

Monitoring Programme for Coastal Hazards for West Coast Regional Council

Technical Note

Introduction

This monitoring programme has been developed following a meeting between Chris Ingle of WCRC and Terry Hume and Doug Ramsay of NIWA at WCRC on 3-4 November 2005. Discussions identified a number of areas of concern relating to coastal hazards some of which were briefly viewed during the visit.

The main purpose of the monitoring programme is to assist WCRC:

- Understand long-term trends (and where necessary short-term fluctuations) in shoreline movements to aid future developmental decision-making;
- Identify present and future problem areas;
- Understand present day human impacts on the WCRC coastline.

The monitoring programme suggestions take into account that:

- WCRC has limited financial and personnel resources (although student assistance may be available in the summer);
- Available resources and existing information need to be utilized as effectively as possible;
- The value obtained, and accuracy of, the monitoring exercise justifies the cost involved;
- High resolution RTK GPS Survey equipment will soon be available within the Council;
- Any programme needs to be sustainable;
- The data collected needs to be stored, analysed and presented in a way that demonstrates value to local Councilors and the General Public.

Review of previous monitoring

WCRC have already collated much of the prior studies relating to coastal hazards and previous beach profile monitoring activities.

It is suggested that the first task is to review:

- The locations where beach profiles have been collated in the past;
- Identify which of these beach profile locations have benchmarks, which can still be located (and therefore can be re-surveyed).

- Re-survey each of these profiles to provide an updated snapshot of coastal change over the period between the profiles;
- Incorporate this data into a GIS database.

An additional task would be to collate all available cadastral maps for the West Coast coastline from LINZ. From the most appropriate of these maps the coastline could be digitized and incorporated in to GIS. It can then be compared with present surveys/maps to identify large-scale changes and trends in shoreline position over the last century.

An additional task would be to collate all available vertical aerial photographs for the West Coast and identify which ones are suitable for rectification and mapping of the shoreline positions. This analysis should then be undertaken and the coastline incorporated in to GIS. It can then be compared with other surveys to identify large scale changes and trends in shoreline position over the last century.

It is suggested information about this review be reported on the Council's website or newsletter to introduce and raise awareness on what is known about coastal change, where the gaps are, why a sustained data collection programme is required, and where the priority areas are (i.e., create a public interest in what is being done), prior to further monitoring activities commencing.

Future monitoring activities

The nature of future monitoring activities will largely depend on the findings of the initial review. It is understood that much of this will be conducted by a summer student. NIWA would be happy to host the student for a number of days once the initial review is conducted to assist development of a focused monitoring programme and to discuss how this could be achieved.

Below are a number of suggestions as to potential monitoring activities that could be considered. This only considers the sections of coast from Ross in the south to Hector in the North (i.e., that we visited) but it is known there are other areas further south, e.g. Jackson Bay with erosion problems where monitoring programmes should also be established in a similar manner to that suggested below.

It is suggested that the monitoring effort be a mixture of:

- *Beach profiles*: Standard surveyed section lines perpendicular to the shoreline.
 - Benchmarks should be established for each profile cross-section and their location accurately surveyed using the new high resolution GPS system and photographed.

- Profiles can be collected by any suitable survey method (from simple Emery poles to levels to total station or GPS survey equipment).
 - Sufficient measurements should be taken down the profile to accurately establish the profile cross-section and certainly no more than 5 m between measurement points.
 - More profiles are suggested below than are likely to be able to be surveyed on an annual basis. However, if the profiles and bench marks are at least established and an initial profile conducted, they can at least be surveyed on a less frequent basis (e.g. every 2-5 years) or less labour intensive methods can be used (e.g. distance offset measurements, fixed aspect photography).
 - Where possible most profiles should be surveyed at least on an annual basis. In areas of high concern or rapid change this may need to be done 6 monthly.
 - If at all possible, as many of the profiles should be re-surveyed as soon as possible after severe storm events.
- *Distance offset measurements:* Distance measurements from a beach profile benchmark to the edge of a steep eroding scarp (e.g. as found along Carters and Pakiroa Beach). This is a quicker way to survey the dominant feature of interest, i.e. the position of the eroding edge. However, occasional beach profiles should also be conducted e.g. every 2 – 5 years.
 - *Quad bike surveys along the MHWS mark.* This is where a high resolution GPS system on a quad bike records position every couple of seconds as the bike is driven along the high water mark (HWM) on a mean spring tide. This allows general beach planshape to be recorded and over successive surveys general planshape changes along a length of coastline to be assessed (e.g. the longshore movement of “pulses: of sediment) by comparison with previous surveys and shoreline position mapped by other means (e.g., aerial photographs and cadastral surveys). Where possible (e.g. on sand coasts, or where there is little drift wood debris on the upper beach), the vegetation line should also be recorded in this way. At river mouths, such surveys should extend around the end of any spit features and along the inner (estuary / river) edge.
 - *Scarp extents:* Locating the start and end of eroding scarp (steep eroding edges) sections on any dune systems or low coastal edges would also be useful (e.g. recorded during the quad bike survey). Plotting the locations of such eroding sections over time builds up a picture of how erosion locations may change
 - *Fixed aspect photographs:* Photographs taken at: 1) each beach profile location from the HWM location looking both left and right along the beach; 2) taken both left and right along the beach at both ends of sections of coastal defence. A filing system (electronic) needs to be established so that relevant metadata (date, location, comments) is attached to all electronic images.
 - *Aerial photographs:* It is thought that there is unlikely to be sufficient funds to conduct recurring aerial photography for coastal monitoring (hence the suggested quad bike surveys above). However, it is suggested that when aerial photographs are being collected for other purposes in the catchment that coastal

