Selection of rivers and lakes with significant indigenous ecosystems

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Contents

1. Introduction

The Regional Policy Statement provides direction for city and district councils and Greater Wellington Regional Council on the management of the natural and physical resources of the Wellington region. Objective 13 in the proposed Regional Policy Statement is:

The region's rivers, lakes and wetlands support healthy functioning ecosystems.

The Resource Management Act requires the protection of significant indigenous vegetation and significant habitats of indigenous fauna to be recognised and provided for by local authorities in accordance with section 6(c). Policy 17 of the regional policy statement is:

Regional plans shall include policies rules and rules that protect:

…

(b) the significant indigenous ecosystems associated with the rivers and lakes listed in Appendix 1.

And Policy 42 is:

When considering an application for a resource consent, notice of requirement, or a change, variation, or replacement to a district or regional plan, particular regard shall be given to:

…

(e) protecting the significant indigenous ecosystems of rivers and lakes, including those listed in Appendix 1.

The significant indigenous ecosystems of river and lake environments listed in Appendix 1 met one or more of the criteria listed in policy 22, which are:

- Representativeness: high representativeness values are given to particular ecosystems and habitats that were once typical and commonplace in a district or in the region, and:
  (i) are no longer commonplace; or
  (ii) are poorly represented in existing protected areas.
- Rarity: the ecosystem or habitat has biological physical features that are scarce or threatened in a local, regional or national context. This can include individual species, rare and distinctive biological communities and physical features that are unusual or rare.
- Diversity: the ecosystem or habitat has a natural diversity of ecological units, ecosystems, species and physical features within an area.
- Ecological context of an area: the ecosystem or habitat:
  (i) enhances connectivity or otherwise buffers representative, rare or diverse indigenous ecosystems and habitats; or
  (ii) provides seasonal or core habitat for threatened indigenous species.

- Tangata whenua values: the ecosystem or habitat contains characteristics of special spiritual, historical or cultural significance to tangata whenua, identified in accordance with tikanga Maori.

This report provides detail on how aquatic ecosystem indicators were used to assess which rivers and lakes met one or more of the policy 22 criteria for significant ecosystems. This process involved identification of appropriate indicators, identification of criteria for each indicator and application of these criteria to available data to identify significant river and lake ecosystems.

During this process, lakes were evaluated only in relation to their function as migratory pathways and habitat for native fish. Evaluation of the full range of lake ecosystem values has not been undertaken.

Tangata whenua values have not been assessed in this report.

2. River ecosystem indicators used to assess ecological significance

There are a range of aquatic ecosystem data available for the Wellington region including benthic algae, aquatic plants, macroinvertebrates and fish. Ideally an assessment of rivers and lakes with significant ecosystems should be based on as many indicators as possible. To identify significant river and lake ecosystems an indicator needs to be able to be related to one or more of the criteria listed in policy 22. At the time the list of rivers and lakes in Appendix 1 was produced only invertebrate or fish data could be related to these criteria. Benthic algae and aquatic plant data were not used. This section provides detail on the macroinvertebrate and fish indicators used to identify significant river or lake ecosystems and how they relate to the criteria identified in policy 22.

2.1 Macroinvertebrates

Macroinvertebrate community composition is a well established indicator of river ecosystem health that is widely used throughout New Zealand. There is an extensive body of macroinvertebrate community data from rivers and streams in the Wellington region both from the regional council's Rivers State of the Environment monitoring programme and from research projects undertaken in the region.

Macroinvertebrate community composition can be used to represent how close a river or stream is to its natural state and can be related to the representativeness criteria in policy 22. River ecosystems either at or close to their natural state have been significantly reduced from their former extent and consequently those that remain should be identified as significant river ecosystems.

To predict which rivers and streams would meet the criteria for ecological significance across all catchments in the region the relationship between macroinvertebrate indices and native vegetation cover was used.

2.2 Native fish

New Zealand's unique and highly endemic freshwater fish fauna are a significant component of the aquatic ecosystems of the region's rivers, streams, lakes and wetlands. The presence, or absence, of certain fish species can be linked to changes in habitat quality and water quality (McDowall 1990).

