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Application of the River Values Assessment System (RiVAS)

Prepared by:
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LEaP Research Paper No. 23
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Land Environment & People

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ISSN 2230-4207 (online)
ISBN 978-0-86476-343-3 (online)

Lincoln University, Canterbury, New Zealand

Cover photo: Waipoua River Source: Northland Regional Council

Acknowledgements

This work was funded by Northland Regional Council and we gratefully acknowledge their support. Thanks to Northland Regional Council staff who assisted with this assessment: Andrew Macdonald, GIS Officer (GIS support); Dale Hansen, Water Resources/Hydrology Programme Manager (flow regime data); and Gail Townsend, Biosecurity Officer – Aquatic Pests, who reviewed scores for the 'absence of exotic flora and fauna' indicator.

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Executive Summary

The River Values Assessment System (RiVAS) was applied by a River Expert Panel to eight resource attributes to assess 57 river units in the Northland Region for their natural character. The method was applied to differentiate rivers of high natural character (n=10), moderate natural character (n=34), and low natural character (n=13). Few data were available, so the Expert Panel relied on their own assessments for most attributes.

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Chapter 1
Introduction

1.1 Purpose

This report presents the results from an application of the River Values Assessment System (RiVAS) for natural character in the Northland Region.

A regional Expert Panel (see Appendix 1) met on 22 May 2013 to apply the method to Northland rivers. The Panel assessed 40 river units, with some rivers being divided into segments to reflect distinct differences in natural character along their course. Owing to time limitations, 17 river units were assessed subsequently by the three Council staff members on the Panel and then distributed to the full Panel for their comment and agreement.

1.2 River Values Assessment System (RiVAS)

Hughey and Baker (2010) describe the RiVAS method including its application to natural character. Table 1 provides a summary of the method.

Table 1
Summary of the River Values Assessment System method

Step		Purpose
1	Define river value categories and river segments	The river value may be subdivided into categories to ensure the method is applied at a meaningful level of detail. Rivers are listed and may be subdivided into segments or aggregated into clusters to ensure that the rivers/segments being scored and ranked are appropriate for the value being assessed. A preliminary scan of rivers in the region is undertaken to remove those rivers considered to be of 'no' or less-than-local level significance for the value being considered.
2	Identify attributes	All attributes are listed to ensure that decision-makers are cognisant of the various aspects that characterise the river value.
3	Select and describe the primary attributes	A subset of attributes (called primary attributes) is selected and described.
4	Identify indicators	An indicator is identified for each primary attribute using SMARTA criteria. Quantitative criteria are used where possible.
5	Determine indicator thresholds	Thresholds are identified for each indicator to convert indicator raw data to 'not present', 'low', 'medium', 'high' (scores 0-3).
6	Apply indicators and indicator thresholds	Indicators are populated with data (or data estimates from an expert panel) for each river. A threshold score is assigned for each indicator for each river.

Step		Purpose
7	Weight the primary attributes	Primary attributes are weighted. Weights reflect the relative contribution of each primary attribute to the river value. The default is that all primary attributes are weighted equally.
8	Determine river significance	Indicator threshold scores are summed to give a significance score (weightings applied where relevant). Rivers are ordered by their significance scores to provide a list of rivers ranked by their significance for the river value under examination. Significance (national, regional, local) is assigned based on a set of criteria or cut off points.
9	Outline other relevant factors	Factors which cannot be quantified but influence significance are recorded to inform decision-making.
10 - 13	Apply to potential river scenarios (called RiVAS+)	Optional stage (RiVAS+). Relevant steps are repeated for potential future river conditions.
14	Identify information requirements	Data desirable for assessment purposes (but not currently available) are listed to inform a river value research strategy.

