Schedule III. Environmental Guidelines for Surface Water Quality

1 INTRODUCTION

1.1 The Hawke's Bay Regional Council undertakes monitoring of the water quality in the regional waterways as part of the State of the Environment (SOE) monitoring. Various determinants are used in which to assess the water quality:

- Faecal coliform bacteria.
- Macro-invertebrates.
- Total ammonia.
- Suspended solids.
- Electrical conductivity.
- Soluble reactive phosphorous.

1.2 Mean concentrations are used to represent the water quality over the preceding years with the exception of the faecal coliform bacteria figure where median values are used. Due to limited macro-invertebrate data the figure is representative of only the last two years. No analysis of trends over time has been provided as the nature of the monitoring programmes has not lent itself towards this. The information does establish the background quality in which the guidelines have been developed and sets levels against which the performance of this plan may be monitored.

2 FAECAL COLIFORM BACTERIA

2.1 Faecal coliform bacteria and macro-invertebrates are two determinants that are typically used to assess the quality of the water and to gauge the effects of municipal & industrial discharges, land use practices and activities on or within the water body.

2.2 Faecal coliform bacteria are derived principally from the gut of mammals (warm blooded vertebrates) and are contained in their faecal material. Faecal coliforms are used to indicate the presence of potentially pathogenic bacteria, protozoans, and viruses. The concentration of faecal coliforms found within the water body is used to assess the risk to human and animal health. No differentiation is currently made as to the derivation of the faecal coliform bacteria i.e. whether the source is human or animal, although techniques are being developed to enable differentiation to be made. Presently the risk is assumed to be similar independent of the origin, as borne out by national research. Current research is being directed towards identifying the appropriateness of indicator species and the relationship between source of faecal material and health risk. Faecal coliform bacteria have been used as an indicator of Hawke's Bay water quality for some years (dating back to 1971 at some sites). And although directly applicable to recreational water quality under the Water and Soil Conservation Act 1967, it has now been superseded by *e coli* in freshwater, (a species within the faecal coliform bacteria group), and enterococci in marine waters.

2.3 The various guideline/standard values that have been used for assessing the concentration of faecal coliform bacteria and the associated risk to health, the three common ones are:

(a) 0 faecal coliform bacteria (cfu/100 mls) to safeguard human health for drinking purposes (current standard).

(b) Less than 200 faecal coliform bacteria (cfu/100 mls) for recreational use (bathing) (no longer current).

(c) Less than 1000 faecal coliform bacteria (cfu/100 ml) to safeguard animal health for drinking purposes (a current standard).

2.4 This bacteria however is still being used as a state of the environment indicator for reasons noted above, but where compliance to recreational suitability guidelines is concerned *e coli* and enterococci are utilised. To monitor changes within the catchment the faecal coliform group of bacteria are useful indicators and will enable a continual assessment of the state of the waters to be made.

2.5 As well as identifying the risk to health faecal coliform bacteria can help in identifying the presence or potential for other contaminants to be present in the waterway. With increasing bacterial numbers it can be inferred that nutrient concentrations will also increase. An over abundance of nutrients (in excess) can lead to undesirable biological growths manifesting themselves in waterways. This can then lead to reduced clarity, reduced dissolved oxygen, and increased temperatures and pH. The result of this can be a choking of the waterways (eutrophication) reducing the habitat and fishery value and reducing the potential uses of the water e.g. stock water, potable water, irrigation, recreational use, and fishery values.

2.6 Typically levels of faecal coliform bacteria increase with decreasing distance to the coast, which often corresponds to change in land use practises i.e. increasing agricultural intensification. In other cases direct discharges or poor land management practices can lead to localised degradation, although it needs to be borne in mind that other contaminants do not die off or become assimilated readily and can accumulate causing downstream problems (sediments and nutrients).

2.7 The waters that are 'cleanest' are found within the headwaters of each catchment with degradation as distance from the coast diminishes. Those sampled include:

- Sandy Creek (Aropaonui river catchment).
- Clive River including Awanui stream, Irongate Stream, Kawarewa Stream and Poukawa Stream.
- Opoutama Stream.
- Kopuawhara Stream.
- Ikanui Stream.
- Mangakuri River.
- Waipuka Stream.
- Waigongoro Stream.
- Waipataki Stream.
- Nuhaka River.
- Porangahau River including Mangaorapa Stream.
- Te Ngaru Stream.
- Whakaki Lagoon catchment, specifically streams Waikatutu Stream, Tahuru Stream and Whakaki Drain.

2.8 Other areas identified include:

- The Tukituki River around Waipawa, Waipukarau area including tributaries of the Tukituki River specifically Mangatarata Stream, Papanui Stream, Porangahau Stream.
- Tributaries of the Tutaekuri River specifically Awatoto Drain and lower Tutaekuri.
- Wairoa River including the lower tributaries, specifically Ruakituri River.

