Beneficial Uses and environmental values.
3. Identify and assess management objectives to address these threats and to meet the identified Water Quality Objectives.
4. Adopt preferred management options, and establish management targets and objectives.
5. Identify means of implementing management options; and identify management actions.
6. Identify an implementation and performance review program incorporating key performance indicators.

This sequence of the planning process is important in ensuring management effort is effectively focussed on protection or restoration of the significant identified environment values for each sub-catchment. Attempting to address a long list of possible stormwater issues, without reference to how these issues affect achievement of objectives, is unlikely to be cost-effective.

It is important that the SMPs:

- encourage community involvement in stormwater management;
- encourage the preservation of valued existing elements of the water environment;
- maximise the control of stormwater runoff at source;
- identify and prioritise an appropriate mix of cost-effective stormwater management practices to suit the particular opportunities, constraints and requirements of a catchment;
- incorporate monitoring procedures for feedback and improvement of the plan; and
- protect and enhance water quality.

The values and management objectives of the Darwin Harbour Catchment can be found in the *Darwin Harbour Regional Plan of Management*. It is important to take these into consideration while identifying the environment values and water quality objectives for sub-catchments.

In many areas, regional values, uses and water quality objectives have not been established as part of a planning process. Where these are not in place, the stormwater management planning process may need to incorporate an additional stage in order to identify these values and targets.

Many regions within the Darwin Harbour Catchment have identified Beneficial Uses declared under the *Water Act*. These Beneficial Uses must be used as the overarching goal and taken into consideration when identifying environmental values and management objective of sub-catchments.

**The Declared Beneficial Uses for Darwin Harbour are:**

**DARWIN HARBOUR AND MARINE REACHES OF RIVERS AND CREEKS DRAINING INTO HARBOUR**

*Aquatic Ecosystem Protection and Recreational Water Quality and Aesthetics*

Signed 30 August 1996

Other Declared Beneficial Uses for tributaries of the Darwin Harbour include:

**DARWIN AND BLACKMORE RIVERS CATCHMENT AREAS**

*Raw Water for Drinking Water Supply*

Darwin River Dam

*Aquatic Ecosystem Protection, Recreational Water Quality and Aesthetics and Agricultural Water Use*

Darwin River and Blackmore Rivers and tributaries

*Raw Water for Drinking Water Supply and Agricultural Water Use*

All groundwater of the region

Signed 1 October 1998

**RAPID CREEK – FRESHWATER REACHES**

*Aquatic ecosystem protection and recreation and aesthetics.*

Signed 31 January 2000

NTGG No: G5, 9 Feb 2000

**ELIZABETH AND HOWARD RIVERS REGION – ALL WATERWAYS INCLUDING TRIBUTARIES**

*Aquatic ecosystem protection and recreational water quality and aesthetics*

Signed 31 January 2000

NTGG No: 5 9 Feb 2000

**ELIZABETH AND HOWARD RIVERS REGION - GROUNDWATER**

*Raw water for drinking and agricultural water use*

Signed 31 January 2000

NTG G5 9 Feb 2000

## 11 Essential Elements of a Stormwater Management Plan

The following section identifies steps (refer Figure 4) which are essential for the development of SMPs for sub-catchments within the Darwin Harbour Catchment.

