MARLBOROUGH DISTRICT COUNCIL

Coastal Monitoring Strategy, Marlborough

July 2012

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File Reference: E325-003-001
Record No: 12223176

MDC Report No. 12-101

July 2012

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Contents

1. Introduction

1.1. The need for a coastal monitoring strategy for Marlborough

Marlborough has 1,814km of coastline which equates to 17% of New Zealand's coastline; nearly 90% of Marlborough's coastline is located in the Marlborough Sounds. Coastal resources are under increasing pressure from recreational users, aquaculture and land use intensification. The requirements of different users need to be balanced with the resources available. Knowledge of Marlborough's coastline is limited and this impinges on the ability to successfully manage the resource for all users. It is therefore important that the Marlborough District Council develops and implements strategies to collect information to be able to determine the condition of Marlborough's coastal resources.

Under the Resource Management Act 1991 (RMA), the Council has a significant role in conjunction with the Minister of Conservation, in managing Marlborough's coastal resources. The Minister of Conservation is responsible for the New Zealand Coastal Policy Statement (NZCPS), the only mandatory National Policy Statement required under the RMA, whose purpose is to state policies to achieve the purpose of the RMA through promoting the sustainable management of natural and physical resources in the marine environment. Some of the key requirements of the NZCPS are the enhancement of water quality, protecting outstanding landscapes, preserving natural character, managing contaminant discharges (including sediments) to the marine environment and avoiding adverse effects on indigenous biological diversity. The Council has to give effect to the NZCPS through the development of policies and plans.

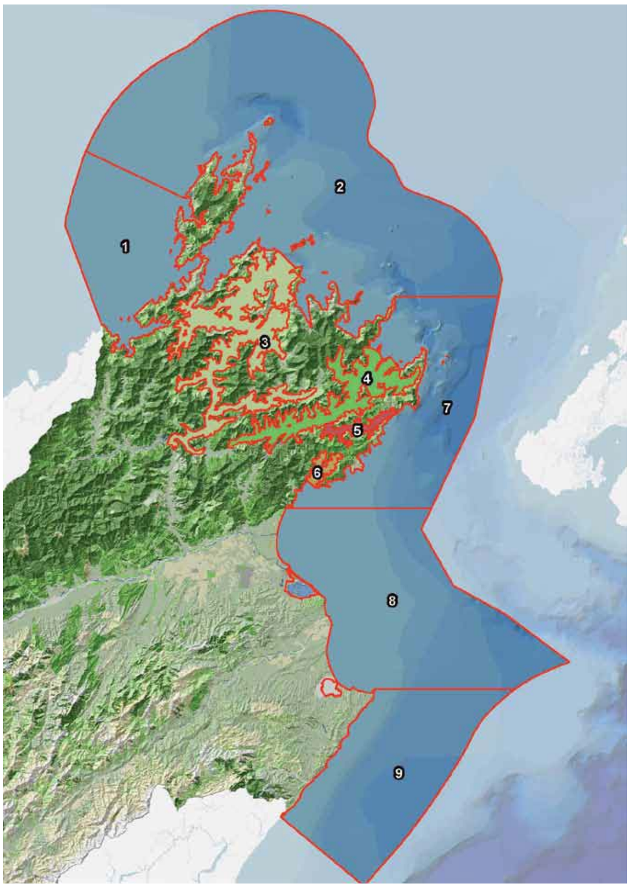
Currently the Council administers the operative Marlborough Regional Policy Statement and the two operative resource management plans – the Marlborough Sounds Resource Management Plan and the Wairau/Awatere Resource Management Plan. These documents set out objectives, policies, rules and other methods to give effect to the requirements of the NZCPS and the RMA. The other methods include monitoring, research or gathering data on matters such as water quality, significant ecological areas, the effects of shipping wake etc as ways in which the objectives of the resource management plans particularly are to be achieved.

The Council is in the midst of reviewing the resource management policies and plans for Marlborough, which eventually will have implications for what is to be monitored. It is anticipated that in the reviewed documents there will be more specifically defined expected outcomes expressed for Marlborough's coastal resources from implementing a new policy framework and consequently greater direction about what is to be monitored.

It is important to remember that good quality data underpins good policy. Good quality monitoring data is vital to supplying objective information from which plans and policies are formulated, administered and then reviewed. Decision making based on poor quality data or no data can result in poor management of resources and ultimately degradation of the natural environment.

