

## **Transcription of Presentation by Mr Roger Hodson**

**Monday 22 May 2017**

### **Proposed Southland Water and Land Plan Hearing**

#### **Slide 1:**

Good morning, my name is Roger Hodson, I'm an environmental scientist with the Regional Council and I am going to provide this morning an overview of the state of environment aspects section 3. Now I just want to illustrate that this draws on a number of long term environmental monitoring programmes across rivers, lakes, ground waters and estuaries. I am going to spend a little bit of a time introducing some of the terms that I will refer to, providing an over view of all of those programmes, expanding on some of the results of those programmes, particularly as they relate to human health and eco system health and then finally answer some questions.

So, human health and eco system health are two important values of water in Southland, and I'll be discussing indicators of human health, pathogens that reflect the risk of illness to a person when interacting with a water body and the risks of toxicity of nitrogen in water supplies with respect to human toxicity.

The aspects of eco system health risk that I will cover are related to toxicity. So toxicity in this context refers to the degree to which a substance can cause damage to an organism, for example the fish and or insects living within water bodies. Secondly, I am going to talk about trophic responses, that is the degree to which nutrient enrichment may drive plant growth within fresh water eco system, which could improve algae and can lead to decreased aesthetic and recreational values, changes of stream habitat, that can result in changes of the aquatic community composition and productivity, and has the potential to lead to toxicity and oxygen depletion.

So the national policy statement for fresh water management provides a number of national bottom lines for pathogens and toxicity, as well as trophic response, and it introduces an A, B, C, D framework. I have some maps which illustrate that using a traffic light system, A, B, C, D. C D represents the national bottom line. So sites that are illustrated using a D are classified as being the national bottom line.

The regional water plan includes some standards for human eco system health, and I'm going to use the eco system health aspects of Macroinvertebrate community composition, as well as the Ministry of Health and Ministry of Environment guidelines for drinking water. Additionally, the Australia and New Zealand Environmental Conservation Council provides some guidelines which identify trigger values for nutrients designed to protect quite a few systems from adverse effects. Those identify levels of nutrients above which the risk of adverse effects can occur. I am going to talk about trends, and I will introduce those a little bit more as I get...

## **Slide 2**

So the very top of that slide looks like has been cut off, but hopefully we can still get it from the headings. So this is a human health summary. So from historical monitoring programmes elevated microbial contamination has been illustrated as an issue in Southland rivers. Six of 55 monitoring sites don't meet secondary contact recreation national bottom line within the national policy statement for management, and none of the six swimming sites identified in the water plan meet primarily contact recreation standards. Potentially toxic, benthic algae blooms have been observed in all mainstream rivers in the Southland region, and within ground waters, elevated levels of nitrate. 58 of 334 waters above the drinking water standard and 80 of 300 bores have e.coli levels above drinking standard.

## **Slide 3**

Moving to a summary of eco system health, with regards to lakes. Our glacial lakes are considered to be in excellent condition, in contrast to shallow coastal lakes which are in somewhat degrading condition owing to elevated levels of nutrients, and in some cases expressed through growth of the algae.

In our estuaries, 12:43 New River Estuary is in a state of eco system health decline, contributed to a combination of nutrient and sediment stress. Similar, Jacob River Estuary is in a state of decline attributed to nutrient and sediment stress. Fort Rose Estuary at the mouth of the Mataura River in moderate health, but with some signs of nutrient stress evident. And the Waikawa system in good health, however considered to be vulnerable to additional nutrient and sediment.

## **Slide 4**

Ground water. Elevated nitrogen levels present a risk to eco system health, particularly in hydrologically connected service water bodies. In rivers no sites have breached toxicity standards, and I will expand on some that are in a C band state further through. Guidelines for the protection of eco system health are not met in many water bodies. Nuisance growths of slime algae are observed to occur in the main stem of the Mataura and Aparima Rivers, as well as tributaries of Mataura and Aparima and Oreti Rivers. The Macroinvertebrate community index, health is impacted, particularly in lowland areas and is in a state of decline across the region.