Chapter 2
Application of the RiVAS method

Step 1: Define the river value, river sites and levels of significance

Natural character is a term used to describe the naturalness of river environments; it has both ecological and landscape connotations. The definition of natural character for the RiVAS application focuses on the degree of modification to naturalness (Hughey and Baker 2010, chapter 11, p93-125):

> *Natural character is a term used to describe the naturalness of river environments. The degree or level of natural character within an area depends on:*
>
> *1. The extent to which natural elements, patterns and processes occur; and*
>
> *2. The nature and extent of modifications to the ecosystems and landscape/riverscape.*
>
> *The highest degree of natural character (the greatest naturalness) occurs where there is least modification. The effect of different types of modification upon the natural character of an area varies with the context and may be perceived differently by different parts of the community.*

The assessment focussed on the major rivers in Northland, i.e. those with the highest flow rates. During the workshop, a few rivers were clumped where neighbouring rivers had very similar characteristics with respect to modification. Ten major rivers were divided into upper and lower reaches because the river flowed through different land uses, land tenures and topography – factors that influenced their natural character. The lower extent of each river was defined as its boundary with the coastal marine area (displayed at the workshop via the Council's GIS mapping system). This resulted in a list of 57 river units (mapped in Appendix 2 and listed in Appendix 3 with boundaries described where applicable).

The natural character of Northland rivers may be summarised as follows:

- Most rivers are relatively short with small catchments. Flows in rivers vary considerably with rainfall: high intensity storms cause flash floods while prolonged dry spells lead to very low flows in many small catchments.
- Low water clarity owing to high sediment loads and, sometimes, high levels of phosphorus (both naturally occurring because the land is dominated by deeply weathered geology and fine clay soils).
- Relatively few built structures within both the river channel and riparian edge apart from those built for flood protection purposes.
- High levels of naturalness (few modifications) associated with many of the upper reaches because they flow through conservation land.
- Lower levels of naturalness (many modifications) associated with many of the lower reaches because they flow through productive landscapes including valley floors, many of which are drained wetlands.

Step 2: Identify attributes

The attributes to describe natural character are presented in Appendix 4. These were adopted from the RiVAS method developed for natural character (Deans et al. 2010).

Step 3: Select and describe primary attributes

Primary attributes are those attributes selected to represent natural character within the RiVAS method. These were adopted from the RiVAS method developed for natural character (Deans et al. 2010). Appendix 4 describes the eight primary attributes (in bold).

Steps 4 & 5: Identify indicators and determine indicator thresholds

The indicators adopted to measure each primary attribute are presented in Appendix 4, together with their thresholds, and indicators are assessed against SMARTA[1] criteria in Appendix 5. Indicators and thresholds were adopted from the RiVAS method developed for natural character (Deans et al. 2010). The modified assessment scale (adjusted from a 5-point scale to a 3-point scale) was adopted, as used in the application of RiVAS for natural character in the Gisborne district (Booth et al. 2012).

Step 6: Apply indicators and indicator thresholds

Expert Panel estimates were required for all indicators (Appendix 3). Some data were available to inform assessments: Regional Council water quality data informed the 'water quality' indicator. Subsequent to the workshop, scores were checked for 'flow regime' (by calculating the consented and permitted takes as a percentage of MALF) and 'absence of exotic aquatic flora and fauna' (by Regional Council biosecurity staff). As a result of these post-workshop checks, 12 indicator scores were adjusted and subsequently agreed by the Expert Panel.

Step 7: Weight the primary attributes

The decision was made to keep weights equal (Appendix 3).

Step 8: Determine river site significance

The spreadsheet was used to sum the indicator threshold scores for each river unit (Appendix 3). The significance thresholds from the RiVAS method developed for natural character (adjusted from a 5-point scale to a 3-point scale) was adopted, as used in the application of RiVAS for natural character in the Gisborne district (Booth et al. 2012). The Panel agreed that the upper threshold (a total score of 20 or more) separated Northland rivers of high and moderate natural character. However, the Panel considered that the lower threshold (a total score of 14 or less) was too low and shifted the threshold up by one point so that low significance sites had a total score of 15 or less.

Based on the 3-point significance scale, river units were identified as having high natural character (the least modified – n=10), moderate natural character (moderately modified – n=34), or low natural character (the most modified – n=13).

