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 *Submitted to J Hydrology*

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

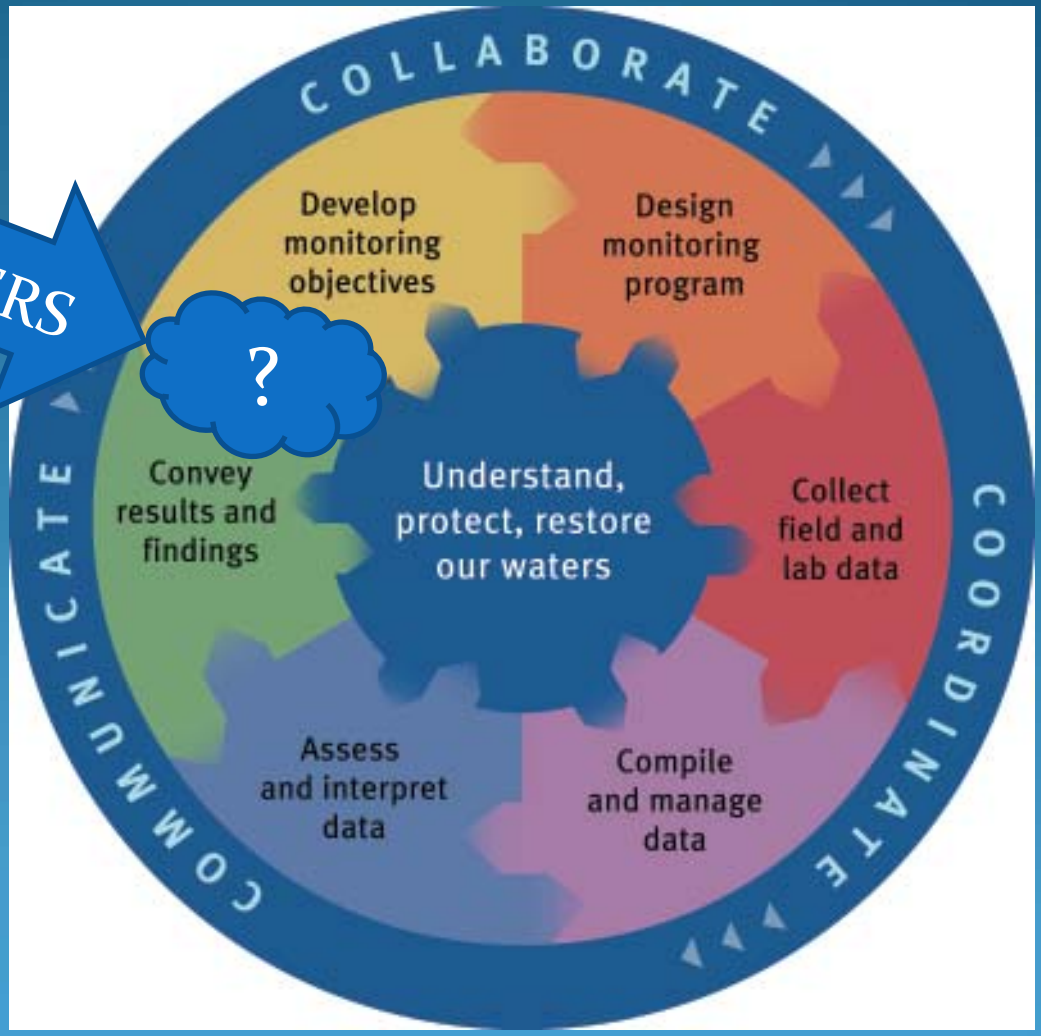
Main lesson: SIMPLICITY

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.