monitoring needs be also considered. Under these circumstances it may be possible to photograph a length of coast at little additional effort or expense. Such photographs should be georeferenced and orthorectified.

High priority sites:

Based on the discussions with WCRC the following sites are identified as high priority. (Note: These suggestions may be too resource intensive but can be used as a starting point for discussion):

Granity to Hector:

- Establish profile benchmarks at approximately 1 km intervals along Granity to Hector frontage (approximately 7) including on either side of the Ngakawau River mouth (within 300 m of either side of the mouth).
- Conduct initial beach profile down to LWM when profile established.
- Re-profile at least four of these on an annual basis (including the profiles either side of the river).
- Fixed aspect photography from all profiles on an annual basis.

Carters Beach and Buller Bay:

- Establish profile benchmarks at approximately 1 km intervals along length of bay (approx 7 profiles).
- Conduct initial beach profile down to LWM when profile established.
- On annual basis measure offset from benchmark to eroding coastal edge (eroding scarp) from all profiles.
- On an annual basis establish spatial extent (start and end) of eroding scarp.
- Fixed aspect photography from all profiles on an annual basis.
- Re-profile all profiles occasionally (e.g. every 3 – 5 years).

Punakaiki:

- Establish two beach profiles, one just north of the northern end of the new rock revetment, and one mid-way along the spit.
- Conduct initial beach profile down to LWM when profile established.
- Conduct profiles on an annual basis to identify any potential impacts of rock revetment on coastline to the north.
- Fixed aspect photography from all profiles on an annual basis.

Pakiroa Beach:

- Establish profile benchmarks at approximately 3 km intervals along length of bay (including end of Cargills and Blake Roads)
- Conduct initial beach profile down to LWM when profile established.
- On annual basis measure offset from benchmark to eroding coastal edge (eroding scarp) from all profiles along the section to the north and south of Cargills Road.
- On an annual basis establish spatial extent (start and end) of eroding scarp.
- Fixed aspect photography from all profiles on an annual basis.
- Re-profile all profiles occasionally (e.g., every 3 to 5 years).

Rapahoe:

- Establish a beach profile mid-way between the southern end of the rock revetment and the end of the spit.
- Conduct initial beach profile down to LWM when profile established.
- Conduct profiles on an annual basis to identify any potential impacts of rock revetment on coastline to the south.
- Fixed aspect photography from all profiles on an annual basis.

Cobden:

- Establish approximately four beach profiles along the length of Beach Road, the first profile should be about 500 m north of the northern tip point.
- Conduct initial beach profile down to LWM when profile established.
- Conduct profiles on an annual basis
- Fixed aspect photography from all profiles on an annual basis.

Taramakau River Mouth to Greymouth:

- Establish profile benchmarks at approximately 2 to 3 km intervals along length of bay to complement existing monitoring efforts around the gravel extraction site. The southern most profile should be within 300 m of the northern edge of the Taramakau River Mouth, with another within 500 m north of this location.
- Conduct initial beach profile down to LWM when profile established.
- Conduct profiles on an annual basis preferable around the same date of one of the gravel extractors surveys
- Quad bike survey of the MHWS line to be conducted at the same time of beach profile survey to include the northern end of the mouth of the Taramakau River and to extend as far north on to the dominantly gravel beach as is possible.

- Fixed aspect photography from all profiles on an annual basis.