Appendix 2 maps the rivers according to whether they have high, moderate or low natural character. Most of the high natural character rivers are located in the northern half of the region while most of the rivers with low natural character are located in the southern half. This reflects the fact that a large proportion of Northland's native forest cover is located in the north and that more intensive agricultural production takes place in the south.

1 Specific, measurable, achievable, relevant, timely, and may be already in use

Step 9: Outline other factors relevant to the assessment of significance

No discussion took place on other factors.

Step 10: Review assessment process and identify future information requirements

Few data were available to inform this case study.

References

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Appendix 1
Credentials of the River Expert Panel members and advisor

The River Expert Panel comprised six members. Their credentials are:

1. **John Ballinger** is Environmental Monitoring Programme Manager at the Northland Regional Council. John is responsible for coordinating the State of the Environment report and has a strong interest in water quality.
2. **Greg Blunden** is the Far North representative for the QEII National Trust. Greg is also convener of the NZ Kiwi Foundation, and provides specialist consultancy services in biodiversity management and land use change.
3. **Mike Farrow** is a Principal Landscape Architect with Littoralis Landscape Architecture. Mike has over 20 years of experience in the field of landscape assessment specifically focused on Northland.
4. **Natalie Glover** is Water Specialist – Policy at the Northland Regional Council. In this role, Natalie serves as project manager for Waiora Northland Water, NRC's work programme to implement the National Policy Statement for Freshwater Management.
5. **Julie Gregson** is a consultant with AgriSpecialists New Zealand Ltd. Prior to this role, Julie was Northland Area Manager for Fonterra for over eight years.
6. **Darryl Jones** is Economist at Northland Regional Council. He is responsible for co-ordinating the RiVAS assessments in Northland.

Advisor and facilitator:

1. **Kay Booth** of Lindis Consulting was the facilitator. Kay has been involved in developing the RiVAS tool since its inception in 2007. She has applied RiVAS to various river values for several regional councils, including previous applications for natural character.

Appendix 2
Map of Northland natural character river units by significance level

Appendix 3
Significance assessment calculations for natural character, Northland (Steps 1 and 5-8)