STAKEHOLDERS

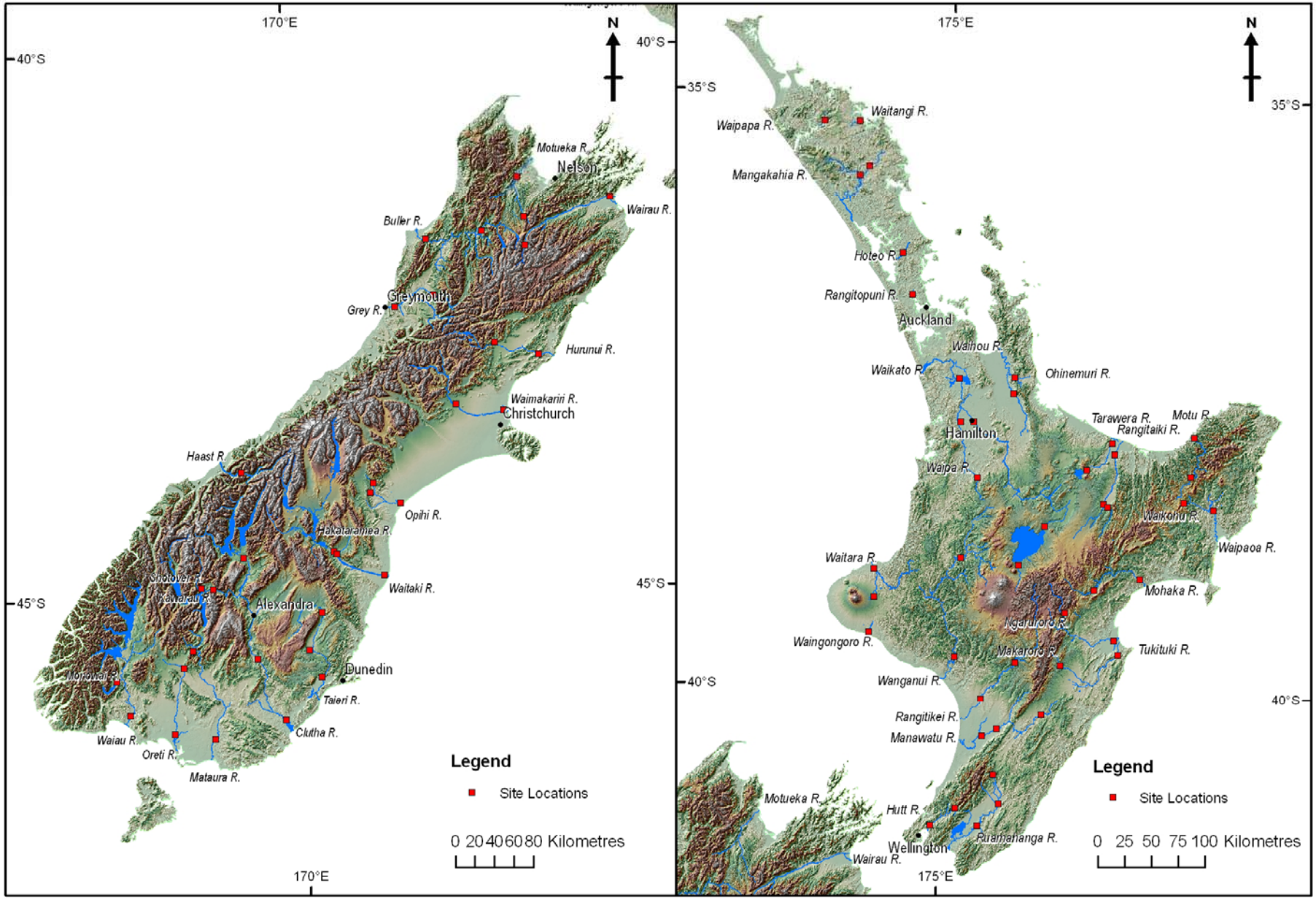


What data & information should be transmitted?

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


170°E
175°E
N
40°S
35°S
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Motueka R.
Nelson
Wairau R.
Buller R.
Greymouth
Grey R.
Hurunui R.
Waimakariri R.
Christchurch
Haast R.
Opihi R.
Hakataramea R.
Waitaki R.
Shotover R.
Kawarau R.
Alexandra
Dunedin
Taieri R.
Clutha R.
Waiau R.
Oreti R.
Mataura R.
Legend
Site Locations
0 20 40 60 80 Kilometres
Waitangi R.
Waipapa R.
Mangakahia R.
Hoteo R.
Rangitopuni R.
Auckland
Waihou R.
Waikato R.
Ohinemuri R.
Tarawera R.
Motu R.
Rangitaiki R.
Hamilton
Waipa R.
Waikohu R.
Waipaoa R.
Waitara R.
Mohaka R.
Ngaruroro R.
Waingongoro R.
Makaroro R.
Tukituki R.
Wanganui R.
Rangitikei R.
Manawatu R.
Motueka R.
Hutt R.
Wellington
Ruamahanga R.
Wairau R.
Legend
Site Locations
0 25 50 75 100 Kilometres

