

Stormwater management

Issues and options for the Wellington Region

Table of Contents

1.	Introduction	1
1.1	Purpose of this Document	1
1.2	Urban development and stormwater	1
1.3	Policy and planning context	3
1.4	Stormwater monitoring and investigation	4
2.	Themes	8
2.1	Information needs	8
2.2	Infrastructure	10
2.3	Jurisdiction	13
2.4	Stormwater quantity	14
2.5	Stormwater quality	20
2.6	Effects on aquatic ecosystems and natural character	27
2.7	Funding	29
3.	Options	30
3.1	Alternative stormwater management	30
3.2	Stormwater infrastructure	31
3.3	Statutory instruments – the Regional Policy Statement, regional plans, district plans and bylaws	32
3.4	Non-statutory codes, design guidelines and catchment management plans	36
3.5	Rehabilitation of streams	37
3.6	Education	38
3.7	Monitoring	40
3.8	Inter-agency collaboration	40
4.	Conclusion	42

Abbreviations:

GWRC Greater Wellington Regional Council

TAs Territorial Authorities (City and District Councils). The territorial authorities in the Wellington region are Kapiti Coast District Council, Porirua City Council, Hutt City Council, Upper Hutt City Council, Wellington City Council, South Wairarapa District Council, Carterton District Council, and Masterton District Council.

RPS Regional Policy Statement for the Wellington Region

RMA Resource Management Act, 1991

1. Introduction

1.1 Purpose of this Document

The purpose of this document is to record the findings of two workshops hosted by Greater Wellington Regional Council (Greater Wellington) and attended by staff from territorial authorities and provide a basis for ongoing discussions about future stormwater management. This document can be used as a basis for preparing a Stormwater Management Action Plan for the region.

At the workshops, held during 2003 and 2004, participants identified a range of issues associated with stormwater management in the Wellington region. The issues have been sorted into seven main themes, and a range of ways to address them are suggested. The seven themes are information needs, infrastructure, council jurisdictions, stormwater quantity, stormwater quality, effects on aquatic ecosystems and natural character, and funding.

A Stormwater Management Action Plan can set out specific actions each organisation is prepared to take. Because of the inter-relationship between the different stormwater issues and effects, none of these options will be stand-alone solutions. A range of options implemented in an integrated way will be required to address stormwater management issues.

1.2 Urban development and stormwater

Over 85% of the region's population live in urban communities of more than 1500 people. Urban development for these communities has led to significant changes in the natural landscape, including the creation of impervious surfaces (roads, car parks, roofs, etc). The region's urban areas are also incrementally expanding and intensifying.

As people move into new areas, or introduce additional development in existing urban areas, they create new impervious surfaces thereby increasing surface runoff and the volume of stormwater produced, this causes the effects outlined in Figure 1. When this increased amount of stormwater is discharged to streams and rivers, it changes peak flow rates and overall flow volumes, potentially causing erosion and flooding. The physical structure of waterways is also affected by stormwater management practices such as straightening streams to allow for greater flows and lining them with rocks to prevent erosion.

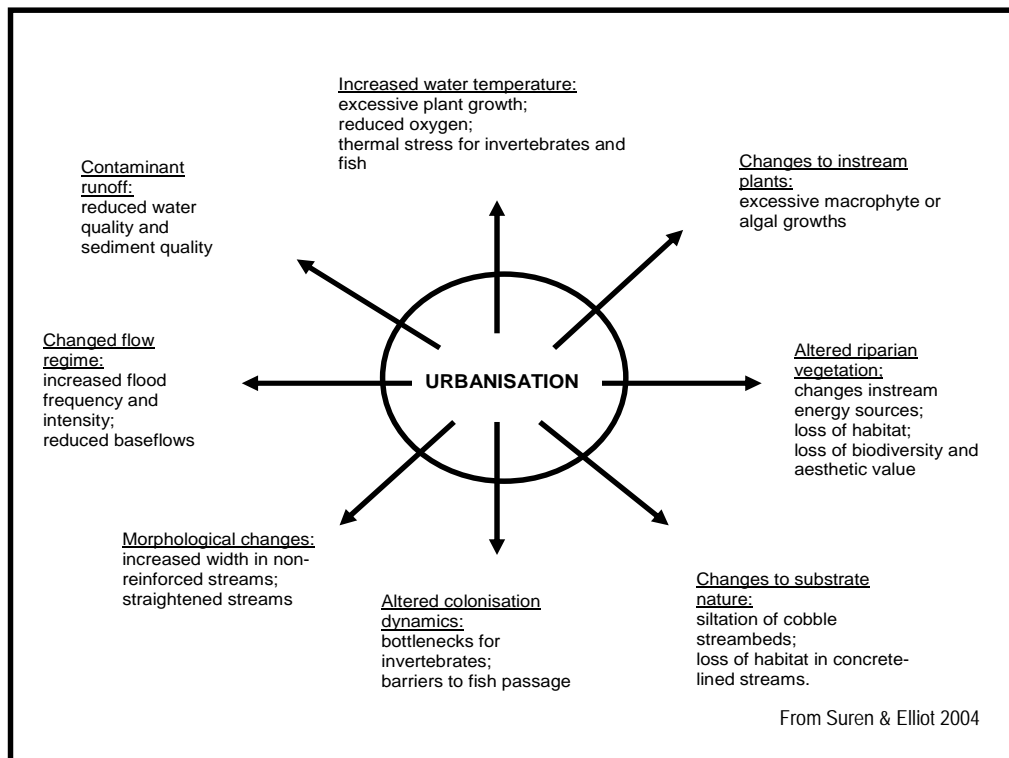


Figure 1: Impacts of urbanisation on streams

It is not only the volume of stormwater discharged that is of concern. Stormwater discharges affect water quality. **Table 1** shows typical contaminants in urban stormwater and their sources. These contaminants affect water quality and the quality of sediment deposits in waterways and coastal areas.

The combined effect of contaminants in stormwater and changes to stream flows can cause adverse effects on:

- aquatic ecosystem health
- human health
- food gathering opportunities
- cultural values
- recreational values
- amenity values
- natural character

Table 1: Typical urban runoff contaminants and their sources

Contaminant Source	Solids	Nutrients	Pathogens	Oxygen Demand	Metals	Oils	Synthetic Organics
Soil erosion	X	X	X	X	X		
Cleared land	X	X		X	X		
Human waste	X	X	X	X			
Animal waste	X	X	X	X	X		
Fertilisers		X					
Vehicle fuels/fluid	X			X	X	X	
Fuel combustion	X				X	X	X
Vehicle wear	X				X	X	
Industrial/household chemicals	X	X		X	X	X	X
Industrial processes	X	X		X	X	X	X
Paints/preservatives					X	X	X
Pesticides					X		X
Source EVA et al 2002							

1.3 Policy and planning context

The policy and planning context for stormwater discharges is the Resource Management Act 1991. The Regional Policy Statement for the Wellington Region (the RPS) identifies the significant resource management issues of the region and provides policies and methods for the integrated management of natural and physical resources. The RPS provides direction to the regional and district plans prepared in the region.

Policies in the RPS provide direction for Greater Wellington and the territorial authorities to maintain and protect the quality of freshwater, and to improve and restore contaminated water quality (see policies 4 and 5 of the Freshwater chapter). Stormwater discharges are controlled in Greater Wellington’s Regional Freshwater Plan and Regional Coastal Plan. Territorial authorities control land use in their district plans.

The issues described in section 2.3 recognise that the current arrangements for integrating the management of stormwater can be, and have to be, improved.

Regional plans

Discharges to water require resource consents unless allowed by a rule in a regional plan. Rules in the Regional Freshwater Plan and Regional Coastal Plan provide for most stormwater discharges as permitted or controlled activities with the following condition required for compliance.

“...after reasonable mixing, the stormwater discharge will not give rise to any of the following effects:

- (a) *the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials; or*
- (b) *any conspicuous change in the colour or visual clarity; or*
- (c) *any emission of objectionable odour; or*
- (d) *the rendering of fresh water unsuitable for consumption by farm animals; or*
- (e) *any significant adverse effects on aquatic life...”.*

When the regional plans were prepared, there was little information specific to the region about the actual impacts of stormwater on stream health and the coast. Since then, Greater Wellington’s regular monitoring and specific investigations on urban stormwater, streams and the coast indicate that stormwater discharges could be causing significant adverse effects on the aquatic ecology in receiving environments. This means that stormwater discharges, at least when considered collectively, are breaching conditions in the regional rules.