River	Boundary (if applicable)	Tributary to (if applicable)	Harbour/ outlet	Added Post-Workshop	Current river state (RiVAS)								Sum	Significance	
					River channel					Riparian edge		Wider Landscape			
					River shape	Flow regime	Water quality	Absence of exotic flora/fauna	Structures/ human modification	Extent of native flora	Structures/ human modification	Landscape character			
Mangamuka upper	Within the DoC estate		Hokianga		3	3	3	3	3	3	3	3	**24**	High	1
Waipapa upper	Within the DoC estate		Hokianga		3	3	3	3	3	3	3	3	**24**	High	2
Waipoua upper	Above the Waipoua Forest Visitor Centre		Tasman Sea		3	3	3	3	3	3	3	3	**24**	High	3
Waitangi upper	Above the Whakataha Road bridge		Bay of Islands		3	3	3	3	3	2	3	2	**22**	High	4
Kaeo upper and Waiare Stm	Above a point on Waiare Road		Whangaroa		3	3	2	2	3	3	3	2	**21**	High	5
Waimamaku upper	Above the SH12 bridge at Waimamaku		Tasman Sea		3	3	2	3	3	2	3	2	**21**	High	6
Mangakahia upper	Above the Twin Bridges	Wairoa	Kaipara		3	2	3	2	3	2	3	2	**20**	High	7
Rotokakahi and Mangonuiwae			Whangapae		3	3	2	2	3	2	3	2	**20**	High	8
Stony Stream		Oruaiti	Doubtless Bay	**	3	2	2	3	3	3	2	2	**20**	High	9
Waipapa lower, Whakanekeneke and Waihou	Outside the DoC estate		Hokianga		3	3	2	2	3	2	3	2	**20**	High	10
Hātea lower	Below Whangarei Falls		Whāngārei		3	1	2	2	3	3	2	3	**19**	Moderate	1
Hikurua		Takou	Takou Bay	**	3	2	3	2	2	2	3	2	**19**	Moderate	2
Kaikou		Wairoa	Kaipara	**	3	3	2	2	3	2	2	2	**19**	Moderate	3
Kerikeri			Kerikeri Inlet		3	2	2	2	3	3	2	2	**19**	Moderate	4
Ngunguru			Tutukaka		3	2	2	2	3	2	3	2	**19**	Moderate	5
Parapara Stm upper	Above the Taumata Road bridge	Awapoko	Doubtless Bay		3	3	2	2	3	2	2	2	**19**	Moderate	6
Pupuke			Whangaroa		2	3	2	2	3	2	3	2	**19**	Moderate	7
Taheke and Horohora		Horahora	Tutukaka		3	2	2	2	3	2	3	2	**19**	Moderate	8
Waima and Kaihu upper	Above the gorge exit (just north of the Kaihu settlement)	Wairoa	Kaipara		3	2	2	2	3	2	3	2	**19**	Moderate	9
Waimamaku lower	Below the SH12 bridge at Waimamaku		Tasman Sea		3	3	2	2	3	2	2	2	**19**	Moderate	10
Waipoua lower	Below the Waipoua Forest Visitor Centre		Tasman Sea		3	3	3	2	2	2	2	2	**19**	Moderate	11
Mangamuka lower	Outside the DoC estate		Hokianga		3	3	2	2	2	2	2	2	**18**	Moderate	12
Tirohanga Stm		Kawakawa	Bay of Islands		3	2	2	2	2	2	3	2	**18**	Moderate	13
Utakura			Hokianga		3	3	2	2	2	2	2	2	**18**	Moderate	14
Aurere Stm		Awapoko	Doubtless Bay	**	1	3	2	2	3	2	2	2	**17**	Moderate	15
Karemuhako Stm		Awanui	Rangaunu		3	2	2	2	2	2	2	2	**17**	Moderate	16
Mangakahia lower	Below the Twin Bridges	Wairoa	Kaipara		3	2	2	2	2	2	2	2	**17**	Moderate	17
Oruaiti			Doubtless Bay		2	2	2	2	3	2	2	2	**17**	Moderate	18
Oruru	Up to Pakanga Stream	Taipa	Doubtless Bay		2	2	2	2	3	2	2	2	**17**	Moderate	19
Parapara Stm lower	Below the Taumata Road bridge	Awapoko	Doubtless Bay		1	3	2	2	3	2	2	2	**17**	Moderate	20
Punakitere, Taheke and Waima			Hokianga		2	2	2	2	3	2	2	2	**17**	Moderate	21

