Alliance Group Limited

Lorneville Processing Plant Consents

Assessment of Environmental Effects

21 December 2015

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GLOSSARY OF TERMS

7DMALF	7 day average mean annual low flow
AAQG	Ministry for the Environment Ambient Air Quality Guidelines
AEE	Assessment of Environmental Effects
AFDW	Periphyton Ash Free Dry Weight
Alliance	Alliance Group Ltd
ANZECC	Australian and New Zealand Environment and Conservation Council
BNR	Biological Nutrient Removal
BOD	biochemical oxygen demand
BPO	best practicable options
Californian Office	Californian Office of Environmental Health Hazard Assessment
CAPEX	Capital Expenditure
CLUES	Catchment Land Use for Environmental Sustainability
CMS	Conservation Management Strategy
DAF	Dissolved Air Flotation
DO	dissolved oxygen
DoC	Department of Conservation
DRP	Dissolved reactive phosphorus
Drinking Water Standard	Ministry of Health Drinking Water Standards for New Zealand 2005 (Revised 2008)
EBPR	enhanced biological phosphorus removal
EMP	Environmental Monitoring Plan
ES	Environment Southland or Southland Regional Council
FC	faecal coliform
FMU	Freshwater Management Unit
Freshwater NPS	National Policy Statement for Freshwater Management 2014
GLCs	Ground Level Concentrations
GV	guideline value
ha	hectare
HAIL	Hazardous Activities and Industries List
HRT	hydraulic residence time
ICC	Invercargill City Council
Iwi Management Plan	Ngai Tahu ki Murihiku National Resource and Environmental Iwi Management Plan 2008
LE	lamb equivalents
MAV	maximum acceptable value

MBR	membrane bioreactor
MCI Score	Macroinvertebrate Community Index
MfE	Ministry for the Environment
MW	megawatt
NES	National Environmental Standard
NESAQ	National Environmental Standard for Air Quality
NES for drinking water	National Environmental Standard for drinking water
NES for soil contamination	National Environmental Standard for soil contamination
NOEC	no observable effects concentration
NPS	National Policy Statement
NZCPS	New Zealand Coastal Policy Statement 2010
NZTA	New Zealand Transport Agency
OPEX	operating expense
PDP	Pattle Delamore Partners
PICs	Products of Incomplete Combustion
PIP	Progressive Implementation Programme
Proposed CMS	Proposed Conservation Management Strategy Southland Murihiku 2015 - 2025
Proposed NPS–IB	Proposed National Policy Statement on Indigenous Biodiversity
RMA or the Act	Resource Management Act 1991
RPs	Southland Regional Policy Statement
SND	Simultaneous Nitrification De-nitrification Process
SP	Suspended Particulates
SSNZ	Slink Skin New Zealand
The Plant	Alliance's Lorneville Plant
TN	Total Nitrogen
TOC	Total Organic Carbon
TP	total Phosphorus
TSP	Trisodium Phosphate
TSS	total suspended solids
TWP	Wastewater Technical Working Party
UASB	Upflow Anaerobic Sludge Blanket
USEPA	United States Environmental Protection Agency
UV	ultra violet
VOCs	volatile organic compounds
WAS	waste activated sludge
WHO	World Health Organisation

EXECUTIVE SUMMARY

1 INTRODUCTION

Alliance Group Limited (Alliance) is a large meat processing and export company operating throughout New Zealand. The company was established in 1948 and is now a wholly farmer owned cooperative company. The company exports product to over 65 different countries. The company employs more than 5,000 people throughout New Zealand (permanent and seasonal staff) and services about 5,000 farmer suppliers of livestock.

Alliance is lodging applications for resource consent to enable the ongoing operation, use and maintenance of its Lorneville meat processing plant (the Plant).

The consents being sought include:

- A discharge permit to discharge treated wastewater to the Makarewa River;
- A discharge permit to discharge treated wastewater via spray irrigation to land;
- A discharge permit to discharge treated wastewater to land for temporary storage purposes;
- A discharge permit to discharge biosolids to land and to an on-site monofill;
- A discharge permit to authorise the discharge of contaminants and odour to air;
- A water permit to take water from the Oreti River; and
- A land use consent to undertake maintenance works (channel clearance) associated with the water take from the Oreti River.

Alliance is seeking a consent term of 35 years for all of the consents required from Environment Southland. The 35 year term suitably recognises the existing asset value of the Plant and the significant economic contribution it provides to the Southland Region and New Zealand. Alliance is also committing to investing significant expenditure in order to upgrade its wastewater treatment system, with the ultimate aim of improving water quality in the long term which is consistent with regional and national directives. This commitment requires an appropriate consent term of no less than 35 years in order to enable the upgrades to be progressively implemented and allow suitable financial investment to be justified over an appropriate timeframe.

2 ENVIRONMENTAL SETTING

The Plant is located within the Southland Region, approximately 7km north of the centre city of Invercargill. Activities undertaken at the Plant are influenced by, and also have an influence on the existing environment.

The Plant is located on the West Southland Plains, within the Makarewa River catchment. The Plant currently discharges treated wastewater to the Makarewa

River, approximately 5km upstream of the confluence with the Oreti River. The Makarewa/Oreti River confluence is approximately 14km upstream of the New River Estuary. The Plant also abstracts water from the Oreti River.

The Makarewa River drains a 991 km^2 catchment that has been fully developed for agriculture with the exception of a small portion of the headwaters on the south-western flanks of the Hokonui Hills. The upper Makarewa River is characterised by high nutrient concentrations, low visual clarity and low ammoniacal nitrogen concentrations. While water temperatures are suitable for protecting river ecosystem health, macroinvertebrate community index scores (a measure of ecosystem health) at the Wallacetown-Lorneville Highway Bridge indicate 'fair' water quality. Similarly, low fish diversity is observed within the upper reaches of the river due to the high level of modification within the catchment.

The lower Makarewa River has been modified by historical river drainage and flood protection works. Makarewa River water and sediment quality, upstream and downstream of the Plant is characterised by high nutrient concentrations, high faecal indicator bacteria counts, low visual clarity, high ammoniacal nitrogen concentrations, generally moderate but occasionally low summer dissolved oxygen concentrations. Both water temperatures and pH are suitable for supporting healthy biological communities.

Benthic invertebrate and aquatic plant communities in the lower Makarewa River change in response to the substrate, channel gradient, water velocity, tidal influence and water quality. Key features of the biological communities in the Makarewa River immediately above and below the Plant discharge are the dominance of macrophytes, water and habitat tolerant benthic invertebrate taxa and a diverse fish community.

The Makarewa River supports a locally significant brown trout fishery with low-moderate recreational use.

The Oreti River is approximately 295km long and has a catchment of 3,400km^2. The lower Oreti River is characterised by a single channel. The water quality within the Oreti River is characterised by moderate nutrient concentrations, moderate to low visual clarity, low unionised ammonia concentrations, and river water temperatures which are suitable for protecting river ecosystem health. Ecological monitoring confirms that the river is affected by elevated nutrient concentrations, which is primarily due to land use activities and land intensification occurring within the catchment.

New River Estuary is a large, shallow 'tidal lagoon' estuary, situated at the confluence between the Oreti River and Waihopai River. The estuary forms part of the Awarua Plains Wetland complex. Its catchment largely consists of agricultural land, but it is also subject to stormwater and wastewater discharges from Invercargill City. Available data indicates that large parts of New River Estuary remain in reasonable condition, but a significant and increasing proportion of the estuary is seriously impacted by fine sediments and elevated nutrient concentrations. The New River Estuary supports high ecological values

including a diverse bird fauna and freshwater and marine fish populations. The estuary provides important spawning and rearing habitat for fish. The estuary also provides game bird hunting, fishing, bird-watching, power boating, rowing, bathing, walking and picnicking opportunities.

Historically rich and varied mahinga kai resources were found within the Makarewa and Oreti Rivers, including:

- Manu/birds such as weka and ducks;
- Rakau/wood, harakeke and rongoa (medicine plants); and
- Freshwater mahinga kai including a wide variety of species such as Tuna, Kokopu, Koara, Waikoura, Paraki, Waikakahi, Ianga, Kanakana and watercress.

The Plant is immediately surrounded by rural land use activities. Wallacetown is situated approximately 2km east of the Plant, with a residential population of around 600. The nearest private residential dwelling to the Plant is located along the eastern boundary of the site, approximately 700m from the Plant.

With respect to existing air quality, the boundary of the Invercargill City Airshed[1] is located approximately 1.5km south east of the Plant. Monitoring of air quality in Invercargill and Wallacetown indicate higher levels of PM_{10} concentrations during the winter months.

3 ALLIANCE LORNEVILLE PLANT PROCESSES AND ACTIVITIES

The Plant is fully integrated with slaughter and further processing operations, the production of edible by-products, cold storage, rendering, fellmongery, potable water treatment, and an on-site wastewater treatment facility. Ancillary to the meat processing activities is approximately 360ha of farm land where stock is able to be kept.

The key processes and activities requiring consent relate to:

- Coal fired boiler operation;
- On-site activities and processes giving rise to potential odour emissions;
- Water abstraction and use; and
- On-site wastewater treatment.

4 RECENT AND PLANNED PLANT UPGRADES

As part of its reconsenting programme Alliance has commissioned a number of comprehensive investigations in order to determine whether its current operating procedures and treatment processes represent the best practicable option for managing the effects on the environment and achieve compliance with the

[1] In September 2005, regional councils and unitary authorities identified 42 areas where air quality could reach levels higher than the national air quality standards. These areas are called airsheds.

current and likely future national and regional regulatory requirements, or whether changes or improvements are necessary in order to appropriately avoid, remedy or mitigate potential adverse effects.

As part of these investigations Alliance has already implemented a number of Plant upgrades. This includes:

- Installation of a new rendering facility in 2012 which is equipped with state of the art technology to reduce odour emissions and minimise waste to drain.
- Operational procedural changes associated with the fellmongery in order to reduce odour emissions.
- Waste separation and further primary treatment using another DAF unit which was installed in 2014. This is expected to achieve a reduction in nitrogen load within the wastewater stream.
- Installation of a new multi-clone grit arrestor system on coal fired boiler #2 which has reduce the flow average PM_{10} discharge concentration from the combined boilers to less than 300mg/Nm^3.

Planned upgrades include:

- Modifications to the outfall from the wastewater treatment ponds in order to reduce the generation of foams arising from the physical discharge into the Makarewa River.
- A comprehensive wastewater treatment upgrade which is discussed further below.

A progressive wastewater treatment upgrade is proposed. The purpose of the upgrade will be to deliver a measureable reduction of nitrogen, specifically ammoniacal nitrogen in the receiving Makarewa River in order to achieve a site specific limit, and assist in enabling the wider Oreti River freshwater management unit (FMU) to achieve the national and likely future regional objectives that are to be established by Environment Southland.

Alliance sought advice as to what methods and technology could be potentially employed in order to reduce the ammoniacal nitrogen concentrations within its treated wastewater discharge to the Makarewa River. A broad range of treatment and disposal options were considered. The preferred method is likely to consist of an upgrade to the primary treatment system and the separation of high and medium strength effluent streams for targeted nitrogen removal. Treatment of this stream includes anaerobic treatment, aerobic treatment via a biological nutrient remover (BNR) reactor, secondary clarification and discharge of treated effluent back into the existing wastewater treatment system after the anaerobic lagoon.

Biosolids generated following the BNR upgrade will comprise of anaerobic lagoon solids and waste activated sludge. Disposal of biosolids to Alliance's land is the preferred method. Under this scenario, land would no longer be utilised for wastewater disposal (ie. via irrigation) and discharge of all (higher quality) wastewater would be to the Makarewa River. Biosolids generated by the

upgraded treatment system would be dewatered and then disposed of onto land at sustainable nitrogen loading rates.

It is noted that on occasions the ability to dispose of biosolids to land may be limited due to rainfall events resulting in saturated soil conditions or conversely when the farmland is required to hold large numbers of overflow stock when farmers are destocking their land due to drought. To allow for an alternative biosolids disposal site under these circumstances, an on-site monofill will operate as a contingency disposal site. It is proposed that the monofill will utilise existing redundant wastewater treatment ponds.

The proposed wastewater treatment upgrade is comprehensive and will deliver significant improvements in the quality of discharges from the Plant to the Makarewa River. It is therefore proposed that the upgrade will be progressively implemented to justify investment and cost recovery, with it being fully commissioned within fifteen years of any consent being granted (ie. around 2030). Notably the resultant improvement to water quality will also coincide with the national and regional regulatory timeframes.

5 CONSULTATION

Embarking on a robust consultation process has been a principal part of the resource consent renewal and acquisition process for Alliance. The main objective of the consultation process was to address, as far as reasonably possible, the key issues and concerns of stakeholder, interested parties and directly affected parties prior to the finalisation and lodgement of the resource consent application. The consultation strategy can be largely separated into three key work streams; consultation with key stakeholders, consultation with the Lorneville Community, and consultation with the wider Southland community.

Methods of consultation included the establishment of a Technical Working Party (TWP), community meetings, and a public open evening.

Overall it is considered that the consultation process has been robust and included substantial technical consultation particularly on the proposed wastewater discharge. Agreement has been reached with key stakeholders on the proposed primary wastewater treatment upgrade and feedback from stakeholders has been instrumental in shaping the form of the assessment and proposed conditions. Immediate neighbours have expressed concern with respect to existing and potential future odour emissions (ie. from the biosolids discharge to land). These matters are addressed in the following section of this report. There has not been widespread community or public interest in the proposed applications to date.

6 ASSESSMENT OF ENVIRONMENTAL EFFECTS

Alliance commissioned a number of technical investigations and assessments as part of its reconsenting programme which commenced in 2012. The environmental assessments undertaken involved the collaborative input of a broad range of engineering, ecological, environmental and cultural specialists.

Alliance and its independent technical advisors collaborated to identify potential adverse environmental effects of the ongoing operation and use of the Plant along with associated measures to ensure that any such effects are appropriately avoided, remedied or mitigated and relevant statutory considerations addressed.

Economic Effects

The New Zealand meat industry plays a major role in generating wealth for the New Zealand economy and in particular the rural communities such as Southland that have developed around farming and processing.

Alliance is Southland's largest employer, employing around 2,500 people seasonally. The Plant also plays an essential role in New Zealand's meat exportation. The meat industry is a partnership between farmers, processors and exporters. Most farms in Southland are owned and operated by farming families and without access to a local and large processing plant, costs associated with transportation and processing elsewhere would increase. There are significant cost savings for local farmers having the continued ability to utilise the Plant. Alliance is also a wholly farmer owned cooperative, with all profits returned to the company's farmer shareholders with a portion retained for growth. Many of these shareholders are based in Southland. Both the direct and indirect economic and social effects arising from the ongoing operation of the Plant are considered to be significant.

Effects on Water Quality, Ecology and Recreational Values within the Makarewa River, Oreti River and New River Estuary

Work associated with the assessment of the current and possible future discharges on the Makarewa River, Oreti River and New River Estuary began in 2012.

Alliance undertakes regular compliance monitoring, and additional field monitoring has been undertaken as part of this assessment. There is a good understanding of the existing water quality both upstream and downstream of the current discharge of treated wastewater from the Plant.

The lower Makarewa River (below Wallacetown) has also been modified by historical river drainage and flood protection works. Makarewa River water and sediment quality in the region of the Plant (immediately upstream and downstream of the Plant) is characterised by high nutrient concentrations, high faecal indicator bacteria counts, low visual clarity, high Amm-N concentrations, generally moderate but occasionally low summer dissolved oxygen concentrations, and pH that is suitable for supporting healthy biological communities. The soft sediment and tidal nature of the lower Makarewa River renders the river environs near the wastewater discharge unsuitable for sensitive invertebrate species.

Overall, the assessment determines that the discharge is not having a significant adverse effect on the quality of water downstream of the Plant, when compared to upstream results. There is a slight reduction in water clarity downstream of the discharge, however there is no evidence from fish, algae and benthic invertebrate

surveys that the discharge is having any adverse effect on downstream water quality.

The monitoring and assessment of the receiving river environment has not identified any measurable adverse toxicity effects that are directly attributable to the discharge. However, it has been determined that the current discharge needs to be improved to be able to meet a site-specific in-river ammonia target and enable the achievement of the bottom line value contained in the Freshwater NPS within the wider catchment. These assessments indicate that a 75% reduction (from 2012-13 season concentrations) in discharge Amm-N concentration is the appropriate target.

The clarity of the lower Makarewa River is low due to a range of catchment scale influences. The lower Makarewa River in the vicinity of the discharge supports limited contact recreation and therefore the effect of the discharge on river clarity is not assessed as significant.

Foams occur at times in the Makarewa River below the discharge, however they have also been observed upstream of the Plant. It is likely that a contributing factor to the generation of foams is the physical delivery of the discharge to the Makarewa River. Modifications to the outfall structures have been undertaken which have reduced the likelihood of foams being created.

The current discharge can elevate faecal bacteria concentrations in the lower Makarewa River on occasions and in some years but in other years appears to dilute the contamination from microbial sources.

Effects of the Water Abstraction – Oreti River

Alliance is seeking to continue to abstract water from the Oreti River of up to 22,500m^3/s/day, at a maximum rate of 260 L/s. The current allocation in the Lower Oreti Catchment is close to 75% of the primary allocation (largely due to the ICC take). This allocation includes Alliance's take. Alliance is not seeking to increase the amount of water that is taken under its current permit and therefore the take will not contribute to the over-allocation of the surface water resource within the Lower Oreti River. The ongoing abstraction effects on the hydrology of the Oreti River, water quality, and aquatic habitat have been assessed and are considered to be minor. The only identified effect on the river due to this abstraction was a likely increase in the number of days that flows were below the natural 7DMALF. This is however considered to have a minor effect. As a consequence of the less than minor effect of the take on low flow duration, flow variability and water quality, and the lack of sensitivity of the receiving environment to water level changes, any effects on biological communities (including fish spawning and rearing habitat, food production, adult habitat and cover, access to spawning and rearing areas and fish passage) are expected to be less than minor.

Effects of the Wastewater Irrigation

The effects of the wastewater irrigation application to land are well understood as monitoring of the soil and groundwater resources has been undertaken by Alliance since 2001. The results of this monitoring are reported in an annual

report which is submitted to Environment Southland. The latest annual monitoring report indicates that there have been no significant adverse effects on the environment that can be clearly attributed to wastewater irrigation application to land. Over the monitoring period concentrations of contaminants in soil and groundwater resources remain relatively consistent and low.

Overall, the assessment determines that the current wastewater irrigation management and recording practice, together with the existing consent monitoring requirements are appropriate for the management of any actual or potential adverse effects.

Effects on Groundwater from Wastewater Ponds

The wastewater treatment ponds were established around 1968, and it is understood that no compacted clay or synthetic liner was installed. Given this, there could be the potential for leakage of wastewater to soil and groundwater resources from the ponds. An investigation to confirm this has been completed. The assessment finds that the wastewater discharge from the ponds is primarily directed toward the Makarewa River and is not having any significant impacts on groundwater to the south of the ponds. The results indicate that the ponds therefore have a reasonable barrier which is containing contaminants successfully.

Effects on Soils and Groundwater from Biosolids and Monofill Disposal

Alliance is proposing to upgrade its existing wastewater treatment facility. The new treatment facility would necessitate the need to dispose of biosolids to land and to an on-site monofill as a contingency option. Prior to land disposal the biosolids will be dewatered to mitigate against water logging, ponding and nutrient runoff. The leaching of nitrogen is a key concern with respect to the application of biosolids to land as this could give rise to adverse effects on the groundwater and surface water resources, and will require application rates consistent with maintaining sustainable biosolids nitrogen loading rate. A proposed biosolids nitrogen loading rate of 250 kg N/ha/yr or a plant available nitrogen rate of 140 kg N/ha/yr has been derived as being appropriate. This would likely result in a nitrogen leaching rate of approximately 13kg N/ha/yr, which is equivalent to the nitrogen leaching rate from sheep grazed pastures.

Effects on Air Quality from the Coal Fired Boilers

The coal fired boilers emit particulates ($PM_{10,}$ $PM_{2.5}$), nitrogen dioxide/oxide, sulphur dioxide, dioxins and heavy metals into the air. Modelling and monitoring of the discharge emissions from the coal fired boilers has been undertaken, and the results assessed against relevant national and international standards and guidelines for air quality and human health. The key findings of the assessment are that all cumulative ambient contaminant concentrations achieve compliance with all relevant standards and guidelines for air quality beyond the property boundary and at locations where people are likely to be exposed.

The assessment concludes therefore that for all contaminants, with the exception of particulates, achieving compliance with the standards and guidelines indicates that the effects on air quality and human health are minor or less.

The assessment determines that PM_{10} discharges generally comply with the national guidelines for ambient particulate concentrations, however because compliance with these thresholds is achieved, the assessment states that this does not ensure only minor, or less than minor effects on human health. This is because PM_{10} does not have an established threshold concentration below which there are only minor or no observable adverse effects on human health. It is therefore recommended that Alliance seek to reduce boiler particulate emissions to achieve a maximum PM_{10} limit of 250mg/Nm^3 (corrected to 12 vol.% CO_2) in the discharge within five years. This would ensure that the best performance of the control systems for managing particulate emissions is achieved, and potential health effects arising from potential exposure to particulate emissions are minimised.

Odour Effects

A number of on-site processes, as well as the wastewater treatment system itself can cause, or have the potential to generate odour discharges. Overall, the assessment with respect to odours concludes that with the continuation of appropriate management practices and technology employed by Alliance with respect to the management of potential on-site odours, coupled with the buffer distance of the Plant from any sensitive receptor, the adverse effects arising from odour emissions will be minor. The upgraded wastewater system is anticipated to also reduce odour emissions from that source, and the application of biosolids to land will be managed to also take into account potential odour effects.

Cultural Effects

Alliance has been engaging with Te Ao Marama to seek iwi perspective on the consents that are being sought. This engagement has been premised on the principles of the Treaty of Waitangi, in particular the principles of good faith and cooperation. As part of this, Te Ao Marama were asked to prepare a Cultural Values Report. This report has been used to help quantify the Ngai Tahu ki Murihiku values within the Makarewa River and Oreti River in particular.

The Cultural Values Report and consultation has identified that there are core cultural values that need to be recognised and appropriately managed as part of the consenting and mitigation developed for the Plant. These core values include kaitiakitanga, mahinga kai, ki uta ki tai (linkages to the wider catchment and processes) and whanaungatanga (health and wellbeing of Maori people). These matters have all been taken into consideration as part of the wider environmental investigations and assessment undertaken (ie. water quality, ecosystem health, economic). In addition, Alliance recognises that a holistic approach to the management of environmental effects is necessary and advocated by Maori.

7 MITIGATION, MANAGEMENT AND MONITORING OF EFFECTS

The assessment of effects identifies a range of positive and adverse actual or potential effects that will, or are likely to arise as a result of the ongoing operation, use, maintenance and upgrading of the Plant. Alliance is committed to ensuring

the adverse effects of its Plant's operations and activities are appropriately managed, and mitigation is adopted that is effective, viable, will provide a measurable or tangible outcome, and is able to respond to changing knowledge where appropriate, including from the results of environmental monitoring. The key mitigation arising from the technical assessments is summarised below.

In order to achieve the future limits for Amm-N as discussed above, a comprehensive upgrade to the existing wastewater treatment system is required. A progressive implementation programme is proposed which aligns temporally with the achievement of Freshwater NPS objectives for improvements in water quality. In addition to seeking to improve the quality of the discharge over time, Alliance is committed to ensuring that the quality of the discharge and receiving river environment does not deteriorate from current conditions. This will be achieved by establishing pre and post upgrade limits on both the discharge and receiving water (refer to the proposed conditions – **Appendix V** attached), assessing compliance with such limits and also tracking progress of compliance with revised Amm-N and total oxidised nitrogen limits on an annual basis. A review of the appropriateness of the post upgrade limits will also be undertaken by Alliance.

As noted above the current discharge can elevate faecal bacteria concentrations in the lower Makarewa River on occasions. Further treatment would reduce the overall loading and would, on occasion, ensure compliance with relevant national and regional standards. However, it is noted that generally these standards would not be met because of the high levels in the upper catchment, and given this, for any further treatment of the microbial concentrations in Alliance's discharge to be effective, this would need to be undertaken as part of a wider catchment plan to reduce the overall faecal coliform concentrations in the Makarewa River. Alliance is also not aware of any reported public health issues as a result of secondary contact with the lower Makarewa River.

To mitigate effects on cultural values, Alliance will prepare and implement in consultation with Te Ao Marama a Habitat Enhancement Plan. This plan will look for opportunities to enhance habitats and areas of ecological significance within the Plant site (ie. riparian margins).

Effects arising from the discharges to land will be monitored via soil and groundwater investigations with results reported to Environment Southland.

As part of the wastewater treatment upgrade the disposal of biosolids will likely be necessary. The application of biosolids is to be managed via the preparation of a Biosolids Management Plant that will include a description of the biosolids generation, volumes and land application details (ie. nitrogen loads). The plan will also describe the managerial procedures to ensure the biosolid spreading does not give rise to adverse odour effects beyond the site boundary. This plan will be coupled with soil and groundwater monitoring and report requirements specifically set out within the proposed conditions.

Air discharges from the coal fired boilers are mitigated by the stack height, coal quality, operational measures and the buffer distance between the boilers and

any sensitive receptors. Particulate emissions from the coal fired boilers will be managed via a requirement to reduce PM_{10} discharge concentrations to 250mg/N^3 within five years. It is also recommended that Alliance discontinue current stack testing, and instead rely on more comprehensive ambient monitoring data. It is proposed that ambient PM_{10} limits in the conditions are set, and if there is an exceedance then this would trigger a requirement for undertaking stack emission testing in order to confirm if the exceedance is directly attributable to the boiler discharge, and how this should be remedied.

