Chapter 1
Introduction

1.1 Objectives of these guidelines

The primary objective of these guidelines is to outline and demonstrate the ARC's preferred design approach for structural stormwater management devices. Specifically this includes design guidance for water quality and water quantity ponds, wetlands, filtration practices, infiltration practices, biofiltration practices and other practices that may be used.

The guidelines also have the following secondary objectives:

1. To provide the reader with a summary of the principles of stormwater management including an outline of environmental effects and management concepts;
2. To outline the statutory process and introduce the rules in the Auckland Regional Council (ARC) Proposed Regional Plan: Air, Land, and Water (which detail when a Stormwater Discharge Permit is required);
3. To provide a resource guideline for those involved with the design, construction and operation of stormwater management devices; and
4. To minimise adverse environmental effects of stormwater discharges through appropriate design, construction and operation of stormwater management practices.

1.2 What is the effect of impervious area on stormwater runoff?

Development of the Auckland Region has changed the character of the natural landform by covering the land with impervious surfaces. Houses, shopping centres and office buildings provide places to live and work. Car travel between buildings is facilitated and encouraged by a complex network of roads and carparks. This infrastructure allows the successful operation of the city and Region and encourages social and economic development.

However, this change from natural landforms and vegetative cover to impervious surfaces has two major effects on stormwater:

- Water quantity (urban hydrology)
- Water quality (non point source pollution)

1. Urban hydrology

Roofs, roads, parking lots, and other impervious areas stop water soaking into the ground, diverting it across the surface and increasing the quantity and rate of water discharging to streams and harbours. Impervious surfaces, compaction of soils and the absence of vegetation reduce the

Plate 1-1: Flood flows in an urban environment

"sponge like" storage capacity of the ground surface, reducing infiltration and the volume of underground water that feeds groundwater resources and stream baseflows. These changes in the hydrological cycle cause flooding, stream erosion , sedimentation and loss of water for abstraction. Flooding and erosion can have direct effects on public safety, while erosion and sedimentation can affect the habitat of aquatic resources.

2. Non-point source pollution

Particles from car exhausts, tyres and brakes, silt, fertilisers, oils, litter and other by-products of urban life fall and collect on impervious surfaces. Many of these small particles adhere onto sediment which stormwater runoff transports to streams, estuaries and harbours. Where the water is still, these contaminants settle out and accumulate. Other contaminants dissolve as rain passes over them and change the physical-chemical composition of stormwater. The accumulation of sediment, contaminants and changes to the chemical make-up of stormwater affect water quality and can then have significant effects on the viability of aquatic resources.

These effects will be detailed further in Chapter Two.

1.3 Managing stormwater

Stormwater management aims to protect human and ecological values by preventing or mitigating the adverse effects of stormwater quality and quantity on the human and aquatic environment.

Stormwater management techniques are generally divided into:

- non-structural practices (which prevent changes to the quality and quantity of stormwater by low impact designs, management practices or planning regulations), and
- structural practices (which reduce or mitigate changes that have already occurred to stormwater by constructed treatment devices).

Non-structural practices may be further categorised into:

- site design practices which reduce the quantity of stormwater runoff, and
- contamination control practices which minimise the risk of contaminants coming into contact with stormwater.

Structural, or treatment, practices assume that the increase in runoff or contamination of stormwater has already occurred and attempt to reduce the contaminants in the stormwater or hold runoff to reduce flooding and erosion.

