Flow

rivers GROUP

A joint technical interest group of IPENZ & Water NZ

Rivers Group Newsletter

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INSIDE THIS ISSUE

SOUTHLAND FLOODS

Michelle Poole, Environment Southland

The Anzac Day crowds had just gone home to breakfast after dawn services around New Zealand when heavy rain began falling all across Southland.

By lunchtime, rainfall and rising rivers were triggering alarms on the Environment Southland Duty Floodwarning Officer's pager. The Met Service had issued a heavy rain warning, and by 6am on Monday 26 April, the joint Emergency Operations Centre for Environment Southland and the Southland Civil Defence Emergency Management Group were fully operational.

Over the next three days, Southland experienced the most extensive flooding since November 1999. Only Eastern Southland escaped relatively unscathed.

The flood protection scheme on the Oreti River was fully tested, with river levels and flows equal to the scheme's design standards.

The Hamilton Burn, a major tributary of the Aparima River, experienced its highest recorded rainfall, and a massive – though not record-breaking – 300mm of rain fell in 24 hours near the Homer Tunnel on the Milford Road.

DOC evacuated trampers from tracks in the Fiordland National Park and all landline and Telecom mobile and internet services into and out of the Te Anau area were disrupted. The Waiau River, which is fed by Lakes Te Anau and Manapouri, remained in flood for a week, due to ongoing high lake levels.

While the stopbanks were overtopped in many rural areas, as they are designed to be, there was only one known breach of the banks. This occurred on the Oreti River in an area where a forestry contractor had compromised the bank by repeatedly driving equipment across it.

Thanks to early warnings, accurate predictions of peaks and levels, and the high standard of maintenance of the region's flood protection schemes, stock losses and damage to infrastructure were very low compared with previous major floods. ≈

The Oreti River in Flood, 27 April 2010

NZ FRESHWATER FISH: A FORGOTTEN TAONGA? THE NEED FOR FISH PASSAGE

Marq Redeker, Work Group Manager, Rivers & Coastal Engineering, Opus International Consultants Ltd

How many indigenous freshwater fish species are there in NZ? This is one of a few questions I asked the audience when I presented my paper on fish passage at this year's Stormwater Conference in Rotorua. The replies ranged from 6 to around 60. The correct answer is: 35. This represents a comparatively small (due to our country's geographical isolation) but very unique fauna. More surprising though, not only for me when I looked up the numbers, but for my audience, was that of these 35 species, a total of 26 are listed in the NZ Threat Classification System Lists 2005. Thus 74% of NZ's native freshwater fish species range from being 'nationally critical' (1) to 'range restricted' (4), with the majority in the 'gradual decline' (13) class. This represents a 30% increase compared with the 2001 assessment. One species (Grayling) is already extinct as a result of human influence. I interpreted the murmur that followed these statements as indicating that New Zealanders are (a) unaware of and (b) concerned about this alarming situation.

Degradation of in-stream habitat, water-quality deterioration, and construction of hydraulic structures have resulted in freshwater fish populations declining not only in NZ but worldwide.

Fish populations are highly dependent upon the characteristics of their habitats and the connectivity between them; for reproduction, food, shelter and growth of juveniles. At a larger scale, the populations' optimal use of resources, and the flow of genetic material within populations through the movement of individuals, are essential for maintaining the fitness of species and their adaptability to change.

Harkortsee Bypass Channel, Ruhr River, Germany (photo: Ruhrverband)

Numerous dams, weirs and waterway crossings interrupt or impede the continuity of rivers and their tributaries, and therewith may delay, hinder or block migrations of fish. Worldwide fish passage has increasingly been restored during the last two decades by retrofitting impassable barriers with fishways and by modifying waterway crossings. Notwithstanding existing legal obligations, e.g. prescribed by the Conservation Act / Freshwater Fisheries Regulations and Regional Plans, this trend is likely to continue in NZ for a variety of reasons, including the implementation of integrated/ sustainable catchment management practices and increases in river/stream restoration efforts.

There exist various types of fishways that enable upstream migration:

pool-type passes (e.g. vertical-slot passes, pool & weir-type passes and nature-like rock boulder-type passes);

channel-type passes (e.g. Denil fishways and nature-like bypass channels);

special technical constructions (e.g. fish locks and fish lifts); and

bottom structures, waterway crossings and other hydraulic structures modified to allow for fish passage (e.g. rock ramps, fish-friendly culverts, and tidal gates).

