

Maintaining River Morphology Through Policy: a Case Study from the Ngaruroro Water Conservation Order

Kay, T. J. (Royal Forest & Bird Protection Society of New Zealand Inc.)
Fuller, I. C. (Massey University)
Anderson, P. (Royal Forest & Bird Protection Society of New Zealand Inc.)



Ngaruroro River at Maraekakaho (Reach 3, 2019).

Overview

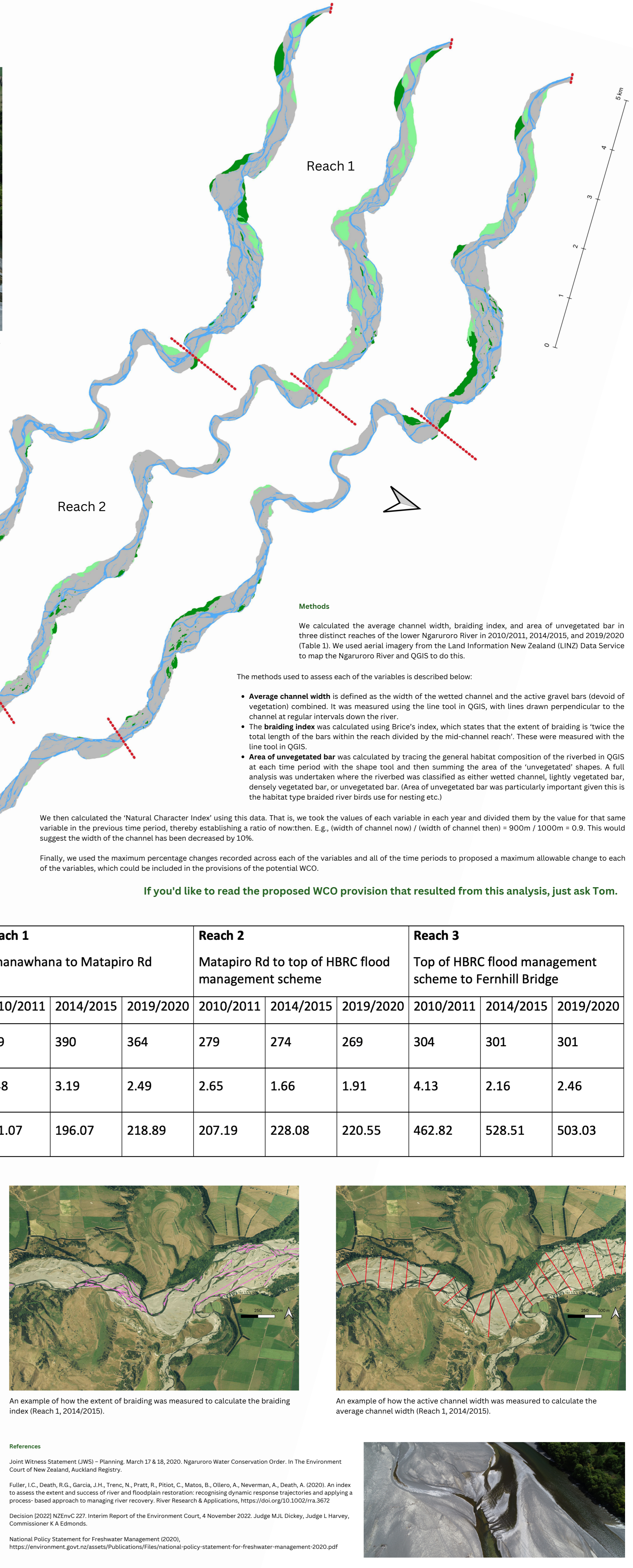
Environmental policy in Aotearoa is increasingly providing specific direction to reduce the impacts of nutrient and sediment pollution, over-abstraction of water, flow regulation, and climate change on rivers. However, direction to protect river morphology or physical habitat is vague at best, despite its connection to ecosystem health. For example, while the National Policy Statement for Freshwater Management (2020) sets out direction such as Policy 7 ("The loss of river extent and values is avoided to the extent practicable."), Policy 9 ("The habitats of indigenous freshwater species are protected."), and Policy 13 ("The condition of water bodies and freshwater ecosystems is systematically monitored over time..."), and sets out 'habitat' and 'natural form and function' as values of rivers, it does not prescribe how these outcomes should be achieved or how these values should be measured and protected.

