Stage 1 ICMP Development: Summary

March 2014

Wellington City 1884: View from Mt Victoria

Wellington City 2014: View from Mt Victoria

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Cover Photos

Wellington City 1884: View from Mt Victoria - WCC
Wellington City 2014: View from Mt Victoria - Ishaq Idris

1 Introduction and purpose of this report

The purpose of this document is to provide a summary of the work undertaken within Stage 1 of the Integrated Catchment Management Plan (ICMP), prepared for the Greater Wellington Regional Council (GWRC) on behalf of Wellington City Council (WCC) by Capacity Infrastructure Services Ltd.

This document and the full report have been prepared in accordance with the conditions of Resource Consent WGN090219 [27418] [27419] [30500] & [30501] granted to Wellington City to "continue to discharge stormwater and occasionally contaminated stormwater….directly into the coastal marine area". The consent requires the consent holder to prepare an ICMP in two stages:

- Stage 1: The presentation of the information, analysis and prioritisation needed to start preparing detailed ICMPs, due in March 2014. Stage 1 is required by condition 7 (see Appendix A for the conditions and Appendix B for the table of contents of the full report).
- Stage 2: The progressive preparation and implementation of catchment-specific plans in accordance with the 'approved' Stage 1 timetable required under condition 7.

1.1 Scope, Vision and Mission

The Stage 1 report that accompanies this summary provides only the analysis of the effects of stormwater discharges that are contaminated with diffuse sources and wastewater inputs. It does not include analysis of wet weather discharges from the Moa Point wastewater treatment plant.

In addition, as stated under Condition 6, the Stage 2 ICMP cannot be expected to address all surface water issues, but (as stated in Condition 6) it "is expected to be prepared in a way that enables other aspects of catchment management to be added over time", such as flooding, on-site management of stormwater flows and water quality in streams, and "is the first stage of an ongoing water management partnership between the Wellington City Council (as consent holder), the Wellington Regional Council (as consent authority) and the community."

That said, addressing land-based issues that impact on the coastal marine area will inevitably have positive outcomes for freshwater bodies that feed into them, and this will likely support future work in due course.

The 'vision' and 'mission' below are proposed in order to ensure that Stage 1 and 2 are supported by a robust foundation for the ongoing development of integrated catchment management planning in Wellington, with other aspects of catchment management being added over time as necessary and as desired.

ICMP Vision

Wellington enjoys healthy fresh and coastal waters and ecosystems, healthy swimming waters and attractive waterways and coastlines. Its people are secure from flood risk at home and work.

ICMP Mission

To address legacy issues, current problems and future challenges through proactive planning and the provision of water services in an integrated, sustainable, environmentally and economically sound manner.

The rugged South Coast, the bays, the harbour, the rural hinterland, the green belts, ridgelines and hilltops – all of these define Wellington. An important part of Wellington's identity is the marine environment that surrounds the city. Wellington is a city where the natural environment permeates the urban environment, enabling a high quality of life for its inhabitants and an attractive, healthy city environment. Our environment holds significant ecological, economic, social and cultural value, and creates economic opportunities for the city. Like other cities and towns in New Zealand, Wellington was originally covered in native vegetation which was modified by Maori and again more extensively by early European settlers. The city was once cloaked by about 20,000 hectares of lowland broadleaved-podocarp forest. Today, less than 5% of this forest remains, mostly in gullies and remote areas out of the reach of development and fire. These relics of ancient forest are now accompanied by regenerating forest. The wind-buffeted and salt-laden coastal escarpments facing the Cook Strait (Wellington's South Coast) and the harbour escarpments were once covered with a mosaic of coastal forest and scrub. Today, less than 1% of this coastal forest remains. The land has also been modified, more than in other New Zealand cities, by the combined effects of earthquakes that uplifted land and reclamation that further extended the shoreline.

Wellington's unique topography, steep hills and thin clay soils, the resulting urban form and variable climate pose challenges for stormwater management. Wellington's marine environment has a wide variety of habitats and a distinctive collection of plants and animals, including giant kelp, blue penguins, dolphins, sting-rays and orca.

Wellington's outdoor areas also hold significant recreation and tourism value, which in part relies on the state of the natural ecosystems (**Figure 1**). Activities include sailing, snorkelling, diving, ocean swimming, kayaking, fishing, wildlife watching and coastal walks (**Figure 2**).

The high demand for apartments overlooking the harbour demonstrates that our relationship with the coastal marine environment is strong. Furthermore, it provides a strong case for us to protect this environment and strive to strike a balance between economic and ecological wellness.

Wellington was originally occupied by Taranaki Whanui and Ngati Toa, and the City's tangata whenua have strong links with the coastal environment. Many sites within the coastal environment are associated with iwi history, traditions and tikanga.

By 2006, Wellington City's population had grown to 187,700, this being 40% of the population of the total Wellington Region. Population growth is expected to continue, particularly in the central and northern suburbs. By 2031, the population of Wellington City is forecast to be 230,600, an increase 22% over 2006. This represents an average annual growth rate of 0.83%.

Human and urban activities generate contaminants, which have increased in step with population growth. Traditional piped stormwater networks very efficiently move these contaminants to aquatic receiving environments. However, contaminated stormwater can create public health risks, particularly in water-based activities such as shellfish gathering, and result in beaches being closed and cultural and tourism value being diminished.

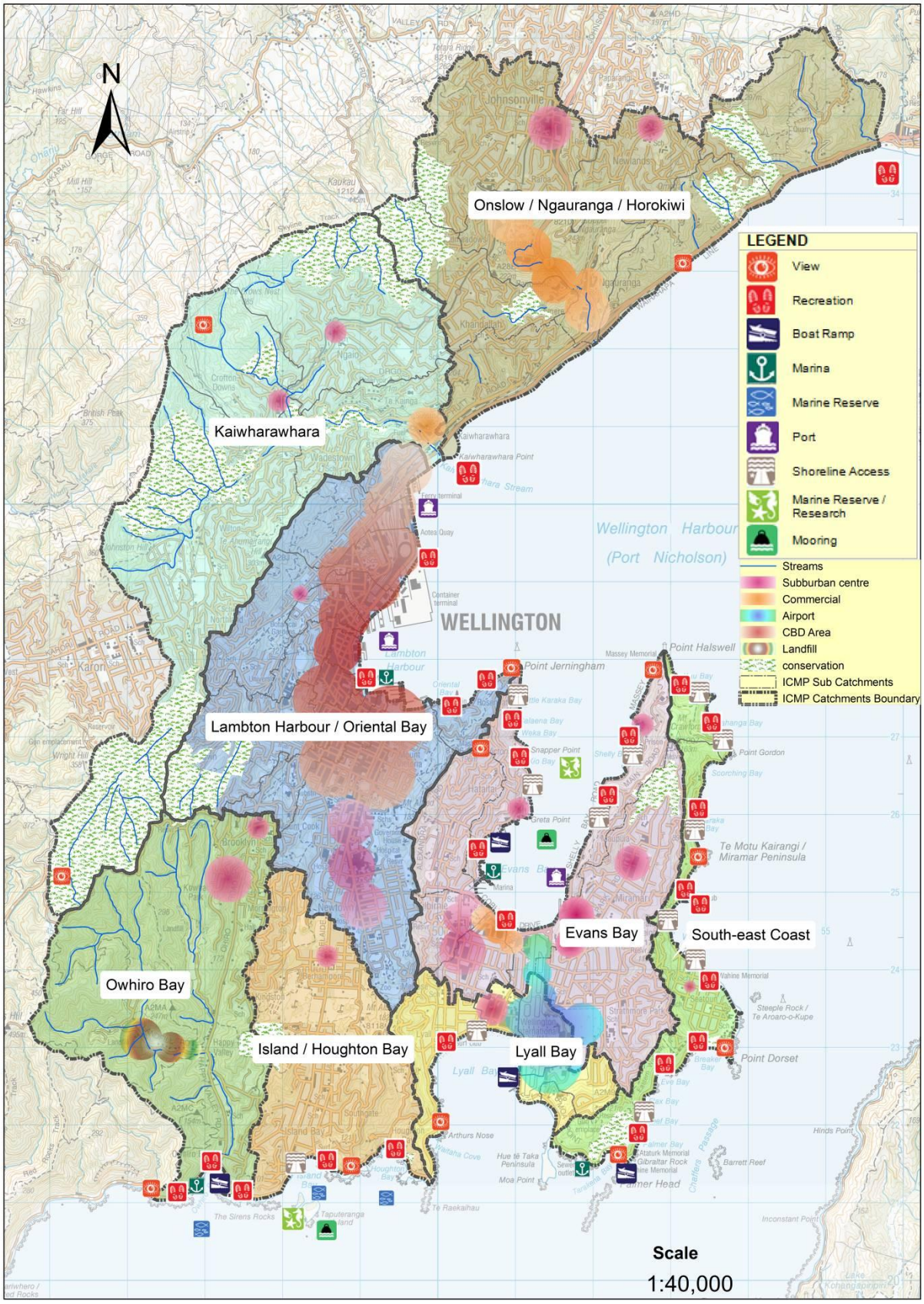

Figure 1: Amenity values

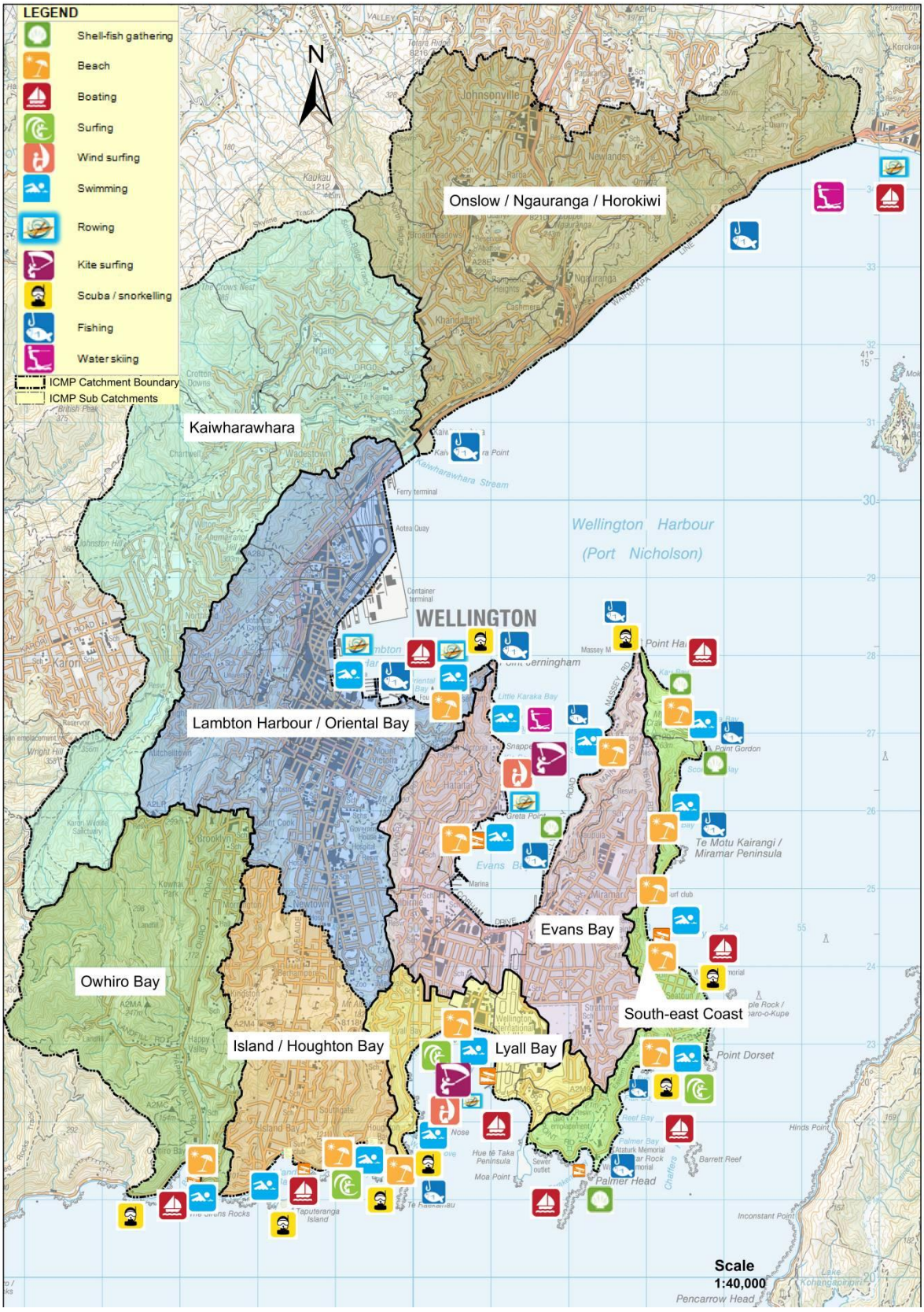

Figure 2: Recreational features

1.1.2 Introducing Wellington's stormwater catchments

The focus of consent WGN090219 is on the coastal receiving environments into which the city's streams and stormwater runoff flow. This makes it desirable to aggregate the city's 34 stormwater sub-catchments around a series of eight readily distinguishable receiving environments. The 34 stormwater sub-catchments were clustered into these eight catchments based on:

- The characteristics of their shared coastal receiving environments and recreational uses, which delineate a group of five catchments adjoining distinctive coastal receiving environments for which Stage 2 ICMPs will be prepared. These are: Lambton Harbour, Evans Bay, Island/Houghton Bay, Lyall Bay and East Coast
- The large size of the three remaining stream catchments, which discharge to the coastal receiving environment (Owhiro Bay, Kaiwharawhara and Ngauranga). Further research is needed before Stage 2 ICMPs can be produced to better understand the impacts of stormwater on the ecosystem health, amenities and the riparian zone in these catchments.

Figure 3 and **Figure 4** show these five coastal receiving environment catchments and their respective receiving environments, and the three stream catchments. Within these eight catchments are 17 stormwater catchments made up of 34 smaller "stormwater sub-catchments".

In compliance with consent conditions for Stage 1 ICMP, research into the individual catchment characteristics was carried out at the 17 stormwater catchments. The findings have been summarised for reporting at the eight coastal and stream catchments.