1.2. Scope

Marlborough's coastal area is a diverse and dynamic environment with a complex web of physical and ecological processes. A report by Davidson *et al*. (2011) divided the region into nine biogeographic zones (Figure 1), this was the first time the regions coastal environment was zoned. A coastal monitoring strategy should take account of all zones, with monitoring appropriate to the values and risks associated with each zone.



Biogeographic area	Coastline (km)	Offshore area (ha)
1. Tasman Bay	180	66,919
2. Two Bay Point to Cape Jackson	360	277,558
3. Pelorus Sound	590	38,477
4. Queen Charlotte Sound	318	19,553
5. Tory Channel	86	3,004
6. Port Underwood	51	2,347
7. Cape Jackson to Rarangi	137	86,576
8. Rarangi to Cape Campbell	53	138,086
9. Cape Campbell south to Willowa Point	39	93,117
Total	1,814	725,637

Figure 1: Biogeographic areas for the Marlborough region (from Davidson *et al*., 2011)

The scope of the strategy outlined in this report is primarily focused on zones which are deemed as high value and high risk, namely the Marlborough Sounds encompassing the Pelorus Sound zone, the Queen Charlotte Sound zone and the Tory Channel zone. These zones have values associated with recreational use, aquaculture, cultural and ecologically significant sites. The bulk of aquaculture (mussel and finfish) lies within these zones, as do the regions two major ports, Picton and Havelock; the main shipping route between Picton and Wellington; forestry and the bulk of intensive dairy farming (Rai/Pelorus catchments) lie within these zones or impact these zones. In combination these activities present a high risk to the environment. The Marlborough Sounds are important from a recreational and cultural aspect with boating, fishing, diving and kayaking being popular pursuits. The Queen Charlotte Track is a world renowned walking track which is a huge draw to tourists for the region helping to support commercial interests such as water taxis, cafes, restaurants and adventure tourism. The Marlborough Sounds, as a result of encompassing nearly 90% of the regions coastline holds the greatest number of ecologically significant marine sites for the region. No other part of Marlborough's coastline supports such a diverse range of activities and values. Balancing each of these activities requires careful planning and a good knowledge of the environment in which they exist.

2. Historic Coastal Monitoring

Prior to July 2011, monitoring in the coastal environment was limited to measuring bacteria levels at a number of beaches widely used for contact recreation activities. Shellfish were also analysed for bacteria to assess against shellfish gathering standards. Both of these programmes look at only one aspect of the marine environment namely bacteria contamination and its impact on contact recreation. These programmes are ongoing and are dealt with separately from this strategy. More information on the programmes can be found in the reports '*2008 State of the Environment Marlborough*' and

'*Recreational Water Quality Report, 2010-11*'. Council has also undertaken ship wake monitoring in the Queen Charlotte Sound to assess the impact from fast ferries on the coastline and biological monitoring of relocated mussel farms. However the historic monitoring has not had a focussed strategy which has resulted in the limited collection of data for the marine environment with no clear strategy or objectives.

In 2010, Cawthron and NIWA were commissioned, through Envirolink funding[1] to look at structuring state of the environment (SoE) monitoring programmes for the coastal environment and specifically for the Marlborough Sounds coastal environment with the aim of assessing the risks from increased and diversifying interests (Zeldis *et al*., 2011; Gillespie, 2011). The reports identified two areas of the marine environment requiring attention, namely intertidal areas and the Marlborough Sounds marine area.

3. Objectives of a Coastal Monitoring Programme

It is proposed that monitoring in the coastal environment be done in a staged approach to allow for the most efficient use of resources and because of the requirement to undertake initial investigations which inform the long term monitoring.

The principal objectives of the proposed coastal monitoring programme are:

1. To assess the state and trends of the coastal environment in order to comply with the requirements of the RMA, New Zealand Coastal Policy Statement (NZCPS) and Regional Plans.

2. To provide water quality data for the Marlborough Sounds to (i) build and develop hydrodynamic and ecological models (ii) to assess the impacts of land use and aquaculture on water quality in the Sounds (iii) to provide baseline data from which future trends in water quality can be assessed.

3. To assess and monitor the state of ecologically significant marine sites identified by Davidson *et al*. (2011) with the help of a co-ordinated multi-agency approach.

4. Identify and describe new significant sites through field surveys where additional or anecdotal reports indicate significant habitats may be present.