## **Slide 5**

So before I summarise the trends, I just want to spend a little bit of time introducing the trend analysis. In general we require a high level of confidence in our trend direction in order to report it, and when we detect that we report an increase in concentration as a deterioration in water quality and a decrease in concentration as an improvement in water quality. Now, the inverse is true for parameters like clarity, for example, where an increase in clarity represents an improvement.

Finally, longer time periods are considered the most reliable indication of long term changes, because they incorporate a larger data set, a larger sample size. To avoid the undue influence and the short time variability.

### **Slide 6**

So to summarise some of the trends from those long term environmental monitoring programmes for nitrate in ground water for the 17 year time period between 2000 and 2016, significant deterioration detected at 15 of 23 Environment Southland operated sites with an improvement at 3 of those sites, and at the balance the trend direction was unable to be confidently determined. For a shorter period, five years, between 2012 and 2016, in those ground water sites there was a deterioration in nitrate at 5 of 25 sites. Again, the balance unable to be confidently determined.

Moving to surface waters and considering that longer time period where deterioration has been observed in 15 of 34 Environment Southland and six NIWA operated sites in the Southland region respectively, with an improvement at 2 of 34 and one of 6 sites in the Southland region. For the 2012 to 16 time period, improvements in nitrate concentration are observed at 9 of 55 sites, with a deterioration at 2 of the 55 sites.

And then looking at the macroinvertebrate community index, some of the text is missing from the bottom of the slide, but deterioration in that is observed at 19 of 72, which is 26% of sites across the region.

### **Slide 7**

I am going to talk now in a little bit more detail and use some maps to illustrate some spatial variability in water quality. This figure illustrates secondary contact recreation graded using national objective framework A, B, C, D with six sites illustrated in red where the national bottom line is not met and smaller numbers in the C band, with increasing numbers of sites in B and A, and a general pattern of lower levels of pathogens in upper parts of catchments and high levels of pathogens in the lower parts of catchments and catchments which have higher pastoral land cover, including the Otepuni, which as just fallen off the very bottom of that map there, and is illustrated in red...sorry, it is there in red at the very lower side

### **Slide 8**

So moving now to primary contact recreation or swimming. There are 7 sites illustrated in red which fail the national bottom line for secondary contact recreation. Now, it looks like one of the dots has moved there, so I am not sure...I will just use it to illustrate one of these locations here around Riversdale is not included in the regional water plan currently. It is in the proposed version of the plan. Environment Southland has historically collected data there of the same frequency used to assess swimming at the other location, so it is illustrated here for that purpose as a fail. You will note also at the top left, two green dots in glacial lakes illustrating compliance. Now, those sites aren't identified in the plan but again adequate data is available for the assessment.

## Slide 9

Looking at ground water nitrate levels, this figure comes from Rissmann et al 2012, and illustrates the extent of ground water nitrate concentrations around the region. It takes the results of many individual wells to create a map that illustrates the extent of nitrate concentration around. Unfortunately the very bottom of the scale is not showing on there, but there is a red and purple part of the key which illustrate the higher levels, with the purple parts areas that are in excess of drinking water standards.

Rather than showing this figure a second time, I'm just going to quickly talk about the risk that elevated nitrate levels may pose to connected service water bodies. So illustrated here in yellow are approximately 20% of managed aquifers with concentrations above 3.5 milligrams. Areas that are considered to have potential to pose a risk to eco system health in rivers and streams which are hydrologically connected.

## Slide 10

So an over view of eco system health. Again, glacial lakes considered to be in very good condition. Lowland lakes with elevated levels of nutrients, and some cases growths of phytoplankton or algae. Degraded or gross eutrophic areas of Fort Rose, Jacobs River Estuaries and New River Estuaries are increasing in size. None of the river sites reached toxicity standards for ammonia or nitrate. A number of service water bodies have nitrogen phosphorus concentrations greater than ANZECC guidelines for protection of ecosystem health. Nuisance growths of slime algae, referred to as periphyton are observed in the matura and aparima main stems, as well as tributaries of the Matura River and the Apariama and Oreti Rivers and the Macroinvertebrate Community Health Standards are not met in approximately 20% of sites.

