



Annual coastal monitoring report for the Wellington region, 2006/07

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Contents

1.	Introduction	1
2.	Microbiological water quality monitoring	2
2.1	Introduction	2
2.2	Monitoring protocol	2
2.3	Results	3
3.	Broad-scale habitat and substrate survey of sandy beaches and river estuaries along the Wairarapa coast	7
3.1	Introduction	7
3.2	Survey methods	7
3.3	Survey findings	8
3.3.1	Habitats identified	8
3.3.2	Vulnerability assessment	10
3.3.3	Monitoring recommendations	10
3.4	Next steps	11
4.	Wellington Harbour sediment quality investigation	12
4.1	Introduction	12
4.2	Sampling sites	12
4.3	Sampling methods	13
4.3.1	Sediments	13
4.3.2	Benthic ecology	13
4.4	Sampling results	13
4.5	Next steps	13
5.	Porirua Harbour risk assessment and monitoring	14
6.	References	15
	Appendix 1: Microbiological water quality monitoring sites	16
	Appendix 2: Wellington Harbour sediment sampling sites	18

1. Introduction

Greater Wellington Regional Council (Greater Wellington) has a responsibility to manage and monitor near-shore coastal waters¹ in the Wellington region. Historically, coastal monitoring has focused primarily on microbiological water quality, reflecting the high usage of much of the region's coastline for contract recreation such as swimming and surfing (Figure 1.1). Periodic assessments of contaminants in shellfish flesh are also undertaken at selected sites (e.g., Milne 2006) and at Castlepoint and Riversdale in the eastern Wairarapa, beach profiling has been undertaken on a regular basis.

In recent years, monitoring has expanded into coastal ecology and sediment quality, with a key focus being the effects of urban stormwater on our coastal harbour environments. Greater Wellington is now working on a coastal monitoring strategy for the Wellington region, with a view to implementing a long-term coastal monitoring programme in the near future.

This report summarises coastal monitoring that Greater Wellington's Environmental Monitoring and Investigations Department has been involved with over the 2006/07 year. This includes:

- microbiological water quality monitoring (undertaken as part of a recreational water quality monitoring programme);
- a broad-scale habitat and substrate survey of the Wairarapa coastline;
- an investigation into sediment quality in Wellington Harbour; and
- an assessment of risks to the health of the Porirua Harbour system.



Figure 1.1: Surfer at Lyall Bay, Wellington City

¹ Greater Wellington's coastal marine jurisdiction lies from mean high water springs to 12 nautical miles offshore.

2. Microbiological water quality monitoring

2.1 Introduction

Microbiological water quality was monitored at 76 marine sites across the Wellington region over 2006/07 (Figure 2.1, Appendix 1), as follows:

- Kapiti Coast District – 20 sites
- Porirua City – 14 sites
- Hutt City – 15 sites
- Wellington City – 22 sites
- Wairarapa – 5 sites

Monitoring was a joint effort involving Greater Wellington, Kapiti Coast District Council, Porirua City Council, Hutt City Council, and Wellington City Council. The sites monitored reflect their use by the public for contact recreation; in particular, swimming, surfing, and boating.

