greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

MEMO

TO	Te Awarua-o- Porirua Whaitua Committee & Te Awarua-o-Porirua Project Team
FROM	Project team
DATE	17 August 2018

Recommendations for draft harbour objectives and key messages from harbour modelling results

This memo sets out recommendations from the Project Team to Te Awarua-o-Porirua Whaitua Committee (the Committee) on numeric objectives for the Porirua Harbour for consideration at the 23 August 2018 workshop.

The recommendations are largely informed by recent quantitative modelling completed by John Oldman of DHI under the Collaborative Modelling Project. A summary of the harbour modelling and technical memo will be provided early next week as further background information, including the key assumptions, emerging messages and any important areas of uncertainty to consider.

At the 23 August workshop, we'll work through the recommendations outlined in this memo to understand how each has been reached. A key aim of the workshop is for the Committee to have robust discussion on whether the objectives are appropriate to meet the committee's expectations; and to reach consensus. This work will bring to (near completion) the work to identify freshwater and coastal water objectives as part of the development of the Whaitua Implementation Programme.

Background

This memo builds on information and assessments from expert opinion at the 31 May 2018 workshop, along with harbour modelling[1] and knowledge of catchment loads.

This memo covers recommendations for numeric objectives on the following attributes:

- Sediment (sedimentation rate, % mud content and spatial extent of mud)
- Pathogens (enterococci)
- Macroalgae
- Metals

1 Quantitative harbour modelling was run to establish the baseline, Business as Usual and Water Sensitive scenarios (i.e. the Improved scenario was not run).

1. Objectives for sediment

Attributes to use in setting objectives

Attribute to use in objective	What is it and why is it important?
Annual average sedimentation rate (mm/year)	Sedimentation rate is the rate at which sediment is accumulating on the bottom of the harbour. High deposition can alter and degrade habitat, change flow and depth (infill), smother invertebrates, seagrass and shellfish, and reduce water clarity. A single rate is proposed for the intertidal and subtidal zones of each harbour arm because sediment moves back and forth between both depending on input sources, tidal movement and wind and wave action. However multiple sites would be monitored to generate an average for each arm to test against the objective. Elevated sedimentation rates are likely to lead to major ecological changes in an estuary and indicate where changes in land use management may be needed. These potential changes will impact food/kaimoana gathering, how healthy the harbour is and whether it is safe for recreational purposes.
Spatial extent of soft mud	Mud is very fine sediment that feels smooth or "slimy" when you work it between your fingers or toes. The attribute reflects the extent of muddy sediments across the harbour and the degree to which the extent of these areas is changing. This is generally measured using the National Estuary Monitoring Protocol method of whether an adult sinks above their ankles (>5cm deep). It is measured in Ha derived from maps of mud dominated habitat (usually mapped 5-10 yearly). It is a relatively robust measure but can be variable depending on deposition and erosion events (storms or floods can deposit sediments that subsequently erode and get washed into subtidal basins or out to sea). High levels of mud affect the types of animals and plants that are able to live and thrive within the sediment on the bottom of the harbour. Extensive areas of mud can cause stress and risk of loss of sensitive species from the harbour, which can affect fish and bird species that feed on them.
% mud content	In their natural state, NZ estuaries would have been dominated by sandy or shelly substrates. Lower percentage mud content reflects firm muddy sands. Fine sediment is likely to impact community composition, can help establishment of invasive species, increase turbidity (from re-suspension) and reduce amenity values. High or increasing mud content can indicate where changes in land use management may be needed.

1.1 Sedimentation rate

What does the modelling show and does it differ from the expert assessment?

Some parts of the harbour have high sedimentation rates and some areas are eroding; this variability will continue even with the significantly reduced sediment inputs that are modelled under the Water Sensitive scenario. Under the scenarios, the areas of the harbour that are most at risk of elevated sedimentation rates are the subtidal basins of both arms and the intertidal areas of Bradeys Bay and Aotea.

Harbour modelling shows significant improvement in sedimentation rate can be achieved in both arms under the Water Sensitive scenario (Table 1).

Expert assessment considered there could be some improvement in the sedimentation rate in the Pauatahanui arm under both the Improved and Water Sensitive scenarios and a more significant

improvement in sedimentation rate in the Onepoto arm with both Improved and Water Sensitive scenarios.