Rock Ramp Neheim-Hüsten, Ruhr River, Germany (Slope = 1:35) in Mean Flow Conditions

Internationally, these structures are well-developed for a wide range of migratory species. Several guidelines for state-of-the-art designs, operation and maintenance are available.

In NZ, fish passage guidelines have only been developed in specific regions and for selected technical solutions, e.g. TP 131 and TR 2009/084 for the Auckland Region, and DOC/NIWA's publication on fish passage at culverts.

In principle, two factors determine the effectiveness and efficiency of fishways:

(Ease of) Location - general location of the fishway, entrance position, and hydraulic conditions at the entrance and attraction flow; and

Passability - fishway design including design discharge, flow velocities and patterns, and (with respects to manoeuvrability) water depths, dimensions, and slot spacings.

Whereas passability depends on the geometric and hydraulic conditions within the fishway, the (ease of) location of the fishway depends on the general layout.

Fishways are commonly designed for the entire fish fauna (i.e. various species and development stages) in a water body, and not only for certain target species (e.g. climbers). A fishway must provide a continuous migration corridor of sufficient space (e.g. water depth, width and slot spacing) to allow fish to manoeuvre upstream. This migration corridor is based on the body size of the largest prevailing migratory species.

The hydraulic conditions in a fishway have to suit the weakest migratory species. As fish swimming ability increases with size and because many species indigenous to NZ migrate upstream at a small size (as juveniles), species using fishways typically have a low swimming ability. Moreover their endurance is limited, e.g. maximum (burst) swimming speeds can only be maintained for a few seconds. Therefore, NZ species are not able to negotiate velocities as high, or distances as long, as most Northern Hemisphere species. Difficulty of passage also increases with turbulence and aeration in the fishway.

Retrofitted Rock Ramp Below a Perched Culvert, Düssel River, Germany

The few NZ guidelines available fall short in stipulating the hydraulic and geometric requirements for successful fish passage, with fish physique and swimming capacity not systematically translated into fishway specifications. Swimming speeds of some species have been investigated, but in general many questions relating to swimming performance await clarification (including the effects of environmental and physiological factors that may affect performance) and require more research. Furthermore, NZ guidelines do not state the limitations of all of the technical solutions. For example, culvert baffles are only suitable for gradients in the range of 2 - 5% (type dependent). Hence solutions have been proposed or are utilised in locations and/or conditions well outside their verified application ranges. Therefore, the development of a comprehensive country-wide guideline on design, operation and maintenance of fishways that suit NZ conditions and fish species would be very helpful.

Many a time I have found that stakeholders have a clear idea as to the specific solution that is required in any given situation. In Europe, for example, nature-like solutions are preferred to technical (concrete) structures. However, as long as a fishway is designed correctly, the type of solution does not really matter. Often the only underlying reason for preference for a specific solution is landscape aesthetics, which is a secondary aspect.

Pool & Boulder-type Bypass Channel, Möhnebogen, Möhne River, Germany

Fish passage (restoration) is a multidisciplinary field and always requires a joint biological and engineering approach. It also demands specialist skills, e.g. in fishway hydraulics, structural design, construction supervision, QA, monitoring etc. Commonly this is not acknowledged, and it is the main reason for the abundance of faulty fishways worldwide.

Internationally, nature-like fishways have become prominent solutions. They are more aesthetically acceptable than other types of fishways and most appropriate in river/stream restorations (see pictures). In my view, there exists a great potential for these facilities in New Zealand. ≈

REVIEW OF THE WAIPAOA RIVER FLOOD CONTROL SCHEME, POVERTY BAY, GISBORNE

Dave Peacock, Director, Peacock D H Ltd

The Waipaoa River Flood Control Scheme (WRFCS) comprises 63.4kms of stopbanks, two major diversion cuts, five major outlet structures and 87 culvert outlets. The Scheme protects some 10,000 ha of fertile Poverty Bay floodplain and has enabled a major land use change from pastoral to horticultural.

The WRFCS was designed in 1949 by A D Todd, the Chief Engineer to the Poverty Bay Catchment Board. Todd proposed a "one in 200 year" design flood, based on only a very short flood record as well as rainfall records.

However, the "Cyclone Bola" flood of March 1988, which has been assessed in a 2006 review as only a "one in 70 year" flood, overtopped the main Scheme stopbanks in three places near the upstream end. The reason for this is two-fold; firstly, the most recent statistical analysis, using a 68-year annual flood record up to and including the year 2006, rated the original design flood as only a "one in 100 year" event, and secondly, the river bed at the upstream end of the flood control scheme has aggraded significantly.