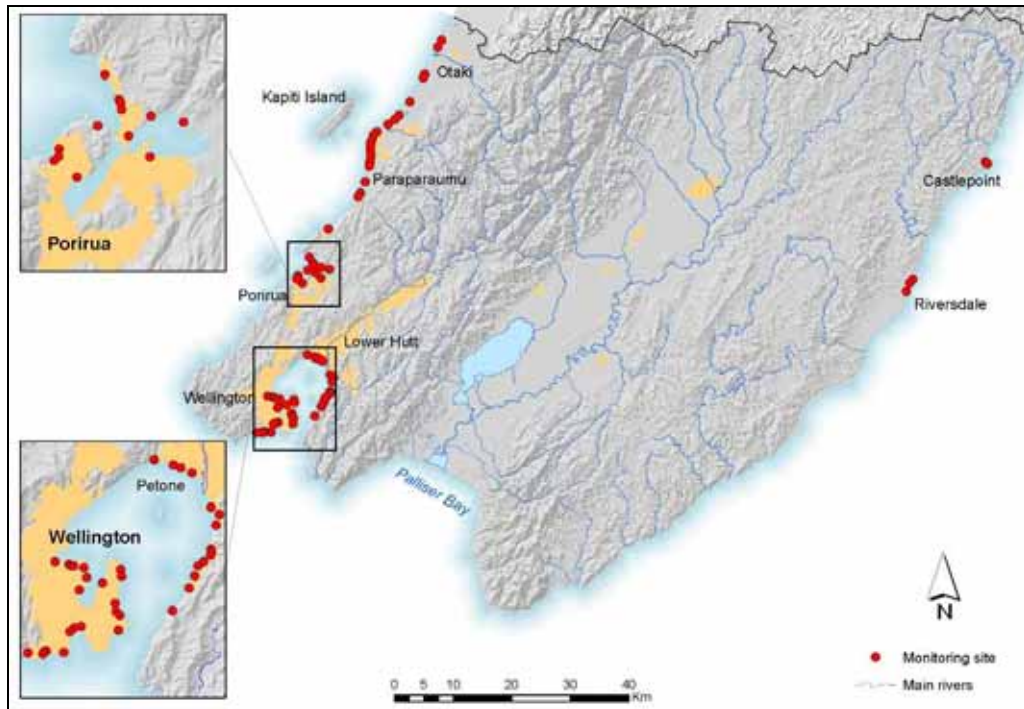


Figure 2.1: Marine sites monitored over 2006/07

2.2 Monitoring protocol

Sites were sampled weekly during the summer bathing season (1 November to 31 March inclusive) as part of Greater Wellington’s recreational water quality monitoring programme (refer Milne 2007), and at least monthly during the remainder of the year². On each sampling occasion a single water sample was collected 0.2 metres below the surface in 0.5 metres water depth and analysed

² Camp Bay (Hutt City), Breaker Bay (Wellington City), Princess Bay (Wellington City) and Riversdale Beach South (Wairarapa) were sampled fortnightly during the summer months (refer Milne 2007). All sites in Wellington City were sampled fortnightly during April to October inclusive.

for enterococci indicator bacteria using a membrane filtration method. In addition, water samples from six sites popular for recreational shellfish gathering were tested for faecal coliform indicator bacteria (Appendix 1).

Observations of weather and the state of the tide, and visual estimates of seaweed cover, were made at each site to assist with the interpretation of the monitoring results. For example:

- Rainfall may increase enterococci counts by flushing accumulated debris from urban and agricultural areas into coastal waters.
- Wind direction can influence the movement of currents along the coastline and can therefore affect water quality at a particular site.
- In some cases, an increase in enterococci counts may be due to the presence of seaweed. Under warm conditions when seaweed is excessively photosynthesising or decaying, enterococci may feed off the decayed seaweed or increased carbonaceous material produced by the seaweed during photosynthesis.

An estimate of the daily rainfall in the catchment adjoining each site over the bathing season was made by obtaining records from the nearest rain gauge.

A list of field and laboratory methods can be found in Milne (2007).

2.3 Results

The results of microbiological water quality testing undertaken during the official summer bathing season are discussed in detail in *On the Beaches 2006/07: Annual recreational water quality monitoring report for the Wellington region* (Milne 2007). Tables 2.1 and 2.2 summarise the median, 95th percentile and maximum enterococci and faecal bacteria counts recorded from all monitoring conducted during the period 1 July 2006 to 30 June 2007 for each of the 76 marine sites (i.e., these statistics include the results of additional follow-up sampling conducted in response to an exceedance of the Ministry for the Environment/Ministry of Health (2003) microbiological water quality guidelines).

The majority of marine sites recorded their highest indicator bacteria counts outside of the summer bathing season and these high counts often coincided with rainfall. The highest enterococci count (7,000 cfu/100 mL) was recorded in Aotea Lagoon in Wellington City on 2 May 2007; 58.8 mm of rain had fallen in the 48 hours prior to sampling.

Table 2.1: Summary of enterococci counts recorded at 76 marine sites monitored over 1 July 2006 to 30 June 2007 inclusive