Takahue		Awanui	Rangaunu		3	2	2	2	2	2	2	2	**17**	Moderate	22
Victoria		Awanui	Rangaunu		3	2	2	2	2	2	2	2	**17**	Moderate	23
Wainui		Oruaiti	Doubtless Bay	**	2	2	2	2	3	2	2	2	**17**	Moderate	24
Waiotama		Wairoa	Kaipara	**	3	1	2	2	3	2	2	2	**17**	Moderate	25
Hikurangi		Wairoa	Kaipara	**	2	2	2	2	2	2	2	2	**16**	Moderate	26
Kaeo lower	Below a point on Waiare Road		Whangaroa		2	3	1	2	2	2	2	2	**16**	Moderate	27
Manganui		Wairoa	Kaipara	**	3	1	1	2	3	2	2	2	**16**	Moderate	28
Oputeke		Wairoa	Kaipara	**	2	2	2	2	2	2	2	2	**16**	Moderate	29
Otiria Stream, Waiharakeke and Kawakawa		Kawakawa	Bay of Islands		2	2	2	2	2	2	2	2	**16**	Moderate	30
Puketotara Stm		Kerikeri	Kerikeri Inlet	**	2	2	2	2	2	2	2	2	**16**	Moderate	31
Waiaruhe		Waitangi	Bay of Islands	**	3	1	2	2	2	2	2	2	**16**	Moderate	32
Waipapa Stm			Kerikeri Inlet		3	1	2	2	2	2	2	2	**16**	Moderate	33
Waitangi lower	Below the Whakataha Road bridge		Bay of Islands		3	1	2	2	2	2	2	2	**16**	Moderate	34
Otaika Stm			Whāngārei		2	1	2	2	2	2	2	2	**15**	Low	2
Pohuenui		Waipu	Bream Bay	**	2	2	1	2	2	2	2	2	**15**	Low	3
Ahuroa		Waipu	Bream Bay		2	1	1	2	2	2	2	2	**14**	Low	4
Hātea upper (including tributaries such as Waitaua Stm and Mangakino Stm)	Above Whāngārei Falls		Whāngārei		2	1	2	1	2	2	2	2	**14**	Low	5
Kaihu lower	Below the gorge exit (just north of the Kaihu settlement)	Wairoa	Kaipara		2	2	1	1	2	2	2	2	**14**	Low	1
Mangere		Wairua	Kaipara		2	1	1	2	2	2	2	2	**14**	Low	6
Ruakaka			Bream Bay		2	1	1	2	2	2	2	2	**14**	Low	7
Whakapara		Wairua	Kaipara	**	1	3	1	2	1	2	1	2	**13**	Low	9
Awanui			Rangaunu		1	2	1	1	2	2	1	2	**12**	Low	10
Mangahahuru lower	Below Glenbervie Forest	Wairua	Kaipara	**	1	2	1	2	1	2	1	2	**12**	Low	11
Waiotu		Wairua	Kaipara	**	1	2	1	2	1	2	1	2	**12**	Low	12
Wairoa			Kaipara	**	2	1	1	1	1	2	2	2	**12**	Low	8
Wairua		Wairoa	Kaipara	**	1	1	1	2	1	2	1	2	**11**	Low	13

Key to attributes scores:
1= Highly modified (low degree of natural character)
2= Moderately modified (moderate degree of natural character)
3= Low or no modification (high degree of natural character)

Colour Code Key
Significance thresholds (highlighted columns)

Green	High = National	20-24
Blue	Moderate = Regional	16-19
Yellow	Low = Local	0-15

Misc (highlighted rivers)

Pink	Rivers overlap with neighbouring council

Data reliability (font colour)

Blue/Purple	Less reliable data
Red	Data checked by Expert Panel and has been adjusted
Orange shaded cells	Scoring changed subsequent to workshop as a result of additional data

