Case Study: Flood Research

1 Nature of the public good research data and information

1.1 The FRST funded research that is used for flood management in New Zealand comprises;

- flood research that produces forecasts of river flows intended for real time response
- river flow and climate data
- information on flood hazard used for planning
- understanding of climate variability and change
- rainfall simulation tools

1.2 The following programmes are FRST funded;

GNS/NIWA joint venture

- RISK0401 The Regional Riskscape Model: developing a generic Riskscape model for emergency responses and hazard mitigation by decision-makers

NIWA

- CO1X0401 Reducing the Impacts of Weather Related Hazards: developing weather forecasts and flood inundation hazard predictions for flood managers
- CO1X0303 Nationally Significant Database (NSDB): Water Resources and Climate
- COIX0202 Adaptation to Climate variability and Change: objectives 3,6,7,8 understanding climate variability and change; climate predictions, scenarios and impacts; climate change scenarios and impacts; climate information for regional development and adaptation
- CO1X0302 Climate-related Risks for Energy Supply: developing rainfall simulation and tools for modelling renewable energy generation and variations in energy demand

Data generated from these programmes can be categorised into four main areas:

1. data collected, and predominantly funded by FRST, as Nationally Significant Databases (NSDB);
2. data collected, but only partly funded (often < 50%) by FRST as NSDBs, with the balance of the funding being derived through a stakeholder commercial contract;
3. data collected as part of a pure research project under contractual arrangements to the Foundation;
4. data collected entirely under a commercial contract with a client.

The arrangements and behaviours for the supply of data and information from these four areas vary considerably, as will be described in more detail below.

2 What is the data and information used for?

2.1 The data and information from the programmes above are needed by a range of users, including researchers (e.g. flow data underpins **all** NZ research on environmental flows, water allocation, and sediment loads); regional, district and city councils; central government agencies such as MfE and MAF; and consultants; for a range of purposes including flood risk management, flood warning, emergency and adverse events management, infrastructure and river scheme design, urban planning, regulatory and legal issues and for rating purposes.

Most of the uses for the public good research are for public purposes.

3 What were the issues?

3.1 The flooding related research case study illustrates a number of significant issues and some flow-on issues of a second order that affect the accessibility of the FRST funded research results;

3.2 The most significant issues are;

- Under funding of databases, their maintenance, curation development and dissemination and some research programmes
- Multiple funding sources and related IP issues (particularly for co-funded data collections in the NSDB programme)

3.3 Second order issues that flow from those above include

- An apparent conflict between government expectations set out in the operating framework for CRI financial performance, and public good interests through wide accessibility of data and information
- Practices arising from pressure to obtain revenue to top up static or falling funding to allow maintenance of data gathering networks at levels useful to NZ and expected for public safety
- Pricing issues for users seeking access
- A lack of knowledge among users about what data and information is available and what is not, depending on ownership of it.

4 How was 'public good' data collection funded?

4.1 The FRST programmes are funded at the following levels:

- RISK0401The Regional Riskscape Model- $2m pa over 4 years 2005-2008
- CO1X0401 Reducing the Impacts of Weather Related Hazards - $1.4m pa over 4 years 2004-2008, objectives 1 and 2: Weather hazard prediction, and Flood-inundation hazard prediction
- CO1X0303 Nationally Significant Database (NSDB): Water Resources and Climate, 2003-2009. Funded at $3.5m pa to 2003, then $4.5m pa 2004-2009 (also funded prior to 2003)
- COIX0202 Adaptation to Climate variability and Change- around $3.6m pa over 5 years 2002-2006, and the $175K in 2007
- CO1X0302 Climate-related Risks for Energy Supply-$210K pa over 5 years 2003-2009

4.2 For just over a decade the funding for the National Climate Database and Water Resource Archive remained static at $3.538m per year[1], (including approximately $0.9m from FRST contracts other than CO1X0303. Between1994-2005, NIWA invested approximately $1.2m per year, over and above the FRST funding to ensure that these networks (and associated data) were maintained for New Zealand's benefit[2]. In addition, NIWA allocates in excess of $150K pa CAPEX, to maintain and upgrade the measurement network each year (there are 1,200

[1] Source of data: FRST audit of Nationally Significant Databases, 2003

[2] The NIWA investment was used for field data collection, quality assurance, developing some internet data access, provision of data to international databases, senior scientists management time, servicing many small enquiries, software and instrument network support.

instruments deployed in the field that require maintenance and upgrade over time). In recognition of this, the programme received an additional $1m pa from FRST, starting in 2005. However, this funding level is still well short of what is required to support the networks and currently NIWA supports >$200K of additional routine work associated with maintaining these databases, compounding each year by inflation.