Bathing Site	Total no. of samples	Enterococci (cfu/100 mL)		
		Median	95 th percentile	Max
<i>Kapiti Coast</i>				
Otaki Beach @ Surf Club	30	5	192	1,150
Otaki Beach @ Rangioru Rd	30	5	237	1,130
Te Horo Beach S of Mangaone Strm	36	35	559	740
Te Horo Beach @ Kitchener St	30	8	208	530
Peka Peka Beach @ Rd End	29	10	118	285
Waikanae Beach @ William St	28	12	92	110
Waikanae Beach @ Tutere St T.C.	28	10	78	100
Waikanae Beach @ Ara Kuaka C.P.	30	17	155	230
Paraparaumu Beach @ Ngapotiki St	31	25	165	315
Paraparaumu Beach @ Nathan Ave	28	13	73	120
Paraparaumu Beach @ Maclean Pk	30	18	236	320
Paraparaumu Beach @ Toru Rd	28	12	60	70
Paraparaumu Beach @ Wharemauku Rd	28	10	63	90
Raumati Beach @ Tainui St	28	8	98	125
Raumati Beach @ Marine Gardens	29	16	125	230
Raumati Beach @ Aotea Rd	28	5	60	120
Raumati Beach @ Hydes Rd	28	4	62	70
Paekakariki Beach @ Whareroa Rd	28	5	58	100
Paekakariki Beach @ Surf Club	28	4	30	115
Paekakariki Beach @ Memorial Hall	28	3	62	140
<i>Porirua</i>				
Pukerua Bay	31	2	526	2,000
Karehana Bay @ Cluny Rd	34	8	519	2,400
Plimmerton Beach @ Bath St	32	8	1,630	2,800
Plimmerton Beach @ Queens Ave	32	11	645	1,000
South Beach @ Plimmerton	34	20	535	1,100
Paremata Beach @ Pascoe Ave	32	4	257	2,000
Pauatahanui Inlet @ Water Ski Club	30	4	1,385	4,000
Pauatahanui Inlet @ Motukaraka Pt	34	8	1,035	2,100
Pauatahanui Inlet @ Browns Bay	33	20	927	5,200
Porirua Harbour @ Rowing Club	29	8	114	276
Titahi Bay @ Bay Drive	35	16	299	1,600
Titahi Bay at Toms Rd	34	8	370	600
Titahi Bay @ South Beach Access Rd	32	9	352	900
Onehunga Bay	28	4	23	30
<i>Hutt</i>				
Petone Beach @ Water Ski Club	31	2	145	1,140
Petone Beach @ Sydney St	30	4	98	1,100
Petone Beach @ Settlers Museum	32	6	394	1,600
Petone Beach @ Kiosk	32	3	863	2,000

Table 2.1 *cont.*: Summary of enterococci counts recorded at 76 marine sites monitored over 1 July 2006 to 30 June 2007 inclusive

Site	Total no. of samples	Enterococci (cfu/100 mL)		
		Median	95 th percentile	Max
<i>Hutt</i>				
Sorrento Bay	29	2	16	56
Lowry Bay @ Cheviot Rd	29	4	67	130
York Bay	30	2	23	250
Days Bay @ Wellesley College	29	4	67	130
Days Bay @ Wharf	29	4	78	92
Days Bay @ Moana Rd	31	2	113	210
Rona Bay @ N end of Cliff Bishop Pk	30	14	159	320
Rona Bay @ Wharf	32	4	146	230
Robinson Bay @ HW Shortt Rec Grd	33	8	432	1,700
Robinson Bay @ Nikau St	30	4	100	240
Camp Bay	20	2	79	520
<i>Wellington City</i>				
Aotea Lagoon	37	12	692	7,000
Oriental Bay @ Freyberg Beach	36	2	50	2,600
Oriental Bay @ Wishing Well	37	8	152	3,200
Oriental Bay @ Band Rotunda	37	8	186	6,000
Balaena Bay	36	2	64	640
Kio Bay	36	2	53	840
Hataitai Beach	36	4	298	2,400
Shark Bay	36	2	95	2,400
Mahanga Bay	36	2	30	330
Scorching Bay	36	2	13	48
Worser Bay	36	2	103	580
Seatoun Beach @ Wharf	35*	2	22*	840*
Seatoun Beach @ Inglis St	36	4	29	960
Breaker Bay	26	2	26	60
Lyll Bay @ Tirangi Rd	40	4	137	4,700
Lyll Bay @ Onepu Rd	39	4	741	4,600
Lyll Bay @ Queens Drive	39	2	220	800
Princess Bay	27	2	132	4,100
Island Bay @ Surf Club	39	8	352	1,100
Island Bay @ Reef St Recreation Grd	41	20	1,700	5,000
Island Bay @ Derwent St	36	2	115	260
Owhiro Bay	44	4	269	2,400
<i>Wairarapa</i>				
Castlepoint Beach @ Castlepoint Strm	28	7	151	180
Castlepoint Beach @ Smelly Creek	28	11	58	2,000
Riversdale Beach @ Lagoon Mouth	27	4	87	302
Riversdale Beach Between the Flags	27	2	28	46
Riversdale Beach South	16	7	22	23

* One erroneous result (51,000 cfu/100 mL, recorded on 7 August 2006) has been removed from the data-set for this site.