3 MACRO-INVERTEBRATES

3.1 Another index that can be used to assess the overall water quality (in relation to the aquatic ecology) is that of the macro-invertebrates (MCI index). Unlike bacteriological water quality that gives a result relevant to that point in time, and accordingly requires a number of samples to be taken before trends can be established, the MCI index is more robust and is useful for making an assessment of long term water quality. The MCI index is able to be used to assist in establishing the 'health' of the instream community. Unlike faecal coliform bacteria a large number is indicative of a 'healthy' stream.

3.2 In the maps prepared as part of the State of the Environment Annual Update results of the late summer MCI index are plotted. Markers of differing colour intensity are used to depict the relative MCI index. The bars are used to

denote the number of taxa found at each site, the longer the bar the greater the number of taxa and therefore the better the water quality. The map illustrates trends similar to that found with faecal coliform bacteria i.e. decreasing water quality with diminishing distance to the coast. The Ruataniwha Plains area is further identified as having reduced water quality with intensive agriculture and pastoral grazing likely to be the main contributors. Factors that would come into this are:

- reduced canopy cover
- grazing of riparian areas
- cultivation close to or into tributaries of the main river systems
- increased temperature (due to direct exposure, see first point)
- reduced riparian vegetation
- increased runoff through irrigation
- fertiliser application close to or into ephemeral stream areas.

4 TOTAL AMMONIA

4.1 Ammonia is toxic to aquatic life at low concentrations, and has been used to indicate the immediate effect that the water quality may be having on the instream life. Direct discharges to the waterways of faecal contaminants, decaying organic material and deoxygenated areas overlying organically enriched substrates can contribute to the total ammonia concentrations. For the protection of aquatic life low concentrations of this determinant should be present.

4.2 In general results show a region of good quality with trends similar to that noted for the other determinants above. Land use changes can have a dramatic effect on the total ammonia. Monitoring the concentrations of total ammonia during the course of the draft plan will enable the assessment of trends over time (representing changes in land use/practices/management), and the identification of problems if they occur in the areas monitored. The effectiveness of the plan (performance) will also be able to be gauged.

5 SUSPENDED SOLIDS

5.1 Suspended solids can be used to identify the clarity of the waters, potential for other contaminants to be present, landuse practices and management, and potential impact on the instream fishery. In times of floods high suspended solids concentrations arising from runoff and erosion can also indicate nutrient input. Although nutrients are needed to sustain plant growth both instream and out of stream, elevated levels sustained at high levels for periods of time may lead to choking and undesirable growths occurring in the water ways. Suspended solids are also used to assist in the characterisation of the catchment. In general terms, the regions water are of a good quality with the lowland rivers and streams being identified as having elevated levels of suspended solids. Efforts made in protecting the lowland streams and minor tributaries of the major rivers could see improvements in the concentrations noted in this baseline.

6 ELECTRICAL CONDUCTIVITY

6.1 Electrical conductivity is seen as a surrogate for contamination in general terms. Geology influences the baseline conductivity to some extent as dissolved minerals (as a result of waterways passing though limestone formations) elevate the concentrations. However this is taken into consideration when analysing conductivity and adjusted for in the interpretation. Conductivity can be useful for characterising the catchment and rivers.

6.2 State of the Environment results show that the waters that are 'cleanest' are found within the headwaters of each catchment with degradation as distance from the coast diminishes. Improvements made in water quality will be reflected in the conductivities exerted for the waters i.e. lower. A useful indicator for assessing the overall contaminant load present and to track changes over time and distance.

7 SOLUBLE REACTIVE PHOSPHORUS

7.1 Soluble reactive phosphorus is generally deficient in the Hawke's Bay region, which leads to an almost oligotrophic state (low biological diversity and/or abundance) in many of the region's rivers headwaters. This pristine condition, as it is often referred to, does not necessarily mean an ideal situation as some instream plant growth is essential to ensure good biodiversity and thus health.

7.2 Normal farming practises, substrates and vegetative decay do contribute to increasing concentrations of this determinant in the waterways as distance from the coast diminishes. With this determinant being limited in the upper catchment enables targeting of this determinant if reduction in instream plant growth is required. Prolific growths of algal slimes and larger plants (e.g. oxygen weeds) have been experienced in a number of the lower Hawke's Bay rivers (Tukituki, Karamu, Tutaekuri). Improvements in land management techniques and removal of unwanted discharges will see a further reduction in instream soluble reactive phosphorus concentrations.

7.3 Care needs to be taken in the assessment of concentrations in relation to other biological indicators such as *chlorophyla* and algal biomass to ensure prolific instream plant growth is not masking the effects of soluble reactive phosphorus through luxuriant plant growth.