NIWA's New Zealand Freshwater Fish Database (NZFFD) provides over 900 records from fish surveys undertaken in the Wellington region. This data can be related to a number of criteria in policy 22.

Across New Zealand many native fish species are declining in range and abundance (McDowall 1990). These national trends are also apparent in the Wellington region with six of the 22 native fish species found within the region classified by the Department of Conservation as threatened species (Hitchmough et al. 2007). The presence of these threatened native fish species in rivers and lakes in the region is relevant to the rarity/special features criteria in policy 22 and will be used to identify significant river and lake ecosystems.

NZFFD records from the Wellington region can also be used identify river and lake catchments with a high diversity of native fish species. This is relevant to the diversity criteria in policy 22 and will also be used to identify significant river and lake ecosystems.

Eighteen of the 22 native fish species found in the Wellington region are diadromous, meaning that they must migrate between freshwater and marine environments to complete their lifecycle. If these migrations cannot be successfully completed, species can be lost from entire river and lake systems. This means that it is not only necessary to protect the river or lake habitat where these fish live, but the whole of the downstream river corridor through which they must migrate. For this reason where a river reach or lake is found to support threatened fish species and/or high fish diversity, the entire length of river downstream must also be classed as significant. This is consistent with the ecological context criteria in policy 22 which states that seasonal habitat for indigenous species must also be identified as ecologically significant.

In addition to the protection of adult habitat and corridors for migration, some species, specifically inanga, have distinct spawning habitat that must also be classed as significant aquatic ecosystems.

3. Identifying ecological indicator criteria

This section provides detail on how criteria were established for each indicator to identify when a river or lake should be classified as ecologically significant.

3.1 Macroinvertebrates

The thresholds used to identify invertebrate communities at or near their natural state (relevant to the representativeness criteria in policy 22) were decided based on a combination of macroinvertebrate data from the Wellington region and nationally established thresholds.

For this exercise we used the Macroinvertebrate Community Index (MCI) and the proportion of pollution sensitive mayfly, caddisfly and stonefly taxa (referred to as EPT taxa) to indicate how close a river is to its natural state.

The MCI user guide (Stark & Maxted 2007) identified >120 ± 5 as the MCI threshold for rivers and stream of 'excellent' quality based on the 25th percentile of reference site data from around the country. To verify whether this threshold is appropriate to rivers in the Wellington region, we assessed invertebrate data collected from 22 reference and 'best available' sites from a range of river types across the region[1].

The 25th percentile of MCI scores calculated for these sites ranged from 118 when just reference sites were included to 114 when MCI scores from both reference and 'best available' sites were included. Based on these results it was decided that an MCI score of 115 or more would adequately represent rivers in the Wellington region at or near to natural state (Table 1).

There are no standard thresholds for the proportion of EPT taxa however using the 25th percentile of results from the 22 reference and 'best available' sites a range of 51-57% was identified. Fifty percent EPT taxa was identified as the threshold to identify significant river ecosystems (Table 1).

These thresholds were used to identify rivers and streams with macroinvertebrate communities at or near to their natural state and consequently meet the significant river ecosystem criteria. These thresholds were then applied to the correlation between macroinvertebrate indices and native vegetation cover to map significant river ecosystems across the whole region.

3.1.1 Predicting macroinvertebrate health

Though there is a significant body of invertebrate data from rivers and streams in the Wellington region it is impossible to obtain invertebrate community data from every river and stream in the region. However, there are well established relationships between macroinvertebrate metrics and catchment land use that can be used to predict which rivers and streams will be at or near to their natural state across all rivers in the region.

The relationship between the macroinvertebrate community health metrics and indigenous forest and scrub cover in the Wellington region was investigated by correlating MCI and EPT richness scores from 78 sites around the region (including both reference and degraded sites across a range of river types)[2] with the proportion of indigenous forest and scrub cover in the upstream catchment. Native vegetation data was obtained from the River Environment Classification raw data (Snelder et al. 2004).