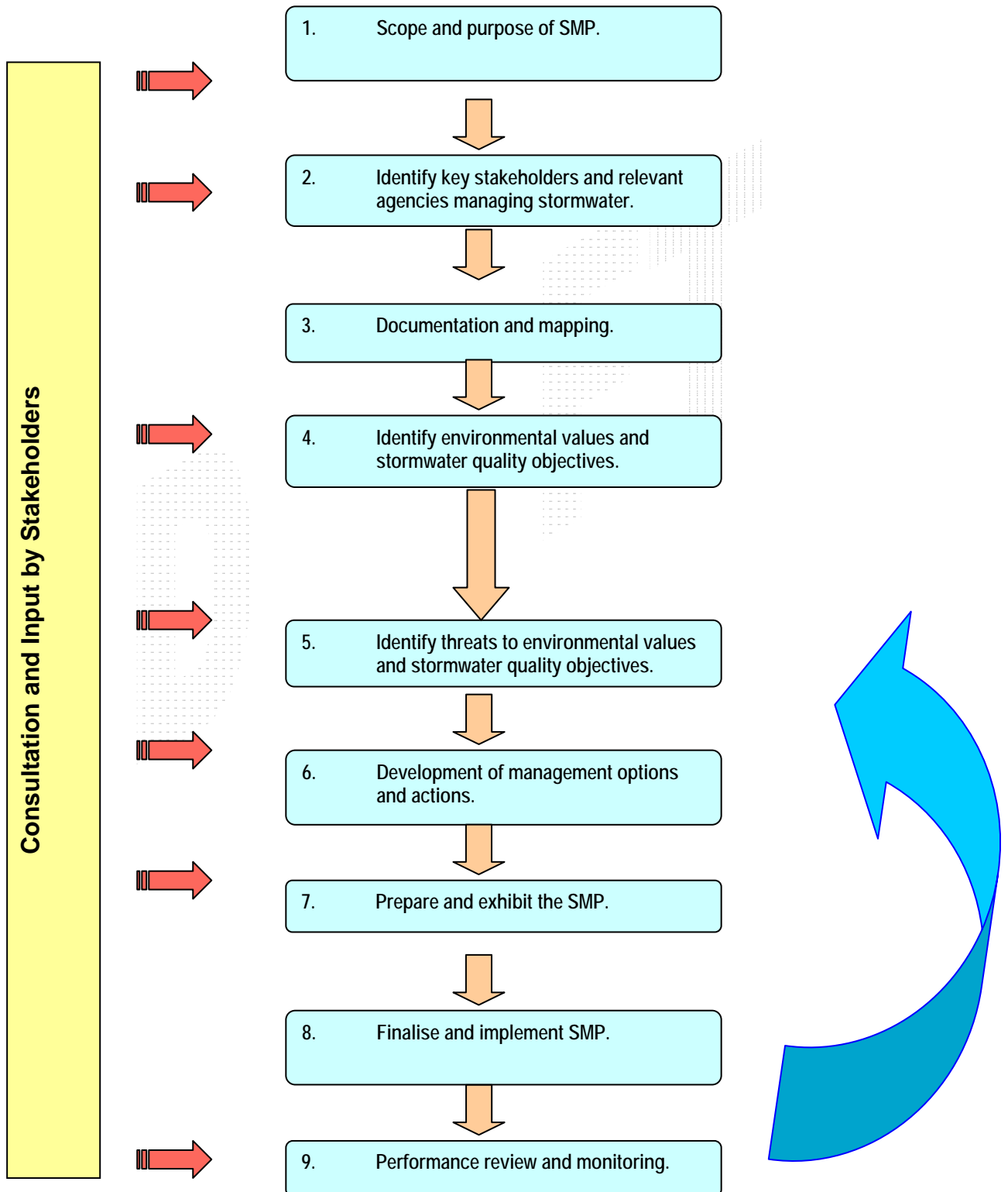


Figure 4: Steps for the Development of a Stormwater Management Plan

### ***11.1 Scope and Purpose of the Stormwater Management Plan.***

It is essential to establish the overall framework for the plan and its preparation process. This should involve establishing:

- the purpose of the plan;
- the scope of the plan;
- responsibilities for stormwater management within the sub-catchment;
- the boundaries for the plan (eg sub-catchment or identified region);
- the proposed public and other stakeholder consultation processes; and
- integration with existing plans, for example, NT Planning Scheme, Land Use Plans, Darwin Harbour Regional Plan of Management.

### ***11.2 Identify Agencies that have the Responsibility for the Management of Local Stormwater.***

The major constraint to improved stormwater management is a lack of agreement or a lack of consensus on stormwater management priorities. The key to achieving consensus on SMPs includes:

- generating commitment to a best practice approach;
- establishing agreed priorities and management strategies or actions; and
- establishing a basis for ongoing cooperation with and coordination between agencies, local stormwater management agencies and other stakeholders.

Commitment is achieved mostly through involvement of a wide cross section of authorities, key agency representatives and other stakeholders in the planning process and in the assignment of accountabilities. Many stakeholders have their own specific interests in decisions on stormwater management. Some examples of the types of stakeholders are listed in Table 3.

#### **Stormwater Management Planning Group (SMPG)**

It is essential to identify the relevant agencies that have the responsibility for the management of local stormwater. Representatives of these various agencies will form the SMPG. The SMPG will hold the responsibility for the development and implementation of the SMP. In most cases the SMPG will consist of the local council, and other agencies responsible for infrastructure such as roads, crown land, defence land etc. It is important to ensure all parties who manage stormwater infrastructure are involved in the SMP at its inception in order to pool resources, manage the whole of the sub-catchment and ensure ownership and commitment from all parties.

#### **Other Key Stakeholders**

Stakeholder ownership and involvement in SMPs are essential for success and gaining their support may time. It is essential to identify and engage stakeholders in order to:

- make links with existing projects, groups and individuals;
- gain support from key groups and individuals;
- access data; and
- access technical assistance.

Building the necessary support can take as much time as preparing the plan itself, but it is time well invested. The pay-off in terms of stakeholder commitment and active involvement is likely to minimise outlays in the area of money and time.

**Table 3: Examples of Stakeholder Types within the Darwin Harbour Catchment and their Interests.**

Stakeholder Type	Interest
Property owners adjacent to drainage corridors	Protection of property from flooding, local area amenity, and recreation opportunity. Opportunities to incorporate stormwater treatment measures
Environmental groups (eg DHAC, Environment Centre NT, Landcare Groups, Coastcare Groups.	Identification of environmental values, impacts of urban stormwater
Stormwater Management agencies (eg LG, DPI, Parks and Wildlife)	Efficient provision and operation of drainage services, drainage infrastructure standards, stormwater treatment, operation of the drainage system, receiving water management, risk and liability
Sewerage authorities (PowerWater)	Sewer overflows, treatment plant discharges, stormwater infiltration
Environmental regulatory authorities DNRETA (EPA), LG, Parks and Wildlife.	Designation of environmental values and uses, Water Quality Objectives. The licensing of point source discharges. Pollution prevention.
Natural Resource Management Agencies DNRETA, Parks and Wildlife.	Protection of biota, habitat, natural communities and the balance and equitable use of natural resources
Road authorities (LG and DPI)	Minimising pollution from roads and construction activities; ensuring road surfaces are quickly drained of stormwater
Business (NT Chamber of Commerce.)	Adoption of best practice to minimise pollution.
Town planners (DAS, LG and other referral agencies)	Land use planning, controls on land users, urban form, infrastructure requirements.
Infrastructure engineers (LG and NT Govt)	Engineering standards, minimisation of liability, risk and costs
Operations (LG, DPI)	Service/maintenance standards, pollution response, enforcement, cost minimisation
Major Land Developers	Development of major land projects including residential and industry. Designing and construction of new stormwater infrastructure.

### 11.3 Documentation and Mapping

A critical stage in the planning process involves the gathering of information to support the rest of the planning process and to ensure the active involvement of the key stakeholders. During this stage, it is important to gain an understanding of the extent to which existing and potential future activities may threaten receiving environments, such as Darwin Harbour or natural waterways including streams and wetlands.

A review of management processes should be undertaken at this stage. The review should cover planning, regulation, education, enforcement and operations as well as any existing structural approaches to managing stormwater impacts such as outlined below. The relationship between the local stormwater management authority and other agency activities should also be examined. This information will contribute to the formulation of management strategies later in the planning process.

**Table 4: Review of the Management Process**

Planning	Planning scheme, planning policies, relevant Town Plan, planning permit conditions, Darwin Harbour Regional Plan of Management.
Operations	Specifications for service delivery (eg waste collections), asset maintenance activities (eg local roads), depot operations.
Regulation	Integration between policy, planning controls, local laws and enforcement activities. <i>Water Act, Waste Management and Pollution Control Act</i> and Local Government Regulations.
Education	Programs aimed at those involved in activities with potential to affect the stormwater system. Stormwater guidelines and education materials.
Structural measures	Incorporation of structural measures into buildings, roads and drainage systems to reduce environmental impacts.

