BRIEFING NOTE

Bay of Plenty
REGIONAL COUNCIL

To: Freshwater Futures: Rangitāiki Community Group

From: Nicki Green, Senior Planner, Water Policy; Paul Scholes, Freshwater Scientist

Date: 10 September 2018

Subject: **Workshop 8: Surface water quality**
24 September 2018, Galatea Hall

1 Summary – *If you don't have time to read the rest, just read this*

The briefing note and workshop present and discuss surface water quality modelling results, and what they mean in our work towards setting freshwater quality objectives and limits. The key messages are:

1. Modelling and science indicates water quality is generally safe for contact recreation / swimming in Rangitāiki Water Management Area (WMA). There may be localised *E.coli* hot spots in the WMA which Council can address on a case by case basis.
2. Current nitrate and ammonia concentrations do not pose significant risk of toxicity to aquatic life, but these nutrients can promote plant, weed or algal growth in the Hydro Electric Power Dam Lakes Matahina and Aniwaniwa.
3. Sediment, phosphorus and nitrogen loads from human activities (i.e., productive land uses and discharges) contribute to poor trophic state and likely poor ecological health of Matahina dam lake, although relationships need to be clarified.
4. Algal growth in streams is generally not an issue. Phormidium (blue-green algae) in Rangitāiki River can be an issue, but it is uncertain whether this is related to changes in nutrient concentration.
5. Macro-invertebrate monitoring indicates ecological health is generally fair to good but compromised in some lowland water bodies.

The results suggest the focus of water quality work should be on:

- arresting increasing nitrate and phosphorus trends.
- reducing loads of sediment, nitrogen and phosphorus entering the HEP dam lakes and/or mitigating effects.
- maintaining *E. coli* concentrations in the A and B band and avoiding increases if land use and practice change.
- addressing sediment loss during and after forest harvesting.
- addressing key source areas generated by human activities.
- action planning to improve ecological health in lowland water bodies.

Questions to think about:

Do these results and conclusions seem "about right"?

If not, what are your concerns and suggestions?

2 Meeting Overview

2.1 Purpose

We continue to work towards maintaining and improving freshwater quality by setting measurable objectives and limits based on community values. This is key work required by National Policy Statement for Freshwater Management. The Community Group provides active feedback and advice to Council.

The main purpose of this workshop is to present and discuss surface water quality modelling results, and what they mean. This includes *E. coli* concentrations and Sediment, Nitrogen and Phosphorus loads and source areas.

2.2 Outcomes sought

For contact recreation, ecological health and other in-river values, group members:

1) Understand and confirm key water quality issues;
2) Understand the science attributes used to measure water quality and ecology;
3) Understand why *E.coli.* Nitrogen, Phosphorous and Sediment are important contaminants;
4) Discuss, understand, and are comfortable with modelling results;
5) Provide feedback on approach to exploring mitigations

The agenda will cover updates on:

- national and regional changes affecting this project;
- project progress and next steps;
- work "on the ground" in your catchments now.

An Environmental Summary Report has been sent to you. Please read it prior to the workshop.

The following sections outline the modelling results and how they relate to community values.

3 Swimming/Contact Recreation and *E. coli*

3.1 What people want

Regional Policy Statement Change 3: Rangitaiki sets objectives, policies and methods that recognise and provide for *Te Ara Whanui o Rangitāiki (*the Rangitāiki River Document). It says "**Ensure that wherever practicable water… is safe for contact recreation**".

In workshops 5 and 6, your community group said "**water quality should be safe for swimming where people swim**, except after heavy rainfall".

These are spelled out in full in the attached document *Rangitāiki Water Management Area: Draft measurable objectives to support in-river values.*

3.2 How we measure water quality for contact recreation

There are several ways people might measure suitability for swimming. Key factors are shown in Figure 1.

E. coli concentration is an indicator for bacterial infection risk to people. Central government has set this as a compulsory attribute.

Using central government's state bands, A, B and C band are suitable for contact recreation, including swimming and any other activity where a person might be immersed in the water (e.g., kayaking, some cultural ceremonies, mahinga kai gathering). D and E band are not suitable.

3.2.1 Measurable objectives

Council staff suggest the following measurable objectives to achieve what people want:

- maintaining *E.coli* concentrations in Freshwater Management Units where *E. coli* concentrations are in the A or B band
- arresting any worsening trends.

Questions to think about:
Do these measureable objectives feel "about right"?
If not, what are your concerns and suggestions?

3.3 Current situation

Based on central government's *E. coli* bands, water quality is safe for swimming at monitored sites (Table 1).