Table 2.2: Summary of faecal coliform counts recorded at six marine sites monitored over 1 July 2006 to 30 June 2007 inclusive

Site	Total no. of samples	Faecal coliforms (cfu/100 mL)		
		Median	95 th percentile	Max
<i>Kapiti Coast</i>				
Otaki Beach @ Surf Club	30	20	642	2,500
Peka Peka Beach @ Rd End	29	25	571	700
Raumati Beach @ Hydes Rd	28	5	465	850
<i>Hutt</i>				
Sorrento Bay	28	2	50	88
<i>Wellington City</i>				
Shark Bay	36	2	565	1,100
Mahanga Bay	36	2	43	140

3. Broad-scale habitat and substrate survey of sandy beaches and river estuaries along the Wairarapa coast

3.1 Introduction

Over the last few years Greater Wellington has engaged coastal scientists from the Cawthron Institute and Wriggle Coastal Management Limited to undertake broad-scale surveys and mapping of the types of substrate (e.g., firm sand, soft sand, mud, gravel) and vegetation (e.g., grasses, duneland, exotic weeds) present along various sandy beaches and river estuaries around the region's coastline. Wellington Harbour and Wellington's South Coast were mapped in 2004 (Stevens & Robertson 2004), while the sandy beaches and river estuaries on the Kapiti Coast, Plimmerton, Titahi Bay, and Makara Estuary were mapped in 2005 (Robertson & Stevens 2006).

The Wairarapa coastline was mapped during 2006/07 (Robertson & Stevens 2007a). This is the first time that a comprehensive ecological study has been undertaken along the entire Wairarapa coastline. Other studies have only concentrated on very small areas of one or more estuaries or dune formations.

Information from the habitat surveys fills a gap in our ecological understanding of coastal biodiversity and is being used to assist with the preparation of a coastal monitoring strategy for the entire Wellington region. The information is also useful in resource consent assessments and policy development (e.g., habitat information can be used to indicate the organisms likely to be present in certain areas, and the sensitivity of different areas to certain pressures).

3.2 Survey methods

The broad-scale survey examined the types of substrate and vegetation present along the entire Wairarapa coastline from Owahanga Estuary (just north of Greater Wellington's regional boundary) to Baring Head on the Wainuiomata coast, west of Orongorongo (217 km length). Data for the survey were collected during December 2006 when the whole of the Wairarapa coastline was visited over a two to three week period (Robertson & Stevens 2007a).

Habitat cover was recorded onto laminated aerial photographs and subsequently digitised and entered into a GIS framework³. Information was also gathered on the various uses and values of the coastal areas (e.g., swimming, shellfish collection, natural character) and the likely pressures present (e.g., erosion, nutrient enrichment, grazing, climate change). This information was later used to determine a "vulnerability rating" ('low', 'moderate' or 'high') for each estuary or beach, derived by assessing its existing condition (health) and its susceptibility to adverse effects (e.g., sedimentation, eutrophication, habitat loss).

³ This produced coastal habitat maps in the form of an Arcmap GIS data set that depict current substrate and vegetation cover types, based on both aerial photography and ground truthing techniques.



Figure 3.1: Leigh Stevens (Wriggle Coastal Management) checking salinity at the mouth of the Oterei River on the south eastern Wairarapa Coast

(Source: Wriggle Coastal Management)

3.3 Survey findings

The mapping and risk assessment study identified an exposed and rugged coastline backed by erosion-prone, soft sedimentary rock and primarily grassland catchments except for the southern section where some hard rock catchments appear and scrub and forest become the dominant vegetation cover (Robertson & Stevens 2007a). The soft rock catchments and absence of scrub or forest cover cause high sediment runoff to the estuaries and coast (north of Tora and in Palliser Bay). Erosion of cliffs, duneland and grassland was also evident along many sections of the coast.

3.3.1 Habitats identified

The study identified a wide range of coastal shoreline habitats including:

- Rocky shores (121 km of the 217 km long coastline): primarily soft sedimentary rock platform reefs and turbid water to the north and hard boulder and rockfield shores to the south. Each rock type has its own biological diversity.
- Beaches (107 km): primarily broad, flat, sandy beaches with white sand and wide surf zones to the north (bathed by cloudy waters) which progressively change towards the south to moderately steep beaches, coarser grained sands to very steep beaches (no surf zone) and clear waters. Biodiversity is greatest in the least harsh environments to the north (Robertson & Stevens 2007a).