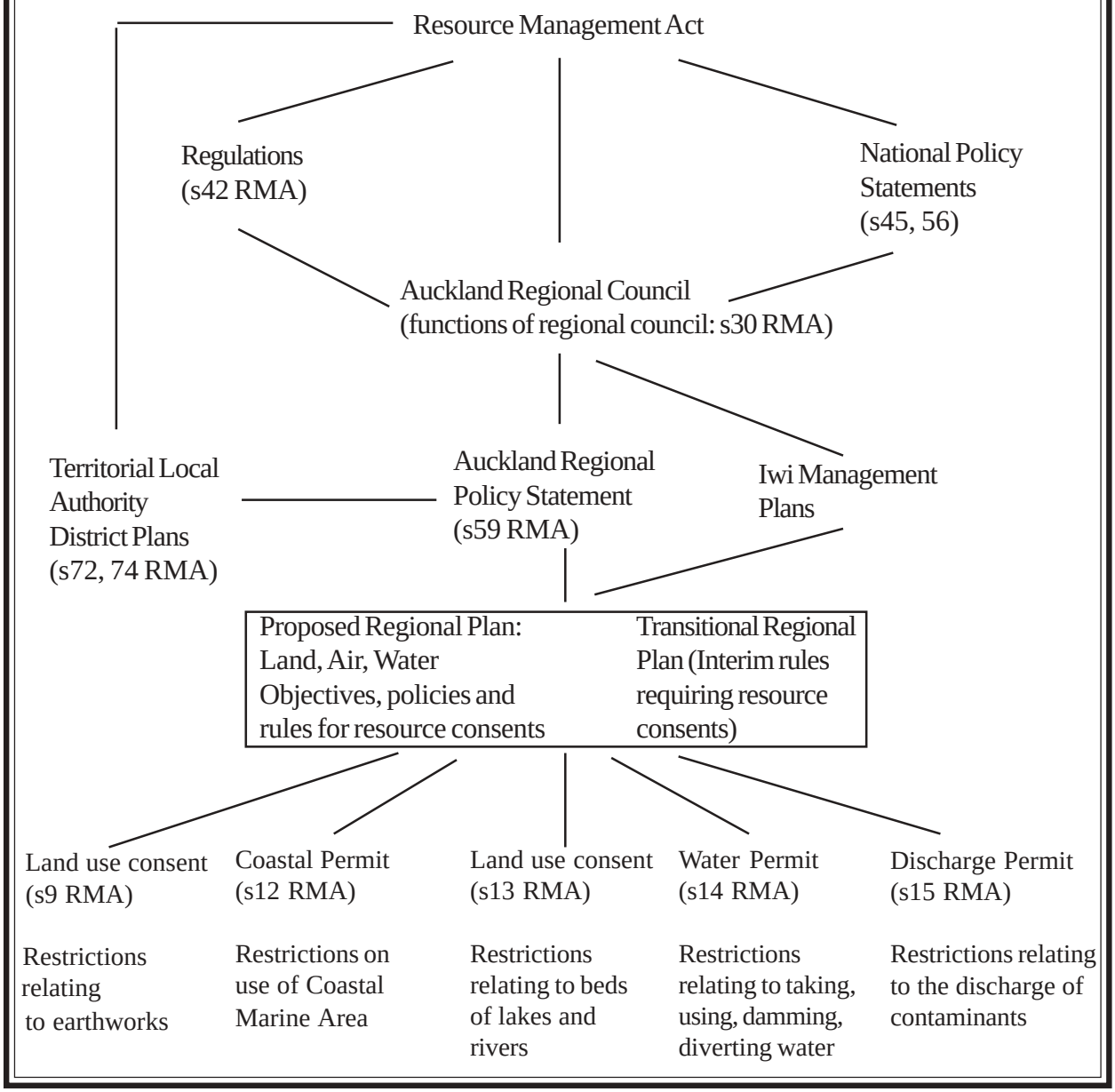
1.4 Regulatory framework

The Resource Management Act (RMA) sets up the statutory framework requiring stormwater discharge permits and is shown in Figure 1-1. Stormwater Discharge Permits are issued under section 15 of the RMA which controls the discharge of "contaminants or water into water". Activities which do not meet the permitted activity criteria of the Transitional Regional Plan and the proposed Regional Plan: Air, Land, and Water (ALW) require resource consents.

Permitted activities allow the discharge of water to any land or water body from any development which has an impermeable surface area of less than 1000 square metres.

When considering a resource consent application, the ARC must have regard to the policy set down in the Regional Plan: Air, Land, and Water and the Auckland Regional Policy Statement. The ALW Plan requires the "best practicable option" (BPO) to be implemented with respect to minimising the effects of stormwater discharges. The BPO will vary depending upon the discharge quality, site conditions, opportunities for mitigation, the downstream receiving environment values and technical and financial constraints. The RMA defines BPO as:

Figure 1-1: Regulatory framework



"Best Practical Option means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to

(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and

(b) the financial implications, and the effects on the environment, of that option compared with other options; and

(c) the current state of technical knowledge and the likelihood that the option can be successfully applied."

s2(1) Resource Management Act, 1991

To protect the human and ecological values attributed to receiving waters and to guide the selection of the BPO, the ARC uses three categories of stormwater management objectives which are set out in the proposed Regional Plan. These are:

- water quantity objectives,
- water quality objectives and
- aquatic resource protection objectives.

Water quantity objectives generally relate to the protection of public safety from the flooding and erosion effects of stormwater. Water quality objectives protect downstream receiving waters from the physical-chemical effects associated with the accumulation of stormwater contaminants. Where the discharge is to a watercourse with high ecological value, aquatic resource protection objectives such as hydrological erosion control requirements or additional water quality measures may also be required.

1.5 Technical Objectives

This manual provides guidelines on the selection and design of structural stormwater management devices. The primary objectives therefore relate to the removal of contaminants from stormwater, reducing peak discharges, and reducing site runoff by volume control. However, prevention is better than cure. To fully meet stormwater objectives set by the ARC will require stormwater management solutions which are integrated with development and all opportunities should be taken to prevent and minimise stormwater effects.