Rangitāiki WMA	***E. coli***	
Site	**State**	**Long term trend**
Whirinaki	A	☞
Rangitāiki at SH5		
Otamatea		
Rangitāiki at Murupara	A	☞
Aniwaniwa		
Matahina Dam	A	
Rangitāiki at Te Teko	A	☞

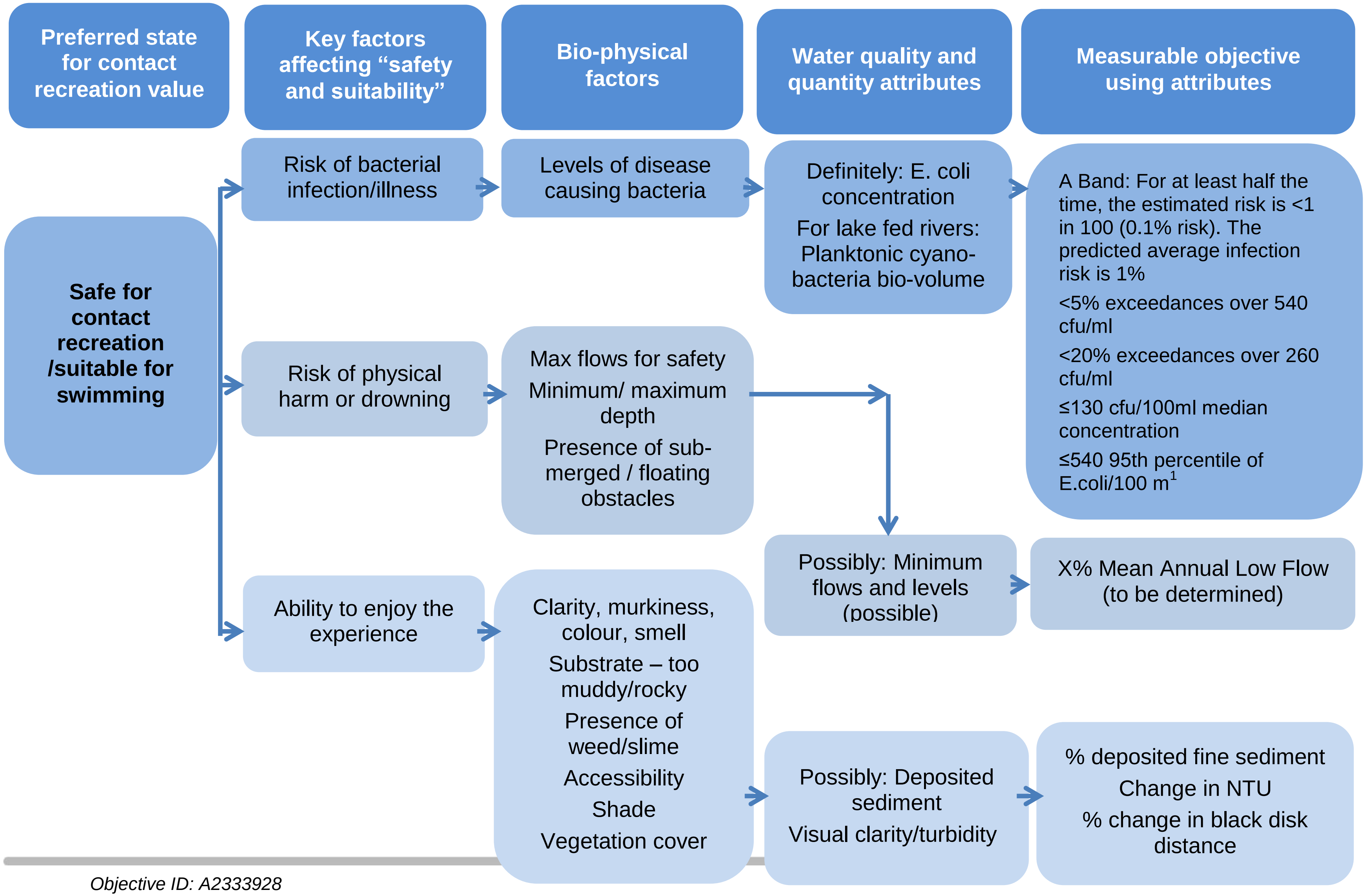
Table 1: *E. coli* concentration state and long term trends at monitored sites. State bands: 'A' (Very good) to 'E' (Very Poor) Trends: ☞ = indeterminate; 👍= improving, 👎= degrading

This is only part of the story. Council will soon publish some water quality monitoring data showing that lowland drainage canals have poorer results.

We can't monitor everywhere and modelling helps us to estimate *E. coli* concentrations throughout all of the rivers in the WMA. An information sheet outlining the catchment model has been circulated previously.

A detailed technical report will be available soon. Modelling indicates that water quality might be in the B band in some water bodies as shown in Figure 2.

Figure 1: Example illustrating that many factors contribute to each in-river value (in this case swimming/primary contact) and only some of those are measurable indicators that may be used for managing water quality and quantity.