Variables in the NRWQN—all with reasons

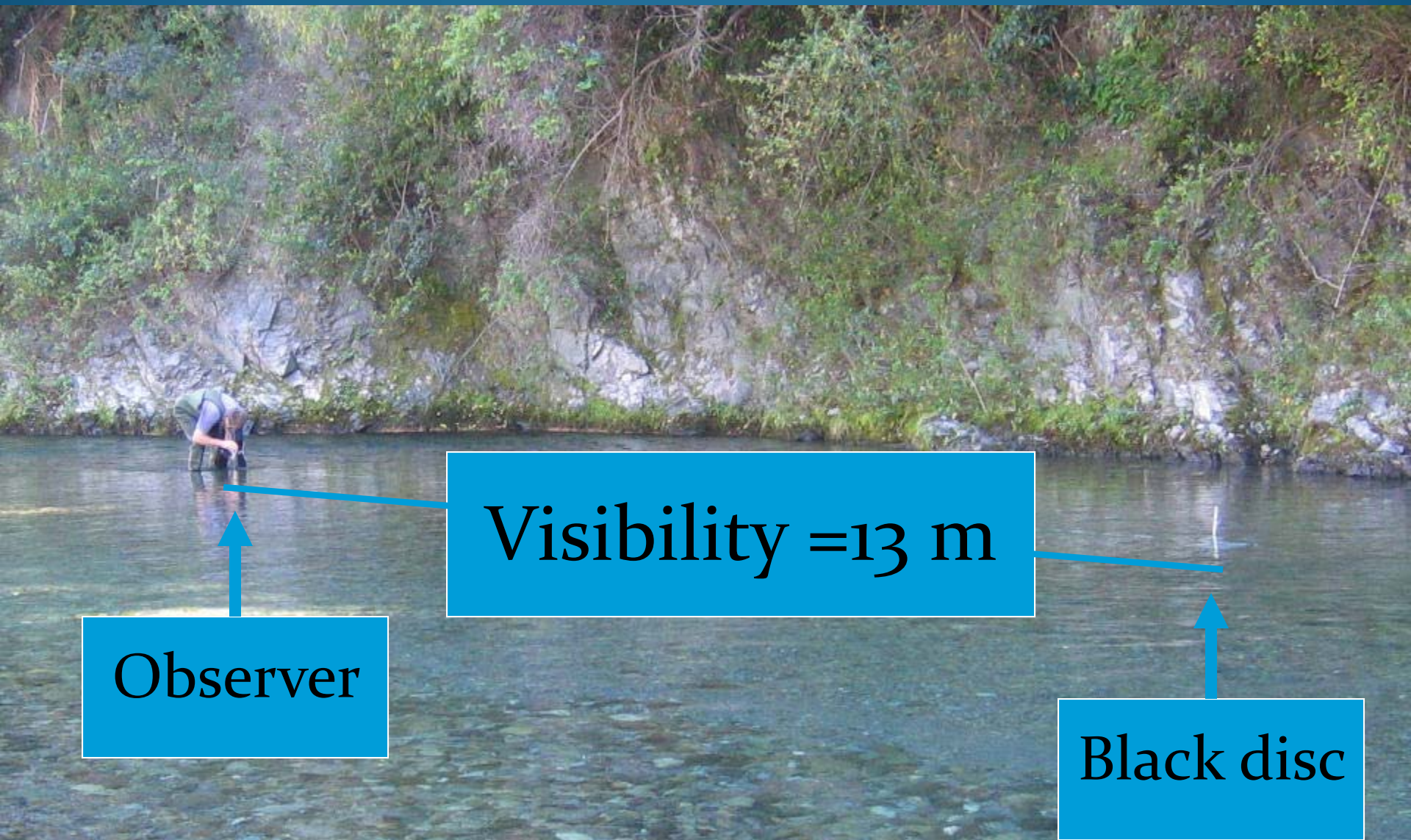
- *Flow*
- Physico-chemical: *DO*, *temperature*, pH, conductivity, ~~BOD_5~~
- Nutrients: TP, DRP, TN, oxidised-N, ammoniacal-N
- Optical: *visual clarity*, CDOM, turbidity
- Microbiological: E. coli (since 2005)
- Benthic biology: *nuisance periphyton growths, invertebrate fauna (annually)*