It is important to compile an overall picture of land use activities and other relevant data in order to determine environmental values, water quality objectives, threats and management objectives. Some examples of data and information that may need to be collated during this step are highlighted in Table 4.

**Table 5: Recommended Data Required for the Development of a Stormwater Management Plan**

Type of Information	Potential Custodians
<b><i>Planning and Development information</i></b>	
Land Use Objectives	DPI
Planning zones (as per the town plan)	DPI
Cadastral information	DPI
Land tenure information	DPI
Proposed development	DPI
<b>Natural Resource Information</b>	
Land systems information	DNRETA
Sub-catchment boundaries	DNRETA
Land unit information	DNRETA
Remnant vegetation	DNRETA
Natural drainage information	DNRETA
Recent aerial photography	DNRETA
Land capability information	DNRETA
Wetlands and habitats of significance	DNRETA
Environmental Guidelines for Stormwater Management	DNRETA
<b><i>Stormwater System</i></b>	
Infrastructure information including drains, culverts etc	DNRETA, LG, DPI
Main drains	DNRETA, LG, DPI
Outfalls to receiving environments	DNRETA, LG, DPI
Maintenance schedules	DNRETA, LG, DPI

It is recommended that the relevant data is collated and displayed by using a spatial database or Geographic Information System (GIS). The use of a GIS will enable quick and accurate manipulation of data and enable the display of complex data on maps and plans.

### ***11.4 Identify Environmental Values and Stormwater Quality Objectives***

‘Environmental values are particular values, or uses of the environment, that are important for a healthy ecosystem or for public benefit, welfare, safety or health and which require protection from the effects of pollution waste discharges and deposits.’ *Taken from NWQMS Australian Guidelines for Urban Stormwater Management.*

#### **Environmental Values**

The guiding documents for identified environmental values will be the Beneficial Uses as declared under the NT *Water Act*, (refer Sections 3.2.1 and 10.3), and the Darwin Harbour Regional Plan of Management. It is essential that any new Environmental Values identified at sub-catchment level do not conflict with these over-arching objectives.

An initial assessment of Environmental Values for the sub-catchments or regions should be undertaken, which may later be refined following receipt of additional information. It may be

useful to establish them by holding a stakeholder workshop to obtain community input into the identification of the values. These values may also be mapped over the catchment area.

Environment Values of sub-catchments may include ecological values (aquatic fauna and flora, terrestrial fauna, urban bushland, social values (public health and safety, recreational use of waters, visual amenity) and economic values (water use, aquaculture, stormwater reuse etc.).

## **Stormwater Quality Objectives**

It is likely that three sets of objectives may be appropriate. The first may be long-term objectives (effectively a ‘vision’ for the catchment) and the second being more short term, quantifiable objectives. These short term objectives can define what the plan should seek to achieve, and may be the basis for evaluating the performance of the plan at the end of a certain period (eg 3 years).

The third set of objectives relate to new development. The stormwater management objectives for new development aim to define the stormwater outcomes which will be required of new developments. These objectives should ideally define outcomes sought, in order to facilitate flexibility and encourage innovation in the management of stormwater at new development sites.

These objectives should be defined in terms of (and linked to) to catchment value(s) to which they relate. Objectives should be consistent with, and incorporate the principles of, ecologically sustainable development, as appropriate.

## **11.5 Identify Threats to Environmental Values and Stormwater Quality Objectives**

A list of major site specific and transient activities with potential to impact receiving environments should be prepared, identifying:

- the type of stormwater threat; and
- a significance rating of the threat.

In arriving at a significance rating, consideration should be given to the magnitude and frequency of occurrence, (eg. quantity of pollutant load generated or severity of pollution spills and frequency) and the level of public concern about these. An informed assessment can be based on professional judgement and experience as well as local knowledge, history of spills, complaints, age of infrastructure and so on.

## **11.6 Identify Management Options and Actions**

A range of strategies and actions to manage urban stormwater threats to receiving water values should be considered. These should take into account local, regional or catchment-wide impacts and benefits, and can include a mix of strategies related to:

- at-source management strategies such as planning and design measures;
- in-transit structural controls; and
- receiving water management.

## Management Options

Management options considered should include a variety of planning, regulatory, infrastructure, source control, and educational approaches. The selection and design of any specific management option will be strongly influenced by local conditions, such as, runoff responses to land use change, receiving water responses to pollutants, and peakflow considerations.

When selecting appropriate management options the following should be taken into consideration:

- The protection of downstream environmental values and receiving waters;
- Allocation of sustainable loadings across whole of Darwin Harbour Catchment sources, e.g. wastewater, urban stormwater, rural/agricultural runoff etc;
- Determining best management practices;
- Costing of components necessary to ensure compliance with Stormwater Quality Objectives eg required infrastructure etc;
- How the management option will meet identified environmental values and declared Beneficial Uses; and
- Changing community expectations and requirements.

## Management Actions

When developing management actions, it is important to consider the following:

- Future changes to the land use or planning frameworks;
- The type, location and indicative cost of proposed structural treatment measures;
- The target audiences for education and training programs;
- Specific locations for targeted programs (a particular industrial or commercial region or receiving environment);
- The need to further investigate the extent or nature of stormwater threats;
- The need for coordination with others;
- Responsibility for leading the implementation (i.e. council department, agency or other); and
- Suggested performance measures and reporting framework.

There is also likely to be a need to include general existing policies and objectives into an existing framework, for example, land use planning. Management actions should be integrated across functional areas within the subcatchment, and coordinated with other agencies.