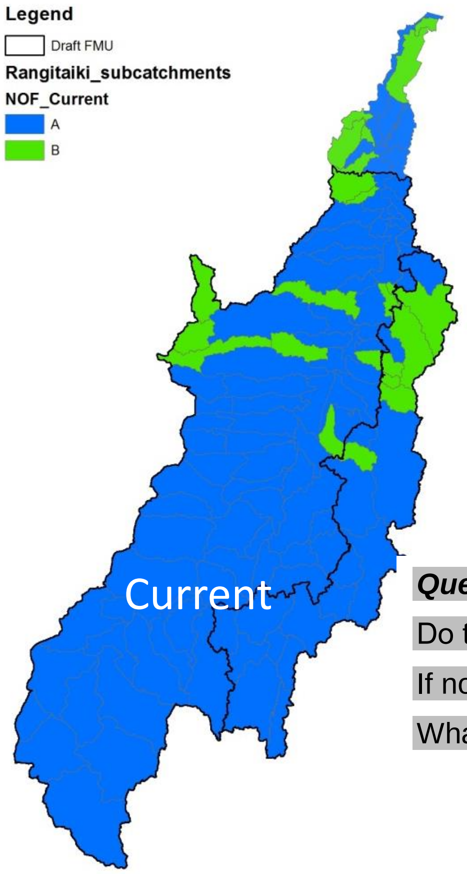


Figure 2: Surface water catchment modelling estimates of current *E. coli* state within the Rangitāiki Water Management Area using the bands expressed in the National Policy Statement for Freshwater Management 2014

Questions to think about:

Do these results seem "about right"?

If not, what are your concerns?

What is your general reaction/response to these findings?

3.4 Where does the *E.coli* come from?

E. coli comes from human, farm animal and wild animal faeces. Modelling indicates that if there was no farmed land, and all of the Water Management Area was covered in natural land cover, E.coli levels would be quite similar to the current map. Some of the areas that are currently B band (near Lake Rerewhakaitu and in the lower catchment) would be in the A band.

3.5 Possible future situation

Remember at workshop 6 we talked about possible credible future land use change?

Staff asked the model "what if land use changes as outlined in Table 2?"

The modelling indicates that some areas may become B band that are current A band as shown in Figure 3.

In conclusion, modelling and science indicates that water quality is generally safe for swimming the Rangitāiki WMA. Our focus should be on:

- Continuing improving trends
- Avoiding causing any increase in E. coli if land use intensifies

There may be localised *E.coli* issues that we are unaware of. Where Council becomes aware of these, causes and sources would need to be explored on a case by case basis.

Staff are still working through which sites are the most important for swimming in the catchment (primary contact sites). Communities may want t measure "swimmability" by other means and this is yet to be explored.

"What if land use changes in the future?	
Land and water use *practice* stay about the same as now, except for consented changes like the initiation of the Waiari water supply take.	
Development Scenario C • New wetlands in coastal areas replace mainly dairy farming • Kiwifruit expands in to suitable areas, mainly from pasture • New forestry and scrub (mānuka) in low capability land in the mid-upper parts of catchments Pastoral and horticulture development on highest capability land in the Kāingaroa Forest	**Development Scenario D** • New wetlands in coastal areas, but less than in scenario C • New dairy on suitable land. • New forestry and scrub in low capability land in the mid-upper parts of catchments • Pastoral and horticulture development on highest capability land in the Kāingaroa Forest

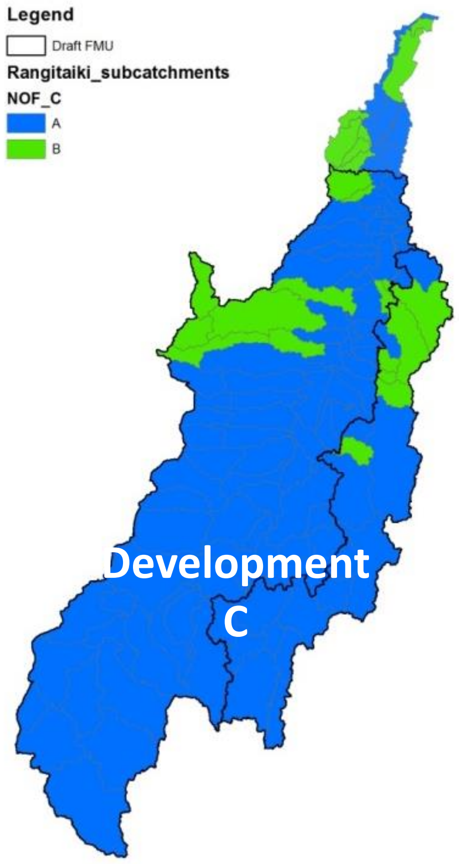
Table 2: Brief description of future development scenarios used in SOURCE modelling

Questions to think about:

Do these results seem "about right"?

If not, what are your concerns and suggestions?

What is your general reaction/response to these findings?