***I am just going to ask Mr Hodson to pause there so that we can fix this screen, because the next slide has a line at the bottom that we might need to see. We will just take a moment.***

## Slide 11

OK, so this map illustrates total nitrogen levels in lakes. The green are the Glacier lakes, [Manapouri and Te Anau. And then around the coast a number of coastal lakes in C and D bands, namely Waituna Lagoon, during periods that are closed to the sea. So anyone who is not familiar with the Waituna Lagoon it is subject to an opening regime, whereby during periods of high lake level the lake is mechanically opened to the sea to reduce the inundation of surrounding land. So during periods of time where that opening is non-existent and the lake is closed, the total nitrogen levels are in D band. Similarly, for Lake Vincent, slightly further to the east.

So looking at the trophic response within these lakes, algae growth. Again, Lakes Te Anau and Manapouri are both considered in good condition in A band. Green. Left with coastal lakes in culmination of B, C and D in The Reservoir.

## **Slide 12**

So moving now to talk about estuaries and the front response within estuaries. I have got up here a map of the Southland coastline. Hopefully you can make that out, but I've used some blue circles there just to illustrate the four main estuaries that I'm going to be referring to. And before I get into some of the details there,

## **Slide 13**

I just wanted to quickly introduce what a trophic response within an estuary may look like, with increased nutrients and sediment loads driving increased Macroalgae cover. And that in turn breaking down and driving de-oxygenation, removing oxygen from the sediments resulting in black anoxic sediment illustrated in the photograph there.

So the weight of evidence from multiple measured parameters indicates that the combined effects of nutrients and sediments are negatively impacting the four estuaries to varying degrees. That was a conclusion reached by Townsend and Lohrer 2015 reviewing multiple sources of estuary monitoring information in Southland.

The Waikawa Estuary located out to the east south end of the Catlins is in good overall health, however the upper estuary is considered moderately healthy and management of nutrient inputs are necessary to prevent threshold change. The Fort Rose Estuary at the Maitai River mouth and is in a moderate state of ecological health. The main stresses are nutrient enrichment in that catchment.

## **Slide 14**

Then moving to New River Estuary, just outside Invercargill City, the largest estuary in Southland. There are sections of the central and outer parts of the estuary that appear in a moderate to healthy condition, however there are also sections that have degraded. In general the eco system health of estuary is in a state of decline, with the impacts of nutrient enrichment and sediment being the main driver.

And this map here illustrates the increase in macro algae cover from 2007, on the left, to 2012 on the right.

## **Slide 15**

So moving out towards Riverton, to Jacobs River Estuary at the mouth of the [NAME] River. It is also considered to be in a state of ecological decline due to the impacts of nutrient enrichment and sedimentation. The ecological health of the estuary is severely compromised in certain parts and there is some evidence of further degradation occurring. This image here illustrates changes of macro algae cover from 2008 on the top, to 2011 on the bottom left, through to 2013 on the bottom right, with three main areas illustrated using red circles where increases in algae cover have been observed in the Pourakino Arm, Central Basin and northern flats.

## **Slide 16**

So eco system health within our rivers. No sites breach toxicity standards for nitrate or ammonia. Nitrogen and phosphorous concentrations do not meet guidelines for eco system health protection in many water bodies. Nuisance growths of slime, algae and periphyton occur in the main stem of Mataura, Aparima and lowland tributaries of the Mataura, Aparima and Oreti. There is a map there of macroinvertebrate community health standards are not met at approximately 20% of sites and the map there that the community health index is deteriorating at approximately 26 sites, 26% sorry.

#### **Slide 17**

This figure just provides a breakdown of the number of sites within each of the bands for nitrate. On the left, 21 sites in A band, 17 in the B, 9 in the C and no sites in D band for nitrate toxicity to fish. Similar for ammonia toxicity to fish, 31 sites in A band, 20 in the B, 4 in C band.