5. Develop a web-based database for the collation of knowledge on marine biodiversity.

6. To ensure the ecological integrity, recreational and cultural values of the marine environment are not compromised through mismanagement and/or intensification of the marine environment.

7. Explore opportunities to involve Iwi in the implementation of the strategy.

8. To investigate and collect information to help inform the community on the pressures and issues related to the coastal environment.

4. Stages

Monitoring in the coastal environment is best done on a staged approach for reasons such as resources and the requirement to undertake initial investigations which inform the long term monitoring. The staged approach proposed for the next 3-5 years is thus divided as follows:

[1] Funds administered by the Ministry of science and Innovation to allow councils to engage with the environmental research and technology sector, further details in section 6.1.

(i) Broad-scale mapping of intertidal habitats and fine-scale surveys of benthic characteristics of intertidal habitats.

(ii) Baseline water quality data to assess the current state of coastal waters and to validate hydrodynamic and ecological models.

(iii) Expand existing sub-tidal monitoring to develop a baseline of biological communities within the diverse range of habitat types in Marlborough.

(iv) Development and validation of hydrodynamic models.

(v) Development and validation of ecological models.

(vi) Long term state of the environment monitoring to include: water quality, inter-tidal, sub-tidal and terrestrial habitats, to inform the Anticipated Environmental Effects (AEEs) as outlined in the second generation Marlborough Resource Policy Statement.

4.1. Broad-scale mapping and fine-scale surveys of intertidal habitats

Davidson *et al*. (2011) identified areas of ecological significance for inter-tidal, sub-tidal and terrestrial marine areas. Each of these areas require specific types of monitoring and assessment. It is proposed that monitoring of these environments should be carried out based on the risk or sensitivity of the environmental.

A list of ecologically significant intertidal habitats is shown in Table 1. It is commonly accepted that intertidal marine areas are among the more sensitive marine environments as they are where landuse activities first affect the marine environment. Developments such as urban growth and intensive agriculture can adversely affect the intertidal areas, particularly estuarine areas.

National protocols for the assessment of estuaries was first developed by Robertson *et al*. (2002). The protocols involved mapping and undertaking fine-scale surveys of a number of estuaries throughout the country. The Havelock Estuary in Marlborough was one of the estuaries assessed and as such there is baseline data for the Havelock Estuary from which changes can be assessed. The protocols have been adapted to enable the development of statistically robust sampling with a suite of indicators capable of identifying changes in ecological condition over time. Once baseline data has been collected (i.e. once an initial assessment is made) for a particular area, follow-up sampling can be carried out every 5 years to track changes over time.

Table 1: List of significant marine intertidal sites (from Davidson *et al*., 2011)

Name	Biogeographic Zone	Reference
Whangarae Bay	1	1.1
Greville Harbour	1	1.7
South Arm Port Hardy	2	2.2
Anakoha Estuary	2	2.25
Tuna, Harvey and Duncan Bay Estuaries	3	3.10
Clova Bay	3	3.14
Chance Bay	3	3.17
Kaiuma Bay	3	3.19
Havelock/Mahakipawa Estuaries	3	3.2
Kenepuru Estaury	3	3.21
Okiwa Bay	4	4.1
Ngakuta Bay	4	4.5
Shakespeare Bay	4	4.1
Whatamango Bay	4	4.12
Endeavour Inlet	4	4.27
Wairau Lagoon	8	8.2
Lake Grassmere	8	8.3

The proposed methods of habitat mapping and fine-scale surveys (Gillespie *et al*., 2001; Gillespie *et al*., 2011) will also benefit the region by expanding a joint TDC/NCC estuary monitoring strategy for the Nelson Bays to include the adjacent Marlborough region. This will enable a more extensive cross-referencing of top of the South Island estuarine habitat coverage according to a standardised methodology.

4.2. Baseline water quality data

Water quality monitoring is required to (i) build a hydrodynamic model of the Sounds (ii) to monitor change in water quality over time. An Envirolink funded report (Zeldis *et al*., 2011) helped establish a baseline monitoring programme for the Queen Charlotte and Pelorus Sounds. This involved having 5 sites located in the Queen Charlotte Sound and 7 in the Pelorus Sound. A variety of parameters are measured including, nutrients, suspended sediments, turbidity, pH, salinity and phytoplankton. Water quality data from this monitoring will initially be used to build a hydrodynamic model of the two Sounds. The monitoring will then be re-assessed to determine the most appropriate number and location of sampling sites for the Sounds. The results will be used to determine state and trends in marine water quality over time.