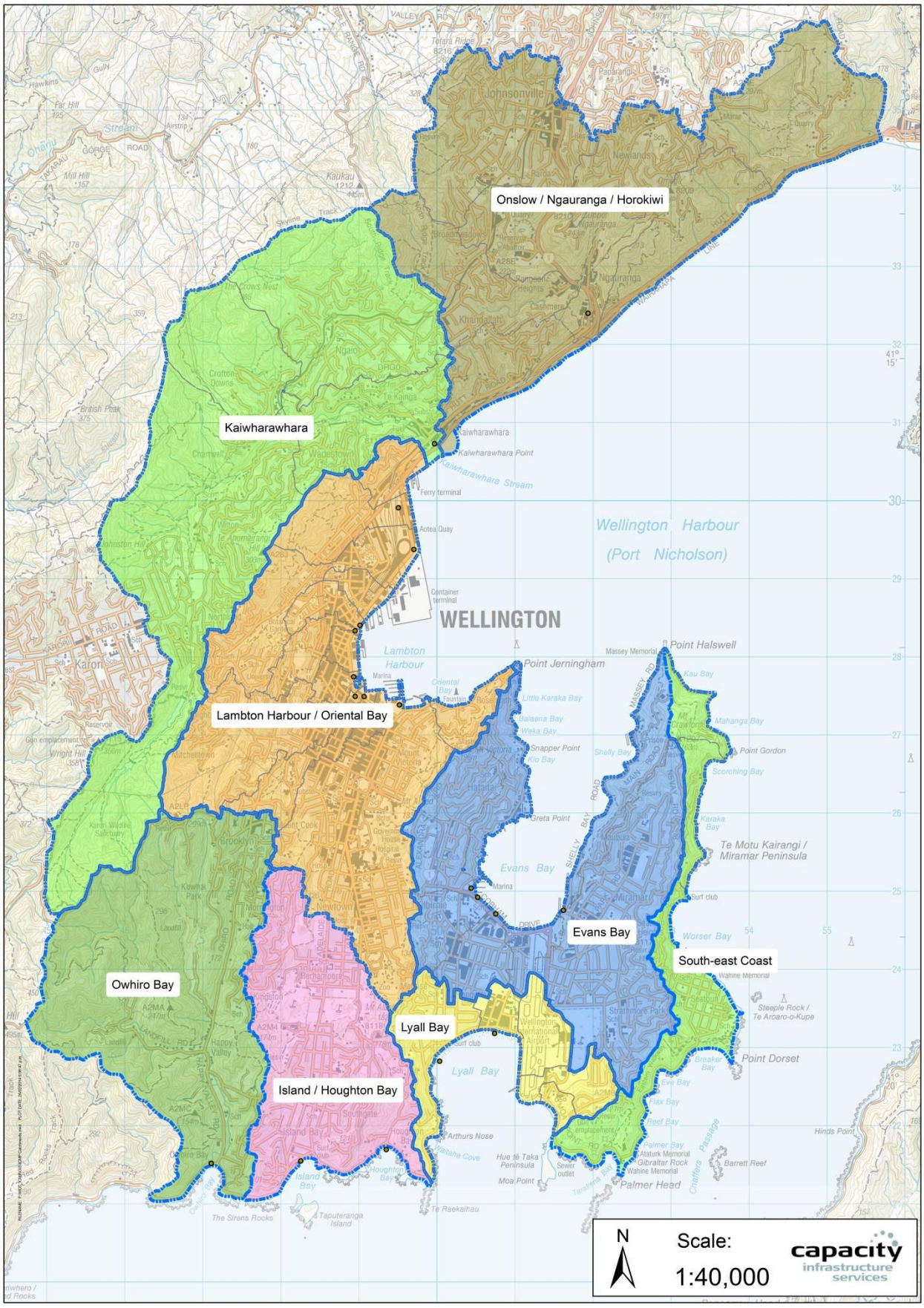

Figure 3: Wellington's eight receiving environment catchments for which ICMPs will be prepared

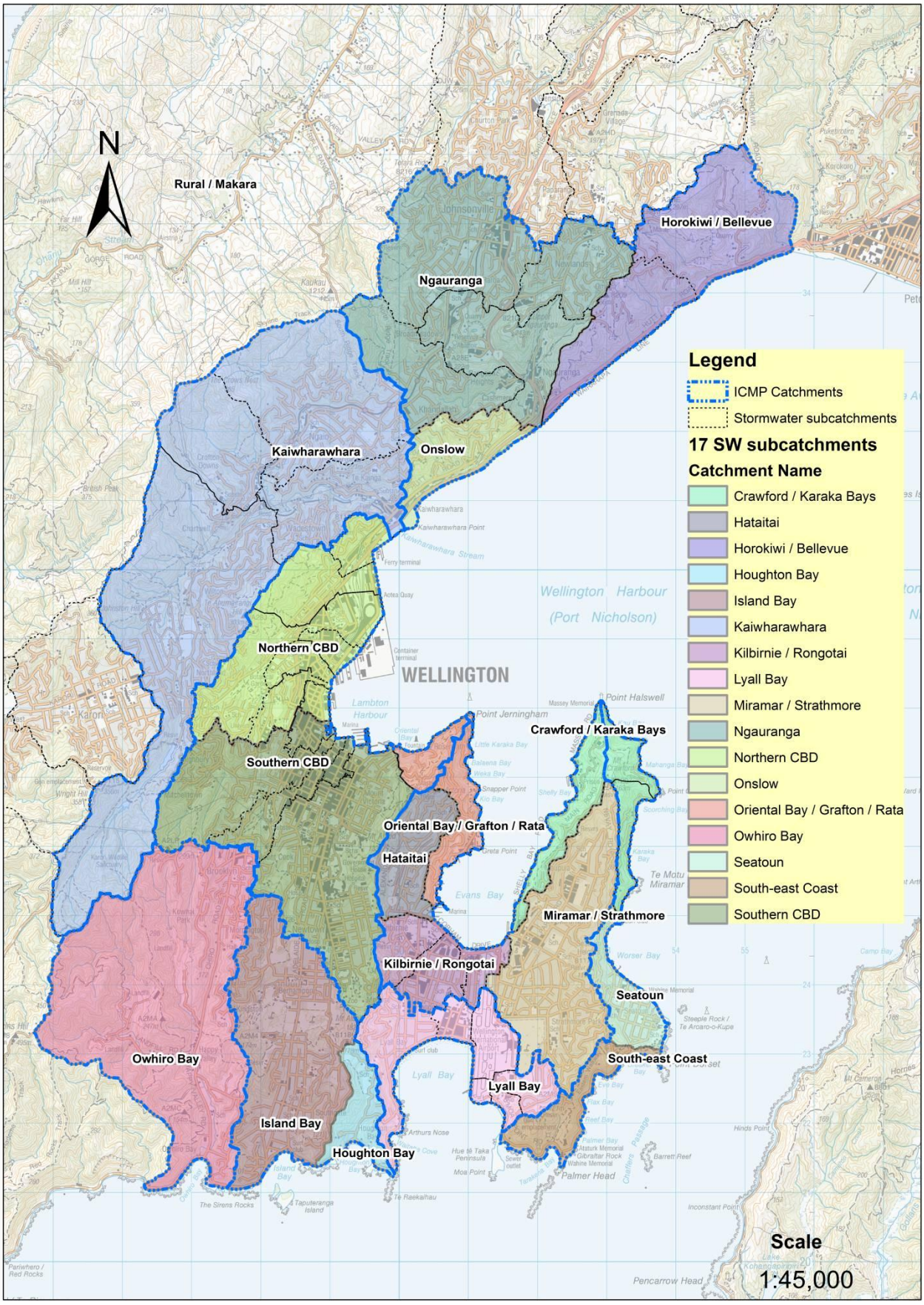

Figure 4: Wellington's 34 stormwater sub-catchments, grouped into 17 stormwater catchments

2 Flooding, wastewater, sediment runoff and climate change effects

2.1 Introduction

Wellington City's successful functioning depends on a complex network of infrastructure - water supply, wastewater, stormwater, solid waste disposal and transport systems - to support the platform for economic development and community wellbeing. These assets represent a major historic investment.

However the wastewater, solid waste and stormwater utility operations and other urban activities can cause contamination of freshwater and the coastal receiving environment to varying degrees, depending on contaminant type, concentration and loading, together with the sensitivity of the receiving environment. The results can adversely affect public health, recreational and economic activities and degrade amenity values.

The following section discusses the stormwater and wastewater systems, identifies wastewater and sediment inputs into the stormwater network, and provides a high level city-wide assessment of flooding and overland flow paths and areas potentially at risk for flooding.

2.2 Stormwater system

Wellington's public stormwater system has developed over the last 130 years or more. While there are still some remnants of open watercourses and streams in reserves and other parts of the City, most areas are serviced by piped stormwater drains. There are now some 550 km of piped systems and upwards of approximately 25 km of open semi-urban watercourses (excluding those in rural areas).

The current stormwater network comprises a complex gravity system of reticulated pipes, culverts, catch-pits, grit traps, secondary overland flow paths and streams, that together convey almost 80 million cubic metres of untreated stormwater every year from buildings, roads, urban areas and open spaces into the city's coastal receiving waters.

Over 80% of the stormwater pipes are 40-60 years old, and only about 10% meet Council's current 50-year return storm capacity standard. The remaining 90% of pipes generally have capacity for 2-5 year return storms.

Conventional stormwater management has traditionally focused on flood risk management. Urban development needs and flood issues have been dealt with by building pipes and culverting streams.

2.3 Flooding, overland flow paths and depressions

Wellington City is tightly confined by hills around the harbour and is generally fully built-up, so nearly all stormwater is carried to the sea via the stormwater piped network.

The Resource Management Act 1991 requires councils to control the potential effects of development and to mitigate natural hazards. The Building Act 2004 requires buildings to be protected up to a 1 in 50-year return period event. To meet these requirements, councils need to keep records of natural hazards and prepare management and response plans.

Wellington City has, for the last 15 years, prepared Flood Hazard Maps as part of its Catchment Management Planning process. To date ten flood hazard assessments have been produced, covering 7,419ha. These maps are based on the 50-year return period storm event. A freeboard of 300mm is added to the estimated peak flood water level which informs the minimum floor level in each flood risk area and the hazard map information is continually improved.

Previous investigations triggered by flooding events have identified areas where the stormwater network is inadequate in terms of capacity to effectively convey the amount of water. Stormwater managers must also consider changes in rainfall and sea level and the appropriate mitigation of these risks. Until the 1980s, the stormwater network was designed to carry 5-year return period storms, with excess flow being carried along the streets. These overland flow paths along streets were considered acceptable in the past because buildings, shops and houses were generally much higher above the ground than in the last 30-40 years.

Depression areas have been mapped to give a high-level indication of potential flood risk areas. There are a number of significant depression areas in all catchments. These areas are generally drained by large culverts or tunnels.

The most significant areas of flooding, overland flow paths and depressions are shown in **Figure 5**.

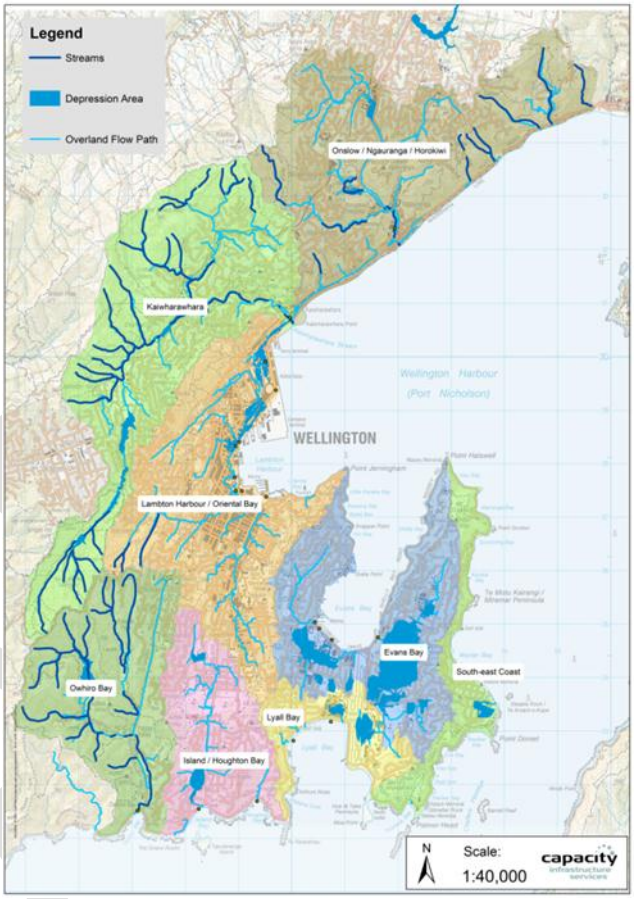

Figure 5: Significant areas of flooding, overland flow and depressions

2.4 Wastewater system, wastewater overflow and infiltration issues

The current wastewater reticulation system conveys wastewater to the main trunk wastewater pipe which flows by gravity from Ngauranga Gorge through the central city, beneath Mt Victoria, through the low-lying coastal areas and the eastern suburbs to Moa Point. Wastewater from Island Bay, Brooklyn, Houghton Bay and Berhampore is delivered by gravity and pumped to a major pump station located between Island Bay and Owhiro Bay. Wastewater is pumped from this station back through Island Bay and a tunnel beneath Mount Albert to join the main interceptor at Kilbirnie. This intercepts all wastewater from the Wellington area, except Karori and the Northern suburbs. The Moa Point Treatment Plant serves a population of approximately 130,000. Approximately 70% of the wastewater comes from domestic and commercial sources. Industrial flows comprise less than 15% of the total wastewater flow. Approximately 10 to 15% of the dry weather flow comes from inflows and infiltration into the system.

Inflow and infiltration results in stormwater entering the wastewater system and wastewater entering the stormwater system through inter-connected pipes built in the past, current illegal cross-connections, leaky joints, old cracked pipes or overflows as the wastewater system becomes overloaded or fails. The result is wastewater-contaminated stormwater entering freshwater and/or coastal receiving environments.

Inflow and infiltration is estimated to account for approximately 10 to 15% of the dry weather flows arriving at the Moa Point Wastewater Treatment Plant. The proportion of inflow and infiltration increases significantly during or immediately after rainfall events, and in some wastewater catchments in the City the ratio of peak wet weather flows to average dry weather flow is as high as 10:1.

Computer modelling and monitoring data indicate that the most significant wastewater overflow point in the City's wastewater network is the main wastewater interceptor at Murphy Street, where a constructed overflow provides significant system relief for the downstream network. However, more monitoring and reticulation network modelling is needed to identify overall levels of rainfall-dependent infiltration and inflow around the City.

Since 1993, Wellington City has been implementing a programme of works aimed at progressively reducing wastewater contamination of stormwater. The key work programmes are a Wastewater Pollution Elimination project (a 15 year, $70 million project); the Drainage Rehabilitation Strategy (1998); and an Inflow and Infiltration Reduction Plan (Wellington Overflow Mitigation Plan, 2011). The Wastewater Pollution Elimination project was successful in meeting its goals of reducing wastewater pollution across the city: persistent dry weather wastewater pollution has been reduced to an acceptable standard. Wet weather pollution, however, remains problematic. The first work programme was scheduled for a period of 15 years (1993-2008). The second work programme was implemented in 2008 and is currently on-going.

Rehabilitation works undertaken since 1993 include cross-connection studies and repairs, removal of constructed wastewater overflows, rehabilitation of known wastewater pipe faults and pump station upgrades including backup facilities to prevent overflows.

A new series of programs started recently assesses inflow and infiltration in wastewater catchments. Wastewater network performance and the potential effects of this on the stormwater system were evaluated using monitored data and the trunk network model for the catchments across Wellington. Catchment leakiness (a measure of the amount of infiltration and inflow) and average annual overflow volumes are shown in **Figure 6**.

There were insufficient data to verify the model's estimates of leakiness in the CBD, so the CBD catchment is not presented in the figure, and is simply marked in white. A further assessment will be carried out for this catchment after gathering detailed flow data for sub-catchments during preparation of the Stage 2 ICMPs.

