Te Awarua-o-Porirua Whaitua Committee

greater WELLINGTON REGIONAL COUNCIL Te Pane Matua Taiao

Title: Attributes

Purpose: To provide the Committee with an introduction to the concept of 'attributes' and how they will be used in the whaitua process

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Attributes

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1. What is an attribute?

An ‘attribute’ describes a characteristic of a value of water. For example, algae is an attribute of the health of the estuarine ecosystem of Te Awarua-o-Porirua Harbour. Attributes are used as tools to assess whether values are being achieved or not.

Attribute is not a commonly used term – you may be more familiar with terms like indicator, measure, tohu or feature. These terms have similar meanings and can roughly be used interchangeably. To be consistent, we will be using attribute throughout the whaitua process.

The term attribute is given to us by the National Policy Statement for Freshwater Management 2014 (NPS-FM). In the NPS-FM, an attribute is defined as ‘a measurable characteristic of freshwater, including physical, chemical and biological properties, which support particular values’.

While you will not find the term attribute in the equivalent national policy document for coastal water (the New Zealand Coastal Policy Statement 2010), the concept equally applies to thinking about values for estuarine and open coastal water.

2. What are attributes used for?

Attributes provide information on how values of water are changing over time. Values are hard to measure in of themselves as they can be broad and complex. Attributes provide a means with which to assess values instead.

Attributes will be used in the whaitua process to:

- test how different scenarios (land and water management options) provide for values of fresh and coastal water. This includes by illustrating, where possible, the results of the collaborative modelling process by showing how the chosen attributes are affected under different scenarios, and
- set objectives for fresh and coastal water that the Whaitua Implementation Programme (WIP) is seeking to achieve, and
- through time, measure how successfully the implementation of the WIP actions is at achieving these objectives for fresh and coastal water.

3. Choosing attributes

It is up to the Committee to choose the attributes for Te Awarua-o-Porirua whaitua. Over the coming months you’ll work on refining the values the community of the whaitua has for fresh and coastal water, and to identify the best set of attributes to help measure how these values are being achieved.

In selecting attributes, the Committee will need to consider which are best to measure the impacts of different land and water management options. Attributes will help in understanding the potential impacts and effects of different management scenarios in a consistent way.

There will be tradeoffs when selecting attributes. For example, the most precise attribute may not be the most cost-effective. It may be a collection of attributes together that provides the best description of a value, rather than any one attribute alone. You may also find that some attributes are useful across a range of values. For example, water clarity is an attribute of ecosystem health as well as of recreation.

Attributes may be described in quantitative or qualitative ways. Attributes that can be described in quantitative or numeric terms are useful because they can be monitored and analysed with certainty. However, there may not be quantitative means of measuring some values or quantitative measures may not describe the fullness or complexity of a value. Attributes that can only be described in qualitative or narrative terms may be harder to monitor and analyse with certainty, but may be more realistic and meaningful measures a value.

Typically we are better at identifying and assessing attributes of environmental values than we are at cultural and social values. There are many attributes already identified that could be used to assess environmental, cultural, social and economic values or water. However, the Committee's work does not need to be constrained only to those attributes that can already be actively measured or tightly defined. If an attribute does not exist to adequately assess a value, we may need to design a suitable attribute.

It's useful to note too that we can use attributes that are proxies for an actual characteristic of a value, but which still provides useful information on that value. One example is measuring *E.coli* concentrations in fresh water to determine risks to human health. *E.coli* itself is not pathogenic to people, but it is easy to test for and can be used as an indicator of the presence of other dangerous pathogens that are harder to test for.

The NPS-FM provides a list of attributes in the National Objectives Framework (NOF) that the Committee must use when setting freshwater objectives for the 'compulsory values' of ecosystem health and human health (see Appendix 1). NPS-FM does not limit the Committee only to those attributes in the NOF, but they must be used when they are relevant.

4. What makes a good attribute?

In looking for good attributes, the following criteria adapted from Allen et al (2012) are useful. Attributes should:

- Be directly relevant to the issue or problem in question
- Have a direct or a proxy relationship to the value being assessed
- Complement other attributes so that together they represent the system being assessed
- Be able to be feasibly collected, analysed and reported on in a cost-effective and timely way
- Be accepted and understood by a range of audiences
- Have a direct use for decision-making

Choosing attributes will be an iterative process and the Committee will need to revisit any selected attributes as we move through the whaitua process. This list provides a useful set of criteria to consider when choosing attributes for the values of water in Te Awarua-o-Porirua and a starting point for the discussion at our workshop into understanding and identifying attributes.