Table 1. Modelled sediment loads to, and sedimentation rates in, Te Awarua-o-Porirua harbour

Onepoto Arm				
Scenario	**Catchment inputs (T/yr)**	**Amount exported (T/yr)**	**Amount deposited (T/yr)**	**Average sedimentation rate (mm/yr)**
Baseline	3300	750	2550	4.1
BAU	2800	750	2050	2.5
Water Sensitive	1400	690	710	0.3
Pauatahanui Arm				
Scenario	**Catchment inputs (T/yr)**	**Amount exported (T/yr)**	**Amount deposited (T/yr)**	**Average sedimentation rate (mm/yr)**
Baseline	5500	1500	4000	4.7
BAU	5400	1500	3900	4.4
Water Sensitive	3000	1450	1550	2.0

The load modelling results in Table 2, however, show that the difference in reduction in estimated average sediment load is negligible between the Improved and Water Sensitive scenarios (Table 2). Table 2 also shows the proportion of sediment coming from different erosion processes in each freshwater WMU.

Table 2. Modelled baseline annual sediment loads from FMU's (including percentage contribution from different erosion processes) and the modelled percentage reduction under the improved and water sensitive scenarios.

Pauatahanui Arm						
Freshwater WMU	**Under Baseline scenario**				**% reduction in annual average sediment load between Baseline and**	
	Annual average sediment load (T/yr)	**% load from different erosion processes**			**Improved scenario**	**Water Sensitive scenario**
		Hillslope	**Landslide**	**Streambank**		
Pauatahanui Stream	3,214	41	6	53	-35	-43
Horokiri Stream	955	31	36	33	-49	-51
Duck Creek	526	69	26	6	-56	-57
Kakaho Stream	245	43	41	16	-64	-65
Ration Creek	196	91	0	9	-12	-13
Onepoto Arm						
Freshwater WMU	**Under Baseline scenario**				**% reduction in annual average sediment load between Baseline and**	
	Annual average sediment load (T/yr)	**% load from different erosion processes**			**Improved scenario**	**Water Sensitive scenario**
		Hillslope	**Landslide**	**Streambank**		
Porirua Stream	2,655	59	32	9	-47	-50
Kenepuru	818	48	50	2	-70	-71
Porirua Stream catchment (u/s Kenepuru Drive)	1,705	66	26	7	-40	-42

Recommended objectives for sediment

The PT recommends the Committee consider the following objectives for sediment rates:

Pauatahanui arm

The annual average sedimentation rate is less than 2mm per year [and no more than double the natural sedimentation rate] in the Pauatahanui Arm.

Onepoto arm

The annual average sedimentation rate is less than [1mm or 2mm] per year [and no more than double the natural sedimentation rate] in the Onepoto Arm.

Why these recommendations?

- Achievable under Water Sensitive scenario modelling in the Pauatahanui arm
- Level that shellfish beds can cope with - ANZECC guidelines have 2mm per year above natural background levels.
- Less than 2mm sedimentation rate will protect the majority of infauna (creatures that live in the sediment) from sediment burial (2mm)

Things to consider:

- Recommendation is to set 2mm per year in each arm so that reductions need to be made in each arm, not averaged over the whole harbour
- Committee may want to consider a rate less than 2mm per year in the Onepoto arm as the modelling indicates a lower rate is achievable
- The Te Awarua-o-Porirua Harbour and Catchment Strategy and Action Plan has an interim target of 2mm per year and a long term target of 1mm per year (by 2031)
- The modelling shows 2mm per year is achievable under the water sensitive scenario for the Pauatahanui arm, however:
    - Most of the reductions in sediment load from the FMUs are made under the Improved scenario
    - Other freshwater objectives in the rural areas require an improved level of effort.

1.2 Mud

What did the experts say in May?

Expert opinion considered there could be an improvement in the percentage of area with soft mud in the both arms of the harbour under the Improved scenario and a further improvement under the Water Sensitive scenario.

Recommended objectives for mud

Sediment mud content does not exceed 20% in the intertidal sediments and should not increase from current state.
Spatial extent of soft mud shall not exceed 15% of the available intertidal area and no increase in soft mud area from current state.