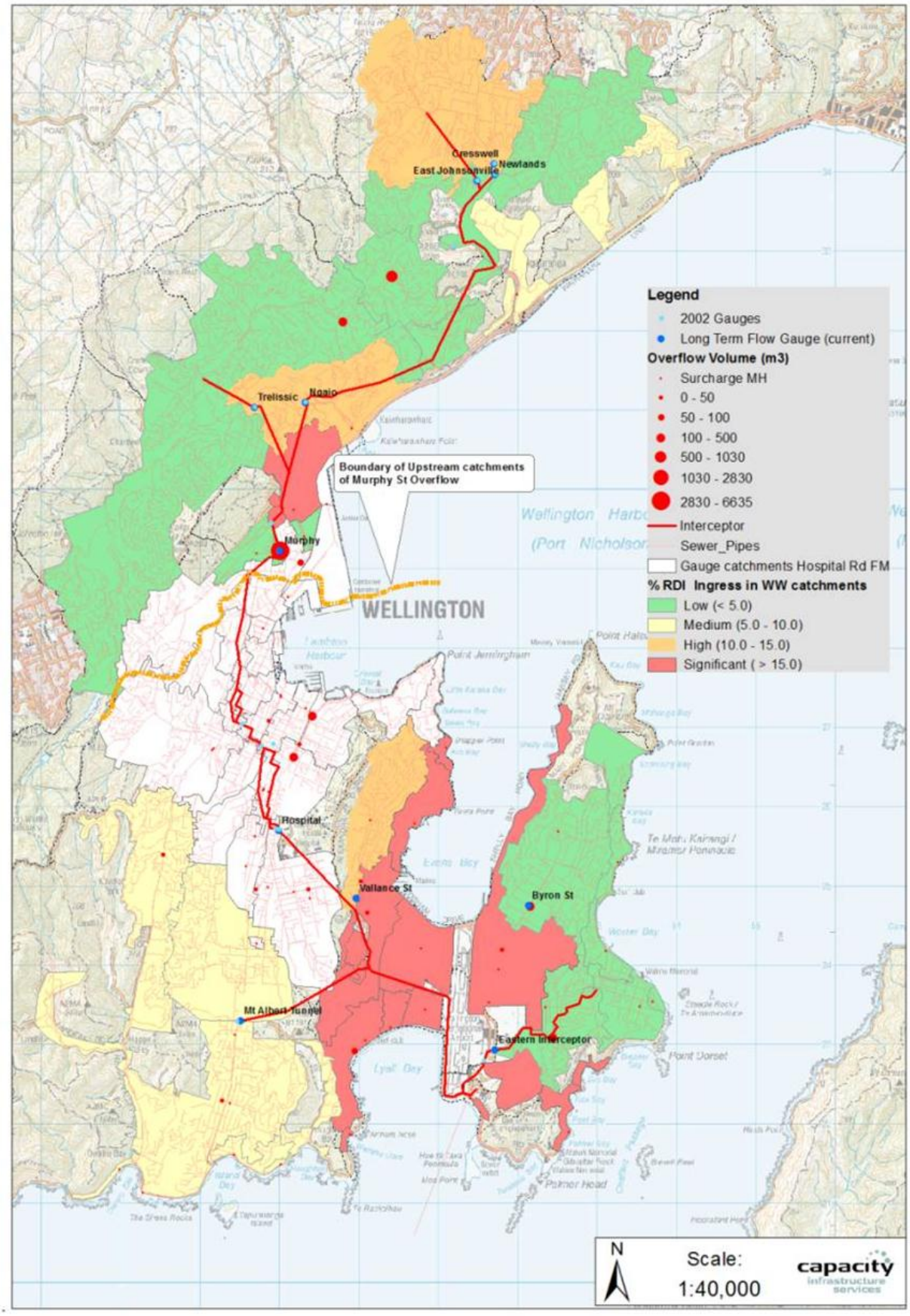

Figure 6: Catchment leakiness and average annual overflow volumes

2.5 Sediment loads in stormwater

Sediment loads from Wellington City to the Harbour and coastline are relatively low. There is relatively little ongoing urban development and hence bare soil, which is the major source of fine sediments in urban areas. Limited sampling of Wellington's stormwater drains showed fine sediment concentrations were not particularly high (MWH 2008) and were typical of mature urban areas (Williamson 1993). There are no reports or strong indications that urban-derived sediment deposition or discolouration is a major issue in Wellington's harbour or coastline. These findings are in contrast to Porirua/Pauatahanui harbours where sediment loads are high and sediment deposition is an issue because of larger rural catchments and significant areas of urban development.

A decrease in the clarity of stormwater discharges during rain events is likely, resulting in visible plumes in the harbour near outfalls. There is little information available on this, however, apart from a few observations near outfalls. In the absence of information, we have categorized this as a less than significant effect, partly because it will be common to any stream discharge irrespective of land use, partly because such events are not readily visible during rain storms, and partly because, being small 'flashy' urban catchments, the effects will be highly localised and of short duration.

Beyond a reasonable mixing zone, we do not anticipate that urban-derived sediments will impact the harbour sediments significantly in terms of sedimentation rate or benthic ecology.

Urban-derived sediments beyond the mixing zone will dilute contaminant concentrations accumulating in the harbour, but because sediment loads are anticipated to be relatively low, the effect will be relatively minor.

Estimated annual sediment loads entering the Wellington harbour from different catchments are portrayed in Table 1 below.

Table 1: Estimated sediment loads to Wellington Harbour

Catchment	**Area (km^2)**	**Annual sediment load (tonnes/yr)**
Hutt River	615	132000
Kaiwharawhara stream (including urban areas)	16.8	1300
Ngauranga stream (including urban areas)	9.2	600
Wellington Harbour urban area (Lambton Harbour, Kaiwharawhara, North Coast, Evans Bay)	56.5	2200

Note: These are approximate estimations only. Open space and rural estimations are based on NIWA's Water Resources Explore Model and urban yields are based on a global average. Detailed monitoring is recommended to develop Wellington-specific yields.

2.6 Climate change and sea level rise

Climate change could present a risk to infrastructure and this poses significant challenges in terms of the future planning of infrastructure needs.

While there is some uncertainty about the timing and exact nature of climate change impacts, effective forward planning is vital for their cost-effective management.

The global impacts of climate change are already becoming evident. Climate models predict that Wellington is likely to experience more extreme storms with sea temperature increases, stronger winds, more intense and possibly more frequent rainfall events and a rise in sea level. This has significant implications for preventing flood damage and managing stormwater.

Wellington City has worked with the Greater Wellington Regional Council and NIWA on a coastal study to identify sea level rise, storm surge and wave set-up scenarios and the areas of the region most at risk. This study shows that Wellington has the highest rates of sea level rise in New Zealand. In addition the City has been studying the social, cultural, environmental and economic risks of future sea level rises. This work will identify potential response options for different areas of the city in a consistent and coordinated way. Both of these studies will inform the future planning for District Plan rules including zoning and asset management and city preparedness.

Wellington City mapped sea level rise effects for different planning horizons. **Figure 7** shows potentially affected areas of the CBD for 1.1m sea level rise coinciding with storm surge. The future holds a gross loss of flood protection services to these areas, unless special provision is made for stormwater management in the future. We therefore need to integrate the impacts of climate change on our services and infrastructure into our future planning. This will be addressed in the Stage 2 ICMPs.

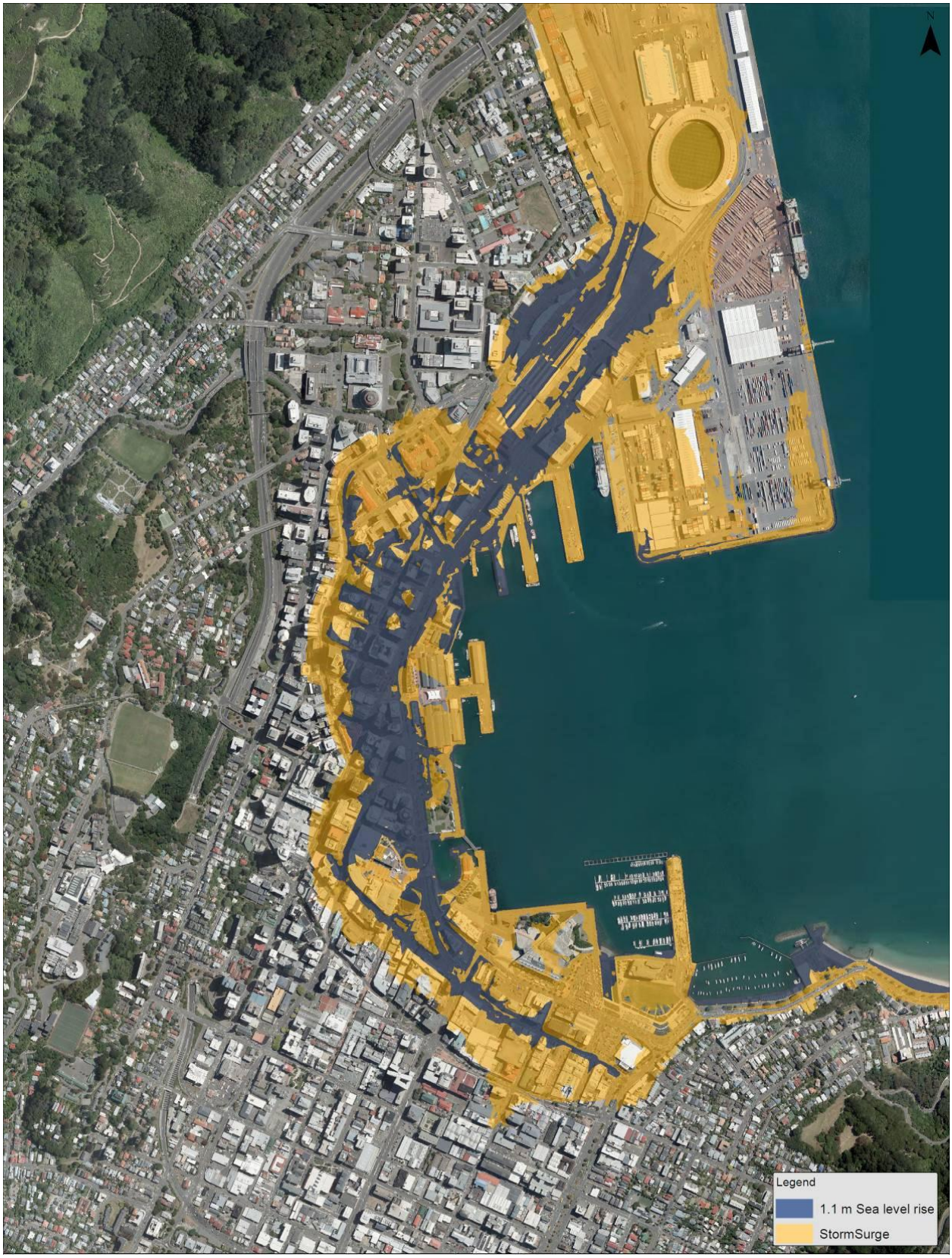

Figure 7: Areas of the CBD potentially affected by sea level rise

3 Catchment characteristics and descriptions

Everyday urban activities and services together with the effects of historical activities like old landfills, gasworks and industries generate distinctive contaminants that enter stormwater. When it rains, these contaminants are washed into stormwater pipes and streams that flow directly or indirectly to the coastal marine environment. Contaminants are generally sourced from:

- Roads, especially those with very heavy traffic: there is accumulation of fine particles of zinc and rubber from motor vehicle wear, as well as hydrocarbons from oil drips and exhaust pipes and grit from wear and tear of roading materials
- Industrial areas: these are home to a host of routine activities that pose a risk of spills of all sorts of materials, and if not properly controlled, these too will flow across the ground and into the stormwater system
- Brownfields development areas and the opening up of new land for roads and construction: If poorly controlled, development can result in significant soil loss resulting from the combination of high rainfall, hilly terrain, clay soils and the underlying geology. This means that if soil is disturbed during site development, it is easily washed away by rainfall, causing serious impacts on streams, beaches and harbours
- Overflows of wastewater during heavy rainfall events when stormwater enters into wastewater pipes and wastewater enters into stormwater pipes: when combined with animal droppings, this can lead to bacteria discharging into coastal waters
- Stormwater flowing through and over sites contaminated by historical land uses including old landfills: this flow can pick up hydrocarbons, heavy metals, pesticides, herbicides and fertiliser used on private and public land and carry it in its flow
- Domestic and commercial building materials including unpainted galvanised iron roofs and walls commonly used in commercial and industrial areas:rain washing over these materials picks up copper and zinc and carries it in its flow
- Litter dropped or blown around the city: this may be swept by runoff into the stormwater system, onto beaches and into coastal waters
- Rural farmland: Some of Wellington's catchments still have rural farmland, and this too, depending on the type of farming carried out, can wash contaminants into streams stormwater network

Once these contaminants reach the coastal marine environment, most settle out into marine sediments. The strong offshore gradients in contaminant concentrations and the chemical nature of some of the contaminants in the sediments of Wellington Harbour provide a clear indication of their land-based origin. Here they join contaminants of historical origin, including lead from before 1996 (when unleaded petrol was introduced), and DDT (banned in New Zealand in 1989).

Wellington Harbour sediment quality investigations show sediments, and heavy metals and chemicals associated with them in some harbour areas, exceed sediment quality guidelines.

The different historic and current land uses, rainfall patterns, terrain, soil types, underlying geology and age of piped systems around Wellington mean that stormwater runoff from each of the Wellington catchments contains different types and levels of contaminants. Depending on the types and intensity of land use activities, catchments with a higher proportion of impervious cover, traffic and industrial activities that can potentially contaminate stormwater have more runoff per unit area and a higher contaminant load. Each of the eight catchments also drains into a readily distinguished coastal receiving environment, some in the sheltered inner harbour waters, and others along the higher energy, more turbulent south coast.

As required by Consent Condition 7, each catchment has been described in the **Stage 1 ICMP report** with more detailed information appearing in Appendices covering the following information:

- Stormwater catchment characteristics and descriptions:

    - catchment areas, boundaries, stormwater network and major outfalls, including streams and the coast
    - existing land uses permitted under the Wellington City District Plan, categorised and described in relation to their potential to generate increased runoff and stormwater contaminants to the stormwater network, and an estimate of the rate and extent of the likely changes in land use
    - location and description of industries and other high risk facilities (for example current and historic landfills and/or industry) that may potentially make a disproportionate contribution to stormwater contamination
    - location and description of the current stormwater network and treatment devices and the sub-catchment areas serviced by these assets
    - location and description of constructed wastewater to stormwater overflows, wastewater pump stations and wastewater storage facilities
    - identification of the types, sources and loads of sediment and key physical and chemical contaminants in stormwater, and predictions of future trends in key chemical contaminant loads, including but not limited to copper, zinc and polycyclic aromatic hydrocarbons
    - the ecological, recreational, amenity and cultural values, recreational uses (including food gathering) and environmental quality of the receiving environments potentially affected by stormwater discharges
- assessment of the effects of chemical stormwater contaminants on the coastal receiving environment and predictions of future trends in chemical contamination
- management options

Key findings for the eight catchments are briefly summarised below. It is noted that most of the catchments have their own 'hotspots', such as industries and other high risk facilities like old landfills or factories, that may potentially make a disproportionate contribution to stormwater contamination. Furthermore, all coastal areas are vulnerable to climate change induced sea level rise and associated storm surge.

3.1 Evans Bay

The Evans Bay catchment has 50% impervious surface, with mostly urban-residential land use and some areas of significant commercial and light industrial land use, including part of the airport runway and the Kilbirnie bus depot. Key points include:

- Sub-catchment headwaters are in the Town Belt and reserve land
- Historical flooding issues and aging pipes will need to be modelled and addressed as levels of service and asset condition indicate
- The receiving environment is a sheltered, depositional bay
- Major sources of stormwater contamination include vehicle emissions, run-off from roads including State Highway 1, general run-off from residential and commercial properties and intermittent illegal discharges of contaminants into the stormwater network
- A very wide range of amenity and recreational values and uses is seen in this catchment, ranging from port activities to swimming, surfing and boating
- Present-day discharges are expected to lead to a gradual increase in concentrations of zinc and to a lesser extent copper, in Evans Bay sediments, and a decrease in concentrations of historic contaminants such as lead, mercury, DDT and PAH
- Only moderate to low ecological effects are observed from both legacy and present impacts (**Figure 8**).
- Management options include on-going water quality monitoring, on-going use of source controls for stormwater quality and quantity, such as pollution prevention and stormwater treatment devices.