Odour effects are generally managed to appropriate levels through odour technology controls and operating practices and procedures. It is anticipated that the wastewater treatment upgrade, including the separation of waste streams and further treatment will further assist in mitigating potential on-site odour effects. If odour is detected offsite then the community may make a complaint. This will be set out in the conditions and Alliance will be required to respond to the issue and remedy the odour if necessary.

In addition, Alliance proposes to continue to consult with key stakeholders throughout the life of any consent being granted. Regular meetings with a Technical Working Party will continue and this is to be secured via a proposed condition of consent.

8 ALTERNATIVES AND BEST PRACTICABLE OPTION

Under the RMA there is an obligation to consider alternative locations and methods of undertaking an activity where it is likely to have significant adverse effects on the environment, or where it involves the discharge of a contaminant to land, water or air. With respect to discharges, the best practicable option is to be applied.

As part of its investigations Alliance has undertaken an extensive assessment into its current practices and operating procedures, and the availability and practicalities of alternative methods and technologies in order to minimise any actual or potential effects arising from its discharges to water, land and air in particular. Overall it is considered that Alliance has adopted the most robust and best practicable option for managing and mitigating the effects from its activities, in particular its discharges to water, land and air.

9 STATUTORY EVALUATION

A range of objectives and policies in national, regional and local policy and other documents are relevant to the consideration of these applications. The applications have been assessed against these provisions with the main conclusions as follows:

- Overall the applications are not considered to be inconsistent with, and will give effect to (as required) the relevant objectives and policies of the statutory planning documents;
- The ongoing operation of the Plant is regionally significant and provides direct economic benefits such as employment and shareholder returns,

economic resilience and efficiencies with the existing rural and agricultural sector in southland. It also provides benefits to the local community.

- The ongoing operation of the Plant also recognises the significant sunk investment that exists with respect to the existing Plant equipment and activities.
- The ongoing operation, use and upgrading of the Plant will promote the sustainable management of natural and physical resources; including by:
    - Complying on an individual and cumulative basis with national and regional air quality standards, and by implementing a measureable reduction in particulate emissions to further protect human health and safety;
    - Achieving discharge and water quality limits that have been deemed appropriate to continue to support the ecological and biological characteristics of the receiving water environments, and by implementing a progressive upgrade in order to reduce ammonia and achieve national and future regional water quality standards.
    - Managing discharges to land so that vulnerable soils are avoided, and by ensuring that the discharges to land adopt a sustainable nitrogen loading rate. Ongoing management and monitoring of discharges to land is also proposed.
    - Understanding the sensitivity of the receiving ecosystems and managing the discharges in particular, in order to achieve the appropriate water quality and ecosystem limits. Adopting a holistic approach to the management of potential effects of the Plant operation and implementing, where appropriate, a programme to enhance on-site habitats and ecosystems values (ie. riparian margins).
- Measures to avoid, remedy or mitigate potential or actual adverse effects arising from the ongoing operation of the Plant have been identified. These are set out in **Table 16** and will be achieved via the implementation of appropriate conditions.

1. INTRODUCTION

This report accompanies Alliance Group Limited's (Alliance) applications for resource consents for Alliance's Lorneville Plant's (the Plant) continued operation.

Alliance operates a meat processing plant, which is located at 205 State Highway 99, Underwood, Invercargill. Legal descriptions of the Plant and copies of the relevant Certificates of Title are attached as **Appendix A**. The Plant has operated at this site since 1959.

The Plant operates under twelve resource consents issued by Southland Regional Council (Environment Southland or ES) and Invercargill City Council (ICC). The resource consents authorise discharges to water, land, air and the taking of water. Of the twelve consents, six including the key wastewater discharge and air discharge consents, are due to expire on 7 August 2016. Alliance is now applying to ES for the following resource consents under the Resource Management Act 1991 (the RMA or the Act), to authorise a further 35 years of operation, maintenance and upgrading at the Plant. These consents are as follows (refer to **Table 1** for further detail and description):

- A discharge permit to discharge treated wastewater to the Makarewa River;
- A discharge permit to discharge treated wastewater via spray irrigation to land;
- A discharge permit to discharge treated wastewater to land for temporary storage purposes;
- A discharge permit to discharge biosolids to land and to an onsite monofill;
- A discharge permit to discharge contaminants from an industrial process to land;
- A discharge permit to authorise the discharge of contaminants and odour to air;
- A water permit to take water from the Oreti River;
- A land use consent to undertake maintenance works (channel clearance) associated with the water take from the Oreti River.

1.1 ALLIANCE GROUP LIMITED – COMPANY OVERVIEW

Alliance is a large meat processing and exporting company operating six meat processing and exporting plants throughout the South Island and two plants in the North Island. These plants are located at:

- Stoke, Nelson
- Smithfield, Timaru
- Pukeuri, North Otago
- Mataura, Southland
- Makarewa, Southland

- Lorneville, Southland
- Levin, Horowhenua
- Dannevirke, Hawkes Bay

The company was established in 1948 and is now a wholly farmer-owned co-operative company. On an annual basis, Alliance processes approximately 6 million lambs, 1 million sheep, 200,000 cattle, 115,000 deer and 270,000 calves. This equates to approximately 30% of New Zealand's sheep meat production, 10% of beef and 30% of venison.

The company exports products to over 65 different countries. Approximately 80% of its activities are related to sheep and lamb processing, the remainder being beef, and deer processing. Processing is vertically integrated with about 80% of the meat production being further processed by boning, cutting and consumer packaging. A proportion of the production is exported in a chilled state to Europe and North America. Co-products such as wool, skins and other carcass material are also processed for export by the company, usually at the same location as the meat processing facility.

As a wholly farmer-owned co-operative company, all profits are returned to the company's farmer shareholders with a portion retained for growth. The company employs over 5,000 people (permanent and seasonal staff) and services about 5,000 farmer suppliers of livestock. Alliance's annual turnover for the 2014/2015 season was $1.5 billion.

1.2 ALLIANCE'S ENVIRONMENTAL POLICY AND ENVIRONMENTAL MANAGEMENT SYSTEMS

Alliance is committed to the sustainable management of the natural and physical resources that it depends on. Alliance therefore adheres to the following environmental policy:

> *Alliance Group Limited is committed to the sustainable management of the natural and physical resources that it depends on.*
>
> *In meeting this commitment, Alliance Group will align itself with applicable New Zealand and international standards and will take all practicable steps to:*
>
> - *meet or exceed internal and key stakeholder expectations and relevant regulatory requirements;*
> - *continually improve environmental performance by identifying and measuring impacts, developing clear objectives and meaningful targets, and measuring progress with effective monitoring;*
> - *optimise the use of all resources including energy, water, packaging and chemicals, to minimise the wastes produced and the overall impact of our operations;*
> - *annually review the adequacy of the environmental management programme and progress towards achieving environmental objectives and targets;*

- *communicate regularly on environmental matters with stakeholders including shareholders, employees, customers, suppliers, communities and regulatory bodies;*
- *allocate appropriate resources to enable effective environmental management.*

All of Alliance's plants hold ISO 14001 and Enviro-Mark®NZ Diamond environmental management systems certifications, as well as numerous quality certifications including ISO 9001. ISO 14001 is an internationally recognised environmental management standard and Enviro-Mark is a five-step environmental management standard administered in New Zealand. As part of these systems all environmental aspects of Alliance's plants are identified and prioritised for action, and processes are put in place to control these aspects. Targets and objectives are established and monitored to enable demonstration of continuous performance and improvements are driven by internal audits and management reviews.

Alliance employs an Environmental Manager who has authority and responsibility to co-ordinate and implement the on-site environmental management systems. They are also responsible for ensuring that all the necessary regulatory consents and approvals are held and are current, and that compliance with all conditions of the consents held is being achieved.

1.3 OVERVIEW OF ALLIANCE'S LORNEVILLE PLANT

The Plant is located approximately 7km north of Invercargill (refer to **Figure 1** over).

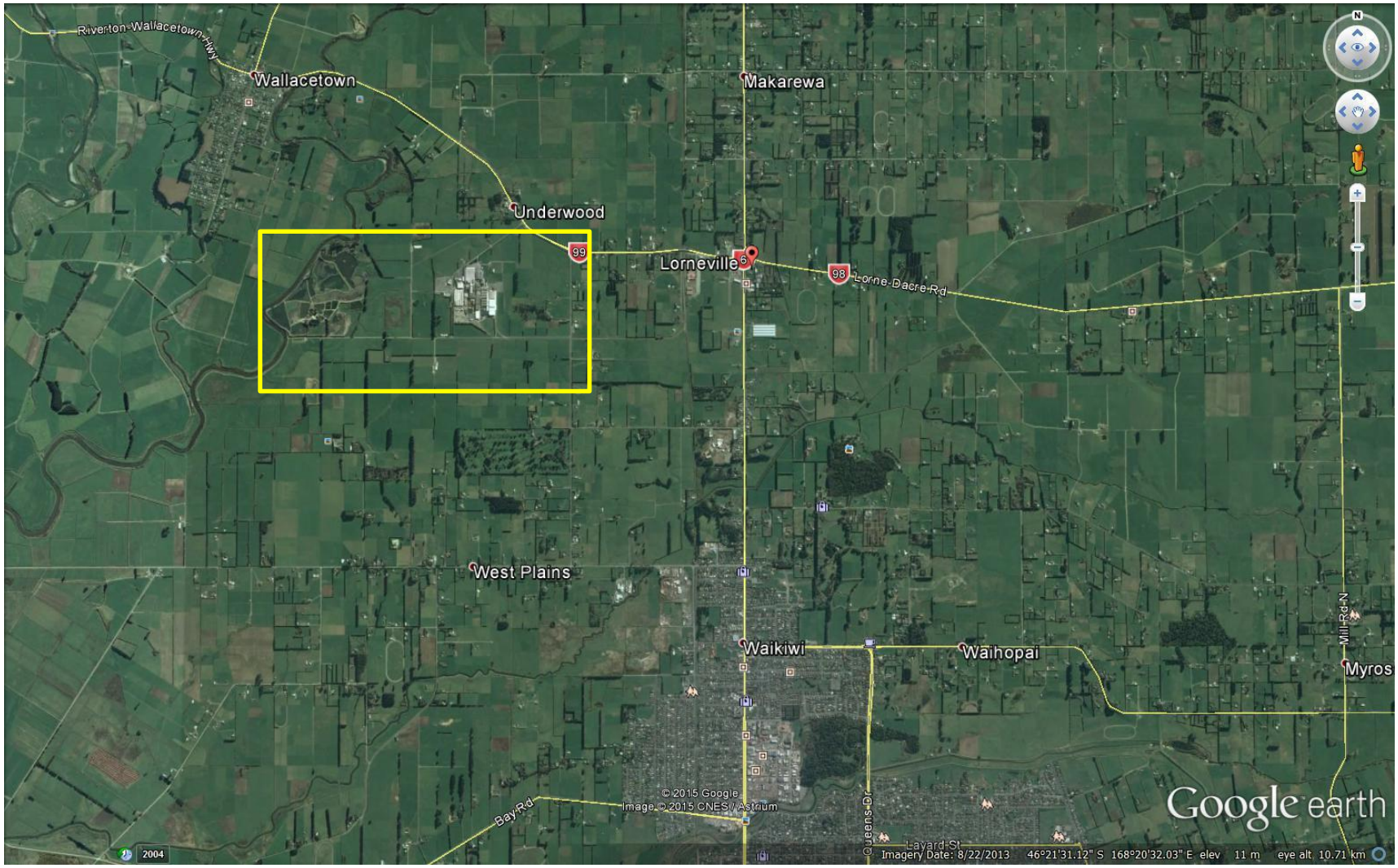


Figure 1: Location of the Alliance Lorneville Plant.

The Plant began as the foundation plant of the Alliance Freezing Company and was opened in 1959. The Plant is the largest ovine processing export plant in the world. It currently processes in excess of 40% of Alliance's total sheep and lamb products. In the 2013/2014 season the Plant processed 2.4 million lambs, 0.54 million sheep and 64,000 bobby calves.

All processing of stock killed at Lorneville is carried out on-site. The Plant is also equipped to undertake further processing of stock killed and products (such as beef bones from Mataura) from its other Southland Plants. The Plant and the wastewater facility also has capacity to process waste products from its other Southland Plants. The Plant also receives products from other Southland facilities for processing.

The Plant has the ability to operate an eight chain configuration with a maximum throughput of 32,000 lambs per day, and with the current seven chain operation 28,000 lambs per day. The Plant is a fully integrated plant, with slaughter and further processing operations, the production of edible by-products, cold storage (chilling and freezing), rendering, fellmongery, potable water treatment and an on-site wastewater treatment facility. An overview of the activities undertaken on-site is shown in **Figure 2** over.

Figure 2: Site location plan showing the location of various activities undertaken at the Alliance Lorneville Plant.

Stock are held in yards prior to slaughter. The stockyards on-site have capacity to hold 20,000 lambs. The ancillary farm land is primarily used for holding stock prior to slaughter, with a total property area of 460 hectares (ha). Cleaning of the yard occurs regularly. Alliance also operates a truckwash on-site for trucks that deliver stock.

The wastewater from the on-site processing activities is pre-treated on-site and then pumped to the Plant's wastewater treatment system prior to discharge to the Makarewa River and to Alliance's farm land. Two coal-fired boilers operate in order to provide hot water and steam for processing activities, and operate 24 hours per day from late November until May/June, with peak production in the December – May period. They operate periodically throughout the year at a lower rate.

The main processing season generally commences in late November and extends through to May/June, followed by a shutdown period of around four weeks. This is followed by a low-level winter processing period with one chain operation occurring.

The Plant employs approximately 165 permanent staff, and around 1700 seasonal staff. The Plant is the largest employer in the Southland region, and staff generally reside in Invercargill, Winton and Western Southland.

1.4 EXISTING RESOURCE CONSENTS HELD AND KEY CONDITIONS

Alliance holds the following resource consents issued from Southland Regional Council (Environment Southland) and/or Invercargill City Council (ICC) in order to operate the Plant. It is noted that the Plant and wastewater treatment facility is located on land that is within the jurisdiction of the Southland District Council (SDC) and is zoned Industrial. The Plant and associated activities are permitted in this zone. The farm land to the south of the Plant, owned by Alliance, is within the jurisdiction of ICC and is zoned Rural. Industrial-related activities on land zoned Rural are not permitted, and as such consents have been sought from the ICC, as detailed below.

The resource consents authorise discharges to air, land and water, irrigation, and the taking of water. Of the twelve consents, six expire on 7 August 2016. The remaining consents are not due to expire until at least 2027.

Table 1: Current resource consents held by Alliance for the operation of the Lorneville Plant.

Consent Reference	Authority	Activity	Status
92195	Environment Southland	Discharge treated meat processing waste to Makarewa River	Current consent. Expires 7 August 2016

95077	Environment Southland	Discharge contaminants to air	Current consent. Expires 7 August 2016
200034	Environment Southland	Discharge treated wastewater to land	Current consent. Expires 7 August 2016
202347	Environment Southland	To discharge treated wastewater to land - short-term storage	Current consent. Expires 7 August 2016
RMA200301848	ICC	To operate a temporary dam for storage of treated wastewater	Current consent. Expires 7 August 2016
201227	Environment Southland	Maintain water intake channel	Current consent. Expires 7 June 2027
203358	Environment Southland	Take surface water for meat processing operation (Oreti River)	Current consent. Expires 2 September 2027
201126	Environment Southland	Take 6,500m^3/day of water from Makarewa River	Current consent. Expires 2 September 2037
94468	Environment Southland	Discharge leachate to ground from closed landfill	Current consent. Expires 5 June 2033
206363	Environment Southland	Discharge contaminants to land and to air (sheepyards solids)	Current consent. Expires 31 July 2034
201068	Environment Southland	Use and erect a sampling structure in Makarewa River bed	Current consent. Expires 14 March 2037
206299	Environment Southland	Discharge stormwater to the Makarewa River	Current consent. Expires 10 April 2038
00/1382/NY	ICC	Land-use consent for irrigation	Current consent. Expires n/a
S/4/00121	Environment Southland	Gravel extraction	Certificate of compliance

1.5 ACTIVITIES AND RESOURCE CONSENTS SOUGHT

This application seeks to provide for discharges to water, land and air arising from the ongoing operation, maintenance and upgrade of the Plant. At the same time, Alliance is seeking to renew its water take consent from the Oreti River, which is not due to expire until 2027. The water take consent is being renewed concurrently on the basis that common consent expiry dates for the major ES consents is seen as a desirable and efficient outcome.

A brief description of the activities requiring consent follows. A more detailed description of the Plant activities and consents sought is contained within section 3 of this report.

Table 2: Description of Activity and Consents Required

Activity	Consent Type	Relevant Plan and Rule	Description of the activity
Discharges to Water	Section 15	Rule 2(b) of the Southland Regional Water Plan	Application for the discharge of treated effluent to land and to water where it may directly or indirectly enter the Makarewa River as a **discretionary activity**.
Discharges to Land	Section 15	• Rule 2(b) of the Southland Regional Water Plan • Rule 56 of the Southland Regional Water Plan • Rule 5.5.1 of the Southland Regional Effluent Land Application Plan	Application for the discharge of treated effluent to land as a **discretionary activity**.
Discharges to Air	Section 15	Rule 5.5.2 of the Southland Regional Air Plan	Application for the discharge of contaminants and odour to air as a **discretionary activity**.
Water permit to abstract water	Section 14	Rule 18(e) of the Southland Regional Water Plan	Application for the abstraction of water from the Oreti River as a **discretionary activity**.
Land use consent	Section 13	Rule 47 of the Southland Regional Water Plan	Application to undertake works (maintenance, channel clearance) within the embayment channel associated with the intake structure as a **discretionary activity**.

1.5.1 Discharges to Water

Discharges to water (via the Boiler Ditch into the Makarewa River) arise from:

- Treated effluent from the Plant operations and domestic sewage from Wallacetown that is also treated by the Plant.

Alliance's current consent conditions (specifically condition 2 of Discharge Permit 92195) require that the discharge into the Makarewa River does not exceed 22,730m^3/day. On no occasion has the discharge limit been exceeded during the life of the current consent. The same discharge limit (22,730m^3/day) is being sought by this application. The main discharge period typically starts around two weeks after commencement of the processing season after the wastewater treatment ponds levels have increased. The discharge is not continuous during the processing season and is closed at times during the season. The main discharge period typically ceases about four weeks after the processing season finishes, but the discharge may occur intermittently after this time.

Consent to discharge treated effluent to water and to land where it may enter water is being sought as a discretionary activity pursuant to Rule 2(b) of the Southland Regional Water Plan.

1.5.2 Discharges to Land

Discharges to land arise from:

- Treated wastewater to land via an irrigation system;
- Temporary storage of wastewater during emergency conditions;
- Disposal of biosolids post-upgrade of the wastewater treatment system to land and to an on-site monofill; and
- Discharge of stockyard solids to an on-site monofill.

As part of the existing wastewater treatment process it is proposed that up to 3000m^3/day of treated wastewater may be discharged onto farm land owned by Alliance. Around 100ha of land is available for irrigation purposes. Discharge is accomplished via a K-line pod irrigation system and is used periodically as part of the current wastewater treatment disposal process in order to reduce the extent of the discharge of treated effluent to water. This consent is necessary, until such time as the proposed progressive upgrades to the wastewater treatment plant are completed.

Alliance is also seeking consent for the temporary storage of wastewater on land. This is only likely to occur during an extreme summer drought when farmers are forced to de-stock their farms and discharges to the Makarewa River cannot occur due to extreme low flows.

As discussed later in this report, Alliance is proposing to progressively upgrade its existing wastewater treatment plant by installing a biological nutrient removal (BNR) system that will result in operating any future plant as an activated sludge plant. This will produce biosolids that will need to be managed on-site or

removed. Separate consents, as explained below, are being sought to enable the discharge of biosolids to land and to an on-site monofill.

Consent to discharge treated effluent to land is being sought as a discretionary activity pursuant to Rules 2(b) and 56 of the Southland Regional Water Plan, and Rule 5.5.1 of the Southland Regional Effluent Land Application Plan.

1.5.3 Discharges to Air

Discharges to air arise from:

- Discharges from the boiler operations;
- Discharges of odour associated with operations at the Plant including stockyards, rendering and fellmongery processes;
- Discharges of odour associated with the existing wastewater treatment system; and,
- Discharges of odour associated with the upgraded wastewater treatment system and the disposal of biosolids.

Two coal fired boilers provide steam to maintain Plant hot water supplies and for steam requirements in processes such as rendering. Lignite coal is currently sourced from Solid Energy's New Vale Mine. The boilers produce hot exhaust air streams containing combustion products and particulates. The latter arise due to a wide range of processes including fly ash carry over, un-combusted carbon (soot) and from the condensation of un-combusted organic volatiles. The main portion of the exhaust consists of nitrogen (N_2) and residual oxygen (O_2) from the combustion air. The primary products of combustion include carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and water vapour. There is also a range of products of incomplete combustion (PICs) that mainly include volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxide (NO) and nitrous oxide (N_2O).

The individual boiler plants operate at varying rates throughout the day and year, relative to the processing occurring at the Plant.

Odours from the site can originate from on-site processes including blood processing, rendering, fellmongery and soup stock facilities, as well as the stockyards. A description of the potential on-site odours and assessment is undertaken later in this report.

Odours can also arise from the existing wastewater treatment facility. As is described elsewhere in this report, the existing wastewater treatment facility has an initial anaerobic pond stage which removes in excess of 80% of the inlet organic material. This is followed by treatment within mechanically, then naturally, aerated ponds before discharging to the Makarewa River. The anaerobic pond is the main potential source of odour arising from the existing wastewater treatment facility.

Potential odours could also be generated from the proposed upgrade to the wastewater treatment facility referred to above and discussed in detail later in this

report. The odour sources could arise from the treatment facility as well as the disposal of biosolids to land and to an on-site monofill.

Consent to discharge contaminants and odour to air is being sought as a discretionary activity pursuant to Rule 5.5.2 of the Southland Regional Air Plan.

1.5.4 Water Take and Channel Maintenance

Alliance is proposing to abstract water from the Oreti River of up to 22,500m^3/day. Access to water is necessary as it is an essential component of a number of on-site plant processes including:

- Stock washing;
- Stock drinking;
- Wash down;
- Potable on-site uses;
- Cleaning; and,
- Fellmongery processes.

To meet the demands for water on-site, Alliance has two resource consents for abstraction of water from the Oreti and Makarewa Rivers. First priority is given to abstraction from the Oreti River, with the Makarewa River supply only required in peak production periods, or as a contingency supply should the Oreti River intake structure or pump fail. It is noted that the Makarewa River consent does not expire until 2037, so renewal of this consent is not being sought at this time.

Alliance is seeking consent to continue to abstract water from the Oreti River of up to 22,500m^3/day, with a maximum rate of 260 L/s. The current consent is not subject to any minimum flow conditions, and this is appropriate given the essential nature of the take. Access to a continued water supply is critical for the processing plant to operate, and is particularly necessary during times of drought conditions when animal welfare is at stake. There is however a requirement to introduce water conservation measures when flows become low in the river at the Wallacetown water level recorder. In response, Alliance has prepared a low flow contingency plan which requires that water conservation measures commence at certain river flow trigger levels.

Consent to abstract water from the Oreti River is being sought as a **discretionary activity** pursuant to Rule 18(e) of the Southland Regional Water Plan.

Alliance is also seeking consent to undertake works within the intake embayment area. The embayment area is approximately 45m long, and needs to be cleared annually to ensure that the intake structure is free from gravel and debris. Additional clearance might be required after a flood event. Consent to undertake works within the bed of the river for this maintenance activity is also being sought pursuant to Rule 47 of the Southland Regional Water Plan.

1.5.5 District Council Land Use Consents

The majority of the Plant and wastewater treatment ponds are within the jurisdiction of the Southland District Council. In terms of the Southland District Plan, the Lorneville Plant is specifically provided for and industrial activities are permitted on the site. No consents are being sought from the Southland District Council.

Land to the south of Crowe Road is within the jurisdiction of the Invercargill City Council (ICC). The site of the temporary wastewater storage facility and area of land where wastewater is discharged (described above) is zoned Rural in the Invercargill City District Plan. In the Rural zone, industrial activity is a restricted discretionary or discretionary activity. The Invercargill City District Plan defines industrial activity as including the storage, treatment or disposal of waste. Therefore the storage and discharge of wastewater associated with the Plant requires resource consent as a discretionary activity. For this reason Alliance holds two consents from ICC:

- To operate a temporary dam for storage of treated wastewater at 223 Crowe Road, Invercargill; and
- To discharge treated wastewater to land on a temporary basis at 159 Crowe Road, Invercargill

Alliance requires these consents when low flow conditions in the Makarewa River cause its discharge of treated wastewater to the river to be restricted or to cease. The consents enable the Plant to remain operational and provide for the increased demand during such conditions. The consent to operate a temporary storage dam was issued by the ICC with an expiry date of August 2016 and therefore a new consent will be required at this time.

It is however noted that ICC is reviewing its operative District Plan. Alliance has sought, via a submission on the Proposed District Plan, to have its land within the jurisdictional boundary of the ICC rezoned to Industrial. This would align Alliance's land holdings with an overall industrial zoning, and potentially permit the use of this land for the storage of wastewater during emergency conditions. Decisions on submissions on the Proposed District Plan are expected in 2016. Depending on the outcome of that process Alliance will then consider any necessary approvals required from the ICC. In other words, consent is not currently being sought from the ICC at this time.

1.6 STRUCTURE OF THE CONSENTS AND CONSENT TERM

As set out at section 1.5.2 above, Alliance intends to progressively upgrade its existing wastewater treatment plant. This has implications for the nature of the consents being sought and how the consents are likely to be ultimately structured.