[1] These sites included 15 sites sampled in 2007 as part of the RSoE monitoring programme (Perrie 2007) and 7 sites sampled in 2001 as part of a study undertaken by Kingett Mitchell (Kingett Mitchell 2001). The sample collection and analysis methods were slightly different between these two studies (for example Kingett Mitchell results were based on 3, 1 minute kick net samples per site, GW results were based on 3 kick net samples collected over an area of 0.6-1.0 m^2). However, these differences should not significantly affect the MCI scores and EPT richness results for each site.

[2] These sites included 49 sites sampled in 2007 as part of the RSoE monitoring programme (Perrie 2007) and 29 sites sampled in 2001 as part of a study undertaken by Kingett Mitchell (Kingett Mitchell 2001).

There was a reasonably strong relationship between both MCI score and proportion of EPT taxa and proportion of indigenous forest and scrub cover in the upstream catchment (r^2 = 0.49 and 0.51 respectively) (Figures 1 and 2). Similar relationships have been observed both in New Zealand and internationally (e.g., Death & Collier in prep).

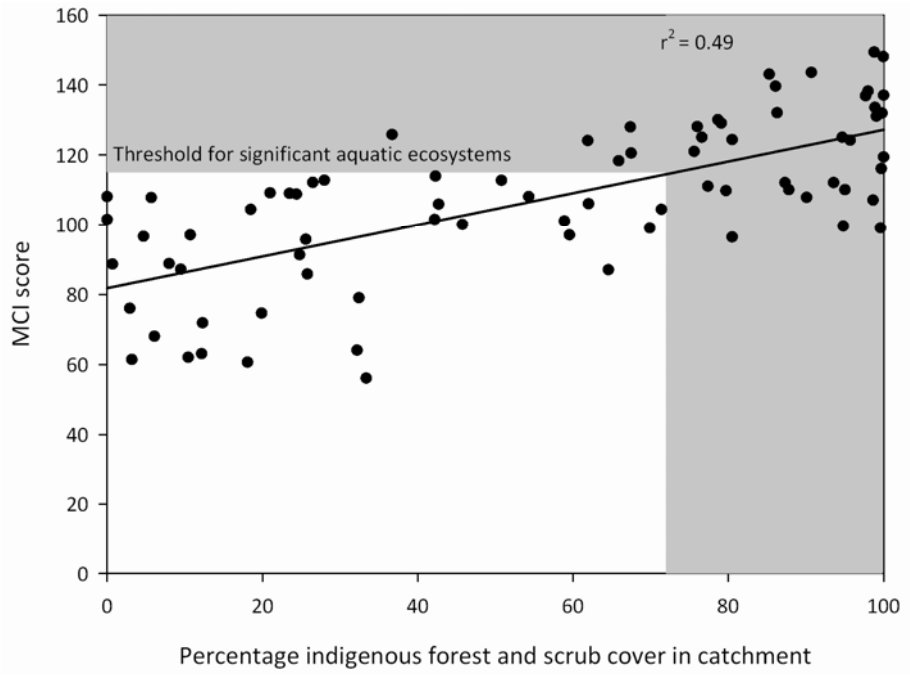

Figure 1: The correlation between MCI values from 78 sites in the Wellington region and the proportion of indigenous forest and scrub cover in the upstream catchment