Hokitika & Taramakau River Mouth (south):

- Establish profile benchmarks at approximately 1 km intervals from Hokitika River mouth to north of the town (approximately 4 in total)
- Establish profile benchmarks at approximately 1 km intervals south from Taramakau River mouth (approximately 3 in total)
- Conduct initial beach profile down to LWM when profile established.
- Conduct profiles on an annual basis
- Quad bike survey of the MHWS line to be conducted at the same time of beach profile survey to include: 1) the northern end of the mouth of the Hokitika River and the entire coast to the mouth of the Arahura River, and 2) the coast from the Arahura River to the Taramakau River.
- Fixed aspect photography from all profiles on an annual basis.

Secondary priority sites:

Little Beach:

- Establish profile benchmarks at approximately 2 locations within the bay
- Conduct initial beach profile down to LWM when profile established.
- Fixed aspect photography from all profiles on an annual basis.
- Re-profile all profiles occasionally (e.g. every 2 to 5 years).

Hokitika to Taramakau River:

- Establish profile benchmarks at approximately 3 km intervals along coast (i.e. areas not covered above).
- Conduct initial beach profile down to LWM when profile established.
- Fixed aspect photography from all profiles on an annual basis at same time as Quad bike survey (above).
- Re-profile all profiles occasionally (e.g. every 2 to 5 years).

Mikonui River to Hokitika River:

- Establish profile benchmarks at approximately 3 km intervals along coast.
- Conduct initial beach profile down to LWM when profile established.
- Quad bike survey of the MHWS line to be conducted on an annual basis between Mikonui River and Hokitika River

- Fixed aspect photography from all profiles on an annual basis at same time as Quad bike survey (above).
- Re-profile all profiles occasionally (e.g. every 2 to 5 years).

Analysis and information dissemination

Using the data to provide information is a fundamental component in maintaining an ongoing data collection exercise.

It is suggested that a focus of the summer student's work be:

1. Develop an effective and efficient system of storing and processing the data collected, e.g. based on:
 - GIS – storing and presenting Quad bike survey data, distance offset measurements and scarp extents.
 - Setting up an image library for electronic images (photos of the coasts and hazard related images)
 - NIWA's Beach Profile Analysis Toolbox (BPAT) for beach profile data storage and analysis, and fixed aspect photography storage.
2. Automating (as far as possible) the outputting of information in a useable and easily understood format for the general public, Councilors, other WCRC staff members etc (e.g. via the web).

Community involvement

The feasibility of coastal monitoring by community groups or other organizations should be evaluated. The records of coastal processes collected at Pororari Beach between 1983 and 1987 proved to be valuable in the analysis of the erosion issue at Punakaiki Village. Once the WCRC's monitoring efforts are up and running it is suggested that the use of communities to improve both the spatial and temporal collection of coastal hazard information be investigated. This could involve identifying reliable community groups (e.g. DOC, Schools and youth groups, Coast Care Groups) who have an active interest in the coast and the motivation to sustain a monitoring programme in the long-term. Some of the types of measures that we have suggested (e.g., distance offset measurements and photography) can be easily made by such groups.

It is suggested that such groups could:

- Make distance offset measurements
- Undertake fixed aspect photography
- Assist with daily (or other) visual observations of the state of the beach and current coastal processes.
- Use simple beach profile monitoring techniques (e.g. Emery method) to collect beach profile data on a routine basis

Four fundamental components of a community based data collection programme will need to be implemented to ensure the long term success of any such activities:

- It has to be easy for the participants to feed the information to the WCRC.
- There needs to be a timely method of feeding information, derived from the data being collected in an easily understood format back to the community groups collecting the data (i.e., they have to feel that their effort is effective and worthwhile).
- There needs to be a simple methodology for collating and submitting information to the Council (e.g. web-based, paper based).
- Education and awareness activities to improve general understanding of how coastal systems operate (e.g. the short and long-term morphological changes that occur) needs to be incorporated.

The main effort from the council will be keeping this system operational. This is an area that NIWA has considerable interest in, has ongoing work associated with the development of such activities, and would welcome further discussion as to how this may be implemented for WCRC.

Other matters

Other matters that were discussed that relate to the monitoring are identified below.

Hazards database

The Council should proceed to compile a database of storms and hazard related events from information contained within the council, various local studies, newspapers and local residents. This is a suitable task for the student. NIWA is currently compiling such a database for parts of the coast and we can provide guidance on the type of information the search should focus on and also on how that information is best stored in a searchable database.

Gravel supplies from the rivers

Gravel extraction from the rivers deprives the coast of sediment. Thought needs to be given to the most appropriate way of monitoring extraction and assessing gravel transport to the coast from the rivers, in order that the impact on the coastal sediment budget can be evaluated, and sustainable levels of extraction set and appropriate conditions be attached to consents. Murray Hick in NIWA's Christchurch office has considerable experience in this area and can advise WCRC on this matter.

Terry Hume

Doug Ramsay

NIWA

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