As discussed, Alliance discharges some of its wastewater to the Makarewa River, and some via irrigation to its land. This regime will continue until such time as the wastewater treatment upgrade technology is confirmed, implemented and the upgrade is completed. At that time Alliance will no longer dispose of wastewater

to land via irrigation and will instead dispose dewatered biosolids to land. Alliance therefore seeks that all of the discharge-related consents are issued with a 35 year consent term, with the discharge of biosolids to land commencing once the irrigation consent has been surrendered.

Alliance holds a water take consent to abstract water from the Oreti River and a land use consent to undertake maintenance channel activities. These consents do not expire until 2027, however because these activities are an integral component of the Plant's operations, consent for these activities is being sought now in order to align all of the Plant's key consents. If consent is granted for the proposed water abstraction and maintenance activities with acceptable conditions, Alliance will surrender the existing consents (203358 and 201227).

Alliance is seeking a consent term of 35 years for all of its consents. The 35 year term suitably recognises the existing asset value of the Plant, the essential nature of the activity as a service to the rural sector, and the significant economic contribution it provides to the Southland region and New Zealand. In particular Alliance is committed to significant expenditure to upgrade its wastewater treatment system, thereby improving water quality over the long term consistent with regional and national directives. This commitment requires a consent term of no less than 35 years in order to enable the upgrades to be progressively implemented and allow financial investment to be justified and recovered over an appropriate timeframe.

As set out in section 6 of this report, it is noted that a number of stakeholders who have been consulted with have expressed concern for the duration of the consent term, with respect to the discharge to water consent being sought by Alliance. This has been acknowledged by Alliance and in the proposed conditions (refer section 8) a number of check points or review opportunities throughout the life of the consent are proposed. These require Alliance to progressively assess the quality of its discharge, the receiving water environment and any improvements required. In addition to the significant upgrade and revised in-river limits that will need to be complied with, this includes an annual comparative analysis of discharge quality, consideration of further treatment of its microbial load, and the ability for Environment Southland to initiate a review of the consent to impose additional post upgrade discharge limits following a review undertaken by Alliance post commissioning of the upgraded wastewater treatment system.

1.7 THE RESOURCE CONSENT ACQUISITION PROCESS

Alliance is seeking to obtain the above resource consents to enable the ongoing operation of the Plant and in particular the operation, maintenance and upgrade of its key components such as the wastewater treatment plant and coal fired boilers through one process. This approach was taken to allow comprehensive, integrated public consultation, plant-wide integration of environmental studies and investigations and to ensure the application meets the requirements of the RMA. Ensuring all major Plant components secure long term consents at the same time also provides certainty to justify significant and staged capital investment in upgrades and improvements.

Extensive environmental investigations and assessments were undertaken prior to lodgement of the consent applications. Alliance engaged leading independent experts in wastewater management, water quality and ecology, air quality, soil and groundwater quality to assess the environmental effects arising from the current Plant operation and to recommend appropriate mitigation methods. Experts completed extensive on-site and receiving environment monitoring and data collection to determine the effects arising from the current Plant operation. Technical assessments were then prepared, quantifying the existing effects and the mitigation options that are available and/or necessary to pursue. As a result of these investigations and assessments it has been determined that various resource consents from Environment Southland will be required to enable the ongoing operation, maintenance and upgrading of the Plant. These activities are described in more detail in the following section of this report. It has been assessed that these activities comprise discretionary activities pursuant to the relevant regional plans.

Consultation with key stakeholders commenced in 2013. It consisted of a series of individual meetings with stakeholders and meetings with the surrounding community. Alliance's approach to consultation is underpinned by a commitment to a genuine process, which is to consult early, openly and honestly. An important element of the consultation process was the establishment of the 'Wastewater Technical Working Party' (TWP). The purpose of this group was to consult about technical matters associated with the discharge of wastewater to the Makarewa River and land, and the water take from the Oreti River. The members of the TWP include representatives from:

- Environment Southland
- Southland District Council
- Invercargill City Council
- Fish and Game
- Department of Conservation
- Public Health South
- Te Ao Marama

A series of meetings was held with the TWP. This enabled information to be shared between Alliance and key stakeholders and to obtain critical feedback prior to finalising technical assessments, reports and proposed conditions. Alliance has committed to continued long-term consultation with the TWP as the proposal progresses through the resource consent process and beyond. Feedback from the TWP has been positive in terms of the group advising that they find the information sharing process useful and feel informed with regard to the issues.

A summary and outcome of the consultation undertaken by Alliance is contained in the report attached as **Appendix B**.

A public information evening was held on 26 August 2015. Alliance invited members of the surrounding Lorneville and Wallacetown community directly (approximately 500 households) and advertised the event in public newspapers.

The session was attended by 6 people. Those who attended commented that it was useful, enabling them to understand more about the Plant and the nature of the effects and the mitigation proposed. Specific feedback from the open evening is contained in the report attached as **Appendix B**.

Other aspects of the consultation process are set out within the report attached as **Appendix B**.

Environment Southland was also given the opportunity to provide comments on the draft technical applications that had been prepared. Environment Southland engaged independent technical experts to review the various draft water quality, air quality and soil and groundwater assessments. Written feedback from this process was received from the various reviewers. This feedback has been helpful in finalising the various technical reports. There has been sufficient time for this feedback to be considered by Alliance and its advisors and where appropriate it has been addressed in the finalised technical reports which are attached to this application.

The consultation process has been extensive and opportunity has been provided to stakeholders, iwi and the wider community to participate. A collaborative approach to consultation has been adopted by Alliance and this application, including the proposed mitigation and conditions, has been developed taking into account outcomes arising from the consultation process.

1.8 PURPOSE AND STRUCTURE OF THIS REPORT

This report and the supporting information contained in **Appendices A – V** attached has been prepared in support of the applications for resource consent which would authorise the ongoing operation, maintenance and upgrading of the Plant.

This report, in conjunction with the technical reports, contains the information required in support of the applications for resource consent, including:

- A description of the Plant's operations and activities;
- A description of the current operation of the Plant's wastewater treatment facility, water take and boiler operation;
- A description of recent and planned Plant upgrades;
- A description of the existing environment, including a description of the receiving environment and statutory framework;
- Identification of persons affected by the proposal and a description of the consultation undertaken in the development of this application;
- An assessment of the actual or potential effects on the environment arising from the ongoing operation of key components of the Plant, including the wastewater treatment facility, air discharges and the water take;
- A description of the proposed mitigation and monitoring methods and suggested conditions for the resource consents sought;
- An assessment of alternatives considered and the best practicable options;
- An assessment of the proposal against the provisions of relevant Plans.

2. ENVIRONMENTAL SETTING

2.1 DESCRIPTION OF THE RECEIVING ENVIRONMENT

The purpose of this section of the report is to provide a high level description of the receiving environment and context in which the Plant currently exists. Because the Plant is currently operational, some of the immediate receiving environment is already influenced by existing Plant operations and activities, some of which are subject to this application. A more detailed description of the effects of the existing Plant discharges to water, land and air is provided in section 7 of this report.

2.2 UNDERWOOD, WALLACETOWN AND LORNEVILLE

The Plant is located approximately 3km north of the Invercargill City residential area and is located off the Lorneville-Wallacetown Highway (State Highway 99). The small rural community of Underwood is located less than a kilometre to the north of the Plant, with the larger rural townships of Lorneville and Wallacetown located 2km west and east respectively.

The Plant is surrounded by rural land use activities, including approximately 360ha of farm land immediately surrounding the Plant, which is owned and operated by Alliance for temporary stock holding and wastewater irrigation purposes.

Rural residential activities, including both farm houses and lifestyle blocks, surround the plant at varying densities. The nearest dwelling to the Plant is located along the eastern boundary of the site, approximately 770m from the Plant. A number of dwellings are located along Wills, Leonard and Steel Roads to the south and Moore Road to the east. A small cluster of dwellings is located in Underwood, approximately 500m north of the Plant. The community of Wallacetown, with a population of approximately 400 people, is the single largest residential enclave in close proximity to the Plant.

Two other industrial sites operate within 5km of the Plant. These are the Prime Range Meats Meat Processing Plant and Alliance's Makarewa Plant.

2.3 CLIMATE

Southland has a temperate oceanic climate. Invercargill has a mean temperature of 9.9°C, and a range from highest to lowest of 32.2°C to -9.0°C. The rainfall total at Invercargill is on average 1112mm per year, with rain occurring on 158 days per year, and ground frosts on 94 days (source: NIWA data; mean annual values from 1971-2000). The mean wind speed is 18km/h (or 5m/s), with on average 18 'gale' days per year (with average speed greater than 63km/h, or 17.5m/s).

Wind roses at the Invercargill Airport and Wallacetown monitoring sites show that the distribution of wind speed and direction differs slightly between the sites due to their differing proximities to the New River Estuary and the coast. However,

both sites have predominant westerly and south-westerly components due to their exposure to large-scale weather systems approaching from the Tasman Sea and the Southern Ocean. High winds from other directions also occur as weather systems pass over the region, but the wind flow is typically from west to east.

The area also experiences land- and sea-breezes, and terrain-driven flows such as valley-channelling and slope flows. Although the terrain within 20km of Invercargill is quite flat, drainage flows are typically from the north (via Winton) and northwest (via Gore and Mataura). These are likely to be relatively weak when they reach Invercargill and Wallacetown, as the flow is no longer channelled along a valley. However, there is a signature of weaker winds with speeds up to 2-3m/s from the north and northwest in the wind roses at both monitoring sites. These flows are in the same general direction of the Makarewa and Oreti River flows towards the New River Estuary. In periods of low wind speed (particularly on cold days when there is very little vertical mixing), the general air flow is to the southwest approximately following the river system.

2.4 GEOLOGICAL ENVIRONMENT

The Plant is located on gently undulating topography formed by highly weathered fluvio-glacial outwash. The Quaternary aged fluvio-glacial outwash deposits comprise quartz gravels within a weathered clay matrix with varying proportion of silts and sands. The thickness of the strata varies from less than 5m up to around 30m, with the greatest thickness typically occurring underneath ridges.

Underlying the Quaternary deposits are older, Tertiary Gore Lignite Measures which were deposited between 65 million and 2 million years ago. Higher sea levels between these periods resulted in deltaic deposits, which include extensive mudstone and lignite sequences that occur across much of the Southland region.

Groundwater levels in the shallow Quaternary sediments can be close to the surface near streams and rivers but are known to occur at greater depths below the intervening ridges in the undulating topography. That pattern results in a groundwater table surface that generally follows the topographic surface although local variations can occur, for example close to pumping bores and/or close to surface waterways and drainage channels. Recharge to shallow strata is almost exclusively the result of rainfall infiltration, with recharge estimates of around 436mm/year. However, much of the shallow strata is covered by a network of tile drains and other artificial drainage channels. As a result, a significant proportion of the rainfall may be intercepted and discharged into surface water courses before it reaches the underlying groundwater table. Notwithstanding that interception, many smaller streams in the area are fed by groundwater where they occur at a lower elevation compared to the local groundwater table.

Groundwater resources are also present in the underlying Gore Lignite Measures, although they are poorly defined and typically low yielding. Reports from bores in the area confirm this. Most bores in the area are shallow and are used for domestic, stockwater and small scale irrigation, reflecting the low yield available from the shallow strata.

2.5 CULTURAL LANDSCAPE

In Southland (Murihiku) there are four Papatipu Rūnanga whose members hold manawhenua status within the region. The Te Rūnanga o Ngāi Tahu Act 1996 describes the takiwa of these four as follows:

- Te Rūnaka o Waihōpai - centres on Waihōpai and extends northwards to Te Mata-au sharing an interest in the lakes and mountains to the western coast with other Murihiku Rūnanga and those located from Waihemo southwards.
- Te Rūnanga o Awarua - centres on Awarua and extends to the coasts and estuaries adjoining Waihopai sharing an interest in the lakes and mountains between Whakatipu-Waitai and Tawhititarere with other Murihiku Rūnanga and those located from Waihemo southwards.
- Te Rūnanga o Oraka Aparima - centres on Oraka and extends from Waimatuku to Tawhititarere sharing an interest in the lakes and mountains from Whakatipu-Waitai to Tawhititarere with other Murihiku Rūnanga and those located from Waihemo southwards.
- Te Rūnanga o Hokonui - centres on the Hokonui region and includes a shared interest in the lakes and mountains between Whakatipu-Waitai and Tawhititarere with other Murihiku Rūnanga and those located from Waihemo southwards.

The takiwā of three rūnanga (Hokonui, Waihōpai and Awarua) extend across the area encompassed by the Makarewa and Lower Oreti Rivers and the New River Estuary.

A detailed cultural values report for the Makarewa River has been prepared by Kitson Consulting Limited on behalf of Te Ao Marama. A copy of this report is attached as **Appendix C** and is summarised in the following sub-sections.

2.5.1 Cultural values and uses of freshwater

In the traditional Māori worldview water is viewed as taonga or treasure. It sustains life and is at the core of Māori life and wellbeing. Waterways can be valued and protected for particular cultural reasons. The tangible and intangible aspects of water feature in all aspects of Ngāi Tahu culture and are often the feature of stories, place names and waiata.

The core Ngai Tahu whānui values and uses relating to the freshwater environment include:

- Whakapapa;
- Te Ao Māori;
- Mauri;
- Wairua;
- Kaitiakitanga;
- Tino Rangatiratanga;
- Mahinga kai;

- Manaakitanga;
- Mātauranga Māori;
- Te Reo; and,
- Whānaungatanga.

A detailed description of each of these values and their relationship to cultural use of the freshwater environment is set out in the cultural values report attached as **Appendix C**.

The maintenance and enhancement of mauri or life force/life principle is a key Ngāi Tahu resource management principle. While there are a range of intangible elements associated with the mauri of a freshwater body, there are elements of physical ecosystem health which Ngāi Tahu can use to reflect the state of mauri, such as the life supporting capacity of the waterbody and ecosystem robustness.

2.5.2 Cultural Landscape of the Makarewa and Lower Oreti River Catchment

Ngāi Tahu ki Murihiku cultural landscapes of the Makarewa Catchment are evidenced by the Wāhi Ingoa (place names), archaeological and Wāhi Tapu sites and Maori lands within Southland.

A number of places within the region reinforce Ngāi Tahu creation traditions, tūpuna, incidents and mahinga kai resources.

2.5.3 Mahinga Kai

Mahinga kai is central to the Ngāi Tahu way of life and wellbeing. It encompasses the resource harvested, the ability to access the resource, the site where gathering occurs, the act of gathering and using the resource and the good health of the resource.

Rich and varied mahinga kai resources were historically found within the Makarewa and lower Oreti River catchment, including:

- Manu/birds such as weka and ducks;
- Rakau/wood, harakeke and rongoa (medicine plants);
- Freshwater mahinga kai, including a wide variety of species such as Tuna, Kōkopu, Koaro, Waikoura, Paraki, Waikakahi, Inanga, Kanakana and watercress.

2.6 RIVERINE ENVIRONMENT

The Plant is located on the West Southland Plains, within the Makarewa River catchment. Activities undertaken at the Plant are influenced by, and also have an influence on the surrounding catchments, including the Makarewa River, the lower Oreti River and the New River Estuary. The following sections describe the hydrological and ecological characteristics of these environments. Further detail is provided in the report attached as **Appendix D**.

2.6.1 Makarewa River Overview

The Makarewa River drains a 991km^2 catchment. The catchment has been fully developed for agriculture with the exception of a small portion of the headwaters on the south-western flanks of the Hokonui Hills. The upper Makarewa River is characterised by high nutrient loads, low visual clarity and low Amm-N concentrations. While water temperatures are suitable for protecting river ecosystem health, macroinvertebrate community index scores (a measure of ecosystem health) at the Wallacetown-Lorneville Highway Bridge indicate 'fair' water quality. Low fish species diversity is observed within the upper reaches of the river due to the high level of modification within the catchment.

The lower Makarewa River has been modified by river drainage and flood protection works. Makarewa River water and sediment quality upstream and downstream of the Plant is characterised by high nutrient concentrations, high faecal indicator bacteria counts, low visual clarity, high Amm-N concentrations, and generally moderate but occasionally low (in summer) dissolved oxygen concentrations. Water temperatures and pH are suitable to support healthy biological communities.

Benthic invertebrate and aquatic plant communities in the lower Makarewa River change in response to the substrate, channel gradient, water velocity, tidal influence and water quality. Key features of the biological communities in the Makarewa River immediately above and below the Plant discharge are the dominance of macrophytes, water and habitat tolerant benthic invertebrate taxa and a diverse fish community. The Makarewa River also supports a locally significant brown trout fishery with low-moderate recreational use.

2.6.2 Makarewa River Hydrology

The Makarewa River flow is gauged at Counsell Road. Data from this gauge has determined that the mean flow of the river is 15.67m^3/s and the median flow is 7.65m^3/s. The 7 day mean annual low flow is 1.75m^3/s.

2.6.3 Makarewa River Water Quality

River water temperatures upstream and downstream of the discharge point are generally similar. The pH of the river increases slightly downstream of the discharge point.

Dissolved oxygen concentrations are slightly lower downstream of the discharge point most of the time but remain above 5g/m^3 (median values taken across a 12 year database). Water clarity reduces downstream of the discharge point. Total nitrogen concentrations in the river increase significantly downstream of the discharge point, while total phosphorus concentrations increases between the upstream and downstream river monitoring sites. Faecal coliform counts of *E.coli* concentrations are elevated throughout the catchment, however monitoring demonstrated that median faecal coliform counts were lower downstream of the discharge, compared to upstream sampling on 56% of the sampling occasions.

Water quality at the lower Makarewa River site located just upstream of the confluence with the Oreti River is similar to water quality upstream at the

confluence of the Tomoporakau Creek and the Makarewa River (boundary monitoring site) with respect to physico-chemical parameters, although nutrient concentrations recorded at the confluence with the Oreti River are lower than at upstream sites.

River sediment at sites upstream and downstream of the discharge point has elevated nutrient concentrations.

2.6.4 Makarewa River Habitat

The Makarewa River in the vicinity of the upstream site near the Wallacetown-Lorneville Highway Bridge has different habitat characteristics to that in the vicinity of the discharge point with a higher proportion of gravels/cobbles, shallower riffle areas, higher water velocities and shaded near-bank areas.

The Makarewa River in the vicinity and downstream of the discharge point is a meandering low gradient river characterised by soft riverbed and riverbank sediments. The gently flowing run and pool habitat is dominated by submerged macrophytes and has a riparian zone comprising grazed and rank pasture grasses. Aquatic habitat reflects the low channel gradient and highly modified nature of the riparian habitat. There is also a gradient of change between upstream and downstream sites reflecting the increasing downstream influence of the tide and natural changes in channel morphology.

2.6.5 Makarewa River Aquatic Flora Community

The lack of periphyton (algal mats and filaments attached to rocks) downstream from the discharge point reflects the unsuitable nature of the habitat available. Periphyton growth is more common upstream of the discharge point due to the more suitable conditions. Nuisance long filamentous green algal cover has exceeded the national guideline at sites upstream of the discharge point during spring and summer.

Total macrophyte cover significantly increases as the river flows downstream, reflecting the increase in soft sediments and decrease in water velocity. Macrophytes recorded include submerged and surface reaching rooted species that can reach nuisance levels, such as the curly pondweed and blunt pondweed.

2.6.6 Makarewa River Benthic Invertebrate Community

Benthic invertebrate communities in the lower Makarewa River are dominated by water and habitat tolerant taxa. Poor habitat quality, rather than contaminants, is likely to exclude freshwater crayfish and mussels from large portions of the Makarewa River.

2.6.7 Makarewa River Fish Community

The Makarewa River supports high native fish diversity including five species with a threat classification of ‘declining’. The most common species in the vicinity of the discharge are shortfin eels and common bully.

The lower Makarewa River and lower Oreti River support very productive shortfin eel, and to a lesser extent, longfin eel fisheries. The lower Makarewa River

provides very good eel habitat despite historical channelisation and habitat modification. In particular, extensive macrophyte beds in the lower Makarewa River provide important cover for shortfin eels.

Some of the native fish found in the Makarewa River are only likely to use the lower Makarewa River as a migratory pathway to upstream adult habitat (eg. koaro and banded kokopu) with most fish migration occurring when there is no discharge (or a low volume discharge) occurring from the Plant. Other species such as inanga, shortfin eels, trout and black flounder use the lower Makarewa River to feed and grow. The Makarewa River downstream of the Plant provides habitat for adult brown trout but is unsuitable as spawning/rearing habitat due to the lack of gravel substrate and riffle habitat.

2.6.8 Makarewa River Recreational Values

As noted above the Makarewa River supports a locally significant brown trout fishery that receives low-moderate use. A study in the late 1970's classified a large number of recreational users downstream of Wallacetown as 'onlookers' followed by boating, picnicking, swimming and angling. The report attached as **Appendix B** includes more detail about those recreational groups having an interest in the river environment and the consultation undertaken with them.

2.6.9 Oreti River Overview

The Oreti River is approximately 195km long and has a catchment of 3,400km^2. The headwaters of the Oreti River are located in the Mavora Lakes and Eyre Mountains. Land use in the middle and lower reaches is dominated by sheep, cattle and deer farming. The Oreti River discharges into the New River Estuary near Invercargill City. The tidally influenced section of the river extends 25.7km upstream from the New River Estuary to approximately 2.8km downstream of the Plant's existing water take. Within the tidal reach, the Makarewa River joins the Oreti River. The Waikiwi Stream joins the Oreti River further downstream from the Makarewa and Oreti River confluence.

The lower Oreti River catchment downstream of Wallacetown has a maximum elevation of approximately 640m. The lower Oreti River is characterised by a single channel and point bar dominated gravel bed. Further downstream, the Oreti River naturally meanders within a single channel characterised by a series of long runs, shallow pools, and occasional rifles. Mean rainfall in the catchment varies between 2,500mm/year in the headwaters to 750mm/year at Lumsden.

There are two key water level recording sites in the Oreti River catchment, one located at Lumsden and the other at Wallacetown. The Lumsden record began on 1 July 1976, and the Wallacetown record began on 1 July 1977. Records for both sites are available up to September 2012.

Analysis of the hydrological data has determined that the mean flow of the river is 39.0m^3/s and the median flow is 27.6m^3/s. The mean annual 7 day low flow is 7.4m^3/s. As of October 2012 the total calculated consented abstraction from the catchment was 1.528m^3/s. This includes a maximum consented abstraction by the ICC of 720 L/s, and Alliance's existing consented abstraction of 260 L/s. Of

the other abstractions included in the total, some consents have not yet been exercised and some are for groundwater abstractions.

The water quality within the Oreti River is characterised by moderate nutrient concentrations, moderate to low visual clarity, low unionised ammonia concentrations and river water temperatures which are suitable for protecting river ecosystem health. The ecology monitoring results indicate that the lower Oreti River is characterised by moderate benthic invertebrate community health and organic enrichment. It is considered that such results are reflective of the elevated nutrient concentrations, and the increasingly developed nature of the catchment.

The Oreti River supports a healthy native fish fauna. The Oreti River also supports a nationally significant brown trout fishery that receives moderate-high use (21,850 angler days in the 2007/2008 fishing season) with approximately 75% of use occurring downstream of Lumsden. By comparison, the Mataura River had 48,490 angler days in the 2007/2008 season. The Oreti River was the seventh most heavily fished river out of the 33 rivers surveyed during the 2007/2008 national angler survey (NIWA 2009).

2.6.10 New River Estuary

New River Estuary is a large, shallow 'tidal lagoon' estuary, situated at the confluence between the Oreti River and Waihopai River. The estuary forms part of the Awarua Plains Wetland complex. Its catchment largely consists of agricultural land but it is also subject to stormwater and wastewater discharges from Invercargill. Data indicates that large parts of New River Estuary remain in reasonable condition but a significant and increasing proportion of the estuary is seriously impacted by fine sediments and elevated nutrient concentrations. The New River Estuary supports high ecological values including a diverse bird fauna and freshwater and marine fish populations. The estuary provides important spawning and rearing habitat for fish. The estuary also provides game bird hunting, fishing, bird watching, power boating, rowing, bathing, walking and picnicking opportunities.

2.7 AIR QUALITY

The following section sets out the existing air quality characteristics in the vicinity of the Plant, describes external factors that contribute to the current quality of this environment, and establishes a baseline against which future activities can be assessed. Detailed baseline ambient air quality and odour exposure reports have been prepared by Golder Associates and are attached as **Appendices E and F**.

2.7.1 Ambient Air Quality

The Invercargill City airshed (a listed Ministry for the Environment polluted airshed) is located at a point commencing approximately 1.5km south east of the Plant.

From April 2010 to January 2011, Environment Southland monitored PM_{10} in Invercargill and Wallacetown. The monitoring site in Invercargill was situated

approximately 9km south east of the Plant site. The monitoring showed that during the cooler months (April to September) concentrations of PM_{10} were higher than in the warmer months. This can be attributed to the use of solid fuel burners in urban areas for domestic heating purposes during the winter months. During the cooler months, Invercargill's PM_{10} concentrations tend to be higher than in Wallacetown, with the national environmental standard (NES) for PM_{10} (50µg/m^3, 24 hour average) exceeded in Invercargill on numerous occasions. Conversely, during the warmer months of the monitoring programme, the 24-hour average PM_{10} concentrations in Invercargill and Wallacetown were similar, generally between 5 to 15µg/m^3.

The Good Practice Guide to Assessing Discharges to Air from Industry (Ministry for the Environment, 2008) notes that in rural areas the typical maximum 24-hour average PM_{10} concentration is in the order of 15µg/m^3 when there are no obvious sources upwind.

In order to determine the existing background ambient air quality, a number of monitoring programmes in the vicinity of the Plant have been undertaken as part of this assessment process. The sites are described in the report attached as **Appendix E**.

