Values, objectives and policy responses

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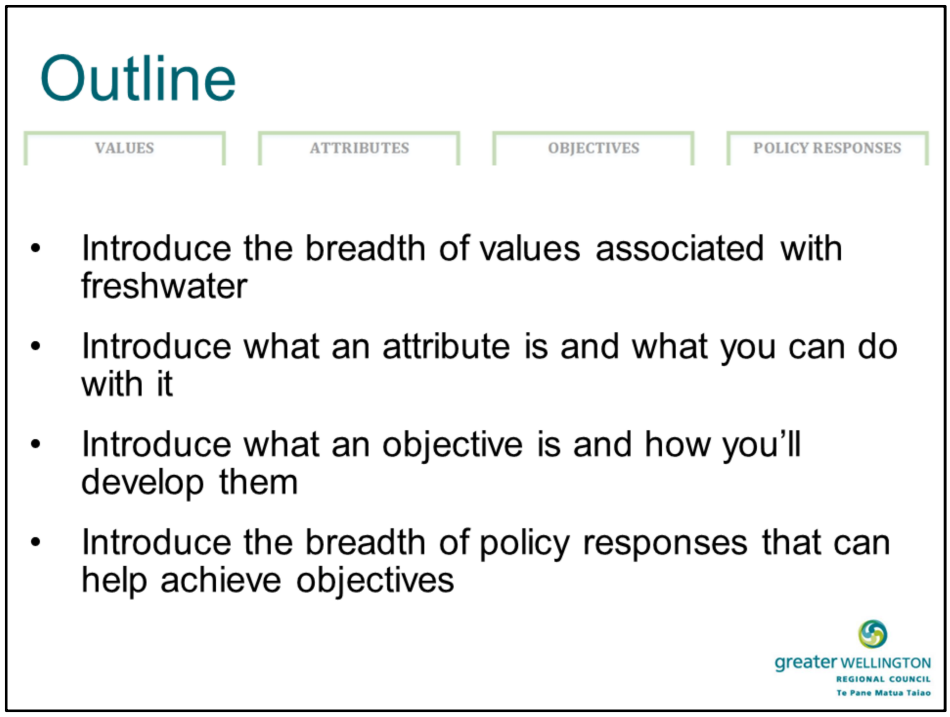
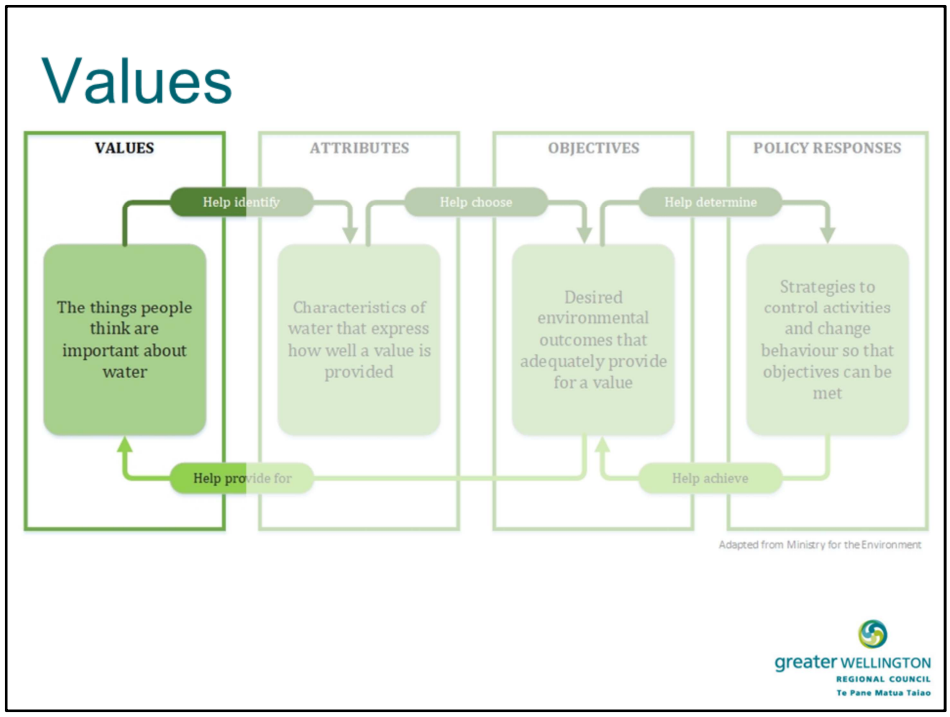


Session outline

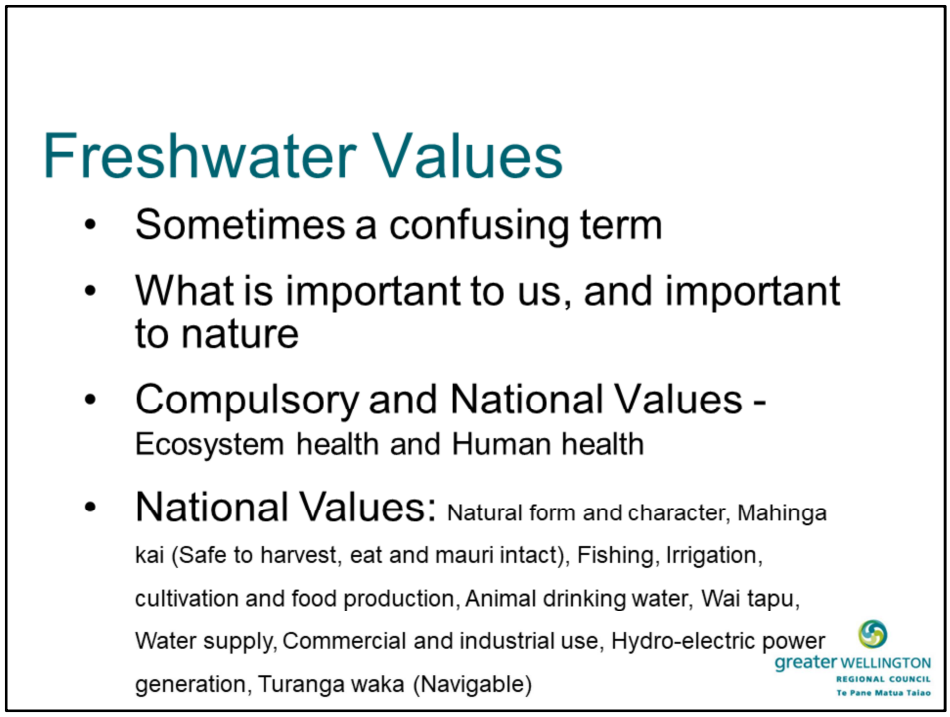
Over this session, we are going to help you explore the building blocks of values, attribute, objectives and policy responses. I won't go through each one now, but you can see a brief explanation of each of these on the slide. We'll talk about each bit in more detail as we go through, and follow a couple of examples through as we do that.

This session will give you an introduction to the content, choices and decisions that you'll need to come to consensus on as you work though the process during the next 18 months or so, and introduce some of the types of information that you'll work with as you go through that.

This will be quite interactive with Phill, Mark and myself presenting different parts and leading you through exercises and discussions throughout



The first part of the session is about values. These are the things that people think are important about water. The reasons we care. Some are about the intrinsic nature of a river being a river and doing the things a river does, others are about the benefits that we as people receive from rivers.



Confusing term, because it can be a bit abstract

"Value" means:
a) any national value; and
b) includes any value in relation to fresh water, that is not a national value, which a regional council identifies as appropriate for regional or local circumstances (including any use value).
"Compulsory values" mean the national values relating to ecosystem health and to human health for recreation included in Appendix 1 and for which a non-exhaustive list of attributes
"National value" means any value described in Appendix 1.

By every regional council making or changing regional policy statements and plans to consider and recognise Te Mana o te Wai, noting that:
a) te Mana o te Wai recognises the connection between water and the broader environment – Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people); and

b) values identified through engagement and discussion with the community, including tangata whenua, must inform the setting of freshwater objectives and limits.

COMPULSORY NATIONAL VALUES

Ecosystem health – The freshwater management unit supports a healthy ecosystem appropriate to that freshwater body type (river, lake, wetland, or aquifer).

In a healthy freshwater ecosystem ecological processes are maintained, there is a range and diversity of indigenous flora and fauna, and there is resilience to change. Matters to take into account for a healthy freshwater ecosystem include the management of adverse effects on flora and fauna of contaminants, changes in freshwater chemistry, excessive nutrients, algal blooms, high sediment levels, high temperatures, low oxygen, invasive species, and changes in flow regime. Other matters to take into account include the essential habitat needs of flora and fauna and the connections between water bodies.

Human health for recreation – In a healthy waterbody, people are able to connect with the water through a range of activities such as swimming, waka, boating, fishing, mahinga kai and water-skiing, in a range of different flows.

Matters to take into account for a healthy waterbody for human use include pathogens, clarity, deposited sediment, plant growth (from macrophytes to periphyton to phytoplankton), cyanobacteria and other toxicants.

Natural form and character – Where people value particular natural qualities of the freshwater management unit.

Matters contributing to the natural form and character of a freshwater management unit are its biological, visual and physical characteristics that are valued by the community, including:

i. its biophysical, ecological, geological, geomorphological and morphological aspects;

ii. the natural movement of water and sediment including hydrological and fluvial processes;

iii. the location of the water body relative to its natural course;

iv. the relative dominance of indigenous flora and fauna;

v. the presence of culturally significant species;

vi. the colour of the water; and

vii. the clarity of the water.

They may be freshwater management units with exceptional, natural, and iconic aesthetic features.

Mahinga kai – Kai are safe to harvest and eat.

Mahinga kai generally refers to indigenous freshwater species that have traditionally been used as food, tools, or other resources. It also refers to the places those species are found and to the act of catching them. Mahinga kai provide food for the people of the rohe and these sites give an indication of the overall health of the water.

For this value, kai would be safe to harvest and eat. Transfer of knowledge would occur about the preparation, storage and cooking of kai. In freshwater management units that are used for providing mahinga kai, the desired species are plentiful

enough for long-term harvest and the range of desired species is present across all life stages.

Mahinga kai – Kei te ora te mauri (the mauri of the place is intact).

For this value, freshwater resources would be available and able to be used for customary use. In freshwater management units that are valued for providing mahinga kai, resources would be available for use, customary practices able to be exercised to the extent desired, and tikanga and preferred methods are able to be practised.

Fishing – The freshwater management unit supports fisheries of species allowed to be caught and eaten.

For freshwater management units valued for fishing, the numbers of fish would be sufficient and suitable for human consumption. In some areas, fish abundance and diversity would provide a range in species and size of fish, and algal growth, water clarity and safety would be satisfactory for fishers. Attributes will need to be specific to fish species such as salmon, trout, eels, lamprey, or whitebait.

Irrigation, cultivation and food production – The freshwater management unit meets irrigation needs for any purpose.

Water quality and quantity would be suitable for irrigation needs, including supporting the cultivation of food crops, the production of food from domesticated animals, non-food crops such as fibre and timber, pasture, sports fields and recreational areas. Attributes will need to be specific to irrigation and food production requirements.

Animal drinking water – The freshwater management unit meets the needs of stock.

Water quality and quantity would meet the needs of stock, including whether it is palatable and safe.

Wai tapu – Wai tapu represent the places where rituals and ceremonies are performed, or where there is special significance to iwi/hapū.

Rituals and ceremonies include, but are not limited to, tohi (baptism), karakia (prayer), waerea (protective incantation), whakatapu (placing of raahui), whakanoa (removal of raahui), and tuku iho (gifting of knowledge and resources for future generations).

In providing for this value, the wai tapu would be free from human and animal waste, contaminants and excess sediment, with valued features and unique properties of the wai protected. Other matters that may be important are that there is no artificial mixing of the wai tapu and identified taonga in the wai are protected.

Water supply – The freshwater management unit can meet people's potable water needs.

Water quality and quantity would enable domestic water supply to be safe for drinking with, or in some areas without, treatment.