In 2017, an application for a Water Conservation Order (WCO) on the Ngaruroro River (in Hawke's Bay, Aotearoa New Zealand) was publicly notified. The applicants (Forest & Bird, Fish & Game, Jet Boating NZ, Whitewater NZ, & Ngāti Hori ki Kohupātiki) sought (among other things) recognition and protection of what they considered 'outstanding' river habitat for native birds in the 'lower' section of the river, based on the braided character of the river in that section. The applicants sought protection of this value, and the character of the river, in their draft WCO through a narrative provision that would allow "[no] more than minor effect(s)" on the morphology of the channel.

However, through subsequent Environment Court proceedings environmental planners determined this wording "[did] not meet good drafting principles because [no more than minor] is unclear and open to interpretation" (JWS, 2020).

In response, we (led by Forest & Bird, as one of the co-applicants) analysed changes in the Ngaruroro River over time to determine background levels of adjustment in its morphology under existing management conditions – and therefore what degree of change could be considered 'more than minor' – using the 'Natural Character Index' (Fuller et al., 2020). Results of this analysis were then translated into a proposed quantitative provision for the WCO in expert evidence. A further iteration of this provision – whereby no activity causing a change in those measurements beyond a certain percentage would be permitted – was then presented to the Court through closing legal submissions.

While the Environment Court ultimately recommended a WCO for the lower river, it rejected our proposed provision in its most recent (2022) report. However, we consider this approach is still useful for the monitoring, and potentially for the protection, of 'habitat quality' and 'natural form and function' in other freshwater policy. For example, it could be adapted for upcoming regional plan changes to monitor and protect 'habitat' and 'natural form and function' as values of rivers to give effect to NPSFM (2020).



Methods

We calculated the average channel width, braiding index, and area of unvegetated bar in three distinct reaches of the lower Ngaruroro River in 2010/2011, 2014/2015, and 2019/2020 (Table 1). We used aerial imagery from the Land Information New Zealand (LINZ) Data Service to map the Ngaruroro River and QGIS to do this.

The methods used to assess each of the variables is described below:

- **Average channel width** is defined as the width of the wetted channel and the active gravel bars (devoid of vegetation) combined. It was measured using the line tool in QGIS, with lines drawn perpendicular to the channel at regular intervals down the river.
- The **braiding index** was calculated using Brice's index, which states that the extent of braiding is 'twice the total length of the bars within the reach divided by the mid-channel reach'. These were measured with the line tool in QGIS.
- **Area of unvegetated bar** was calculated by tracing the general habitat composition of the riverbed in QGIS at each time period with the shape tool and then summing the area of the 'unvegetated' shapes. A full analysis was undertaken where the riverbed was classified as either wetted channel, lightly vegetated bar, densely vegetated bar, or unvegetated bar. (Area of unvegetated bar was particularly important given this is the habitat type braided river birds use for nesting etc.)

We then calculated the 'Natural Character Index' using this data. That is, we took the values of each variable in each year and divided them by the value for that same variable in the previous time period, thereby establishing a ratio of now:then. E.g., (width of channel now) / (width of channel then) = 900m / 1000m = 0.9. This would suggest the width of the channel has been decreased by 10%.

Finally, we used the maximum percentage changes recorded across each of the variables and all of the time periods to propose a maximum allowable change to each of the variables, which could be included in the provisions of the potential WCO.

If you'd like to read the proposed WCO provision that resulted from this analysis, just ask Tom.