Waipaoa River; Young Nicks Head (Background)

With the capital value of the floodplain assets protected by the Scheme now over $1 billion, a review of the WRFCS assessed the present level of protection, rated at less than a "one in 70 year" event, to be no longer adequate. The review investigated three higher levels of service; "one in 100" year, "one in 150" year and "one in 200" year. Two main options have been identified; Option "A" which comprises entirely stopbank raising, and Option "B" which comprises stopbank raising plus hydraulic improvements between Waituhi and Kaitaratahi. These latter improvements include the relocation of private stopbanks to give a minimum floodway width of 305m, and the development of floodways across the necks of Lovelock and Ormond loops.

The costs of these options vary from $15.2M (option A; 100 year standard); to $29.2M (option B; 200 year standard). Option B is about $1.7M more for each level of service than Option A, but it allows the potential development of up to a net 250 ha of land to a higher level, i.e. from pastoral to horticultural land use.

The authors of the review recommended to Council a minimum "one in 150" year design flood standard; with a 4m wide stopbank top width (rather than the original 6 foot (1.83m) top width. This will allow for raising the bank up to 500 mm without widening of the bank, should this be needed in the future to allow for any or all of the following reasons; future river bed aggradation, freeboard variations, and climate change effects on level of service.

Whilst more expensive, Option B is preferred by the reviewers over option A. The preferred option B with a "one in 150" year design standard is estimated to cost $24.3M; excluding GST.

In addition to protection works within the Scheme itself, the review also advocates a "whole of catchment" approach, with proposals for soil conservation works in the upper catchment, as well as a new classification over the whole catchment.

Following the review proposals, council staff have recently carried out preliminary public consultation to gather feedback from the community on the most appropriate level of service.

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MINISTRY FOR THE ENVIRONMENT EXTENDS GUIDANCE ON CLIMATE CHANGE

The Ministry for the Environment has extended its range of guidance and information to assist local government and other key stakeholders to better understand climate change impacts.

Recently the Ministry released technical guidance on incorporating climate change impacts into flow estimation. This extends the previous publications on climate change impacts and effects, and coastal hazards.

In parallel with the documents of technical guidance, the Ministry prepares shorter publications aimed at a broader audience. These publications are popular references on best-practice guidance to assist local government and engineers in assessing and managing the impacts of climate change on their planning and decision-making processes as well as infrastructure and asset management.

The range of guidance now available in this series includes (http://www.mfe.govt.nz/publications/climate/#local):

'Climate Change Effects and Impacts Assessment', and its summary publication 'Preparing for Climate Change'. This guidance provides the latest projections of the expected physical impacts of climate change, both at the national level and for regions around New Zealand. It is designed to help identify and quantify opportunities and risks that climate change poses for management functions and responsibilities, and infrastructure. It also demonstrates how to incorporate climate risk assessment into local government regulatory, assessment and planning processes to reduce vulnerability to the impacts of climate change.

'Coastal Hazards and Climate Change', and its summary publication 'Preparing for Coastal Change'. This guidance highlights the impacts that climate change is expected to have on coastal hazards. It details the climate change impacts that are expected not only through sea-level rise but also through storm surge, wind and waves. The publication also discusses a risk management framework in which to consider the consequences of these hazards.

'Tools for Estimating the Effects of Climate Change on Flood Flow', and its summary publication 'Preparing for Future Flooding'. This guidance details the key effects of climate change on flooding and presents methods for estimating changes in rainfall, flow rates and inundation. It also includes some best practice case studies to illustrate these methods. The summary publication also provides good practice information, guidance and examples to help local authorities incorporate climate change impacts into flood risk assessments. ≈

FROM THE CHAIR

Stephen Coleman, Chairman of the Rivers Group

On behalf of the Rivers Group Committee, we hope that this newsletter finds you all well. There are some interesting developments to share with this newsletter.

For those interested in modelling, you will have recently received an email inviting you to subscribe to a free discussion group WaterModellingNZ by sending a blank message to WaterModellingNZ-subscribe@yahoogroups.com.

Members of the Rivers Group Committee recently met with the flood risk management team at the Ministry for the Environment to discuss the current policy work in this area. We understand that it is recognised that there has been interest in, but insufficient evidence of need for, either national flood management guidelines, or a national policy statement on flood management. We would be interested to hear your thoughts on this matter (please send an email through to the Rivers Group riversgroup@ipenz.org.nz).