Appendix 4
Assessment criteria for natural character (Steps 2-4)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
Step 2: Identify attributes Step 3: Select and describe primary attributes		Step 3: Select and describe primary attributes	Step 4: Identify indicators	Step 5: Determine significance thresholds	
River channel	**Channel shape**	Modification to cross section (e.g., slope-banks) and long section (e.g., cut through meanders) .This also includes changes to a river bed width (e.g., narrowing of the channel), which is commonly undertaken in modified rivers with valuable land adjacent. Changes to the bed sediment should also be taken account of in this attribute.	Aerial photographs, river cross sections, changes in river width/ length and water allocation resource consents (where available). Judgement from Expert Panel was also required due to limited available data for all rivers.	Judgement made on a 3-point scale: 1= Highly modified river, (i.e., straightened and channelised, often with concrete or rock fill banks) often within an urban context. 2= A river displaying a patchwork with moderate natural channel shape in places together with many human influences such as long stretches of stopbanks, groynes. 3= A highly natural river with no modifications to its channel shape.	Regional council, NIWA or other water quality data [i.e., GIS data]. Aerial photography. (Very good)
	Degree of modification of flow regime	Hydrological information on a river's low, median and mean flows assist in determining natural character. Substantial flow that appears to fit the nature and scale of the channel may suggest a higher degree of natural character. Dewatered bed or 'misfit' flows suggest upstream diversions, which reduce natural character.	Change to natural flow regime. % Flow rate modification (would show low flows). Would need to know the flow data for each river. Expert Panel judgement based on quantitative data available.	Judgement made on a 3-point scale: 1= Highly modified or diverted flow/ water-take (e.g., large-scale dams; take averaging 50% or more of median flow). 2= Moderately modified or diverted flow (e.g., several irrigation takes taking a moderate proportion of MALF). 3= Highly natural flow regime with no modifications to the flow pattern.	Regional council, NIWA or other water quality data. (Very good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
	Water quality	Perception of the water quality, especially its clarity, colour, etc.	Information from council or other parties. Also judgement from Expert Panel taking account of visual and biological aspects where they apply, particularly water clarity, nutrient content, temperature, salinity and faecal coliforms.	Judgement made on a 3-point scale: 1= Highly contaminated or permanently discoloured water displaying very high levels of human-induced changes to the water quality with limited life supporting capacity (e.g., within polluted urban/ industrialised areas or intensive farming). 2= Water displaying reasonable levels of naturalness although contains occasional high-moderate levels of human induced changes to part of the waterway or at some times. 3= Highly natural water quality displaying no human induced changes.	Regional council, NIWA or other water quality data. (Very good)
	Exposed riverbed	Extent of the exposed bed appropriate for river type (and flows) would assume higher natural character than one with unexpected areas of exposed bed not relating to flows.	Not all river types have exposed areas; depends on flow regime and nature of the channel. Also, difficult to judge for a braided river.		
	Bed material substrate	Exposed bed material appropriate for river type (i.e., size, geology for type of flow).	Visible geological make-up of the river substrate/ bed. Expert Panel judgement.		
	Exotic 'aquatic' flora and fauna within the river channel	Presence of aquatic flora and fauna within the river channel (including waterweeds, pest fish (which include trout and salmon), the eggs and fry of pest fish, and the invasive alga, e.g. didymo) can reduce the natural character of the river. This does not include vegetation on 'islands' within the river channel. This is contained under 'riparian vegetation'.	Expert Panel judgement, looking at volume, variety.	Judgement based on a 3-point scale: 1= River system choked with exotic aquatic flora and fauna. 2= Occasional stretches (some quite long) of introduced flora and fauna evident within waterway (approx. 50% of river). 3= No evidence of introduced flora or fauna within the water channel.	Regional council, NIWA or other water quality data. (Very good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		Algal bloom may be evident in some rivers due to seasonal low flows. Expert ecological judgement will be required to assess extent and may have a bearing on the degree of naturalness of this primary attribute.			
	Structures and human modifications within the river channel	Including dams, groynes, stopbanks, diversions, gravel extractions which may affect the level of natural character of the river channel.	Expert Panel judgement based on knowledge of river, assisted by aerial photos, council GIS, REC and LCDB. Linear measurement/ % proportion of human modification.	Judgement based on a 3-point scale: 1= River channel completely modified or artificial (i.e., dam/ weir/ flood defence structure). 2= Occasional 'reaches' of human modifications (i.e., a settled rural landscape with bridge/ aqueduct supports, pylon footing). 3= Overwhelmingly natural with no/ very limited evidence of human interference.	Regional council, NIWA or other water quality data. (Very good)
Riparian Edge	**Vegetation cover in the riparian edge**	Dominance of native communities in natural patterns (the presence of exotic species in natural patterns will reduce natural character but is of higher naturalness than the absence of such vegetation (unless this is natural) or the presence of planted vegetation). This includes all bankside vegetation as well as vegetation within 'islands', such as those within braided river systems. Vegetation comprises all types, including grasses, remnant scrub, shrubs and trees. In some instances, the natural elements and patterns indicate limited vegetation (i.e., high country rivers), where native	Proportion of native vegetation against other vegetation. Extent to which river processes have generated natural vegetation patterns. Expert Panel judgement based on REC (LCDB) and aerial photographs to assist in determining vegetation cover.	Judgement based on a 3-point scale: 1= Complete absence of vegetation due to human-induced changes (or limited presence (in pockets) of exotic vegetation such as occasional willow, gorse or buddleia). 2= Predominantly exotic vegetation in natural patterns (i.e., willows/ gorse) and/ or patches of remnant indigenous vegetation. 3= Overwhelmingly indigenous vegetation with no or few introduced species.	River Environment Classification system (REC), developed by NIWA. (Good)