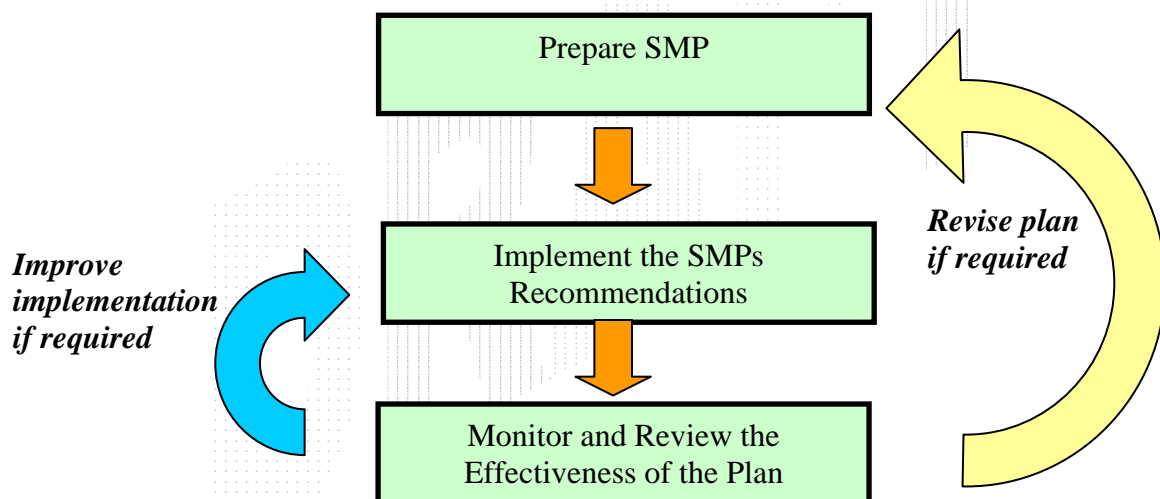
### ***11.7 Prepare and Exhibit the Draft Stormwater Management Plan***

A draft SMP should be prepared and made available for review by stakeholders including the community. An adequate exhibition period should be provided for the public to access and review the draft document.

### 11.8 Prepare and Implement the Final Stormwater Management Plan

Following receipt of comments from stakeholders on the draft plan, a final SMP can be prepared.

The preparation of the SMP constitutes only the first step towards the ultimate aim of improved stormwater quality management. It is essential for stormwater managers to also focus on the implementation of the plan. It is important for the SMP to be viewed as ‘live’ documents, which are actively consulted, reviewed and revised. Stormwater managers should adopt a model of ‘continuous improvement’ in the progressive refinement of the Stormwater Management Plans. Stormwater managers should actively monitor the effectiveness of the plan, and report on the findings of that monitoring to the community. Such monitoring and reporting is considered to form integral components of the ‘continuous improvement’ of the SMP.



**Figure 5: The Stormwater Management Process**

Public reporting can include both a progress report on the SMPs implementation and reporting on the environmental outcomes achieved by the plan’s actions. This reporting could be included in DHAC reporting, reports, regular newsletters and NT Government and Local Government websites. Public reporting is important if community support for the SMP is to be maintained. Feedback from the public which can assist in the monitoring and review of the SMP, can also be requested through this process.

### ***11.9 Performance Review and Monitoring***

As part of the implementation of the SMP, the SMPG should identify specific milestones and objectives. These milestones should relate to:

- achieving improvements in specific receiving environment values which are currently threatened; or
- reductions in specific stormwater threats.

Performance in implementing the SMP should be assessed annually and reported back to DHAC, key NT Government agencies, the community and relevant stakeholders.

DHAC will oversee the monitoring of prioritisation, development and implementation of all SMPs across the Darwin Harbour Catchment.

## 12 APPENDICES

- 12.1 Appendix A: Summary of Focus Group Meetings*
- 12.2 Appendix B: Methodology*
- 12.3 Appendix C: References*
- 12.4 Appendix D: Glossary*
- 12.5 Appendix E: List of Acronyms and Abbreviations*

**Focus Group Meetings  
Regarding the Development of a  
Storm Water Management Strategy**

**March 2005**

**Gail Humble  
Janette Mulherin**

## 1. Introduction

This report represents a summary of the outcomes of three community consultation sessions conducted by Gail Humble and Janette Mulherin in March 2005. The sessions were structured as follows:

Session 1: Engineering Representatives

Session 2: Environmental Representatives

Session 3: Industry Sector Representatives

Throughout the report comments that were specific to particular sessions have been colour coded accordingly as indicated above. Opinions or issues that were common to all groups have been recorded in black.

Structured questions were prepared by the client, regarding participant's current perceptions of Storm Water Management together with strategies that could be useful for adoption in the future. The key focus of the sessions concentrated on the priority issues to be considered in the development of a future framework. The comments below are a summary of the responses to these questions.

## 2. Consideration of NT Context

At the outset consideration needs to be given to the specific and unique context of the Northern Territory with regard to its existing circumstances and projected population and development growth. In all sessions the following issues were identified as examples of particular areas for consideration:

- Extreme tidal range;
- Rainfall patterns;
- Season variability (in the dry season no flushing occurs and in the wet continual flushing takes place);
- Evaporation.
- The impact of early storms in relation to the release of pollutants. Special measures need to be put in place to address 'the first big flows'.
- Threats of cane toads/mosquitoes;
- Insect population;

There is a need to clarify proposed land use and land use objectives around the Harbour in order to conduct a risk assessment and plan appropriate strategies. It is important to consider the whole catchment area.

## 3. The Need for Clear Guidelines and Standards

It was agreed across all groups that the strategy needs to:

- specify preventative measures;
- specify consistent base line design standards;
- specify guidelines;
- specify classifications and clear specifications on what can and cannot be done.

It was considered that issues are being dealt with on a case-by-case basis.

- The strategy needs to put existing legislation into context and clearly outline areas of responsibility. As such the strategy should function as a one-stop-shop. It should however not be a stand-alone document.
- The current legislation is 'ok'. There are however gaps in the guidelines. These 'gaps' are currently being addressed by referring to other jurisdiction's guidelines for advice.
- Standards need to be developed for design and for acceptable levels of water borne sediment. There should be values assigned to receiving waters.
- There needs to be certainty and consistency in the building/development approval process and design criteria and a more transparent and co-ordinated approach concerning areas of responsibility. For example there needs to be clarity on who controls overflows, and swimming pool discharges.
- Up to date design standards are required.