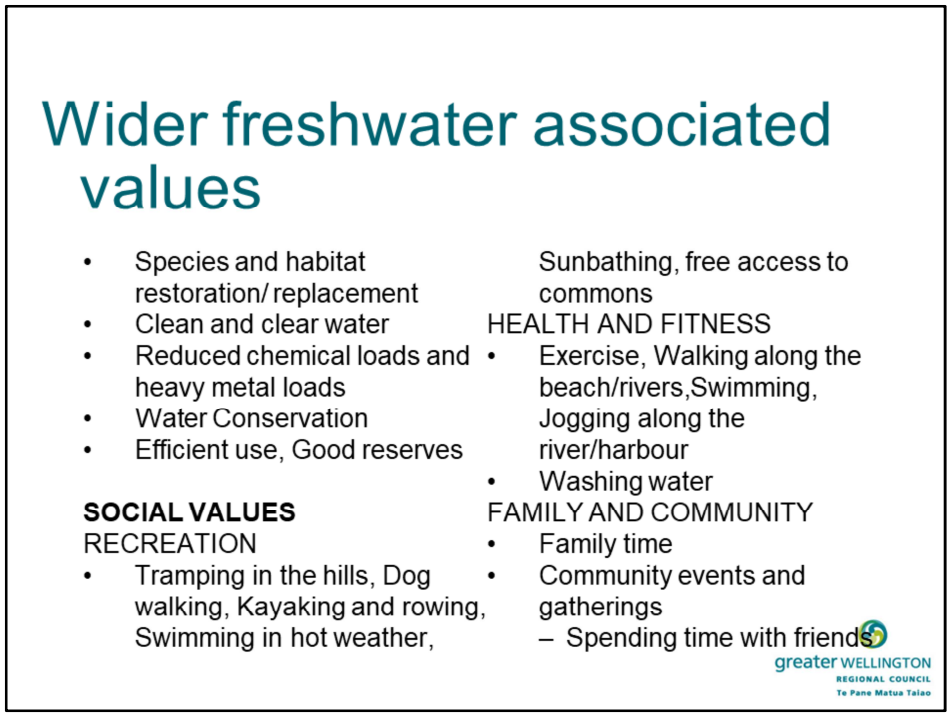
Commercial and industrial use – The freshwater management unit provides economic opportunities to people, businesses and industries.

Water quality and quantity can provide for commercial and industrial activities. Attributes will need to be specific to commercial or industrial requirements.

Hydro-electric power generation – The freshwater management unit is suitable for

hydro electric power generation.
Water quality and quantity and the physical qualities of the freshwater management unit, including hydraulic gradient and flow rate, can provide for hydro-electric power generation.

Transport and tauranga waka – The freshwater management unit is navigable for identified means of transport.
Transport and tauranga waka generally refers to places to launch waka and water craft, and appropriate places for waka to land (tauranga waka).
Water quality and quantity in the freshwater management unit would provide for navigation. The freshwater management unit may also connect places and people including for traditional trails and rites of passage, and allow the use of various craft.



ENVIRONMENTAL VALUES
ECOSYSTEM VALUES
Species recovering
- Tuna/eel populations restored
- Torrentfish restored

Urban streams restored
CLEAN ENVIRONMENT VALUES
Improved water quality
- Clean and clear water
- Reduced e.coli and bacteria
- Reduced chemical loads
- Reduced heavy metal loads

WATER CONSERVATION
Efficient use
Good reserves
SOCIAL VALUES
RECREATION
Fishing
Tramping in the hills
Dog walking

Kayaking and rowing
Swimming in hot weather
Sunbathing
HEALTH AND FITNESS
Exercise
    Walking along the beach/rivers
    Swimming
    Jogging along the river/harbour
    Cycling
Drinking water
Washing water
FAMILY AND COMMUNITY
Family time
Community events and gatherings
    Spending time with friends
INTANGIBLE WELLBEING
Enjoying nature
    The sound of flowing water or waves
    Seeing fish in the rivers
    Seeing whales in the harbour
Having green and blue in the city
Clearing the mind
Clearing the soul
Sea views
IMPORRANT INFRASTRUCTURE
Flood management
CULTURAL VALUES
RECREATION
Kauhoe (swimming)
Kaukau (bathing)
    Wahi kaukau (bathing place)
Mahi parekareka (enjoyment)
FOOD GATHERING
Mahinga kai (customary food and resouce gathering)
Kai awa (freshwater foods)
    Mahinga tuna (eel harvesting place)
Kai moana (food from the sea)
    Mahinga mataitai (customary seafood gathering site)
Koura (crayfish)
Taunga ika (fishing ground)
RESOURCE GATHERING
Rongoa (healing plants)
    Puna rongoa (source of healing plants)
Puna raranga (source of weaving material)
RITUAL AND SPIRITUALITY
Wahi tapu (sacred place)

Tanga I te kawa (place of ritual)
    Tohi (ritual performed over child in flowing water)
Taniwha (water guardian)
HEALTH
Wai ora (water used for healing)
Whakawatea (using water to restore emotional wellbeing)
    Wahi Whakawatea (places where water is used to restore wellbeing)
Wahi Whakahaumanu (place of healing)
Wahi horoi (washing place)
OTHER
Tauranga waka (canoe landing place)
Te Ara o Kupe (the path of Kupe)

CULTURAL VALUES

RECREATION

- Kauhoe (swimming)
- Kaukau (bathing)
  - Wahi kaukau (bathing place)
- Mahi parekareka (enjoyment)

FOOD GATHERING

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OTHER

- Tauranga waka (canoe landing place)
- Te Ara o Kupe (the path of Kupe)

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Also

INTANGIBLE WELLBEING

- Enjoying nature
  - The sound of flowing water or waves
  - Seeing fish in the rivers
  - Seeing whales in the harbour
- Having green and blue in the city
- Clearing the mind
- Clearing the soul
- Sea views

IMPORTANT INFRASTRUCTURE

- Flood management
- Industry specific, Ports, Airports, Forestry, Irrigation etc.

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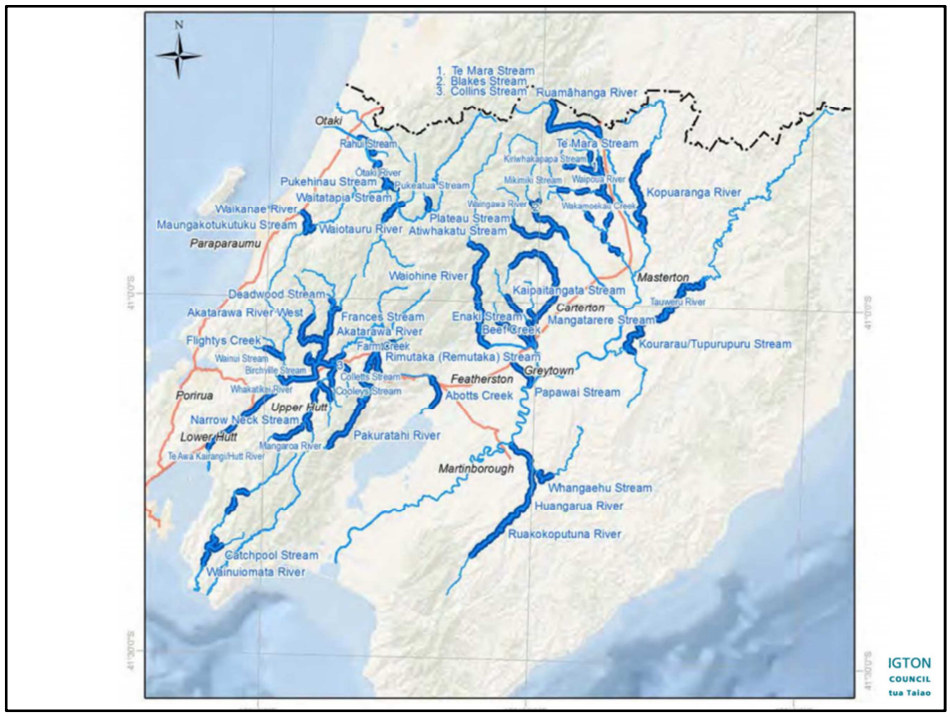
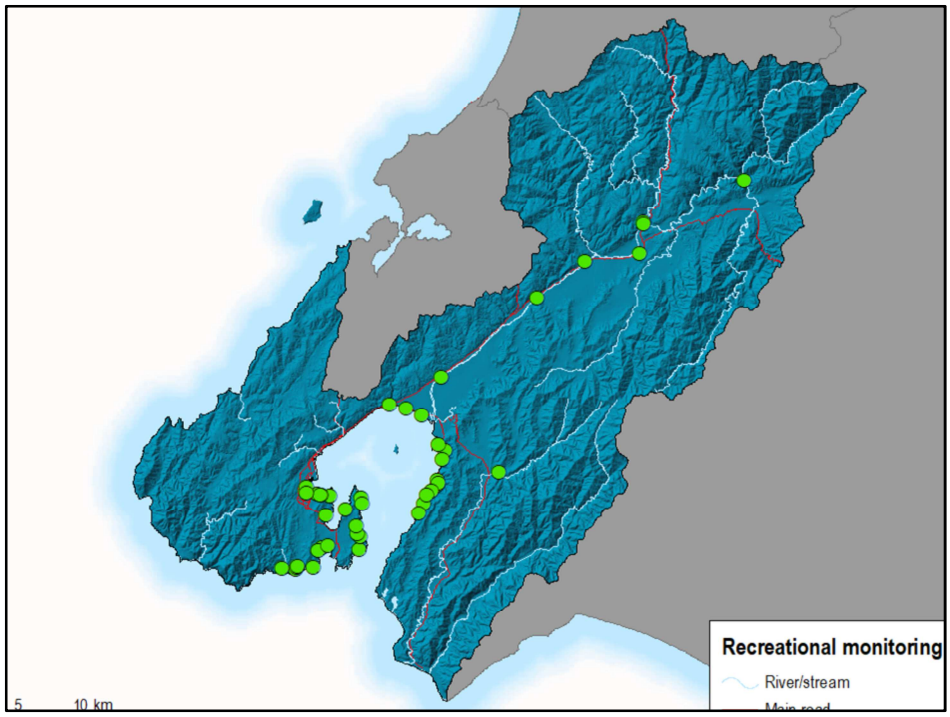


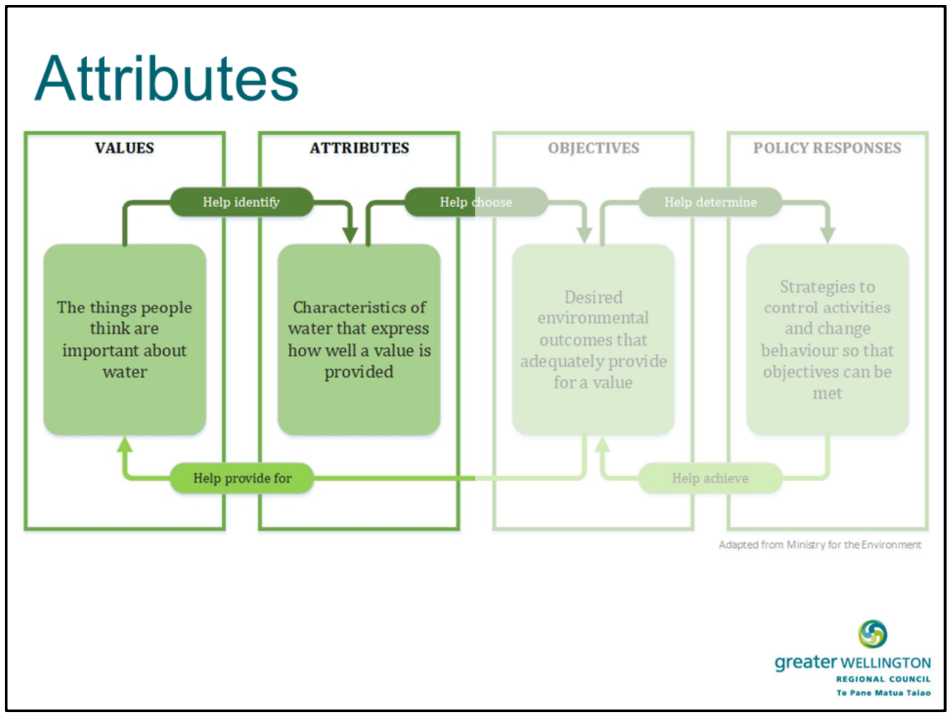
Trout fishery rivers and spawning waters – a key driver for other ecological values and water quality



Summer Recreational Monitoring Sites

With such a population in this Whaitua we can fairly assume that wherever people come across a pool or stream big enough to swim in, then people do.