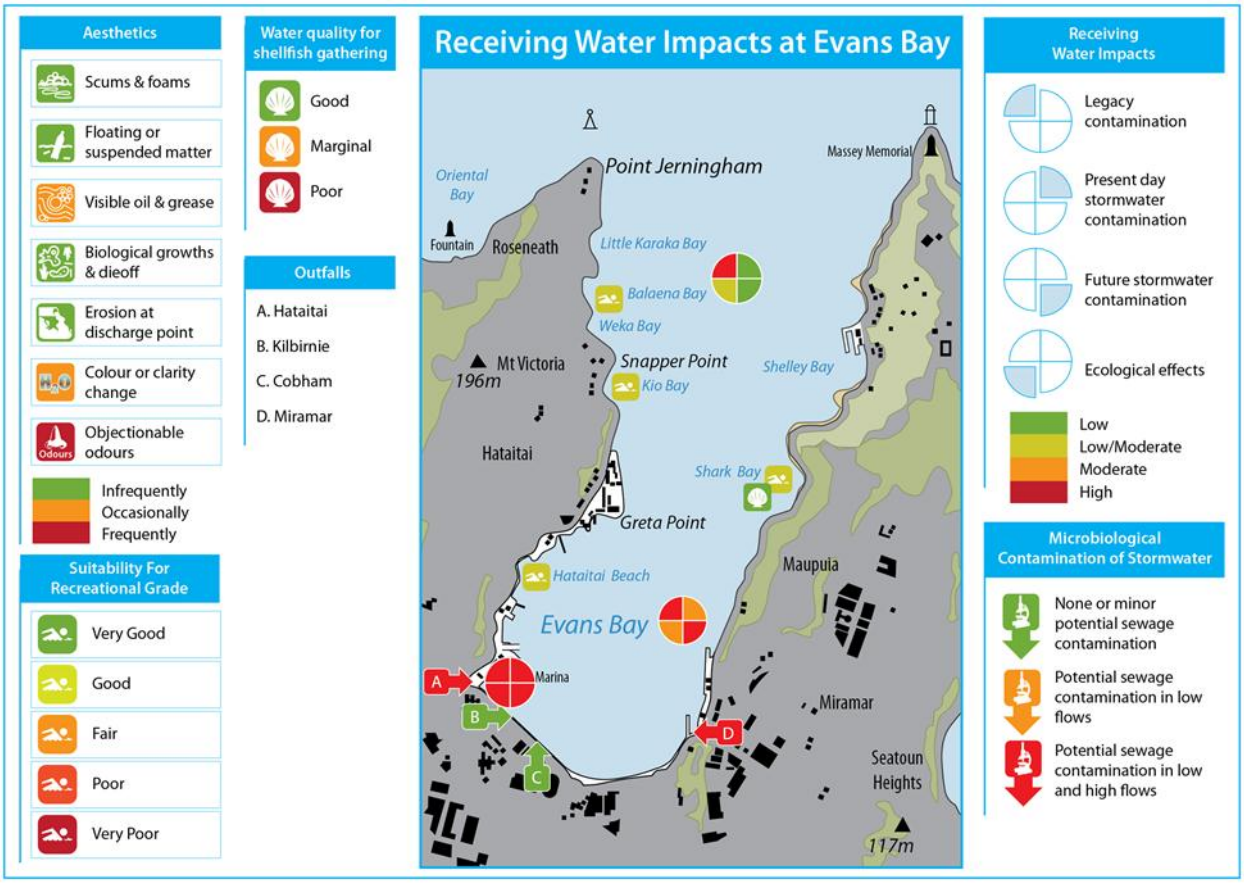

Figure 8: Receiving impacts at Evans Bay

3.2 Lambton Quay-Oriental Bay

The Lambton Quay-Oriental Bay catchment has a mix of inner city commercial and high density residential living environments, together with port and railway areas, motorways and some light industrial areas, resulting in very heavy traffic densities (including truck and rail). The catchment also has large areas of open space (the Town Belt including the Botanic Gardens and Ahumairangi Hill) and low-medium density residential areas, with cafés, restaurants and the Freyberg and Thorndon Swimming pools. Other features include the Chaffers and Clyde Quay Marinas. Key points include:

- Significant areas of flooding in the CBD, which are likely to become worse with climate change
- The receiving environment is a sheltered, low energy harbour
- A unique range of amenity and recreational values and uses exists, ranging from a central port to some of Wellingtonians' favourite recreational beaches.
- Some issues with bacteriological water quality exist. This has improved in recent times, but still needs on-going investigation and remediation
- Historical contamination of harbour sediments with DDT, high molecular weight PAH, lead, mercury, copper and zinc exceeding sediment quality guidelines.
- Strong biological effects are noted close to stormwater outfalls, and medium effects in Lambton Harbour, decreasing to minor effects in the middle of Wellington Harbour (**Figure 9**).
- Management options include ongoing water quality monitoring staged asset upgrades, ongoing use of source controls for stormwater quality and quantity and other best practice management measures.

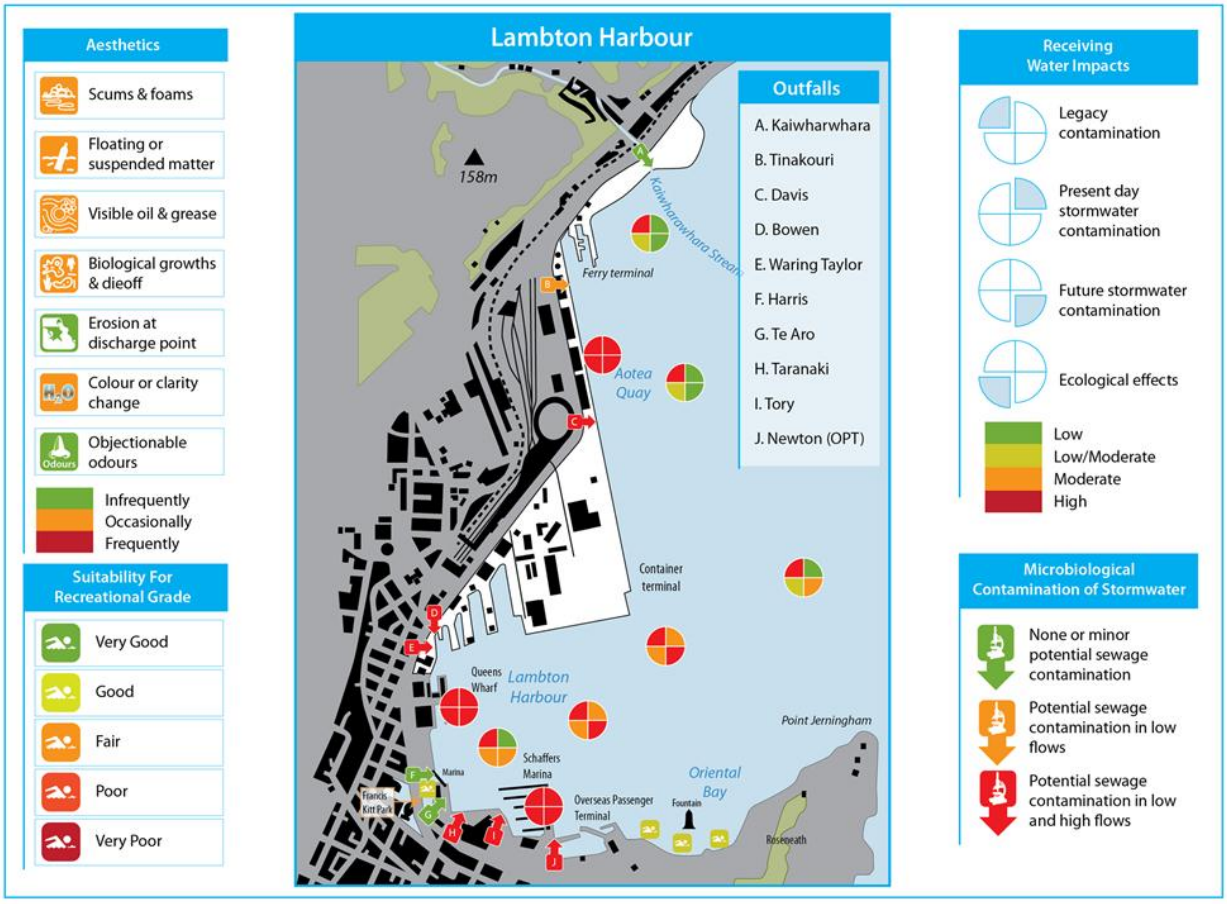

Figure 9: Receiving impacts at Lambton Harbour

3.3 South-East coast

The South East Coast catchment is predominantly residential and open space, with small town centres. The open space is mostly re-generating forest with relatively high diversity, sheltered by old stands of pines, macrocarpas and gum trees. Key points include:

- Some known historical flooding issues
- The discharge environment is spread along a semi-exposed coast consisting of beaches separated by rocky headlands and subject to relatively high energy waves and currents
- Diffuse urban-sourced pollution is expected to be at the low end of the urban contamination range. Impacts are not expected to worsen significantly in the future.
- There is no information on the ecological sensitivity to stormwater on this coast, but it is probably high, having high water quality from Cook Strait, diverse habitats and biologically rich and diverse communities of plants and invertebrates. This section of the marine environment has a wide variety of habitats and a unique collection of plants and animals, such as dolphins, rays, orcas, blue penguins and giant kelp.
- It is a major area for recreation and tourism, which in part relies on the state of the natural ecosystems; activities include sailing, snorkelling, diving, fishing, wildlife watching, and recreational walking along the coast (**Figure 10**).
- Local coastal areas are highly significant with respect to mana whenua.
- Source controls and other best management practices should be applied to any development planned by the City.

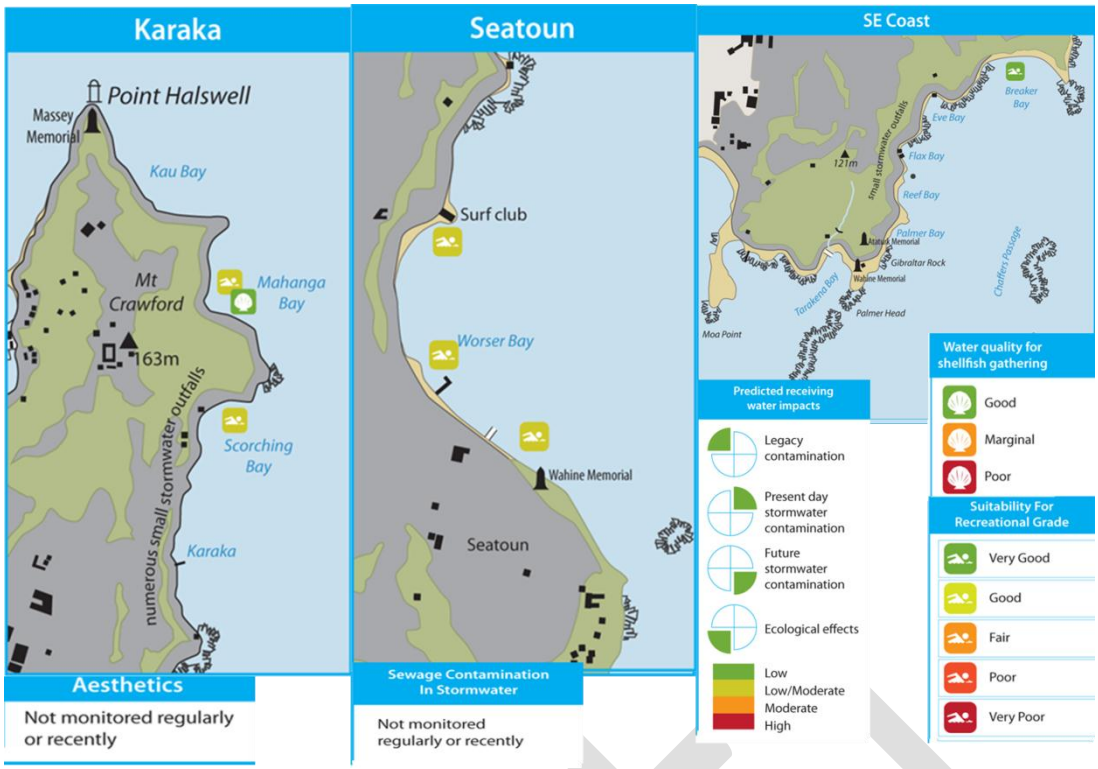

Figure 10: Receiving impacts at the South-east coast

3.4 Lyall Bay

The Lyall Bay catchment is predominantly residential, light commercial and industrial (including wellington Airport). Traffic densities are relatively high, with roads servicing shopping centres and the airport and providing access to the Miramar Peninsula. Key points include:

- There has been recent flooding in the catchment due to very high rainfall (a 50 year event) and a number of potential flood hazard areas have been identified
- The Lyall Bay receiving environment is a large embayment on Wellington's exposed south coast. It has a large popular beach enclosed by rocky headlands
- Much of the amenity values are related to recreation and environmental values
- The chemical quality of stormwater has not been measured in these outfalls, but because of the high impervious area and high density of sources, diffuse sourced pollution is probably in the medium category of the urban contamination range
- Bacteriological quality has been monitored at the Lyall Bay East outfall since 1992. There have been substantial improvements in quality as the result of WCC's Sewage Pollution Elimination Project. Annual median faecal coliform values have fallen about 40-fold from the early 1990s to the present day. The two outfalls show low wastewater contamination of stormwater during dry weather, but there can be significant wet weather contamination
- Any overflow occurring at the Moa Point treatment plant at the long outfall is likely to have some impact on the Lyall Bay beach water quality, depending on the currents at the time.
- There is no information on the Bay's ecological sensitivity to stormwater, but it is probably high, it being a relatively pristine environment with high water quality from Cook Strait and very diverse habitats

- Accumulation of contaminants in the Bay is probably very low on account of the relatively high-energy environment. Therefore, the ecological impacts are expected to be low and are not expected to worsen significantly in the future (**Figure 11**)
- Source controls and other best management practices should be applied to any development planned by the city.

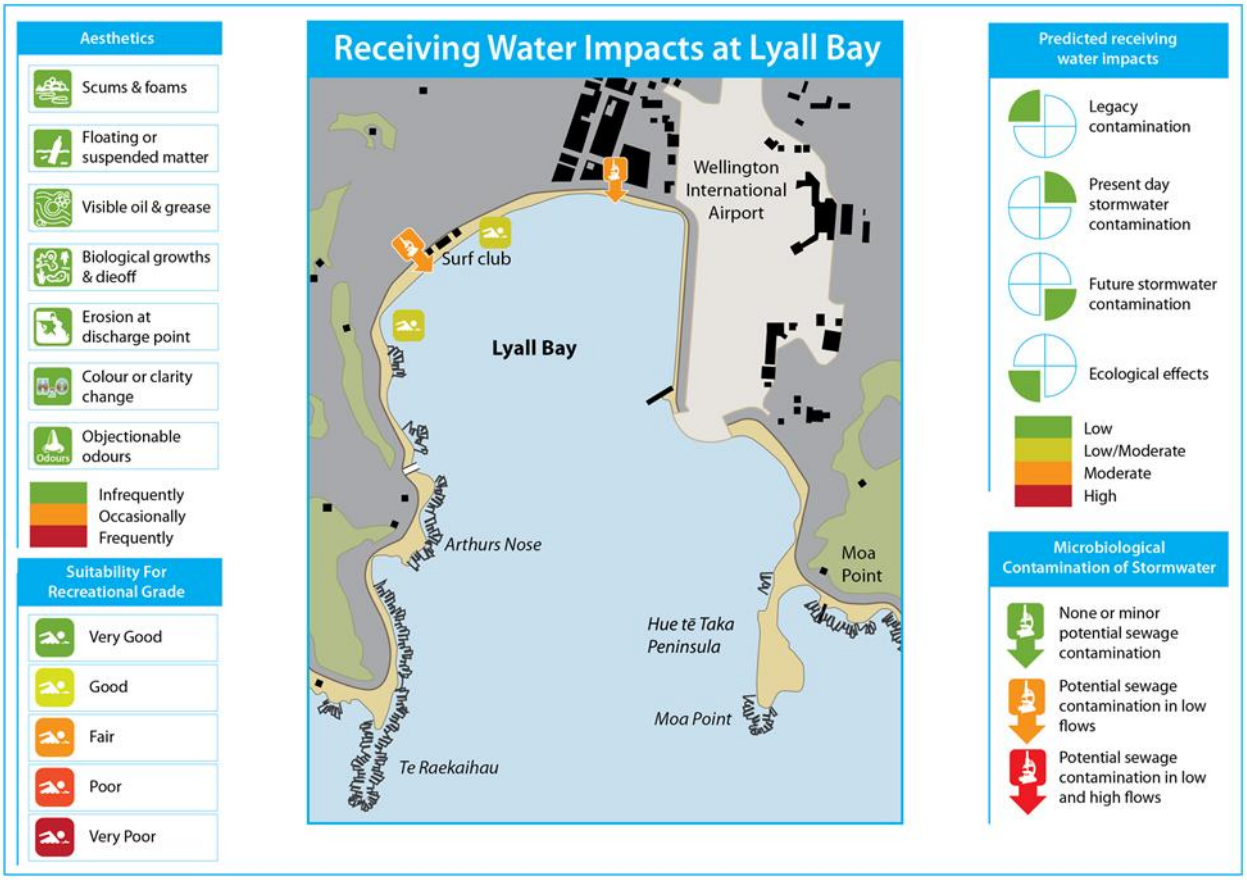

Figure 11: Receiving impacts at Lyall Bay

3.5 Island Bay-Houghton Bay

The Island Bay-Houghton Bay catchment is predominantly residential with parks, reserves and small pockets of commercial land use. It has an estimated 50% impervious cover. Key points include:

- There are no known significant flooding issues in the Houghton catchment, though overland flow and ponding may affect residential properties in the lower part of the valley around Cave Road in more extreme events
- Both bays are on the open South Coast and are subject to relatively high energy from large swells, although Island Bay is partially sheltered by Taputeranga Island.
- Much of the amenity and recreational value relates to the marine reserve and accessible coast line, including a number of beaches
- There are five locations where wastewater is designed to overflow into the stormwater system during extreme situations: three overflow points and two pumping stations. Inadvertent and/or illegal cross connections with wastewater, as well as wastewater pumping malfunctions, have been surveyed, monitored and repaired since 1994. Because of the old ceramic piping system (some parts are circa 1910), maintenance repairs continue as needed.
- A major known contamination hotspot is the large closed Houghton Bay landfill in the valley floor. Leachate enters the stormwater pipes because of the age and poor condition of the pipe beneath the landfill. The lack of capping or layers in the landfill to retain the leachate is also an issue. This

situation is exacerbated by the existence of field drains connected to the stormwater system which capture groundwater from the landfill. High flows from the landfill has been diverted to the wastewater system during rain events to manage the problem, and is continuing to investigate the issues.