4.3 In the case of the hydrometric network stations, 120 are supported in part or wholly by co-funding with regional, district and city councils and hydro-power companies. Hydro-power companies contribute $1.7m to such stations and associated data collection. In some cases power companies fund these as a 'good neighbours' even though they may have no direct use for the data. For the climate network stations, approximately 66 are part or wholly funded by the Metrological Service and/or local authorities (small proportion). There are also a large number of stations serviced by the public as a voluntary contribution to the network.

5 How is access managed?

5.1 NIWA has policies for IP, access and pricing arrangements. These are consistent with the documents of transfer of databases to CRIs when they were established, CCMAU policies, the annual Ministerial operating framework for CRI's and FRST contract provisions.

5.2 These policies all envisage access to maximise the benefit to New Zealand at cost of dissemination and include the ability to recover costs invested by CRIs that are not paid for from public good funding (the value-added part), and the right of CRIs to charge a market value for commercial use of data and information.

5.3 With respect to the NSDB data and information, NIWA practice is to make it available to the public and stakeholder groups on request at the cost of retrieval and supply (i.e., to cover the cost of providing the service), although in practice two-thirds of the flood-related data requests are answered for free. Thus, there is generally no attempt to recover the re-invested cost of data provision, only the cost of servicing the data request. Data may be withheld where supplying the data would prejudice the objectives of a NIWA research programme (e.g. a request for data to produce a derived product that is also being produced by a NIWA programme) or where supplying the data would prejudice NIWA's commercial position (e.g. data to on-sell as data or as a derived product). In the latter case NIWA reserve the right to deny access or agree a price on commercial terms. These same access provisions apply to data gathered by NIWA in other FRST programmes.

5.4 The terms and conditions of granting access may;

- specify the use to which the data can be put (so that NIWA can track and document data use as part of an accountability process for public expenditure)
- limit the use to a particular purpose (to prevent direct conflicts of interest)
- prohibit on-sale or transfer (to ensure that different datasets are not promulgated which might compromise resource management decision making and allow the setting up of alternative databases without the ongoing quality control etc.)
- specify no vesting of IP or copyright
- specify acknowledgement of NIWA and
- specify liability protection in the use of the data by the client

5.5 If large amounts of data are requested, NIWA will often offer consultancy services to provide added-value products. Where this is outside NIWA expertise they may provide data for one-off use, but at a price that reflects the value to the project, specifies the use to which the data may be put, and requires its destruction when the project is completed.

5.6 Data gathered by NIWA for other clients is managed according to conditions of the contract with that client. The ownership of the data is with the client, not NIWA (even when NIWA store the data for the owner). Such data is released, only if the organisation owning the data gives permission.

6 What is accessible?

6.1 The considerable investment made from retained earnings by NIWA over the last ten years especially (and with some recent FRST NSDB investment), has enabled FRST-funded data and information to be made more accessible to users.

6.2 It has enabled continued reinvestment in data collection and delivery systems and enabled the networks to continue to operate while there has been a fall in relative funding of programmes from FRST as a result of costs rising above inflation levels. The NIWA investment has enabled the development and integration of a large number of additional data collection sites which are now wholly or in part paid for by end users and embedded in the national network using the same collection and quality assurance protocols as for the FRST-funded sites. Data from these sites is generally available for all to use with the appropriate approvals which are almost always given.

6.3 The developments that make the data accessible include the development of Cliflo web interface which provides access to the National Climate Databases. The interface provides links to the National Climate Centre for Monitoring and Prediction; Climate Explorer (another web interface); Climate and Weather for Schools; Climate Update and the National Centre for Weather Research.

6.4 Greater Web accessibility has been developed for climate than hydrological data, reflecting a much broader demand by the public/industry for the former type of data. This is priced at an accessible level which generally reflects the ability of the client to pay, rather than the full cost of the development e.g. the regional climate mapping capability and the HIRDS[3] software developments. There is ongoing development of new ways to extend the accessibility of data by the public e.g. Climate Explorer.

6.5 The goal is to provide comprehensive and accessible data which has been stringently quality assured to give national consistency and assurance that the data can be used confidently for science, resource management and planning purposes for the national benefit

6.6 A number of activities have improved access to FRST- funded data and information or derived products including;

- Data sharing with councils which has improved the database quality and improved access by flood managers. Some regional councils have traded their data with NIWA –e.g. council data that is useful for NIWA's research on sediment models, regional flood frequency and low flow

[3] High Intensity Rainfall Design System a tool for planners and engineers to apply in any region in New Zealand to establish frequency, intensity and depth of intense rainfall events

models has been traded for large NIWA data sets of value to regional councils.