This map is the monitoring network that is indicative of recognised high use swimming sites – there are many more places people swim and this gives us an indication of where.
An aspect of the Committee's work to provide for human health is to identify where this is of key importance and to what degree that it can and should be provided for

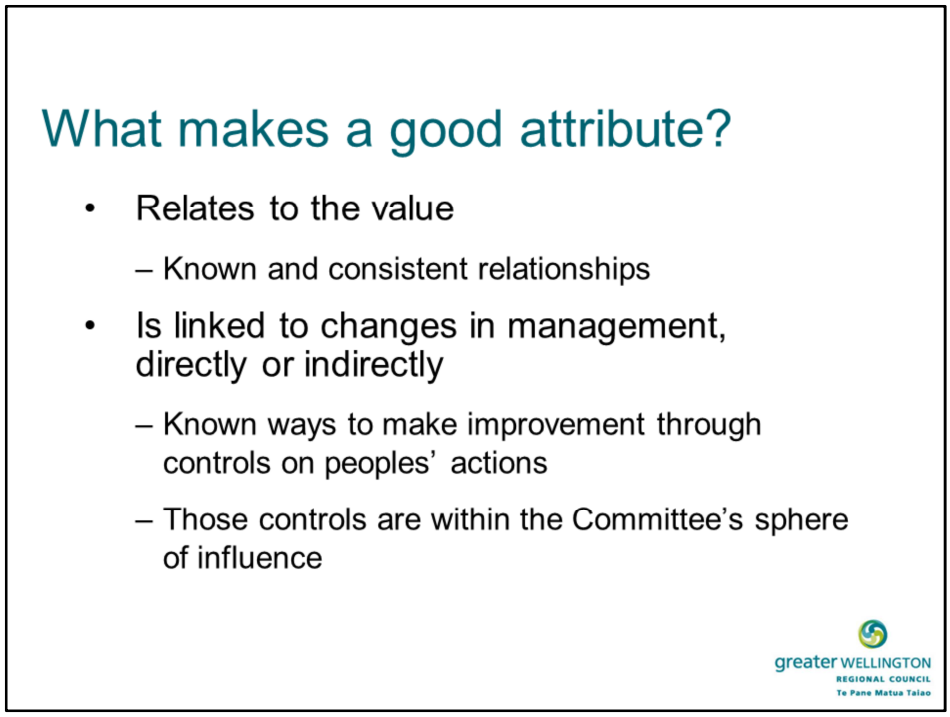


Conceptual introduction

Attributes are the characteristics or properties of fresh water that need to be managed for a particular value.
There can be many characteristics that could express how well a value is provided for. There could be loads of characteristics we could identify across the range of values.

We could also note that some characteristics might relate to multiple values. Breaking down into component parts makes it hard to keep a holistic view. However, we will aim to build up a broad coverage of the values and attributes so we'll hopefully get that holistic view as we go along.

To illustrate that, lets quickly pick up the example value of swimming, and some of the characteristics of the river that could express that value



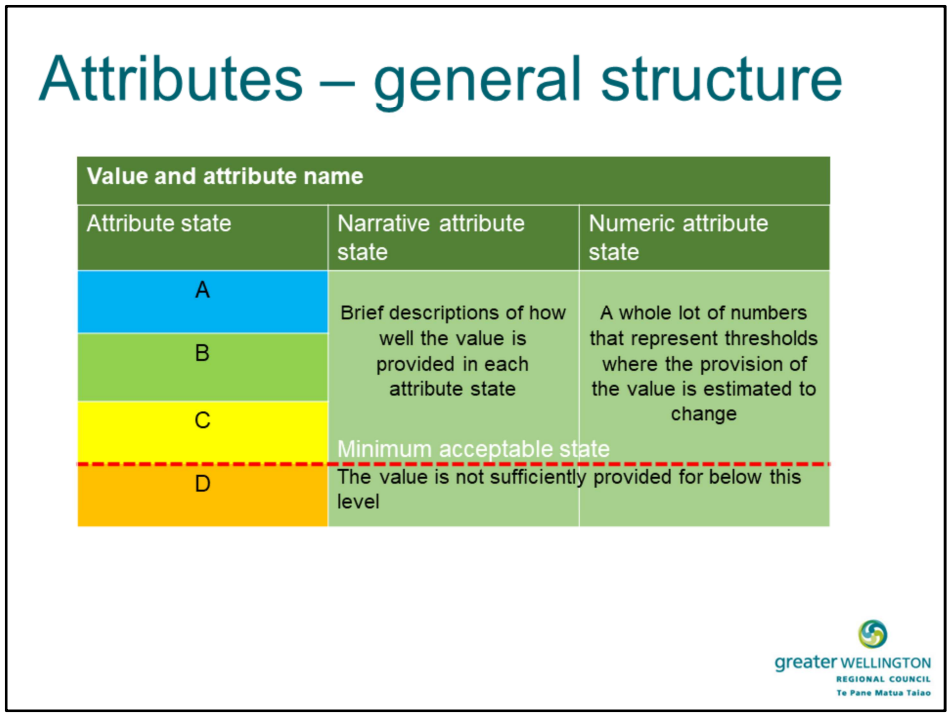
Firstly, these need to relate to the value.
While all of those things listed do relate to the value, they're not necessarily related in a known and consistent way. However, we do need to know how well a certain condition provides for the value – what is good, bad or ugly.

Scanning across this list, some of these might be hard to clarify that linkage, for example number of other people – some people might like lots of company, others might want an isolation experience.
E. coli,

- relates to the value of human health for recreation. When we go swimming etc, we don't want to be exposing ourselves to unacceptable levels of risk of getting sick. There are well developed relationships between infection rates and *E. coli* levels that allow us to describe different levels of risk. This work has been done for us nationally and is defined in the NPS-FM.
- we can understand the sources of E. coli and other pathogens and develop strategies to help reduce them to keep the risk at tolerable levels
- Well established, accurate and relatively inexpensive procedures to assess instream conditions

Another important function is for the attributes and subsequent objectives to

provide a basis for changes in management of pressures that lead to the instream conditions. This helps give a reliable basis to justify the recommended policy responses and move to the right across the diagram.



All attributes have some or all of these features:

- Will name the value it relates to and the name of the attribute
- A series of attribute states – usually A-D or A-E (there's only one that goes to E)
- For most, the boundary between C and D represents the minimum acceptable state
- Narrative attribute states – these are descriptions of how well the value is provided for at each attribute state, OR, the level of risk to the value at each attribute state
- Numeric attribute state – these will set out statistical thresholds that represent numeric estimates of change in the value or risks to the value.

Some are given to us by NPS-FM for the compulsory values and attributes.
We can and have developed others – that is a largely tech exercise.

Attributes – an example

Endurance running – marathon time		
Attribute state	Narrative attribute state	Numeric attribute state
A	Top 100 finishers	Under 3.5 hours
B	Top half of finishers	Under 4.5 hours
C	Complete	Under 7 hours
D	Did not finish	Over 7 hours

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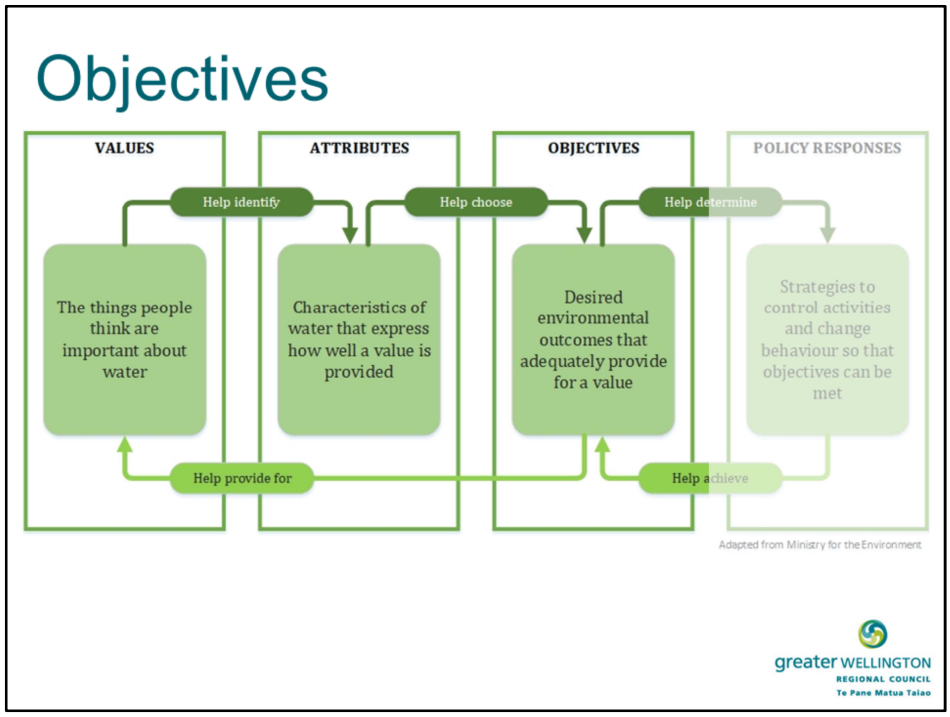
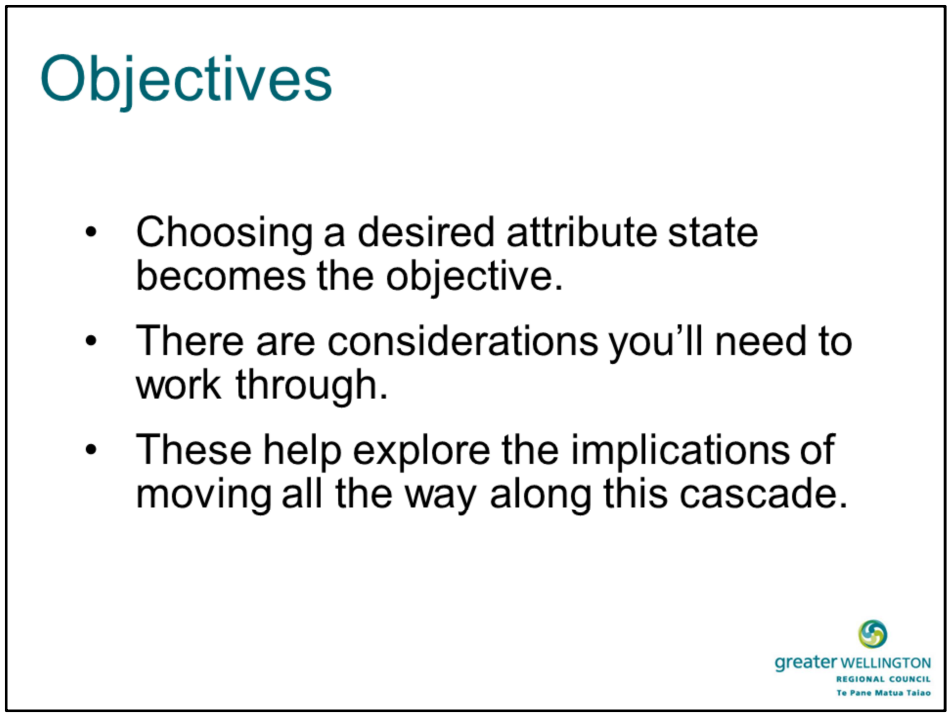
The value here is endurance running, and an attribute that could represent that might be your marathon time
And we can categorise how well people can do endurance running based on their time – ranging from A to D.

If we changed the value to Elite endurance running or mountain endurance running, the numbers would probably change for the same measure ie, marathon time.
You don't really need to worry about that, but the point to illustrate is
that we might see the same attribute with different numbers depending on the value its being related to

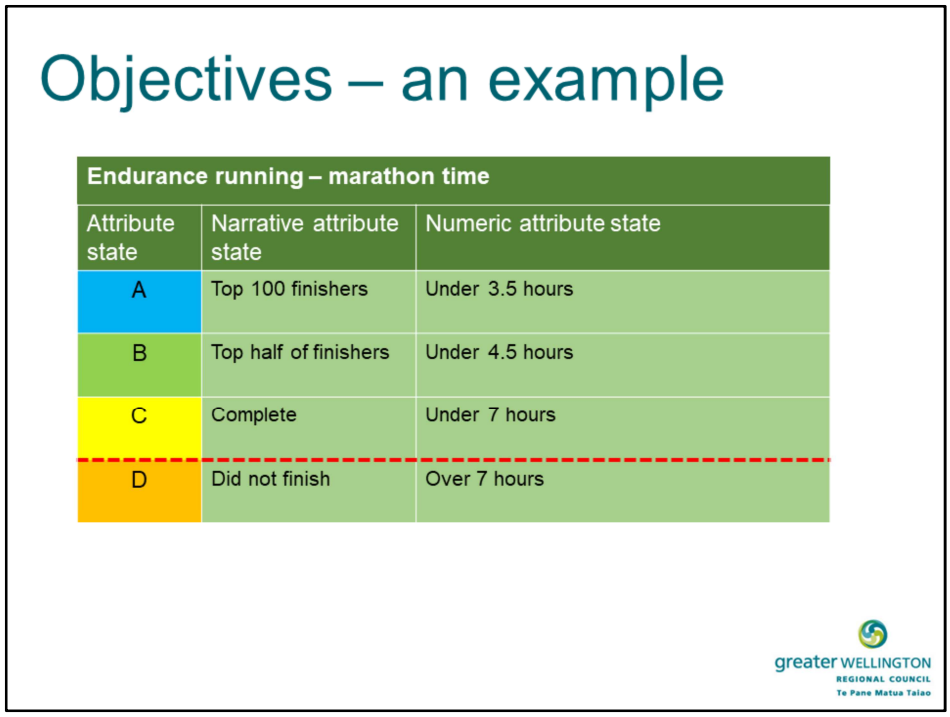


Next step in using an attribute is to set an objective.
In a nutshell – an objective is a statement of desired environmental outcome that adequately provides for the value



Some of the questions you'll need to ask are:

- What is the current attribute state and is the associated value provision acceptable?
- Why is it in that state?
- What might it take to change the attribute state?
- Would that state be acceptable for the value?
- What might the other impacts of that change be?
    - Positive or negative
    - for the environmental, economic, social and cultural value
    - of peoples property or activities that might be changed
- Where should different objectives be defined?
- How quickly should we aim for that change?