4.3. Hydrodynamic models

The Marlborough Sounds are a complex system of drowned river valleys also known as rias. The many inlets and Sounds make it a challenging environment to model. The key to accurate and realistic predictions of spatial effects from a range of point sources is the accurate simulation of the hydrodynamic (currents, temperature and salinity induced stratification of the water column) conditions. The models need to be sufficiently fine-scale to detect cumulative effects from point sources such as fishfarms, outfall pipes, rivers and streams etc. Hydrodynamic models are typically 2D or 3D. Because of the complex nature of the Sounds a 3D model is recommended. The construction of hydrodynamic models for the Queen Charlotte Sound and the Pelorus Sound has been discussed in depth with scientists from NIWA. A ROMS (Regional Ocean Modelling System) which takes account of the effects of salinity, temperature, wind and tides is proposed. Modelling down to 100m resolution will be able to detect the effect of marine structures on bay scale currents, a finer resolution of 25-50m is also possible if required for specific locations.

4.4. Ecological models

Ecological models can be added to the ROMS hydrodynamic models. These models can assess the likely ecological effects from changes in nutrient loads in the Sounds. The proposed model discussed with NIWA could be used to predict effects from e.g. future fish farm scenarios on nutrient concentrations, phytoplankton, zooplankton and sediment deposition. Data required for the ecological model has been largely collected for the QCS and would be required to be collected for the Pelorus Sound.

4.5. Biological Monitoring

Monitoring of sub-tidal biological communities throughout the Marlborough Sounds will establish a baseline of species distribution. Having a baseline in place allows the impact of development on individual species and the community as a whole to be determined. Currently the only biological monitoring that is undertaken by the Council is monitoring the effect of ship wakes on communities in the Tory Channel. By expanding this programme throughout the Queen Charlotte Sound and Pelorus Sound a consistent approach will allow for changes to be detected and will allow comparisons with existing sites.

4.6. Long term State of the Environment monitoring

The objective of long term state of the environment monitoring is to monitor the state and trends of the coastal environment. For habitat and fine-scale monitoring of estuaries and intertidal areas 5 yearly monitoring is recommended as the timeframe in which changes can be detected. To assess state and trends of water quality monthly monitoring at key sites is recommended. The number and location of water quality monitoring sites is best done with input from the hydrodynamic and ecological models and will inform the Anticipated Environmental Effects as outlined in the second generation Resource Policy Statement.

5. Implementation and Timeframes

5.1. Intertidal Areas

As discussed in section 4.1 the significant intertidal areas for Marlborough have been identified. The next step is to identify the risks/pressures of each area in order to prioritise a long term monitoring programme. It has already been identified that 5 yearly monitoring is sufficient to detect trends using the proposed methods for state of the environment monitoring (Gillespie, 2011). For intertidal areas that have less risk/pressures 10 yearly monitoring may be appropriate. Frequency of monitoring proposed for the intertidal areas identified by Davidson *et al*. (2011) are as follows:

Frequency of monitoring

5 yearly	**10 yearly**
Okiwa Bay & Ngakuta Bay	Kaiuma Bay /Chance/Nydia Bay
Havelock/Mahakipawa Estuaries	Whangarae Bay
Shakespeare Bay	Greville Harbour
Wairau Lagoon	Whatamango Bay and Endeavour Inlet
Lake Grassmere	South Arm Port Hardy
	Kenepuru Estuary
	Anakoha Estuary
	Tuna, Harvey and Duncan Bay Estuaries
	Clova Bay

The proposed timeframes for mapping and fine-scale assessments of intertidal areas for the next 5 years are shown in Table 2.

Table 2: Schedule for mapping and fine scale benthic sampling for intertidal areas

Timeframe	Location	Method
2011/12	Okiwa Bay & Ngakuta Bay	Habitat Mapping*
2012/13	Havelock/Mahakipawa Estuaries	Habitat mapping and fine-scale survey
2012/13	Okiwa Bay & Ngakuta Bay	Fine-scale survey
2013/14	Whangarae Bay & Kaiuma Bay	Habitat mapping and fine-scale survey
2014/15	Shakespeare Bay	Habitat mapping and fine-scale survey
2015/16	Wairau Lagoon	Habitat mapping and fine-scale survey
2016/17	Lake Grassmere	Habitat mapping and fine-scale survey

* completed using Envirolink funds

5.2. Sub-tidal areas

It is proposed to expand on the existing monitoring of sub-tidal areas (currently monitored to assess the impact from ship wakes) into the Pelorus and Queen Charlotte Sounds and to assess the different pressures impacting the biological communities. The number, methodology and location of sites are yet to be determined.