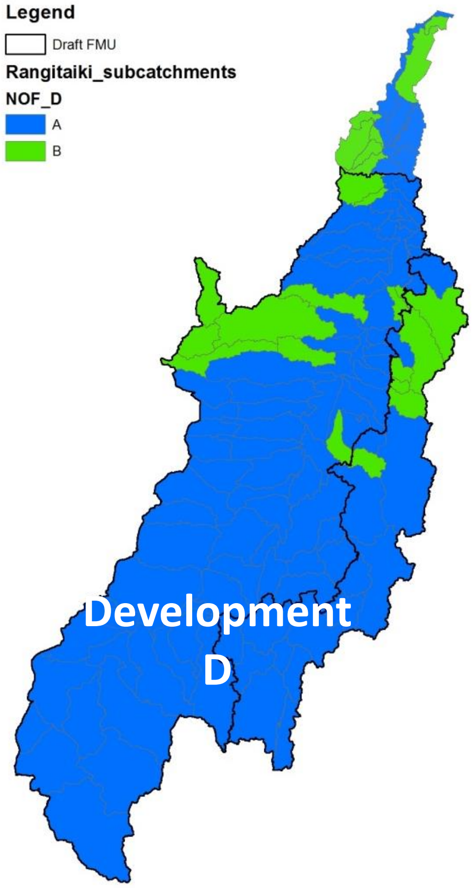


Figure 3: Surface water catchment modelling estimates of *E. coli* state within the Rangitaiki Water Management Area for future development scenario C (left) and D (right) (see Table 2), using the bands expressed in the National Policy Statement for Freshwater Management 2014

4 Ecosystem Health and Sediment, Phosphorus and Nitrogen

4.1 What people want and how we measure water quality for ecosystem health

The attached information sheet[1] outlines what *Te Ara Whanui o Rangitāiki, RPS change 3: Rangitāiki,* and Rangitāiki Community Group have said they want to achieve in relation to ecological health. There are several ways people might measure ecosystem health. The key science attributes are outlined in the information sheet, along with draft measurable water quality objectives to support these.

Question to think about: Do these measureable objectives seem "about right"? If not, what are your concerns and suggestions?

4.2 Why Nitrogen, Phosphorus and Sediment are important

Nitrogen and **phosphorus** are essential for growth of plants. Too much nitrogen and phosphorus can cause excessive growth of slime, algae and aquatic plants, which can reduce ecological and aesthetic values.

Nitrate and ammonia are the dissolved component of nitrogen and, if present in strong enough concentrations, can be toxic to aquatic life. **Phosphorus** is not toxic at higher concentrations.

Too much **suspended sediment** can smother beds of lakes, rivers and estuaries, which can diminish shellfish, native plant and fish life and recreational values. It can also clog up waterways and increase the risk of flooding.

4.3 Current and possible future situation

The modelling results for sediment, phosphorus and nitrogen source areas and loads for the same scenarios (current, naturalised and Development C and D) are in Appendix 1. Note that Nitrate concentrations are increasing at the Te Teko and Murupara monitored sites but improving it the Whirinaki site as shown in Table 2 below.

Rangitāiki WMA	Nitrate (toxicity)		Ammonia (toxicity)	
Site	**State 2017**	**LT Trend**	**State 2017**	**LT Trend**
Whirinaki	A	👍	A	👍
Rangitāiki at SH5	B		A	
Otamatea	B		A	
Rangitāiki at Murupara	A	👎	A	☞
Aniwaniawa	A		A	
Matahina Dam	A		A	
Rangitāiki at Te Teko	A	👎	A	☞

Table 3: Nitrate and ammonia toxicity state and long term trends at monitored sites. State: 'A' (Very good) to 'D' (Poor). Trends: ☞ = undeterminate; 👍 = improving, 👎 = degrading

[1] A2832914

4.3.1 **Nitrogen – key messages**

- Natural nitrogen load is larger than in some areas (e.g., Kaituna) owing to catchment size, geology and landuse.
- Nitrogen starts off relatively low at the top of the catchment with the smallest difference between natural and current loads, with load increasing downstream as flow increases. There is a larger change between natural and current load downstream reflecting the increase in human made load due to more intensive land use.
- Modelling indicates that human-made contribution to TN loads range from <1% in small headwater catchments dominated by native forest, to ~99% in catchments draining into lowland drainage canals.
- Modelling indicates that Development C would generally reduce the human-made TN load with the exception of the area around Kāingaroa village. This will ultimately reduce the load going into receiving environments and help reduce nutrient enrichment in our HEP dam lakes.
- Under Development D, modelling indicates improved mitigation measures would be needed to maintain current nitrogen loads in water bodies (although results are mixed across the WMA).