Why these recommendations?

- For sediment mud content, if the mud percentage exceeds 30% there are significant impacts on marine species; 25% will put at risk some sensitive species; and less than 20% is required to avoid significant impacts on infauna including kaimoana species and seagrass.

- For the spatial extent of soft mud, estuaries with extensive areas of soft mud have low seagrass cover, poor infauna communities, and degraded sediment conditions.

Things to consider and think about

- The mitigations put in place to reduce sedimentation rate will also work towards achieving the muddiness objectives.

2. Objectives for pathogens

Attributes to use in setting objectives

Attribute	What is it and why is it important?
Enterococci 95th percentile Number of exceedances over 500 ml	E. coli and enterococci are indicators of the presence of faecal material in water and therefore possible presence of disease-causing bacteria, viruses and protozoa. These may present a risk to human health from recreational contact of freshwater and saltwater. Enterococci are distinguished by their ability to survive in salt water and are typically more human-specific and are therefore used as an indicator of pathogens in salt water.

What does the modelling show?

The PT have developed a band framework for enterococci similar to the *E. coli* NOF framework. The modelling of the Water Sensitive scenario suggests we are likely to get a band change improvement in enterococci levels across various modelling and monitoring points in the harbour e.g. Waka ama, the rowing club, Paremata. See Appendix 1 for further details. (The expert opinion assessment carried out in May did not consider pathogens).

Recommended objectives for pathogens

Onepoto Arm intertidal – C band *Onepoto Arm subtidal – A band* *Pauatahanui intertidal – B band* *Pauatahanui subtidal – B band*
Potential objectives for Open Coast – to be discussed?

Why these recommendations?

- To achieve the Committee's freshwater objectives will require more than Water Sensitive measures in order to achieve them. The bands recommended above are based on the Water Sensitive scenario.
- Makes sense to set objectives at larger spatial scale to cover all harbour water, rather than only at specific monitoring/modelling points (such as Waka ama, the rowing club, Paremata) to protect a

range of values, and to be consistent with the NPSFM approach to FMU scale objective setting. Note that monitoring would still occur at specific recreation points to help test against the objectives through time.

- Setting objectives in the open coast may be desired but difficult to develop technically

Things to consider:

- Is C band for the intertidal area of the Onepoto arm good enough to meet Committee and community values? The justification is that it is going to be extremely difficult to achieve anything better, but could we aim higher by considering a longer timeframe?

3. Macroalgae

Attributes to use in setting objectives

Attribute	What is it and why is it important?
Macroalgae (intertidal only) • % cover of intertidal • Entrainment	The "macroalgae" attribute uses an index called "Ecological Quality Rating" or EQR, to reflect multiple underlying metrics. This incorporates the coverage of intertidal areas by macroalgae species, (red and green seaweeds), the degree to which these species are entrained within the sediments and the density of the algae. In simpler terms, the more lush and well-rooted the algae are, the worse the attribute state. Some level of cover is valuable to the ecology of the harbour, however, frequent, extensive and persistent macroalgae blooms have a range of adverse effects, including: • Reduce light for desirable species • Smother shellfish beds and other desirable species • Reduce waves and currents causing mud to accumulate

What did the experts say?

Macroalgae is persistent in the harbour but is not a nuisance. Current assessments of macroalgae indicate there is moderate macroalgae cover and low biomass so no problematic nuisance conditions.

Recommended objectives for macroalgae

EQR is not less than 0.6 (B band) and does not worsen from current state in intertidal areas

Why these recommendations?

- The draft freshwater objectives for nutrients (nitrogen and ammonia) require the level of nutrients to maintain or reduce and therefore nutrient stimulation of macroalgae is also expected to maintain or improve.
- *Using EQR does not worsen from current state or is in B band – less than 0.6*

Things to consider and think about:

Important to acknowledge EQR and underlying metrics are still under development but based on best available information for NZ estuaries.

4. Metals Cu, Zn

Attributes to use in setting objectives

Attribute	What is it and why is it important?
Sediment metals • Copper (Cu) • Zinc (Zn)	The attribute refers to levels of metals in sediment in the harbour. Metals can be directly toxic to animals that absorb/ingest them from the sediments and they can also bio-accumulate as larger species eat smaller ones.