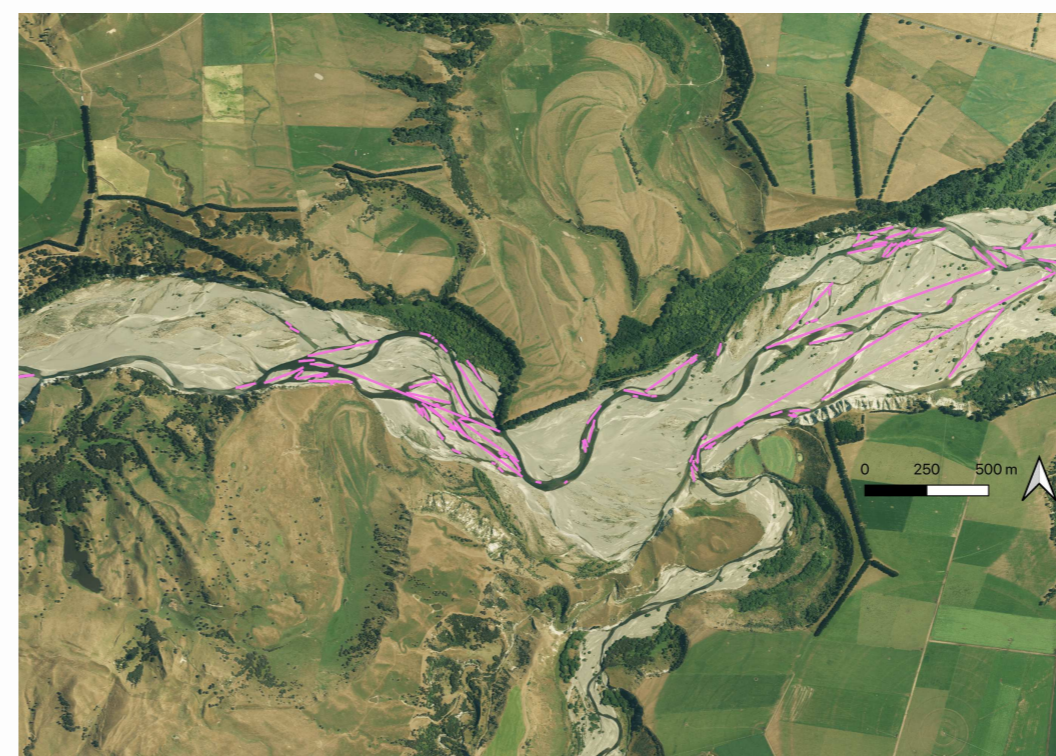
Reach	Reach 1			Reach 2			Reach 3		
	Whanawhana to Matapiro Rd			Matapiro Rd to top of HBRC flood management scheme			Top of HBRC flood management scheme to Fernhill Bridge		
Year	2010/2011	2014/2015	2019/2020	2010/2011	2014/2015	2019/2020	2010/2011	2014/2015	2019/2020
Active channel width (m)	379	390	364	279	274	269	304	301	301
Braiding index (Brice's)	5.48	3.19	2.49	2.65	1.66	1.91	4.13	2.16	2.46
Unvegetated bars (area, ha)	211.07	196.07	218.89	207.19	228.08	220.55	462.82	528.51	503.03

- Key**
- Reach separation
 - Riverbed Type
 - Densely vegetated bar
 - Lightly vegetated bar
 - Unvegetated bar
 - Wetted channel

2010/2011

2014/2015

2019/2020



An example of how the extent of braiding was measured to calculate the braiding index (Reach 1, 2014/2015).



An example of how the active channel width was measured to calculate the average channel width (Reach 1, 2014/2015).

References

Joint Witness Statement (JWS) – Planning, March 17 & 18, 2020. Ngaruroro Water Conservation Order. In The Environment Court of New Zealand, Auckland Registry.

Fuller, I.C., Death, R.G., Garcia, J.H., Trenc, N., Pratt, R., Pitlot, C., Matos, B., Ollero, A., Neverman, A., Death, A. (2020). An index to assess the extent and success of river and floodplain restoration: recognising dynamic response trajectories and applying a process-based approach to managing river recovery. *River Research & Applications*, <https://doi.org/10.1002/rra.3672>

Decision [2022] NZEnvC 227. Interim Report of the Environment Court, 4 November 2022. Judge MJL Dickey, Judge L Harvey, Commissioner K A Edmonds.

National Policy Statement for Freshwater Management (2020), <https://environment.govt.nz/assets/Publications/Files/national-policy-statement-for-freshwater-management-2020.pdf>