- Dunes (104 km): tend to be very thin or absent, dominated by marram grass and grazed by stock. Only in Cape Palliser are there areas dominated by native duneland species. Biodiversity is greatest in these areas (Robertson & Stevens 2007a).
- Estuaries: the Wairarapa coast has 14 moderate sized estuaries, including 12 river mouth lagoon estuaries, one shallow coastal estuary (Lake Onoke) and one tidal river estuary (Whareama Estuary). There are also a further 60-70 very small estuaries, predominantly river mouth lagoon (hapua) estuaries. Because of the exposure to high seas the estuaries tend to regularly block up, especially in the summer months (Figure 3.2). The lagoons tend to be small with saline water intrusion extending only a few hundred metres upstream or not at all. Tidal flats are rare or absent and biodiversity is generally low. In addition, such estuaries are extremely susceptible to water and sediment quality degradation during periods of mouth restriction. However in high flows the mouths unblock and are flushed clean (Robertson & Stevens 2007a).
- Hinterland (inland of beaches and estuaries): landward of the coastline the predominant land use is extensive grassland farming of sheep and cattle (75% cover) with areas of exotic forestry and scrub (17% cover). The catchment of Lake Onoke is the only one that differs from this pattern with more intensive farming, including dairying.



Figure 3.2: The blocked mouth of the Rerewhakaitu River on the eastern Wairarapa coast

(Source: Wriggle Coastal Management)

3.3.2 Vulnerability assessment

The major issues in terms of the vulnerability of coastal habitats were identified as –

- Climate change: loss of habitat and biodiversity from sea level rise. This will lead to removal or inland migration of sea-cliffs, shingle beaches, sandy shores and salt marsh habitats due to enhanced erosion.
- Coastal erosion: soft rock areas north of Tora are particularly susceptible to loss of dunes, beaches and cliff habitat.
- Estuary water and sediment quality: threat to water quality from land use intensification (e.g., Lake Onoke).
- Invasion of marram grass: this species over-stabilises sand dunes and results in the reduction of sand released to the foreshore during storm events.

Despite these issues, the majority of the Wairarapa coastal habitats rated in the 'low' or 'low to moderate' classes for ecological vulnerability (Robertson & Stevens 2007a).

3.3.3 Monitoring recommendations

Robertson and Stevens (2007a) recommended a long term coastal monitoring programme for the Wairarapa coast. The programme should:

- Monitor the major stressors leading to degradation of estuaries, including major land use change, every five years.
- Monitor the long-term condition of Lake Onoke. This lake receives significant inputs of sediment, nutrients and pathogens and is susceptible to ecological deterioration.
- Monitor the long-term condition (benthic fauna and sediment quality) in representative Wairarapa estuaries with the highest biodiversity (e.g., Whareama Estuary).
- Measure the presence of marram grass and other invasive weed species.
- Measure the reduction in duneland through sea level rise, erosion, grazing and property development.
- Establish one long-term monitoring site for dissipative beach types (most species rich) between Castlepoint and Whakataki River to assess any reduction in biodiversity through climate change.
- Establish one long-term monitoring site in both soft rock substrate (i.e., Flat Point) and hard rock substrate (i.e., Cape Palliser) to assess any reduction in biodiversity through climate change.

3.4 Next steps

Implementation of the monitoring recommendations (Section 3.3.3) is currently being considered, alongside other coastal monitoring priorities in the Wellington region (e.g., mapping of seagrass and eelgrass cover in Porirua Harbour). A synoptic survey and risk analysis of Lake Onoke is planned for 2007/08 – this will assist in identifying appropriate monitoring and management options for the lake.

4. Wellington Harbour sediment quality investigation

4.1 Introduction

During 2006/07, sediment quality in Wellington Harbour was investigated, the first comprehensive assessment since the survey by Stoffers *et al.* (1986) in 1984. The primary aims of the investigation were:

- To make an initial assessment of the Wellington Harbour receiving environment in terms of sediment quality and benthic community health to provide a sound scientific basis for any management response in relation to urban stormwater discharges and other on-going contaminant inputs.
- To select the monitoring sites that will be used to detect changes in sediment quality and benthic community health over time, thereby allowing ongoing evaluation of urban stormwater management actions directed at the Wellington Harbour receiving environment.

Wellington City Council and Hutt City Council assisted with funding for the investigation.

4.2 Sampling sites

Seventeen sub-tidal sites were sampled in Wellington Harbour over October-November 2006 (Figure 4.1, Appendix 2).