We'll quickly come back to our running example

There will be some people that value endurance running more than others. And we'll have a range of current abilities.

Where are people now – How many can run under 3.5? 4.5? Who's completed under 7 hours? Who hasn't completed or not even started one!
Who's happy with their 'current state'? Who's not?

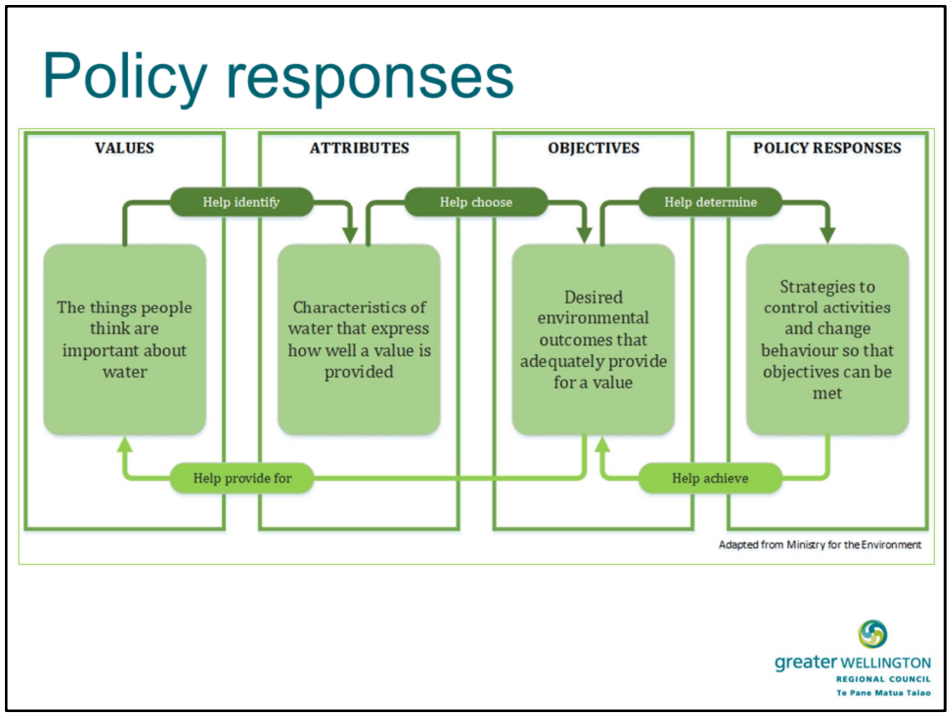
Now think about what would it take to change? For me? For yourself? For your neighbour?
How might that impact on other values you have?

- The change in training to shift from where you are to completing, top half, top 100?
- How might that affect your family, work or other recreation?
- Change in nutrition and eating habits?
- Holidays focused on running events instead of something else?

So thinking about how much you value endurance running, and the potential impacts on other values, what state would you like to achieve some time in the future? A, B,

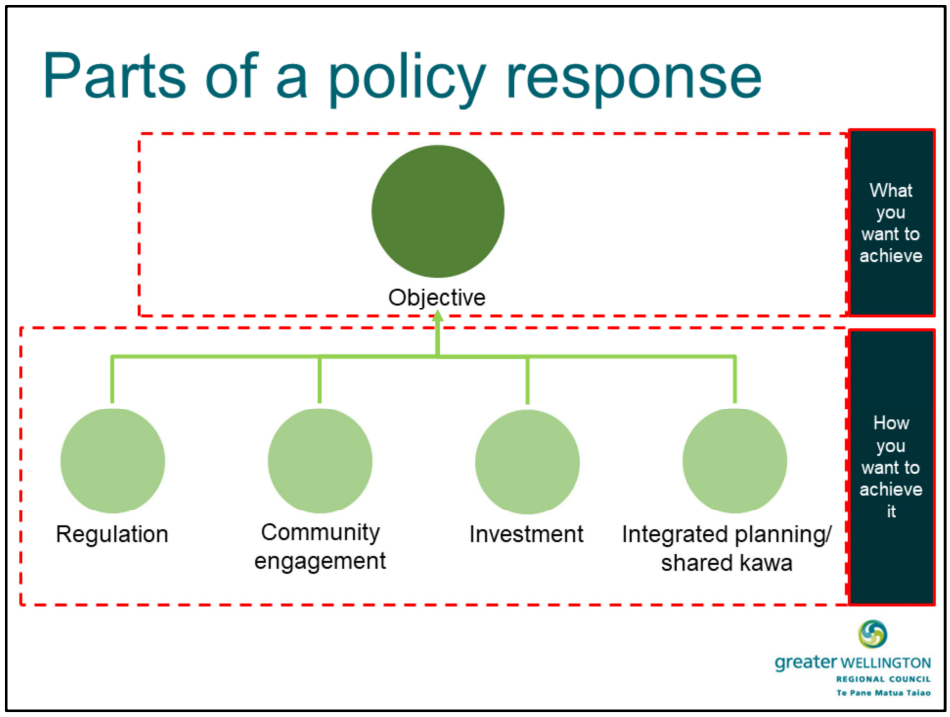
C or D?

Note the different levels of objective sought.
This likely reflects the different weighting that each person puts on the value of endurance running and the values impacted to make a change from where we currently are.



Finally, we get to the policy responses –
These are the set of strategies that help control and change peoples' activities and behaviours so that the objectives can be met

This is then where we recognise that we are responsible for care of the water
While our building blocks go left to right, our end result is to move from right to left.
The strategies aim to look after the water which sustains the values



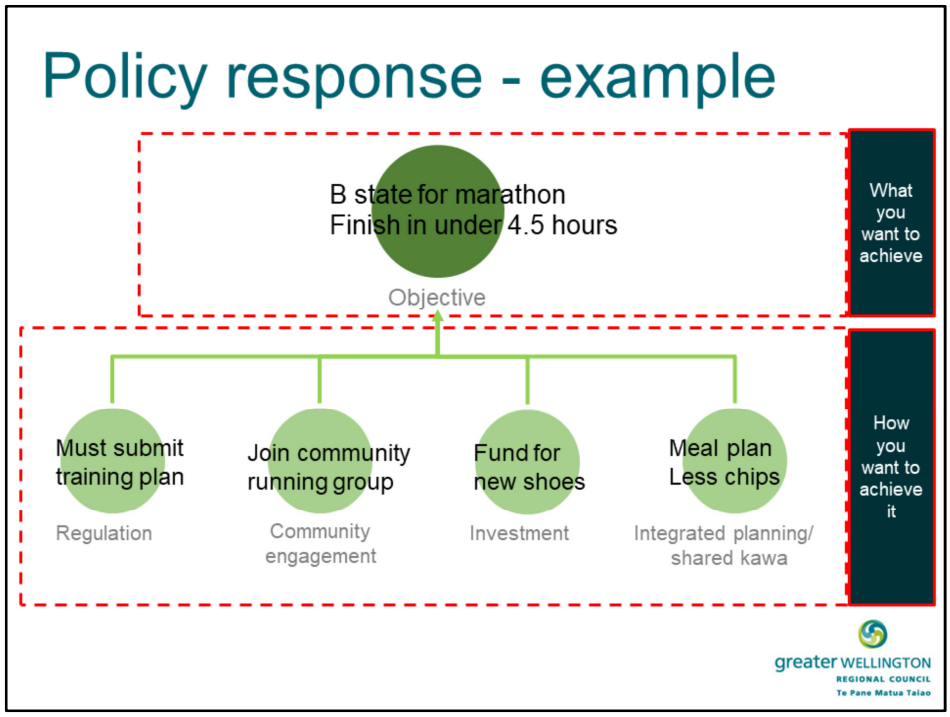
Briefly dropping down a level, there are four broad headings of potential responses – all of these collectively help achieve the objectives

Regulation
- Limits, Rules (discharges and land use), Charges.

Education/change programmes
- Case studies/demonstrations of better practice
- Advisors (eg, land management, take charge)
- Incentives
- Behaviour change programmes
- Enable and empower catchment communities/citizen led groups

Investment
- Infrastructure upgrades
- Catchment treatment devices
- Partnership funding
- Long-term maintenance

Integrated planning
- From one RMA planning layer to the next
- Between RMA and LGA processes
- Between institutions


Policy response - example
B state for marathon
Finish in under 4.5 hours
Objective
What you want to achieve
Must submit training plan
Regulation
Join community running group
Community engagement
Fund for new shoes
Investment
Meal plan Less chips
Integrated planning/ shared kawa
How you want to achieve it
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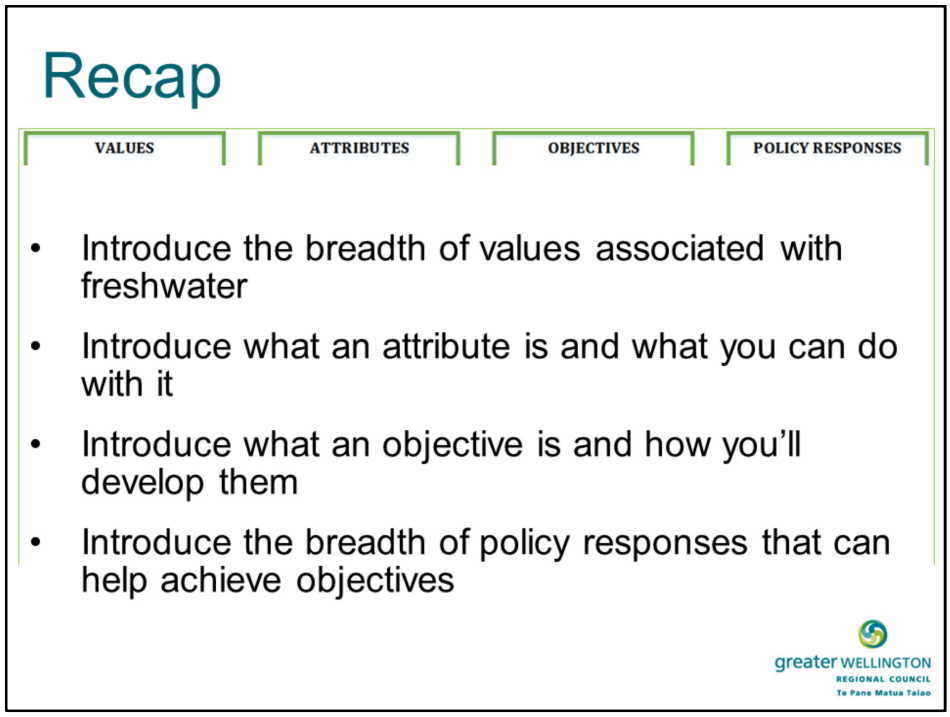
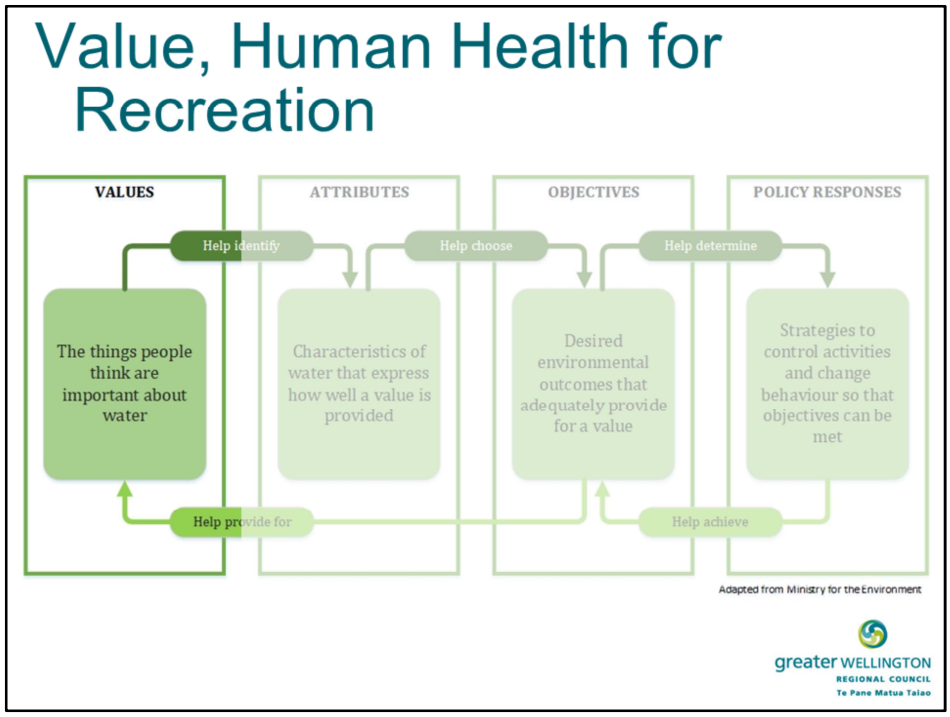
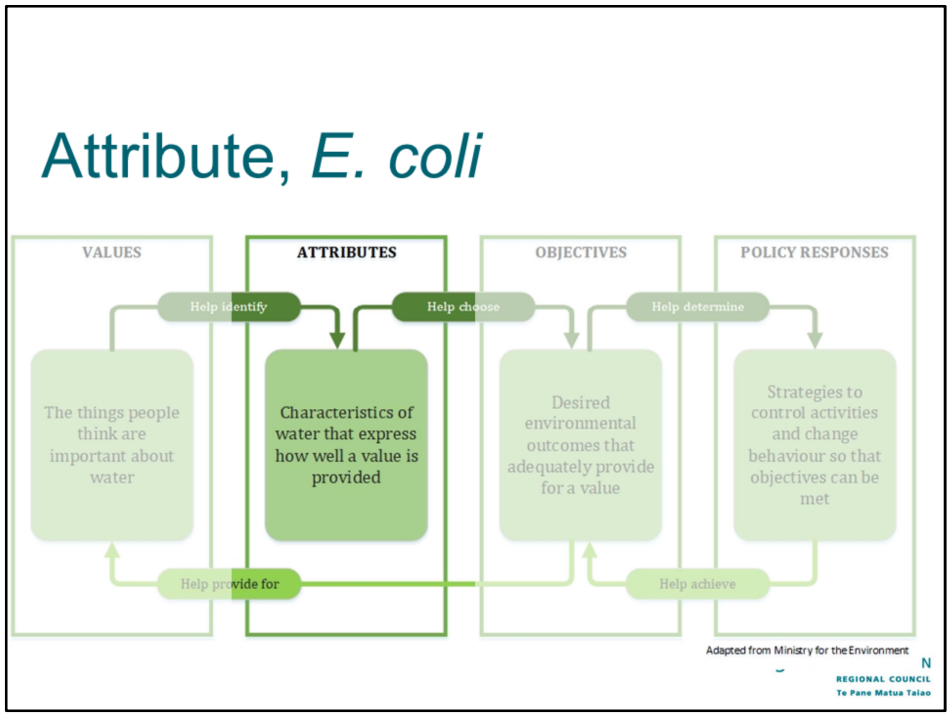