- NIWA not charging for the first 30 minutes to 1 hour of work and some peer review of methodologies used by councils
- Training programmes provided by NIWA have improved the ability of users to access information and use it effectively
- Recent availability of EnviroLink funding has facilitated further useful interactions between NIWA and regional councils having the effect of improving access to data and information needed by councils

7 Expectations of Users

7.1 This case study found a general expectation amongst central and local government users and consultants working for them, that public good research data/findings should be made freely available. This in-turn, creates an expectation that all data and information NIWA holds should be accessible (albeit, at the cost of provision) regardless of whether it has been paid for through FRST, by an external client, or through NIWA's own re-invested funds.

7.2 Most of the situations where concerns were expressed about access in the area of hydrology/flood-forecasting, involved users who were unaware of the complexity of the ownership of such data/findings, or did not agree with the CRIs model and the associated access policies for data and information they regarded as public good.

7.3 Some regional council users expressed concern about NIWA centralising access to river flow data. This was a concern for access to real-time data for flood management purposes. NIWA cited quality assurance reasons for such centralising and any difficulties in granting access were related to issues of under-funding of database and system maintenance and for the development of dissemination tools.

8 Provider expectations

8.1 The source of funding for data and information, and thus its ownership, along with the access policies of the government, determine the way in which access is granted to users. (See section 1 above). When the expectations of the users differ from the legitimate expectations of CRIs, access concerns arise.

8.2 In the area of flood forecasting, both NIWA and users have a similar driver- that is, to ensure there is reliable and accessible data and information to reduce the risks to property and life. NIWA outlined how frustrations set in when users expect everything for free and tensions arise in the process of seeking data. In addition, inadequate funding has resulted in repeated short term "fix ups" of systems and sites, to enable data to keep flowing, and NIWA has been falling progressively behind in application of technologies where some infrastructure has become outmoded. Dealing with the associated user frustrations adds to provider frustrations.

9 Accessibility Issues

9.1 Users generally found NIWA staff responsive, helpful and accessible when seeking data and information. They spoke highly of the work NIWA does to add value to the primary research results and the information they disseminate about their

work. There are however, some tensions in the system generated by the following issues.

Under-funding of databases

9.2 This case study has identified examples of where there is insufficient funding from the Crown to support all the necessary activities for data collection/databases to allow primary data to be made more accessible (e.g. for the NSDBs and other data derived from FRST funding). The recent one-off and ongoing investment by FRST to the two NSDBs only goes some way to addressing this issue.

9.3 Where rising costs associated with delivering science and in this case for databases occurs they are generally under-funded. NIWA has used retained earnings from the sale of products it funds or services it provides, to add value to research results relevant to flooding. For example, links between the water resource and climate database and other networks (e.g. sea level, soil moisture, snow and ice monitoring network) have been paid for from NIWA's capital expenditure (CAPEX) investment.

9.4 NIWA has invested $1.2m annually for 10 years 1994-2005 in maintaining and upgrading the National Climate Database and Water Resources Archive. This has included:

- the development of "Cliflo" a web interface for the databases to facilitate access to climate data
- automation of stations to enable access to real- time data especially during flood events,
- health & safety inspections and engineering certification of structures.

9.5 This investment has been insufficient to address changes in technology and demand for more real time information as climate variability and change and pressure on water resources from land developments, have become more prominent. While the recent injection of funding from the FRST has addressed this to some extent, NIWA will still have to find an ongoing and increasing >$200K shortfall. The sea level monitoring system is a notable example of where there is no dedicated funding for maintenance and development and where NIWA has used its own limited resources to maintain the system.

9.6 In addition, there are historical paper records that have never been entered into the database which if more accessible, could help the understanding of climate extremes and how they have changed over time for use in hazard mitigation, climate change, flood risk management and related policy. However, to date constrained funding has not enabled this data and information to be 'rescued' and made accessible before it is lost. New technology could now allow digitising of such historical records (e.g. to analyse and estimate the effect of climate variability and change on rainfall).

9.7 During summer months regional councils need exact flow measurements from NIWA water level recorders for irrigation scheduling and restriction operations. The under-funding of the water resource and climate database programme, has meant that flow measurements also are not made frequently enough to meet regional councils' needs during summer low flows.

9.8 Now that FRST is investing more in the maintenance and upgrade of the National Climate Database and the Water Resources Archive, it would be timely to look at whether the funding levels are sufficient to maintain and develop the data in

the long-term national benefit and to fund nationally significant databases sustainably into the future.

Multiple funding

9.9 Multiple funding of flood related data and information and associated ownership results in a number of access issues.

9.10 In some cases the data/findings might be owned by another agency (but held by the CRI) so cannot be furnished by the CRI without the owner's permission. In other cases, the underlying data might be owned by the CRI, but the derived product is not. If this product has been made freely available, it can give the impression that the data on which the product is based is also available which is not the case e.g. the digital river network of NZ is owned and IP protected by NIWA, but the product derived from this – the 'River Environment Classification' – is owned by the client, MfE, and has been made freely available.

9.11 There is some user resistance to the processes around having to get permission for release of data held by NIWA in the water resources archive that is owned by third parties, or where NIWA has used its own funds to make the product more accessible. In practice however, in almost all cases, permission is granted free of charge by power companies for information from sites owned by them and similarly most requests for data are provided through automated systems, provided free or at costs of dissemination. It is where value is added to data and information that charges apply.

9.12 Better communication of the multiple funding streams for data and information, and the policies of NIWA, would help relationships with users.

Government ownership and public good interests

9.13 The flat funding of the research programmes producing data and information of interest to users, and the commercial drivers on CRIs including the more recent requirement of government for a 9% return on equity, has generated behaviours that seek to cover costs, such as:

- Introduction of charging for commercial users
- Full cost recovery for products that have had investment of NIWA funds

9.14 While there is little resistance from most users to paying for the cost of dissemination of the data and information, many inquiries often go beyond a simple request for data as outlined above and thus attract a charge.

9.15 Central and local government agencies like Ministry for the Environment (MfE), Ministry of Agriculture and Forestry (MAF) and regional and district councils are advising Ministers and communities on national and regional/local flood risk. To do so they need access to the sort of information that NIWA holds, whether it is FRST- funded or not. In situations like this, the user agencies do not distinguish between government's ownership interest in CRIs and its public good interest for the management of flood risk and thus expect information to be readily available.

9.16 The FRST- funded research results, in primary form, will not be as useful to the government users as the derived information funded by NIWA. It is in the government's ownership interest for CRIs to charge for public good use of data and information, and it is also in the national interest to make it accessible at the cost of dissemination. Yet there is no mechanism to decide which of these maximises the national benefit. Until this is addressed the tensions in the system will remain.

Consultancy

9.17 There is a perception among users that NIWA, in using publicly funded data for consultancy, was holding back data that might be of value to competitors.

9.18 NIWA policy is clear in that Commerce Act requirements (regarding anti-competitive behaviour by monopoly suppliers) must be met for any requests for data that is publicly funded. In other words, staff must not with-hold publicly funded data (conditional on it being free of IP constraints) to give NIWA a pecuniary advantage when competing for a specific commercial contract.

9.19 Since NIWA are sometimes the only agency doing the research that generates the data, they effectively have a natural monopoly for such data and derived information. Consequently, when they enter the consultancy market, they are perceived as having a monopoly advantage. However, there was no evidence found of NIWA withholding publicly funded data and information.

9.20 NIWA is the agency with the primary expertise in this area, and thus are often asked to assist at the scoping stages of a piece of work. However, in a competitive environment where they may ultimately be bidding against other agencies, they are careful about what they provide for a scoping study. From a commercial perspective, they will not want their IP to appear in a subsequent RFP. On the other hand, NIWA acknowledges that to withhold such information is probably suboptimal for New Zealand as a whole. Thus, in many cases, they negotiate a commission to scope a study which might then go to open tender.

Pricing

9.21 Two thirds of the requests to NIWA for flood related information are answered free of charge. There are 80,000 automatic website requests per annum. In addition, there are a number of users licensed to use the data for a defined purpose through a client agreement and with the condition not to pass the information on the third parties. NIWA receives $40,000 from such licences. Some products that have been developed from NSDBs e.g. regional climate mapping, climate explorer services and HIRDS are priced at an accessible level which generally reflects the ability of the client to pay, rather than the full cost of the development.

9.22 A charge based on costs of retrieval and dissemination, stops trivial requests and most clients accept this approach. However, there is a small group of users, including some of the smaller local authorities, who have limited interpretive capability, and a small group of consultants who find price and negotiation of access a barrier to access to the information. Most of these are not always aware of the ownership issues around multiple funding of data, and also have the view that NIWA is publicly funded, so therefore their data should be free.

9.23 There were two instances cited where price and IP requirements were thought to have influenced user decisions as to whether or not to engage NIWA for flood management related work. In such circumstances these clients were not totally aware of the pricing policies and ownership arrangements with NIWA data and know-how.

Awareness of what information is available and who owns it

9.24 Several users commented that there was a need for more information on what information is available and who owns it to enable better access to what is available. Councils did not always know what FRST funded research NIWA had undertaken that might be of value to them, and in particular, smaller councils don't

always have access to the technical expertise to know what information is available e.g. some of the district councils who have low rating bases.

Other access issues

9.25 NIWA generally makes data available for others to use once the primary value from it has been extracted and contractual obligations to FRST have been satisfied and it doesn't prejudice NIWA's commercial position. Where users want research data/findings publicly available prior to publication this was perceived by NIWA as being in conflict with those obligations and policies. Such a response was seen by some users as frustrating access to useful data and information that had wider public benefit.

9.26 Some consultants raised software barriers for access to flood related data and information, especially where they didn't have the software to handle time series data that NIWA held. This increased the price to them of accessing the data. Such interface issues are being addressed by the additional FRST investment in 2005.

10 The Foundation Draft Access principles

10.1 The Foundation's draft access principles are;

1. ***Public good primary results and codified information should be made available to the maximum extent possible at the cost of dissemination, so long as that access maximises the national benefit.***
2. ***Where possible, research organisations would identify in advance the public good outputs that should be publicly accessible.***
3. ***Disclosure by research contractors to the Foundation when release of public good outputs or primary results is denied and reasons for the denial.***
4. ***Provide for a dispute resolution and escalation process where there is a difference of views between the Foundation and research contractors over access to public good outputs***

There are several conditions where withholding or deferral of access could align with the national benefit. These are:

a. ***Where release may result in loss of, or significant reduction in commercialisation opportunities and returns to New Zealand, including damaging commercial partnerships between research contractors and firms or industry groups;***
b. ***Where the release may have significant adverse effects on the environment, existing New Zealand industry, or the cultural values of groups of people***

Interviewee comments

Comment on the above principles concentrated on Principle 1 and 2.

10.2 Principle 1 up to "dissemination" was supported by all interviewees. There was a strong response from users that all the data and information relevant to floods that NIWA holds should be made available at cost of dissemination.

10.3 NIWA believes it already makes its FRST-funded data and information available to the maximum extent possible at cost of dissemination. Where it doesn't release, or charge for dissemination, this was viewed as justified within NIWA and

government policy. This occurred mostly where value from CRI funds had been added to the FRST funded data and information.

10.4 Where users felt that delaying release or charging for access was unjustified, they were often unaware of the multiple funding streams; for the water and climate data in particular.

10.5 Most interviewees were cautious about *"so long as that access maximises the national benefit"*. The national benefit was thought to be difficult to define and some users thought it could be used to bar release of information, since it might be argued that the use of the IP for CRI research and innovation, *ipso facto,* reaped national benefit.

10.6 Principle 2 elicited several responses. NIWA and some users were aware that the precise outputs from research cannot be always precisely predicted at the outset of a programme. Others commented that Principle 2 raised the need for a better system to publicise what research results are produced.

10.7 With respect to Principle 3 some users thought the onus should be on users to notify FRST and that FRST should have a channel for those denied to seek redress. Other users thought that the CRI should seek FRST permission for denial of access. However, this view was held by those who were opposed to providers holding ownership of publicly funded research results and who were unaware that FRST transfers ownership of research results to CRIs by contract. Disclosure of delays in releasing data and information was also suggested as an addition to Principle 3.

Consequences of applying the Principles

10.8 Under a situation where data and information is multi-funded, or where a CRI puts in significant funding of its own into a product, maximising the access at cost of dissemination is influenced by the access and charging policies that NIWA operates under and which are consistent with the CRI Act. (See Synthesis Report for details)

10.9 As a Crown Company the recovery by CRIs of their investment of retained earnings to make data and information more accessible to users, is a legitimate charge. However, a significant group of users make no distinction between FRST funded government funding and CRIs own funding (with the exception of information and data funded by the private sector).

10.10 Given that the Principles would apply only to FRST-funded data and information in the public good area, as worded they would make very little difference to the current practices of NIWA for floods related data and information for the following reasons;

- NIWA pricing and consultancy policies are consistent with government policies and current FRST contract conditions
- findings from FRST-funded work are already available for free or at cost of dissemination
- charging is only applied to work that has had a contribution from CRIs own funds

- FRST, in most cases, has not funded the work that improves accessibility of findings e.g. construction of derived, user-friendly datasets and web interfaces