What did the experts say?

In managing for sediment inputs we are more likely to achieve reductions in metal contamination in intertidal areas (metals adhere to sediment). The subtidal areas will always be muddy and have legacy contamination above guideline levels. Clean sediment is the only thing that will dilute the legacy contamination in these areas.

In intertidal areas the objectives are likely to be achieved under improved scenario, however water sensitive approaches will be required to get a movement within the band for sub tidal areas.

Recommended objectives for metals

Concentration of metals in sediment should be no more than 0.5 of ANZECC guideline values (ISQG) – low guidelines in intertidal areas, including reducing contamination in known intertidal hot spot areas
Concentration of metals in subtidal area sediments to reduce below ANZECC guidelines

Why these recommendations?

- Clear guidelines and good data available
- Need to be managing metals better in the subtidal areas but it is going to be difficult – should not get any worse than current in subtidal

- Note Semple Street is a major contributor along with all other stormwater drains and setting harbour objectives will help direct management of stormwater and its discharge into the harbour.

Things to consider and think about:

- Legacy issues and the management responses (roofing, brake pads) make it difficult to resolve heavy metal issues

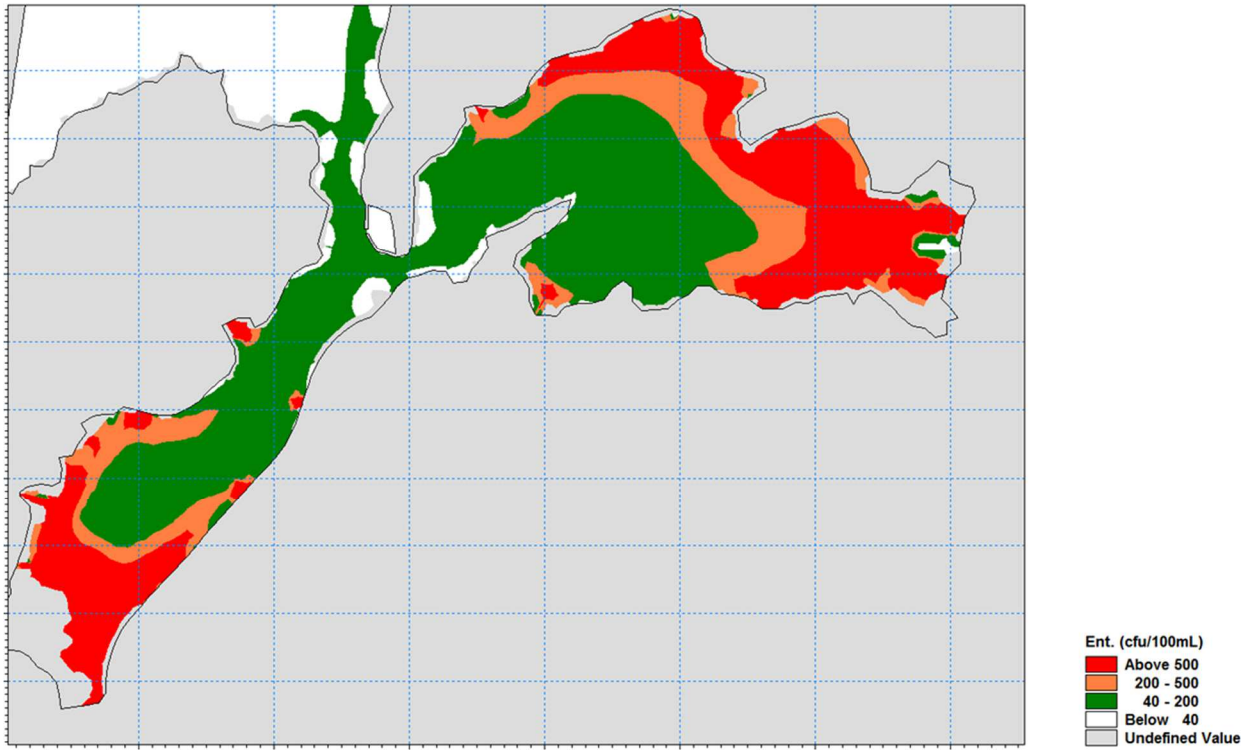
Appendix 1

The harbour model results for enterococci have been mapped (below) in the harbour to give an indication of the patterns of risk and changes observed through the scenarios. Results in these places can also help us understand connections between freshwater inputs and changes in conditions around the harbour.