Based on the 2010 Environment Southland monitoring programme and Alliance's on-site monitoring programmes, a conservative background PM_{10} 24-hour average concentration for the area surrounding the Plant is 15µg/m^3.

Robust estimates of typical background NO_2 concentrations for the area surrounding the plant are 15µg/m^3 for both 1-hour and 24-hour average time periods. This value has been derived from monitoring undertaken by New Zealand Transport Agency (NZTA). Seasonal variations in NZTA's data show slightly elevated concentrations during the winter months. Domestic heating is likely to contribute to this variation.

On-site SO_2 monitoring was undertaken in association with the 2014 PM_{10} monitoring programme. This data was used to enhance the estimated background concentrations obtained from the Fonterra Edendale Plant. A conservative estimate of typical background SO_2 concentrations for the area surrounding the Plant is 5µg/m^3 for both the 1-hour and 24-hour average concentrations.

Very little information is available regarding ambient concentrations of metal in rural New Zealand. In the absence of any nearby sources of metal contaminants to air, it is assumed that the background concentrations of metals surrounding the Plant will be negligible.

Dioxins and Furans formed during the combustion process are only likely to be present at trace levels in the discharges from the Plant, or approximately 16fg I-TEQ/m^3 as an annual average.

The following table sets out the background air quality concentrations of key contaminants:

Table 3: Background Air Quality Concentrations

Pollutant	Source of Data Reviewed	Averaging Period	Estimated Background Concentration
PM_{10}	Environment Southland, MfE, Alliance Lorneville	24 hour	15 µg/m^3
		Annual	10 µg/m^3
NO_2	NZTA, MfE	1 hour	15 µg/m^3
		24 hour	15 µg/m^3
SO_2	Environment Waikato, Fonterra, Alliance Lorneville	1 hour	5 µg/m^3
		24 hour	5 µg/m^3
Metals: arsenic, cadmium, lead, and mercury	N/A	3 month and Annual	0 µg/m^3
Dioxins and Furans	MfE	Annual	16.0fg l-TEQ/m^3

2.7.2 Nature of Receiving Environment

As described above in section 2.2 (description about the site relative to towns), the Plant is located on a 360ha area of land owned, operated and farmed by Alliance. The area of the land and the location of the Plant within that land provides a significant buffer to surrounding properties, including the mitigation of off-site odour effects. The nearest dwelling is located east of the processing site, close to Alliance's property boundary. The dwelling is located approximately 700m from the source of odour within the processing site.

2.7.3 Odour Surveys

Alliance has commissioned odour surveys in order to determine the existing odour effects arising from the Plant on the surrounding community. In 2013 35 residents participated in the odour survey, and in the following year 30 residents. These residents are considered to be those within closest proximity to the Plant and its activities. Figures 3 and 4 within **Appendix F** attached shows the locations of the survey respondents. The survey data, coupled with Plant recorded complaints has been used to establish a baseline level of odour exposure due to existing emissions arising from the activities at the Plant. The results of this assessment are discussed later in section 7 of this report.

3 DESCRIPTION OF THE ALLIANCE LORNEVILLE PLANT AND ACTIVITIES

3.1 INTRODUCTION

This section of the report provides a description of the activities undertaken at the Plant, an explanation of the components that make up the Plant, and how it operates. A more detailed description of the key components that are the subject of the consent application such as the wastewater treatment system and air discharges generated on-site is also provided.

3.2 DESCRIPTION OF THE PLANT AND ACTIVITIES

The Plant began as the foundation plant of the Alliance Freezing Company and was opened in 1959. The Plant is the largest ovine processing export plant in the world. It currently processes in excess of 40% of Alliance's total sheep and lamb products and has capability to process venison and beef products.

The Plant is fully integrated, encompassing slaughter and further processing operations, the production of edible by-products, cold storage (chilling and freezing), rendering, fellmongery, potable water treatment and an on-site wastewater treatment facility. Ancillary to the meat processing activities is approximately 360ha of farm land where stock is held. In 2001 processing capability changed from a six chain single shift operation to a four chain double shift operation. In 2014 the processing pattern changed from the previous seasonal operation, which included an extended winter closedown period (without processing), to include a low level of winter sheep and lamb processing, rendering and seasonal calf processing.

A summary of the activities occurring within the Plant is set out below. A more detailed description of the plant wastewater facility follows.

3.2.1 Stock Holding

The stock yards at the Plant have a holding capacity of 20,000 sheep and lambs and provide for a maximum daily slaughter tally of 32,000 head. As processing generally occurs over a 20 hour period, stock is held on-site over 24 hours before processing. Stock are required to be emptied for 12 hours prior to transport to the Plant and may be held in the stock yards for up to eight hours prior to slaughter.

Stock are washed with untreated water prior to slaughter. Detergent can be added to the wash if necessary, depending on the cleanliness of the stock on arrival. If their presentation is unsatisfactory for slaughter this process may be followed by a further wash. They are then allowed to stand and drip dry prior to slaughter. The usage of untreated water in the stock yards is calculated to be approximately 2,500m^3/day during peak processing. This is a large proportion of the total water abstracted for use on-site.

3.2.2 Slaughter and Dressing

Following sticking, blood collection occurs as the carcasses move up the collection ramp. Blood is collected and pumped to the processing facility within the rendering plant. Heads and hocks are removed and distributed by chutes to the rendering department. Skins are removed and transported with reused water to the fellmongery.

Carcasses are opened; edible offals and crown sets are collected and transported in potable water to offal, semi-processed casings, and tripe processing departments. The crown sets are directed to the gutshed for pulling and stripping. They are then processed as either frozen green runners or salted casings. The gut is directed to the tripe room for processing. Overflow from the tripe room, and condemned material, are directed to the gut cutting facility within rendering.

The slaughterboard is a significant user of both hot and cold potable water. Water is used primarily for sterilisation stations, equipment and staff wash stations, room cleaning and carcass washing. "Clean" used water is captured and reused in lower grade, inedible processes. Dry floor sweeping is encouraged before wash-downs and all wastewater from the slaughter process is directed to the Dissolved Air Flotation (DAF) unit via contra-shear screens.

3.2.3 Chillers

Approximately 40 chiller rooms are incorporated in the processing plant. They receive carcasses from the slaughterboard and retain them for approximately 24 hours depending on specifications. They are railed from the chillers to the processing rooms. A small percentage of lamb carcasses are bagged and frozen. A greater proportion of sheep carcasses are bagged and frozen for export.

3.2.4 Further Processing

Further processing of the stock includes fresh boning rooms (up to four), a frozen cutting room, pet food room, soup stock, offal, casings and tripe processing departments.

Product is transported to the boning and cutting rooms from the chillers or freezers. It is cut / boned / trimmed to market requirement and packaged.

Product for offal, tripe and pet food is received directly from the slaughterboard and processing and packaging is as for boned and cut product. Stomachs for tripe are emptied and cleaned prior to packaging. The crown sets are received from the slaughterboard, pulled and stripped. The runners are then either packed as frozen green runners or soaked overnight and processed as salted casings. Bile is also produced and packed in plastic barrels.

Beef bones are transported directly to the soup stock department for immediate use, chilling or freezing upon arrival at Lorneville from Mataura. They are processed to form soup stock which is packaged in plastic pails. Bone waste is hogged before being blown to the rendering department.

3.2.5 Freezers

The Plant has five blast freezers on-site. The freezers can store approximately 16,000 tonne of product.

3.2.6 Rendering

The rendering department receives inedible and otherwise un-useable material and by a range of processes, converts the waste material into saleable dried blood, meat and bone meal for pet food manufacturers and for animal feed, and tallow for use in a range of products from cosmetics to biofuels.

Venison blood from Alliance's Makarewa Plant is transported to the Plant for processing, together with the ovine blood. Ovine blood is pumped from the sticking pens area. The venison blood is incorporated with the ovine blood prior to being pumped across to the rendering department. The blood process consists primarily of coagulation, decanting and drying. Liquid waste from the decanter goes to the DAF.

Slaughterboard waste product is transported to the rendering plant with reused water and is screened to remove surplus water before entering the rendering raw material bins. Further processing waste product is hogged and blown to the rendering raw material bins. Wool on material (heads/hocks) is processed through a hydrolyser, and is then combined with the other raw material. De-watering occurs from the raw material bins and this contributes significantly to the wastewater load.

The raw material is ground and then pumped to the rendering plant. The material is first precooked. Free liquids are allowed to percolate out before the material is pressed to remove most of the remaining fat and water. The defatted solids are then dried. The meal is milled and screened before being loaded out by rail in containers. The pressed liquid is pumped to the decanter for removal of the fine solids. Sulphuric acid is added and the liquid is pumped through a disc separator for 'polishing'. The processed tallow is then pumped to storage tanks for loadout in tankers. The wastewater from the separators is fed to a waste heat evaporator where it is concentrated. The concentrated stickwater is directed back to the meal dryer. Any floor drainings, or overflows/spills, are collected in a sump and pumped to the head of the DAF.

The DAF unit alongside the rendering plant receives wastewater from almost all the processing areas within the Plant. The wastewater passes through one of two contra-shears before entering the DAF. Dissolved air is pumped into the head of the tank which assists the floatable solids to come to the surface. There is a top and a bottom scraper operating in the DAF with cross collectors. The top solids are de-sludged and the fat component returned to the tallow process and the solid component returned to the meal process. The scraped bottom solids are blown back into rendering. Constant manning of the DAF is critical to ensure that the maximum amount of fat is recovered, resulting in increased tallow production and reduced losses to the wastewater treatment plant.

Following work commissioned to identify waste streams with high nitrogen loads, Pattle Delamore Partners (PDP) recommended the installation of another DAF (the Mini-DAF). Installation of the mini-DAF was undertaken in 2014 to assist with further primary wastewater treatment to target nitrogen removal. The Mini-DAF is located in the old rendering building adjacent to the saveall and utilises flow balancing and pH adjustment ahead of the main DAF plant. Sludge collected from the Mini-DAF is dewatered and sent direct to rendering as a sludge material.

The rendering plant is the main steam user at the Plant. Heat recovery is with a shell and tube heat exchanger and the recovered heat is used in hot water production.

3.2.7 Fellmongery

Fellmongering is the process of removing wool or hair from the skin of the animal after it has been removed from the carcass. It is noted that tanning does not occur at the Plant. The main product from the fellmongery plant are pickled pelts, which is the main feedstock that is exported to leather manufacturers. It also produces green or salted skins and slipe wool.

At the Plant, skins are piped to the fellmongery plant with reused water. Once received, they are further cooled with reused water combined with untreated water and then squeezed dry in preparation for paint application. Green skins can be removed from the process at this stage and trucked off-site.

Skins pass through a pre-flesher where surplus flesh and fat is scraped from the skin. The fleshings are transferred in bins to rendering.

The depilatory paint is primarily a sodium sulphide and lime mixture with a thickening agent added. The skins are painted and retained on barrows for sufficient time for depilatory action. They are then fed through an automatic wool puller from where the wool is washed and dried prior to grading, baling and trucking off-site. The depilatory paint is captured from drainings and spills and is recycled.

Pelts are processed through the rotary drums where further sodium sulphide, depilamine, lime and bate enzymes are added. The wastewater from this part of the process drains into an open channel and then discharges into the south effluent line.

The processed pelts are emptied into tubs where salt, acid and fungicide are added. When the tubs are emptied the acidic pickle liquor drains separately into the south effluent line.

Remaining fat can be removed by fleshing machine at this stage. The pelts are pressed and shrink wrapped prior to being trucked off-site.

The fellmongery process is a large user of untreated water, consuming around 2,500–3,000m^3/day.

The green skins that are removed early on in the process may be dry salted to help preserve the skins during storage and transport. The salt draws a lot of moisture from the skins which results in significant leaching from the pallets. To capture the leachate from the salted skin pallets, a contoured concrete pad has been constructed at the rear of the garage for preliminary storage and leachate collection and the remaining pelt park area has been contoured to capture surface water. All captured leachate and surface water is drained to the on-site wastewater treatment plant.

3.2.8 Water Abstraction

Water for the Plant is abstracted predominantly from the Oreti River with provision available to abstract smaller volumes from the Makarewa River, should it be necessary. The abstraction pumps are controlled from the Plant engine room and bring the water to one of two raw reservoirs.

3.2.9 Cooling Water

The Plant has a number of cooling water tower systems on-site used for a variety of reasons (ammonia cooling, oil cooling and as part of the rendering process when required). All of the Plant's cooling tower systems are closed loop systems with water treatment programmes in place.

3.2.10 Water Treatment Plant

More than half of the daily water use within the Plant is required to be of potable standard. The on-site Patterson Candy water treatment plant uses coagulation with aluminium sulphate, flocculation, sedimentation, sand filtration, chlorine disinfection and lime for pH correction to treat the water to a potable standard. Sludge control in the clarifiers and filter backwashing creates a periodic waste stream that goes to the wastewater treatment plant. The operation of the wastewater treatment is outlined further in section 3.3 below.

3.2.11 Boiler Operation

Two coal fired boilers are operated on-site to meet the Plant's steam and hot water needs. These include an 18 megawatt (MW) Babcock and Wilcox (B&W) boiler (CFB 1) and a 12.7 MW Foster Wheeler (FW) boiler (CFB 2). The boilers are fired on a lignite coal that is supplied from the Newvale coal mine. The maximum coal consumption (tonnes/hr) and steam production rates (tonnes/hr) are as follows:

- CFB 1: coal rate 7.23 tonnes/hr and steam output 26.65 tonnes/hr (at 8 Bar)
- CFB 2: coal rate 4.57 tonnes/hr and steam output 18.80 tonnes/hr (at 8 Bar)

3.2.12 Plant Disposal Facilities

Landfills have historically been used in the vicinity of the wastewater treatment plant for disposal of general rubbish including some asbestos waste. These landfills are now closed and the monitoring of the long term effects on the groundwater has been addressed by resource consent (94468). The likely

presence of asbestos is recorded on site plans. Currently no issues have arisen as a result of the monitoring undertaken.

A concrete and wire netting “burner” is sited at the wastewater treatment plant. This facility is currently used for short term storage of boiler ash prior to transport off-site but the burning of wood product waste (pallets primarily) is undertaken. The area surrounding the burner is drained to the treatment ponds.

3.2.13 Other Ancillary Activities

The Plant is also equipped with a service department and a maintenance department. The service department fulfils a range of functions including the collection, compaction and disposal of general rubbish and the despatch of product from the site by container / train. They provide a forklift service for the Plant and internal transport of product and equipment. The Plant garage provides a mechanical service and diesel supply for the Plant vehicles.

The main store receives and despatches all supplies for the Plant. As such, it provides a temporary store for chemicals and other hazardous goods before they are transferred to appropriately secure storage areas. The main store also provides storage for a wide range of dry goods for Plant use.

An on-site medical centre provides a full health service to Plant personnel and this includes visiting doctors and physiotherapists.

The on-site laboratory provides a microbiological and chemical testing facility for Alliance’s Plant and external clients.

Plant staff are serviced with a large number of amenity areas providing eating, toilet and ablution areas. The wastewater generated by these facilities is drained to the respective wastewater treatment plant which provides full treatment of the human sewage in combination with the meat processing waste.

A number of offices and administration facilities are also provided at the Plant.

3.3 DESCRIPTION OF THE CURRENT WASTEWATER FACILITY OPERATION

3.3.1 Wastewater Treatment Plant History

A wastewater treatment plant was built when the Plant was opened in 1959 with an annual processing capacity of one million sheep.

At that time, three tanks were used as mixed cold anaerobic digesters. The digested wastewater then passed to the remaining tank that was used as a secondary sedimentation tank. The supernatant from the sedimentation tanks flowed to the clarifiers. The underflow sludge from the sedimentation tank and clarifier was returned and mixed with raw wastewater flow. The clarified wastewater was discharged to the Makarewa River. There was no provision for solids management.

As a result of solids overloading, it was decided in the late 1960's to establish anaerobic lagoons. The mixers in the digester tanks were decommissioned and the three digesters were operated as unmixed anaerobic reactors. The discharge from the sedimentation tank was directed to the anaerobic lagoon and the final discharge passed through the clarifiers.

In 1968, Plant production had increased to two million sheep annually. At around this time, the then-Catchment Board straightened the Makarewa River in the vicinity of the Plant. Alliance purchased a redundant section of the river bed. The section of the riverbed was converted to a treatment pond to treat the discharge from the clarifier prior to discharge to the Makarewa River. The pond was called the "Loop".

Further ponds were formed in series in the mid-1970's to improve effluent quality. In 1976 a beef processing plant was opened at the Plant. That processing ceased in the 2001 season.

In 1983, one of the concrete tanks was converted to an Upflow Anaerobic Sludge Blanket (UASB) gas reactor. All waste that was previously separated out at the Plant and buried was put down the drains to the wastewater treatment plant in an effort to increase biogas production. This significantly increased the loadings to the wastewater treatment plant.

A milli-screening plant and DAF tank were installed upstream of the raw wastewater pump house in 1985. The new plant separated out fat and gross solids, which were pumped to one of the concrete tanks converted to a solids digester, with discharge back into the wastewater treatment system.

In the 1991-92 processing season, a 35kW aeration system was installed at the outlet of the Loop to improve wastewater quality.

3.3.2 Wastewater Treatment Plant Changes to Manage Odour

Between 1995 and 1997 the site had received a considerable number of complaints from the neighbours with respect to odour. Between 1997 and 1999, a comprehensive upgrade in the wastewater treatment system was undertaken to reduce odour emissions. These included:

- Decommissioning of the DAF tank and balance ponds 1-4;
- Conversion of the solids digester to an anaerobic clarifier;
- Waste minimisation and pre-treatment systems for the rendering plant and fellmongery;
- Desludging of the Loop;
- Installation of 315 kW of mechanical aeration into the Loop;
- Segregation of sulphide liquors and commissioning of sulphide oxidation[2] plant; and
- Diversion of sulphide-laden waste streams to the Loop pond[3].

[2] Which has been subsequently discontinued.

[3] Which has been subsequently discontinued.

3.3.3 Wastewater Sources and Characteristics

The wastewater flows and loads generated from the processing site are directly related to the Plant production rate. The main production season typically begins in late November and continues through to June or July.

The total annual production for the 2012-2013 season was 3 million lamb equivalents (LE)[4] over a 36 week period, whereas total production for the 2011-2012 season was 2.4 million LE. Alliance considers the 2012-2013 production was high relative to other seasons, and is unlikely to be exceeded on a regular basis in the future. A total annual production of 2.8 million LE has been utilised for the determination of the production of wastewater and consideration of treatment technologies[5].

Current peak kill tallies of the Plant are approximately 24,500 LE per day. This processing rate is the full-production capacity based on the normal shift length and with 7 chains operating each day made up of 4-chains during the day shift and 3-chains during the night shift.

When required, the duration of the day and night shifts can be increased to increase the full-production capacity to approximately 28,000 LE (extended peak).

There are seven main waste generation sources. These are:

- Edible processes in slaughter room and further processing (sticking bay, evisceration area, equipment and floor washes);
- Edible by-products processing (soup stock and tripe/casings);
- Non-edible by-products for rendering (stickwater, condensates, raw material bin leachate);
- Fellmongery (skin wash, salting area, lime wash, pickling liquors, floor washes);
- Stockyards and truckwash (faecal material and urine);
- Water treatment plant backwash; and
- Domestic sewage.

The following diagram (**Figure 3**) shows the processes that contribute to the wastewater generated at the Plant. In addition, it is noted that the Plant also has capacity to process the DAF solids generated from its Mataura Plant and at times it is necessary to do so.

4 Lamb equivalents – is an indicator of stock size comparative to a lamb. For example sheep are equivalent to approximately the size of 1.1 lambs, and cattle beasts are equivalent to approximately 16 lamb units.

5 If the annual production is however greater than this, it is noted that Alliance would still have to comply with the limits that are imposed via any consent.

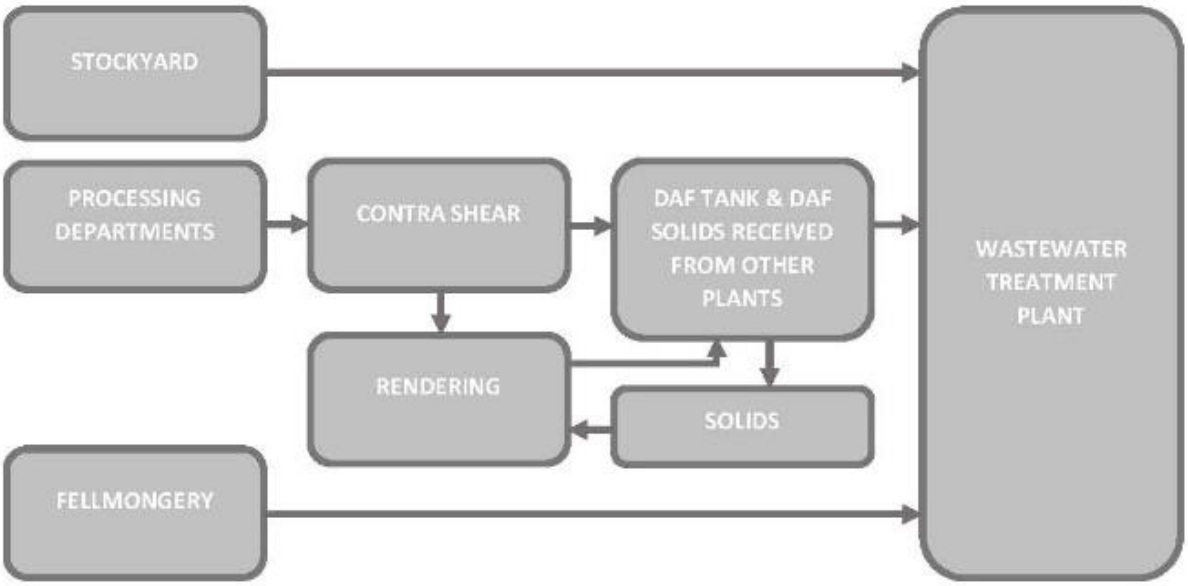


Figure 3: Contribution to Wastewater

At present the sheepyards slurry is disposed of directly to the wastewater treatment plant. However, it is noted that in 2009 a resource consent was granted allowing for the sheepyards slurry to be spread to approximately 100ha of the Lorneville farm. The activity has not yet extended beyond trials while a suitable method for the capture and storage of the material is developed.

3.3.4 Wastewater Volume

The typical peak processing wastewater actual volume is assessed at 17,100m^3/d, with extended peak processing increasing to 19,800m^3/d. Allowing for an additional 10% water use, the design flow of the current wastewater treatment process is assessed at 21,780m^3/d.

The existing resource consent enables a maximum discharge volume of 22,730 m^3/d. This includes sewage from site and Wallacetown and attenuated rainfall inputs into the lagoon based treatment system. Alliance seeks to maintain this volume. It is noted that Alliance can manage the outflow of the discharge so that it can occur on an intermittent basis taking into account river and flow conditions.

3.3.5 Existing Effluent Treatment Plant Description

Effluent is drained via gravity to the inlet works of the disused DAF plant. From the inlet works, the combined flow is conveyed via gravity to a lagoon-based wastewater treatment plant.

The existing treatment process consists of a series of seven lagoons constructed near the banks of the Makarewa River, covering a total area of approximately 25ha. These include an anaerobic lagoon, an aerobic lagoon aerated via mechanical aerators also referred to as the “Loop”, followed by five maturation ponds. Each of these lagoons is connected in series.

The majority of the treated wastewater is discharged to the Makarewa River, however, a small portion is discharged to land on occasions via an irrigation system. The irrigation area consists of an area of approximately 100ha of pasture within the Lorneville farm site. An additional area within the plant site is consented for disposal of sheep yard solids. This is currently undertaken on a limited basis.

The wastewater treatment system requires a low level of operator input and has a low energy demand in the form of electricity to operate the aerobic lagoon aerators. Further details of the existing treatment processes are provided below.

3.3.5.1 Preliminary and Primary Treatment

Within the Plant, solid material is extracted from a number of high-concentrated waste streams by mechanical milli-screening units, prior to being conveyed to a non-chemically assisted DAF unit.

A saveall structure at the fellmongery was once utilised for primary solids separation, however, this has since been bypassed in order to reduce localised odour issues.

3.3.5.2 Anaerobic Lagoon

Further removal of solids is provided by Anaerobic Lagoon 1 covering an area of approximately 1.9ha with an average depth of approximately 2.5m.

Wastewater enters Anaerobic Lagoon 1 through a channelised section approximately 50m long and 15m wide, which collects a significant quantity of fat and floatable material. Material is removed from this section of the lagoon by a mechanical excavator at the end of each processing season.

Floatable material has developed a crust that has built up over some years. Non-biodegradable material accumulates in the remainder of the lagoon volume, reducing its treatment capacity and are removed.

Accounting for some sludge accumulation in the lagoon and the crust volume, the hydraulic residence time (HRT) in the lagoon is estimated to be approximately 2 - 3 days.

Historical sampling and analysis has shown that removal efficiencies through the anaerobic lagoon include up to 95% removal of carbonaceous 5-day biochemical oxygen demand ($cBOD_5$), 85% removal of total suspended solids (TSS) and conversion of proteinaceous organic nitrogen to Amm-N. The lagoon has a crust cover, with no collection of biogas for flaring or energy recovery.

A second smaller anaerobic pond (Anaerobic Lagoon 2) is situated adjacent to Anaerobic Lagoon 1 and covers an area of approximately 1.0ha, but is currently not operational.

3.3.5.3 Aerated Lagoon

Effluent from Anaerobic Lagoon 1 is conveyed to a large shallow aerated lagoon. The total surface area of this lagoon is approximately 9.4ha and the average depth is approximately 1.2m for a total volume of approximately 110,000m^3, for an HRT of the order of 5 - 7 days. The aerated lagoon was formed by realigning a section of the river, which is often referred to as the "Loop".