So we've just taken you through some of the content and considerations that you'll work through and had a little play with the running example. Hopefully that gives some ideas about what's ahead and helped get an introduction to these steps.

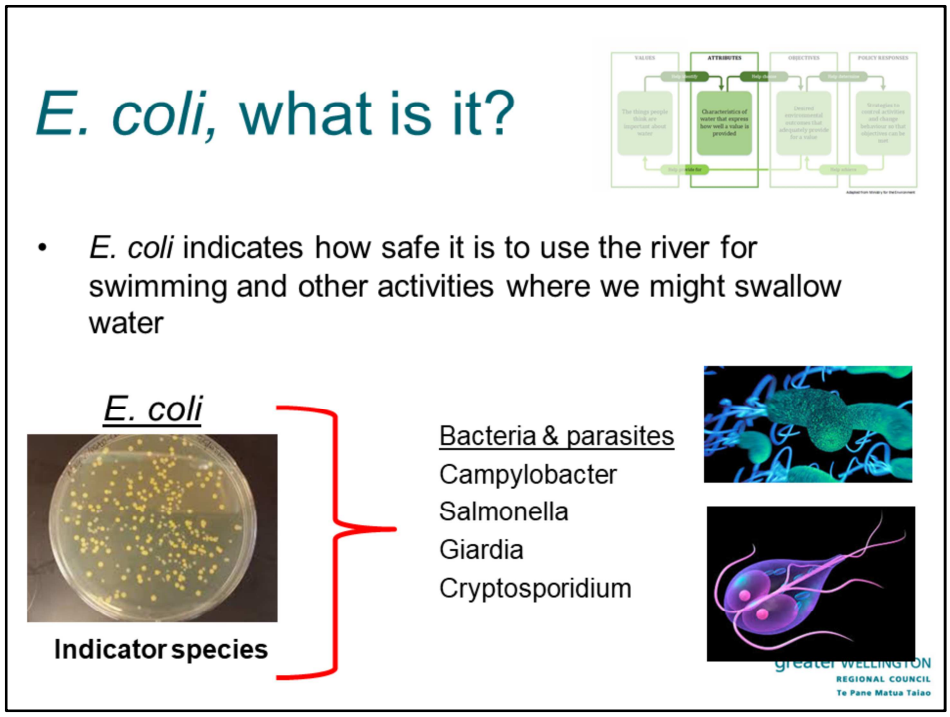
Now let's work through these considerations using a couple of freshwater values that we talked about earlier.



The first **value** we are going to work through is Human Health for the Recreation – one of the two compulsory attributes in the NPS-FM

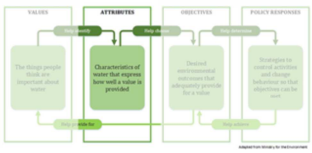


The attribute of the Human Health for Recreation value that we are going to focus on is ***E. coli*** – this one of the key attributes of swimming/recreation that you identified earlier. It is also a compulsory attribute in the NPS-FM, which objectives have to be set for.



- *E. coli* indicates how safe it is to use the river for swimming and other activities where we might swallow water
- E. coli is and indicator of nasty bacteria and pathogens that may also be in the water – these include Campylobacter, Escherichia coli, Salmonella, Cryptosporidium and Giardia.
- These nasty pathogens are generally found in the gut of people and animals – they can also be found in water and some foods. They can cause symptoms such as diarrohoea, abdominal pain, vomiting and nausea.

E. coli, attribute



Attribute state	% of *E. coli* <540 cfu/100mL	% of *E. coli* <260 cfu/100mL	Median *E. coli* (cfu/100mL)	95th *E. coli* (cfu/100mL)	Narrative
A	<5%	<20%	≤130	≤540	For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 1%
B	5-10%	20-30%	≤130	≤1000	For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 2%
C	10-20%	20-34%	≤130	≤1200	For at least half the time, the estimated risk is <1 in 1000 (0.1% risk) The predicted average infection risk is 3%
D	20-30%	>34%	>130	>1200	20-30% of the time the estimated risk is ≥50 in 1000 (>5% risk) The predicted average infection risk is >3%
E	>30%	>50%	>260	>1200	For more than 30% of the time the estimated risk is ≥50 in 1000 (>5% risk) The predicted average infection risk is >7%

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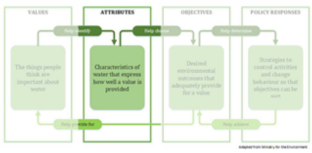
- E. coli has 5 attribute states, the only attribute that does; grades A-E represent a decreasing level of protection
- Both numeric and narrative attribute states
- Multiple metrics… if E. coli concentrations fails just one of these metrics then it drops down a grade.
- Metrics measure slightly different things eg, 260 and 540 cfu is dry weather focused and the 95th is wet weather focused
- 5 years of data is required to determine the attribute state, this ensures year to year variability is accounted for
- Note that there is no bottom line for the *E. coli* - but the C/D boundary is generally considered the threshold for swimmability

E. coli attribute



- 5 attribute states - grades represent a decreasing level of protection from A to E
- Attributes are represented both numerically and narratively
- Multiple metrics representing both wet and dry weather risk
- Assessed over 5 years

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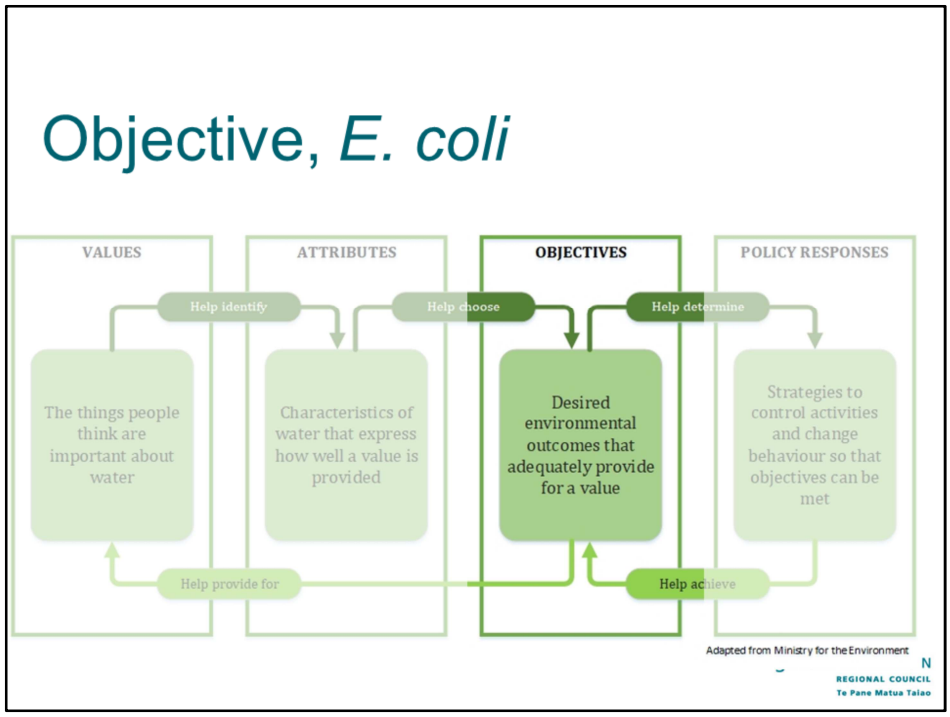
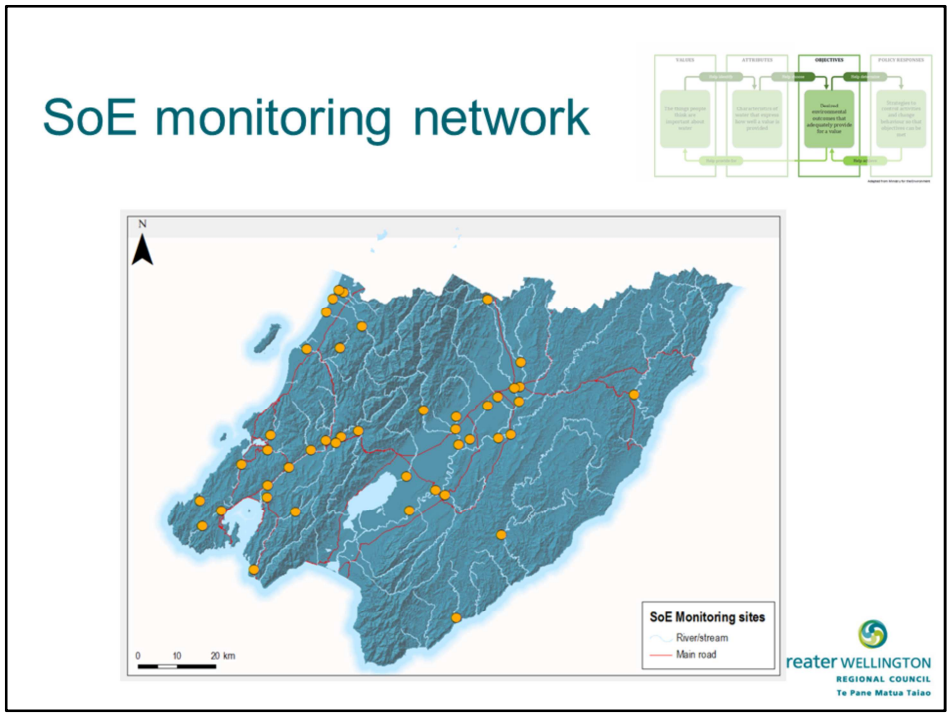
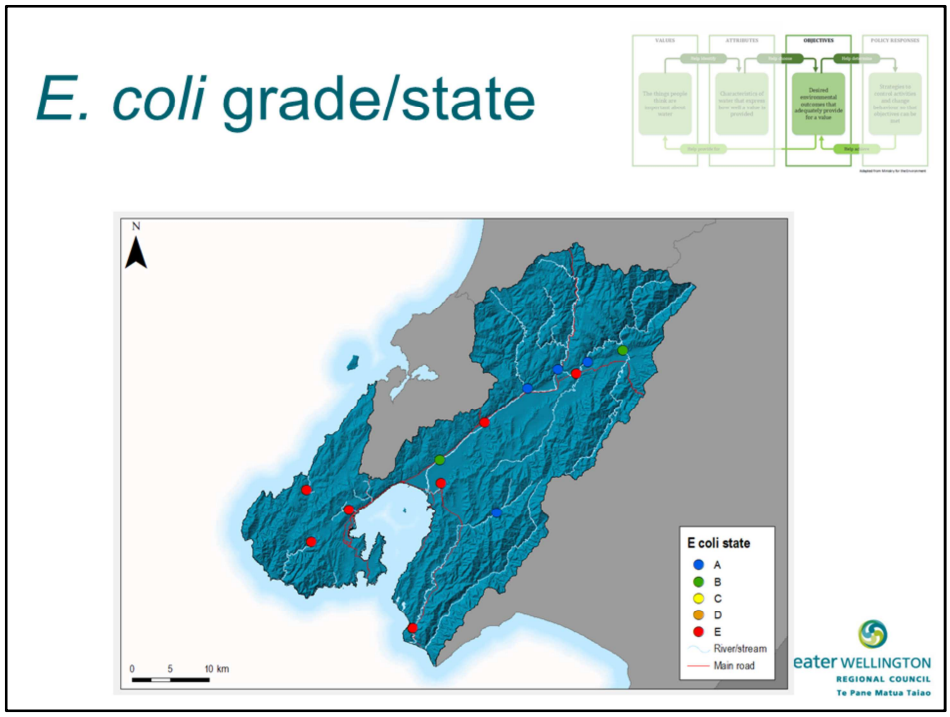