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*



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—<u>these staff are a Network's keystone</u>

- 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 gov^{t} 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

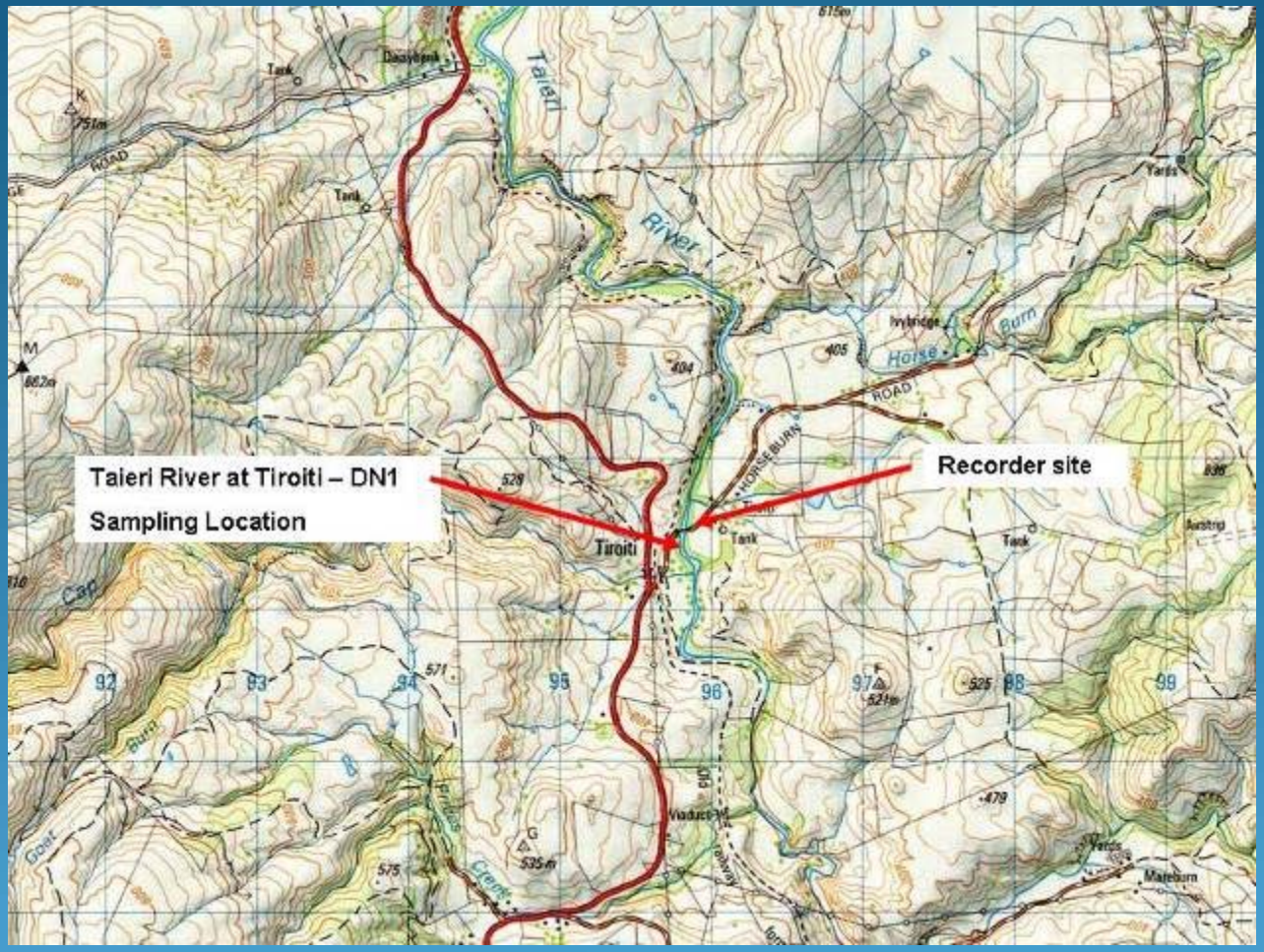
APPENDIX Metadata—a recent innovation

Example:

Site DN1 – Taieri at Tiroiti
First draft May 2008: revised January 2009.