## 4. Evidence Based Approach/Impact Analysis

- There was a perception by the majority of participants that the community needed to be provided with appropriate base line data regarding such matters as water quality and run off etc in order to explain why the development of a storm water strategy was a necessity.
- It is important to identify the areas of greatest potential impact and risk and target accordingly; eg; what is the impact of and on:
  - tourism and fishing;
  - development;
  - the eco –system; and
  - there needs to be a system in place to measure current run-off.
- There is a need for evidence to clarify the standard of water quality of the Harbour. There was a perception expressed by some participants in the Engineering Session that the Harbour was in near pristine condition. This invited some debate, the outcome of which, was that participants were unclear about the availability of data and criteria for measurement that had been used for assessment and was currently available.
- It was recommended by one of the participants that the project team inform themselves of recent aerial infrared photographs in relation to water tables in order to determine the realities of threat and risk.

## 5. Regulation

- The Northern Territory Government needs to be the chief regulator of the strategy.
- There needs to be a joint regulating body consisting of representatives of local and Northern Territory Government, industry and the community.
- The strategy needs to be regulated by a body that is independent of the community and areas of Government. The regulator cannot reside in local government.
- The strategy needs to be regulated by assigning areas of responsibility at the discharge area.

## 6. Co-ordinated Approach

All groups considered there should be a co-ordinated approach between the Northern Territory Government, Local Government and developers regarding planning, management and maintenance of the strategy.

## 7. Maintenance

Funds should be allocated to maintenance issues. The degree of maintenance was perceived to be dependent on the level and sophistication of planning. If there were more rigour in the planning and design stage, this would minimise the maintenance requirements.

Maintenance and management and design of drains have implications for public safety and as a result the monitoring of them to meet agreed standards was seen as important.

## 8. Conservation

It was important to consider the quantity of the run off as well as quality issues. Attention should therefore be given to issues of conservation so as to use stormwater as a resource. The most practical way to address these issues would be initially through commercial building's run-off. Water retention also needs consideration. This should be the responsibility of developers. A coordinated approach is required to design. After design there is a higher run-off – as development ages the situation changes

## 9. Erosion and Sedimentation

Considerable discussion was generated in all three sessions about strategies to address erosion and sedimentation issues as follows:

- The use of hay bales within industry building and residential sites was offered as a consistent suggestion across all groups.
- Attention needs to be given to appropriate filtration methods. There needs to be regulation about the size of sediment and this should be mandatory. There was a need for evidence of measures of current sediment flow. Further investigation is required as to what filtration methods work effectively; eg filtration fences.
- There was a need for a Soil Erosion and Drainage Management Plan. Some sections of the workshop indicated that this would be difficult to monitor and the cost may be prohibitive.
- Consideration should be given to fitting oil water monitors. Whilst the initial suggestion was for these to be fitted in carparks, it was suggested that these should not be restricted to these areas but be extended to all areas of identified risk; eg; industrial areas and at points on the highway.
- Council should take a proactive role in cleaning streets before the build up as a preventative measure
- There needs to be longer term planning with the opportunity for input from engineering groups.
- There should be defined ecological safe limits for sediments and pollution.
- Consideration should be given to improving drainage design. Enhancements could include sloping sides, landscaping and revegetation in order to promote easier maintenance.

## 10. Pollutants and Waste Discharges

- Attention needs to be given to the impact of waste disposal areas and the tracking of key point sources.
- Strategies for reduction of pollution need to be stipulated.

## 11. Enforcement and Degree of Stringency of Legislation

There was a general sentiment expressed across the three groups that the proposed strategy needs to be stringent; ie 'have teeth' and be linked to legislation.

- Currently Council has the capacity to fine you. However this is not enforced and needs to be done more strongly. A question was asked as to what would compel Council to enforce their current powers. (Within the US Councils are fined if they do not enact their powers).
- Whilst there is a need for stringency and linkages with legislation, the framework also needs to be flexible so as to remain current. The *Planning Act* was referred to as an appropriate model.
- Enforcement measures could take the form of fines. There could be different levels of fines depending on your status as an individual; industry group or community group. If a regulation is broken an initial warning should be given together with training or information on ways to ensure the same issue does not occur a second time. If it does a fine should be incurred.
- An overall team should assume an auditing role.
- Enforcement is difficult in the Territory given the geographical expanse.
- If penalties are to be introduced this needs to be phased on over a specified time-frame so as to minimise community and industry agitation.

## 12. Community Awareness and Education

There was a perception that issues concerning the environment are not a high priority for government and for the community in general. People generally are not aware of the problems and do not become engaged unless they understand how it will affect them. It was agreed however that it was critical to develop a comprehensive community awareness and education campaign in order to ensure the effective implementation of the strategy.

An example of a common suggestion was the use of stencilling on storm water drains (there was debate however as to the effectiveness of this strategy).

- The strategy needs a champion; eg the Chief Minister.
- A priority target group should be primary schools (children educate parents).
- The strategy should be launched in an integrated manner recognising that there is a need to develop specific strategies for different segments of the community; ie
- General community/household, agricultural, recreational.
- Industry.
- Land developers.

- In order to make the awareness campaign effective there is a need to drive home what is important to people and to demonstrate the real consequences (cause and effect) of people's actions using a variety of mediums. For example a poster of someone walking on the beach with rubbish coming out of the stormwater drain. Images need to be strong and shock people into action in order to demonstrate the consequences if the community does not pay attention.
- Key messages need to be direct rather than motherhood statements.
- The approach needs to be practical and simple with a clear articulation of benefits.
- Work on the basis that people want to do the right thing and need additional information and assistance.
- Achievements to date need to be highlighted.

### 13. The Issue of Cost

The following issues were raised with regard to cost, as this was particularly pertinent to the industry group:

There is currently uncertainty within industry groups as to the scope of cost associated with a Stormwater Strategy.