_____	_____	_____	_____
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References

Allen W, Fenemore A and Wood D. 2012. Effective indicators for freshwater management: Attributes and frameworks for development. Prepared for Aqualinc Research for the MSI Wheel of Water Project.
http://www.learningforsustainability.net/pubs/developing-effective_indicators.pdf

Appendix

Copy of the attribute tables from Appendix 2 of the National Policy Statement for Freshwater Management 2014[1]

Value	Ecosystem health		
Freshwater Body Type	Lakes		
Attribute	Phytoplankton (Trophic state)		
Attribute Unit	mg/m^3 (milligrams chlorophyll-a per cubic metre)		
Attribute State	**Numeric Attribute State**		**Narrative Attribute State**
	Annual Median	Annual Maximum	
A	≤2	≤10	Lake ecological communities are healthy and resilient, similar to natural reference conditions.
B	>2 and ≤5	>10 and ≤25	Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrients levels that are elevated above natural reference conditions.
C	>5 and ≤12	>25 and ≤60	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrients levels that are elevated well above natural reference conditions.
National Bottom Line	**12**	**60**	
D	>12	>60	Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state, due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

[1] http://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/nps-freshwater-management-jul-14.pdf

Value	Ecosystem health		
Freshwater Body Type	Lakes		
Attribute	Total Nitrogen (Trophic state)		
Attribute Unit	mg/m^3 (milligrams per cubic metre)		
Attribute State	**Numeric Attribute State**		**Narrative Attribute State**
	Annual Median	Annual Median	
	Seasonally Stratified and Brackish*	Polymictic	
A	≤160	≤300	Lake ecological communities are healthy and resilient, similar to natural reference conditions.
B	>160 and ≤350	>300 and ≤500	Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrients levels that are elevated above natural reference conditions.
C	>350 and ≤750	>500 and ≤800	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrients levels that are elevated well above natural reference conditions
National Bottom Line	**750**	**800**	
D	>750	>800	Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state, due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

* Intermittently closing and opening lagoons (ICOLs) are not included in brackish lakes.

Value	Ecosystem health	
Freshwater Body Type	Lakes	
Attribute	Total Phosphorus (Trophic state)	
Attribute Unit	mg/m^3 (milligrams per cubic metre)	
Attribute State	**Numeric Attribute State**	**Narrative Attribute State**
	Annual Median	
A	≤10	Lake ecological communities are healthy and resilient, similar to natural reference conditions.
B	>10 and ≤20	Lake ecological communities are slightly impacted by additional algal and plant growth arising from nutrients levels that are elevated above natural reference conditions.
C	>20 and ≤50	Lake ecological communities are moderately impacted by additional algal and plant growth arising from nutrients levels that are elevated well above natural reference conditions.
National Bottom Line	**50**	
D	>50	Lake ecological communities have undergone or are at high risk of a regime shift to a persistent, degraded state, due to impacts of elevated nutrients leading to excessive algal and/or plant growth, as well as from losing oxygen in bottom waters of deep lakes.

Value	Ecosystem health		
Freshwater Body Type	Rivers		
Attribute	Periphyton (Trophic state)		
Attribute Unit	mg chl-a/m² (milligrams chlorophyll-a per square metre)		
Attribute State	**Numeric Attribute State (Default Class)**	**Numeric Attribute State (Productive Class[1])**	**Narrative Attribute State**
	Exceeded no more than 8% of samples[2]	**Exceeded no more than 17% of samples[2]**	
A	≤50	≤50	Rare blooms reflecting negligible nutrient enrichment and/or alteration of the natural flow regime or habitat.
B	>50 and ≤120	>50 and ≤120	Occasional blooms reflecting low nutrient enrichment and/or alteration of the natural flow regime or habitat.
C	>120 and ≤200	>120 and ≤200	Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or alteration of the natural flow regime or habitat.
National Bottom Line	**200**	**200**	
D	>200	>200	Regular and/or extended-duration nuisance blooms reflecting high nutrient enrichment and/or significant alteration of the natural flow regime or habitat.

1. Classes are streams and rivers defined according to types in the River Environment Classification (REC). The Productive periphyton class is defined by the combination of REC "Dry" Climate categories (i.e. Warm-Dry (WD) and Cool-Dry (CD)) and REC Geology categories that have naturally high levels of nutrient enrichment due to their catchment geology (i.e. Soft-Sedimentary (SS), Volcanic Acidic (VA) and Volcanic Basic (VB)). Therefore the productive category is defined by the following REC defined types: WD/SS, WD/VB, WD/VA, CD/SS, CD/VB, CD/VA. The Default class includes all REC types not in the Productive class.

2. Based on a monthly monitoring regime. The minimum record length for grading a site based on periphyton (chl-a) is 3 years.