Now we move on to the objective… this where we determine whether the current level of provision is acceptable

To do this we must first know what the current state is and what the key pressures are…



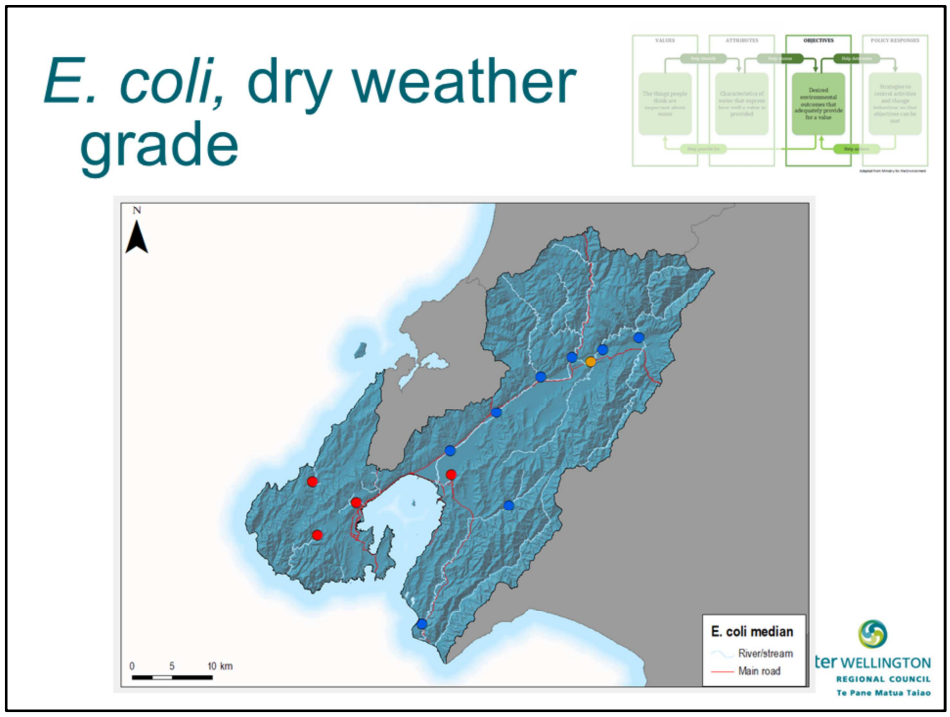
This is a map of out current State of the Environment monitoring site network, which currently consist of 46 site across the region.
The network represents a range of river size classes and land uses.
Each site is monitored monthly on a particular day at the same time rain, hail or shine.
For the most-part it was this networks of sites that informed the state handout reports that we sent out before this committee meeting



So is the value, Human Health for recreation, being provided for…
These are the overall site grade as measured from July 2013 to June 2018 for the 13 TWT Whaitua sites.

Not so great ay...

Let's focus in of the different sites
- Urban streams….
- Rural streams…
- Main-stem Hutt River….

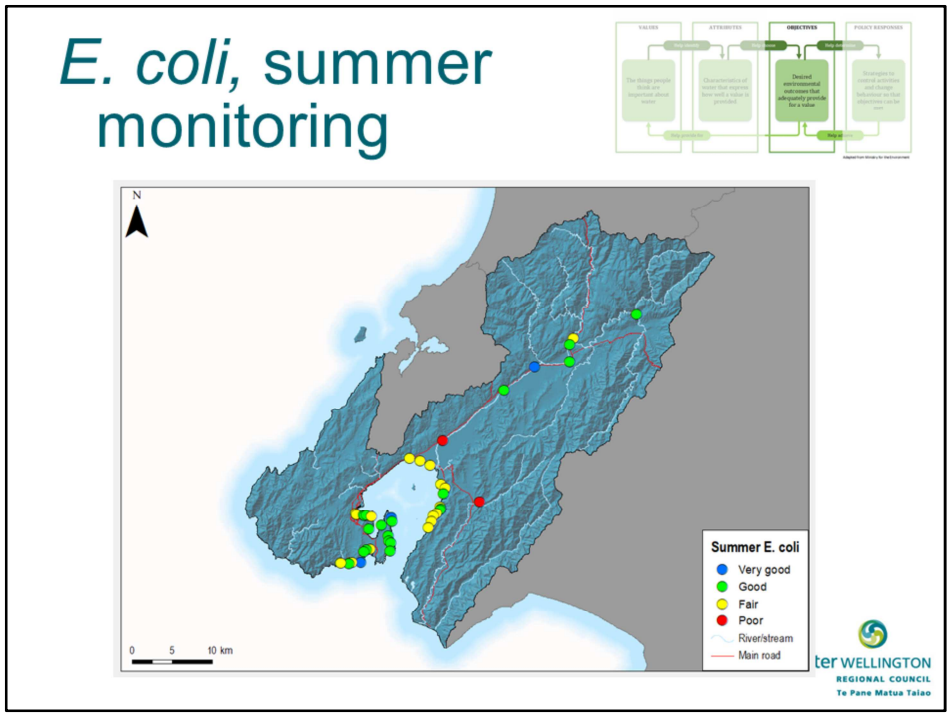


Remember the four metrics of the e coli attribute? This map shows the grade when only the median metric is used… this metric is reflective of dry weather

Can you spot the difference? See the Wainuiomata and Manor park?

The important thing here is that the 95th percentile metric, which represents wet weather, has been excluded. We can see when wet weather is excluded areas such as Wainuiomata and Manor Park are perfectly fine. In contrast urban areas always fail!

The key point here is, different pressures/stressors are at play across the different land uses. And that differing levels of effort and management are going to be required. In areas such as Wainuiomata which is mostly rural in its lower reaches and the Hutt-River main-stem management will have to focus on those stressors that cause exceedance during wet weather (in the Hutt River this may be stormwater inundating the wastewater system). In urban areas it does not matter if it is wet or dry…

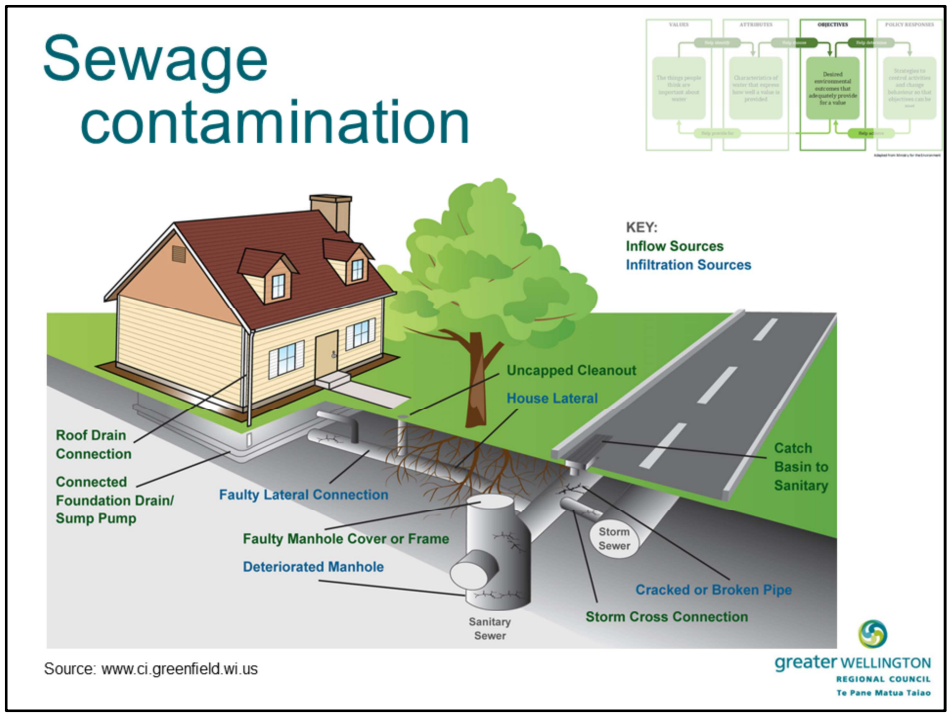


This map here shows our recreational water quality monitoring sites – this map was introduced earlier showing where swimming values exist
These sites are only monitored during summer and they differ to the SoE sites on the earlier maps.

The important points here are:
- We have other data/monitoring programmes that will help us determine what the state of E. coli is beyond the SOE
- This programme includes Coastal/Harbour sites…
- Coast in a receiving environment – it receives all the nasty bugs that comes out freshwater environments – this can have a large impact on the provision of the value Human Health for Recreation in coastal receiving environments.
-There is no attribute human health for recreation for the coast, the NPS-FM as the name suggest is a freshwater national policy statement. However we can design and develop an attribute for the costal receiving environments… it was done so for the Porirua Whaitua

Now that state has been determined… what are the pressures…

- Animals – especially during wet weather. In the Porirua reduction Whaitua modelled reductions in Grazing resulted in some large reductions in E. coli
- Septic tanks – poor performing septic tanks can result in surface overflows… and contamination of groundwater
- Settling or oxidation ponds… Wainuiomata



The second key pressure on urban streams is sewage contamination

Sewer mains as well as private laterals can be cracked – tree roots are a common problem as they grow around sewers and can crack and block them resulting in sewage leaks
It's not uncommon for private sewer laterals to be illegally connected to the stormwater and vice versa
And during rainfall stormwater inflows into the sewer system is often a major problem resulting in overflows

Sewage leaks or overflows find their way into streams pretty quickly.
Evidence of sewage contamination is very clear in our monitoring of urban streams.

Other sources…

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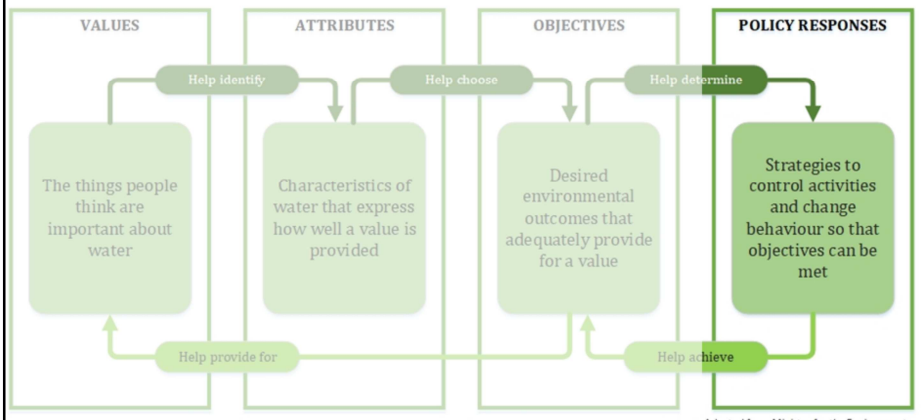
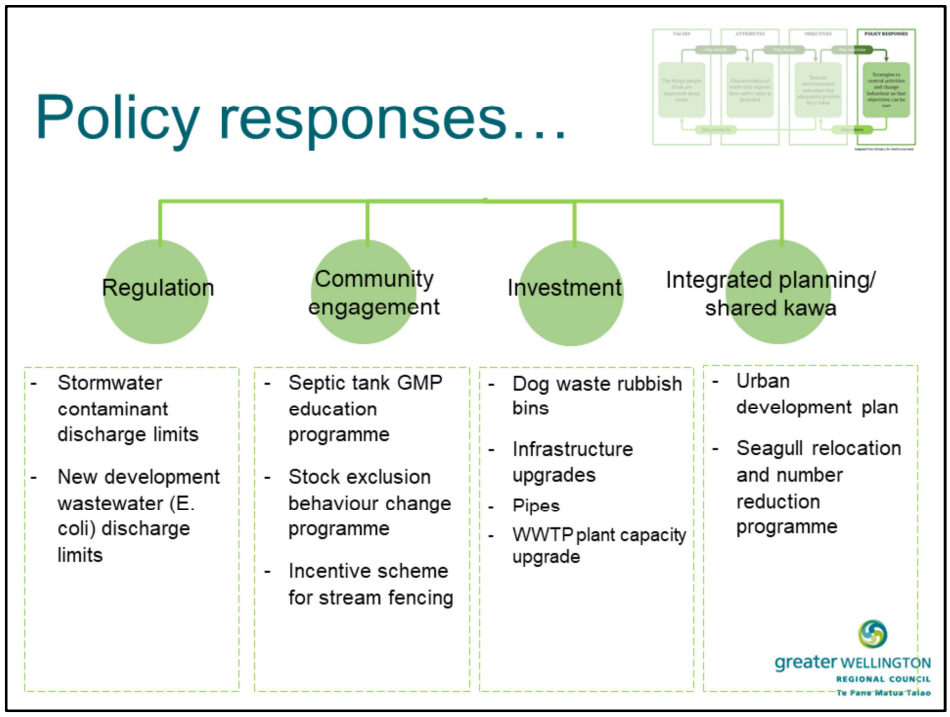
Dogs… in the Porirua….
Seagulls… in the Hutt River – just above Manor Park at Silverstream