4.3.2 **Phosphorus – key messages**

- Phosphorus starts off relatively low at the top of the catchment, with the smallest difference between natural and current load.
- Load increases downstream as flow also increases.
- There is a larger change between the natural load and current downstream reflecting the increase in human made load due to more intensive land use.
- Modelling indicates that human-made contribution to TP loads range from <1% in small headwater catchments dominated by native forest, to ~95% in catchments draining into lowland drainage canals.
- Development C and D show similar results for Rangitāiki WMA, with increases in TP load around the middle and lower parts of the catchment.

4.3.3 **Sediment – key messages**

- Sediment starts off relatively low at the top of the catchment with the smallest difference between natural and current load.
- Load increases downstream as flow also increases.
- There is a larger change between the natural load and current downstream reflecting the increase in human made load due to more intensive land use.
- Modelling indicates that human-made contribution to TSS loads range from <1% in small headwater catchments dominated by native forest, to ~95% in some lowland catchments draining into drainage canals.
- Development C and D show mixed results of small increases and decreases in TSS load across the WMA, consistent with changes in land use.

4.3.4 Conclusions

- Human generated TSS, phosphorus and nitrogen loads are influencing the ecological health in the HEP dam lakes.
- Algal growth in streams is generally not an issue, with survey results pending. Phormidium (blue-green algae) growth in the Rangitāiki can be an issue but it is uncertain if this is related to any changes in nutrient concentration.
- TSS, TN and TP ‘hotspots’ (aka yield) are around developed areas in both WMAs. These are the areas effort could be focussed to reduce load if that was required/desired.
- Focus needs to be on arresting increasing concentrations of Nitrate and Phosphorus, and on reducing loads of TSS, TN and TP entering the HEP dam lakes.

Questions to think about:

Do these results and conclusions seem “about right”?

If not, what are your concerns and suggestions?

What is your general reaction/response to these findings?

5 What shall we do with the modelling results?

5.1 Limit setting

A big next step is to estimate just how much we need to reduce nitrogen, phosphorus, sediment, and *E. coli* by in each main river catchment, Freshwater Management Unit, or possibly even sub-catchment. This is likely to be driven firstly by water quality requirements for ecological health of HEP dam lake Matahina.

5.2 Exploring options to reduce contaminants

Council’s land management officers are already discussing possible land use practice improvements with some land owners in “hot spots”. An update can be given at the workshop.

Remember at workshop 7 we talked about possible mitigation bundles to address *E. coli*, sediment, nitrogen and phosphorus for land use? A separate workshop paper is being circulated to provide you with an analysis of cost effectiveness of these mitigations.

Staff intend to use the SOURCE model to ask:

1. Firstly, “what if everybody improved their practice to include basic good practice (the M1 bundle);

   and then, if that is not enough to get the results we are looking for ….

2. “What if more advanced mitigation actions were also applied in key source areas?” (such as the M2 and M3 bundles)

The big question is, “will these mitigations be enough to achieve our measurable water quality objectives in section 2 above”.

Staff will also use the SOURCE model to ask what would happen if rainfall and temperature changes as predicted by a few national climate change scenarios.

Question: What do you think of this approach to testing mitigation options?

Appendix 1: Surface water catchment modelling results for sediment, nitrogen and phosphorus

The graphs and maps below show:

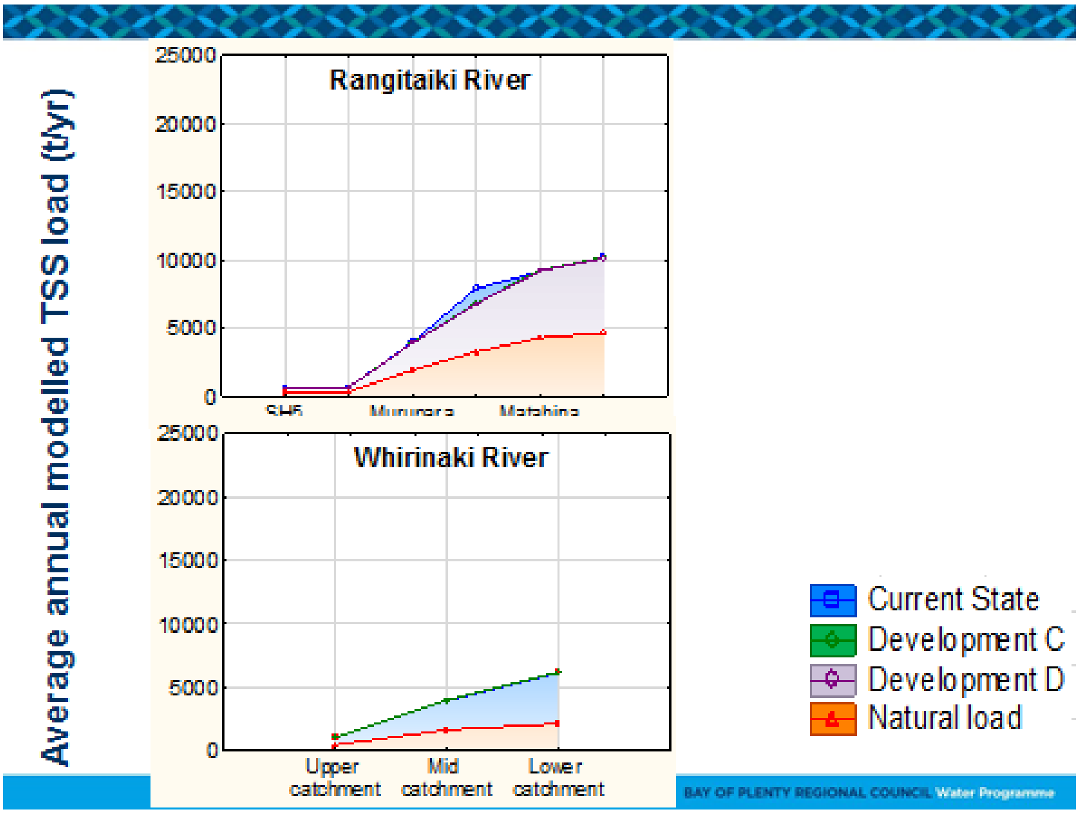
a) cumulative load, i.e., the quantity of contaminant (in tonnes) reaching certain points in the river each year from all of the sources upstream; and