The aerated lagoon is installed with floating mechanical axial flow type aerators with a combined capacity of 300kW, although only 175 - 190kW of aeration is typically utilised.

The aerobic lagoon provides for further $cBOD_5$ removal; with minimal oxidation of nitrogen. This is expected given the limited aeration/mixing energy provided to the extent of the lagoon, with the result that biological nitrogen utilising bacteria (nitrifying bacteria) will not be kept in suspension and will instead settle to the bottom of the lagoon where their growth cannot be maintained. There is also no separation of solids from the Aerated Lagoon effluent to maintain populations of nitrifying bacteria.

3.3.5.4 Maturation Ponds

Effluent from the aerobic lagoon passes through a series of five maturation ponds with a combined surface area of approximately 13.4ha.

These ponds rely on natural processes for the diffusion of air via the water surface, and also algal growth to provide oxygen via photosynthesis. The performances of these natural processes are highly vulnerable to climatic variables such as temperature, sunshine hours and wind velocity.

These ponds may assist with some further microbial reduction, however, historical sampling and analysis has shown little improvement in NH_4-N and suspended solids concentrations in the effluent quality downstream of the maturation ponds. It is likely that the maturation ponds have a negative impact on suspended solids concentrations and *E.coli* levels at certain times of year due to algal growth and water fowl. The water level in these ponds can be varied to provide storage when conditions in the Makarewa River limit discharge of treated effluent.

It is important to ensure that the pond systems (Pond 1 in particular) do not have excessive sludge build up and periodic de-sludging operations occur during winter months when the sludge layer is relatively inactive and has a low level of odour.

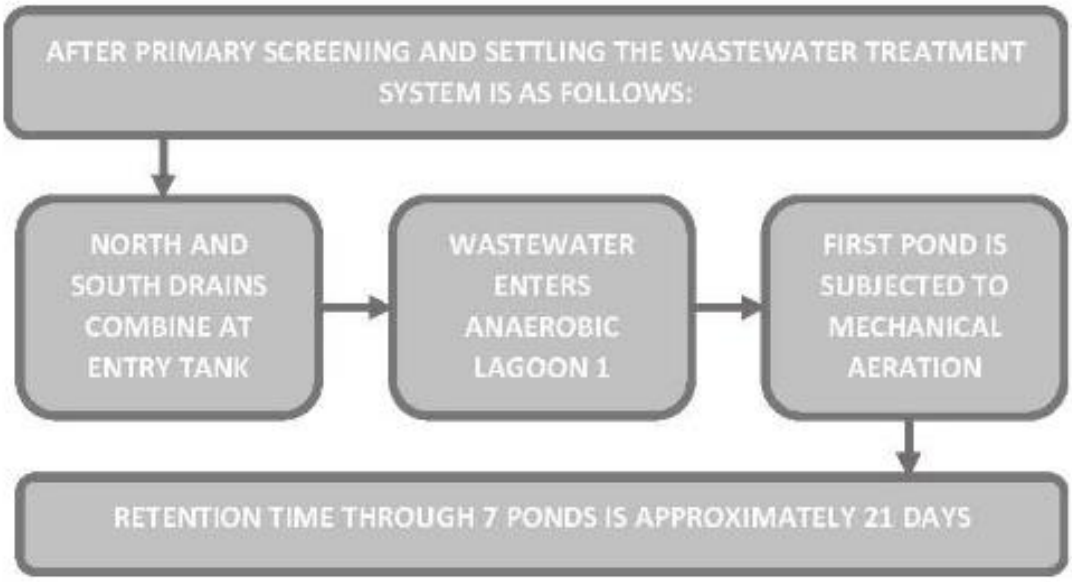


Figure 4: Systematic diagram of the wastewater treatment process at the Plant

3.3.6 Disposal of Treated Wastewater

Under the current treatment system there are two methods of discharging treated wastewater:

- Discharge to the Makarewa River; and
- Up to 3000m^3/day may be discharged onto farm land owned by the Alliance. Approximately 100ha of land area is available for irrigation purposes. Discharge is accomplished via a K-line pod irrigation system. Restrictions on the quantities able to be discharged via irrigation are mainly focused on Nitrogen loadings and soil conditions.

3.3.7 Existing Wastewater Discharge Quality and Characteristics

Alliance discharges treated wastewater from the Plant and Wallacetown into the Makarewa River approximately 4.4km downstream of the Wallacetown-Lorneville Highway Bridge and 5km upstream of the confluence between the Makarewa and Oreti Rivers. This confluence is approximately 14km upstream of the New River Estuary (refer to **Figure 5**).

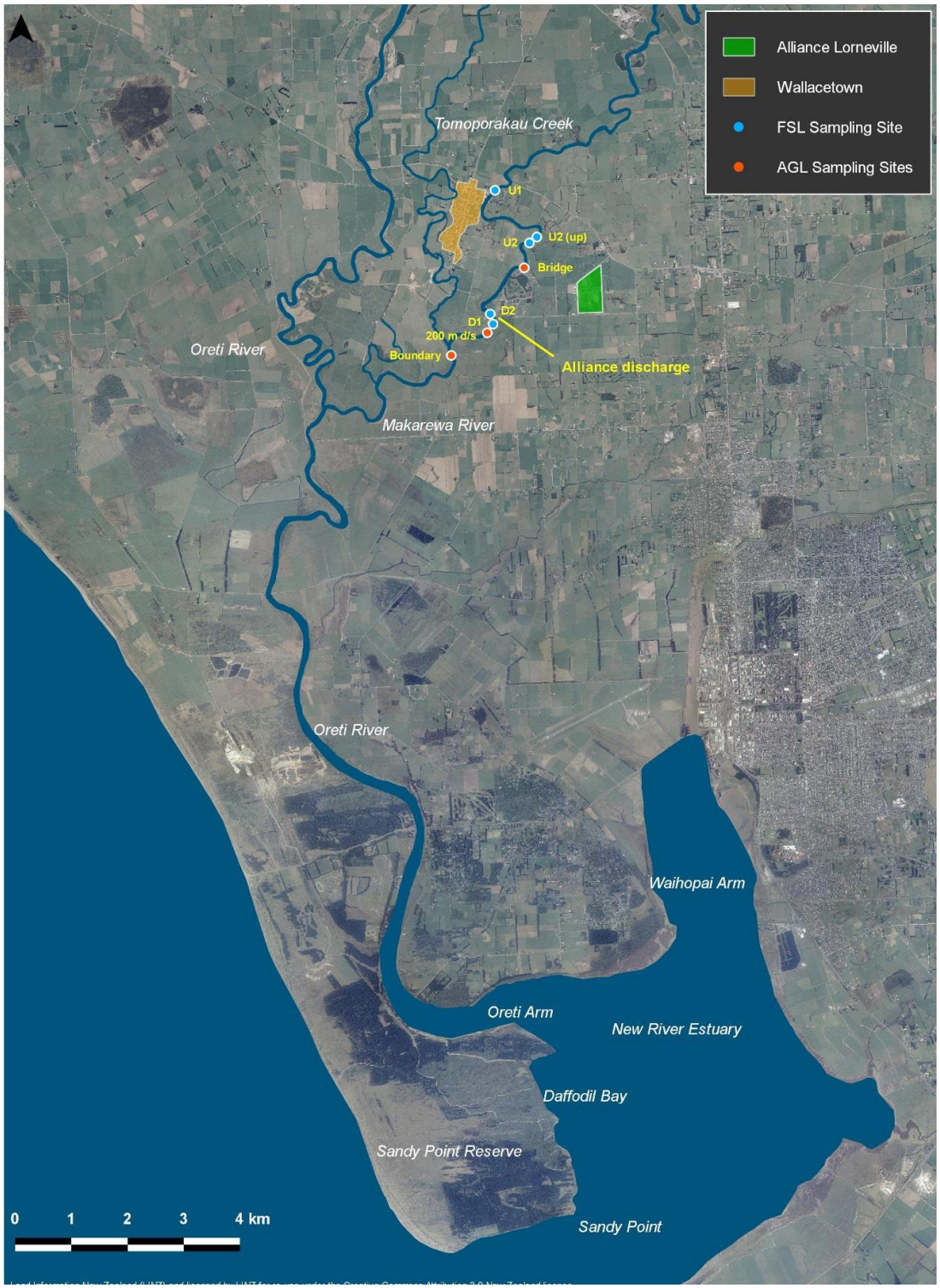


Figure 5: Aerial map of lower Makarewa River, Oreti River and the New River Estuary showing the locations of the discharge and sampling sites.

Typically, treated wastewater discharges from the Plant start two weeks after commencement of the processing season, once levels in the treatment pond have increased. Alliance manages the discharge to comply with the existing resource consent conditions and Plant discharge volumes have been below the consent limit on all occasions between December 2001 and June 2014. Other discharge parameters (ie. contaminant limits for this same sampling period (2001

– 2014[6])) are summarised in **Table 4** below and discussed in further detail later in this report.

Table 4: Median discharge concentration characteristics at the Plant

Characteristic	Median discharge concentration
Biochemical oxygen demand concentration	16 g/m^3
Biochemical oxygen demand load	120 kg/day
Faecal coliform concentration	3,100 MPN/100mL
Faecal coliform load	4.5 x 10^{11} MPN/day
Escherichia coli concentration	2,400 cfu/100mL
Escherichia coli load	3.6 x 10^{11} cfu/day

3.3.8 Mixing Zone

Mixing of the discharge in the Makarewa River is dependent on the flow in the river and the tidal conditions at the time of discharge. This is discussed in further detail later in this report. At high tide, the tidal influence in the river means that flows in the river are travelling upstream at the point of discharge. The mixing characteristics are summarised in **Table 5** below.

Table 5: Mixing Characteristics at the Makarewa River discharge point

River Flow and Tidal Characteristic	Mixing Zone
Low river flows and near low tide	The discharge is well mixed transversely at the river surface 200m downstream of the discharge point.
Low river flow and near high tide	The mixing zone extends from 250m upstream of the discharge to 200m downstream of the discharge. The discharge is well mixed transversally at the river surface and vertically beyond these points.

6 With the exception of *E.coli* which has a two year sampling period.

3.3.9 Treated Wastewater to Land – Irrigation

As noted above, treated wastewater can also be disposed of to land using a 'K-Line" irrigation system with a low (5mm/hour) application rate. The wastewater irrigation occurs over a period of approximately 50 days each season, and this occurs during the summer and early winter period.

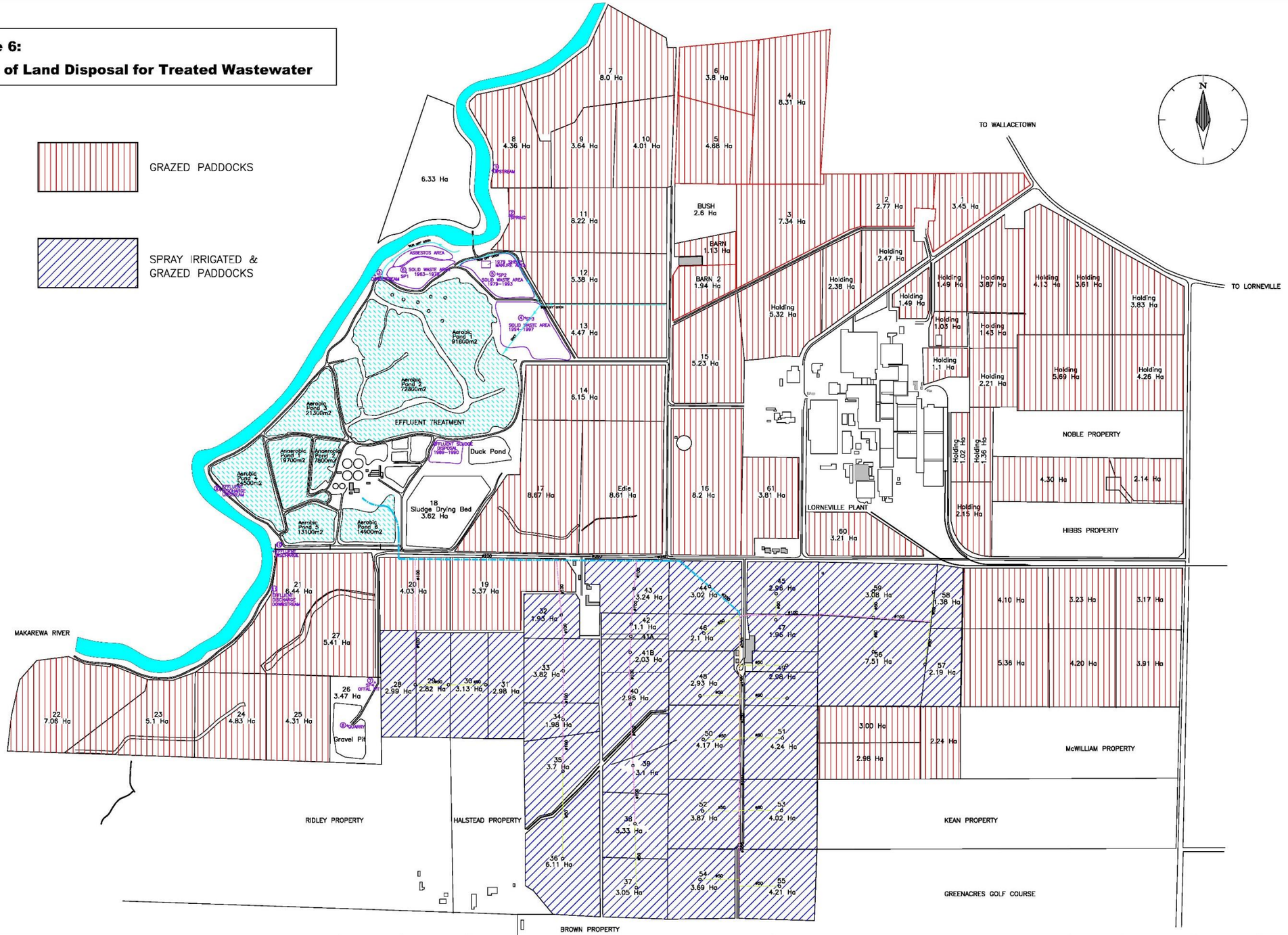
The land that is used for wastewater irrigation is located on the south side of Crowe Road, adjacent to the plant as shown in **Figure 6** below.

The discharge of treated wastewater to land via irrigation occurs when the soil and weather conditions are suitable (usually during dry weather and soil conditions), and is utilised in order to reduce the amount of treated effluent entering the Makarewa River. The treated effluent also serves a dual purpose in that it provides a source of fertiliser for the farmland owned by Alliance.

Figure 6:
Areas of Land Disposal for Treated Wastewater

GRAZED PADDOCKS

SPRAY IRRIGATED & GRAZED PADDOCKS



REV	REVISION AMENDMENTS	SIGNATURE	DATE
A	DUMP SITES & SAMPLING POINTS ADDED	BARRY STEWART	7 MARCH 2000

Alliance Group Project Engineering
P.O. BOX 1410, INVERCARGILL, NEW ZEALAND
Telephone: (03) 215-6400 Fax: (03) 215-6401

FARM LAYOUT & SITE PLAN

TOTAL AREA approx 463 Ha

PLANT : LORNEVILLE

DESIGNED		SHEET	1
DRAWN	ALAN CHAMPION		
CHECKED			
DATE	JUNE 1993	TOTAL NUMBER OF SHEETS	1
SCALE	1:5000 approx		

DRAWING No: 2000/2510 REV: A

P:\CAD\Lornell\FARM & SITE\FARM LAYOUT.dwg, 27/09/2013 2:33:56 p.m., 1439529

3.3.10 Temporary Storage

Alliance manages the treated effluent discharge to ensure it complies with its existing consent conditions (202347) and at times of low river flow during summer months, Alliance is able to reduce or occasionally hold the discharge for periods of up to 15 days. During extended periods of extreme drought and very low river flow, resource consent 202347 allows Alliance to discharge treated effluent to land for temporary storage purposes. Alliance has not had to utilise this emergency storage area in the past 13 years of operation, however it is important to have the ability to do so during extreme drought, when farmers may be forced to de-stock their farms and for animal welfare reasons stock must be slaughtered.

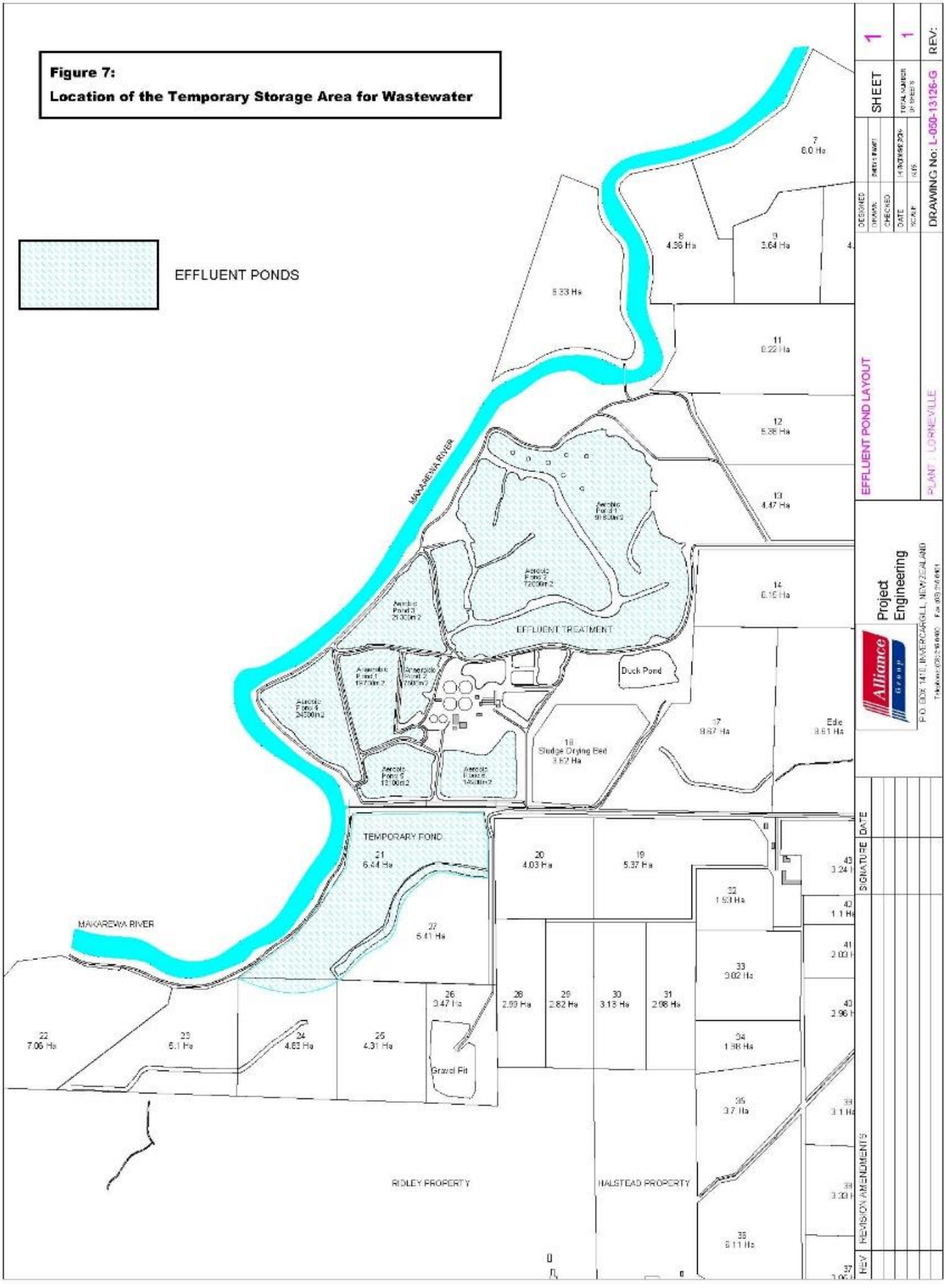
During such circumstances, the treated wastewater would be discharged from Aerobic Pond 5 to a storage area, where it would be retained until it can be discharged to the Makarewa River later in the processing season. It is intended that this activity will only occur when the conditions in the Makarewa River have limited the discharge to such an extent that the use of the storage area is deemed to be a precautionary measure.

The site of the temporary storage area is shown in **Figure 7** below and has an area of approximately 8.3ha. If filled to a depth of 1.0 metre this represents storage of 83,000m^3 and at the peak rates of production of wastewater could store about 5 days of total wastewater production. When discharge is reduced, rather than stopped to avoid adverse effects on the river, it is anticipated that this storage will extend production by approximately 10 days.

Wastewater could be stored in the temporary storage area for up to 3 months depending on river flows and meat processing levels. The duration of storage in any one event will not exceed 3 months and will not occur more than once in any one processing season. Environment Southland and immediate neighbours will be notified prior to the filling of the area. Wastewater will be discharged to the temporary storage area by gravity flow via a pipeline from Pond 5 at a maximum rate of 9,000m^3/day.

The level of wastewater in the temporary storage area will be maintained at least 300mm below the crest of all banks to ensure that no overtopping results from any sustained heavy rainfalls. The wastewater stored in the temporary area will be discharged back into Pond 5 and then into the Makarewa River when river conditions are appropriate.

Figure 7:
Location of the Temporary Storage Area for Wastewater



3.4 AIR DISCHARGES

As described earlier in this report, consent is also being sought for the discharge of contaminants and odour to air arising from key activities and processes operating at the Plant. The discharges to air arise predominately from the use of the two coal fired boilers, and from odour from various processes and activities on-site. These activities are described in more detail below. Ancillary and minor air discharges from the Plant include the incineration of trade wastes in a specifically designated concrete area within the site.

3.4.1 Coal Fired Boilers

The boilers produce hot exhaust air streams containing combustion products and particulates. The latter arise due to a wide range of processes including fly ash carry over, un-combusted carbon (soot), and from the condensation of un-combusted organic volatiles. The boilers operate at varying rates throughout the day and year, but are consistently used during the peak processing season, and periodically during the off season.

The main portion of the exhaust consists of nitrogen (N_2) and residual oxygen (O_2) from the combustion air. The primary products of combustion include carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and water vapour. There is also a range of products of incomplete combustion (PICs) that mainly include volatile organic compounds (VOCs), carbon monoxide (CO), nitrogen oxide (NO) and nitrous oxide (N_2O).

The condensation of VOCs within the boiler stack and un-burnt carbon particulates (soot) are a key source of fine respirable particulate ($PM_{2.5}$), whereas PM_{10} and larger suspended particulates (SP) are derived from these sources as well as larger fractions of fine fly ash and coal fines. VOCs also include trace levels of poly aromatic hydrocarbons and dioxin like compounds.

The metal and mineral composition of coal also results in trace levels of various heavy metals being discharged, mainly in association with particulate emissions, although, a significant proportion of metals (other than mercury) are captured in the recovered fly ash. Mercury is volatile and mostly discharges with the exhaust air as either a gas or as a condensed component of the particulate emissions.

Given the above, the primary air pollutant impacts that have been assessed and described later in this report include SO_2, PM_{10}, NO_2, mercury, chromium, lead, arsenic and dioxins/furans.

3.4.2 Odours

A number of the Plant processes could potentially generate odours. The main sources of potential odour could arise from:

- Stockyards
- Soup Stock
- Wool Hydrolysing
- Blood processing

- Rendering
- Fellmongery
- Wastewater

3.4.2.1 Stockyards

Sheep and bobby calves are delivered to yards for housing prior to processing. The yards are raised with urine and faeces dropping through grating to a collection area where they can be periodically hosed down towards a sump prior to discharging to the wastewater treatment facility via the southern discharge drain. Solids can be scraped out and discharged to land. Yards have a distinct odour which is similar to that associated with farm woolsheds. The odour is due to the animal's urine and faeces and the sheep themselves have a distinct smell. The dominating compounds of the odour are ammonia, amines and other nitrogen related compounds. A characteristic feature of these types of odours is that they tend to rapidly reduce in intensity as they disperse and dilute in the atmosphere.

3.4.2.2 Soup Stock

During the processing season the soup stock facility processes 100 – 140 tonnes/week of fresh beef bones from other sites into soup stock, edible tallow and bagged bone meal. This batch process involves cooking the bones in one or two digesters (effectively large pressure cookers). The cooked bones are dried, milled and then bagged. The liquid extract is split into tallow and bone extract. The bone extract is concentrated through two evaporators and a finisher before being put into tubs as concentrated liquid stock product.

The digesters emit gases during different parts of the cooking cycle. These are condensed and discharged via a roof vent. At the end of the cooking process, steamy emissions are released when the digesters are opened for the manual removal of bones into the covered screw conveyor. These are also extracted and discharged via roof vents.

Where there are steamy discharges from the bone meal and liquid processes, extraction hoods are installed and the discharge is vented from the building via roof vents. Dust from the dried bone meal mill area is also discharged via a separate vent.

The odour associated with the discharge from the soup stock processes has a relatively neutral character consistent with beef stock being cooked. During on-site investigations this odour was not noticeable, except immediately adjacent to the facility during the bone meal removal from the digesters. As such, it is unlikely that this activity will generate odour effects beyond the boundary of the site.

3.4.2.3 Wool Hydrolysing

The site operates two hydrolysers; one batch and one continuous. These remove wool from head, hocks and skin pieces received from the fellmongery process before these are sent to the rendering plant. The hydrolysers' exhaust gases that are discharged to the coal fired boiler house for odour destruction via combustion.

This is achieved by mixing the hydrolyser stream with the inlet primary combustion air stream to the boilers. The odour associated with the periodic discharge from the hydrolysers has a distinct character, however during downwind assessments this odour was not recognisable. Therefore it is unlikely to be generating odour effects beyond the boundary of the site.