District plans

Land use activities are controlled by district councils and are allowed as of right unless rules in a district plan say otherwise. Most district plans have earthworks and/or subdivision rules that set thresholds for when resources consents are required and the matters that will be considered. All districts have different standards, discretions and assessment criteria. In general, if reference is made to stormwater it is usually with regard to controls that can be imposed under 220 of the RMA (e.g. erosion, subsidence, slippage or inundation), or minimum engineering standards for stormwater infrastructure through codes of practice or subdivision guides.

Engineering standards in the codes and guides were generally prepared a number of years ago and are typically strict, providing very few options for innovation in relation to stormwater management. They have been perceived as creating barriers to the use of new techniques such as low impact urban design. Kapiti Coast District Council reviewed its Code of Practice in 2005 and has developed a new framework that provides for both innovative design as well as traditional methods.

1.4 Stormwater monitoring and investigation

Regular monitoring

Greater Wellington monitors physico-chemical and microbiological water quality in rivers and streams around the region every month. Monitoring results to date indicate that there is significant microbiological contamination present in many of our urban streams. Both faecal coliform and *Escherichia coli* (*E. coli*) indicator bacteria are present in very high counts, often an order of magnitude above recommended water quality guidelines. For example, the Ministry for the Environment/Ministry of Health (2003) Microbiological Water

Quality Guidelines for Freshwater Recreational Areas state that *E. coli* counts above 550 cfu/100 mL pose an unacceptable health risk from contact recreation. As illustrated for selected streams in Figure 2, a significant number of *E. coli* sample results recorded to date are significantly higher than 550 cfu/100mL:

- Porirua Stream at Wall Park – exceeded the MfE/MoH (2003) alert level on 87% of sampling occasions and the action level on 61% of sampling occasions.
- Karori Stream at Makara Peak – exceeded the MfE/MoH (2003) alert level on 96% of sampling occasions and the action level on 78% of sampling occasions (11 of the 23 sample results exceeded the action level by at least one order of magnitude).
- Kaiwharawhara Stream at Ngaio Gorge – exceeded the MfE/MoH (2003) alert level on 78% of sampling occasions and the action level on 44% of sampling occasions.
- Waiwhetu Stream at Wainui Hill Bridge – exceeded the MfE/MoH (2003) alert level on 65% of sampling occasions and the action level on 35% of sampling occasions.

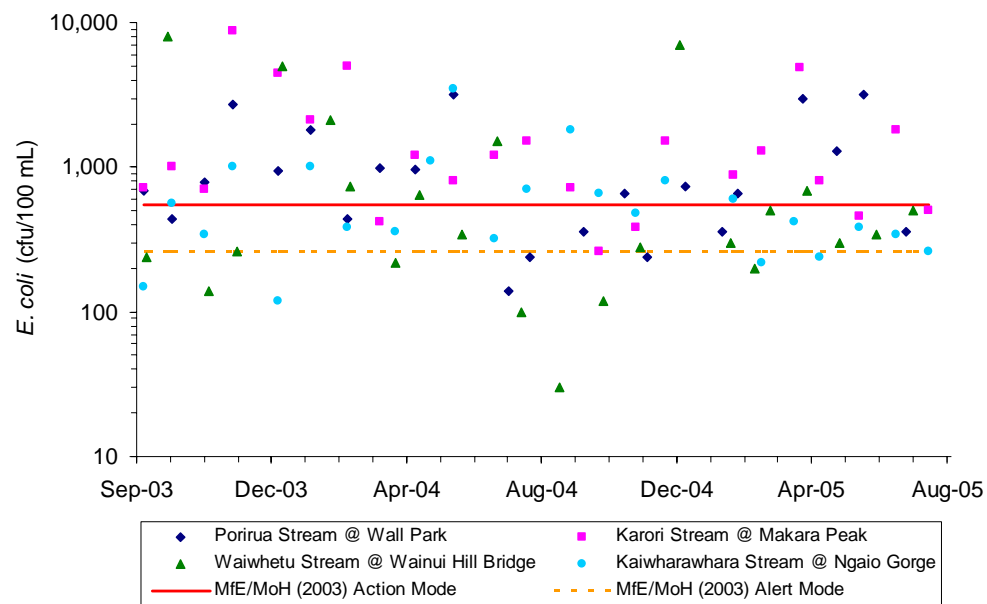


Figure 2: *E. coli* counts recorded in selected urban stream over August 2003 to July 2005

While many of our urban streams may not be used for primary contact recreation activities such as swimming, the very high levels of *E. coli* do indicate a likely health risk to secondary contact activities (e.g., children playing in streams, people biking through streams or collecting watercress). Moreover, many urban streams discharge into coastal waters used for contact recreation (e.g., Owhiro Stream in Wellington City discharges to the coast at Owhiro Bay).

Specific stormwater investigations

Over the past four years Greater Wellington has commissioned several studies to establish the effects of stormwater discharges on various receiving environments around the region. The results of these studies are in line with studies done elsewhere, nationally and internationally, and show that measures need to be taken in the Wellington region to mitigate the effects of stormwater discharges.

The studies are summarised here.

In 2001, an investigation of water quality and sediments was carried out in the Porirua Stream, two of its tributaries, and three stormwater inflows.¹ The study found that during wet weather, metal concentrations in the Porirua Stream were elevated and in the case of chromium, lead, and zinc they exceeded the USEPA guidelines at several sites. Chromium and zinc also exceeded USEPA guidelines in the middle reaches of the stream during moderate rainfall event. This result indicated that rainfall events with a return period of less than one month *may* lead to the occurrence of potentially toxic metal concentrations in the stream.

Sediment concentrations of heavy metals reached a maximum concentration below the intensive commercial and industrial zone of Linden. These concentrations indicated a moderate probability of toxic effects on sediment biota. The investigation confirmed Porirua Stream as a source of heavy metals accumulating in sediments of the Porirua Harbour. Most of the organic compounds tested for were not detected with notable exceptions. Four sampling sites showed concentrations of DDT and its breakdown products DDE and DDD at levels that indicated a moderate probability for toxic effects to occur.

In 2001 and 2002, Greater Wellington measured the levels of some contaminants in the tissues of four species of shellfish commonly found around the coastline.² This study found that shellfish in waters near urban areas contain contaminants that are likely to come from urban stormwater. These contaminants include heavy metals, PCBs and PAHs.

Over a three year period from 2001-2004, stormwater samples were collected from 11 different sampling sites from a selection of stormwater catchments around the region. The results showed there are chemical contaminants in the region's urban stormwater, particularly heavy metals.³ These heavy metals are present at levels likely to cause significant adverse effects on the aquatic ecosystems of some streams and the deposition zones on Wellington and Porirua harbours. The results also showed that stormwater adds significant amounts of nutrients to some streams and harbours, encouraging excessive growth of algae and plants.

¹ Porirua Stream Water and Sediment Quality, Environment Committee Report 01.514, 12 July 2001, Wellington Regional Council.

² Progress report on the investigation of chemical contaminants in shellfish, Environment Committee Report 03.208, 14 April 2003, Greater Wellington Regional Council.

³ Assessment of Urban Stormwater Quality in the Greater Wellington Region June 2005

An investigation of marine sediment quality in Porirua Harbour was undertaken in 2004.⁴ The results showed that sediments in the Porirua Harbour and the Pauatahanui Inlet were contaminated with toxic substances derived from the surrounding catchments. In the Onepoto Arm, copper, lead and zinc had accumulated to concentrations where impacts on aquatic life may begin to occur, and mercury was approaching ecologically significant concentrations. DDT has accumulated in both arms at concentrations where impacts on aquatic life may begin to occur.

In 2005 sediments from 22 streams around the region were investigated for a range of contaminants.⁵ The results showed that sediments in most streams contained residual levels of DDT. Substances such as dieldrine, lindane, mercury, zinc and lead were also common. In seven streams the contaminants were present in the sediments at levels where ecological effects were likely to be occurring.