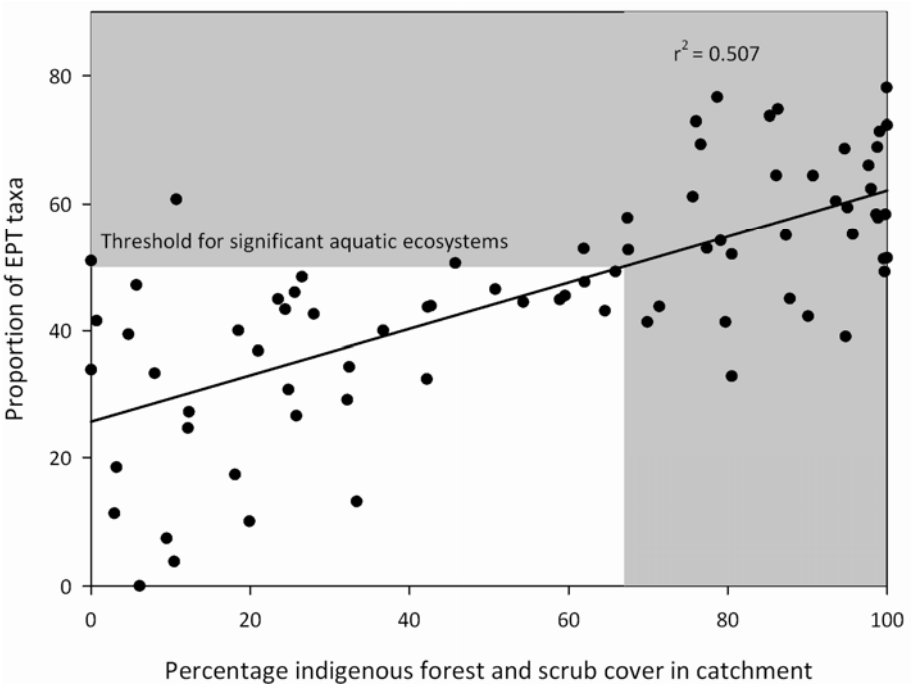

Figure 2: The correlation between the proportion of EPT taxa from 78 sites in the Wellington region and the proportion of indigenous forest and scrub cover in the upstream catchment

This relationship was strong enough to be used to predict which rivers are at or near to their natural state across the region rather than being restricted to sites for which invertebrate data is available.

To do this the macroinvertebrate indicator thresholds identified previously were applied to the regression line to identify the corresponding percentage indigenous forest and scrub cover. When the 115 MCI threshold was applied to the MCI and indigenous vegetation cover regression line, it corresponded to a catchment indigenous vegetation cover of approximately 75%. When the 50% EPT taxa threshold was applied, it related to a catchment indigenous forest vegetation cover of approximately 65%. Thus, in the Wellington region, rivers that are at or near to their natural state are generally those that have catchment indigenous vegetation cover values of between 65-75% or greater.

Based on these results, rivers and stream at or near their natural state were identified as those with 70% or more indigenous vegetation cover in the catchment (Table 1).

However, when these criteria were applied, very few catchments in the eastern Wairarapa were represented. Rivers and streams in the eastern Wairarapa have distinctive water quality and habitat characteristics due to the dominance of marine sedimentary geology and it is important that these rivers and streams are adequately represented in the list of significant river ecosystems for the Wellington region. Consequently, rivers and streams at or near to their natural state east of the Ruamahanga River were identified as those with 60% or more indigenous vegetation cover in the catchment (Table 1).

Table 1: Macroinvertebrate metric thresholds and corresponding catchment indigenous vegetation cover thresholds used to identify significant indigenous river ecosystems

Invertebrate metric	Significant river ecosystem threshold	Corresponding indigenous vegetation cover threshold (%)	
		West of Ruamahanga River	East of Ruamahanga River
MCI	115	70	60
Proportion of EPT taxa (%)	50	70	60

Though only the relationship between indigenous forest and scrub cover and macroinvertebrate indicators were assessed for this exercise it is important to note that strong relationships have also been observed between indigenous vegetation cover and other river ecosystem indictors such as fish (see section 4.2). Indeed the proportion of indigenous forest cover in a catchment is likely to be strongly correlated with the health of stream and river ecosystems as a whole.

3.2 Native fish

Significant river and lake ecosystems for native fish in the Wellington region were identified as those that support one or more threatened native fish species or have high native fish diversity. The entire river reaches downstream of these sites were also identified as significant in order to protect the migratory pathways of these species. These indicators relate to the rarity/special features, diversity and ecological context criteria in policy 22 respectively.

3.2.1 Nationally threatened species

The Department of Conservation identifies species that are at risk of extinction across New Zealand. Using the most recent classification (Hitchmough et al. 2007), six species of native freshwater fish found within the Wellington region are classified as being at risk of extinction.

These six nationally threatened species belong to one of two threatened classifications. Giant kokopu, longfin eel, dwarf galaxias and brown mudfish are classified as 'chronically threatened – gradual decline'. Chronically threatened species are considered to be declining in abundance but are currently buffered by a slow rate of decline or by a large total population size. Lamprey and shortjaw kokopu are classified as 'at risk – sparse', populations of these species are not currently considered to be declining but certain characteristics of their populations, such as scattered sub-populations or restricted ranges, mean that a new threat could lead to a rapid decline and or extinction (Hitchmough et al. 2007).