ATTRIBUTE CLUSTERS	ATTRIBUTE (primary attributes in bold)	DESCRIPTION OF PRIMARY ATTRIBUTES	INDICATORS	INDICATOR SIGNIFICANCE THRESHOLDS	DATA SOURCES (AND RELIABILITY)
		grasses or herbs are the only form of vegetation in the area.			
	Extent of exotic flora	Proliferation of exotic flora.	% of exotic vegetation on REC (LCDB).		
	Structures and human modifications in the riparian edge	Include bridges, roads. All potentially impact on the naturalness of a river. An absence of human modifications. However minor, structures particularly if constructed from natural or local materials may not influence natural character greatly, but will have a localised effect. The scale and nature of modifications will influence the effect on natural character.	Expert Panel judgement with potential to base it on LCDP and REC GIS layers. Linear measurement/ Number of structures.	Judgement based on a 3-point scale: 1= Major modification to the riparian edge (i.e., dam/ weir/ flood defence structure). 2= Occasional 'pockets' of human modifications (i.e., a settled rural landscape with bridge/ aqueduct supports, boathouses). 3= Overwhelmingly natural with no/ very limited evidence of human interference.	River Environment Classification system (REC), developed by NIWA (good); Aerial photos LCDP. (Good)
Wider landscape character	**Character modifications**	Broader scale landscape modification beyond the immediate river margin, leaching from agricultural land, intensification of land use all impact on natural character. Protected natural areas such as reserves, parks and estates managed by DoC indicate a higher natural character. Catchment modifications if ecologically or visually linked to the waterway.	Expert Panel judgement based on intensification of land use adjacent to river (includes more distant views beyond the river banks). Expert Panel to rank from indigenous bush to urban scenarios. Use of LCDB and Landscape Assessments to inform decision.	Judgement based on a 3-point scale: 1= Heavily modified landscape (urban or highly intensive setting) with limited vegetation. 2= Settled pastoral landscape with areas of commercial forestry and pockets of indigenous vegetation. 3= Overwhelmingly indigenous landscape with no or very little human modification.	District or regional wide Landscape Assessments. (Good)

Appendix 5
Assessment of indicators by SMARTA criteria

Indicator	Specific	Measurable	Achievable	Relevant	Timely	Already in use
Channel shape	Yes	Expert judgement. Overlay of aerial photos or earlier maps, where available	Potential data available	Known to influence river's naturalness	Potential data available	Not known
Degree of modification of flow regime	Yes	Current minimum flow/ natural MALF- would show low flows	Data available for most rivers in proportion to river's use	Known to influence river's naturalness	Data usually already available	Not known
Water quality	Yes	Information from councils or others	Potential data available	Known to influence river's naturalness	Data already available	Not known
Exotic 'aquatic' flora and fauna within the river channel	Yes	% of native vegetation within waterway – LCDB	Data available	Known to influence river's naturalness	Data available	Not known
Structures and human modifications within the river channel	Yes	Number of structures within waterway (dams) including dams, bridge abutments etc – water allocation resource consents and regional council GIS database available where possible	Councils often hold such data	One main indicator of natural character	Data available	Not known
Vegetation cover within the riparian margin	Yes	% of native vegetation within 50m buffer from waterway – LCDB	Data available	One main indicator of natural character	Data available	Not known
Structures and human modifications within the riparian margin	Yes	Number of structures along the waterway edges or % of modified banks, e.g., stopbanks – regional council GIS database available where available	Councils often hold such data	One main indicator of natural character	Data available	Not known
Character modifications	Yes	% of native vegetation in LCDB or REC*	Data available	Known to influence rivers naturalness	Data available	Not known