Memorandum

To: Alex Erceg, Senior Consents Officer (Environment Southland)

From: Dr Pete Wilson, Senior Water Quality Scientist (4Sight Consulting)

Date: 07/11/2019

Subject: Alliance Mataura Meat Processing Plant – Potential Environmental Effects Summary

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The purpose of this memo is to summarise the key potential ecological effects that have been presented in resource consent applications by Alliance Group Ltd ('Alliance') for the Mataura Processing Plant ('the Plant') (APP-20191339). The information in this memo is sourced from the applications and the technical reports included as appendices within. Those documents contain all identified potential and actual effects and have more comprehensive descriptions of the Plant and potential effects of the Plant discharges.

This summary is written in plain language so that a wide audience is able to understand the potential environmental effects that the activities proposed in the application could have on the Mataura River and the Toetoes Estuary located downstream. Although best efforts have been made to convey information accurately in this summary, submissions and other correspondence should refer back to the original application documents and technical reports where appropriate.

Introduction

Alliance owns and operates the Plant on the riverbank of the Mataura River in the Mataura township, which is approximately 44 km upstream from the Toetoes Estuary.

Alliance is applying for resource consents with a consent term of 35 years for the Plant for the following activities:

- Discharge up to 8,000 m^3 per day of treated meat works wastewater into the Mataura River;
- Discharge of condenser cooling water into the Mataura River;
- Take up to 21,200 m^3 water per day from the Mataura River for cooling water;
- Take up to 14,400 m^3 water per day from the Mataura River for meat processing and truck washing; and
- Use an existing weir and hydro race structure to dam and divert water[1];

Each of these activities has the potential to cause adverse ecological effects, which are described in the following sections.

Potential ecological effects of damming, diverting, and taking water

Taking, damming, and diverting water in any river modifies the natural flow. This could have adverse effects on the aquatic plants and animals that live there or that may be trying to move through the area. Adverse effects may arise due to water levels being reduced, the natural flow path of the river being changed, change or loss of natural habitats, or the introduction of obstacles that fish are not able to pass.

[1] Resource consents for land and water permits for this activity were applied for under a separate application to the others titled 'Use of Mataura River weir to dam and divert water'.

Damming and diverting water

A concrete, u-shaped weir exists upstream of the Mataura Falls, which is believed to have been constructed in the 1920s or 1930s. The weir dams and diverts water into a channel along the true right (western) bank of the Mataura River. The channel is known as the 'hydro race' and the Plant's 18 water intakes are placed along it (six for cooling water and 12 for processing water). An unquantified volume of water spills over the top of the weir and flows down the 'original' path of the river. A similar race and associated hydro scheme are present on the opposite bank of the river. This scheme is operated by Mataura Industrial Estate under a separate set of consents.

The key potential ecological effects from the damming and diverting of water by the weir are modifying the natural river flow and instream habitats and introducing an obstacle for fish to navigate. Freshwater fish species known to live in this area include migratory native species (longfin and shortfin eels, lamprey and koaro). The exotic brown trout is also present within and surrounding this part of the river. Trout migrate within the river system at times. Altering the natural flow may reduce the amount or quality of the instream habitat for plants and animals that live there and may increase the difficulty for fish swimming upstream or downstream.

The weir is an obstacle that some fish may have difficulty traversing or not be able to traverse it at all. To mitigate this effect, a fish ladder was installed as a requirement of the hydro scheme (separate to this application) and is targeted to one particular type of fish (exotic salmonid species). To assist eels moving upstream, they are trapped and transferred upstream of the weir. The effectiveness of these approaches is not presented in the application and there was no assessment of effects on other taonga species, such as kanakana (lamprey).

Taking water

The Mataura River has a Water Conservation Order (1997), which aims to protect the river from adverse environmental effects from water takes. In particular reference to water takes, the Water Conservation Order states that water extracted from the river should not reduce the flow any more than 95% of its natural flow rate.

The total volume of water extracted for meat processing and truck washing (up to 14,400 m^3 per day; equivalent to 167 litres per second) represents <2% of the minimum flow and <1% of the mean annual low flow. Based on the information presented, the volume of water extracted for processing water is within the restrictions placed by the Water Conservation Order. The applicant has assumed that water taken for cooling purposes is 'non-consumptive' as it is all returned to the river (up to 21,200 m^3 per day) and, therefore, has not addressed the volumes of water removed for cooling in light of the Water Conservation Order.