- Twice-yearly sampling since1992 shows that the Island Bay stormwater discharge is typical of urban stormwater quality, i.e. highly variable and at times having elevated concentrations of suspended solids, organic matter, nutrients, copper, lead and zinc. Measurement of persistent organic pollutants throughout one particular storm showed quite high levels of banned organochlorine chemicals in the particulate matter within the stormwater.
- Aesthetics are poor in Houghton's Bay, with reports of odours and discoloration. This is probably due to leachate-derived hydrocarbons and iron oxides
- There is no information on the bays' ecological sensitivity to stormwater, but it is probably high, given that it is a relatively pristine environment, with high water quality from Cook Strait and very diverse habitats.
- Accumulation of contaminants in the Bay is probably very low because of the relatively high energy in this environment. Therefore, the ecological impacts are expected to be low and not to worsen significantly in the future (**Figure 12**)
- Source controls and other best management practices should be applied to any development planned in this catchment. A high priority task will be to address the ongoing issue of wastewater contamination in the outfall at Island Bay during dry and wet weather flows, and the landfill leachate at Houghton's Bay. It is proposed to continue to manage flood risk on an as-required basis.

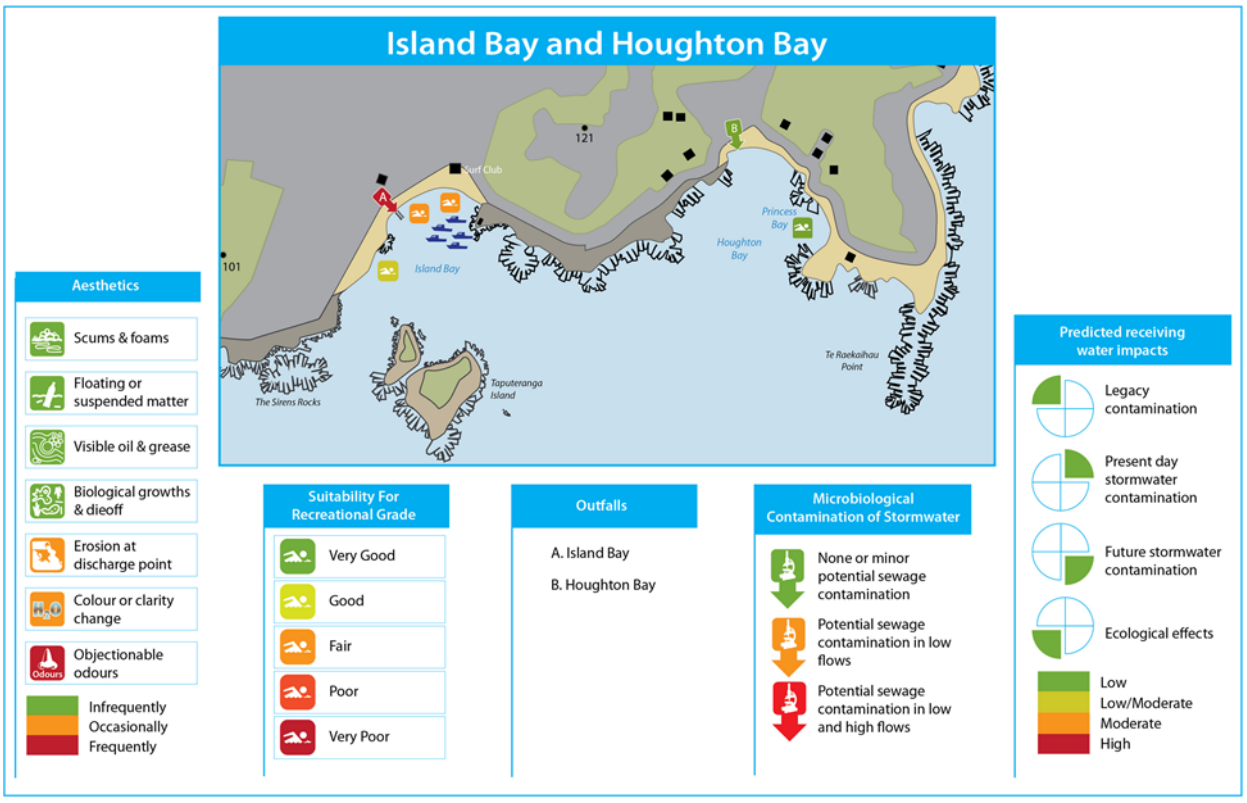

Figure 12: Receiving impacts at Island and Houghton Bay

3.6 Owhiro Bay Stream catchment

The Owhiro Stream catchment has only 9% impervious surface area, being open space or in rural land use (mostly gorse scrubland). The catchment has 22% urban land use and 4% bare ground, and contains an operating landfill and clean fill sites. Key points include:

- There are no known historic flooding issues in the catchment and little development in the valley floor other than roads, so flood risk is considered relatively low
- The receiving environment is on the open south coast and is subject to relatively high energy from wave action
- Recreational use includes diving, fishing, swimming and boating, being serviced by the sheltered Owhiro Bay boat ramp and car park. A project is underway to restore and protect Owhiro Bay Stream, the only un-piped city stream flowing to the south coast: the Friends of Owhiro Stream community group has planted more than 8,000 native trees in the catchment. The marine reserve is a key tourist attraction for the city and has high amenity value.
- Stormwater is dominated by runoff from the gorse scrubland, with urban stormwater a relatively minor input. Potential known point sources (hotspots) of stormwater contamination include a number of operating and closed landfills, i.e. WCC's Southern Landfill and adjacent private landfills
- The landfills may have a slight to moderate impact on contaminant concentrations in the stream. Stormwater during one storm in 2002 had unusually high levels of arsenic, copper, chromium, iron, silver and zinc, which are inconsistent with the degree of urbanisation and predominantly rural land cover. This points to contamination from the landfills or other industrial activity. Measurement of persistent organic pollutants during this one storm (2002) also showed occasionally high levels of DDT and dieldrin, and moderately elevated PCB in the particulate matter in stormwater, which requires further investigation
- Expansion plans for landfills are under consideration
- The Bay's ecological sensitivity is probably high, being a relatively pristine environment, and having high water quality from Cook Strait, with diverse habitats. There is unlikely to be any accumulation of contaminants, so the ecological effects have been classified as low. However, the unknown contribution of landfill leachate makes the degree of confidence of these predictions uncertain (**Figure 13**).
- Source controls and other best management practices should be applied to urban development planned in the catchment. Monitoring should continue for faecal coliforms, enterococci and contamination and dispersion processes in the stream and Bay, and, in light of the landfill inputs, in stream sediments and stormwater for heavy metals, PAH, organochlorine pesticides, ammonia and BOD.

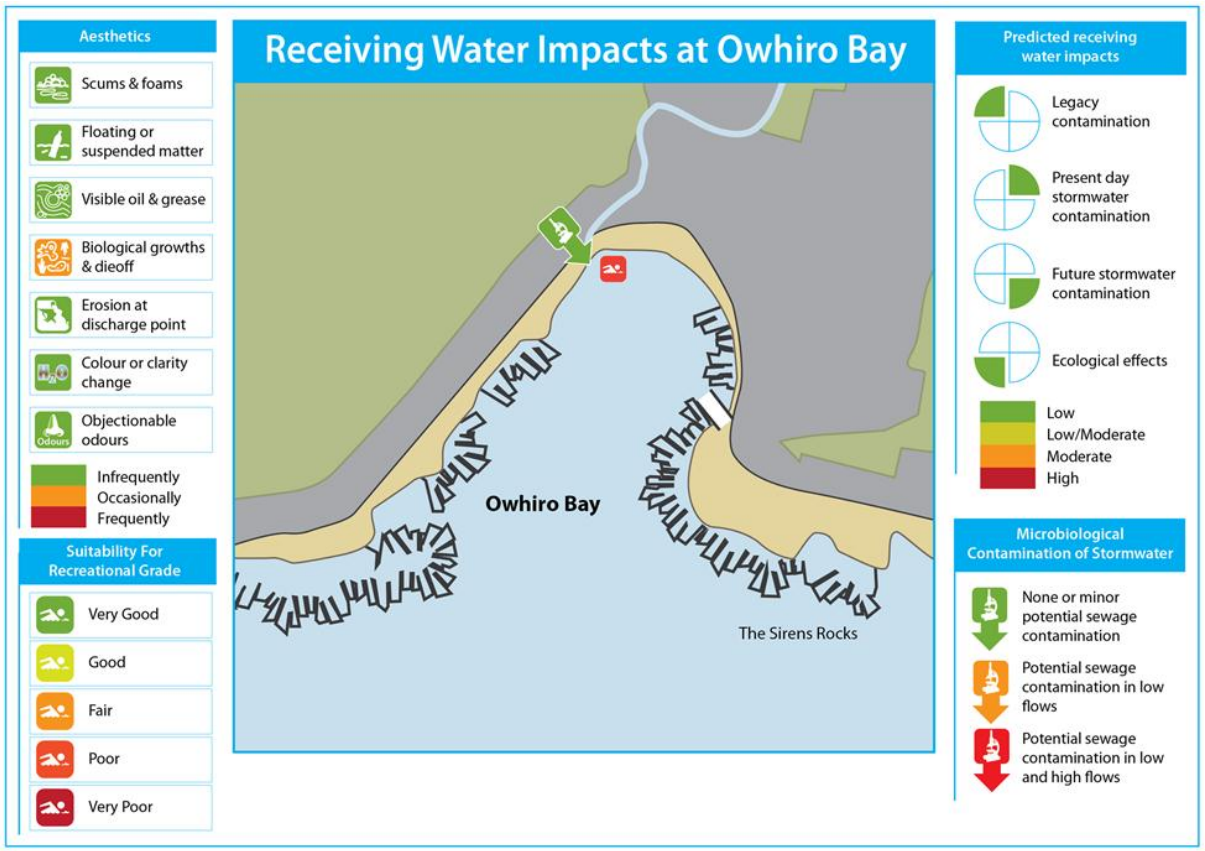

Figure 13: Receiving impacts at Owhiro Bay

3.7 Kaiwharawhara Stream catchment

The Kaiwharawhara Stream catchment includes large areas of open space in the headwaters including Zealandia and the outer town belts of the western hills. This contrasts with the motorway, railway yards, and industrial and commercial zone near the stream mouth. The middle reaches of the stream drain through old and new residential areas, with small suburban centres. There is a significant closed landfill beneath Ian Galloway Park. Key points include:

- The stream has been highly impacted through contamination and modification by industrial land runoff, reclamation, channelization, reduced riparian vegetation, invasive weed species and sedimentation. The stream-mouth has been significantly modified by reclamation along the coastline for road and rail services. The estuary is poorly defined with a restricted mouth and no lagoon in the lower reaches. It offers little habitat for birdlife or fish. The regular inundation of the gravel banks by the tide makes them of little use to nesting shorebirds, and the modified margins and gravel beds of the estuary offer no suitable habitat for inanga (whitebait) spawning
- The coastal receiving environment at the northwest corner of the harbour is sheltered and protected from deep ocean swells. It may be subjected to waves produced by local winds.
- There are no known significant flooding issues in the catchment. The commercial area at the bottom of Ngaio Gorge is susceptible to flooding due to the constrained channel and low bridges. The flood risk in this area is likely to be exacerbated by future sea level rise.
- The Kaiwharawhara Stream estuary has limited access due to the presence of roads and railway lines, and has little recreational value. However, the area is being promoted as a desirable recreational destination and a link between the Sanctuary to Sea Walkway and the proposed Great Harbour Way – Te Aranui o Poneke Project.
- Potential contaminant hotspots include the Wellington-Hutt and Porirua motorways (State Highway 1 has an average daily traffic count in excess of 50,000 vehicles); the Kaiwharawhara stream, which is piped under disused landfills which were known to have contributed to elevated

concentrations of arsenic, lead, zinc and other metals in stream sediments in the past; and three other additional disused landfills in the catchment.

- The stream has been strongly impacted in the past by landfill leachate and diffuse source pollution from urban areas exceeding water quality criteria for cadmium and copper. Stream sediments were highly contaminated with zinc and lead and moderately contaminated with copper and arsenic. More recent surveys of sediments have found sediments strongly contaminated with zinc and hydrocarbons. Legacy contamination by DDT and lead was still elevated in some samples of Kaiwharawhara stream sediments
- Sediment offshore of the mouth of the Kaiwharawhara Stream is contaminated by Zn, Cu, Hg, PAH and DDT. Contamination is also caused by the inputs from other outfalls along the North Coast (particularly from Onslow) and Aotea Quay. Refer to the summary above for Lambton Harbour for a summary of chemical and ecological effects, **Figure 14**.
- In terms of management options, the Karori dams are no longer used for water supply purposes so can provide a buffer for downstream flood flows. Source controls and other best management practices such as stream and riparian margin protection should be applied, and contaminant monitoring should continue.

3.8 Ngauranga Stream Catchment

The Ngauranga Stream catchment includes coastal areas near the stream and the adjacent Horokiwi / Bellvue stream. The Ngauranga Stream itself drains a predominantly residential catchment, but includes significant commercial and light industry areas in Johnsonville, Newlands and Ngauranga. There are also large open space areas as well as significant areas of motorway and light industrial and commercial premises. The Horokiwi / Bellevue subcatchments are mostly rural. About 24% of the catchment area has impervious surfaces. Key points are:

- The Ngauranga Stream discharges to the north coast of Wellington Harbour. In this area, the harbour is a straight, rocky and exposed coast stretching from Aotea Quay to Petone Beach.
- There are no known significant flooding issues in the catchment, although a number of areas are potentially susceptible to ponding and many do not have adequate secondary flow paths. The commercial area and state highway at the bottom of Ngauranga Gorge are potentially susceptible to flooding due to the narrow channel and low bridges. Flood risk in this area is likely to be exacerbated by any future sea level rise
- Recreational activities undertaken in the area include boating and fishing, with some water skiing off Petone Beach. State Highways 1 and 2 and the Wellington-Hutt railway line mean that there is limited and difficult access to the shore. The coast is also exposed and some distance from suitable launching places. Coastal receiving waters are not monitored for microbiological quality.
- The Ngauranga Stream appears to be contaminated by wastewater in both dry and wet weather. There are therefore routine and responsive investigations in place regarding cross-connections between wastewater and stormwater in the catchment.
- Catchment-wide sources of contaminants include roofs and other building materials found in urban areas, road surfaces and other permeable pavements, while emissions from vehicles using the motorways, main feeder roads, shopping areas and industrial parking lots are probably the major generic source.
- Potential hotspots include the Wellington-Hutt and Porirua motorways; a large landfill which operated in the Ngauranga catchment from 1961 to 1971; the Kiwi Point Quarry; and the Taylor Preston Abattoir
- Historic monitoring of the Ngauranga stream has showed contamination by copper, lead and zinc, with stream sediments shown in 2007 to contain the legacy contaminants DDT and lead.
- Impacts along the north coast are also strongly affected by the inputs from Kaiwharawhara Stream and, to a lesser extent, Aotea Quay. Marine sediment quality investigations near the Ngauranga Stream mouth in 2006 and 2011 found that concentrations of DDT, lead and mercury exceeded sediment quality guidelines. This contamination is probably mostly historical, because current

contaminants are likely to be discharged in sufficient quantities into urban stormwater to make such levels of contamination unlikely (**Figure 14**).