3.4.2.4 Blood Processing

Blood generated at the Plant, as well as that received in bins from Makarewa's venison processing plant, is processed into meal. The process involves the collection of blood from the slaughterboard and storage in a tank before processing. Processing consists of in-line coagulation with steam, a cooling stage, then decanting to produce a wet solid for drying, followed by screening and bagging of the dried product. The odour from the drying process generates a wet exhaust airstream that contains odorous organic volatile compounds. This exhaust stream is cooled by a water jacket heat exchanger and the resultant non-condensable air stream is relatively odorous, especially if the blood has been stored for longer than a day. The odorous non-condensable air stream is extracted to the coal fired boiler house for odour destruction via combustion.

3.4.2.5 Rendering

Historically, the Batch Iwell method of rendering the Plant's waste animal by-products was a source of off-site odours. In 2012, a new low temperature rendering plant was installed and during the commissioning phase this new plant also caused off-site odours. This was due to operational errors, and as the new equipment and technology has become more familiar, staff are now successfully operating the rendering plant with its odour control system effectively working as designed.

There are two raw material reception systems at the site. Ovine rendering material that is generated at the Plant is directed to the rendering plant raw material reception system. Raw materials are also brought in from off-site (via truck) and unloaded at the off-site raw material reception building. The on-site raw material is ground and then pumped to the ovine material bin within the rendering plant. The off-site raw material is ground, then pumped to either the ovine or bovine material bins within the rendering plant. The transfer of solid rendering materials from the raw material bins and successive rendering processing stages (cooking, drying and milling) is undertaken by using enclosed screw conveyors.

The receipt and storage of raw material associated with the rendering plant has the potential to generate odours. The transfer of material along the conveyors is also a potential odour source, and without air extraction and containment of air from these conveyors the cooked offal odour emissions could be significant. The tallow recovery process could also produce odours.

The most significant potential odour source from the rendering process is the production of exhaust air from the solids drying stage. The exhaust air stream undergoes a pre-cooling and condensing stage via the waste heat evaporation plant. The effective condensing of vapour within the waste heat evaporation plant

is important to ensure an adequate vacuum is applied to the dryer exhaust and to ensure adequate pre-cooling. The resultant non-condensable gases are pulled to the waste heat evaporation plant and further cooled by the rendering plant's concentrated source extraction and cooling system.

3.4.2.6 Fellmongery

The fellmongery plant typically processes 24,500 fresh skins per day from the Plant and on occasions salted skins from other Alliance plants, covering both the day and night shifts. During the off season, the site can on infrequent occasions receive salted skins from other sites. These are washed and processed.

The fellmongery plant includes ten rotary drums for processing slats into pickled pelts for export, and other equipment for skin washing, wool removal, wool drying, salting of pelts, grading and dispatch. The resulting products are green or salted skins, pickled pelts and slipe wool.

Discharges to air from the skin processing operations are by way of both natural and forced ventilation and include hydrogen sulphide and ammonia type odour. The discharged lime bearing liquors have the potential to discharge hydrogen sulphide when these streams mix with acidified wastewater streams that are also discharged from the fellmongery. This odour is expected to emanate mainly from the wastewater drains where spent fellmongery liquors are discharged and to a lesser extent from the venting to atmosphere of air extracted from the processing drums.

3.4.2.7 Wastewater

The on-site wastewater treatment facility, described above, also has the potential to generate odours. The existing wastewater treatment facility has an initial anaerobic pond stage which removes in excess of 80% of the inlet organic material. This is followed by treatment within mechanically, then naturally, aerated ponds before discharging to the Makarewa River via the Boiler Ditch. The Boiler Ditch emerges from a pipe just to the west of Boyle Road. The ditch flows past the southern edge of the wastewater treatment ponds before discharging into the Makarewa River. Treated water from the wastewater treatment ponds is discharged into the Boiler Ditch from the two southern most ponds.

The anaerobic pond is considered to be the largest source of odour from the site and is the first biological treatment process stage of the wastewater treatment plant. The pond is partially covered in grass, and the remainder has a substantial fat layer. The abovementioned commissioning problems associated with the new rendering plant resulted in high organic loadings which resulted in a disturbed surface of the anaerobic pond. This resulted in increased odour discharges early in the 2013 season. The aerobic pond "loop" area includes a number of aerators and these may also result in odour discharges.

3.5 WATER ABSTRACTION

Access to a reliable water source is critical for the efficient and effective operation of the Plant. Water is an integral component of many of the activities undertaken on-site and a sufficient quantum needs to be available, particularly when demand for processing is high (November – May). Water abstraction varies and is largely reflective of processing demand, the daily abstractions records for the Plant range from 0 to 18,743 m^3/s/day (217 L/s). It is noted however that Alliance is seeking consent to abstract up to 22,500m^3/s/day. This volume (and the additional abstraction from the Makarewa River) is reflective of the processing capacity of the Plant, and needs to be available should demand reach these volumes.

Alliance's abstraction is also not currently subject to a minimum flow cessation. A continued water supply is critical to the functioning of the Plant, and an obligation to stop abstraction will jeopardise the welfare of stock, particularly when demand for processing is high (due to prolonged drought periods for example). There is however a requirement to introduce water conservation measures when flows become low in the river at the Wallacetown water level recorder. As a response, there is an obligation within Alliance's existing consent (203358) to prepare a low flow contingency plan. This plan requires that initial water conservation measures commence at low flow trigger levels of 4.2m^3/s and further measures are implemented when flows reach 3.3m^3/s in the Oreti River. It is noted that these flow triggers were originally derived as 50% and 39% of the 7 day average mean annual low flow (7DMALF) at the time the existing consent (203358) was granted. The 7DMALF has since changed (decreased) in the Oreti River, however Alliance will continue to implement the conservations measures at the trigger levels specified in its existing Plan.

4. RECENT AND PLANNED PLANT UPGRADES

Over the past ten years Alliance has undertaken a number of investigations and studies in relation to its on-site discharges to water, land and air in order to identify improvement options. As part of its re-consenting programme, Alliance has commissioned a number of further comprehensive investigations. As a result of these past and present investigations, Alliance has already initiated a number of Plant upgrades in order to improve the quality of its discharges to water and air. These recent Plant upgrades are described below.

As described later in this report, the assessments undertaken in the preparation of this resource consent application outline a number of Plant upgrades which also emerge from the recommended mitigation. These upgrades are described in detail in sections 7 and 8 of this report, but are described here as some trigger additional consenting requirements. The upgrades are comprehensive and will deliver significant improvements to the quality of discharges from the Plant. They will ensure Alliance meets its obligations with respect to adopting the best practicable option and complies with national and regulatory statutory requirements.

4.1 RECENT PLANT UPGRADES - WASTEWATER TREATMENT FACILITY

One of the key issues for the wastewater discharge is the management of nitrogen, especially ammoniacal nitrogen released into the receiving water environment after passing through the wastewater treatment plant. In order to reduce the nitrogen being discharged, Alliance has investigated the sources of nitrogen in the waste streams generated from its processing operations. In general terms, the waste streams from casings, stockyards, lime wash, soup stock, and the raw material bins contribute to 25% of the total daily volume of the discharge, but contribute to 75% of the nitrogen load. Within these waste streams, it was identified that separation and further treatment using another DAF unit could reduce the nitrogen loads. In late 2014, an upgrade for the primary wastewater treatment system was installed. This included the installation of a new screen, an additional mini0DAF plant and the reconfiguration of the existing solids dewatering system. The estimated nitrogen reduction from improvements in the primary treatment as part of this upgrade is expected to be between 10 – 20%. This upgrade is also anticipated to significantly reduce the odour generation potential within the anaerobic pond by BOD reduction.

4.2 RECENT PLANT UPGRADES – ODOUR CONTROL

As noted above, a new rendering plant was installed in 2012. This modern facility is equipped with state of the art technology to minimise odours. An assessment undertaken by Golder Associates, and summarised in the report attached as **Appendix G**, describes the rendering plant's odour control facility as being one of the best examples that exists in Australasia, and as the best system operated in New Zealand by any rendering facility.

As part of on-site investigations into potential odour sources, Golder Associates identified that odour discharges from the fellmongery process could be improved by making some changes to onsite operational procedures. It was identified that the release of hydrogen sulphide from the wastewater reticulation system is a main source of odour from the fellmongery, particularly on a Monday morning when a number of process drums, which have been stored over the weekend, have liquors simultaneously discharged to the drain over a short period of time. Golder Associates considered that the events of elevated hydrogen sulphide odours (rotten egg type odour) occurring on a Monday morning could be mitigated by staggering the discharge of the process drums to the drain. This procedural change has been implemented on-site and the anecdotal evidence from site management indicates this change has been successful in eliminating these events of elevated hydrogen sulphide odours occurring from the fellmongery area on a Monday morning.

4.3 RECENT PLANT UPGRADES – BOILERS

Historical testing of the two coal fired boilers' in-stack particulate concentrations showed relatively high particulate concentrations especially within CFB2. Stack testing results indicated flow averaged PM_{10} concentrations in the discharge to be close to 400mg/m^3. To address this issue, Alliance installed a new multi-clone grit system on CFB2. Subsequent stack testing undertaken in February 2015 includes that the flow average PM_{10} discharge concentration from CFB1 and 2 is less than 300mg/m^3 (corrected to 12 vol. % CO_2 and dry basis).

4.4 PLANNED UPGRADES

4.4.1 Outfall Improvements

As part of the water quality investigations undertaken by Alliance, foams in and around the discharge point into the Makarewa River have been observed. As part of its water quality monitoring programme, observations as to the presence of foams has been made. The written observations record whether foam is present at the discharge point, and whether it is also present upstream and downstream of the site. Usually when foam is present at the discharge point, it is also present upstream, however a potential contributor to the foam generation has been identified as being the design of the current pond discharge and outfall structures. Alliance has investigated this and amendments to the design of the pipe and outfall structures into the Boiler Ditch from Ponds 5 and 6 in order to reduce the likelihood of foams resulting from the physical discharge into the river have been identified. The modifications to the pond outfall structures are shown on the plans attached as **Appendix H**.

4.4.2 Wastewater

Based on the assessment of effects of the wastewater discharge on the Makarewa River, and the water quality parameters and bottom lines established by the national and regional regulatory regime in which the Plant operates, Alliance has undertaken further assessments in order to establish the best practicable option for the upgrading of the wastewater treatment facility. Based on the identification of nitrogen, specifically ammoniacal nitrogen, as the key

constraint for the site with respect to continued and long term discharges to the Makarewa River, a number of wastewater treatment options and disposal options were considered. The options included land treatment and a range of on-site wastewater treatment processes. In addition to these treatment options, Alliance has also considered, and as noted above, implemented other strategies in order to minimise and improve its waste generation and disposal. A detailed description of the technology and options that have been considered and assessed by Alliance is contained in the report attached as **Appendix I**, and is discussed in further detail in sections 7 – 9 of this report.

The preferred and best practicable option (refer section 9 of this report) is the flow separation of nitrogenous waste streams contributing to around 25% of the Plant's wastewater volume, but contributing to in excess of 75% of the nitrogen load. A parallel wastewater treatment system that would include fully covered anaerobic reactor with biogas management, biological nitrogen removal reactor would be operated as an activated sludge plant and a clarifier. The upgrade could also include provision for phosphorous and microbial disinfection, if required.

The proposed wastewater upgrade will generate biosolids and the disposal of these biosolids to land is the preferred approach. Under this approach, land would no longer be utilised for wastewater disposal (ie. via irrigation), and discharge of all (higher quality) wastewater would be to the Makarewa River. Biosolids generated by the upgraded treatment system would be dewatered and then disposed of onto land at sustainable nitrogen loading rates to ensure that the nutrients are utilised on the grazed pastoral lands surrounding the Plant.

The solid waste generated by the upgraded wastewater system is likely to include:

- Anaerobic lagoon solids removed on an infrequent basis;
- Waste activated sludge (WAS) will be generated from the treatment system and will need to be removed and disposed of on a daily basis in order to maintain the efficiency of the BNR treatment system; and,
- Stockyard solids generated on a daily basis.

Characterisation of biosolids likely to be generated from the upgraded wastewater treatment plant is currently unavailable. However, site processes at Alliance's Pukeuri Plant in North Otago are similar to those at the Lorneville Plant, and the biological wastewater treatment process is also similar to that which is proposed at the Lorneville Plant. The expected characteristics of the biosolids generated have been derived from sampling and analysis of Alliance's Pukeuri Plant biosolids. The nutrient elements consist of nitrogen, sulphur, phosphorous, potassium, calcium and magnesium, and are considered beneficial for plant growth. However, some can be regarded as contaminants if lost from the soil as runoff or leaching to waterways and groundwater. Nitrogen is the key element in this regard.

The ratio of N:P:K within the biosolids is anticipated to be approximately 7:1.5:1, and therefore it is recommended that the biosolid loading rate should be limited by the nitrogen load, which is typically the case for biosolid applications. The

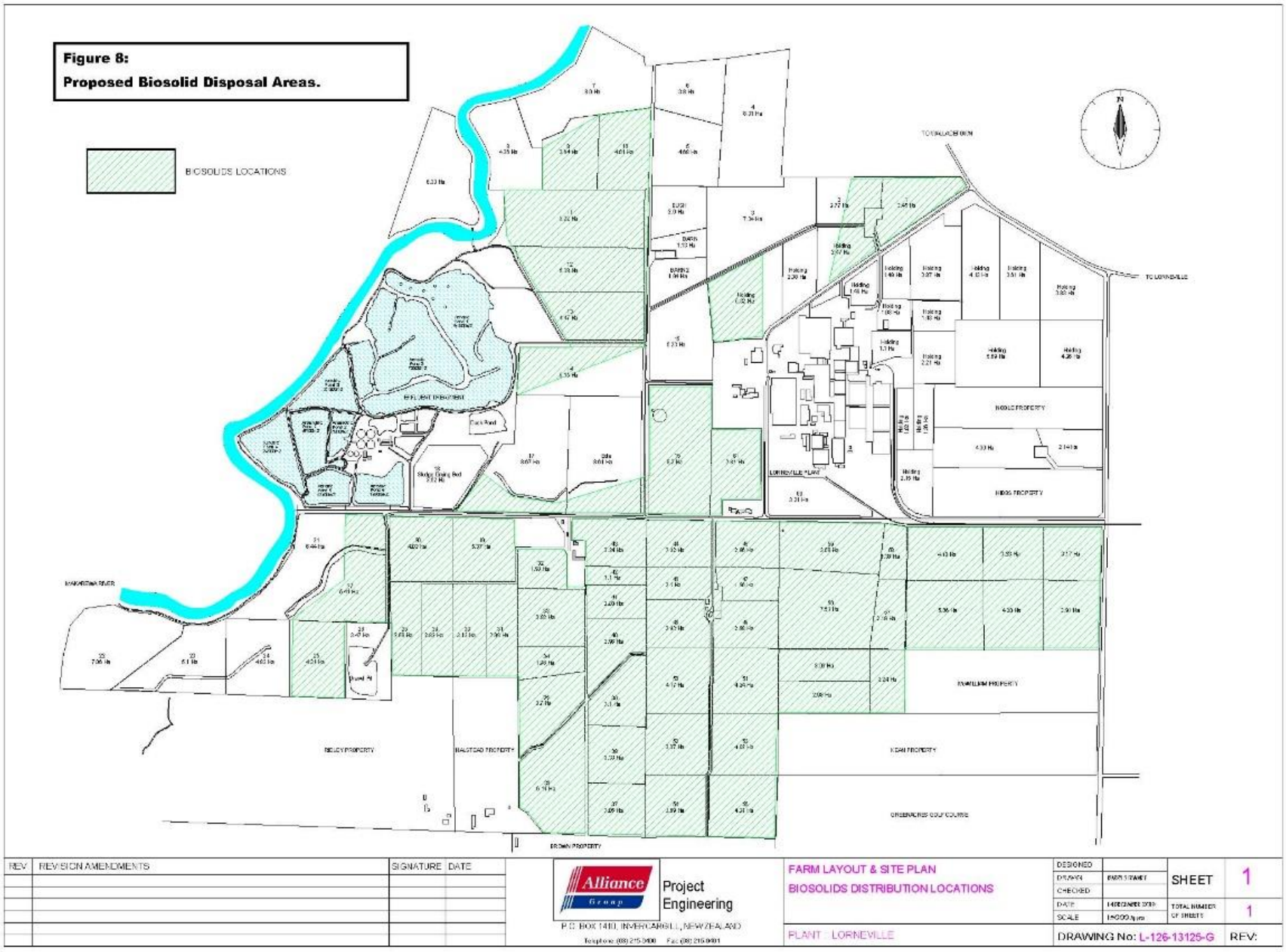
proposed loading rate that has been developed for the site-specific application of biosolids at the Plant is 250kg total-N/ha/yr (140kg Plant Available Nitrogen (PAN) /ha/yr. The rationale for this limit is set out in the report attached as **Appendix J.** Section 7 of this report provides an assessment of the effects of this nitrogen loading rate on the receiving environment. The area of the proposed biosolids to land is shown in **Figure 8** below.

It is noted that once the wastewater treatment upgrade is complete and the discharge of biosolids to land becomes a necessary component, the discharge of irrigated wastewater will no longer be required, and this consent will be relinquished.

On occasion, the ability to dispose of biosolids to land may become limited due to rainfall resulting in saturated soil conditions, or conversely when the farmland is required to hold large numbers of overflow stock when farmers are destocking their land as a result of drought. During these periods, Alliance needs to provide for either temporary field storage of biosolids or secure disposal to an off-site landfill. Having assessed the implications for landfilling at a regional landfill, Alliance has concluded that it has capacity available in parts of its existing redundant wastewater treatment system that could be converted to dedicated field storage of biosolids, or for permanent placement of biosolids in nominated cells (ponds).

In addition, Alliance is progressing to separate the stockyard solids (sheep manure as consented by 206363) so that the material can either be composted off-site or also be disposed of on-site to land. Alliance is also proposing to utilise capacity available in its existing wastewater treatment system for the disposal of dewatered stockyard solids.

Figure 8:
Proposed Biosolid Disposal Areas.



REV	REVISION AMENDMENTS	SIGNATURE	DATE

Alliance Group Project Engineering
P.O. BOX 1410, INVERCARGILL, NEW ZEALAND
Telephone: (03) 215-0400 Fax: (03) 215-0401

FARM LAYOUT & SITE PLAN
BIOSOLIDS DISTRIBUTION LOCATIONS

PLANT : LORNEVILLE

DESIGNED		SHEET	1
DRAWN	BARRY STEWART		
CHECKED			
DATE	14 DECEMBER 2010	TOTAL NUMBER OF SHEETS	1
SCALE	1:40000 @ A3		

DRAWING No: L-126-13125-G REV:

mitchell partnerships

To allow for an alternative biosolids disposal site when farm operations or wet weather conditions prevent land disposal, it is proposed that a biosolids monofill will operate as a contingency disposal method. It is proposed that the biosolids monofill will utilise the existing redundant treatment ponds. The proposed monofill will only receive solids produced at the site from the stockyards and WAS from the biological treatment system once this is operational. Based on the anticipated WAS and stockyard solids production rates, and assuming that 20% of biosolids generated on an annual basis will be monofilled as a contingency measure, the annual and peak gross biosolids load destined to monofill each year is set out in the table below (**Table 6**):

Table 6: Annual and peak gross biosolids load to monofill per year.

Parameter	Unit	Waste Activated Sludge	Stockyard Solids
Solids Concentration	(% DS)	18	25
Solids Deposition (wet)	(t/yr)	780	220
Peak Solids Deposition (wet)	(t/d)	45	11

The total capacity of the ponds for monofill disposal is 18,800m^3. Based on 20% of the annual biosolids being diverted to the monofill, the capacity of the monofill cells is likely to be exhausted at around 15 – 20 years. A conservative estimate of the active service life of the monofill is therefore deemed to be in the order of 15 years. This active service life is adequate in the context of the 35 year duration of consents being applied for as the monofill will only be required once the wastewater upgrade has been commissioned.

5. STATUTORY CONTEXT

5.1 INTRODUCTION

When making a determination on a resource consent under the RMA a consent authority is required to give consideration to a number of national, regional and district level statutory documents.

The following chapter provides a brief analysis of the main statutory considerations of relevance to the application. An analysis of the applications against these provisions is provided in section 10 of this report.

5.2 RESOURCE MANAGEMENT ACT 1991

5.2.1 Purpose and Principles of the RMA

The RMA is the principal guiding statutory document governing the use of land, air and water. Part 2 of the RMA is comprised of sections 5 to 8 which outline the purpose and principles of the RMA. Section 5 states that:

> ***5 Purpose***
>
> *(1) The purpose of this Act is to promote the sustainable management of natural and physical resources*
>
> *(2) In this Act, sustainable management means managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while:*
>
> *(a) Sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
>
> *(b) Safeguarding the life supporting capacity of air, water, soil and ecosystems; and*
>
> *(c) Avoiding, remedying, or mitigating any adverse effects of activities on the environment.*

The method of applying section 5 therefore involves an overall broad judgement which allows for the comparison of conflicting considerations, the scale of the activities and their relative significance or proportion in the final outcome.

Sections 6, 7 and 8 of the RMA set out the principles to be applied in achieving the purpose of the Act. Section 6 outlines the matters of national importance that all persons exercising functions and powers under the RMA must recognise and provide for when managing the use, development and protection of natural and physical resources. These include:

> *(a) the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development;*
>
> *(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:*

(c) *the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:*

(d) *the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:*

(e) *the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:*

(f) *the protection of historic heritage from inappropriate subdivision, use, and development:*

(g) *the protection of protected customary rights.*

Section 7 of the Act outlines the other matters that all persons exercising functions and powers under the Act shall have particular regard to, including:

"(a) kaitiakitanga:

(aa) the ethic of stewardship:

(b) the efficient use and development of natural and physical resources:

(ba) the efficiency of the end use of energy:

(c) the maintenance and enhancement of amenity values:

(d) intrinsic values of ecosystems:

(e) [Repealed]

(f) maintenance and enhancement of the quality of the environment:

(g) any finite characteristics of natural and physical resources:

(h) the protection of the habitat of trout and salmon:

(i) the effects of climate change:

(j) the benefits to be derived from the use and development of renewable energy."

Section 8 of the Act states that all persons exercising functions and powers under the Act shall take into account the principles of the Treaty of Waitangi.

It is important to note that the principles contained in Sections 6, 7 and 8 of the RMA are subordinate to the overall purpose of the Act. Each plays a part in the overall consideration of whether the purpose of the Act has been achieved in a particular situation. These matters are not an end in themselves but are an accessory to the principal purpose.

5.2.2 Part 3 Duties and Restrictions

Part 3 of the RMA sets out the duties and restrictions in relation to use of land (sections 9 to 11), the coastal marine area (section 12 to 12B), beds of rivers and lakes (section 13) and water (section 14). Part 3 also sets out the duties and restrictions in relation to discharges into water, the air, or onto land. Section 87 of Part 6 outlines the types of resource consents. The sections of Part 3 that are relevant to this application are as follows:

5.2.2.1 Water Take and Channel Maintenance

Section 14 of the RMA places restriction on the taking, use, damming or diversion of water. Under section 14 (2),

"(2) No person may take, use, dam, or divert any of the following, unless the taking, using, damming, or diverting is allowed by subsection (3):

(a) water other than open coastal water; or

(b) heat or energy from water other than open coastal water; or

(c) heat or energy from the material surrounding geothermal water.

(3) A person is not prohibited by subsection (2) from taking, using, damming, or diverting any water, heat, or energy if—

(a) the taking, using, damming, or diverting is expressly allowed by a national environmental standard, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent; or

(b) in the case of fresh water, the water, heat, or energy is required to be taken or used for—

(i) an individual's reasonable domestic needs; or

(ii) the reasonable needs of an individual's animals for drinking water,— and the taking or use does not, or is not likely to, have an adverse effect on the environment; or

(c) in the case of geothermal water, the water, heat, or energy is taken or used in accordance with tikanga Maori for the communal benefit of the tangata whenua of the area and does not have an adverse effect on the environment; or

(d) in the case of coastal water (other than open coastal water), the water, heat, or energy is required for an individual's reasonable domestic or recreational needs and the taking, use, or diversion does not, or is not likely to, have an adverse effect on the environment; or

(e) the water is required to be taken or used for firefighting purposes."

The renewal of the water take from the Oreti River requires consent under section 14. Channel maintenance associated with the water take embayment area will also be undertaken and this necessitates consent under section 13 of the RMA.

5.2.2.2 Discharge Permit

Section 15 of the RMA places restrictions on the discharge of contaminants into the environment. As defined in section 2 of the RMA, "contaminant" includes:

"any substance (including gases, odorous compounds, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar or other substances, energy, or heat –

(a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or

(b) When discharged into land, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged."

Under section 15(1):

"No person may discharge any –

(a) Contaminant or water into water; or

(b) Contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; or

(c) Contaminant from any industrial or trade premises into air; or

(d) Contaminant from any industrial or trade premises onto or into land –

Unless the discharge is expressly allowed by a national environmental standard or other regulations, a rule in a regional plan as well as a rule in a proposed regional plan for the same region (if there is one), or a resource consent".

Section 105 sets out further matters which are specifically relevant to discharge permits:

"(1) If an application is for a discharge permit or coastal permit to do something that would contravene section 15 or section 15B, the consent authority must, in addition to the matters in section 104(1), have regard to –

(a) The nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(b) The applicant's reasons for the proposed choice; and

(c) Any possible alternative methods of discharge, including discharge into any other receiving environment".

Furthermore, under section 107:

"(1) Except as provided in subsection (2), a consent authority must not grant a discharge permit or a coastal permit to do something that would otherwise contravene section 15 or section 15A allowing –

(a) The discharge of a contaminant or water into water; or

(b) A discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water;….if after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

(c) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

(d) Any conspicuous change in the colour or visual clarity:

(e) Any emission of objectionable odour:

(f) The rendering of freshwater unsuitable for consumption by farm animals:

(g) Any significant adverse effects on aquatic life:

(2) A consent authority may grant a discharge permit or a coastal permit to do something that would otherwise contravene section 15 or section 15A that may allow any of the effects described in subsection (1) if it is satisfied –

(a) That exceptional circumstances justify the granting of the permit; or

(b) That the discharge is of a temporary nature; or

(c) That the discharge is associated with necessary maintenance work –

And that it is consistent with the purpose of this Act to do so."

The following activities at the Plant require discharge permits:

- The discharge of treated effluent to water or to land where it may directly or indirectly enter the Makarewa River;
- The discharge of wastewater to ponds where it might enter land and groundwater;
- The discharge of treated wastewater to land;
- The discharge of contaminants and odours to air.

Section 108 of the Act relates to conditions attaching to resource consents., This section sets out that a discharge permit or a coastal permit to do something that would otherwise contravene section 15 (relating to the discharge of contaminants) or section 15B, may include a condition requiring the consent holder to adopt the best practicable option to prevent or minimise any actual or likely adverse effect on the environment of the discharge and other discharges made by the person from the same site or source.

"Best practicable option" is defined as follows:

"In relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to –

(a) The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and

(b) The financial implications, and the effects on the environment, of that option when compared with other options; and

The current state of technical knowledge and the likelihood that the option can be successfully applied."

5.2.3 Application for Resource Consent

Section 88 of the RMA stipulates that all resource consent applications are required to be made in the prescribed form and manner and be accompanied by an Assessment of Environmental Effects (AEE) in accordance with the provisions of Schedule 4 of the RMA. Schedule 4(2) states:

*(1) An application for a resource consent for an activity (the **activity**) must include the following:*

(a) a description of the activity:

(b) a description of the site at which the activity is to occur:

(c) the full name and address of each owner or occupier of the site:

(d) a description of any other activities that are part of the proposal to which the application relates:

(e) a description of any other resource consents required for the proposal to which the application relates:

(f) an assessment of the activity against the matters set out in Part 2:

(g) an assessment of the activity against any relevant provisions of a document referred to in section 104(1)(b).

On 3 March 2015, clause 3 was inserted into Schedule 4 of the RMA. This relates to additional information that is required with respect to "some" applications. This clause requires that if an application is affected by section 124 of the Act then an assessment of the value of the investment of the existing consent holder shall be provided. An assessment of the value of the investment of the Plant to the consent holder is undertaken later in this report (refer section 7).

Section 88 further specifies that a resource consent application must provide an assessment of the activity's effects on the environment that includes the following information:

(1) An assessment of the activity's effects on the environment must include the following information:

(a) if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity:

(b) an assessment of the actual or potential effect on the environment of the activity:

(c) if the activity includes the use of hazardous substances and installations, an assessment of any risks to the environment that are likely to arise from such use:

(d) if the activity includes the discharge of any contaminant, a description of—

(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and

(ii) any possible alternative methods of discharge, including discharge into any other receiving environment:

(e) a description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect:

(f) identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted:

(g) if the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved:

(h) if the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).

(2) A requirement to include information in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

(3) To avoid doubt, subclause (1)(f) obliges an applicant to report as to the persons identified as being affected by the proposal, but does not—

- *(a) oblige the applicant to consult any person; or*

- *(b) create any ground for expecting that the applicant will consult any person.*

Moreover, the assessment of environmental effects must address the following matters (clause 7, schedule 4):

(1) An assessment of the activity's effects on the environment must address the following matters:

(a) any effect on those in the neighbourhood and, where relevant, the wider community, including any social, economic, or cultural effects:

(b) any physical effect on the locality, including any landscape and visual effects:

(c) any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity:

(d) any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations:

(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants:

(f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or the use of hazardous substances or hazardous installations.

(2) The requirement to address a matter in the assessment of environmental effects is subject to the provisions of any policy statement or plan.

The Act requires that the detail provided corresponds with the scale and significance of the effect that the activity may have on the environment. This report and accompanying technical appendices is intended to meet the obligations inherent in section 88 and the Fourth Schedule to the Act.

5.2.4 Section 104

Subject to Part 2 of the Act (the Purpose and Principles), in considering this application the Consent Authority is required, pursuant to section 104 of the Act, to have regard to:

(1)(a) any actual and potential effects on the environment of allowing the activity; and

(1)(b) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

(v) a regional policy statement or proposed regional policy statement:

(vi) a plan or proposed plan; and

(1)(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.

(2A) When considering an application affected by section 124, the consent authority must have regard to the value of the investment of the existing consent holder.

Section 104 does not give any of the matters to which a consent authority is required to have regard, primacy over any other matter. All the matters are to be given such weight as the consent authority sees fit in the circumstances and all provisions are "subject" to Part 2 of the RMA, as set out in sections 5 – 8. It is noted that section 104(2) – (7) sets out a number of other obligations upon the consent authority when considering and determining resource consents.

5.2.5 Actual and Potential Effects on the Environment of Allowing the Activity

When considering an application for resource consent, section 104(a) requires that the consent authority must, subject to Part 2, have regard to:

(a) any actual and potential effects on the environment of allowing the activity;

Two fundamental questions arise with respect to these applications: what is the "environment" that is affected, and what are the relevant "actual and potential" effects?

"Environment" is defined in section 3 of the RMA:

"Environment includes—

(a) Ecosystems and their constituent parts, including people and communities; and

(b) All natural and physical resources; and

(c) Amenity values; and

(d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters:"

Environment is afforded a broad definition. It is not restricted to the "natural ecological values", and encompasses a wide range of social, economic, cultural and aesthetic values, as well as ecosystems and natural and physical resources.

The second important consideration is what constitutes the "actual and potential effects" of an activity and the ramifications of this for what could be considered to be the relevant effects of the continued operation of Alliance's wastewater and air discharges, and ancillary activities. "Effect" is defined under section 3 of the RMA:

Meaning of effect

In this Act, unless the context otherwise requires, the term ***effect*** *includes—*

(a) any positive or adverse effect; and

(b) any temporary or permanent effect; and

(c) any past, present, or future effect; and

(d) any cumulative effect which arises over time or in combination with other effects—regardless of the scale, intensity, duration, or frequency of the effect, and also includes—

(f) any potential effect of high probability; and

(g) any potential effect of low probability which has a high potential impact.

There is a range of case law as to the extent to which effects need to be considered. In practice, what constitutes an effect can be broadly interpreted.

5.2.6 Provisions of the Relevant Policy Statements, Standards and Plans

The relevant national, regional and district policy statements, standards and plans are identified in the following sections of this report, and a statutory assessment of the proposed activities against policies and plans is made in section 10. The objectives and policies guide what type of activities and associated effects are considered appropriate, and how the effects of an activity should be managed. In doing so they are intended to guide the consent authority considering an application for a resource consent under the RMA, on a case-by-case basis as to what constitutes an acceptable outcome from an application.

5.2.7 Other Matters

Section 104(c) also allows other matters considered relevant by the consent authority to be considered. Whether a specific matter is "relevant" is generally determined on a case-by-case basis. However, they must be related to the issues contemplated by the purpose of the RMA. Section 5.8 of this report outlines the other matters considered to be relevant to these applications.

5.2.8 Section 124

Specific recognition is given to the value of existing investment when considering renewal applications. The current bundle of resource consent applications seeks to renew the existing operations at the Plant. Section 124 therefore applies to the current and future operation of the Plant, until such a time that a new consent is granted or opposed and all appeals have been determined.

5.3 NATIONAL POLICY STATEMENTS

The purpose of National Policy Statements (NPS) is to state objectives and policies for matters of national significance that are relevant to achieving the purpose of the RMA. There are currently two National Policy Statements of relevance to the consents being sought by Alliance:

- New Zealand Coastal Policy Statement (December 2010); and
- National Policy Statement Freshwater Management (July 2014).

National Policy Statements are also proposed for Urban Design and Indigenous Biodiversity, however these have yet to be given effect to. Only the two NPS's above are considered relevant to the application.

5.3.1 New Zealand Coastal Policy Statement 2010

The New Zealand Coastal Policy Statement 2010 (NZCPS) came into effect on 3 December 2010.

The purpose of the NZCPS is to state objectives and policies in order to achieve the purpose of the RMA in relation to the coastal environment[7] of New Zealand. The issues, objectives and policies within the NZCPS address both the coastal marine area and the coastal environment.

The activities undertaken at the Plant do not involve any activities within the coastal marine area. The New River Estuary is however the ultimate receiving environment for discharges to the Makarewa River and the lower portion of the Makarewa River is tidally influenced, and is therefore within the coastal environment, as defined by Policy 1 of the NZCPS. The provisions of the NZCPS are therefore relevant to the consideration of the discharge to water permits being sought by Alliance.

The most relevant objectives and policies are particularly concerned with:

- The integrity, form, function and resilience of the coastal environment and sustaining its ecosystems (Objective 1);
- Preserving natural character and protecting natural features and landscape values (Objective 2 and associated Policies 13 to 15);
- The Treaty of Waitangi and tangata whenua (Objective 3 and Policy 2);
- Enabling people and communities to provide for their social, economic and cultural well-being and health and safety through subdivision use and development (Objective 6 and associated Policy 6);
- Adopting a precautionary approach towards activities whose effects on the coastal environment are uncertain, unknown or little understood, but potentially significant (Policy 3);
- Providing for integrated management of natural and physical resources in the coastal environment and activities that affect the coastal environment (Policy 4);
- Protecting indigenous biodiversity (Policy 11);
- The enhancement of water quality (Policy 21); and
- The management of the discharge of contaminants (Policy 23).

Section 10 of this report provides an assessment of the proposed discharge activities against the provisions of the NZCPS.

5.3.2 National Policy Statement for Freshwater Management 2014

The National Policy Statement for Freshwater Management 2011 (Freshwater NPS) took effect on 1 July 2011. Further amendments to the Freshwater NPS were gazetted on 4 July 2014 and superseded the earlier 2011 version.

The purpose of the Freshwater NPS is to recognise the national significance of freshwater for all New Zealanders and Te Mana o te Wai. In achieving this purpose, the Freshwater NPS sets out a series of objectives and policies for

[7] The Coastal Environment is broadly defined (Policy 1) and includes the coastal marine area, islands within the coastal marine area, areas affected by coastal processes and hazards.

freshwater management primarily relevant during the development of regional plans and policy statements.

The Freshwater NPS contains eight categories of objectives and policies generally categorised into the following freshwater management themes:

- Water quality;
- Water quantity;
- Integrated management;
- National Objectives Framework;
- Monitoring Plans;
- Accounting for freshwater takes and contaminants;
- Tangata whenua roles and interests; and
- Progressive implementation programme.

The objectives contained within these overarching themes are primarily concerned with:

- Safeguarding the life-supporting capacity, ecosystem processes and indigenous species of freshwater through sustainably managing the use and development of land, discharges of contaminants, and the taking, using, damming or diverting of freshwater (Objectives A1 and B1);
- Maintaining or improving the overall quality of freshwater within a region (Objective A2);
- Avoiding the over-allocation of freshwater, phasing out existing over-allocation, improving and maximising its efficient allocation and use (Objectives B2 and B3);
- Improving the integrated management of freshwater and the use and development of land in whole catchments (Objective C1);
- Establishing freshwater objectives for national values that are nationally consistent while recognising regional and local circumstances (Objective CA1);
- Providing an approach for the monitoring of progress towards, and the achievement of, freshwater objectives (Objective CB1);
- Improving information on freshwater takes and sources of freshwater contaminants (Objective CC1); and
- Providing for the involvement of iwi and hapū and ensuring that tāngata whenua values and interests are identified and reflected in the management of freshwater (Objective D1);

5.3.3 National Objectives Framework

The Freshwater NPS sets out a National Objectives Framework (NOF) (Objective CA1) that directs how Councils are to go about setting objectives, policies and rules about freshwater in their regional plans. They must do this by establishing freshwater areas (freshwater management units) across their regions and

identifying the values (for example, irrigation, mahinga kai, swimming, etc) that communities hold for the water in those areas. Policy CA1(f)(ii) requires Councils to consider the spatial scale at which freshwater management units are defined. The Freshwater NPS Implementation Guide sets out that a freshwater management unit should not be set at such a large scale that effective management of freshwater is inhibited, or water quality is disguised by averaging. It also notes that freshwater management units should not be set at too small a scale, which may result in a costly planning process and undue complexity in the plan (e.g. multiple limits affecting infrastructure or commerce which spans a water body or water bodies).

Councils are then required to gather water quality and quantity information on the water bodies to assess their current state and decide the water quality objective or goal (grouped into A, B or C bands) for each value the community has chosen based on the economic, social, cultural and environmental impact to that community (Policy CA2). The final step is for the community to assess how, and over what timeframes, those goals are to be met (Policy CA2(f)).

“Ecosystem health” and “human health for recreation” are two compulsory national values and must be provided for. The Freshwater NPS details nationally-set minimum acceptable states for these two values which are called national bottom lines (Policy CA3).

Councils are required to maintain or improve water quality within their regions and cannot set an objective below a national bottom line. There are only two circumstances where an objective may be set below a national bottom line: where the water quality is naturally below the bottom line, for example a native bird colony nesting in a river bed causing high *E.coli* levels downstream; or where significant existing infrastructure, as specified in Appendix 3 of the Freshwater NPS, means water quality is below the bottom line. It is noted that Appendix 3 has not yet been populated with existing infrastructure, so it is not clear where this would apply.

If a community is of the view that the process to manage a water body to a level at or above the bottom line would place an unmanageable burden on their community, they can apply to the Government for that area to be specified in Appendix 4 of the Freshwater NPS. This would effectively allow a longer time period, and staggered approach, for developing the process to move above the bottom lines. No such areas have yet been identified for inclusion in Appendix 4. As with Appendix 3, any addition of areas to Appendix 4 would require a Cabinet decision after public consultation.

The following limits have been set by the Freshwater NPS as national bottom lines with respect to rivers in New Zealand (refer **Table 7**). It is noted that these limits are to apply to the Council derived freshwater management units referred to above. These limits will also only be a consideration if the current water quality of the freshwater management unit is below a bottom line or trending towards it.

Table 7: Freshwater NPS Environmental Bottom Lines for Rivers

Indicator	Limits	
Periphyton	Exceeded no more than 8% or 17% of samples: 200mg chl-a/m^2	
Nitrate	Annual median: 6.9mg NO_3 – N/L	Annual 95th Percentile: 9.8mg NO_3 – N/L
Ammonia	Annual median: 1.30mg NH_4 – N/L	Annual maximum: 2.20mg NH_4 – N/L
Dissolved oxygen	7 day mean minimum: 5.0 mg/L	1 day minimum: 4.0mg/L
E.coli	Annual median: 1000 *E.coli*/100ml	
Cyanobacteria - Planktonic	80th Percentile: 1.8mm**3**/L biovolume equivalent of potentially toxic cyanobacteria OR 10mm**3**/L total biovolume of all cyanobacteria	

Policy E outlines the timing for implementation of the objectives and policies within the Freshwater NPS. This policy sets out that full implementation is required by 31 December 2025, the timeframe can however be extended to 2030 if the 2025 timeframe will affect plan quality or it would be impracticable for the Council to complete implementation of a policy by 2025. A discussion on Environment Southland's programmed implementation of the Freshwater NPS is set out below.

5.3.4 Environment Southland Implementation of the Freshwater NPS

Environment Southland has implemented an initiative known as "Water and Land 2020 and Beyond". The project is a partnership with Ngai Tahu ki Murihiku. The project includes a range of measures aimed at halting the decline of Southland's water quality, including promoting good farm management practices, and developing a water and land plan that updates and brings together existing policies and rules[8]. As part of the project, catchment limits will be set for water quality and quantity. The indicative timeframe is that this will be occur in 2016 and continue through to 2020. In order to inform the catchment limits, Environment Southland has commenced scientific and economic research in order to understand the communities' objectives and values, the natural water systems and the potential impacts of limit setting. Environment Southland is continuing to work with key sectors and stakeholders in order to derive appropriate limits.

8 Water and Land 2020 & Beyond Fact Sheet, January 2015.

It is intended that the catchment limits will address the limit-setting requirements of the Freshwater NPS. Environment Southland describe a “catchment” as the total area of land draining into a water body and “limits” refer to the total amount of water that can be taken out of a water body, or the total amount of contaminants that can be discharged into it without jeopardising the desired outcomes. Environment Southland sets out that the preparation phase for establishing catchment limits will extend through to mid-2015, with the foundation science projects continuing into the implementation phase. With respect to the Oreti catchment, limits are likely to be in place by 2020.

Environment Southland notes that interim limits have already been established for the region via the Regional Water Plan. These limits aim to maintain water quality and achieve a 10% improvement by 2020 in degraded areas (predominately Southland lowland rivers).

Section 10 of this report describes the relevant regional policy framework and provides an assessment of the proposal against these. A draft Land and Water Plan was released for public comment in August 2015.

5.3.5 Proposed National Policy Statement on Indigenous Biodiversity

The Ministry for the Environment (MfE) publicly consulted on the proposed National Policy Statement on Indigenous Biodiversity (proposed NPS-IB) between January and May 2011. Following the receipt of 426 submissions on the proposed NPS-IB, the MfE prepared a report and recommendations for the Minister for the Environment to consider. The Government intends to consider the report from the Waitangi Tribunal on claim 262 before finalising the NPS-IB, as part of this claim relates to rights in respect of indigenous flora and fauna.

The proposed NPS-IB has no legal effect under the RMA and has been on hold for almost four years pending the outcome of Waitangi Tribunal claim 262. The proposed NPS-IB has therefore not been considered further in this report. In giving effect to the principles and purpose of the RMA, indigenous biodiversity forms part of the considerations of the Regional Policy Statement and Regional Plans. These are discussed further in section 10 to this report.

5.4 NATIONAL ENVIRONMENTAL STANDARDS

Sections 43 and 44 of the RMA provide for national environmental standards. These standards can prescribe technical standards, methods or other requirements for environmental matters. There are currently five national environmental standards in place. The following national environmental standards are considered relevant to these applications[9]:

[9] The three national environment standards not considered relevant to this project include:
- Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007;
- Resource Management Standards for Telecommunication Facilities) Regulation 2008;
- Resource Management (National Environmental Standards for Electricity Transmission Activities) Regulations 2009.

- Resource Management (National Environmental Standards for Air Quality) Regulations 2004;
- Resource Management (National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011; and
- Resource Management (National Environmental Standards for Sources of Human Drinking Water) Regulations 2007;

5.4.1 National Environmental Standards Air Quality

The Resource Management (National Environmental Standard for Air Quality) Regulations 2004 (the air quality regulations or the NES Air Quality) came into effect progressively between 2004 and 2006. The air quality regulations relate to the management of air quality on an airshed basis.

Regulations 13 to 16 and associated Schedule 1 of the air quality regulations set ambient air quality standards. In accordance with Regulation 14, the ambient air quality standard for a contaminant applies at any place that is in an airshed that is in the open air and where people are likely to be exposed to the contaminant. If the discharge of a contaminant is expressly allowed by a resource consent, the ambient air quality standard for the contaminant does not apply to the site on which the resource consent is exercised.

Schedule 1 of the NES Air Quality sets out ambient air quality concentration limits for the following contaminants:

- carbon monoxide (CO);
- nitrogen dioxide (NO_2);
- ozone;
- particulate matter less than 10 micrometres in aerodynamic diameter (PM_{10});
- sulphur dioxide (SO_2).

The NES Air Quality requires regional councils to monitor air quality and give public notice if the ambient air quality concentration limit is breached in an airshed in its region. Schedule 2 sets out monitoring methods for ambient air quality standards.

The Regulations set out prohibitions and restrictions on discharges from certain activities[10]. The Regulations also apply to resource consents for discharges of PM_{10}[11] and to resource consents for discharges of other contaminants[12]. The Regulations set out in what circumstances the consent authority must decline consent. In considering the resource consent application, the consent authority

[10] Clauses 4–12, 22-27: Lighting of fires and burning of waste at landfills; burning of tyres, bitumen, coasted wire and oil; incinerators at schools and healthcare institutions; and high-temperature hazardous waste incinerators, discharges from wood burners and the control of greenhouse gas emissions at landfills.

[11] Clause 17: Certain applications must be declined unless other PM_{10} discharges reduced.

[12] Clauses 20 – 21: Resource consents for discharges of carbon monoxide, oxides of nitrogen, and volatile organic compounds, resource consents for discharge of sulphur dioxide.

will consider whether the discharge will result in a substantial increase in concentration, whether it will be a principal source of contamination and whether it will breach the ambient air quality standard.

The Regulations state that a rule, resource consent, or bylaw that is more stringent than these Regulations prevails over the Regulations[13].

The airshed around the City of Invercargill is a gazetted airshed. The Lorneville site is outside of this gazetted airshed area.

Section 10 provides an assessment of the proposed air discharge activities against the provisions of the NES Air Quality.

5.4.2 National Environmental Standard Assessing and Managing Contaminants in Soil to Protect Human Health

The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (the contamination Regulations or NES for soil contamination) came into effect on 1 January 2012.

The purpose of the contamination Regulations is to provide a nationally consistent set of regulations for activities on "pieces of land" where soil may be contaminated in such a way as to be a risk to human health.

The contamination Regulations of the NES for soil contamination apply when one of the following activities is proposed on a piece of land that is currently used for, has historically been used for, or is more likely than not to have been used for, an activity or industry described in the Ministry for the Environment's Hazardous Activities and Industries List (HAIL)[14].

- Removing or replacing a fuel storage system (as described in Regulation 5(2));
- Sampling the soil of a piece of land to determine whether or not it is contaminated (as described in Regulation 5(3));
- Disturbing soil for a particular purpose (as described in Regulation 5(4));
- Subdividing land (as described in Regulation 5(5));
- Changing the use of the piece of land, which because the regulations apply, is reasonably likely to harm human health (as described in Regulation 5(6)).

5.4.3 National Environmental Standard for Sources of Human Drinking Water

The Resource Management (National Environmental Standard for Sources of Human Drinking Water) Regulations 2007 (the drinking water Regulations or NES for drinking water) came into effect on 20 December 2007. It is intended to reduce the risk of contamination of drinking water sources such as rivers and groundwater. The NES for drinking water requires regional councils to ensure

[13] Clause 28: More stringent rule, resource consent or bylaw prevails.

[14] A "piece of land" is described in Regulations 5(7) and 5(8) and the activities captured by the NES in Regulations 5(2) to (6).

that effects on drinking water sources are considered in decisions on resource consent applications and in the implementation of regional plans.

5.5 REGIONAL POLICY STATEMENTS

The resource consent assessment process must have regard to the relevant objectives and policies of the Regional Policy Statement and plans of the Southland region in accordance with section 104(1)(b) of the RMA. Currently, Environment Southland has both an operative and proposed RPS. Both of these are relevant to the approvals being sought by Alliance.

5.5.1 Southland Regional Policy Statement

The Southland Regional Policy Statement (RPS) became operative on 15 December 1997. A full review of the RPS began in 2008. The Proposed RPS was publicly notified in 2012. Hearings took place between October 2014 and January 2015, and the Council's decisions were publicly notified in June 2015.

A variation to the Biodiversity Chapter of the Proposed RPS was publicly notified in May 2015. Submissions have been made and a hearing occurred in October 2015.

With the exception of the Biodiversity Chapter of the Proposed RPS, the proposed RPS is considered to carry greater weight than the operative RPS.

A detailed assessment of the project against the relevant objectives and policies is undertaken in section 10 of this report.

5.6 REGIONAL PLANS

The resource consent assessment process must have regard to the relevant provisions of a plan or proposed plan, in accordance with section 104(1)(b)(vi) of the RMA. Currently, Environment Southland has five regional plans including:

- Southland Regional Water Plan;
- Southland Regional Air Plan;
- Proposed Regional Air Plan 2014;
- Southland Regional Effluent Land Application Plan; and
- Southland Regional Coastal Plan;

These plans are all relevant to the approvals being sought by Alliance.

5.6.1 Southland Regional Water Plan

The purpose of the Southland Regional Water Plan (Water Plan) is to promote the sustainable management of Southland's rivers, lakes, groundwater and wetland resources. The Water Plan is aimed at enabling the use and development of freshwater where this can be undertaken in a sustainable way, providing a framework for activities such as discharges to water, taking and using of water, and structures and bed disturbance activities in river beds. The majority

of the Water Plan was made operative on 18 January 2010, and remaining Water Plan provisions were made operative on 13 April 2010.

A detailed assessment of the applications against those provisions is outlined in section 10 of this report.

The Water Plan contains a number of expected outcomes that are to be achieved through the adoption of the rules, policies and other methods. The Water Plan sets out both long term and short term outcomes. Those relating to water quality are:

- Long term (beyond 10 year life of the Water Plan):
  - The water quality of all surface water bodies in the region will be suitable for contact recreation, trout, and native fish (including all life stages the water body naturally contains habitat for), stock drinking water and Ngai Tahu cultural values, including mahinga kai.
- Short term (within the 10 year life of the Water Plan):
  - There will be no reduction in water quality in the Southland region beyond the zone of reasonable mixing for discharges;
  - Water quality will be maintained in Natural State Waters;
  - The water quality of surface water bodies will be maintained and enhanced so that it is suitable for bathing in popular bathing sites, trout and native fish, stock drinking water and Ngai Tahu cultural values, including mahinga kai;
  - An improvement in the water quality and in particular a minimum 10 percent reduction in levels of microbiological contaminants, nitrate, and phosphorus and a minimum of 10 percent improvement in water clarity will be achieved in hill, lowland and spring-fed surface water bodies over 10 years from the date this Water Plan became operative;
  - Discharges to water bodies will not result in levels of toxic substances that harm humans, domestic animals including stock or aquatic life;
  - Wherever practicable, and where effects are less adverse, discharges will be to land rather than to water;
  - The significant adverse effects of discharging during low flows are avoided;
  - The number of surface water bodies with riparian vegetation that assists in maintaining and enhancing water quality, bank and channel stability is significantly increased;
  - Stormwater discharges will meet water quality standards and current Australian and New Zealand Environment and Conservation Council (ANZECC) sediment guidelines by 2010;
  - Freshwater quality does not have an adverse effect on coastal water quality.