Water is taken from the Mataura River from 18 intakes along the hydro race. Each intake is covered by a screen with a mesh size of about 5–6 mm. There is the potential for some small, juvenile fish to be sucked into any one of these intakes. The recommended mesh size is 2–3 mm, which the applicant proposes to implement to reduce the likelihood of adverse effects.

Potential ecological effects of discharging wastewater

The application is proposing to discharge up to 8,000 m^3 per day of treated processing plant wastewater into the Mataura River. This discharge has the potential to affect the water quality in the Mataura River downstream of the discharge.

The Plant stopped processing sheep and lamb in September 2012, which resulted in a reduction in water use and of the potential contaminant loads in the discharge. For this reason, discharge quality

and its potential effects on the environment have been analysed and presented based on data from September 2012 to March 2019, both in the application and this summary.

Discharge quality

The Plant's existing consent has upper limits for the concentration of total suspended solids (TSS), sulphide, biological oxygen demand (BOD), and ammonia (ammoniacal nitrogen) in the wastewater discharge. The concentrations of these contaminants in the Plant's wastewater have generally (>95%) been within these limits, which indicates a high level of compliance with regard to these parameters.

With regard to ammonia levels, the Freshwater Solutions report (appendix 2 of the application) points out that levels of ammonia in the discharge have the potential to cause adverse effects in the discharge and mixing zone through chronic (long term) and acute (short term) toxicity, as well as result in non-toxic effects such as adversely affecting fish migration through the mixing zone.

There are a number of other key water quality parameters that are used to indicate ecosystem health and the water's suitability for recreation that have the potential to be affected by the Plant's discharge, but do not have consent limits and/or are not monitored in the wastewater discharge. Most notably, these are nutrient levels (nitrogen and phosphorus) and faecal bacteria. Elevated nutrient levels can cause nuisance algal growth and elevated faecal bacteria levels can make the water unsuitable for swimming or for collecting shellfish.

With regard to phosphorus, both total phosphorus and dissolved reactive phosphorus (more readily available in the environment) are measured but there are no consent limits. The data shows that total phosphorus concentrations have been increasing in the discharge by about 7.5% per year. Only some nitrogen parameters are measured in the discharge. They are ammoniacal nitrogen (ammonia) and total Kjeldahl nitrogen (TKN; ammonia + organic nitrogen). Total nitrogen, nitrate nitrogen and nitrite nitrogen are not measured. Potential water quality effects from the discharge of nutrients are discussed in the following section.

Faecal bacteria (measured by the indicator bacteria, *Escherichia coli (E. coli)*) are measured in the discharge but do not have consent limits. *E. coli* concentrations measured in the discharge are in the range of 1,000–10,000,000 CFU/100 mL. For comparison, national recreational water quality guidelines[2] state that water is highly unlikely to be suitable for swimming if *E. coli* concentrations exceed 550 CFU/100 mL. The discharge is diluted by the Mataura River but there still appears to be a substantial increase in *E. coli* in the river after dilution and mixing. The potential water quality effects are discussed in more detail in the following section.

Potential water quality effects

This section provides a summary of the potential effects of the wastewater discharge on the Mataura River water quality based on routine monitoring conducted by Alliance upstream and downstream of the discharge point. This provides an overview of the potential water quality effects after taking into account the dilution and mixing of the discharge by the Mataura River.

A variety of water quality parameters are measured to assess the suitability of the water for the plants and animals that live there and for human recreational use. An overview of the water quality parameters measured by Alliance and their relevance is shown in Table 1.

[2] MfE/MoH, 2003. Microbiological water quality guidelines for marine and freshwater recreational areas. Available from https://www.mfe.govt.nz/publications/fresh-water/microbiological-water-quality-guidelines-marine-and-freshwater-0

Table 1: Description of water quality parameters monitored upstream and downstream of the Plant's wastewater discharge.