Value	Ecosystem health		
Freshwater Body Type	Rivers		
Attribute	Nitrate (Toxicity)		
Attribute Unit	mg NO_3-N/L (milligrams nitrate-nitrogen per litre)		
Attribute State	**Numeric Attribute State**		**Narrative Attribute State**
	Annual Median	**Annual 95th Percentile**	
A	≤1.0	≤1.5	High conservation value system. Unlikely to be effects even on sensitive species
B	>1.0 and ≤2.4	>1.5 and ≤3.5	Some growth effect on up to 5% of species.
C	>2.4 and ≤6.9	>3.5 and ≤9.8	Growth effects on up to 20% of species (mainly sensitive species such as fish). No acute effects.
National Bottom Line	6.9	9.8	
D	>6.9	>9.8	Impacts on growth of multiple species, and starts approaching acute impact level (ie risk of death) for sensitive species at higher concentrations (>20 mg/L)

Value	Ecosystem health		
Freshwater Body Type	Lakes and rivers		
Attribute	Ammonia (Toxicity)		
Attribute Unit	mg NH_4-N/L (milligrams ammoniacal-nitrogen per litre)		
Attribute State	**Numeric Attribute State**		**Narrative Attribute State**
	Annual Median*	**Annual Maximum***	
A	≤0.03	≤0.05	99% species protection level: No observed effect on any species tested
B	>0.03 and ≤0.24	>0.05 and ≤0.40	95% species protection level: Starts impacting occasionally on the 5% most sensitive species
C	>0.24 and ≤1.30	>0.40 and ≤2.20	80% species protection level: Starts impacting regularly on the 20% most sensitive species (reduced survival of most sensitive species)
National Bottom Line	**1.30**	**2.20**	
D	>1.30	>2.20	Starts approaching acute impact level (ie risk of death) for sensitive species

* Based on pH 8 and temperature of 20°C.

Compliance with the numeric attribute states should be undertaken after pH adjustment.

Value	Ecosystem health		
Freshwater Body Type	Rivers (below point sources)		
Attribute	Dissolved Oxygen		
Attribute Unit	mg/L (milligrams per litre)		
Attribute State	**Numeric Attribute State**		**Narrative Attribute State**
	7-day mean minimum[1] (Summer Period: 1 November to 30th April)	1-day minimum[2] (Summer Period: 1 November to 30th April)	
A	≥8.0	≥7.5	No stress caused by low dissolved oxygen on any aquatic organisms that are present at matched reference (near-pristine) sites.
B	≥7.0 and <8.0	≥5.0 and <7.5	Occasional minor stress on sensitive organisms caused by short periods (a few hours each day) of lower dissolved oxygen. Risk of reduced abundance of sensitive fish and macroinvertebrate species.
C	≥5.0 and <7.0	≥4.0 and <5.0	Moderate stress on a number of aquatic organisms caused by dissolved oxygen levels exceeding preference levels for periods of several hours each day. Risk of sensitive fish and macroinvertebrate species being lost.
National Bottom Line	**5.0**	**4.0**	
D	<5.0	<4.0	Significant, persistent stress on a range of aquatic organisms caused by dissolved oxygen exceeding tolerance levels. Likelihood of local extinctions of keystone species and loss of ecological integrity.

1. The mean value of 7 consecutive daily minimum values.

2. The lowest daily minimum across the whole summer period.

Value	Human health for recreation		
Freshwater Body Type	Lakes and rivers		
Attribute	*E. coli**		
Attribute Unit	*E. coli*/100 mL (number of *E. coli* per hundred millilitres)		
Attribute State	**Numeric Attribute State**	**Sampling Statistic**	**Narrative Attribute State**
A	≤260	Annual median	People are exposed to a very low risk of infection (less than 0.1% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating)
		95th percentile	People are exposed to a low risk of infection (up to 1% risk) when undertaking activities likely to involve full immersion.
B	>260 and ≤540	Annual median	People are exposed to a low risk of infection (less than 1% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).
		95th percentile	People are exposed to a moderate risk of infection (less than 5% risk) when undertaking activities likely to involve full immersion. 540 / 100ml is the **minimum acceptable state** for activities likely to involve full immersion.
C	>540 and ≤1000	Annual median	People are exposed to a moderate risk of infection (less than 5% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating). People are exposed to a high risk of infection (greater than 5% risk) from contact with water during activities likely to involve immersion.
National Bottom Line	1000	Annual median	
D	>1000	Annual median	People are exposed to a high risk of infection (greater than 5% risk) from contact with water during activities with occasional immersion and some ingestion of water (such as wading and boating).

*Escherichia coli