Though brown mudfish and longfin eel are categorised as being at risk of extinction, these species were not included in the list of threatened native fish species for this exercise for the following reasons:

Brown mudfish

Brown mudfish are considered to be wetland specialists (McDowall 1990) and as such are typically associated with wetland habitats. Brown mudfish and its wetland habitat will be protected by giving effect to policy 23 of the Regional Policy Statement, which requires district and regional plans to include policies, rules and methods to protect indigenous ecosystems and habitats with significant biodiversity values from inappropriate subdivision, use and development.

Longfin eel

Longfin eels are the most commonly recorded fish in the Wellington region (Strickland & Quarterman 2001). This means that if this species was included in the list of threatened species used for this exercise the majority of rivers and streams in the Wellington region would be classified as ecologically significant. It is unrealistic for all rivers in the Wellington region to be managed as significant river ecosystems. However, the common co-occurrence of longfin eels with other native fish species identified as threatened, as well as the inclusion of longfin eels in the assessment of native

fish biodiversity (see section 3.3.2), is considered to give the longfin eel a high level of protection.

3.2.2 Native fish diversity

Classification of sites with high native fish diversity, is based on methodology previously used by Strickland & Quarterman (2001) who undertook a similar exercise in the Wellington region. Strickland & Quarterman (2001) categorised a reach or river as having "high" value if six or more diadromous species were present within the river system.

Non-diadromous species were excluded from this analysis. The two non-migratory bully species, cran's and upland bullies, are distributed widely throughout the region and commonly occur with migratory species so will gain protection via protecting habitat of migratory species. Habitat for the other two non-migratory species, dwarf galaxias and brown mudfish, will be protected because the former is identified as an indicator species by its nationally threatened status, while the latter will be protected by Policy 23 of the Regional Policy Statement.

4. Applying criteria to identify significant river ecosystems

This section provides detail on how the criteria for each indicator were applied to data from the Wellington region to identify significant river ecosystems.

4.1 Predicting significant river ecosystems using correlation between macroinvertebrate community health and indigenous vegetation cover

Rivers and streams at or near their natural state as indicated by macroinvertebrate community composition were identified using the correlation between macroinvertebrate community composition and catchment indigenous vegetation cover. Catchments indigenous vegetation cover of 70% or more was identified as the threshold for identification of river and streams either at or near their natural state. For catchments east of the Ruamahanga River, 60% indigenous vegetation cover was identified as the threshold.

Using indigenous forest and scrub cover data from the LCDB v2 (Land Cover Database) catchments that met the above invertebrate criteria were identified. Indigenous forest and scrub cover was calculated for each fourth order catchment. For rivers and streams draining straight to sea or to lakes these criteria were applied at down to the first order catchment scale. This analysis was undertaken using ArcMap v92 to produce a map showing all significant river ecosystem catchments in the region (Figure 3). The rivers within these catchments were then listed in Appendix 1.