b) total yield from each sub-catchment, i.e., the amount of contaminant (in kg) coming from a sub-catchment, per hectare, each year - excluding any influences from upstream sub-catchments.

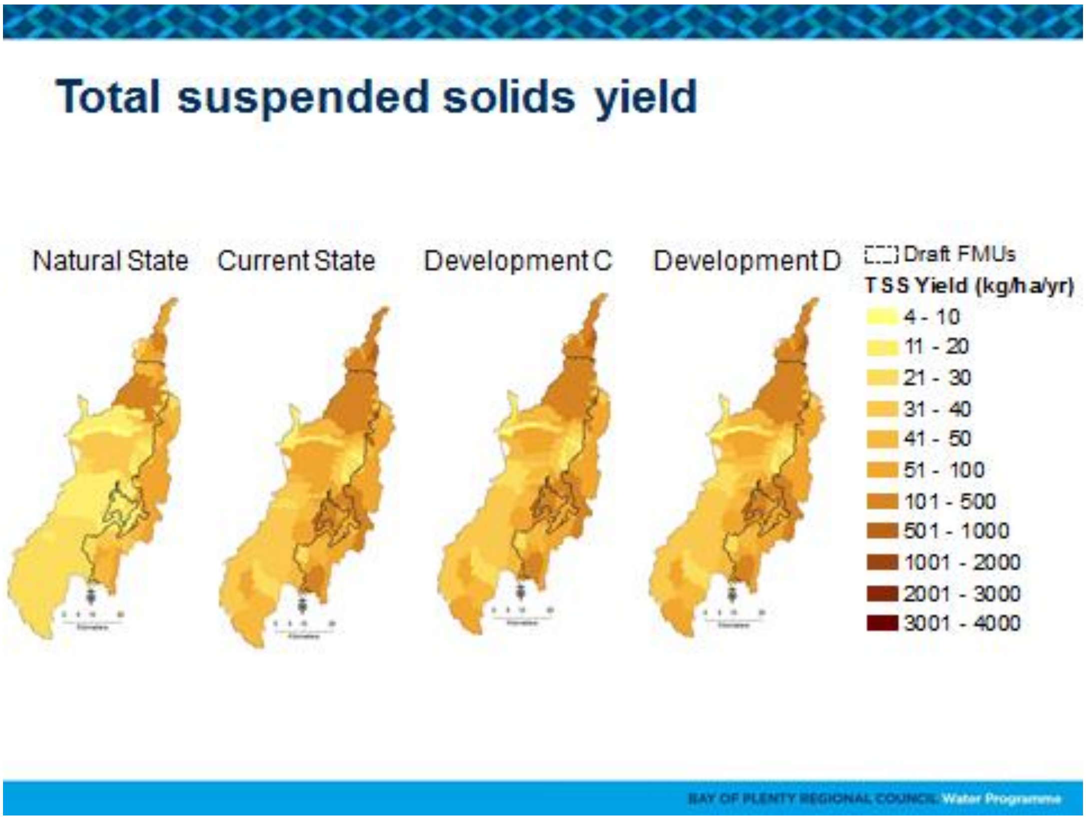
They include graphs and maps for sediment (Total Suspended Solids), nitrogen (Total Nitrogen), and phosphorus (Total Phosphorus) for the naturalised, current, and development C and D scenarios.

These will be explained fully at the workshop.