⁴ Porirua Marine Sediment Quality Investigation, Environment Committee Report 05.42, 22 February 2005, Greater Wellington Regional Council

⁵ Urban Stream Sediment Quality Investigation, Environment Committee Report 05.380, 16 August 2005, Greater Wellington Regional Council

2. Themes

2.1 Information needs

Issue 1
More information is needed on the effects of stormwater discharges on rivers and the coast.

There is still limited information about the effects of stormwater discharges on receiving waters in the Wellington region, although ongoing monitoring and recent specific investigations indicate that there is cause for concern. It is important that monitoring and investigations of stormwater allow us to make links between stormwater discharges, adverse effects in receiving waters and practical and effective ways of mitigating adverse effects.

There need to be more investigations into whether stormwater discharges are causing any of the effects described in the regional rules – these are also a bottom line requirement of the Resource Management Act, 1991. In addition, the Regional Freshwater Plan directs that rivers and streams in the region are managed for aquatic ecosystems, contact recreation, or trout fishery and fish spawning purposes, and the Regional Coastal Plan directs that coastal water is managed for contact recreation and shellfish gathering purposes. There have been limited investigations into the effect of stormwater discharges on these management purposes. Further studies may be necessary to determine the effects of stormwater discharges on human health and cultural values.

Greater Wellington’s monitoring and investigation of stormwater impacts to date has been limited to selected catchments. Until monitoring of stormwater is carried out more widely and more regularly in the region, doubt will remain over the true impact of stormwater discharges.

An important area that needs further investigation is the lack of information about the “zone of influence” of stormwater discharges. There has been no community discussion about what would be acceptable as maximum or minimum areas for “reasonable mixing” in urban streams and on the coast. For example, should stormwater outlets at beaches be required to comply with standards at the outlet, or at some distance away from it.

Options for Issue 1

- Develop a long-term regionally co-ordinated environmental monitoring programme for stormwater quality and effects. *See Option 16.*
- Identify streams that would benefit most from rehabilitation. *See Option 11.*
- Investigate developing an education resource that provides council staff, stormwater industry professionals and property developers with

information about alternative stormwater management practices and devices. *See Option 14.*

- Support staff attendance at and involvement with stormwater conferences, workshops and training courses. *See Option 15.*
- Establish a regular Regional Stormwater Forum for discussing regional stormwater management issues. *See Option 17.*

Issue 2
People often pollute stormwater through ignorance of the effect they have.

Domestic sources of stormwater pollution are usually avoidable. Some people are unaware that stormwater flows straight to streams and the coast without treatment, or they are unaware of the significant effects their actions may have. The most common examples of stormwater pollution from domestic sources are listed below.

- **Putting hazardous substances** such as used engine oil, excess paint, or old garden chemicals down the stormwater drain. While these events are occasional, the effects can be significant and include fish kills.
- **Carwash chemicals and dirt** end up in stormwater if people wash their cars on the roads or in driveways that drain to roads. Detergents can contain chemicals harmful to aquatic ecosystems or nutrients that cause algal growth. The dirt removed from cars can contain traces of fuel, lubricants, or heavy metals.
- **Garden and house cleanups** using water blasters or garden hoses to clean dirt from houses or hosing dirt and leaves off paths and driveways can result in that dirt and leaves getting into the stormwater systems.
- **Dog poo** gets washed into streams and beaches.
- **Litter** can block stormwater grates causing flooding or accumulate at beaches.



Options for Issue 2

- Investigate the use of bylaws to control inappropriate practices such as discharging carwash chemicals or pouring hazardous substances down stormwater drains. *See Option 8.*
- Strengthen and extend existing community environmental education programs about stormwater and stream care. *See Option 13.*

2.2 Infrastructure

Issue 3
Some stormwater infrastructure is old and not adequate for current demands.



Some stormwater infrastructure now serves catchments which are much different in size and character than those they were originally designed to serve. In some circumstances this may mean that stormwater volumes can exceed the infrastructure capacity.

In older parts of some cities there might not be accurate plans showing where infrastructure is, what the pipes are connected to, where they discharge and what size they are. Older sections sometimes need repair or upgrading to work effectively.

Options for Issue 3

- Develop a programme to review the state of existing stormwater infrastructure and assess its adequacy to meet current flows. *See Option 3.*
- Undertake or continue with sewage elimination programmes. *See Option 4.*

Issue 4
Cross connections between stormwater and sewerage systems contaminate streams and coastal water and increase flows in sewerage systems.

Greater Wellington's regular stream monitoring shows that some urban streams have very high levels of faecal coliforms and *E. coli* indicating that there are leaks from sewers or illegal cross-connections. If there are connections from sewer pipes to the stormwater system, raw sewage can end up in streams, rivers, and seas. The presence of untreated sewage in rivers, lakes and coastal areas can present a threat to public health when people swim in, bike through or gather food from the water.

If stormwater pipes are connected to the sewerage system, the sewerage system will overflow in heavy rainfall because it is not designed to cope with very high flows. When sewers overflow they contaminate stormwater, beaches and streams.

Elimination of cross connections and upgrading stormwater pipes is an expensive task. Wellington City Council has committed \$52M dollars to their Sewage Pollution Elimination Programme which is focussing on removing cross connections and upgrading sewage pumping stations to prevent sewage contamination of the harbour after heavy rainfall.

Options for Issue 4

- Develop a programme to review the state of existing stormwater infrastructure and assess its adequacy to meet current flows. *See Option 3.*
- Undertake sewage elimination programmes where not already being implemented. *See Option 4.*

Issue 5
New stormwater technology has yet to be accepted in the region.

Territorial authorities, developers and stormwater industry professionals may not want to adopt new stormwater practices and technology without sufficient knowledge about their effectiveness and costs. Even when new practices and technology have been tested in other countries or other parts of New Zealand, assurance is needed that they are appropriate for the Wellington region.

The actual costs of new technologies also need to be well known. Design cost, installation costs, training costs and maintenance costs all need to be assessed. Territorial authorities' development codes need to be flexible enough to support new technologies and innovative practices otherwise people will continue to use stormwater management methods they are familiar with.

Options for Issue 5

- Trial alternative stormwater management techniques and devices. *See Option 1*
- Produce a technical guideline for the use of alternative stormwater management devices in the Wellington Region. *See Option 2.*
- Strengthen and extend the Greater Wellington *Take Charge* programme. *See Option 13.*
- Investigate developing an education resource that provides council staff, stormwater industry professionals and property developers with information about alternative stormwater management practices and devices. *See Option 14.*
- Support staff attendance at and involvement with stormwater conferences, workshops and training courses. *See Option 15.*



2.3 Jurisdiction

Issue 6
There is not enough integration or co-ordination between the efforts of Greater Wellington, territorial authorities and other parties to ensure that stormwater discharges are adequately controlled.

Under the Resource Management Act 1991, regional councils are responsible for discharges of contaminants and water into water. In the Wellington region, discharges of stormwater to coastal and fresh water are allowed as a permitted activity subject to compliance with conditions stated in the rules – see the Regional Freshwater Plan and the Regional Coastal Plan. Discharges of stormwater to freshwater from sites of bulk earthworks (more than 0.3 hectares) are covered by the Regional Freshwater Plan. The regional rules have been constructed so that stormwater discharges are regulated at the end of the pipe, not the top of the pipe. Stormwater discharged **into** pipes is allowed as a permitted activity by Rule 1 of the Regional Plan for Discharges to Land, without any conditions.

Territorial authorities are responsible for controlling any effects of the use, development, or protection of land. This includes controlling the effects of earthworks and urbanisation. Earthworks, subdivision and other uses and development of land are controlled by district rules in district plans.

There is some potential for gaps and overlaps in regional and district rules to occur, particularly if district rules about land use activities do not reserve control over the effects of the use and development on streams and coastal water.

Poor integration can also lead to missed opportunities for sharing knowledge and project costs. Better integration of monitoring programmes and rehabilitation projects between councils could improve understanding of stormwater issues and water quality around the region.

Options for Issue 6

- Explore ways to reduce gaps and overlaps in regional and district rules through a Regional Stormwater Forum. *See Options 6, 7 and 17.*
- Review the effectiveness of provisions for stormwater management in Regional Policy Statement, regional plans and district plans. *See options 5, 6 and 7.*
- Develop a long term regionally co-ordinated monitoring programme to address stormwater effects. *See option 16.*

Issue 7
Current regional rules governing stormwater discharges are difficult to enforce.