Policy responses, *E. coli*

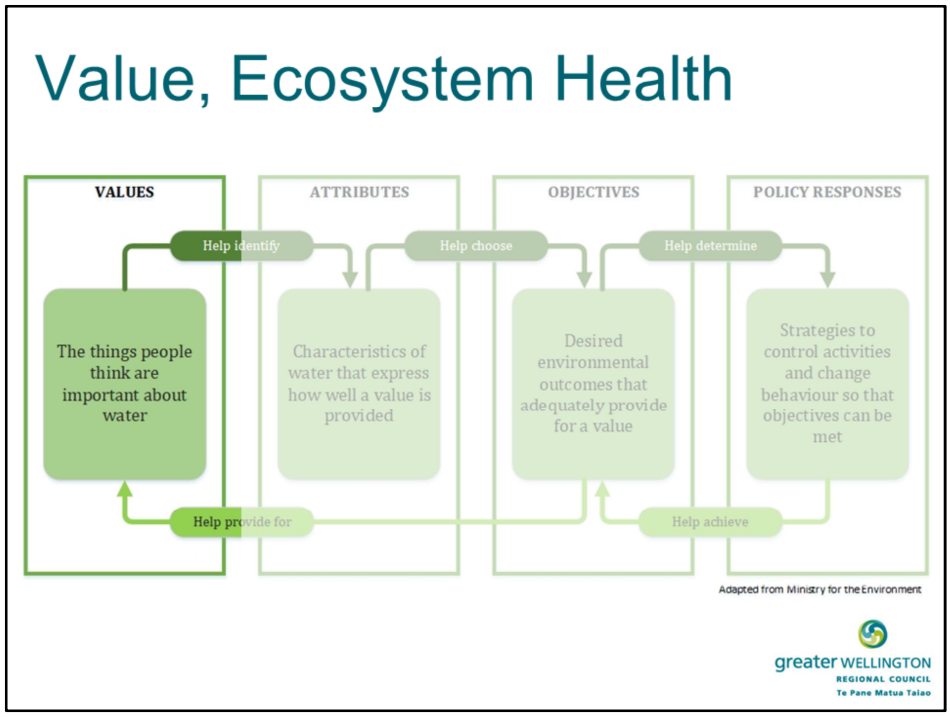


Now that objectives have been set… based on the state information presented and a good understanding of the key pressures (and their trade-offs) we now have to look at the strategies that will be employed to achieve the objectives…

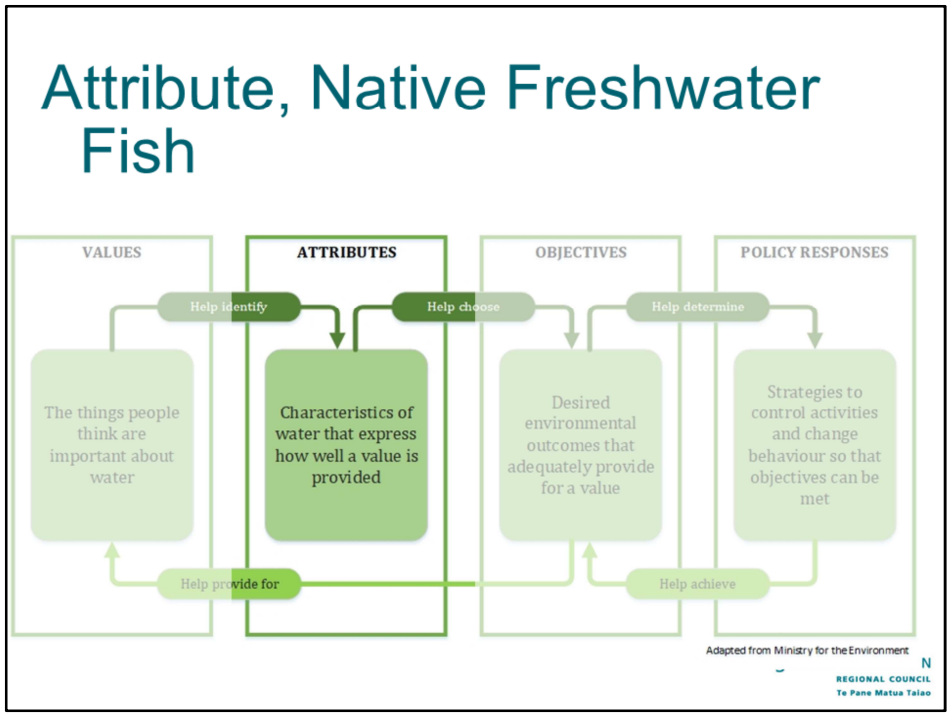


E. Coli, using Porirua modelling scenarios as a case study.
Potential levels to set objectives come from the NPS-FM
They provide varying levels of protection from risk of getting sick when people come into contact with the water through recreation, eg, swimming, wading, boating
Where we set objectives for contact with the water, they must be at least band C or better.
What does the modelling tell us?
Current state and BAU are likely to provide poor and very poor levels of protection from getting sick everywhere. This suggests that wherever we set E. coli objectives for contact recreation means we're going to have to do something different to achieve those objectives.
This is the case in both rural and urban WMUs
'Improved' and 'Water Sensitive' scenarios let us explore how different we'd need to go to achieve given objectives
Rural
One thing that our 'minimum state' banding doesn't illustrate is that for many of these sites that are 'D' in Improved or 'C' in Water Sensitive, that grade is driven by only one of the four metrics the NOF uses. In many cases, those are also quite close to the thresholds for the next attribute state.
Working through what this might all mean to help explore the effects of different E.

coli objectives for contact recreation
Rural WMUs with extensively grazed catchments and low flows (Upper Kenepuru, upper Duck, Judgeford and Takapu) are unlikely to get to a C band with either the Improved or Water Sensitive levels of effort
Most other rural WMUs are likely to or will get close to meeting a C band with the types of effort modelled in the Improved scenario
Taupo might be a little different and may need more towards Water Sensitive levels of effort to get to a C
Horokiri, Pautahanui and Stebbings may get to or very close to a meeting a B band with the types of effort modelled in the Water Sensitive scenario.
Big drivers of change in the Improved scenario are the fencing and stock exclusion of grazing land which reduces E. coli from those areas by about 45%, and the retirement of grazing land which reduces E. coli from those areas by around 99.5%.
To illustrate the levels of retirement we're talking about:
Horokiri goes from about 40% grazing to 20% grazing in improved
Pautahanui from about 55% grazing to 40% in improved
The change between Improved and Water Sensitive is further retirement, and again to illustrate the levels we're talking about:
Ration goes from about 30% grazing now to about 4% grazing
Horokiri goes from about 40% grazing to 20% grazing in Improved and 12% in Water Sensitive
Pautahanui from about 55% grazing, 40% in improved and 21% in Water Sensitive
Urban
In urban WMUS, it's likely to be very hard to make the improvements required to achieve a C band objective.
Unlike rural, the 4 metrics used for the overall grade are generally all in poor or very poor states and are still some way from the band thresholds. That said, there are some substantial movements within bands. For example:
We achieve a 50-75% reduction in the E. coli concentrations at the urban Kenepuru and Porirua stream sites in the Improved scenario,
And a 70-85% reduction in the concetrations in the Water Sensitive scenario
Biggest changes in the scenarios come from reduced E. coli from repairing leaking wastewater pipes and cross connections, which reduce the E. coli in those areas by around 75%, and reducing the wastewater overflows from on average 12 to 4 and 2 per year. These show up as the difference between BAU and Improved.
Treatment of runoff in infill and greenfield areas is highly effective for E. coli, removing around 90% of E. coli from those areas, but those areas are relatively small so effects are probably masked in bigger catchments.
Marginal improvements in the Water Sensitive scenario for some urban WMUs are probably due to the additional retirement in rural areas of the catchments.



Now we will examine the only other compulsory value – Ecosystem Health



The case study attribute that we will pick on is Native Freshwater Fish…
This attribute is not a compulsory attribute in the NPS-FM…
However, it's one that is important… because fish don't respond in the same way as other Ecosystem health indicators…
Kaiwharahwara catchment for example…

What are Native Freshwater fish?

But it's not all bad news for urban streams
They still support a diverse range of native fish species especially in the Kapiti, Wellington and Porirua city areas

15 species recorded in the Hutt catchment
9 have some "conservation status"

This high native fish diversity is likely to be related to the fact that our urban streams are generally very close to the coast.
Most of our native fish species are diadromous which means that they need to be able to reach the sea to complete their life cycle, so the closer streams are to the sea the more fish species likely to be present.

But fish communities in our urban streams are likely to be much reduced compared to what they used to be due to a range of pressures associated with urban land use.

Value and attribute name		
Attribute state	Numeric attribute state	Narrative attribute state
A	N/A	Fish community is typical of undisturbed or reference conditions for the stream type
B	N/A	All expected reference condition species are present but populations may be under a low level of stress from, for example: • habitat disturbance • passage barriers • toxicants or organic pollutants
C	N/A	Most expected reference condition species are present but populations may be under a moderate level of stress from, for example: • habitat disturbance • passage barriers • toxicants or organic pollutants
D	N/A	Fish community shows large changes with loss of species that would be expected for the reference stream type. Reflects significant levels of disturbance and/or pollution