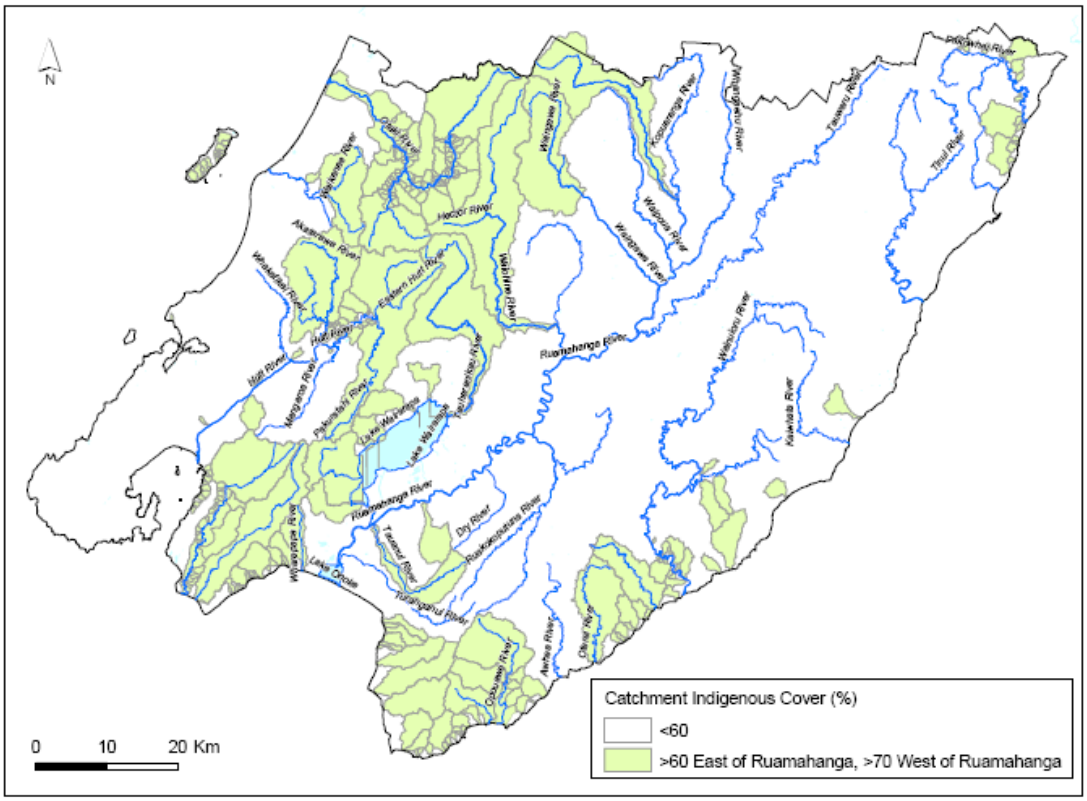

Figure 3: Catchments identified as supporting significant river ecosystems based on the relationship between macroinvertebrate community health and indigenous forest and scrub cover in the upstream catchment. Catchment indigenous vegetation cover was assessed at the 4th order catchment scale apart from rivers draining directly to the coast or to a lake.

4.2 Native fish

The NZFFD was used to identify rivers and lakes in the Wellington region that support one or more threatened species and/or high fish biodiversity. This assessment was undertaken using records from between 1960 and 2008. This is a more conservative time range than has been used in similar exercises (e.g., McArthur et al. 2007 used records from 1990 onwards). However, it was chosen to provide a degree of protection to rivers that support threatened fish species or high fish diversity but are not represented in recent NZFFD records.

The native vegetation cover criteria identified in section 3.1 are also considered to provide some protection to native fish communities in catchments with no NZFFD records. As with invertebrate communities, ecologically significant native fish communities are typically correlated with indigenous forest cover.

As mentioned in section 2.4, the entire length of river downstream from a reach or catchment supporting threatened fish species or high native fish diversity was classified as significant due to the diadromous nature of most native fish.

Rivers and lakes identified as ecologically significant for native fish are shown in Figure 4 and listed in Appendix 1. Inanga spawning habitats within the Wellington region as identified in Taylor and Kelly (2001 & 2002) were also

classed as significant river ecosystems and are also shown in Figure 4 and listed in Appendix 1.