The conditions in the regional rules controlling stormwater discharges contain a lot of discretion. For example, no *significant* adverse effects on aquatic life, no *conspicuous* change to colour and clarity of water, the production of any *conspicuous* oil or grease films. This can make it difficult to enforce perceived breaches in the rules.

Another enforcement difficulty is that people responsible for the final breach to the rule may be difficult to identify because the stormwater systems are very big. Taking enforcement action, or even providing advice, requires identifying the person responsible for the discharge into the system that caused the effects at the bottom.

Options for Issue 7

- Review the effectiveness of rules for the discharge of stormwater in the Wellington Regional Freshwater Plan and Regional Coastal Plan. *See Option 6.*
- Strengthen and extend Greater Wellington’s existing community environmental education programs about stormwater and stream care and the *Take Charge* programme. *See Option 13.*

2.4 Stormwater quantity

Issue 8
Changing land use from rural to residential or other urban uses means greater areas of impervious surfaces which increases the overall quantity of stormwater needing to be managed, and increases the peak discharge of stormwater to natural water bodies.
Issue 9
Most stormwater systems are constructed to aid the fast passage of water from the built environment to the natural environment.

Impervious surfaces, such as roofs, roads and car parks, alter the natural hydrological regime in streams and rivers receiving the stormwater runoff. When rain falls on impervious surfaces, runs off straight into the stormwater system instead of soaking into the ground – so the natural water cycle is interrupted.

Figure 3 shows the changes that typically result from urban development. When rain falls on impervious surfaces, the volume of surface runoff is more than doubled compared to natural vegetated landscapes. There is also a substantial decrease in groundwater flows and storage.

Most stormwater management systems are designed to remove water from the built environment as fast as possible. This has a major impact on the hydrology of receiving environments because it increases the peak flow response and decreases the time difference between peak rainfall and peak discharge of stormwater (see Figure 4).

Increased stream flows have an effect on the physical structure of stream beds and banks, and consequently on aquatic fauna. When peak flows increase, stream channels erode to meet the increased volume and velocity of water. Stream substrate is washed away along with some of the stream invertebrates that are a food source for larger aquatic creatures. Increased stream flows can also cause flooding. In order to carry larger flows and prevent erosion, streams are straightened, channelised and lined with concrete or rock. Both the hydrological changes and the way they are managed impacts on aquatic ecosystems, natural character and amenity values.

Figure 4 shows stream flow changes in response to rainfall after a change has been made to urban land use. Higher stream flows can also cause stream bed and bank erosion. This can substantially increase the amount of sediment discharged to coastal areas such as estuaries.

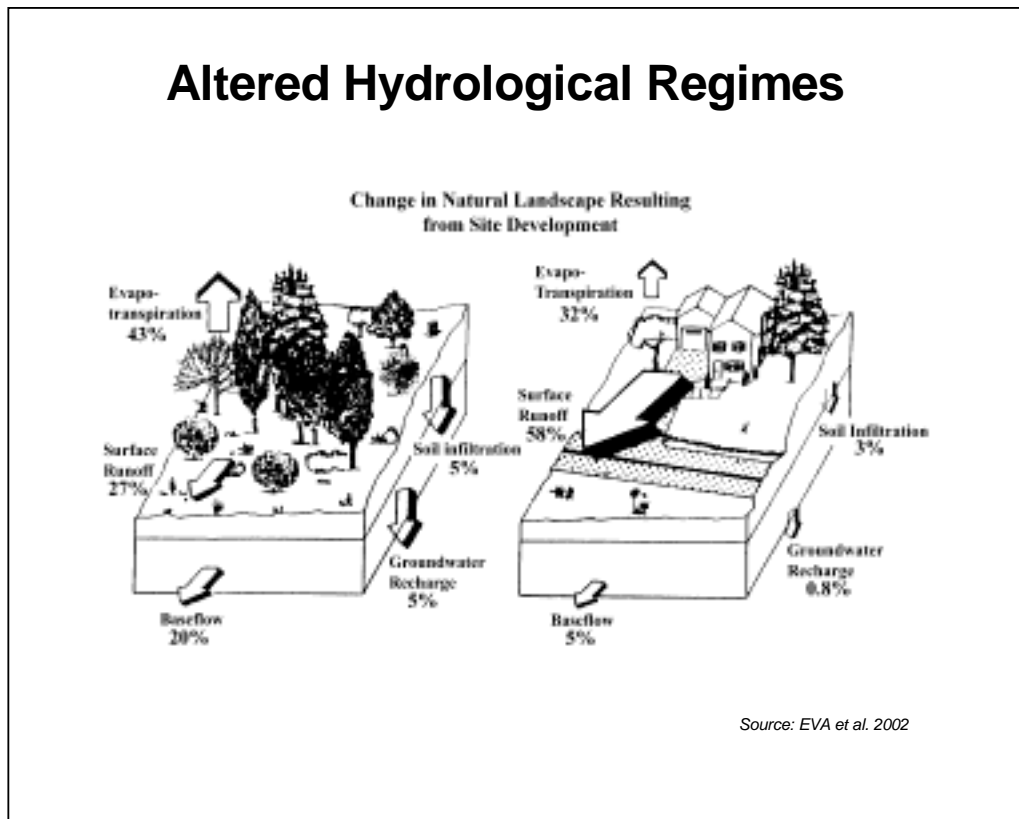
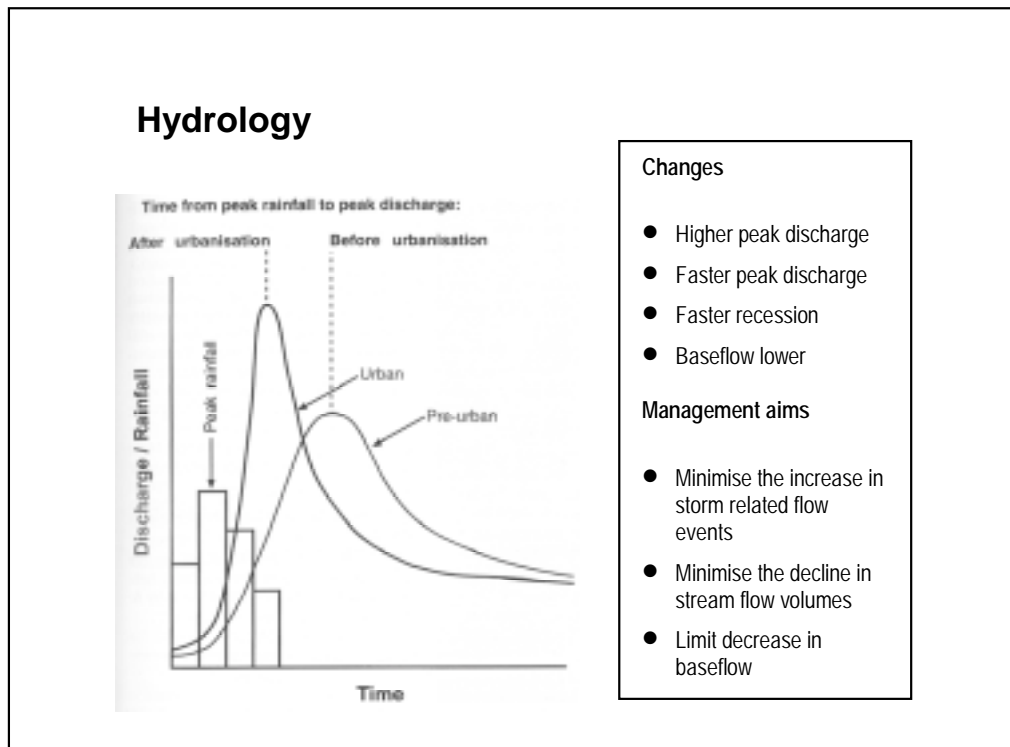


Figure 3: Altered Hydrological Regimes



Source: Boothroyd 2004

Figure 4: Changes to stream hydrology after urbanisation

Options for Issues 8 and 9

- Investigate and trial specific alternative stormwater management practices and devices that reduce the peak discharge of stormwater and decrease the volume of stormwater needing to be managed. *See Option 1.*
- Produce a technical guideline to the use of alternative stormwater management practices and devices in the Wellington region. *See Option 2.*
- Review the effectiveness of district plan policies in relation to their recognition of the values of urban waterways and beaches and the consideration they give to water sensitive urban design in subdivision and redevelopment plans. *See Option 7.*
- Investigate the effectiveness of stormwater design standards for new urban developments in district plans. *See Option 7*
- Review and if necessary, update existing development codes or subdivision guidelines. *See Option 9.*
- Investigate developing educational resources that provide council staff, stormwater industry professionals and property developers with information about alternative stormwater management practices and devices. *See Option 14.*



Issue 10
Small streams and gullies are sometimes filled in or piped when land is subdivided and developed. This increases the rate and volume of stormwater needing to be managed (see also Issue 17)

Transforming rural or undeveloped land for residential or industrial use often requires earthworks to create land contours suitable for housing and roads. Even small-scale earthworks can fill in first order streams and remove riparian vegetation. Replacing these natural features with pipes or artificial channels increases the volume of stormwater discharged by removing opportunities for rainfall to soak into the stream beds – essentially all the small tributaries are replaced with roadside gutters.



Options for Issue 10

- Review the effectiveness of guidance on waterway and stormwater management as part of urban design in the Built Environment chapter of the Regional Policy Statement. *See Option 5.*
- Review the effectiveness of provisions that identify the values of urban waterways and beaches and protection of these values in the Freshwater and Coastal chapters of the Regional Policy Statement. *See Option 5.*
- Review the effectiveness of policies about the values of urban waterways and beaches and the rules governing their modification in the Regional Freshwater Plan and the Regional Coastal Plan. *See Option 5.*
- Review the need for policies in the Regional Freshwater Plan to provide for financial contributions and offsite mitigation when streams are modified or filled in. *See Option 6.*
- Review the effectiveness of district plan policies that recognise the values of urban waterways and beaches and consider water sensitive urban design in subdivision and redevelopment plans. *See Option 7.*
- Review the effectiveness of stormwater design standards and district plan rules for new urban developments in. *See Option 7.*
- Review and update codes and design guides for subdivision and urban development to include alternative stormwater management practices and devices. *See Option 9.*

Issue 11
Stormwater is considered a waste product rather than a resource.

Stormwater flow and its quality is changed by urban development. Most stormwater systems are constructed to aid the fast passage of water from the built environment to the natural environment. This helps protect urban areas from flooding.

The faster water is removed from urban areas, the more likely it is that the receiving environment is adversely affected. When large quantities of stormwater are discharged into streams and rivers, their peak flow volumes are increased, changing their hydrological regimes.

If stormwater was valued as a resource, for example, as a source of garden water, then it wouldn't be discarded to streams where it can cause problems.

Options for Issue 11 (see Section 3 for detail)

- Investigate and trial specific alternative stormwater management systems that store and re-use water. *See Option 1.*
- Produce a technical guideline to the use of alternative stormwater management devices in the Wellington region. *See Option 2.*
- Investigate developing an education resource that provides council staff, stormwater industry professionals and property developers with information about alternative stormwater management practices and devices. *See Option 14.*

Issue 12
As a consequence of climate change more frequent, more intense storm events are predicted, increasing the quantity of water needing to be managed by stormwater systems.

Stormwater management systems are designed to manage a maximum rate of stormwater flow. Beyond this, stormwater systems will overflow - potentially causing flooding, slips and erosion. Climate change scientists predict more extreme weather events bringing heavier rainfalls and therefore these natural hazards are likely to occur more often. The design parameters that prescribe the capacity of stormwater infrastructure may need to be reviewed using more recent rainfall data.

The provision of secondary flow paths will become increasingly important when more rainfall events happen that are greater than the stormwater infrastructure's ability to cope with. Secondary flow paths are crucial for protecting property from flood damage.



Options for Issue 12

- Review and if necessary, update development codes or subdivision guidelines to ensure climatic changes are taken into account. *See Option 9.*

2.5 Stormwater quality

Issue 13
Land development such as vegetation clearance and earthworks increase sediment loads in stormwater runoff

When land is cleared of vegetation or disturbed by earthworks, the rate of erosion increases because exposed soil is more easily washed away by rain. Soil transported by stormwater runoff enters streams or coastal waters.

Suspended sediment in water reduces the amount of sunlight penetrating the water and reaching aquatic plants. When particles settle out of the water they accumulate on the beds of lakes, streams, harbours and estuaries. Deposited sediment can suffocate aquatic organisms, and can smother fish spawning and nursery areas. It can take a long time for streams and estuaries to recover from high sediment loads. Sediment can also make bathing areas unsuitable and can damage food gathering areas.

For large earthworks sites (greater than 0.3 ha) Greater Wellington requires a resource consent to discharge stormwater runoff from the site. Condition on the consent can require the effects of sediment in the stormwater to be managed, usually by installing sediment retention ponds. However, with sediment

removal rates in sediment retention ponds not usually exceeding 75% there will still be an increase in the amount of sediment discharged compared to background levels. Sites less than 0.3 ha do not require a resource consent from Greater Wellington but may do from a territorial authority. If there are many small sites discharging sediment their cumulative effect can affect small urban streams. If the discharge is not directly to fresh water, no discharge permit is required.



Options for Issue 13

- Review the effectiveness of rules for discharges of stormwater in the Regional Freshwater Plan and Regional Coastal Plan. *See Option 6.*
- Review the effectiveness of policies about the values of urban waterways and beaches and the rules governing their modification in the Regional Freshwater Plan and the Regional Coastal Plan. *See Option 6.*
- Review the effectiveness of district plan policies that recognise the values of urban waterways and beaches and consider water sensitive urban design in subdivision and redevelopment plans. *See Option 7.*
- Review the effectiveness of district plan rules that require new urban developments to meet stormwater design standards. *See Option 7*
- Strengthen and extend Muddy Waters, Greater Wellington’s sediment control programme. *See Option 13.*

Issue 14
Road runoff is a major source of stormwater contamination.

Road surfaces make up a large proportion of the urban environment, are highly impervious and are usually directly connected to the stormwater drainage system. Stormwater from roads picks up considerable quantities of pollutants from the roads and gutters. Recent research estimates that upwards of 40% of the contaminant load of all stormwater runoff comes from roads.⁶ Auckland Regional Council estimates that up to 80% of stormwater contaminants are derived from vehicles while the remaining 20% comes from domestic and industrial sources⁷.

These are the main sources of contaminants on roads:⁸

- **Vehicle exhaust emissions** contain a wide range of heavy metals and organic compounds such as polycyclic aromatic hydrocarbons (PAHs).
- **Tyres** are the main source of zinc on roads and also contain organic compounds.
- **Brake pads** are the main source of copper, lead and antimony. They also contain organic compounds.
- **Vehicle fuels** contain a wide range of volatile organic compounds and metals.
- **Vehicle lubricants, greases and coolants** contain zinc and a wide range of organic compounds.
- **Road surface wear** is a source of particulate matter and organic compounds including PAHs.

⁶ Integrated Stormwater Management Guidelines for the New Zealand Roding Network, Transfund New Zealand Research Report No. 260, B Kouvelis & W Armstrong (Editors) MWH (NZ) Ltd, Wellington (2004), p89.

⁷ ARC Stormwater Action plan (2004)

⁸ Integrated Stormwater Management Guidelines for the New Zealand Roding Network, Transfund New Zealand Research Report No. 260, B Kouvelis & W Armstrong (Editors) MWH (NZ) Ltd, Wellington (2004.) p90.



Source: Ministry of Transport 2005

These contaminants can be toxic to aquatic ecosystems and accumulate in the tissue of fish and shellfish, potentially affecting human health.

Options for Issue 14

- Investigate and trial alternative stormwater management techniques and devices for reducing or controlling discharges from roads such as swales or wetlands. *See Option 1.*
- Produce a technical guideline for the use of alternative stormwater management devices in the Wellington region. Include specific measures that would be suitable for roads. *See Option 2*
- Review the effectiveness of rules governing the discharge of stormwater in the Regional Freshwater Plan and Regional Coastal Plan. *See Option 6.*
- Review the effectiveness of district plan policies for water sensitive design for new roading projects. *See Option 7.*
- Review the effectiveness of district plan rules for new urban developments and stormwater design standards. *See Option 7.*
- Review and where necessary, update existing development codes and guidelines for roads. *See Option 9.*
- Identify streams that would benefit most from rehabilitation. *See Option 11.*

Issue 15

Stormwater from industrial areas has the highest risk of containing hazardous contaminants.