Water quality parameter	Relevance
Dissolved oxygen	Oxygen for aquatic animals to breathe
Temperature	Can affect aquatic plants and animals
pH	Can affect aquatic plants and animals
Turbidity	Can restrict plant growth
Total suspended solids	
Colour	
Clarity	
Biological oxygen demand	Potential to deplete dissolved oxygen
Ammoniacal nitrogen (ammonia)	Potentially toxic to fish and other animals
Total nitrogen	Potential to cause nuisance plant growth
Nitrate + nitrite nitrogen	
Total phosphorus	
Dissolved reactive phosphorus	
E. coli	Risk to human health

Water quality parameters that are not significantly altered downstream of the discharge

Based on monitoring data presented in the application and the attached technical reports, the wastewater discharge appears to have no substantial adverse effects on the following water quality parameters in the Mataura River after reasonable mixing:

- Temperature;
- Dissolved oxygen;
- pH;
- Turbidity;
- Total suspended solids;
- Colour; and
- Clarity.

Water quality parameters that are significantly altered downstream of the discharge

The following section describes water quality aspects in the Mataura River that are significantly altered after reasonable mixing due to the wastewater discharge.

Nutrients

Elevated levels of nutrients (nitrogen and phosphorus) can cause nuisance algal growth in some rivers. These nutrients are also carried downstream where they have the potential to cause nuisance algal growths in the Toetoes Estuary.

Nutrient levels in the Mataura River are above national guidelines for periphyton[3] (the slimy coating that adheres to rocks). Although the nutrient levels are higher downstream of the discharge, there does not appear to be nuisance algal growth other than during the end of summer.

[3] MfE 2000. New Zealand Periphyton Guideline: Detecting, monitoring and managing enrichment of streams. Ministry for the Environment. Available at https://www.mfe.govt.nz/publications/freshwater-publications/new-zealand-periphyton-guideline-detecting-monitoring-and

The Toetoes estuary, about 44 km downstream of the discharge point, has been reported to have excessive algal growth in the upper reaches, primarily due to nutrient enrichment.[4] The Plant's wastewater discharge was calculated to be about 1–2% of the total nitrogen load and about 1% of the total phosphorus load from the entire Mataura catchment.

Ammonia (toxicity)

Elevated ammonia concentrations have the potential to be toxic to a range of aquatic organisms and they also contribute significantly to nitrogen enrichment. After the discharge has mixed with the Mataura River, the levels of ammonia are substantially higher (up to twice as high at times) than upstream of the discharge. The concentrations after mixing and dilution are below the recommended toxicity guideline value for slightly to moderately disturbed ecosystems[5] and, therefore, are unlikely to pose a substantial risk to most aquatic species outside of the mixing zone.

As noted above in the Discharge Quality section, the elevated levels of ammonia in the discharge have the potential to cause adverse effects in the discharge and mixing zone through chronic and acute toxicity, as well as result in non-toxic effects such as adversely affecting fish migration in the mixing zone.

Faecal bacteria

Elevated levels of faecal bacteria in the water pose a risk to human health to those who may be swimming or consuming shellfish gathered from the river.

The Proposed Southland Water and Land Plan lists Mataura River at Mataura River Bridge as a popular bathing site and it is located approximately 300 m downstream of the discharge point. The requirements for a popular bathing site are *E. coli* concentrations less than 130 *E. coli* per 100 mL. This limit is more stringent than the water quality standard for the other sections of the river as it relates specifically to human health in a known popular bathing location.

Routine monitoring upstream and downstream of the discharge from 2012 to 2019 did not include measurements of *E. coli*. Additional sampling was carried out between December 2017 and May 2018 and the results from this are used in the following summary.

On each of the 16 sampling occasions, *E. coli* concentrations were higher downstream of the discharge than they were upstream. On average, the downstream *E. coli* concentrations were elevated by about 5,000 *E. coli* per 100 mL. This indicates an increased risk to anyone who may be using the water recreationally downstream of the discharge.

It should be noted that upstream of the discharge, measured E. coli concentrations were less than 130 *E. coli* per 100 mL on only three occasions and less than 550 *E. coli* per 100 mL on 11 out of 16 occasions. This indicates that there are also sources of faecal bacteria upstream of the Plant.

E. coli is once species of bacteria that is measured as indicators of all the possible pathogens in the water, which include mostly bacteria and viruses. Because of the high levels of *E. coli* in the discharge, Alliance carried out an additional investigation to determine the presence and quantity of pathogens in the water. The investigation confirmed the presence of a number of pathogens but at lower concentrations than would be expected considering the high concentrations of *E. coli*.

[4] Stevens, L.M. 2018. Fortrose (Toetoes) Estuary 2018: Broad Scale Habitat Mapping. Report prepared by Wriggle Coastal Management for Environment Southland. 50p.

[5] ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines