New Zealand’s National Rivers Water Quality Network (NRWQN)—21 years old and still going strong

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(NIWA = National Institute of Water & Atmospheric Research, NZ)
Network co-designers:
GB McBride; GG Bryers; JM Quinn, WV Vant

20th ‘birthday’ (January 2009). Major review article authors: DG Smith; RJ Davies-Colley; RC Ward; GG Bryers; GB McBride; JM Quinn; and MR Scarsbrook
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Topics to be covered today:

- Brief introduction to the design of the NRWQN — how we went about it
- The main reasons why we believe this Network is so successful after 21 years
Began with a comprehensive review of readily available national and international WQ monitoring networks. Learn from the experiences of others.

Tendencies:

• Goals/objectives poorly defined

• Overly ambitious and costly

Main lesson: SIMPLICITY
Initial design thoughts

Q. Who are the main recipients of the data and information?

A. Publicly funded so the NZ public are the recipients—took a National perspective.
What data & information should be transmitted?

*Status and Trends*—what are the waters like and are there any changes over time?
(Examined analytical methods so we knew—and stated— *a priori* the detectable trend magnitudes.)
Brief NZ Network overview

- 77 sites on 35 rivers (‘Baseline’ versus ‘Impact’ sites – d/s of agriculture, forestry, industry and urban)—result of MUCH discussion
- Monthly site visits by NIWA’s field staff
- Samples analysed at NIWA’s Hamilton Laboratory
- 14 variables (3 in field) + benthic biology
Variables in the NRWQN—all with reasons

- **Flow**
- Physico-chemical: $DO$, *temperature*, pH, conductivity, $BOD_5$
- Nutrients: TP, DRP, TN, oxidised-N, ammoniacal-N
- Optical: *visual clarity*, CDOM, turbidity
- Microbiological: *E. coli* (since 2005)
- Benthic biology: *nuisance periphyton growths*, *invertebrate fauna* (annually)

No ‘exotic’/nice-to-do variables... and no suspended sediment!

*Minimal field work with dedicated runs.*

*Parsimonious.*
An innovation in the NRWQN – visual clarity measurement

Observer

Visibility = 13 m

Black disc
Benthic biology
(an innovative feature)

- Benthic algae
  - Nuisance periphyton
- Invertebrate animals
  - Mostly good ecological ‘health’
- Applications
  - Fundamental ecology studies
  - Management applications
Quality Assurance

Built in to lab and field methods

Lab—conventional: blanks etc.
GEMS/water paired comparisons

Field—initial field staff training and regular follow-up visits
—now far more detailed than original to ensure rigor
Foundation for all data is well trained field teams—these staff are a Network’s keystone

- Sampling—all techniques defined, not left to chance
- QA built into all field methods: temperature, DO (incl $P_{(atmos)}$), visual clarity, nuisance periphyton cover, invertebrate collection, sampling
- Methods Sign-off sheet
- Two-yearly formal field visits to audit Field Teams
Staff

Run by senior scientists/technical staff who are capable of good communication

Active involvement. Someone always available to respond to field staff requests and data requests

Very little change in key staff – central and field team leadership
Information (1)

Network is productive (>90 articles):

Annual reports (21). Papers (>25), Popular Articles (>10), Presentations (>14), Client reports (>18), Workshops (>5)

Status and trends analysis + much good river science (C flux in rivers, national scale flux modeling) and practical water management (AEEs & planning by consultants and RCs)
Information (2)

Data available via NIWA website:

https://secure.niwa.co.nz/wqis/index.do

Now boosted QA via Metadata*— this information is also available via the NIWA website

*See Appendix
Finance has been maintained!! Despite 2 radical govt science structure changes.

Reason: The Network has shown valuable results of national consequence.

Now a “Nationally Significant Database”-stable government funding.

Consequence: very few changes over time.
Several reasons for success

• Very careful initial design
• Well defined goals & objectives
• Parsimonious & cost effective
• Measurements made are major indicators of water values—avoided ‘nice-to-do’ ones
• Frequent & relevant outputs
• Updates as appropriate—very few changes made
• Well defined QA and tight standards
• Quality, motivated, and stable staff
APPENDIX  Metadata—a recent innovation

Example:

**Site DN1 – Taieri at Tiroiti**

**Site details**
Hydrometric site number: 74311
Sampling Location: NZMS 260 142: 959 466

*Flow measurements:*

*Sampling site:*

*Catchment:*
Site photo and sampling/assessment details

Photo taken in January 2008 looking upstream from sampling area