Water quality in streams in industrial catchments is worse than in streams in residential or rural catchments.⁹ The probable cause of this poor water quality is the high level of contaminants in the stormwater from those areas. Contaminants can enter stormwater systems from industrial yards without on-site treatment or protection, or by accidental spills or deliberate dumping of chemicals down stormwater drains.

Many industries take measures to prevent contamination of stormwater through staff training and having spill clean up equipment on site.



Options for Issue 15

- Review the effectiveness of rules for the discharge of stormwater in the Wellington Regional Freshwater Plan and Regional Coastal Plan. *See Option 5.*
- Strengthen and extend *Take Charge*, Greater Wellington's pollution prevention programme. *See Option 13.*

⁹ Porirua Stream Water and Sediment Quality, Environment Committee Report 01.514, 12 July 2001, Wellington Regional Council.

- Consider preparing Catchment Management Plans (CMP) for high risk urban catchments. *See Option 10.*
- Identify streams that would benefit most from rehabilitation. *See Option 11.*

Issue 16
Contaminants in stormwater accumulate in sensitive low-energy environments.

Stormwater pollutants that are attached to sediments are not flushed away from low-energy receiving environments such as estuaries, wetlands, shallow and sheltered harbours. These environments can also be particularly sensitive to pollutants because they are biologically productive, contain rare species, have high cultural values, are traditional food gathering areas, have high recreational values, or have high aesthetic values.



Pauatahanui Inlet

Options for Issue 16

- Review the effectiveness of rules for the discharge of stormwater in the Wellington Regional Freshwater Plan and Regional Coastal Plan. *See Option 6.*
- Review the effectiveness of district plan policies that recognise the values of urban waterways and beaches and consider water sensitive urban design in subdivision and redevelopment plans. *See Option 7.*

- Consider preparing Catchment Management Plans (CMP) for urban catchments. *See Option 10.*
- Identify streams that would benefit most from rehabilitation. *See Option 11.*

Issue 17
Small streams and gullies are sometimes filled in or piped when land is subdivided and developed. This decreases the quality of water in the streams downstream (see also issue 10).

Even small-scale earthworks can fill in first order streams and remove riparian vegetation. Replacing these natural features with pipes or artificial channels essentially replaces all the small tributaries with roadside gutters which pick up rubbish and contaminants and transport them to the streams downstream. On top of this, water temperatures from water washing off roads is higher than when it filters through the land. The overall effect is a decrease in water quality in the streams.

Options for Issue 17

- Review the effectiveness of guidance on the management of waterways and stormwater as part of urban design in the Built Environment chapter of the Regional Policy Statement. *See Option 5.*
- Review the effectiveness of the provisions that identify and protect the values of urban waterways and beaches in the Freshwater and Coastal chapters of the Regional Policy Statement. *See Option 5.*
- Review the effectiveness of policies that recognise and protect the values of urban waterways and beaches and the rules governing their modification in the Regional Freshwater Plan and Regional Coastal Plan. *See Option 6.*
- Consider the need for policies in the Regional Freshwater Plan to provide for financial contributions and offsite mitigation when natural water ways are modified or filled in. *See Option 6.*
- Identify streams that would benefit most from rehabilitation. *See Option 11.*
- Strengthen and extend Muddy Waters, Greater Wellington’s sediment control programme. *See Option 13*



2.6 Effects on aquatic ecosystems and natural character

Issue 18
The development of urban areas and stormwater systems adversely affect ecosystems and the passage of freshwater fish.
Issue 19
Current approaches to stormwater management adversely affect amenity values and the natural character of natural water bodies.

Streams flow through, and influence, the landscapes that people live in. In turn, streams and their aquatic ecosystems are dependent on the surrounding environment. Streams and streamside vegetation have natural character that is important to communities. People value the amenity and recreational opportunities that streams provide, whether it's through walking alongside one or the visual contrast in a city landscape.

The development of land from green field to urban can necessitate changing the landform to provide suitable gradients for roads and prepare building sites for houses. This can sometimes result in the removal of riparian vegetation and first order streams, construction of stop-banks to prevent flooding, straightening streams, channelisation, rock lining to prevent erosion and even piping entire streams. These changes result in a loss of natural character, amenity values and aquatic habitat. Where small streams are removed or

replaced with long sections of piping, the aquatic habitat is permanently destroyed.

The lifecycle of native freshwater fish depends on them being able to migrate into streams from the sea and swim to clean habitat in the upper reaches. Piping streams makes it harder for fish to reach habitats that they could live in as adults.

Small streams are very important to the ecology of larger streams downstream. They supply clean water, invertebrates (like mayflies), clean detritus like leaves and wood for invertebrates and other fauna to eat. Removing small streams in urban catchments results in streams fed mostly from road and roof runoff.

Some benefits from retaining urban streams and planting their margins are:

- More attractive scenery and improved amenity value.
- Nicer recreation areas and places where children play.
- Increased abundance and variety of birds in the area.
- Less waste land available for rubbish, weeds and pests.
- Less need for concrete and stonewall lined streams.

Options for Issue 18 and 19

- Review the effectiveness of guidance on the management of waterways and stormwater as part of urban design in the Built Environment chapter of the Regional Policy Statement. *See Option 5.*
- Review the effectiveness of the provisions that identify and protect the values of urban waterways and beaches in the Freshwater and Coastal chapters of the Regional Policy Statement. *See Option 5.*
- Review the effectiveness of policies that recognise and protect the values of urban waterways and beaches and the rules governing their modification in the Regional Freshwater Plan and Regional Coastal Plan. *See Option 6.*
- Investigate the need for policies in the Regional Freshwater Plan to provide for financial contributions and offsite mitigation when natural water ways are physically modified or removed. *See Option 6.*
- Review and update development codes or guidelines to improve consideration of amenity values. *See Option 9.*
- Identify streams that would benefit most from rehabilitation. *See Option 11.*

2.7 Funding

Issue 20
To address the issues identified will require specific funding.

Before options are selected each council will need to assess its budgets and allocate money to stormwater projects. This would need to be done as part of the long-term community planning process.

Options for Issue 20

- Establish a Regional Stormwater Forum for identifying, discussing and managing regional stormwater management issues including funding options. *See Option 17.*

3. Options

3.1 Alternative stormwater management

Option 1:
Investigate and trial alternative stormwater management practices and devices.
Option 2:
Produce a technical guideline for the use of alternative stormwater management practices and devices in the Wellington region.

The purpose of most existing stormwater systems is to collect stormwater and discharge it to natural waterbodies as fast as possible. Apart from a sump, there is usually no treatment of stormwater before it is discharged. The effectiveness of sumps is directly related to their design and maintenance regime and even then their efficiency is limited during heavy rainfall events.

Alternative stormwater management practices and devices generally each have a range of purposes including the reduction of peak flows, the reduction in stormwater volume and improving the quality of stormwater discharges. They can also result in fewer adverse physical effects on waterways and beaches. Below is a brief summary of the different types of stormwater management practices and devices.

Stormwater management ponds have three main purposes; providing water quality treatment, reducing flooding, and minimising downstream channel erosion. Ponds are designed to retain runoff from a specific rainfall event, then discharge runoff at a rate compatible with downstream capacity. If a pond has additional capacity, then the longer retention time allows for contaminant settling.

Constructed wetlands are essentially shallow, vegetated, artificial ponds. They have three main purposes; to provide habitat for wetland species, to improve water quality and to provide flood control. They can also provide recreational and landscape amenity values in urban situations.

Filtration devices use a filtering media such as sand, soil, gravel, peat or compost to remove contaminants from stormwater. Their purpose is to improve water quality before discharge to the stormwater system. There are many different designs and they have an excellent ability to remove sediment, a variable ability to remove phosphorus, low to moderate ability to remove nitrogen and a high ability to remove bacteria, metals and hydrocarbons.

Swales and filter strips use vegetation to slow down stormwater flows allowing infiltration into the soil and settlement of sediment. The result is reduced volume of stormwater and less contaminants. Riparian vegetation is essentially a filter strip.

Infiltration methods as dry wells, trenches and porous paving blocks are simple ways of directing stormwater runoff into the ground. They reduce the overall volume of stormwater produced and help recharge groundwater aquifers.