Examples were provided of strategies that are being adopted within Melbourne Water and Queensland Water regarding the adoption of standards concerning:

- Trapping and handling by another party;
- Determinations regarding release and slow release methods (10 parts per million).

(The current estimated cost of waste management to these industries is 20cents per litre/\$3000 per year).

A clear message was sent that in developing regulations and guidelines attention will need to be given to the cost to industry. In this regard the sector is in a 'wait and see' mode. Silence does not necessarily mean agreement or compliance.

It was noted that the cost of compliance by the Darwin Airport Aviation area was passed on to its customers.

(It was noted that in the development of this strategy negotiations needed to take place with PowerWater).

## 14. Ratings of Potential Objectives

At the conclusion of the session all groups were asked to rate the following proposed objectives in order of importance. The numbers in bold represent the rating, the numbers in brackets represent the number of participants who nominated the particular rating; eg **1**-(3) = 3 people rated this item as number 1. 1 = Highest. 8 = Lowest

<b>Objectives</b>	<b>Engineers</b>	<b>Environmental</b>	<b>Industry</b>
Ecosystem Health	<b>2</b> -(3), <b>3</b> -(3), <b>4</b> -(4)	<b>1</b> -(3), <b>2</b> -(4)	<b>2</b> -(1), <b>3</b> -(2), <b>4</b> -(2)
Flooding and Drainage	<b>1</b> -(4), <b>2</b> -(5), <b>3</b> -(2)	<b>1</b> -(2), <b>3</b> -(3), <b>4</b> -(2)	<b>1</b> -(3), <b>2</b> -(2)
Public Health and Safety	<b>1</b> -(6), <b>2</b> -(2), <b>3</b> -(1)	<b>1</b> -(2), <b>2</b> -(1), <b>3</b> -(2), <b>5</b> -(1)	<b>2</b> -(2), <b>3</b> -(1), <b>4</b> -(2)
Economic Considerations	<b>2</b> -(1), <b>3</b> -(3), <b>4</b> -(5), <b>5</b> -(1)	<b>3</b> -(3), <b>4</b> -(3), <b>7</b> -(1)	<b>1</b> -(3), <b>2</b> -(1), <b>4</b> -(2)
Recreational Opportunities	<b>4</b> -(2), <b>6</b> -(4), <b>7</b> -(4)	<b>5</b> -(2), <b>6</b> -(2), <b>7</b> -(1), <b>8</b> -(2)	<b>3</b> -(1), <b>5</b> -(4)
Social Considerations	<b>5</b> -(1), <b>6</b> -(5), <b>7</b> -(2)	<b>4</b> -(3), <b>5</b> -(3), <b>6</b> -(1)	<b>6</b> -(3), <b>7</b> -(2)
Aesthetic Values	<b>4</b> -(1), <b>5</b> -(3), <b>6</b> -(4), <b>7</b> -(1)	<b>3</b> -(2), <b>5</b> -(1), <b>6</b> -(2), <b>8</b> -(1)	<b>6</b> -(3), <b>7</b> -(2)

Top 3 objectives

Flooding and Drainage

Public Health and Safety

Ecosystem Health

## ISSUES TO BE ADDRESSED BY THE STRATEGY

As part of the catchment management approach, the Strategy identifies catchment management, water quality management, as areas of principal interest will provide for:

- Delineation of catchments and discharge points in key stormwater management areas;
- Sub-catchment planning and management which would minimise impacts of urbanisation or industrial land use on stormwater flow and quality and seek to:
  - Identify flow management objectives;
  - Minimise of risk from high flows/floods
  - Minimise local and “in-stream” environmental risks (erosion, scouring)
  - Minimise downstream environmental impacts (sedimentation, altered channel morphology).
- Assessment of the stormwater management requirements of these catchments inclusive of:
  - Risk assessment relating to existing and future uses;
  - Flood protection/mitigation;
  - Extent of existing infrastructure and integration of its ownership and management responsibilities;
  - the quantity of stormwater runoff and how that volume is/should be managed;
  - a stormwater/catchment auditing system for the waterway corridors and any protection or rehabilitation that may be needed;
  - the likely infrastructure costs to minimise impacts and ensure equitable distribution of contributions to those costs (NTG, Council, developers, industry);
  - consideration of stormwater management issues at the local level; and
  - opportunity to inform and consult with local residents about local issues.

As part of water quality management approach, the Strategy will provide for:

- definition of impacts from poor water quality;
- definition of flow management objectives including:
- protection of environmental values in natural receiving waters
- protection of public health from exposure to poor quality water
- monitoring; and

The Strategy will also address specific issues such as:

- stormwater discharge to Darwin Harbour, especially from the light industrial precincts;
- stormwater management on land zoned for a single dwelling;
- development of a policy and procedures for the management of point source discharges;
- provisions for sediment and erosion control;
- address dispersed pollution sources via operational and preventive measures;
- trade waste initiatives in non-sewered areas by providing alternatives to sewer disposal in industrial facilities (eg, on-site pre-treatment and disposal to stormwater as well as disposal of collected waste that would be consistent with and complement PowerWater’s trade waste practices); and
- providing assistance and guidance to PowerWater in review of their sewage overflow plan.

The Strategy also seeks to:

- address issues relating to capital, operational and maintenance costs;
- identify priorities for action;
- Provide for Monitoring and review of Strategy implementation;
- provide for appropriate community education programs on stormwater pollution prevention practices as well as on appropriate and viable means of reducing, reuse, recycling, minimisation, treatment and

disposal of waste which would be part of an appropriate mix of regulatory measures, economic instruments and communications strategies to achieve its objectives.