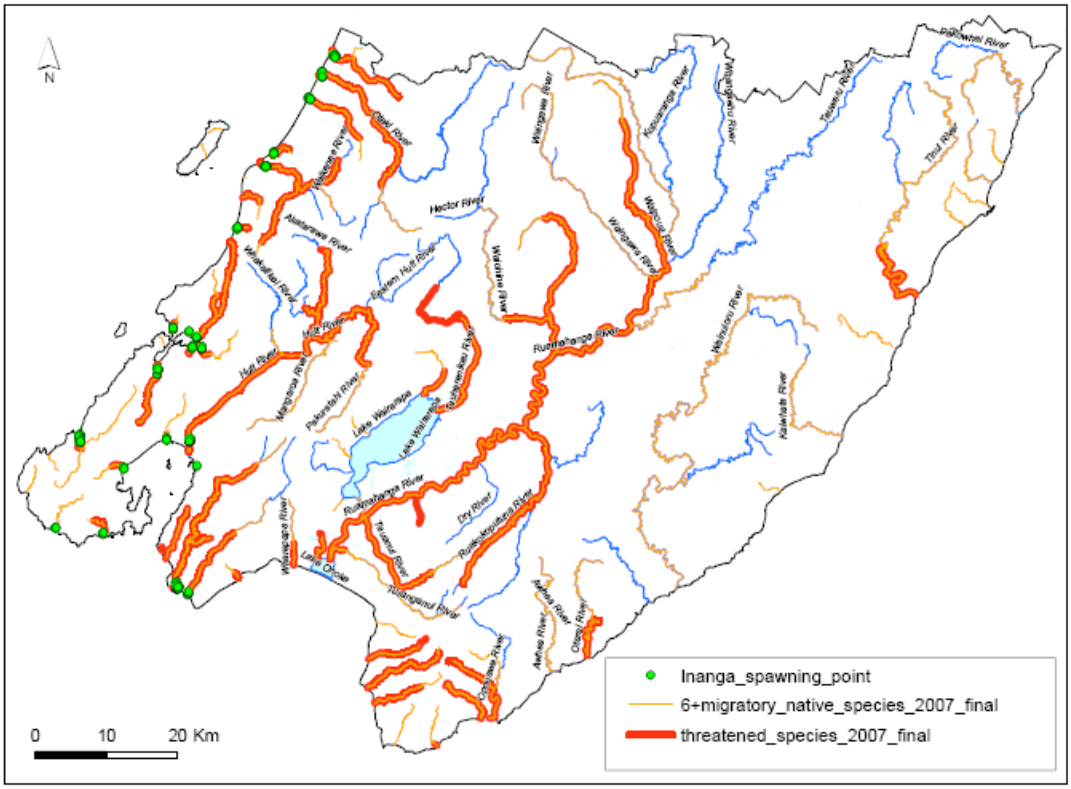

Figure 4: Significant river ecosystems identified for the Wellington region based on reaches supporting threatened native fish species, high native fish diversity and downstream river reaches used as migratory pathways. Sites identified as important for inanga spawning are also classed as ecologically significant.

5. Future tools

The list of rivers in Appendix 1 was produced using the data and tools available at the time. There are currently a number of projects underway both regionally and nationally that may improve our ability to identify ecologically significant rivers and streams in the future. These include development of models to predict native fish distribution and indices to represent fish community health. The Department of Conservation is co-ordinating the identification of Waterbodies of National Importance (WONI) using predictive modelling of a range of aquatic ecosystem factors to score aquatic ecosystem values of rivers across the country.

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Appendix 1

Table 16 from the proposed Regional Policy Statement RPS. Rivers and lakes associated with significant aquatic ecosystems in the Wellington region.

Key to symbols used in Table 16
"•" means that all rivers in the catchment of the rivers or lakes specified held the value identified
"T" means that the value identified was only found in the area of tidal influence in the river

River or lake	Criteria			
	Catchments with a high percentage of indigenous vegetation cover	Habitat for threatened indigenous fish species in the catchment	Habitat for six or more indigenous fish species in the catchment	Inanga spawning habitat in the catchment
All rivers on Kapiti Island	•	•	•	
Waitohu Stream		•	•	T
Otaki River	•	•	•	T
Mangaone Stream		•	•	T
Waimeha Stream		•	•	T
Waikanae River	•	•	•	T
Wharemauku Stream		•	•	
Whareroa Stream		•	•	T
Wainui Stream		•	•	
Taupo Stream		•	•	T
Kakaho Stream		•	•	T
Horokiri Stream		•	•	T
Little Waitangi Stream		•	•	
Pauatahunui Stream		•	•	T
Duck Creek		•	•	T
Porirua Stream		•	•	T
Makara Stream		•	•	T
Te Ikaamaru Bay Stream			•	
Oteranga Stream			•	
Karori Stream		•	•	
Owhiro Bay Stream		•	•	T
Kaiwharawhara Stream		•	•	
Korokoro Stream		•	•	