- Marine sediment quality investigations have distinguished only moderate biological effects at distances 0.5 to 1 km off the Northern shore, with low or no effects towards the middle of Wellington Harbour, 4-6 km from the shore.
- Zinc concentrations are expected to reach levels of concern within 30 years in the two sediment monitoring sites closest to the shore
- Future management recommendations should focus on on-going environmental monitoring and flood hazard assessment.

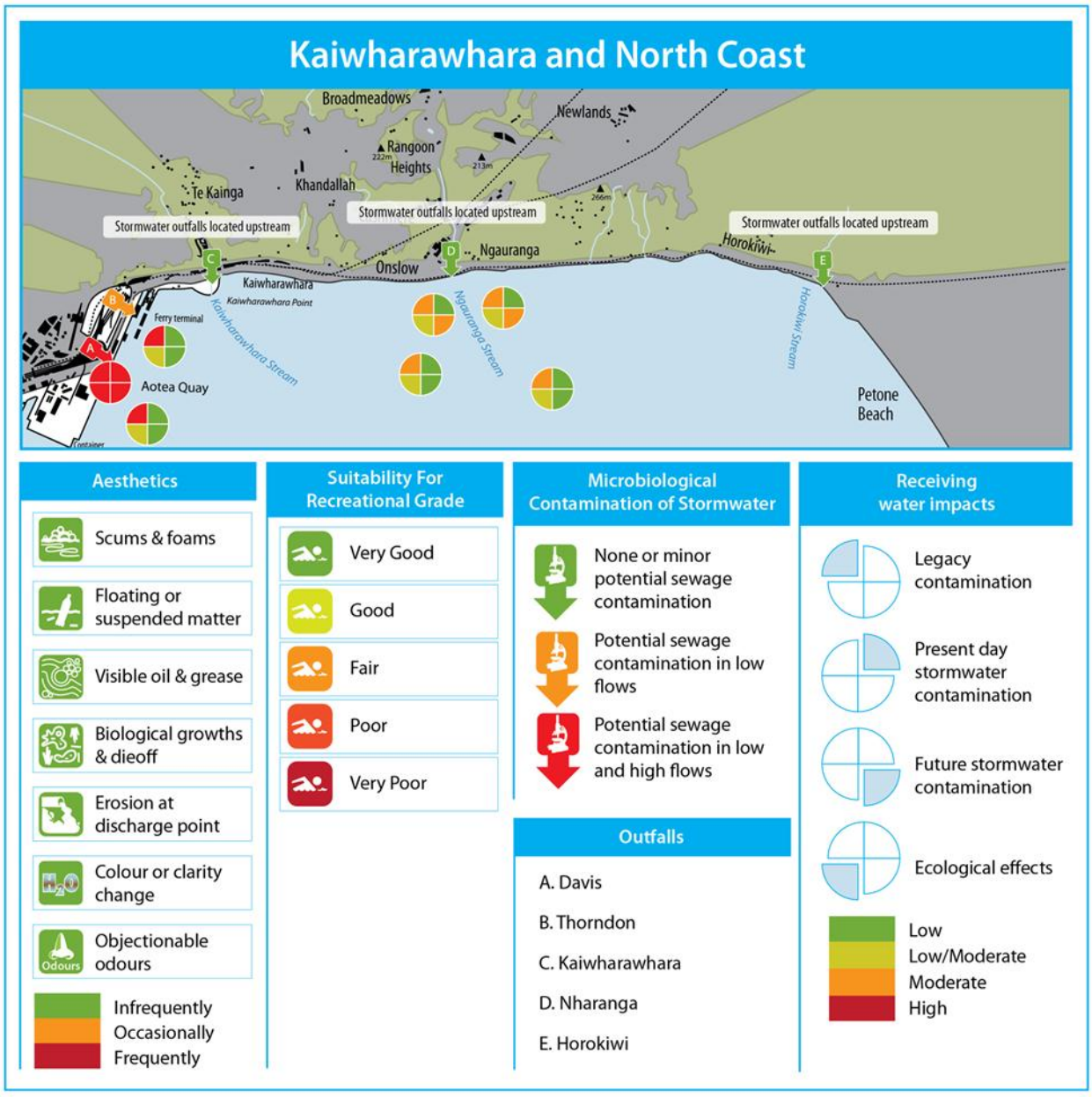

Figure 14: Receiving impacts at Aotea Quay – North Coast

4 Methods and Timetables

The management issues for the catchments covered by the consents are discussed in this section. Management options available to the Council in its ICMPs are provided for under:

- The statutory methods provided for, pursuant to the Local Government Act 2002
- The statutory and non-statutory methods in the Resource Management Act 1991
- Statutory and non-statutory methods available under other legislation, such as that relating to parks, biodiversity and roading.

These options provide a large and ever-growing portfolio of methods for achieving the objectives of ICMPs, ranging from the traditional asset management approaches to community input via technologies such as crowd-sourcing of GIS information on asset faults or other values. The methods used in a given catchment reflect the issues, opportunities and priorities identified in the research and engagement work carried out as part of the catchment planning process (**Table 2**). Detailed catchment-specific methods will be selected as part of Stage 2 ICMP preparation.

The resource consent requires the development of objectives to provide a framework for addressing the adverse effects of stormwater discharges. The five categories of objectives approved by GWRC under the resource consent are (Capacity, 2012):

1. Catchment objectives associated with the underlying assets
2. Water quality objectives associated with inputs and the receiving environment
3. Stormwater quantity objectives associated with the management of stormwater generally
4. Amenity value objectives associated with the amenity value of the city's natural areas
5. Community engagement objectives associated with the interaction with the community

Figure 15 shows how ICMPs synthesise the large amount of legal, asset, environmental, social and cultural information they collect in order to be able to follow the environmental management process, and create work plans based on objectives. Table 2 below gives indicative timelines for methods of addressing the adverse effects of stormwater discharges over a timeframe from 2014 to 2038.

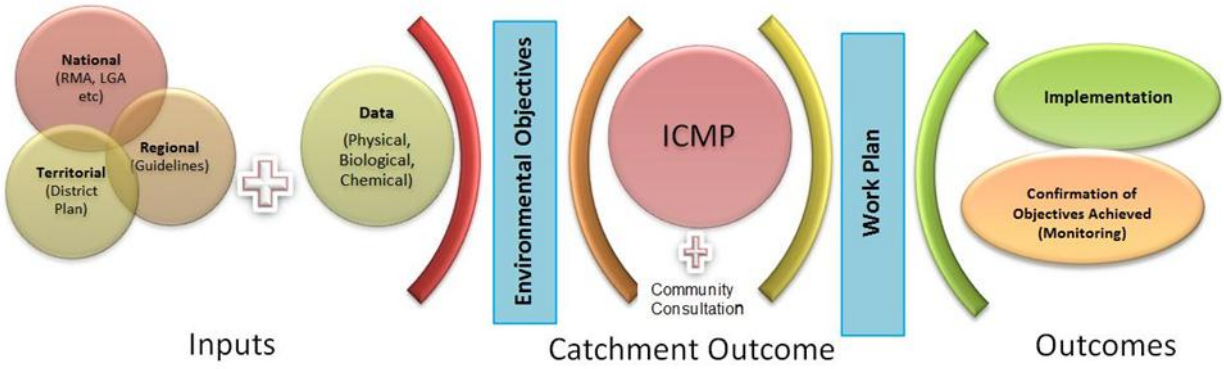

Figure 15: The Process of ICMPs

NOTE: The process synthesises legal, asset, environmental, social and cultural information for action and monitoring

Table 2: Indicative timelines for methods of addressing the adverse effects

Option	Methods/work programmes	Responsible	ICMP Environmental Objectives					Time Frame		
			1. Catchments (Assets)	2. Quality	3. Quantity	4. Amenity	5. Community	Short term (June 2018)	Medium term (2018 – 2021)	Longer term (2021 – 2038)
Local Government Act methods / work programmes										
Capacity's Strategic Plan	This sits above the operational plans, and provides input into them to provide long-term direction and to ensure the 3 Waters Asset (activity) Management Plans are not developed in isolation, but are cost-effectively developed and delivered.	Capacity / WCC	✓	✓	✓	✓	✓	Review to align programmes with ICMP priorities	Ongoing	Ongoing
Stormwater Service Plan (Asset Development Plan – Stormwater) – **These are ongoing programmes**	• Stormwater grit cleaning • Beach and stream water quality monitoring • Baywatch recreational bathing water monitoring • Asset renewals • Routine maintenance of stormwater intake and outlets • Routine Inspection and cleaning of stormwater culverts • Condition assessment • Culvert Inspection Plan • Stormwater Intakes and Outfall Operation and Maintenance Plan • Critical Drain Inspection Plan • Repeat drainage faults • Treatment Device Operation and Maintenance Plan • Pipe renewal / Upgrade Plan - CAPEX • Stormwater pump station operation and maintenance plan • Reactive Maintenance Plan - Under Operation Team • Environmental Monitoring-Culvert outfall Monitoring Plan (20 outfalls, 21 coastal beach sites) • Three-Waters Strategy Implementation	Capacity / WCC	✓	✓	✓	✓	✓	Review to align programmes (as required) with ICMP priorities	Ongoing	Ongoing
Stormwater Service Plan – These are ongoing programmes	• Level of Service consultation, benchmarking and standard-setting • Liquid waste management plan		✓	✓	✓	✓	✓	Review to align programmes (as required) with ICMP priorities	Ongoing	Ongoing
Wastewater Action Plan (Asset Development Plan –	• Wastewater network and PS Operation and Maintenance plan • Sanitary Surveys • Wastewater Network Grit Chambers Operation and	Capacity / WCC	✓	✓	✓	✓	✓	Review to align programmes (as required) with ICMP	Ongoing	

Option	Methods/work programmes	Responsible	ICMP Environmental Objectives					Time Frame		
			1. Catchments (Assets)	2. Quality	3. Quantity	4. Amenity	5. Community	Short term (June 2018)	Medium term (2018 – 2021)	Longer term (2021 – 2038)
Wastewater)	• Maintenance Plan • Wastewater PS wet well cleaning							priorities		
	• Trunk model upgrade plan • Wastewater pump upgrade plan • Asset renewals / upgrades	Capacity / WCC	✓	✓	✓	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Wastewater Action Plan (Asset Development Plan – Wastewater)	• Overflow monitoring • Wastewater flow monitoring • Condition assessment • Interceptor Management Plan (includes Trunk model management plan) • Hydrogen Sulphide Management Plan • Moa Point Treatment Plant Management Plan • Inflow / Infiltration (I/I) Reduction Plan • Overflow Mitigation Plan • Level of Service consultation, benchmarking and standard-setting	Capacity / WCC	✓	✓	✓	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Roading Activity Management	• Transport Asset Management Plan 2010/11 - 2019/20 • Road Open Space operational activities • Road sweeping • Sump cleaning • Code of Practice for Working on the Road	WCC / NZTA	✓	✓	✓	✓	x	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Parks, Sports and Recreation Activity Management	• Biodiversity Action Plan (September 2007) • Our Capital Spaces (2013) • Town Belt Management Plan • Outer Green Belt Management Plan • Northern Reserves Management Plan (2008) • Parks and Open Space Asset Management Plan • Marinas Asset Management Plan, • Play Areas, Skate parks and bike skills Asset Management Plan	WCC	✓	✓	x	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Parks, Sports and Recreation Activity Management	• Botanic Gardens, Asset Management Plan • Sports fields Asset Management Plan • Cemeteries Asset Management Plan	WCC	✓	✓	x	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Solid Waste Activity Management	• Solid Waste Management and Minimisation Plan • Closed Landfill Management Plans	WCC / Private	✓	✓	x	✓	✓	Review to align programmes (as required) with ICMP	Ongoing	Ongoing

Option	Methods/work programmes	Responsible	ICMP Environmental Objectives					Time Frame		
			1. Catchments (Assets)	2. Quality	3. Quantity	4. Amenity	5. Community	Short term (June 2018)	Medium term (2018 – 2021)	Longer term (2021 – 2038)
								priorities		
Strategy, Plans, Policy and Bylaws	• Long Term Plan • Wellington Towards 2040 • Environmental Strategy • Urban Development Strategy • Trade Waste Bylaw	WCC	✓	✓	✓	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
	• Consolidated Bylaw • Assessment of Water and Sanitary Services (2005) • Climate Change Action Plan (2013) • Lateral Policy (2005)	WCC	✓	✓	✓	✓	✓	Review to align programmes (as required) with ICMP priorities	Ongoing	Ongoing
Strategy, Plans, Policy and Bylaws	• Trade Waste Charges Policy (2008) • Water Conservation and Efficiency Plan (2011) • Water and Sanitary Services Assessment (2005) • Our Living City Programme (2013)	WCC	✓	✓	✓	✓	✓	Review to align programmes (as required) with ICMP priorities	Ongoing	Ongoing
Resource Management Act methods / work programmes										
National Policy Statements (NPS) and Environmental Statements (NES)	• New Zealand Coastal Policy Statement • NPS Freshwater	GWRC/ WCC	✓	✓	✓	✓	✓	Align ICMPs with intent of policy document		

Regional Planning	• Regional Strategy
	• Regional Policy Statement (2013)
	• Proposed Regional Rules (2014)
	• Whatua process ;
	  ○ Porirua Harbour (2014)
	  ○ Wellington Harbour (2014)
	• Regional Stormwater Action Plan (XXXX)
		GWRC and TA's	✓	✓	✓	✓	✓	Align ICMPs with intent of policy document	Ongoing	Ongoing

District planning	• Land use controls • Development Contributions Policy (July 2009) • Code of Practice for Land Development (2012)	WCC	✓	✓	✓	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing

Option	Methods/work programmes	Responsible	ICMP Environmental Objectives					Time Frame		
			1. Catchments (Assets)	2. Quality	3. Quantity	4. Amenity	5. Community	Short term (June 2018)	Medium term (2018 – 2021)	Longer term (2021 – 2038)
	• Water Sensitive Urban Design guide (draft 2013)									
Structure and Spatial Panning	Some examples:: • Centres Policy (September 2008) • Johnsonville Town Centre Plan (November 2008) • Kilbirnie Town Centre Revitalisation Plan (August 2010) • Newlands Centre Plan (April 2010) • Northern Growth Management Framework • Public Space Design Policy (2010) • Waterfront Development Plan 2010/11	WCC	✓	✓	✓	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Consents and compliance	• Issuing, applying for and monitoring compliance with resource consents, including for stormwater treatment devices and other water sensitive measures	WCC / GWRC	x	✓	✓	✓	x	Review to align programmes (as required) with ICMP priorities	Ongoing	Ongoing
Consents and compliance	• Pollution Management (Prevention of point source inputs • Management of contaminated sites • Pollution Management (education)	GWRC	✓	✓	x	✓	✓	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Environmental monitoring	• Shellfish Sampling assessment - 5 yearly	GWRC	x	✓	x	✓	x	Ongoing	Ongoing	Ongoing
	• Harbour sediment sampling programme - 5 yearly	GWRC/WCC/HCC	x	✓	x	✓	x	Ongoing	Review to align programmes (as required) with ICMP priorities	Ongoing
Examples of other methods under the RMA										
Iwi Partnerships	• Port Nicholson Block Settlement Trust, Te Rūnanga o Toa Rangatira	WCC/ Iwi	✓	✓	x	✓	✓	Ongoing	Ongoing	Ongoing

Option	Methods/work programmes	Responsible	ICMP Environmental Objectives					Time Frame		
			1. Catchments (Assets)	2. Quality	3. Quantity	4. Amenity	5. Community	Short term (June 2018)	Medium term (2018 – 2021)	Longer term (2021 – 2038)
Research, monitoring and evaluation by Council, iwi and Community	• E.g. Community based monitoring such as community SHMAK (Stream Health Monitoring and Assessment Kit) and CHI (cultural health index)	WCC / Community	✓	✓	x	✓	✓	Ongoing	Ongoing	Ongoing
Environmental protection and restoration	• E.g. Trees for Survival (See Battle Hill) • 70plus environmental care groups	Community / WCC / GWRC	✓	✓	x	✓	✓	Ongoing	Ongoing	Ongoing
Education and awareness raising	• E.g. Education advice and information, including website information, meetings, workshops, seminars, presentations, libraries etc	Capacity /GWRC / WCC /	✓	✓	✓	✓	✓	Prepare work programme	Implement	Ongoing
Economic instruments	• Partnerships with others, subsidies and incentives for sustainable stormwater management / water sensitive urban design; GWRC/ WCC/ QE II grants for environmental enhancement such as for riparian planting	GWRC / WCC / QEII Trust	✓	✓	✓	✓	✓	--	Prepare programme	Implement
Industry training	• Workplace, on-site, classroom and/or e-training, e.g.: Take Charge and trade training through Industry Training Organisations (ITOs)	GWRC / WCC / ITOs	✓	✓	✓	✓	✓	--	Prepare programme	Implement

KEY

	Ongoing ("business as usual") work programmes and methods, realigned to reflect the receiving environment priorities identified in
	Special (one-off or periodic) programmes, such as 5-yearly surveys of hazardous substances locations and uses
	New methods to be introduced as needed, based on current proposals for new work programmes and as indicated by the first high priority ICMPs
	Implementation of new and ongoing methods

Items in **red** font are proposed methods. Items in black font are existing methods.