Rainwater Tanks are not usually considered a stormwater management device however they can be used to reduce stormwater volumes by using the collected water onsite and reduce peak flows by providing storage. Their use is probably best considered where there is a need to supplement the reticulated water supply.

Before there is widespread acceptance of these alternative stormwater management practices, they need to be investigated to assess their suitability for the Wellington region. Pilot trials carried out as a partnership between Greater Wellington and territorial authorities could be undertaken to assess different stormwater management techniques. Any pilot trials should be carried out in both new and existing urban developments and in various parts of the region. Ultimately, a technical guide similar to the Auckland Regional Council stormwater design manual (TP10) could be prepared to explain their use. Territorial Authorities and developers could then use the guide when they implement these practices and devices.

Related Options: District Plans, Development Codes and Design Guidelines

3.2 Stormwater infrastructure

Option 3:
Develop programmes to review the state of existing stormwater infrastructure and assess its adequacy to meet current flows.

A review and assessment of existing stormwater infrastructure would make it easier to link the effects of stormwater discharges with the stormwater catchment. It could also help with maintenance schedules and replacement and upgrading plans, and with the identification of cross connections with sewers.

A review would involve gathering information about all stormwater pipes and stormwater outlets, and having this information available on a GIS database.

This option would only be necessary when knowledge about a stormwater system is limited and is not stored as a GIS layer. It would be the responsibility of the owner of the stormwater infrastructure, primarily Transit New Zealand and the territorial authorities.

Option 4:
Undertake sewage elimination programmes where not already being implemented.

Sewage in stormwater that discharges to streams and beaches puts people at risk of illness and infection. Most territorial authorities are aware of sewage-stormwater contamination problems and work is being carried out in some areas to prevent it. Further work is needed to completely eliminate sewage contamination of stormwater.

3.3 Statutory instruments – the Regional Policy Statement, regional plans, district plans and bylaws

Option 5:
Review the effectiveness of RPS provisions, particularly in relation to
<ul style="list-style-type: none"> • guidance on the management of waterways and stormwater as part of urban design • identification of the values of urban waterways and beaches and the protection of these values.

The Regional Policy Statement for the Wellington Region (RPS) provides an overview of the region’s resource management issues and policies and methods to achieve integrated management of natural and physical resources. It provides policy guidance for both regional and district plans, enabling an integrated approach to be taken for stormwater management by territorial authorities and Greater Wellington.

A review of the RPS began in 2005 with an assessment of the level of achievement of its objectives for the State of the Environment report. This will be published in December 2005. Following that, there will be an assessment of how well the policies and methods are being implemented.

The Built Environment chapter of the RPS has some influence on developments in the urban environment depending on the level of uptake in district plans. There could be more work carried out on urban design incorporating water sensitive urban design, focusing on managing stormwater and natural water within an urban context. If this approach was adopted in the RPS, it would influence the way district plans and subdivision design guidelines control new urban development and redevelopment projects so that waterways receive greater protection.

Water sensitive urban design requires an integrated approach to stormwater management. Rather than accept the traditional methods of stormwater management it embraces alternative measures that are used collectively to reduce the volume of stormwater runoff, reduce the peak flow and reduce the amount of contaminants entering natural water bodies.

The principles of water sensitive design are the following.

1. Protect natural water systems within urban developments.
2. Integrate stormwater treatment into the landscape.
3. Protect the quality of water draining from urban development.
4. Reduce the volume of runoff and the peaks flows.
5. Add value to a development while minimising development costs.

When urban design is considered alongside stream values, stormwater is no longer seen as a waste product. Rather, it is considered a potential landscape asset and an important part of the natural water cycle.

Option 6:
Review the effectiveness of policies and methods, including rules, in the Regional Freshwater Plan and Regional Coastal Plan

The Regional Freshwater Plan and Regional Coastal Plan contain the regulatory and non-regulatory provisions for managing activities such as damming and diverting water, structures in the seabed and beds of lakes and rivers, disturbance of the seabed and beds of lakes and rivers, and discharges to fresh water and coastal water. These activities often occur as part of urban development and stormwater management.

Investigation of stormwater over the last few years (see section 1.4) has established that adverse effects are occurring on receiving waters as a result of stormwater discharges. Possible options for more effective rules for stormwater discharges include placing more stringent controls, such as requiring resource consents, in the following situations:

- stormwater discharges from roads with high traffic volumes.
- stormwater discharges entering identified receiving waters with high habitat, amenity, recreational or food gathering values.
- stormwater discharges from all new subdivision and development
- stormwater discharges into identified low energy receiving environments.
- Stormwater discharges from identified industrial areas
- existing stormwater discharges and include conditions that allow discharges to improve according to identified standards and timeframes

The Regional Freshwater Plan and the Regional Coastal Plan have no requirement for financial contributions to require money or land to offset any

adverse effect of activities. Conditions on resource consents requiring financial contributions can only be allowed under the following circumstances:

- The condition is in accordance with a purpose specified in the plan, including ensuring positive effects to offset any adverse effect.
- The level of contribution is determined by a formula described in the Plan.
- It requires a contribution of money, land or a combination of the two.

Financial contributions can be used when adverse effects on natural and physical resources cannot otherwise be avoided, remedied or mitigated. They focus on the direct impact of a particular development such as a length of stream that is diverted or a wetland that is reclaimed. While appropriate conditions need to be placed on these activities as to how they are carried out, they would still result in a net loss of aquatic habitat that could be offset. Where there is a net loss in habitat, a financial contribution could be required and this money put towards funding habitat replacement.

Another way of achieving the same outcome is to require developers to carry out offsite mitigation works. For example, where a stream may be piped for a certain distance, another stream in the same catchment could be revegetated and protected to “offset” the loss of habitat in the catchment. The use of financial contributions recognise that not all streams or water bodies can be preserved if a development is to go ahead and also recognises that once a stream is lost then that loss of potential habitat is permanent.

Financial contributions are not “development impact fees” which are required by many territorial authorities. These focus on the wider cumulative impact of developments on the infrastructure and communities facilities such as roads, sewers, water supply and stormwater.

Because financial contributions would not always be required, it would encourage developers to use more water sensitive development measures to avoid the need to pay compensation. In some cases controversial developments might get through the RMA process more smoothly if people who object to the development are satisfied that financial contribution will enable no net loss of habitat.

Related Options: Regional Policy Statement, District Plans, Development Codes and Design Guidelines

Related Options: District Plans

Option 7:
Review the effectiveness of policies and methods, including rules, in district plans

Through district plans, territorial authorities have the ability to control where urban development occurs, and influence the way it is carried out. The design of a subdivision can have a large impact on the amount and quality of stormwater produced. Even small developments can cumulatively have an impact on stormwater. The initial earthworks can be a huge source of sediment if appropriate sediment control measures are not taken.

With appropriate subdivision design, impacts on water quality, quantity and ecosystems can be avoided by designing around natural gullies, limiting impervious surfaces, requiring rainwater storage and re-use or implementing low-impact urban design practices that retains riparian vegetation and natural water courses as much as possible. Other options involve the treatment of stormwater to remove contaminants before discharge to natural water. Sediment and oil traps are an example of this.

Related Options: Regional Policy Statement, regional plans, bylaws, codes and design guides, catchment management plans

Option 8:
Investigate whether bylaws can be used to control practices such as discharging carwash chemicals or pouring hazardous substances down stormwater drains.

The bylaw making powers for territorial authorities are set out in section 145 and 146 of the Local Government Act 2002. The general bylaw making powers allow a territorial authority to make bylaws for its district for one or more of the following purposes:

- (a) protecting the public from nuisance
- (b) protecting, promoting, and maintaining public health and safety

A territorial authority may also make bylaws for the purposes of managing, regulating against, or protecting from, damage, misuse, or loss, or for preventing the use of, the land, structures, or infrastructure associated with wastewater, drainage, and sanitation.

Greater Wellington and the territorial authorities need to investigate whether it's more appropriate to control discharges into stormwater systems via bylaws or the existing provisions in the regional plans.

3.4 Non-statutory codes, design guidelines and catchment management plans

Option 9:

Review and update development codes and guidelines.

Territorial authorities and Greater Wellington have non-statutory planning documents such as development codes, design guidelines, subdivision guidelines and erosion and sediment control guidelines that set out how land should be developed and subdivided. These documents usually include specific details about how stormwater systems should be designed and installed as these structures usually become the responsibility of territorial authorities once the development is complete.