Site details
Hydrometric site number: 74311
Sampling Location: NZMS 260 I42: 959 466
Flow measurements:
Sampling site:
Catchment:

Site location



Site photo and sampling/assessment details

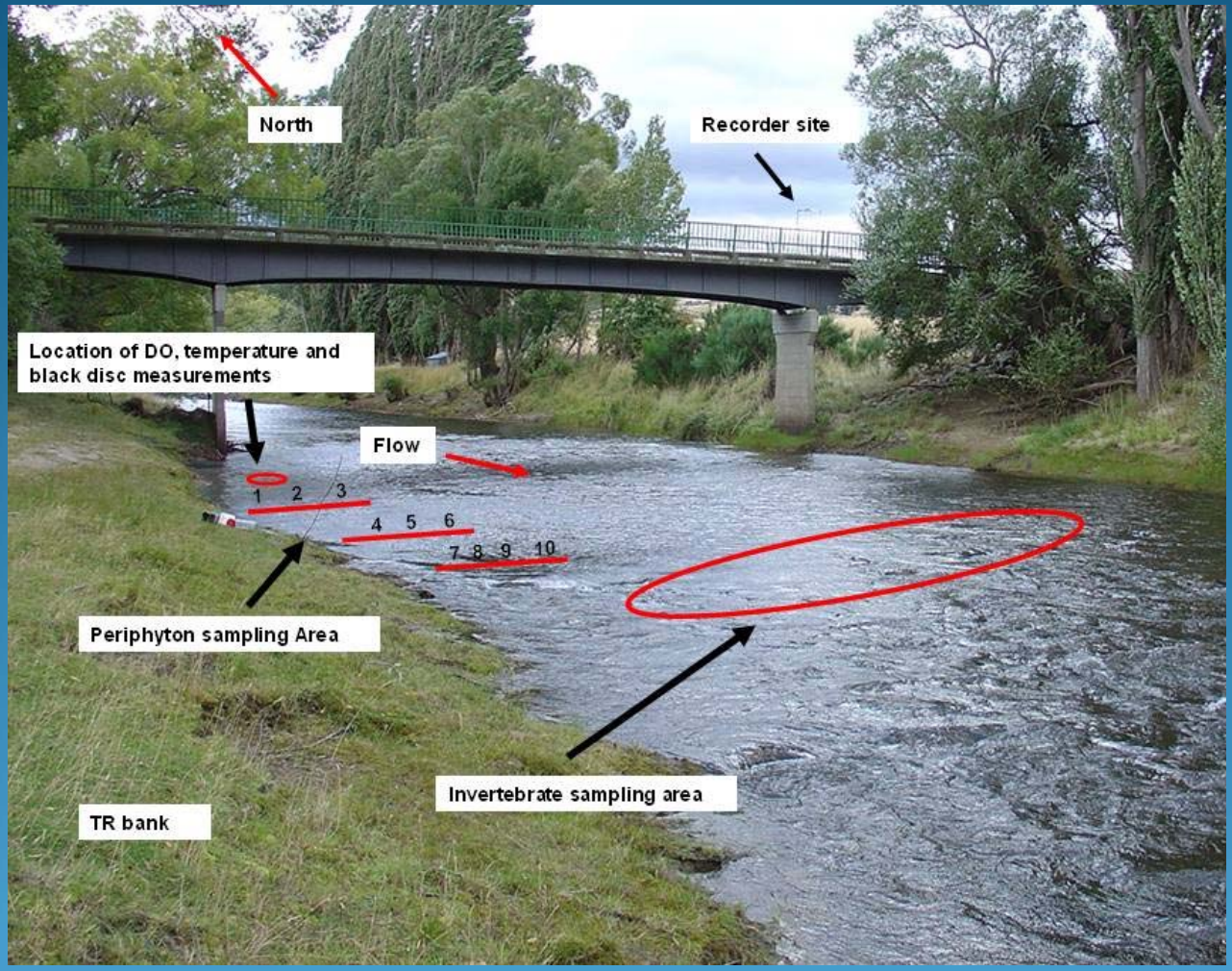


Photo taken in January 2008 looking upstream from sampling area