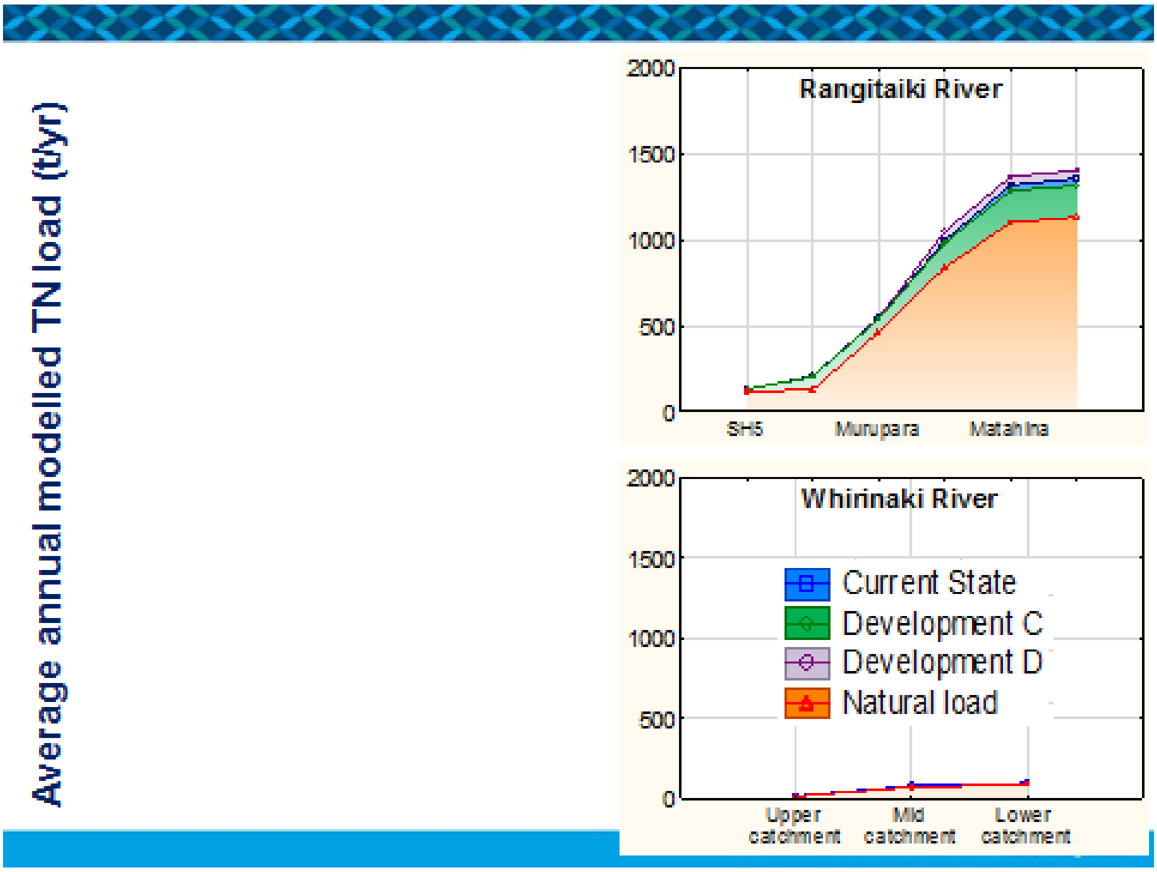
Cumulative Total Suspended Solids load



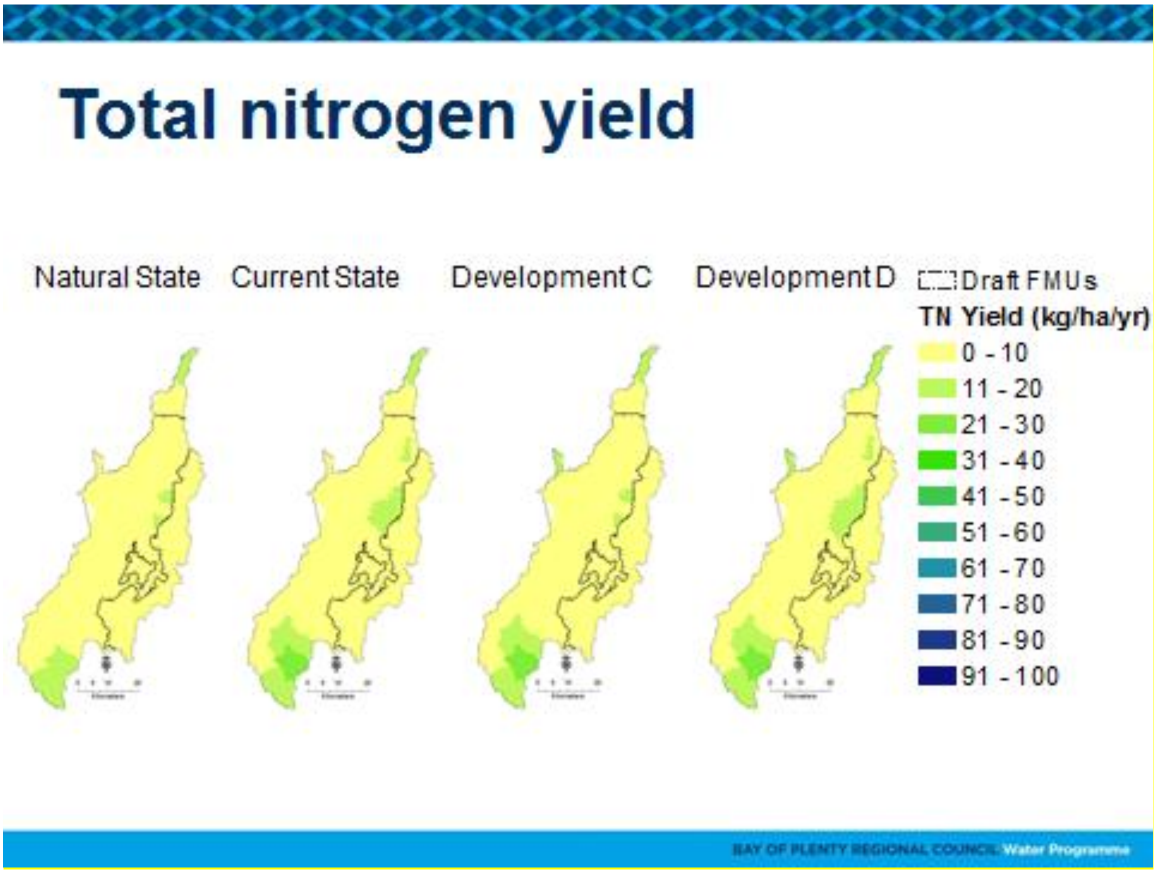
Total Suspended Solids yield from each sub-catchment