Some of these guidelines are out of dates and should be reviewed. The review would need to consider the alternative stormwater practices and devices that would most suit the topography, geography, soils and climate of the local authority concerned. It should also take into account heavier rainfalls predicted with climate change.

Changes which enable developers to have more discretion over road design such as allowing narrower roads to minimise impervious areas or steeper roads to minimise earthworks are options. In addition, new design specifications could be used to require specific stormwater treatment such as sediment and oil traps for car-parks to be installed in new developments.

Related Options: District Plans

Option 10:

Consider preparing Catchment Management Plans (CMP) for urban catchments.

A Catchment Management Plan (CMP) is an integrated non-regulatory plan, which considers all the water issues within a catchment, then sets out a strategy to effectively manage the catchment from both an environment and development perspective.

Because of the relationships between land use, water quality and quantity, and the health of aquatic ecosystems, water management needs to be approached in an integrated and holistic manner. This means that all issues such as flooding, water quality, ecologically significant areas, water supply, point and non-point source discharges relating to a catchment can be considered in the one document. Because of this integrated approach Catchment Management Plans need input from a wide variety of experts including engineers, planners, and ecologists. They also require the collection of a lot of information in their preparation.

Catchment Management Plans are an effective tool for high risk catchments and for areas that are undergoing urban growth. They can take into account cumulative effects which other regulatory planning tools do not. If resource consents were required for stormwater discharges then the CMP would form part of the resource consent application.

Wellington City Council have started to use this approach for high risk catchments. GWRC could require Catchment Management Plans to be prepared for resource consent applications.

Related Options: Regional Plans, District Plans

3.5 Rehabilitation of streams

Option 11:
Identify streams that would benefit most from rehabilitation.

Some streams would benefit from greater protection from the adverse effects of stormwater discharges. They might be streams in high risk catchments, streams which enter sensitive receiving environments, streams with special aquatic habitats. Rehabilitation of these streams and stream banks would offer them an extra level of protection from stormwater impacts.

Related Options: Catchment Management Plans, Monitoring

Option 12:
Fund or support planting and rehabilitation projects that help mitigate the impacts of stormwater discharges.

The benefits of planting vegetation near streams include:

- Providing habitat for birds and insects
- Filtering contaminants from runoff
- Providing biological uptake of nutrients in stormwater
- Attenuating flood peaks and so protecting waterways from erosion
- Stabilising stream banks
- Shading water to decrease high temperature impacts
- Focussing community attention on streams as part of the natural environment
- Improving the amenity of the stream
- Increasing perceived value to people.

Greater Wellington has funding available through its *Take Care* programme for community groups wanting to work on stream or coastal enhancement projects. This is a very successful programme, but it is not targeted at mitigating stormwater impacts. The territorial authorities also fund and carry out planting

programmes, for example, Wellington City Council is involved in planting projects around the town belt and city parks, but again, these are not necessarily targeted at mitigating the effects of stormwater.

Planting could be carried out as a new, stand-alone stormwater mitigation programme, as part of existing council programmes, or as part of development activities.

It could involve:

- Offering funding for community groups to plant riparian vegetation alongside specific streams that are in need of help and would most benefit from restoration
- Giving a consideration to water quality benefits of community group proposals for restoration projects
- Seeking out new sources of funding from corporate sponsors for specific replanting projects
- Requiring financial contributions from new developments that impact on water ways and use them to fund specific stormwater mitigation projects (*See Option 7 above*)
- Requiring offsite mitigation of new development that impact on waterways (*See Option 7 above*).

Related Options: Regional and district plans, education

3.6 Education

Option 13:
Strengthen and extend : <ul style="list-style-type: none">• existing community environmental education programs about stormwater and stream care.• Greater Wellington <i>Take Charge</i> programme.

Greater Wellington has several education programmes running in the region. They have been designed to improve people's understanding of, and commitment to, stormwater issues and to encourage changes in behaviour. They are briefly outlined below.

Be the Difference is Greater Wellington's social marketing campaign to encourage people to take personal responsibility for the effects of their everyday activities on the environment. Information about small changes people can make to their daily life is sent to people who sign up as *Be the Difference* members and is also on the Greater Wellington website. Issues covered in 2004 and 2005 were stormwater, waste, air quality and biodiversity.

Take Action is an environmental education programme to help 8 -12 year olds understand and care for the environment. The first programme that has run around the region since 2003 is freshwater, and covers issues to do with stormwater. The programme is divided into three stages: Investigate, Explore and *Take Action* with the objective being for students to *Take Action* to improve the quality of a local waterway.

Take Charge is a programme designed to help businesses to achieve compliance and reduce pollution, and has an emphasis on stormwater protection. It looks for small and simple changes in the way a business is organised or operates that would improve environmental management and increase efficiency. While it has been successful, opportunities to strengthen and extend the programme exist.

Muddy Waters is a Greater Wellington initiative to reduce sediment inputs to stormwater from subdivisions sites. It's main focus is in educating developers (about the impact of their activities and regulators expectations) and territorial authority officers (in processing applications and assessing compliance).

Some territorial authorities have their own community education programmes.

Option 14:
Investigate developing an education resource that provides council staff, stormwater industry professionals and property developers with information about alternative stormwater management practices and devices, and any changes made to stormwater policies and rules.

If changes are made to the way stormwater is managed in the region, those involved in the stormwater industry will need to be kept up-to-date. An educational resource made available to developers and industry professionals would make this transition smoother by improving understanding of, and commitment to stormwater issues and encouraging changes in behaviour. The information provided might include:

- Any changes to rules, policies, design guidelines and development codes
- Alternative stormwater practices and technologies
- Any changes to urban design requirements
- Catchment Management Plans

Related Options: Alternative stormwater management, regional policy statement, regional plans, district plans, development codes and design guidelines, inter-agency collaboration, catchment management plans

Option 15:
Support staff involvement in stormwater conferences, workshops and training courses.

Conferences, workshops and training course are a good way of keeping staff up-to-date with the latest in stormwater technology, the best methods for monitoring stormwater and different approaches to the management of stormwater discharges. Staff from different professional fields including engineers, planners and aquatic biologists should be involved in learning more about stormwater issues.

Related Option: Education

3.7 Monitoring

Option 16:
Develop a long-term regionally co-ordinated environmental monitoring programme to assess the effects of stormwater on the environment.

A regional environmental monitoring programme would identify high risk catchments and build a greater understanding of the impacts of stormwater, particularly on aquatic ecosystems. It would also enable monitoring costs and results to be shared between local government agencies.

Monitoring some stormwater discharges and stormwater affected catchments has already been carried out by Greater Wellington and some territorial authorities. These investigations could be continued under the framework of a regionally co-ordinated environmental monitoring programme. They could help with the identification of problem discharges and where upgrading of stormwater infrastructure is needed.

Related options: Education, Rehabilitation, Catchment Management Plans

3.8 Inter-agency collaboration

Option 17:
Establish a Regional Stormwater Forum for identifying, discussing and managing regional stormwater management issues.

Stormwater is an issue that is shared by Greater Wellington and territorial authorities, as well as other owners of stormwater infrastructure like Transit New Zealand. It involves different professions such as engineers, planners, aquatic biologists, and stream rehabilitation staff.

Setting up a Regional Stormwater Forum that involves representatives from all councils in the region would enable better communication about stormwater

issues and a sense of working together on stormwater issues. Other benefits could include, shared technical documents and educative resources, shared monitoring programmes and results, consistency in approaches to stormwater management and a clarification of roles and responsibilities.

Related Options: Education, Monitoring

4. Conclusion

If no changes are made to the way we manage stormwater then its effects will continue to degrade the environment. The options for improving stormwater management identified above are not, individually, solutions to the stormwater problem.

A package of options will need to be selected by local government agencies to target the main stormwater issues. To achieve this, the following process will be followed.

- Distribute this document to the agencies who participated in the Regional Workshops.
- Establish a Regional Stormwater Forum (Option 17) to discuss the options and identify the main areas of action that need to be taken. These should reflect the issues of most concern and the options that will provide the most benefit for the least cost.
- Prepare a Regional Stormwater Action Plan. The Plan should identify which options are to be implemented, including any additional options, and by whom.
- Work towards implementing the Regional Stormwater Action Plan.