5 Identification and Prioritisation

5.1 Approach to identifying priority areas for Stage 2 ICMPs

The first set of Stage 2 ICMPs will be prepared for the five coastal receiving environment catchments (Lambton Harbour, Evans bay, South east coast, Lyall bay, Island Bay / Houghton Bay; refer to **Figure 3**), because the combined effects of flooding and contamination are expressed in coastal receiving environments and the consent relates to discharges to the coastal marine area.

ICMPs for the three stream catchments (Owhiro bay, Kaiwharawhara and Ngauranga, refer to **Figure 3**) will therefore be prepared later as a lower priority for the following reasons:

- The consent envisages fresh water issues being addressed in the future, with the initial focus being on the coastal receiving environments
- Because the Kaiwharawhara stream catchment has such a small coastal receiving environment, assessment of its effects has been included in the rest of the North shore of the Wellington Harbour coastal receiving environment (Figure 3). There will be an overlap of effects on this very similar and contiguous receiving water environment. An ICMP for the stream catchment itself can thus be carried out after the implementation of the Stage 2 ICMP has begun to address the effects of its discharge to the coast
- For the remaining two stream catchments, priorities reflect both catchment size and land use, with the legacy influences of old landfills and other activities. The Owhiro catchment outweighing its smaller size relative to the Ngauranga catchment; Stage 2 ICMP will therefore be developed for Ngauranga catchment before Owhiro catchment at a later.
- The coastal receiving environment catchments are aligned with the 20 significant stormwater outfalls listed in the resource consents (**Figure 16**), and there are no significant stormwater outfalls from the Onslow, Horokiwi and Bellevue sub-catchments. These three sub-catchments are in the Ngauranga Stream catchment, the discharge from which has a minimal adverse effect on its coastal receiving environment.

5.2 Approach to prioritising areas for developing Stage 2 ICMPs

All stormwater catchments were prioritised using nine different criteria relating to land use, water quality, amenity, recreational values and asset-based risks and issues referred to in Consent Condition 7, using risk based reasoning and the use of a multi-criteria analysis (MCA).

These indicators were defined and scored to ensure that indicators which are considered more important, have a greater impact on the total score than indicators which are considered less important. Each of the eight catchments was then scored against the indicators on a scale of 0-5 (or 0-3 for some), with zero representing ‘no issue’ and three or five, a ‘significant issue’. The indicators are not weighted with respect to each other, so summing the scores across the rows produces a simple total. The sum produced a final score which was used to rank the catchments in order of priority.

The results of this prioritisation process are presented in **Table 3**.

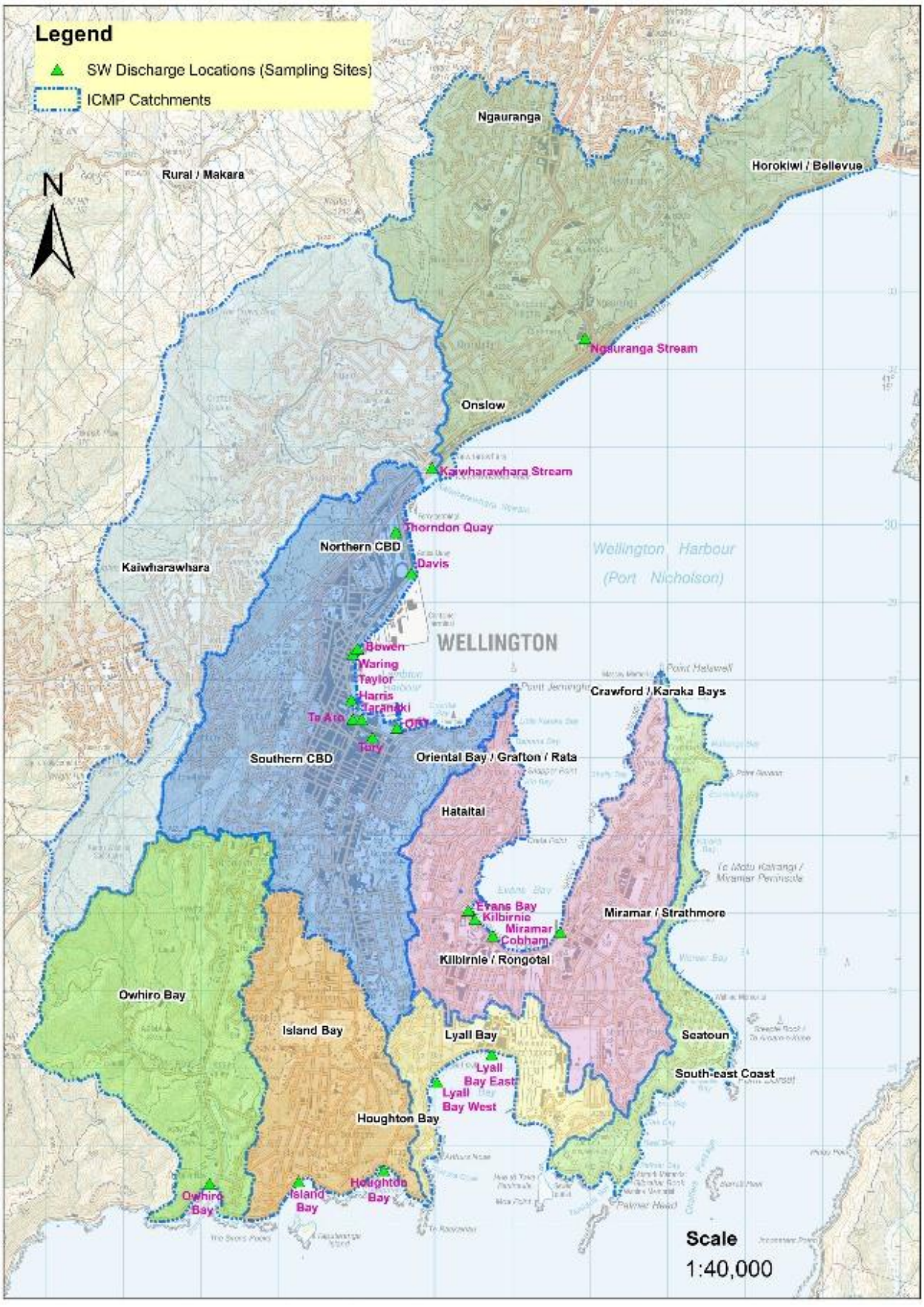

Figure 16: Significant stormwater outfalls listed in the resource consents

Table 3: Results of multi-criteria analysis of catchment values and issues

Table 3a: Coastal receiving environment catchments

Stormwater sub-catchment/s	Area	Prioritisation Assessment											Identified potential adverse effects		Detailed sub-catchment investigation and CMPs likely to be required
		1 to 5	1 to 5	1 to 5	1 to 3	1 to 4	1 to 5	1 to 4	1 to 5	1 to 5	Total score	Priority	SW quality	SW quantity	
		Land use state	Flooding / Sea level rise impacts	Wastewater Inputs	Microbial WQ	Chemical /Sediment WQ	Swimming Grading	Marine Ecology	Amenity / Recreational Use	Terrestrial amenity					
Coastal receiving environment catchment: Lambton Harbour															
Northern CBD (Aotea North, Tinakori, Glenmore St, Aitken, Bowen and Waring-Taylor)	495.0	5	4	5	3	3	4	3	5	4	36	**1**	✓	✓	Yes
Southern CBD (Hunter, Harris, Te Aro, Taranaki, Tory and Newtown)	825.0												✓	✓	Yes
Oriental Bay	49.5												×	×	No
Coastal receiving environment catchment: Evans bay															
Crawford	100.2	3.5	3	4	3	3	2	3	5	2	28.5	**2**	×	×	No
Grafton / Rata	89.5												×	×	No
Hataitai	139.5												✓	✓	Yes

Kilbirnie / Rongotai	175.4												✓	✓	Yes
Miramar / Strathmore Park	440.5												✓	✓	Yes
Coastal receiving environment catchment: Island Bay and Houghton Bay															
Island Bay	512.0	2.5	2	3	2	1	3	1	5	3	22.5	**3**	✓	✓	Yes
Houghton Bay	87.6												✓	×	Yes
Coastal receiving environment catchment: Lyall Bay															
Lyall Bay (Lyall bay West, Lyall Bay East)	283.8	4	2	1	2	1	2	1	5	2	20	**4**	✓	✓	Yes
Coastal receiving environment catchment: East Coast															
Karaka Bays	89.0	2	1	1	1	1	1	1	5	4	17	**5**	×	×	No
Seatoun	96.2												×	×	No
South-East Coast	108.7												×	×	No

Table 3b: Stream catchments

Stormwater sub-catchment/s	Area	Prioritisation Assessment										Identified potential adverse effects		Detailed sub catchment investigation and CMPs likely to be required
		1 to 5 Land use state	1 to 5 Flooding / Sea level rise impacts	1 to 5 Wastewater Inputs	1 to 3 Microbial WQ	1 to 4 Chemical /Sediment WQ	1 to 5 Swimming Grading	1 to 4 Marine Ecology	1 to 5 Amenity / Recreational Use	1 to 5 Terrestrial amenity	Total score	Priority	SW quality	SW quantity	
Stream catchment: Kaiwharawhara															
Wellington Harbour North (Kaiwharawhara	1667	2	1	5	3	4	3	3	3	3	27	**1**	✓	✓	Yes
Stream catchment: Owhiro Bay															
Owhiro Bay	971.5	2	1	3	2	3	2	1	3	5	22	**2**	✓	×	Yes
Stream catchment: Ngauranga															
Horokiwi / Bellevue	473.0	3	2	2	2	3	0	2	2	2	18	**3**	×	×	No
Ngauranga	964.0												✓	×	Yes
Onslow	144.6												×	×	No

NOTE:

1. Information on cultural values was not available at the time of writing. It is proposed to engage with iwi during the detailed Stage 2 ICMPs, in order to enable iwi to have input into the vision and mission, and frame objectives and outcomes that reflect cultural values. Similarly, while consultation with some community stakeholders is already under way, further engagement on the basis of this report is proposed as part of preparing the detailed Stage 2 ICMPs.
2. A tick (✓) in either the Stormwater quality or Stormwater quantity column indicates that discharges from a particular stormwater sub-catchment affects one or more environmental objectives. In such cases, a detailed CMP may need to be prepared in that sub-catchment.

Based on the above analysis, the first set of Stage 2 ICMPs will be prepared for the five coastal receiving environment catchments (**Figure 17**), because the combined effects of flooding and contamination are expressed in coastal receiving environments and the consent relates to discharges to the coastal marine area. However, more detailed investigation may be needed in some of the sub-catchments, which may include detailed network modelling and refining of contaminant load estimation and assessment before management options can be identified.

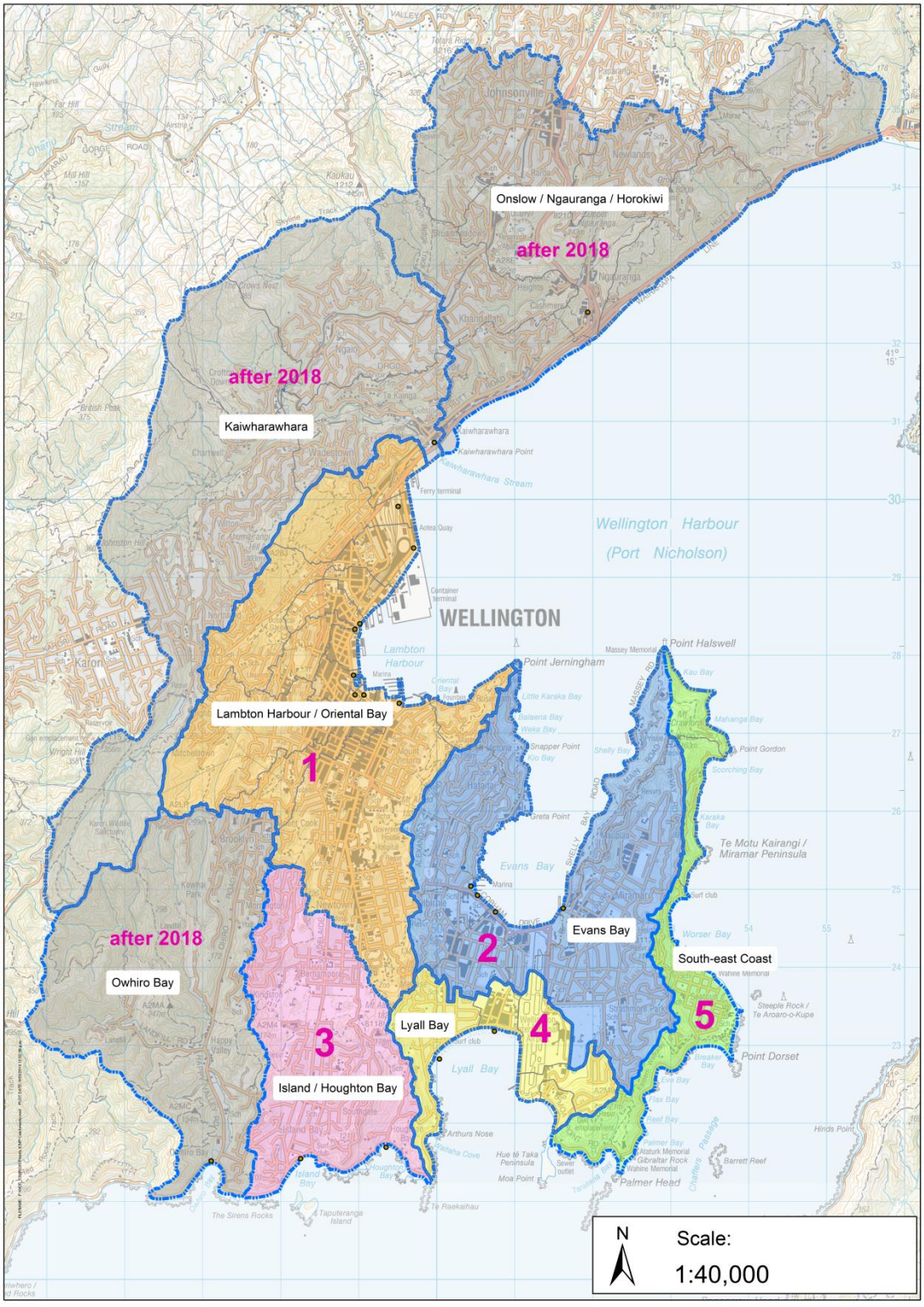

Figure 17: Stage 2 ICMP Catchment Priority Order

6 Timetable for the development of Stage 2 ICMPs

Reflecting the priorities identified above, the table below provides a timetable for the work to be done to develop stage 2 ICMPs for the eight catchments in order of priority for completion.