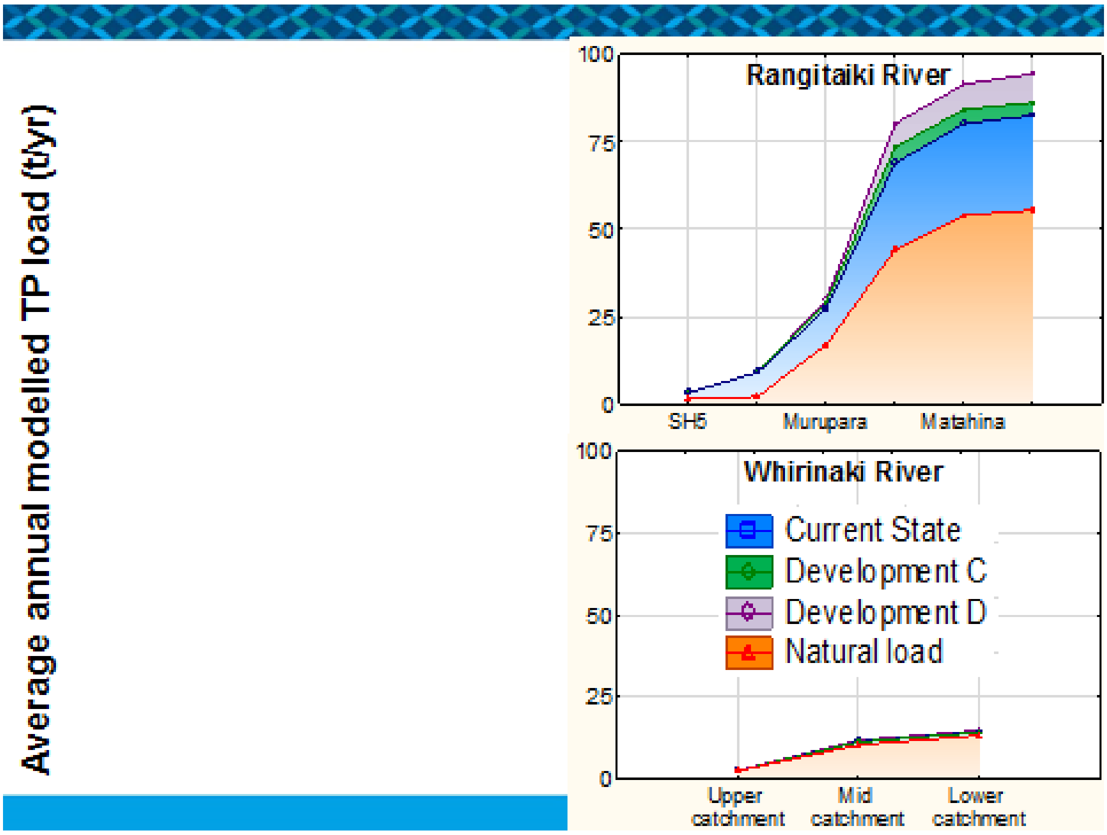
Cumulative Total Nitrogen load



Total Nitrogen yield from each sub-catchment



Cumulative Total Phosphorus load



Total Phosphorus yield from each sub-catchment