- complemented by regulation/enforcement;
- identify and communicate the cost of stormwater management to the community;
- address the need for certainty;
- Involve development and building industry in the stormwater planning process;
- Including the provisions of standards concerning:
- Trapping and handling by another party;
- Determinations regarding release and slow release methods (10 parts per million); as well as
- be consistent with:
  - *Waste Management and Pollution Control Act;*
  - *Water Act;*
  - *Local Government Act;*
  - *Control of Roads Act;*
  - *Soil Conservation and Land Utilisation Act;*
  - *Marine Pollution Act;*
  - *Litter Act;*
  - *Agriculture and Veterinary Chemicals (Northern Territory) Act 1995;*
  - Darwin Harbour Regional Plan of Management;
  - Integrated Natural Resource Management Plan;
  - Litter Abatement Strategy; and
  - NT Government’s Economic Development Strategy.

## 12.2 Appendix B

### **METHODOLOGY**

The project was overseen by a Project Steering Committee made up of key stormwater management organisations including DNRETA, Darwin City Council, Palmerston City Council Litchfield Shire Council and the Land Development Corporation. The above agencies were selected on the basis of their experience in the management of stormwater and their commitment and capability to undertaking various initiatives identified in this strategy.

Input was also sought from a number of groups with an interest in stormwater management, such as, environmental and local Indigenous groups, manufacturing and construction industries, engineering professionals, land development consultants, PowerWater, Department of Defence, Building, Planning and Lands Divisions of DPI, as well as organisations representing property and economic development interests.

Key outcomes from this consultation process include recognition for:

- A more coordinated, cost efficient approach to stormwater management;
- certainty in agreed practices and outcomes;
- consistent and enforceable erosion and sediment control guidelines; and
- development of guidance material for the disposal of pollutants and contaminants.

The information and comments received as part of this consultation process was used to formulate the Strategy's goal and outcomes which guide and inform the Strategy's focus and determine what further actions will be required. More detailed information on the outcomes of this consultation process can be found in Attachment A.

A detailed review of interstate, national, international and industry initiatives was also undertaken to ensure consistency with NWQMS policy requirements and to compare and contrast the Strategy's focus and direction with approaches other jurisdictions have taken in respect to their own stormwater related issues. Comments on the draft Strategy are also invited from the general public during the second round of the consultation process to ensure that actions and initiatives, proposed by the Strategy, have commitment and support from all sectors of the general community.

## 12.3 Appendix C

### REFERENCES

*A water resources management strategy for the ACT* (“Thinkwater, actwater” Volume 2: Explanatory document April 2004)

**Source:** [http://www.Attachment B.doc.thinkwater.act.gov.au/water\\_strategy.shtml](http://www.Attachment B.doc.thinkwater.act.gov.au/water_strategy.shtml)

ARMCANZ and ANZECC (2000), *Australian Guidelines for Urban Stormwater Management*, National Water Quality Management Strategy, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Chapter 1 of the *Stormwater Management Manual* prepared by the Department of Environment, Western Australia;

**Source:**[http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE\\_ADMIN/GUIDELINE\\_REPOSITORY/CHAPTER1.PDF](http://portal.environment.wa.gov.au/pls/portal/docs/PAGE/DOE_ADMIN/GUIDELINE_REPOSITORY/CHAPTER1.PDF)

Commonwealth of Australia (1992) *National Strategy for Ecological Sustainable Development*. Canberra.

Darwin Harbour Advisory Committee (2003) *Darwin Harbour Regional Plan of Management*. Department of Infrastructure, Planning and Environment, Darwin.

*Environment Protection (Water Quality) Policy and Explanatory Report 2003* prepared by Environment Protection Authority, South Australia;

**Source:** [http://www.epa.sa.gov.au/pdfs/epwq\\_report.pdf](http://www.epa.sa.gov.au/pdfs/epwq_report.pdf)

*Model urban stormwater quality management plans and guideline* prepared by the Environmental Protection Agency, Queensland.

**Source:** [http://www.epa.qld.gov.au/environmental\\_management/water/](http://www.epa.qld.gov.au/environmental_management/water/)

*Stormwater Management Planning* prepared by the Environment Protection Agency, NSW.

**Source:** <http://www.epa.nsw.gov.au/stormwater/usp/smp.htm>

*Victorian Stormwater Action Program*

**Sources:** [http://www.epa.vic.gov.au/Water/Programs/stormwater\\_management.asp](http://www.epa.vic.gov.au/Water/Programs/stormwater_management.asp)  
<http://www.clearwater.asn.au/about.cfm>

## 12.4 Appendix D

### GLOSSARY

For the purposes of this document these terms have the following meaning:

#### **Abatement**

Action to reduce the level or intensity of peak discharge or pollutant concentration or loads discharged in storm events.

#### **Anaerobic or anoxic zone**

An environment devoid of oxygen.

#### **Armouring or stabilisation**

The use of rock, geotextile and/or vegetation to bind the soil forming the bank or bed of channels such as to resist erosion by elevated flow velocities.

#### **Attenuation**

The reduction in the magnitude of flows, concentrations or loads of pollutants.

#### **Average Recurrence Interval (ARI)**

Average time between events of a given value being exceeded.

#### **Bank-full flow**

The flow rate at which a stream or channel will run full. The frequency of bank-full conditions is commonly adopted as the criteria for maintaining the channel cross section and freedom from sedimentation in the longer term. This frequency will vary according to climatic regions.

#### **Bank stabilisation**

(Refer to Armouring or bank stabilisation).

#### **Baseflow**

The underlying flow rate that cannot be directly attributed to storm events.

#### **Best Management Practice (BMP)**

Structural measures used to store or treat urban stormwater runoff to reduce flooding, remove pollution or to provide other amenities.

#### **Beneficial Use Declarations**

Beneficial Use (water values) is a legislated process that reduces the effects of waters pollution. Declarations are made for individual regions through the NT Water Act.

#### **Bio-diversity**

The variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and includes:

- (a) diversity within species and between species; and
- (b) diversity of ecosystems.

#### **Buffer zones**

A vegetated strip between the edge of a stream or drainage channel and a land use activity, designed to trap the lateral overland flow borne pollutants.

**Catchment**

A topographically defined area drained by a stream such that all outflow is directed to a single point.

**Channel**

The bed and banks of a stream or constructed drain.