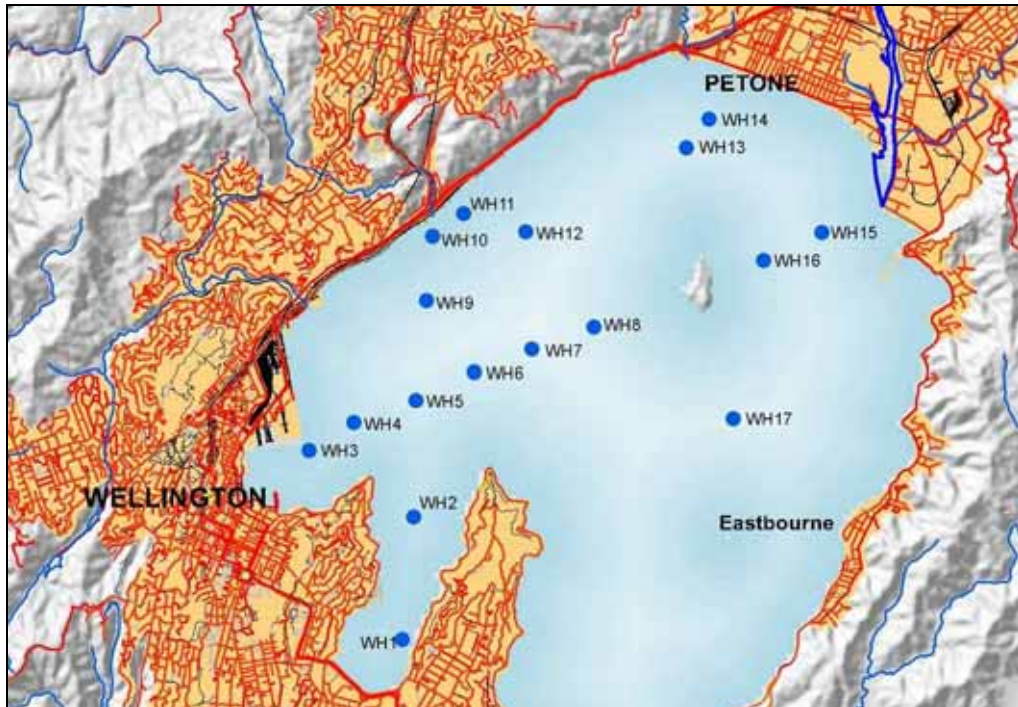


Figure 4.1: Map of Wellington Harbour showing the locations of sediment quality and benthic fauna sites sampled over October-November 2006

4.3 Sampling methods

Samples were collected by the use of a boat, GPS and scuba divers using similar protocol to recent surveys of contaminants in Porirua Harbour sediments (Williamson *et al.* 2005, Stephenson and Mills 2006).

4.3.1 Sediments

Twenty five sediment core samples were collected from a sampling area 20 m in diameter, with samples randomly assigned into five replicate groups for analysis (top 30 mm). Samples are currently being analysed for a range of contaminants likely to be present in the harbour sediments, including metals (weak acid-extractable and total), PAHs, organochlorine pesticides, and organotin compounds. Particle size analysis is also being conducted on samples from each site, along with an assessment of total organic carbon content.

4.3.2 Benthic ecology

Eight “benthos” sediment core samples were collected from an area adjacent to each sediment sampling site. These samples were sieved on a 500 micron screen, fixed in 5% formalin in seawater, and later rinsed from fixative and preserved in 70% isopropyl alcohol. Processing included:

- identification (to the lowest taxonomic level practicable) and enumeration of benthic fauna under a binocular microscope;
- measurement of shell lengths of selected species (e.g., bivalves); and
- selection and labelling of specimens for a reference collection.

4.4 Sampling results

At the time of preparing this report, sediment sample analysis was still being completed. Results will be available later in 2007/08.

In terms of the benthic fauna, a total of 102 species were found, mainly polychaete worms, crustaceans, bivalve molluscs and nemertean worms (Stephenson 2007). Among the named species only one, the bivalve *Theora lubrica*, is an introduced species.

4.5 Next steps

A detailed report documenting the aims, methods and results of the Wellington Harbour sediment quality investigation will be prepared later in 2007/08 once all of the sediment quality analyses have been completed. This report will also set out recommendations for future monitoring in Wellington Harbour.

5. Porirua Harbour risk assessment and monitoring

In April 2007, Greater Wellington and Porirua City Council engaged Wriggle Coastal Management to prepare a brief overview of the key issues and risks to the health of the Porirua Harbour system, including areas where further investigations, monitoring or research may be required. This involved a desk-top review of existing information⁴ compiled by Greater Wellington and a site visit.