The most exciting update is that planning has begun on our annual symposium and AGM, to be held in Hamilton on Monday September 27 (see following page). An interesting line-up of presentations is being arranged, combining discussions of national issues with a celebration of rivers. This year, the symposium is linked to activities celebrating World Rivers Day on 26 September.

In line with the Rivers Group philosophy (http://www.ipenz.org.nz/riversgroup/), we have now set up respective membership categories for retired members, and also non-commercial community groups that simply wish to receive information updates, including the newsletter. These membership categories have reduced or no fees, but in each case a request to join one of these categories needs to be sent to the Rivers Group (riversgroup@ipenz.org.nz) so that records can be adjusted as required.

If you have yet to pay your subscription for this year, we would also like to hear from you – either to confirm your membership or to resign, so our billing system won't accrue any unpaid subscriptions.

More generally, we continue to invite ideas from the membership as to possible themes or events that they'd like to see the Rivers Group coordinate. Check our website for information updates as they arise, and be sure to let us know of potential future activities and articles that we can distribute further to the group membership.

Hopefully we'll be able to see you at our annual symposium and AGM!

Nau Mai Haere Mai. ≈

SYMPOSIUM 2010

The Rivers Group is currently in the process of organising a symposium, to be held in conjunction with the group's first AGM.

Date: 27 September 2010

Location: Hamilton

Theme: NZ River Symposium

The symposium date immediately follows World Rivers Day (Sunday 26 September 2010). This event is celebrated annually on the last Sunday of September. For more on this please visit the website at:

http://commons.bcit.ca/worldriversday/

The **draft** programme for the Rivers Group Symposium include sthe following:

- ≈ Land and Water Forum
- ≈ Integrated Catchment Management
- ≈ Flood Risk
- ≈ Comanagement
- ≈ Rivers Group AGM
- ≈ Dinner and Social

Please plan on spending a full day at the symposium, which will include a wide range of relevant topics, stimualting discussion and the opportunity to integrate socially with other Rivers Group members. The symposium will run from 09:00 through to 17:30, with an optional dinner and social function that follows. A significant discount on attendance fee is offered to current Rivers Group Members, and there will be an opportunity for new members to sign up.

Some sponsorship opportunities for the symposium are currently available. Please contact the current committee if you would like to follow up on any such opportunities.

The symposium organisation is currently work in progress, and the programme will be finalised in due course. At this stage please keep your diaries open for an event on the above date, and keep an eye on the Rivers Group website for updates. ≈

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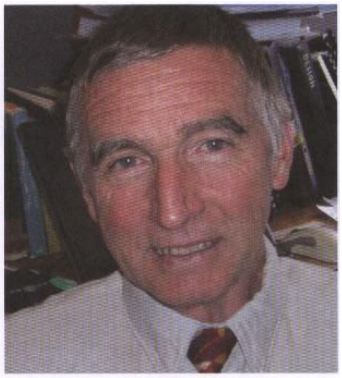
IPENZ HONOURS RIVER ENGINEERS

At the IPENZ Fellows and Achievers Awards held on 19 March, two prominent river engineers were awarded fellowships of IPENZ. The Rivers Group is proud to have these members being recognised in these awards.

Brin Williman is elected a Fellow of IPENZ for his contribution to the advancement of engineering practice. IPENZ recognises his contribution to developing the *Rivers Handbook* website, which is currently being prepared, and to advancing strategies for managing rivers. His expertise has been sought for working parties on flood emergency insurance, and on climate change impacts on river control. He is renowned for taking a holistic approach to river management and incorporating aesthetic and ecological values into engineering design. He has been an active contributor to the River Managers' Forum.



Gary Clode is elected a Fellow of IPENZ for his contribution to the advancement of engineering practice and application of engineering and technology in the community. IPENZ particularly recognises his contribution to developing protocols that require waterway management to consider a wide range of social and cultural values, as well as ensuring adequate attention to drainage and river control functions. His technical successes in meeting the challenges of the willow sawfly's impact on river protection works are likely to have wider application.

flow is the official newsletter of the Rivers Group, is published quarterly, and is distributed to all Rivers Group members.

Limited advertising in subsequent issues may be considered.

We welcome contributions for future newsletters, and particularly appreciate any photographs of rivers that readers are willing to share. Please contact the editor, Mark Pennington, for further information: mark.pennington@pdp.co.nz.