**Detention (dry) basins**

A basin designed to temporarily detain storm or flood waters, to attenuate peak flows downstream to acceptable levels.

**Discharge**

The volume of flow passing a predetermined section in a unit time.

**Dissolved Oxygen (DO)**

The level of dissolved oxygen in streams is a critical property sustaining aquatic biota, and in determining the risk of occurrence of anoxic conditions.

**Drainage network:**

The system of channels and pipes and overland flow pathways which drain a catchment area. Networks typically comprise a main drain, branch drains, and collector drains.

**Easement (right of way)**

A corridor of land over which the drainage function is the primary role.

**Effluent**

Sanitary, industrial or agricultural discharge from wastewater treatment plants or treatment lagoons.

**Event**

A single precipitation and associated runoff occurrence.

**Floodway**

Corridor of land identified as a major stormwater flow path, often in association with a minor (pipe or channel) flow path.

**Flow retardation**

See Detention Basins

**Frequency**

(Refer to Average Recurrence Interval)

**Geomorphology**

Processes of weathering, flow and sediment transport which determines the pattern of drainage features across a catchment, and the equilibrium between sediment accumulation in channels and sediment re-suspension.

**Geotextile**

A thin, flexible permeable sheet of synthetic material used to allow the transmission of water through the pores of the geotextile while preventing the transmission of soil particles.

**Grey water**

Non-potable water derived from other household uses, suitable (with or without treatment) for other uses such as toilet flushing, garden watering.

**Gross Pollutant Trap (GPT)**

A trap designed to intercept coarse particulate material (by sedimentation) and trash and debris (by screens or booms). GPT's may be incorporated into the inlet pits, collector drains or main drains.

**Impermeable or impervious surface**

The part of the catchment surfaced with materials which prevent infiltration of rainwater into the underlying soil and groundwater.

**Integrated Catchment Management (ICM)**

Managing natural resources within a 'whole of system' approach. In a stormwater context, it requires whole of catchment and total urban water cycle based design and management approach, with integral consideration of land and water processes and values.

**On-site and off-site**

On-site facilities are located on individual residential or development blocks so as to enhance local detention and interception of runoff and pollutants. Off-site facilities are located on drainage network to provide area wide detention and interception of runoff and pollutants.

**Oil trap or separators**

A stilling tank configured to separate lighter oily matter, scums and hydrocarbons from stormwater.

**Overland flow**

The component of rainfall (excess) which is not removed by infiltration and discharges down the slope as surface flow.

**Permeable (porous) pavement**

Pavements comprising materials which facilitate infiltration of rainwater and transfer to the underlying sub-soil.

**Point source and non-point source pollution**

Point source is any discernible confined and discrete conveyance, including pipes, channels, and conduits. Non-point source is a diffuse pollution source without a single point of origin or specific discharge point.

**Pollutant retention**

The proportion of pollutant load intercepted and retained by a device, either on an event or annual basis.

**Recycled water**

The re-use of treated stormwater, grey water or black water for toilet flushing, irrigation, industrial processing or other suitable applications.

**Retarding or Retention Basin**

*See Detention Basin*

**Riparian vegetation**

Plant communities on the fringes and adjacent to water bodies.

**Runoff**

The portion of precipitation on a drainage area or surface that is discharged from the drainage area to drainage.

**Sediment trap**

A structure designed to intercept and retain sediment transported by the flow.

**Sedimentation**

The physical process of settling of suspended particulates under forces of gravity. The sedimentation efficiency is a function of eddy forces in the settling basin, and the period of detention of flow in the basin.

**Sewer overflow**

The discharge of sewage to surface water or stormwater drainage as a result of sewage flow exceeding the sewer capacity (infiltration of rainwater), or sewer blockage.

**Stormwater**

Water flowing over ground surfaces and in natural streams and drains as a direct result of rainfall over a catchment.

**Stormwater Treatment Measures (STM)**

*See Best Management Practices*

**Street sweeping**

The removal of particulates and litter from street surfaces by sweeping or vacuuming.

**Sub-catchment**

A topographically defined area drained by a tributary or branch drain of a primary stream or main drain draining a catchment.

**Swales**

A grassed open channel, designed to intercept and convey surface runoff to a drainage network inlet; promote infiltration; promote interception of particulate material by the vegetation, and to provide a landscape element.

**Terrestrial**

Belonging to or living on the land.

**Water Sensitive Urban Design (WSUD)**

Design of subdivisions, buildings and landscape which enhances the opportunities for at-source conservation of water, rainfall detention and use, infiltration, and interception of pollutants in surface runoff from the block.

## 12.5 Appendix D

### List of Acronyms and Abbreviations

COAG	Council of Australian Governments
DAS	Development Assessment Services (Division of DPI)
DCA	Development Consent Authority (NT Planning Authority)
DEET	Department of Employment, Education and Training
DHAC	Darwin Harbour Advisory Committee
DNRETA	Department of Natural Resources, Environment and The Arts
DPI	Department of Planning and Infrastructure
ECNT	Environment Centre NT
EMG	Ecosystem Monitoring Group (overseen by DHAC)
EPA	Environment Protection Agency (Regulatory Division of DNRETA)
ESD	Ecologically Sustainable Development
GIS	Geographic Information System
ICM	Integrated Catchment Management
KPI	Key Performance Indicators
LG	Local Government
NRM	Natural Resource Management
NT	Northern Territory
NTG	Northern Territory Government
NWQMS	National Water Quality Management Strategy
SMPG	Stormwater Management Planning Groups
SMP	Stormwater Management Plan
WSUD	Water Sensitive Urban Design

### Contact details

Department of Natural Resources,  
Environment and the Arts.

Environment Protection Agency  
2nd Floor Darwin Plaza  
41 Smith St  
Darwin NT 0800

PO Box 496  
Palmerston NT 0831

Telephone: 8924 4218  
Email: [epa.nreta@nt.gov.au](mailto:epa.nreta@nt.gov.au)  
Website: [www.stormwater.nt.gov.au](http://www.stormwater.nt.gov.au)