The review confirmed that the key risks related to sediment quantity and quality, nuisance macroalgae blooms (sea lettuce, Figure 5.1), microbiological contamination and habitat loss (Robertson & Stevens 2007b). In addition to recommendations relating to tracking catchment land use over time and identifying various best management practices, a range of monitoring was recommended, incorporating:

- broadscale mapping of the existing substrate and vegetation types, including eel grass and salt marsh beds as well as macroalgal density;
- deployment of sedimentation plates to measure sedimentation rates on an annual basis; and
- fine-scale inter-tidal monitoring of selected sediment condition indicators, including heavy metals, organic matter, sediment grain size and macroinvertebrate abundance and diversity.

This monitoring is set to commence later in 2007/08 and will complement previous monitoring to date, including the 2004 and 2005 investigations of sub-tidal sediments (Williamson *et al.* 2005, Stephenson and Mills 2006).



Figure 5.1: Sea lettuce (*Ulva* sp.) and eelgrass (*Zostera* spp.) on the inter-tidal flats at the southern end of the Onepoto Arm of the Porirua Harbour

⁴ A range of monitoring and investigations have been undertaken in Porirua Harbour by Greater Wellington and other organisations to date, including microbiological water quality monitoring, shellfish flesh testing, stormwater and sediment quality and quantity investigations, cockle counts, and water quality and ecological health monitoring in tributary streams.

6. References

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⁵ Published June 2002, updated June 2003.

Appendix 1: Microbiological water quality monitoring sites

Area	Site Name	NZ Map Grid		Type
		Easting	Northing	
Hutt	Petone Beach @ Water Ski Club	2665765	5996304	Marine
Hutt	Petone Beach @ Sydney Street	2667067	5995961	Marine
Hutt	Petone Beach @ Settlers Museum	2667577	5995770	Marine
Hutt	Petone Beach @ Kiosk	2668348	5995425	Marine
Hutt	Sorrento Bay	2669654	5993098	Marine*
Hutt	Lowry Bay @ Cheviot Road	2670228	5992605	Marine
Hutt	York Bay	2669999	5991874	Marine
Hutt	Days Bay @ Wellesley College	2669639	5990243	Marine
Hutt	Days Bay @ Wharf	2669677	5990027	Marine
Hutt	Days Bay @ Moana Road	2669605	5989834	Marine
Hutt	Rona Bay @ N end of Cliff Bishop Park	2669132	5989367	Marine
Hutt	Rona Bay @ Wharf	2668753	5989084	Marine
Hutt	Robinson Bay @ HW Shortt Rec Ground	2668542	5988387	Marine
Hutt	Robinson Bay @ Nikau Street	2668154	5987569	Marine
Hutt	Camp Bay	2667013	5986001	Marine
Kapiti	Otaki Beach @ Surf Club	2688639	6050044	Marine*
Kapiti	Otaki Beach @ Rangiu Road	2688028	6048783	Marine
Kapiti	Te Horo Beach S of Mangaone Stream	2685797	6044192	Marine
Kapiti	Te Horo Beach @ Kitchener Street	2685513	6043648	Marine
Kapiti	Peka Peka Beach @ Road End	2683233	6039620	Marine*
Kapiti	Waikanae Beach @ William Street	2681406	6037299	Marine
Kapiti	Waikanae Beach @ Tutere St Tennis Courts	2680673	6036577	Marine
Kapiti	Waikanae Beach @ Ara Kuaka Carpark	2679532	6035693	Marine
Kapiti	Paraparaumu Beach @ Ngapotiki Street	2677561	6034477	Marine
Kapiti	Paraparaumu Beach @ Nathan Avenue	2677051	6033889	Marine
Kapiti	Paraparaumu Beach @ Maclean Park	2676712	6032982	Marine
Kapiti	Paraparaumu Beach @ Toru Road	2676595	6032430	Marine
Kapiti	Paraparaumu Beach @ Wharemauku Road	2676521	6031785	Marine
Kapiti	Raumati Beach @ Tainui Street	2676549	6030944	Marine
Kapiti	Raumati Beach @ Marine Gardens	2676535	6030156	Marine
Kapiti	Raumati Beach @ Aotea Road	2676433	6029244	Marine
Kapiti	Raumati Beach @ Hydes Road	2676337	6028550	Marine*
Kapiti	Paekakariki Beach @ Whareroa Road	2675617	6025843	Marine
Kapiti	Paekakariki Beach @ Surf Club	2674810	6023988	Marine
Kapiti	Paekakariki Beach @ Memorial Hall	2674452	6023305	Marine
Porirua	Pukerua Bay	2669309	6017968	Marine
Porirua	Karehana Bay @ Cluny Road	2666113	6013074	Marine
Porirua	Plimmerton Beach @ Bath Street	2666726	6012030	Marine
Porirua	Plimmerton Beach @ Queens Avenue	2666790	6011888	Marine
Porirua	South Beach @ Plimmerton	2666830	6011588	Marine
Porirua	Paremata Beach @ Pascoe Avenue	2667137	6010447	Marine
Porirua	Pauatahanui Inlet @ Water Ski Club	2668094	6011307	Marine
Porirua	Pauatahanui Inlet @ Motukaraka Point	2669506	6011052	Marine
Porirua	Pauatahanui Inlet @ Browns Bay	2668059	6009547	Marine
Porirua	Porirua Harbour @ Rowing Club	2664911	6008661	Marine*
Porirua	Titahi Bay @ Bay Drive	2664152	6009883	Marine
Porirua	Titahi Bay at Toms Road	2664130	6009571	Marine
Porirua	Titahi Bay @ South Beach Access Road	2663926	6009396	Marine
Porirua	Onehunga Bay	2665816	6010895	Marine