The ARC has outlined some preventative methods in the "Low Impact Design" manual (TP124) and the "Environmental Operating Procedures" manual. The Low Impact Design manual presents an alternative approach to residential site design and development from a stormwater management perspective. The Environmental Operating Procedures manual presents a methodology for businesses to assess their environmental impacts and then eliminate and prevent pollution.

The ARC's objectives for managing stormwater are:

1.5.1 Water quantity

The primary water quantity objective of treatment devices is to match the pre-development and post-development peak flow rates for the 50%, 10%, and 1% Annual Exceedence Probability (AEP) rainfall events.

Where significant aquatic resources are identified in a freshwater receiving environment, additional water quantity requirements may be required.

1.5.2 Water quality

The primary water quality objective of the treatment devices in this manual is to remove 75% of total suspended sediment on a long term average basis. Removal of sediment will remove many of the contaminants of concern, including; particulate trace metals, particulate nutrients, oil and grease on sediments and bacteria on sediments.

1.5.3 Aquatic resource protection

Aquatic resource protection is primarily concerned with maintaining the physical structure of the receiving system while promoting practices that provide habitat conditions conducive to a healthy ecosystem in receiving environments.

Physical structure is maintained by designing for by the detention, storage, and release of the first 34.5 mm of rainfall over a 24 hour period.

Other practices include riparian vegetation maintenance or enhancement and a reduction in the volume of runoff through revegetation and use of roof runoff for domestic water purposes.

It is important to note that these are objectives only. They are not standard requirements. There will be situations where alternative approaches or design requirements may be appropriate.

Their application depends upon whether the stormwater issue they address is present and the degree of

implementation depends upon site and catchment circumstances as determined by the Best Practicable Option. For example water quantity objectives are unlikely to be required where stormwater is discharged to an open coastal environment where erosion, sedimentation and flooding issues are not present. While water quality is a significant issue in urban areas, the degree to which the water quality objectives are implemented depends on the practices which are able to be retrofitted into the available space. The same issues also apply to aquatic resource protection.

In addition, the approval by the ARC of a catchment management plan for specific catchment that has been submitted by a TA may provide for alternative requirements that have been defined through a catchment-wide analysis. Proposed individual developments should investigate whether an approved comprehensive catchment plan exists for a given catchment, and if so, should ensure that development is in accordance with that plan.

1.6 Structure of these guidelines

These guidelines replace ARC Technical Publication 10: Stormwater Treatment Devices, Design Guideline Manual, October 1992. This document is divided into the following chapters as follows:

Chapter One:	Introduction
Chapter Two:	Effects of land use on stormwater
Chapter Three:	Stormwater management concepts
Chapter Four:	Choosing a stormwater management device
Chapter Five:	Pond design, construction and maintenance
Chapter Six:	Wetland design, construction and maintenance
Chapter Seven:	Filtration design, construction and maintenance
Chapter Eight:	Infiltration design, construction and maintenance
Chapter Nine:	Swale and filter strip design, construction and maintenance
Chapter Ten:	Oil and water separator design, construction and maintenance
Chapter Eleven:	Rain tank design, construction and maintenance
Chapter Twelve:	Greenroof design, construction and maintenance
Chapter Thirteen:	Outlet protection
Chapter Fourteen	Landscaping guidance for stormwater practices
Chapter Fifteen	Innovative stormwater management practices

Chapters 1 - 4 aim to provide all users with an introduction to the regulatory framework, effects of stormwater and the range of management concepts applicable to the Auckland Region.

Chapters 5 -13 describe different practices. Each will provide guidelines for the design, construction and operation and maintenance phases of development.

Chapter 12 discusses a new technology (at least for New Zealand) on the use of vegetated roofs for stormwater benefits. The discussion in that chapter is more to acquaint people with the concept than to function as a design chapter. Depending on interest, the Chapter will be expanded in the future to provide more design assistance.

Chapter 14 provides discussion on landscaping to enhance site appearance and public acceptability.

Chapter 15 relates to new practices and establishes a framework for the assessing performance expectations of new practices and the level of testing that is required for their widespread use in the Region.

1.7 Statement of intent

Applicants may propose alternative designs that meet the requirements of the ALW Plan, and the ARC will assess whether the design will achieve the Plan's goals and objectives.

In addition, this guideline is being distributed primarily in digital format. One reason for that approach is the recognition that updates may be necessary due to increased knowledge relating to investigations or criteria changes both here and overseas. It is the intent of the ARC to update this manual whenever changes are warranted. Distribution can then be done more easily by posting changes on the ARC website.

Plate 1-2: The key to stormwater management is outside the pipe: site design, source control and management practices should be the primary tools for stormwater management.