It may be possible to gain economies of scale by simultaneously conducting further scientific research and commencing iwi and community engagement. Management options relevant to a number of Stage 2 ICMPs catchments can possibly be developed where an issue exists across several catchments. This could advance the completion of some ICMPs. The dates shown in **Table 4** are therefore regarded as only tentative milestone dates.

The detail of work needed to prepare Stage 2 ICMPs may reveal a need to address issues that are beyond their current scope, such as freshwater quality. This has been recognised by the note to condition 6 of the resource consent, which acknowledges that while the current focus is on stormwater discharges into the coastal marine area, other surface water issues such as flooding, on-site management of stormwater flows, water quality in streams, and other aspects of catchment management could be added over time. As also envisaged in that note, these can be addressed as part of an “ongoing water management partnership between the Wellington City Council (as consent holder), Wellington Regional Council (as consent authority) and the community”.

Hence detailed ICMPs for the three stream catchments will be addressed over a longer timeframe. Works in their respective coastal receiving environments will, however, proceed alongside the preparation of the Stage 2 ICMPs for the receiving environment catchments.

Table 4: Timetable of preparation of Stage 2 ICMPs

No	Coastal Receiving Environment ICMP	Sub Catchment CMP	Catchment Area (Ha)	2013 / 14		2014 / 15				2015 / 16				2016 / 17				2017 / 18			
				3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
1	Lambton Harbour ICMP	Southern CBD (Harris, Taranaki, Tory, Te Aro, Newtown)	825.0																		
		Northern CBD (Aotea North, Tinakori, Glenmore, Aitken, Bowen, Warring taylor, Hunter)	495.0																		
		Oriental Bay	49.5																		
2	Evans Bay ICMP																				
		Hataitai	139.5																		
		Kilbirnie + Rangotoi	175.4																		
		Miramar + Strathmore	440.5																		
		Grafton / Rata / Crawford	190.0																		
3	Houghton / Island Bay ICMP																				
		Houghton Bay	87.6																		
		Island Bay	512.0																		
4	Lyall Bay ICMP																				
		Lyall Bay (East, West, Airport South)	283.8																		
5	South-east Bays ICMP																				
		South-east Coast / Seatoun / Karaka bays	294.0																		

No	Stream Catchments ICMP	Sub Catchment CMP	Catchment Area (Ha)	2013 / 14		2014 / 15				2015 / 16				2016 / 17				2017 / 18				2018 / 19				2019 / 20				2020 / 21			
				3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
1	Khaiwharawhara ICMP	Khaiwharawhara	1667.5																														
2	Wellington Harbour North ICMP	Ngauranga	964.0																														
		Onslow / Horokiwi / Bellevue	617.6																														
3	Owhiro Bay ICMP	Owhiro Bay	971.5																														

NOTE: This programme will be aligned with Regional Plans. This was agreed with GWRC (September 2013); hence no detailed ICMP will be prepared under consent number WGN090219

Detailed CMPs will be prepared, which may include:
SW Network Modelling, WW Network Modelling, Detail Contaminant Load Estimation (refining Stage 1 investigations), Contaminant Impact Assessment and Modelling (refining Stage 1findings), Review Stage 1 Catchment wide Impact Assessment, Consultation (including targets, standards or other benchmarks) Management Options, Option Assessments and Rankings (MCQ), Action programme and Time table (implementation strategy), Funding Implementation Plans (including maintenance), Monitoring Plan

Catchment wide investigation will be carried out without detailed hydraulic modelling, which may include: Catchment wide Impact Assessment (Overall), Catchment Management Options, Implementation Strategy, Funding Implementation Plans (including maintenance), Monitoring Plan

6.1 Assumptions, Constraints, Risks and Inter-dependencies

A number of assumptions, constraints, risks and inter-dependencies have been identified that may influence the ability of Capacity and WCC to meet the proposed timetable above. Key risks identified are the availability of funds / resources, Council priorities for funding, availability of information (e.g. data gathering delays) and lack of political support.

7 Monitoring, evaluation and reporting

The Stage 2 ICMP process will require Council departments with different operational activities to contribute cooperatively towards achieving the environmental objectives. It is crucial to develop indicators that are in line with the internal plan logic of Stage 2 ICMP, so as to enable tracking of implementation, monitoring, evaluation and reporting on the effectiveness of the methods used.

A process is suggested in **Figure 18** below, for this purpose. The aim is to ensure consistent application and alignment of descriptions, definitions, objectives, methods and monitoring indicators and to enable tracking of implementation, monitoring and evaluation of outcomes of the Stage 2 ICMPs.

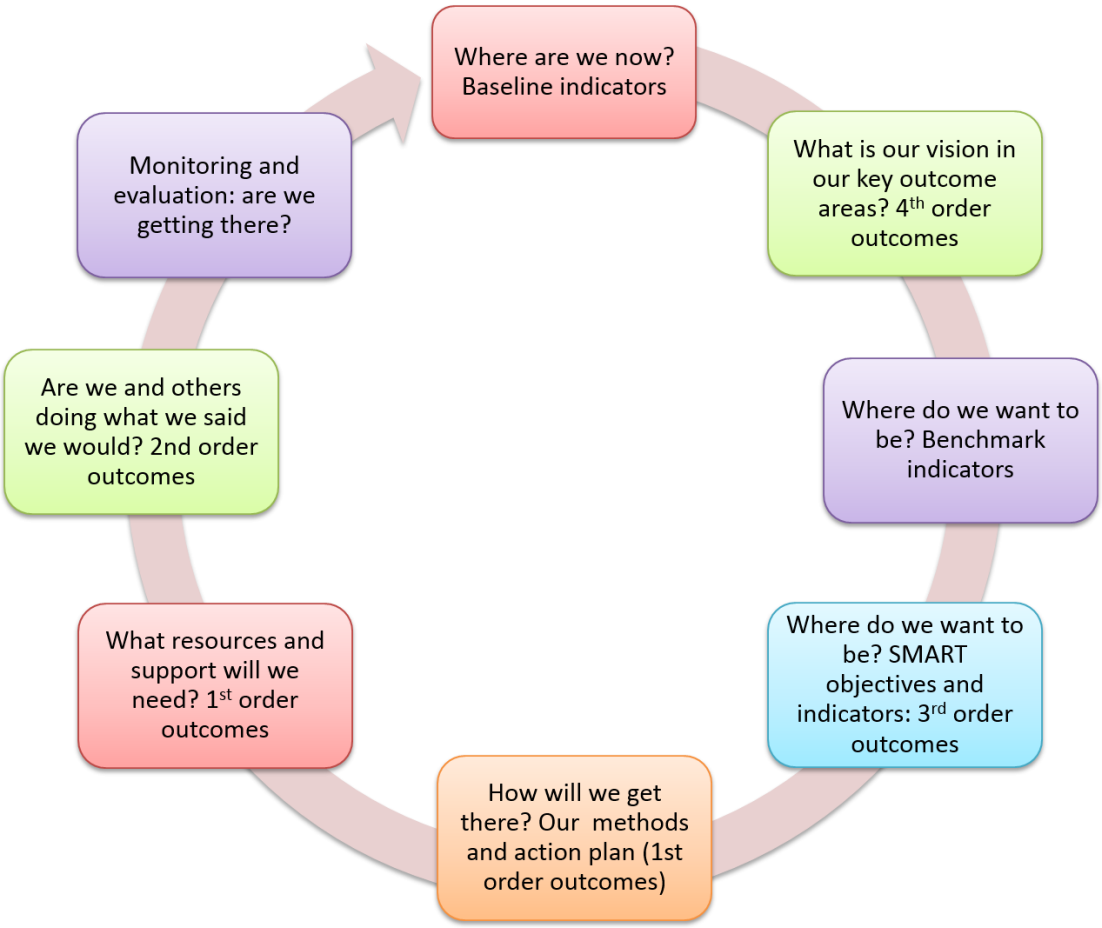

Figure 18: How to prepare Stage 2 ICMPs

NOTE: Process to follow detail ICMPS so their implementation and outcomes can be measured.

Appendix A: Consent Conditions - ICMP Requirements in the global consent

Environmental Objectives of the Integrated Catchment Management Plan

5. The consent holder shall in consultation with the Manager, Environmental Regulation, Wellington Regional Council, develop overall **Environmental Objectives** for the Integrated Catchment Management Plan (ICMP) as required by condition 6 of this consent. The objectives should set out a strategy for a 20 year period (or longer, if appropriate) for the management of stormwater in the catchments covered by this consent.

   The objectives should provide a framework to address any adverse effects stormwater discharges have on receiving environment values and the functions and services that stormwater management provides in relation to urban development and redevelopment. These include consideration of ecological values and processes, water and sediment quality, natural and physical resources, human health and safety, and recreational, cultural and amenity values.

   The consent holder shall submit the environmental objectives for approval to the Manager, Environmental Regulation, Wellington Regional Council, **within 18 months of the granting of this consen**t.
   Any amendments to the environmental objectives shall be to the satisfaction of the Manager, Environmental Regulation, Wellington Regional Council.

   Note: The objectives should be developed with input from the Community as required by condition 11 of this consent.

Integrated Catchment Management Plan (ICMP)

6. The consent holder shall prepare and implement an **Integrated Catchment Management Plan (ICMP)** to cover all of the catchments authorised by consent WGN090219. The ICMP shall be prepared in two stages as outlined in condition 7 and 8 of this consent. The ICMP shall identify and address the management of existing and future water quality and sediment contamination issues related to the stormwater discharges covered by this consent and be in accordance with the environmental objectives approved under condition 5 of this consent. The assessments and development of the ICMP shall be undertaken by a suitably qualified and experienced person(s).

   Note: It is acknowledged that these consents relate only to stormwater discharges into the coastal marine area, and thus the ICMP prepared under this condition cannot be expected to address all surface water issues (such as flooding, on-site management of stormwater flows and water quality in streams). The ICMP required by this consent is expected to be prepared in a way that enables other aspects of catchment management to be added over time, and is the first stage of an ongoing water management partnership between the Wellington City Council (as consent holder), Wellington Regional Council (as consent authority) and the community .

   Note: The ICMP required by this condition, condition 6 of WGN090219 [27419], condition 6 of WGN090219 [30500] and condition 6 of WGN090219 [30501] can be combined into a single ICMP report.

Stage 1 of the ICMP development

7. The consent holder shall submit to the Manager, Environmental Regulation, Wellington Regional Council, **Stage 1 of the ICMP** as required by condition 6 of this consent. Stage 1 of the ICMP shall apply to the whole of the catchments covered by this consent and shall include, but not be limited to, the following:

Stormwater catchment characteristics and descriptions

a) Plans and descriptions of the stormwater network, catchments, and receiving environments covered by this consent. As a minimum, the plans and descriptions shall include information on:

i. Catchment areas and their boundaries and the location of major stormwater outfalls (including streams and the coast) and the network within that catchment

ii. Existing and potential land uses that are permitted under the Wellington City District Plan. Land uses shall be categorised and described in relation to their potential to generate increased runoff and stormwater contaminants to the stormwater network, and an estimate of the rate and extent of the likely changes in land use shall be included.

This information shall be updated, if appropriate, following any proposed or operative changes to the Wellington City District Plan which may result in the changes to the description.

iii. The location and description of industries and other high risk facilities (for example, landfills and/or factories) that may potentially make a disproportionate contribution to stormwater contamination

iv. The location and description of current stormwater management and treatment devices, including the sub-catchment areas serviced by those devices

v. The location and description of constructed wastewater to stormwater overflows, wastewater pump stations and wastewater storage facilities, and

vi. A description of the ecological, recreational, amenity and cultural values, and environmental quality of the receiving environments potentially affected by stormwater discharges authorised by this consent. The descriptions shall also include an assessment of recreational use (including food gathering) in the receiving environments. These descriptions shall be undertaken by a suitably qualified and experienced person(s).

Environmental objectives

b) The approved environmental objectives developed under condition 5 of this consent

Identification and assessment of stormwater network issues and contaminants

c) The identification of flooding and overland flow in relation to stormwater discharges, an assessment of the associated issues and an outline of the options to address these issues, and the development of options for their management

d) The identification and assessment of wastewater overflow and infiltration issues within the stormwater network, and the development of options for their management to prevent or

minimise them

e) The identification of types, sources and loads of sediment and key physical and chemical contaminants in stormwater, and predictions of future trends in key chemical contaminant loads. Key chemical contaminants include, but are not limited to, copper, zinc and polycyclic aromatic hydrocarbons

f) An assessment of the effects of chemical stormwater contaminants on the coastal receiving environment and expected trends in chemical contamination in the coastal receiving environment

g) Methods and a timetable (including, as relevant, annual commitments) to manage issues which are to be addressed on the basis of the whole area covered by these consents, (for example, public education about stormwater and contaminants; any changes to policies, plans, bylaws or standards; ongoing network maintenance and management programmes, strategic upgrades and/or additions to the stormwater network; memoranda of understanding with parties with city-wide interests); and

h) Identification and prioritisation of areas, and a timetable for the development of catchment-specific plans to be prepared in Stage 2 of the ICMP.

The consent holder shall submit **Stage 1 of the ICMP** for approval to the Manager, Environmental Regulation, Wellington Regional Council, **within 3 years of the consent being granted**.

Any amendments to the content of the ICMP, shall be to the approval of the Manager, Environmental Regulation, Wellington Regional Council.

Stage 2 of the ICMP development

8. The consent holder shall submit to the Manager, Environmental Regulation, Wellington Regional Council **Stage 2 of the ICMP** as required under condition 6 of this consent. Stage 2 of the ICMP shall progressively prepare and implement catchment specific plans in accordance with the approved Stage 1 timetable required under condition 7(g). All catchment specific plans developed under Stage 2 of the ICMP shall be complete **within 7 years of consent being granted**.

Stage 2 of the ICMP shall include, but not be limited to, the following:

Management options

a) A catchment by catchment (or group of catchments) assessment of options for the management/treatment of stormwater, including the identification of specific options for addressing wastewater infiltration, and managing stormwater quality and quantity. These options should be developed in accordance to the priority and timetable outlined and approved in Stage 1 of the ICMP

b) A statement of appropriate specific targets, standards or other performance benchmarks to be met on a specified timetable for each catchment (or group of catchments)

c) The identification of preferred methods, including works, management solutions and any other actions, and the development of a programme to meet the stated targets

and standards for each catchment (or group of catchments), and

Note: The preferred methods and the timetable for each catchment or group of catchments is to be identified taking into account the practical, financial and environmental implications of each option relative to other options, the current state of technical knowledge and the likelihood that each option can be successfully implemented. This information is to be provided to the Manager, Environmental Regulation, Wellington Regional Council.

d) A statement of actions and timeframes for the undertaking of the methods, and the achievement of the targets standards or other performance benchmarks developed in accordance with (b) and (c) of the ICMP above for each catchment (or group of catchments).

Any amendments to the content of the ICMP, shall be to the approval of the Manager, Environmental Regulation, Wellington Regional Council.

Implementation of the Integrated Catchment Management Plan

9. The methods identified in accordance with condition 7(g) and the timetable for the development of catchment specific plans in accordance with condition 7(h) shall be implemented by the Consent Holder once written approval for Stage 1 of the ICMP is obtained from the Manager, Environmental Regulation, Wellington Regional Council. Actions and their associated timeframes developed in accordance with conditions 8(c) and 8(d) shall be progressively implemented as catchment specific plans developed in accordance with condition 8 are approved by the Manager, Environmental Regulation, Wellington Regional Council within Stage 2.

Appendix B: Table of Contents of Stage 1 Report

Contents

Appendices