Area	Site Name	NZ Map Grid		Type
		Easting	Northing	
Wairarapa	Castlepoint Beach @ Castlepoint Stream	2781366	6029287	Marine
Wairarapa	Castlepoint Beach @ Smelly Creek	2781670	6028931	Marine
Wairarapa	Riversdale Beach @ Lagoon Mouth	2768974	6009275	Marine
Wairarapa	Riversdale Beach Between the Flags	2768445	6008680	Marine
Wairarapa	Riversdale Beach South	2767844	6007246	Marine
Wellington	Aotea Lagoon	2659007	5989395	Marine
Wellington	Oriental Bay @ Freyberg Beach	2659942	5989176	Marine
Wellington	Oriental Bay @ Wishing Well	2660140	5989098	Marine
Wellington	Oriental Bay @ Band Rotunda	2660265	5989087	Marine
Wellington	Balaena Bay	2660980	5988979	Marine
Wellington	Kio Bay	2661163	5988311	Marine
Wellington	Hataitai Beach	2660654	5987442	Marine
Wellington	Shark Bay	2662233	5987909	Marine*
Wellington	Mahanga Bay	2663490	5988828	Marine*
Wellington	Scorching Bay	2663539	5988360	Marine
Wellington	Worser Bay	2663097	5986535	Marine
Wellington	Seatoun Beach @ Wharf	2663152	5985946	Marine
Wellington	Seatoun Beach @ Inglis Street	2663428	5985706	Marine
Wellington	Breaker Bay	2663335	5984682	Marine
Wellington	Lyll Bay @ Tirangi Road	2660770	5984942	Marine
Wellington	Lyll Bay @ Onepu Road	2660309	5984828	Marine
Wellington	Lyll Bay @ Queens Drive	2660013	5984580	Marine
Wellington	Princess Bay	2659609	5983216	Marine
Wellington	Island Bay @ Surf Club	2658400	5983302	Marine
Wellington	Island Bay @ Reef St Recreation Ground	2658252	5983254	Marine
Wellington	Island Bay @ Derwent Street	2658178	5983127	Marine
Wellington	Owhiro Bay	2657145	5983174	Marine

* Water quality is also monitored for recreational shellfish gathering purposes

Appendix 2: Wellington Harbour sediment sampling sites

Site No.	General location	Latitude S	Longitude E	Estimated depth (m)
WH1	Southern Evans Bay	41°18'39.0"	174°48'36.0"	17
WH2	Northern Evans Bay	41°17'36.0"	174°48'42.0"	17
WH3	Lambton Harbour entrance	41°17'03.0"	174°47'30.0"	17
WH4	Lambton Harbour entrance	41°16'48.0"	174°48'00.0"	19
WH5	Central basin	41°16'36.0"	174°48'42.0"	20
WH6	Central basin	41°16'21.0"	174°49'21.0"	21
WH7	Central basin	41°16'09.0"	174°50'00.0"	21
WH8	Central basin	41°15'57.0"	174°50'42.0"	22
WH9	South of Ngauranga	41°15'45.0"	174°48'48.0"	20
WH10	South of Ngauranga	41°15'12.0"	174°48'51.0"	19
WH11	North of Ngauranga	41°15'00.0"	174°49'12.0"	19
WH12	North of Ngauranga	41°15'09.0"	174°49'54.0"	19
WH13	Western Petone	41°14'24.0"	174°51'42.0"	15
WH14	Western Petone	41°14'09.0"	174°51'57.0"	10
WH15	Seaview	41°15'06.0"	174°53'15.0"	15
WH16	Seaview	41°15'21.0"	174°52'36.0"	19
WH17	North of Ward Island	41°16'42.0"	174°52'18.0"	21