5.3. Water Quality monitoring and modelling

The site network for long term water quality monitoring in the Marlborough Sounds is best done in conjunction with modelling of the Sounds. Initial sites are chosen for baseline information and to build and validate the models. After modelling is carried out a subset of sites can be chosen, based on the modelling results, for long term state of the environment monitoring.

Table 3: Suggested schedule for water quality monitoring

Timeframe	Location	Method
2011/12	Baseline water quality for the Queen Charlotte Sound (complete)	As described by Zeldis *et al*. (2011)
2012/13	Baseline water quality for the Pelorus Sound Validation sampling for the Queen Charlotte Sound Hydrodynamic Model for the Queen Charlotte Sound (complete Jan 2013) Ecological Model for the Queen Charlotte Sound (complete Apr 2013)	Zeldis *et al*. (2011) David Plew (NIWA, pers comm.) ROMS Eco model added to ROMS
2013/14	Hydrodynamic Model for the Pelorus Sound (complete Jan 2014) Ecological Model for the Pelorus Sound (complete Apr 2014)	ROMS Eco model added to ROMS
2014- long term	State of the Environment monitoring at selected sites based on modelling, previous data and Davidson (2011)	TBA

6. Costs

The costs for each of the programmes discussed above are detailed below. Items in italics have already been completed for the year 2011/12. Timeframes may be subject to change depending on available resources from year to year. It is envisaged that from 2013/14 or 2014/15 the programmes will require the additional resourcing of 1 FTE at a cost of approximately $160,000 per annum.

Programme	**Cost**	**Funding**	**Timeframe**	**Annual Cost**
Okiwa Bay and Ngakuta Bay habitat mapping	*$20,000*	*Envirolink*	2011/12	
Baseline water quality for the Queen Charlotte Sound	*$40,000*	*MDC*	2011/12	**$60,000**
Okiwa Bay and Ngakuta Bay fine-scale survey	$20,000	Envirolink	2012/13	
Havelock Estuary habitat and fine-scale survey	$60,000	MDC	2012/13	
Baseline water quality for the Pelorus Sound	$70,000	MDC	2012/13	
Validation water quality sampling Queen Charlotte Sound	$50,000	MDC	2012/13	

Programme	Cost	Funding	Timeframe	Annual Cost
Hydrodynamic and Ecological Models for the Queen Charlotte Sound	$130,000	$20k NIWA; $70k-$90k MDC; $20k-$40k Envirolink ($130k in kind from NIWA for installation of current meters)	2012/13	**$330,000**
Hydrodynamic and Ecological Models for the Pelorus Sound	$115	$20k NIWA; $55k-$75k MDC; $20k-$40k Envirolink ($unknown in kind from NIWA from existing monitoring)	2013/14	
Sub-tidal monitoring [+]	$50,000	MDC	2013/14	**$165,000**
State of the Environment Water Quality Programme	Approx $60,000	MDC	2014/15	
State of the Environment Intertidal Monitoring Programme *	Approx $60,000	MDC	2014/15	
State of the Environment Habitat monitoring (Davidson, 2011) [+]	Approx $50,000	MDC	2014/15	
Ongoing investigations, model calibrations to inform SoE reporting	$50,000	MDC	2014/15	**$220,000**

* The cost of carrying out habitat and fine-scale survey will vary between $40,000 and $60,000 depending on the size of the areas involved in the survey.

[+] No costing done to date. Figure is an estimate only.

6.1. ENVIROLINK Funding

The ENVIROLINK funding scheme funds research organisations such as Crown Research Institutes, universities and some non-profit research organisations to provide advice and support to regional and unitary councils on environmental topics. The funds are administered by the Ministry of Science and Innovation (MSI). Funds of $1.6 million per year are available to councils. The objectives of the scheme are to:

- improve science input to the environmental management activities of regional councils
- increase the engagement of regional councils with the environmental RS&T sector

- contribute to greater collective engagement between councils and the science system generally.

7. References

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