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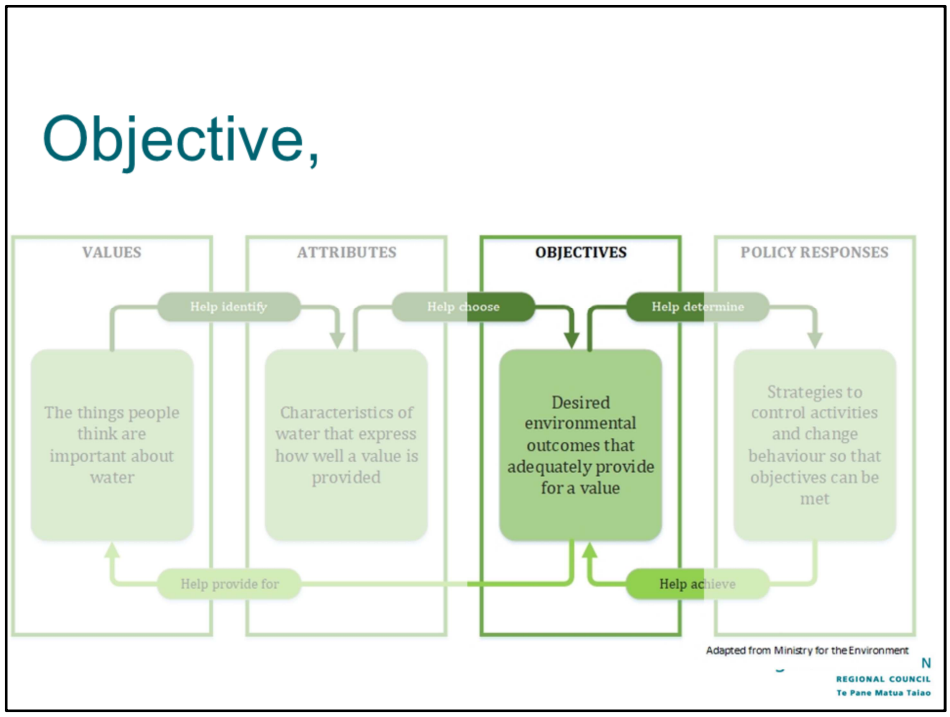
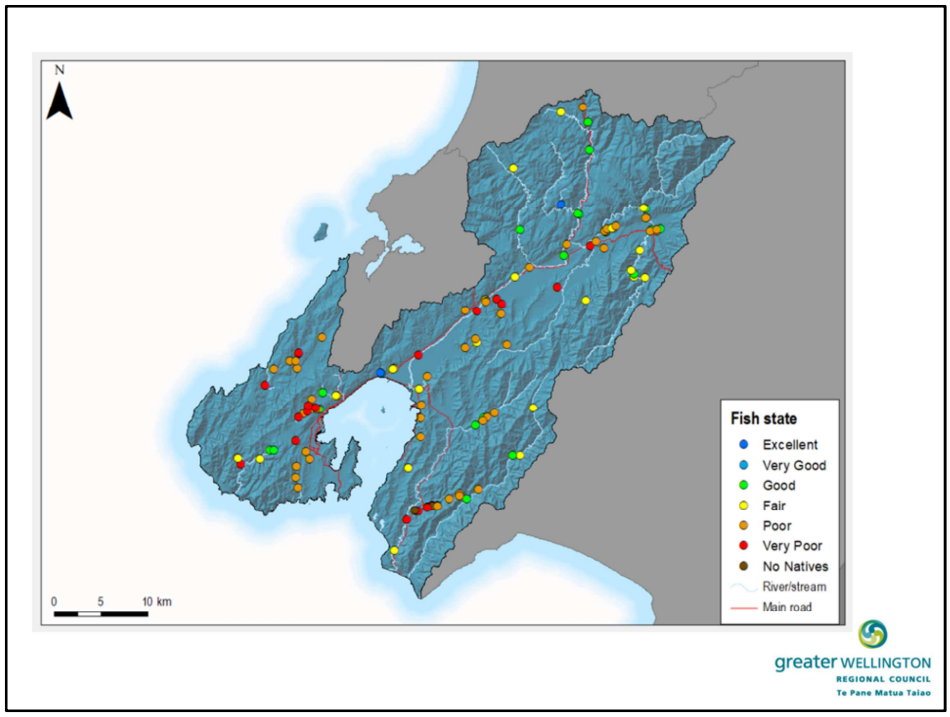
It was, in part, for these reasons that the Porirua Committee selected Native Freshwater Fish as an additional attribute of the EH value.
This is their attribute… note how it is narrative only…



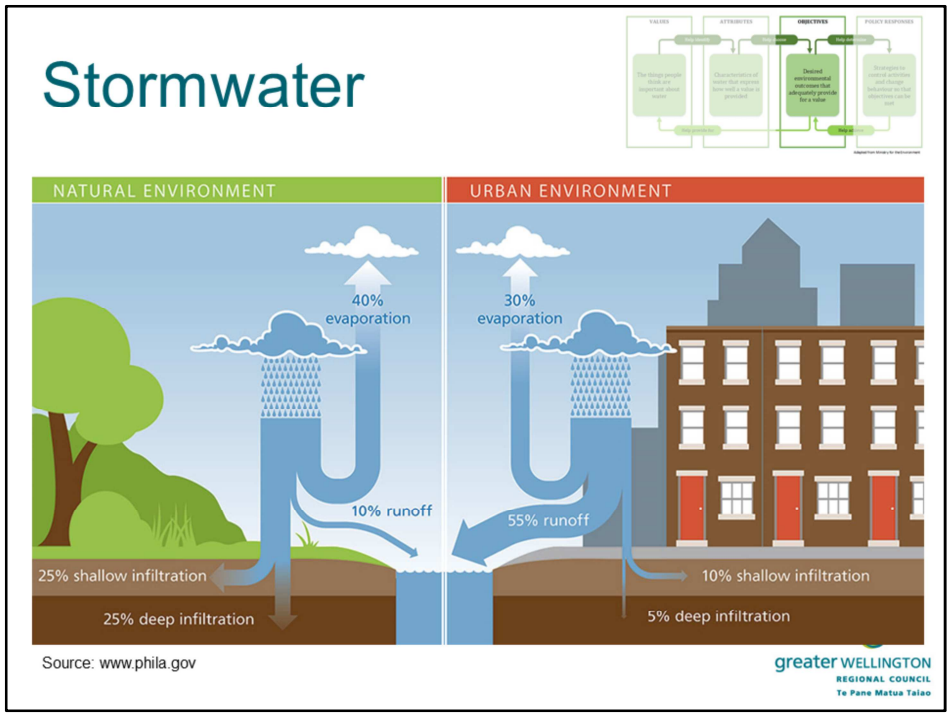
Setting an objective



What is the state of native freshwater fish…

This map is of fish data collected and entered into the Fish database from 1990-2010 (sorry it's a bit dated)
Index of biotic integrity…

Fish data is resource intensive.
Does not look good.



First key pressure is from stormwater inputs – stormwater results in significant changes to the flow characteristics of urban streams as well as contributing contaminants.

Firstly looking at changes in stormwater flows. This diagram (on the left) shows what happens to rainfall in a natural catchment

- Most soaks into the ground
- A small amount runs over the ground into streams and the coast

The picture is quite different in an urban catchment (on the right) with the key difference being that the large amount of paved and impervious surfaces such as roads, foot paths and roofs means that little rainfall can soak into the ground. The large majority of it runs straight off into the stormwater network which is directly connected to streams and the coast.

This means that urban streams are very 'flashy' and have intense high flows and during dry periods they have lower base flows as there is less recharge from groundwater. These conditions then result in a whole range of other effects on urban stream health, from contaminant loads to habitat quality.

Stormwater from urban areas contain a range of contaminants including toxicants, nutrients and bacteria

Roads and vehicles are a key source of contaminants, these include:

- Zinc from the wear of car tyres
- Copper from wear of vehicle brake pad linings
- Polycylic aromatic hydrocarbons (or PAHs) from vehicle exhausts and oil

Also herbicides used to spray roadside verges.

We frequently measure high concentrations of heavy metals at our urban streams sites.
In 2005 and 2006 we tested the sediments of a range of urban streams across the Wellington region and in some we measured significant concentrations of toxicants. Opahu Stream in Lower Hutt was one stream that had toxic concentrations of PAHs.

Industry is another area of high risk in urban areas
On poorly managed sites chemicals can be washed into stormwater drains through yard wash down and by chemicals being poured directly down the drain.
Construction sites can also be a key source of contaminants to urban streams –

particularly sediment.

But we mustn't forget that what we do in our own homes and backyards can end up contaminating urban streams, for example:

- Using fertiliser and herbicides used in gardens and lawns
- Washing paint and other chemicals down stormwater drains
- Washing cars on the street rather than on the lawn or at a carwash
- Not cleaning up after pets – eg dog droppings on the lawn or in the street end up in the stormwater – Faecal Source Tracking has picked up contamination from dog faeces at a number of urban stream and coastal sites

There has been more than 20 sediment and paint call-outs this year on the Kaiwharawhara Stream alone.

Urban stream channels are often highly modified, having been straightened, concreted and have little riparian vegetation. This results in urban streams being poor habitat for stream life such as invertebrates and fish.

Urban stream channels are usually modified to move stormwater as fast as possible through the system and minimise flooding – so habitat degradation of urban streams is closely linked to the increase in stormwater inputs in urban environments that we discussed earlier.

Where streams aren't armoured, they can suffer from significant erosion – caused by the large flood peaks created by the flashy nature of urban runoff from hard surfaces.

Another type of habitat degradation that's common in urban stream catchments is barriers to fish passage.
This perched culvert is an example of a barrier to fish passage, which reduces the number and species diversity of fish in urban streams.

And finally the most extreme type of habitat modification in urban environments is stream loss during new urban development when head water gullies are filled Over the 5 year period up until 2007 there was 15 km of consented stream loss in the Wellington region – most of which was related to urban development.

Over 95% of streams in wellington city are piped

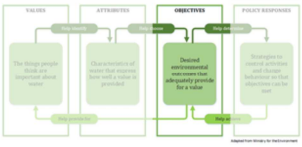
https://stephengibbsdms.wordpress.com/tag/hidden-streams-of-wellington/

When the earthquakes in 1848 and 1855 (the latter was 8.2 on the Richter scale) reformed the city – Oriental Bay was uplifted by 1.5metres – reclamation and draining the wetlands and swaps were a priority for the authorities. Most of the waterways were severely polluted, so the solution was piping and culverting the streams underground.
Nowadays, in 2016, the Hidden Streams of Wellington amount to 95.5% of the waterways in the city – **only 4.5% of the streams are unpiped**.
Statistics can obscure the facts, so another fact is important.
Only 25 kilometres of unpiped streams exist in Wellington – **550 kilometres are piped underground**!!!!!

That's the driving distance from Westpac Stadium to Silverstream, and from Westpac to Gisborne, respectively.

Other pressures

- Aquatic weeds
- Sediment
- Water abstraction
- Nutrient enrichment
- Climate change
- Temperature
- Algae blooms



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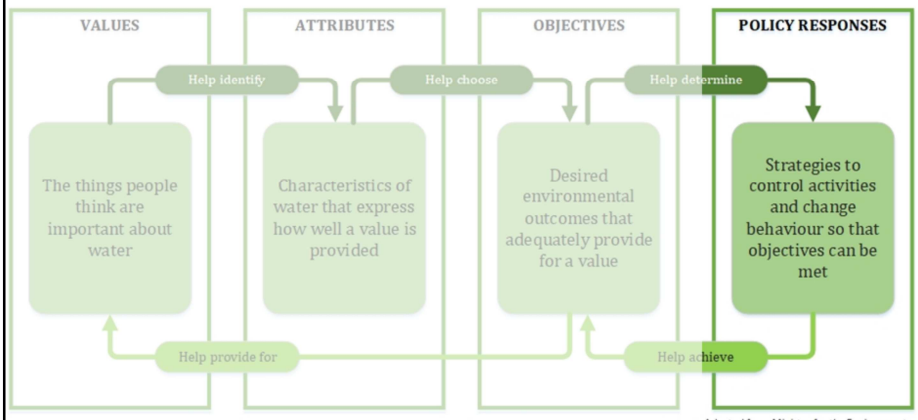
Policy responses



Adapted from Ministry for the Environment

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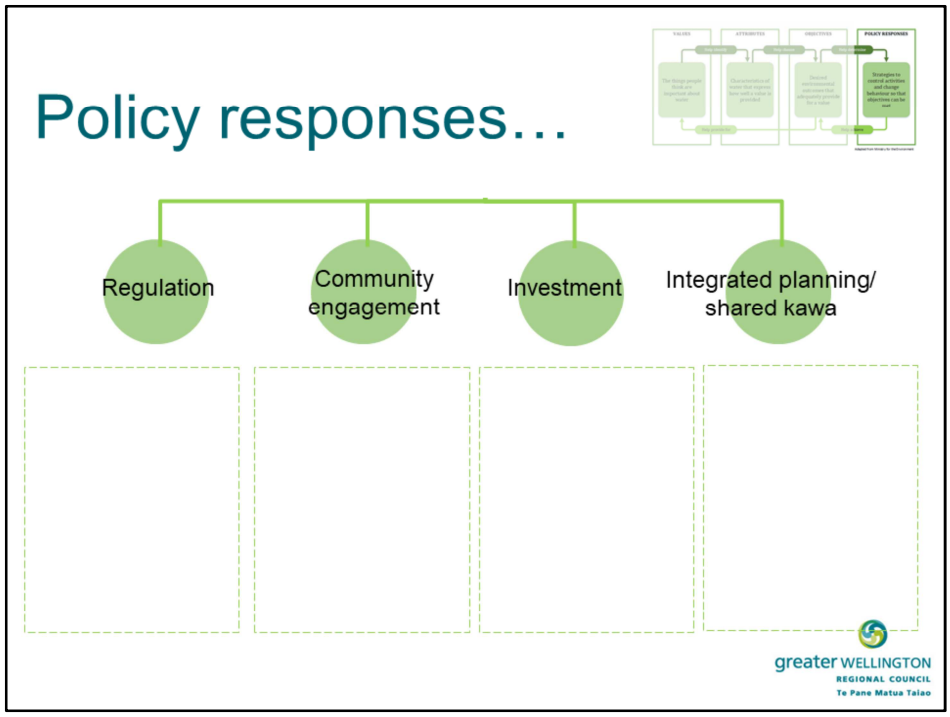

Fix/replace sewers
Less concrete in new developments!
Stormwater treatment
Daylighting streams?
Stronger regulation
Habitat restoration really needs to be accompanied by improvements in sewage and stormwater infrastructure for urban stream health to improve – this is an expensive business

The easiest and cheapest way to minimise these problems is right at the outset when urban areas are being developed. There are many sustainable urban design measures that can reduce the impacts of urban areas on streams.

Important to consider how we include these in our future urban developments.