Now, alongside the A, B, C, D framework is some description of the level of impact that might be expected, so for nitrogen within A band these are considered to be of high concentration value and unlikely that there are effects on fish occurring. Within the D band it is anticipated that growth effects may have occurred in up to 5% of the species present. Within a C band growth effects may be occurring up to 20% of the species present. And within a D band impacts are observed on multiple species.

And then for predicted periphyton there, 8 sites are to be a B band – sorry A, 8 B, 9 C and 8 D.

#### **Slide 18**

So the next map here illustrates station variability and nitrate toxicity. And then orange, those sites in the C band, in yellow in the B band and in green in the A band, with a general pattern of lower levels of nitrate in the upper parts of catchments, increase in concentrations in the lowland areas. And connected to some certain physiographic units which Dr Rissmann will expand on his talk soon.

#### **Slide 19**

So this here provides a summary of rumours with respect to ANZ guidelines. So for Environment Southland operated sites, total nitrogen, 14 sites, complying, 41 exceeding. For nitrate 17 complying, 38 exceeding. For ammonia 47 complying and 7 exceeding. The total phosphorous, 33 complying, 22 exceeding. For dissolved reactive phosphorous, 25 complying and 27 are exceeding, clarity 48 complying and 6 exceeding. I won't summarise the NIWA sites.

#### **Slide 20**

So moving to consider a trophic response, slime algae growth within rivers. Using that A, B, C, D framework. And predictions from long term environment monitoring in the region, 8 sites do not meet the national bottom line for slime algae cover. 9 sites in orange in the C band and 8 in the B and 8 in the A. And just to provide a little more interpretation to this, sites in that green A band are considered to have rare algae blooms and negligible nutrient enrichment. 8 sites within the yellow B band, where occasional blooms of algae are observed. Low levels of nutrients and or flow modification may have occurred. Within the orange C band, periodic short term nuisance algae blooms are experienced, moderate nutrient enrichment and or alteration for natural flow regime or

stream habitat. And within the D band, regular extended nuisance algae blooms are experienced with high levels of nutrient enrichment or significant flow habitat modification.

#### **Slide 21**

So moving now to the macroinvertebrate community index. This figure indicates compliance with regional water plan standards, with 19 of 81 sites illustrated there in red are not meeting regional water plan standards. I will just note that for the Mataura catchment, 36:47 macroinvertebrate community index stands are not provided in water plan. In order to make this comparison we used the equivalent standards from the river environment classification network that had been applied in other parts of Southland to apply it to the Mataura. So if we were to exclude Mataura catchment that number is 11 out of 56 or 19%.

#### **Slide 22**

Looking at trends in macroinvertebrate community index, 19 of 72 sites or 26% showed a decline in macroinvertebrate community health with no sites showing an improvement in macroinvertebrate community health and just over 70% of those sites are in a trend direction that is unable to be confidently determined.

#### **Slide 23**

OK, to summarise, elevated microbial contamination is an issue in rivers in Southland. Potentially toxic algae blooms have been reported to occur in main stem and tributaries of. Elevated contaminants are observed in ground waters, both of nitrogen and e.coli. Estuaries our major estuaries, New River and Jacobs River are in a state of decline in response to nutrient and sediment loads. Nuisance and slime algae growth is predicated to occur in the main stem of Mataura and Apariama and tributaries of Mataura and Apariama and Oreti Rivers, and the macroinvertebrate community health index is impacted and deteriorating.

*What I might have Mr Hodson do next is read out his answers to the questions, followed by the questions from the [NAME].*

***Thanks very much for that. On the way through you were interpolating quite a lot of expert material that wasn't on the slides and you seemed to be reading from some documents. Can you produce for us the revised slides...can you insert the additional text and then on the margins on the appropriate slides on the reading notes when you put in the addition detail and so that 39:42 **INAUDIBLE**...other witnesses in a similar manner if they're going to add additional material verbally. 39:57 **INAUDIBLE*****