River or lake	Criteria			
	Catchments with a high percentage of indigenous vegetation cover	Habitat for threatened indigenous fish species in the catchment	Habitat for six or more indigenous fish species in the catchment	Inanga spawning habitat in the catchment
Hutt River above, and including, the Akatarawa River confluence	•	•	•	
Hutt River below the Akatarawa Stream confluence		•	•	T
Whakatikei River			•	
Akatarawa River	•	•	•	
Pakuratahi River	•	•	•	
Mangaroa River			•	
Days Bay Stream		•		
Lake Kohangapiripiri and Cameron Creek		•		
Lake Kohangatera and Gollans Stream		•	•	
Wainuiomata River	•	•	•	T
Orongorongo River	•	•	•	
Mukamukaiti Stream	•	•	•	
Wharepapa River	•	•	•	
Pounui Stream and Lake Pounui		•	•	
Lake Wairarapa		•	•	
Manganui Stream		•		
Wairongomai River	•			
Burlings Stream	•		•	
Brocketts Stream	•		•	
Abbots Creek	•	•	•	
Tauherenikau River	•	•	•	
Ruamahanga River above the Kopuaranga river confluence	•		•	
Ruamahanga River below , and including, the Kopuaranga confluence		•	•	T
Waiohine River above the Mangatarere Stream confluence	•	•	•	
Waiohine River below, and including, the Mangatarere Stream to the Ruamahanga River		•	•	
Waingawa River above, and including, the Atiwhakatu Stream	•		•	
Waingawa River below the Atiwhakatu Stream to the Ruamahanga River			•	

River or lake	Criteria			
	Catchments with a high percentage of indigenous vegetation cover	Habitat for threatened indigenous fish species in the catchment	Habitat for six or more indigenous fish species in the catchment	Inanga spawning habitat in the catchment
Waipoua River		•	•	
Tauweru River			•	
Ruakokopatuna River		•	•	
Oruapouanui Stream		•		
Waihora Stream	•	•		
Tauanui Stream		•	•	
Turanganui River	•	•	•	
Putangirua Stream	•	•	•	
Makatukutuku Stream	•	•	•	
Pararaki Stream	•	•	•	
Otakaha Stream	•	•	•	
Mangatoetoe Stream	•	•	•	
Waitetuna Stream	•	•	•	
Whawanui River	•	•	•	
Opouawe River	•	•	•	
Awhea River		•	•	
Oterei River	•	•	•	T
All rivers flowing to the coast between the Huariki Stream and the Rerewhakaaitu River	•			
Pahaoa River			•	T
an unnamed tributary on the true left of the Pahaoa River at easting 2742200 and northing 5992169	•			
an unnamed tributary on the true left bank of the Pahaoa River at northing 2739983 and easting 5991469	•			
Rivers on the true left bank of the Pahaoa River between easting 2732790 and northing 5984194 and the coast.	•			
Rivers on the true right bank of the Pahaoa River between easting 2733640 and northing 5981454 and the coast.	•			
Waiuru Stream	•			
Waihingaia Stream	•			
Huatokitoki Stream catchment	•		•	
Kaiwhata River catchment		•	•	

River or lake	Criteria			
	Catchments with a high percentage of indigenous vegetation cover	Habitat for threatened indigenous fish species in the catchment	Habitat for six or more indigenous fish species in the catchment	Inanga spawning habitat in the catchment
Kaimokopuna Stream catchment	•			
Motuwaireka Stream catchment		•	•	T
Whareama River catchment		•	•	T
Ngakauau Stream catchment			•	
Castlepoint Stream catchment			•	
Whakatiki River catchment			•	T
Okau Stream catchment	•		•	
Mataikona River			•	T
Rivers on the true left bank of the Mataikona River between the Pakowhai River and easting 2785345 and northing 6046718	•			
Rivers on the true right bank of the Mataikona River between easting 2784611 and northing 6046207 and the coast.	•			

Water, air, earth and energy – elements in Greater Wellington's logo that combine to create and sustain life. Greater Wellington promotes **Quality for Life** by ensuring our environment is protected while meeting the economic, cultural and social needs of the community

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