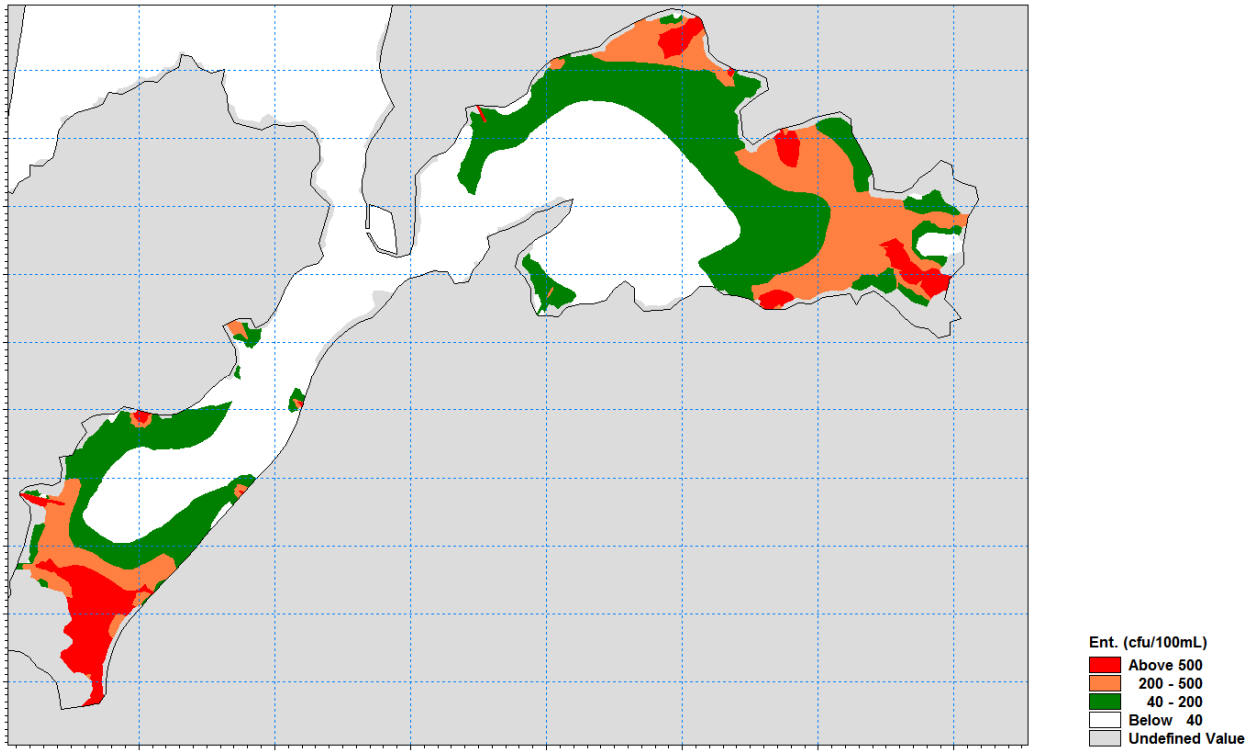
In general, we see that conditions are higher risk at the upper ends and around the edges of both arms of the harbour (red areas) and lower risk in the central parts of the harbour (green). Sources of pathogens vary at most sites, though are often dominated by the closest catchment. The scenario results indicate a reduction in risk in both arms, though higher risk may continue in the upper parts and edges of each harbour arm.

The freshwater *E. coli* objectives in the Porirua Stream are seeking higher reductions than the water sensitive scenario, so achieving those objectives would likely produce further harbour reductions beyond the model results shown here.

The reductions in *E. coli* to reach the freshwater objectives in rural catchments are most likely to fall somewhere between the amounts estimated for the improved and water sensitive scenarios. We have only modelled the harbour outcomes from the water sensitive scenario reductions, so the results shown here are a little better than would be the case under the improved scenario.



Current state – estimated 95%ile



Water sensitive scenario – estimated 95%ile