There are also outcomes relating to water quantity, groundwater and the beds of lakes and rivers. Those relevant to this application seek:

- That the groundwater contribution to surface water bodies does not have any adverse effect on surface water quality, aquatic life or recreational values.

Rule 1 of the Water Plan requires that the discharge of any contaminant or water into a surface water body or into land where it may enter water is a discretionary activity, provided that the discharge does not reduce the water quality below any standards set out in Appendix G. If this is the case, then Rule 2 of the Water Plan applies.

Rule 2(b) of the Water Plan sets out that notwithstanding the provisions of Rules 1 and 2(a), the discharge of biologically treated wastewater, treated to a minimum of secondary standard into the main stem of the Makarewa River, or onto or into land in circumstances where it may enter the main stem of the Makarewa River, is a discretionary activity.

The Water Plan sets out that this rule provides for the discharge of treated wastewater from the Plant to the Makarewa River as a discretionary activity (discharges in other localities that do not comply with the standards are non-complying). This is because the Water Plan acknowledges that the receiving waters cannot comply with the water quality standards at present, regardless of the input from the discharge.

Discharges of contaminants originating from industrial or trade premises are controlled via Rule 16D. Rule 16D sets out that, except as provided for elsewhere in the Water Plan or any other regional plan, the discharge of contaminants originating from any industrial or trade premises onto or into land is a discretionary activity.

Rule 18 sets out the requirements for the abstraction, diversion and use of surface water. In accordance with Rule 18(e), where the abstraction, diversion and use of water is from a surface water body or artificial watercourse draining into a surface water body, where the total volume of water allocated at any time is between 10 to 30 percent of the mean annual flow, or where it is from a surface water body or artificial watercourse that does not drain into a river or stream, the activity is discretionary.

Rule 56 sets out that the discharge of contaminants into or onto land at a landfill is a discretionary activity. The Water Plan defines “landfills” as “*a site that is used for the permanent disposal of waste but excludes cleanfill sites, earthworks associated with any road, driveway or track, and any area within road reserve containing a formed road that is used for the deposition of roading material”*.

5.6.2 Southland Regional Air Plan

The Southland Regional Air Plan (Air Plan) was deemed operative on 1 March 1999 and provides for the sustainable management of the air resource in Southland. The Air Plan manages discharges of contaminants into air and is

directly relevant to the air discharge activities undertaken by Alliance. There are specific objectives, policies and rules that apply to discharges of contaminants to air from industrial and trade premises (or processes). A detailed assessment of the applications against those that are relevant is undertaken in section 10 of this report.

Rule 5.5.2 sets out that the following activities that give rise to discharges of contaminants into air are discretionary activities:

- Combustion processes with a heat release exceeding 5 MW;
- The incineration of trade waste;
- Any animal or plant matter processes:
  - For rendering or reduction or drying through application of heat to animal matter;
- Any fellmongery processes involving the use of sulphides;
- Foulwater treatment processes.

5.6.3 Proposed Regional Air Plan 2014

In September 2014 Environment Southland notified its Proposed Regional Air Plan 2014 (proposed Air Plan). The proposed Air Plan introduces new provisions for domestic home heating, outdoor burning, the application of agrichemical and fertilisers, and fire training. A detailed assessment of the applications against the provisions is contained in section 10. It is noted that the Proposed Air Plan does not yet include objectives, policies or rules specific to the management of air discharges from industrial and trade premises and processes.

Decisions on the first stage of this Air Plan were released in October 2014. However it is understood that aspects of this decision are subject to at least one appeal to the Environment Court[15].

5.6.4 Southland Regional Effluent Land Application Plan

The Southland Regional Effluent Land Application Plan (Effluent Plan) was made operative on 30 May 1998. The Effluent Plan applies to sewage schemes, treatment of foul water by septic tanks, toilet facilities at public places, stock truck discharges, trade wastes and other discharges that may have an effect on groundwater or surface water quality and public health in Southland. The term "effluent" is defined as a liquid that may include solid components, discharged as a waste that originates from (among others):

- An industrial or trade process.

Rule 5.5.1 provides that the discharge onto or into land of effluent from industrial and trade processes, other than agricultural effluent, is a discretionary activity.

The Effluent Plan is therefore also relevant to the wastewater discharges to land. A detailed assessment of the applications against those that are relevant is undertaken in section 10 of this report.

[15] By Horticulture New Zealand.

5.6.5 Southland Regional Coastal Plan

The Southland Regional Coastal Plan (Coastal Plan) is relevant insofar as the New River Estuary will be the ultimate receiving environment for the discharges into the Makarewa River. The Coastal Plan objectives and policies will need to be considered when assessing the discharges. A detailed assessment of the applications against those that are relevant is undertaken in section 10 of this report. As the Plant operations and activities are outside the coastal marine area, the rules of the Coastal Plan are not triggered.

5.7 DISTRICT PLANS

The wider Alliance Lorneville landholdings currently extend into the territorial boundaries of both the Invercargill City and the Southland District Council. The objectives and policies of the District Plans are a relevant consideration when undertaking the statutory assessment of an application.

5.7.1 Southland District Plan

The Southland District Plan sets out how land can be used within the Southland District. There are currently two District Plans for the Southland District; the operative Southland District Plan 2007 and the Proposed Southland District Plan 2012.

The importance of, and weight to be given to, a proposed plan depends on the extent to which it has passed through the submission and appeal process and has been tested and exposed to independent decision making. Decisions have been made on the provisions of the Proposed Southland District Plan, and nine subsequent appeals lodged with the Environment Court. In accordance with Section 86F of the RMA, the provisions of the Proposed Southland District Plan that have not been appealed are now operative.

Alliance's landholdings within the Southland District are zoned for industrial purposes. The Industrial Zone provides an appropriate location for Alliance's Plant activities as the zone provides a higher tolerance for the effects generated by industrial activity. The Industrial Zone provisions of the Proposed Southland District Plan have not been appealed and are now operative.

The relevant zone objectives seek to ensure that subdivision, land use and development within the Industrial Zone occur in an integrated and sustainable manner. Associated policies recognise and provide the benefits of locating industrial activity within the Industrial Zone whilst avoiding, remedying or mitigating adverse effects on the environment.

5.7.2 Invercargill City District Plan

The Invercargill City District Plan (the District Plan) is relevant insofar as the Plant's wider operations, including the temporary storage dam and irrigation of wastewater to land, occurring within the Invercargill City District and appropriate consents have been obtained. It is noted that if necessary, a consent to allow the

ongoing ability to utilise land within the ICC jurisdiction as a temporary emergency storage area will be sought in due course.

In August 2013, Invercargill City Council notified its Proposed Invercargill City District Plan (the Proposed Plan). Hearings have been held throughout 2014 – 2015, however decisions are yet to be released. The objectives and policies of the Proposed Plan were however given immediate legal effect on the date of notification.

Objectives within section 2.40 of the Proposed Plan relate to the Rural 1 Zone and seek to maintain and enhance the amenity values within the zone[16]. Associated policies aim to provide for the establishment and operation of rural activities within the zone[17], whilst avoiding the adverse effects of non-rural activities on the character and amenity of the zone[18].

An assessment of the application against the relevant provisions of both the Operative and Proposed District Plans is undertaken in section 10 of this report.

5.8 OTHER RELEVANT MATTERS

In accordance with section 104 of the RMA, regard must also be had to "*any other matter the consent authority considers relevant and reasonably necessary to determine the application*". The RMA does not define what "*other matters*" are to be considered, however it is accepted that these can include matters outside the RMA, including non-statutory processes. It is considered that there are a number of other matters relevant to this proposal. These include:

- Other relevant water and air quality guidelines;
- Proposed Conservation Management Strategy;
- Ngai Tahu Claims Settlement Act 1998; and
- Iwi Management Plans

5.8.1 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The MfE promotes the use of the Australian and New Zealand Guidelines for Fresh and Marine Water Quality, developed by the Australian and New Zealand Environment and Conservation Council (ANZECC). The guidelines were established in 1992 and updated in 2000 to provide an authoritative guide for setting water quality objectives required to sustain current, or likely future environmental values and uses for natural and semi-natural water resources in Australia and New Zealand. They provide a reference for water quality standards and trigger levels, particularly for toxic contaminants.

The information and values contained in the 'guidelines' are not mandatory, however the ANZECC guidelines are often referred to in regional plans, as is the case in the Southland Water Plan. The Water Plan refers to the ANZECC guidelines in relation to sediment and stormwater discharges, and in developing

[16] Objective 2.40.2: Objective 2.
[17] Policy 2.40.3: Policy 2.
[18] Policy 2.40.3: Policy 3.

the water quality standards for the various water bodies throughout the region (refer to the explanatory text of Policy 4). The ANZECC guidelines are therefore a relevant “other matter” to consider in the assessment of effects on water quality. The ANZECC limits have been taken into account in the assessment of water quality and ecology, and also in developing an appropriate water quality monitoring programme (refer **Appendices K and L** attached).

5.8.2 Ambient Air Quality Guidelines

The Ministry for the Environment has also released ambient air quality guidelines (AAQG). These guidelines advocate how best to manage air quality and their primary purpose is to promote the sustainable management of the air resource in New Zealand. The AAQG values are the minimum requirements that outdoor air quality should meet in order to protect human health and the environment. The AAQG contains limits for various air discharge contaminants including fine particulates, sulphur dioxide, ozone and heavy metals. These limits have been taken into account in the assessment in **Appendix M** attached. It is noted however that these limits are guidelines and are not mandatory compliance values for point source discharges.

The AAQG sets out that where air pollution levels breach guideline values, emission reduction strategies should be implemented to improve air quality. Where levels do not breach the values, efforts should be made to maintain air quality and, if possible, reduce emissions. The AAQG notes that this is particularly important for those pollutants, such as particles less than 10 microns in diameter (PM_{10}), for which the guideline value cannot be based on a 'no observable adverse effects level'.

5.8.3 Proposed Conservation Management Strategy Southland Murihiku 2015-2025

Conservation management strategies (CMS) are 10-year regional strategies that provide an overview of conservation issues and give direction for the management of public conservation land and waters, and species for which the Department of Conservation (DoC) has responsibility. Their purpose is to implement general policies and establish objectives for the integrated management of natural and historic resources, and for recreation, tourism, and any other conservation purposes.

CMS are required under the Conservation Act 1987 and are developed in accordance with the legislation under which DoC operates. Importantly, CMS are one of the main guiding documents when assessing applications for concessions within conservation lands and waters, and they also serve to direct DoC in its advocacy role beyond conservation lands and waters.

The Proposed Conservation Management Strategy Southland Murihiku 2015-2025 (the Proposed CMS) was publicly notified on 26 June 2013. Consultation, including a call for submissions and hearing of submissions on the proposed CMS occurred between June and November 2013. A revised Southland Murihiku CMS has been prepared in light of the feedback received and will be presented to the Conservation Board for Southland Murihiku, the New Zealand

Conservation Authority and the Minister of Conservation for recommendations and comment prior to its approval.

The Plant is not located within public conservation lands, however the Proposed CMS has relevance to freshwater habitats and the New River Estuary. Due to the extent to which the Proposed CMS has been through the public consultation and review phase, it is considered to be the most accurate and current reflection of DoC's policy position role with respect to these matters.

The Proposed CMS identifies water quality and quantity as two important issues within Southland Murihiku. It sets out that freshwater ecosystems within public conservation lands have been improving year by year and are on track to reach the overall long term goal of restoration to healthy ecosystems with clean water which can be used for recreation, drinking and production.

Freshwater policies for the Southland Murihiku area are set out in the 'Freshwater Wai Māori Place' section of the Proposed CMS. Relevant policies promote collaboration between Doc, Ngāi Tahu and the community (including adjacent landowners and relevant industries) to raise awareness about the connection between land use activities, freshwater ecosystems and the coastal environment. The purpose of this approach is to ensure the integrated and holistic management of Southland Murihiku freshwater ecosystems, resulting in the intrinsic values of wetlands, running waters, lakes and estuaries being sustained; the rehabilitation and restoration of the region's freshwater ecosystems; land use activities that do not adversely impact on freshwater ecosystems; and the implementation of the Freshwater NPS.

The New River Estuary has been identified as a "Wetland of International Importance" and is located within the 'Awarua Place' of the Proposed CMS. The New River Estuary is the ultimate receiving environment of discharges from the Plant therefore 'Awarua Place' polices are of relevance to this project.

The Awarua Place section of the Proposed CMS sets out that there are a number of pressures on the internationally significant wetland complex, largely a result of human modification and intensification of agriculture within the catchment. Relevant policies therefore seek to manage those parts of the Awarua Place that are identified as the Waituna-Awarua Wetland of International Importance to maintain the criteria for which it was nominated under the Convention of Wetlands of International Importance especially as Waterfowl Habitat 1971 (also referred to as the Ramsar Convention) and New Zealand's obligations under the Convention. Policies also seek to protect and enhance the Waituna-Awarua Wetland of International Importance by working with Ngai Tahu, relevant agencies and the community, including landowners and businesses.

5.8.4 Ngāi Tahu Claims Settlement Act 1998

After years of negotiations, legislation was passed in 1998 that put into effect the terms and redress package agreed to by Ngai Tahu and the Crown to mitigate and remedy breaches of the Treaty of Waitangi made by the Crown. The key elements of the Ngai Tahu Claims Settlement are:

- Apology: The Crown apologises unreservedly for the suffering and hardship caused to Ngai Tahu;
- Aoraki/Mount Cook: Gifting of Aoraki, co-management and renaming;
- Cultural redress: restoring effective kaitiakitanga;
- Non-tribal redress: Providing a commitment to resolve claims by individuals that were heard by the Waitangi Tribunal.
- Economic redress: To provide finance and mechanisms to give Ngai Tahu the capacity to build tribal assets to generate funds for social and cultural development.

A significant component of the Ngai Tahu Claims Settlement is elements of cultural redress, which seek to restore the ability of Ngai Tahu to give effect to its kaitiaki responsibilities. These include:

- Ownership and control: pounamu, high country stations, four specific sites including Rarotoka/Centre Island, former Crown Titi Islands and Wahi Taonga;
- Mana recognition: Statutory Acknowledgements, Deeds of Recognition, Topuni, dual place names; Mahinga kai: Nohoanga, customary fisheries management, taonga species management, coastal space;
- Management Input: Statutory Advisor, dedicated memberships, Department of Conservation protocols, Resource Management Act implementation, and heritage protection review.

Nohoanga are seasonal or temporary campsites, established adjacent to lakes and rivers to facilitate customary fishing and the gathering of other natural resources. The nohoanga site on the Oreti River is at the confluence of the Irthing Stream. This site reinforces the contemporary importance of the river in terms of kaitiakitanga, culture and identity. Traditionally, the Makarewa River would have had nohoanga. This is evidenced by the number of archaeological sites and ovens found along its length.

Many of the waterways of Southland/Murihiku have specific cultural associations. Statutory Acknowledgement areas under this Act provide for the special association and mana recognition of Ngāi Tahu with these waterways (Rivers, Lakes and Coastal waters). The relevant Statutory Acknowledgements in proximity to the application sites include the Oreti River (Schedule 50), and Rakiura/Te Ara a Kiwa (Rakiura/Foveaux Strait Coastal Marine Area (Schedule 104).

Under the Ngai Tahu Claims Settlement Act, the Crown acknowledges the cultural, spiritual, historic, and traditional association of Ngāi Tahu with the taonga species.

The customary fishery section of the Ngai Tahu Claims Settlement Act lists 'Non-commercially harvested species'. These species are:

a) Kākahi/Koaru (Freshwater mussels – *Unio menziesi*)

b) Kanakana/Ute (Southern lamprey – *Geotria australis*)
c) Karengo (Karengo/Nori – *Porphyra columbina*)
d) Karengo (Sea lettuce – *Ulva* spp.)
e) Rimurapa (Bull kelp – *Durvillee* spp.)
f) Toheroa/Tuphokura (Toheroa – *Paphies ventricosum*)
g) Waikōura (Freshwater crayfish – *Paranephrops* spp.)

5.8.5 Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008

The Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008 (the Iwi Management Plan) is a statement that consolidated Ngāi Tahu ki Murihiku values, knowledge and perspectives on natural resource and environmental management issues. There are numerous sections of the Iwi Management Plan that are relevant to the consideration of Alliance's consents. In particular, the plan is concerned with wastewater disposal, industrial activity, water and discharges to water, Southland's coastal environment, and discharges to air.

Generally, the relevant provisions are particularly concerned with the impacts on flora and fauna, water, air, soil, mahinga kai species and places, including discharge of contaminants to air, stormwater management and potential for effects on soils and water, contaminated run-off entering waterways and discharges of waste to water. Outcomes sought in the policies include:

- Avoiding adverse effects as the first option;
- Commitment to best practice and new technology;
- Assessment of environmental effects to include an assessment of cultural effects and potential cumulative effects on the natural character of the coastal environment;
- Environmental management plans;
- Robust monitoring programmes;
- Consent duration of 25 years or less; and,
- Review conditions.

The Iwi Management Plan contains a number of policies regarding air quality, some of which are directly relevant to industry related air discharges. The policies seek to:

- Discourage discharges that will have an impact on mahinga kai, taonga species, biodiversity, wahi tapu and wahi taonga;
- Ensure that processes used during activities that discharge to air are supervised and monitored to ensure that contaminant emissions are minimised;
- Encourage existing activities that emit contaminants to air to evaluate, and where practical, implement new technologies to reduce adverse effects on air quality; and

- Require new discharges to air to provide for periodic review and evaluation in advances of technologies to reduce adverse effects on air quality and to report on implementation of such technologies.

The Iwi Management Plan also contains policies relating to iwi engagement and odour management and seeks that discharges must not cause objectionable or offensive odour to the extent that they cause adverse effects beyond the boundaries of the consent holder's property.

The Iwi Management Plan also contains a number of specific policies around water quality; broadly speaking, the most relevant of those policies seek the following:

- No deterioration of any surface water body or ground water;
- Avoid the use of water as a receiving environment for the direct or point source discharge of contaminants;
- Avoid the use of upstream waters as a receiving environment for point source discharge of contaminants;
- Assess discharge to water proposals on a case-by-case basis;
- Strive for the highest possible standard of water quality;
- Avoid impacts on water as a result of inappropriate discharge to land;
- When assessing the effects of an activity on water quality, where the water source is in a degraded state, the effects should be measured against the condition that the water source should be in, and not the existing condition of the water source;
- Avoid impacts on coastal waters as a result of inappropriate discharge from activities occurring upstream and in areas adjacent to coastal waters; and
- Promote the uniqueness of estuarine ecosystems through maintenance and enhancement of their productive nature.

Of particular relevance, policy 3.5.12(4) states that "*when existing rights to discharge to water come up for renewal, they must be considered in terms of alternative discharge options. When assessing the alternatives to discharge to water, a range of values, including environmental, cultural and social, must be considered in addition to economic values*".

6. CONSULTATION

6.1 INTRODUCTION

This section outlines the consultation strategy and methodology that was undertaken for these applications. The consultation strategy was developed to provide targeted and effective consultation with key stakeholders and the wider public, and was facilitated by Tony Dons Limited.

A summary of the consultation undertaken for the resource consent renewal process and the key consultation outcomes of this process are set out below. The information contained in this section summarises the consultation report that has been prepared by Tony Dons Ltd and is attached as **Appendix B**.

6.2 CONSULTATION METHODOLOGY

Embarking on a robust consultation process has been a principal part of the resource consent renewal process for Alliance. The main objective of the consultation process was to address, as far as reasonably possible, the key issues and concerns of stakeholders, interested parties and directly affected parties prior to the finalisation and lodgement of the resource consent application.

The consultation strategy can be largely separated into three key work streams; consultation with key stakeholders, consultation with the Lorneville community, and consultation with the wider Southland community.

6.3 WASTEWATER TECHNICAL WORKING PARTY

A Wastewater Technical Working Party (TWP) was established soon after the project inception to ensure the early and collaborative involvement of the region's key stakeholders. The TWP was comprised of representatives from the following organisations:

- Environment Southland;
- Southland District Council;
- Invercargill City Council;
- Fish and Game;
- Department of Conservation;
- Southern District Health Board / Public Health South; and
- Te Ao Marama;

The TWP met on six occasions between March 2013 and July 2015 to discuss the results of the extensive field investigations completed by Alliance, the effects of the current Plant operations on the surrounding environment, and the short and long term mitigation required to address these effects. Members of the TWP expressed support for Alliance's proposal to upgrade the primary wastewater treatment system. Concern was however expressed for the duration of the consent terms being sought, and preference was given to a 25 year term.

At the final TWP meeting Alliance presented responses to various issues raised by SFG, DOC and PHS, presented a summary AEE and proposed consent conditions. Although a large measure of agreement was achieved with the TWP a number of outstanding issues remained. These are summarised in the sections that follow.

6.3.1 Environment Southland, Invercargill City Council, Southland District

The TWP process has provided a useful forum for Environment Southland to gain an early understanding of the consent applications and associated technical information as well as hear first-hand the concerns and consensus achieved between Alliance and other stakeholders.

Alliance consulted Environment Southland over the project plan at the start of the project (7 March 2013) to confirm the general approach, the required consent applications, the range of technical assessments, the consultation programme and the key issues to be addressed in the applications.

Environment Southland was also provided with technical briefings and project updates, and individual meetings between staff and Alliance and its experts in addition to those received at TWP meetings.

No significant issues or concerns were raised by Invercargill City Council or Southland District Council during the consultation process.

6.3.2 Te Ao Marama

Alliance has consulted Te Ao Marama as a member of the TWP and through individual meetings.

Consultation with Te Ao Marama began with Alliance outlining the consent application project plan, providing background information on Alliance, and the Lorneville Plant, clarifying that Alliance intended to apply for 35 year permits and providing a site inspection of the processing plant, wastewater treatment plant and the Makarewa River. Key aspects that arose early in the consultation with Te Ao Marama were:

- Te Ao Marama would represent the interests of Waihopai, Awarua and Hokonui Runanga and TRONT;
- Te Ao Marama acknowledged that the Alliance Lorneville plant makes a significant contribution to the Southland economy and provides much needed employment;
- iwi takes a Southland-wide view of discharges and regarded the reduction in combined wastewater discharges from the Lorneville, Makarewa and Mataura plants as a significant environmental benefit;
- deterioration of New River Estuary water quality and ecology was a significant concern for iwi;
- a Cultural Values Report should be prepared and Kitson Consulting assisted with this.

- Ngai Tahu were normally reluctant to agree to more than a 25 year term for wastewater discharge permits;
- iwi noted that environmental compensation was an acceptable approach where adverse effects on the environment in one locality were compensated for by environmental enhancement in another locality;
- avoiding the discharge of human waste to water was desirable for iwi but this aspect was not clear-cut because other communities still discharged human waste to water and the Alliance discharge included human waste from Wallacetown.

Kitson Consulting prepared a Cultural Values Report (refer **Appendix C** attached) for Te Ao Marama and this was presented to Alliance and its consultants on 15 October 2014. Te Ao Marama explained that the report was not a Cultural Impact Assessment and did not replace consultation with iwi.

Te Ao Marama also explained that freshwater mussels (waikakahi) were an important taonga and that iwi would not give up on trying to restore their population. Alliance noted that in their investigations no mussels had been observed and the setting of site-specific ammonia criteria would not include the very low ammonia levels required by freshwater mussels.

The Cultural Values Report formed the basis for consultation between iwi and Alliance. Alliance outlined its river assessments and wastewater treatment investigations to iwi as well as details of an environmental upgrade plan which included current and proposed wastewater treatment upgrades and proposed habitat improvements of an oxbow on Alliance land and fencing and planting of Makarewa River riparian areas.

After consideration by the Te Ao Marama Board, iwi considered that the proposed wastewater upgrade was a significant improvement and expressed its general support for this aspect but could not support a 35 year term.

Te Ao Marama advised that there is a preference to separate human effluent from the discharge stream, but in the circumstances agreed that this was not practicable for Alliance to achieve at this time. Alliance also outlined the proposed continued abstraction of water from the Oreti River. The continued abstraction did not give rise to the identification of any significant concerns to iwi during the consultation process.

The culmination of pre-application consultation between Alliance and iwi was the completion of an Iwi Values and Mitigation Table. The latest version is included in **Appendix B**. It was agreed with iwi that a formal Cultural Impact Assessment was not necessary and that the table in **Appendix B** represented an agreed position between Alliance and iwi.

Key outcomes from the consultation between Alliance and iwi are:

- iwi express support for the proposed wastewater treatment upgrade in order to improve water quality;

- preference for a lesser consent term duration for the discharges to water;
- iwi have a strong preference for land disposal of all wastewater and for avoiding human waste discharges to water. Iwi indicated acceptance that these preferences are not practicable in this case;
- Alliance has committed to an Environmental Monitoring Plan, a Habitat Enhancement Management Plan, annual monitoring reports, pre- and post-upgrade aquatic biological and fish health surveys, ongoing iwi consultation, a wastewater treatment upgrade plan, continual improvement, avoidance of fish or eel stranding within the water take channel or on the riverbanks, enabling practicable access to Alliance land, post-treatment upgrade review and participation in a catchment-wide water quality approach.

6.3.3 Southland Fish and Game

Southland Fish and Game was represented at all meetings of the TWP and provided written comment on the proposed receiving water limits, the proposed Oreti River water take and on proposed conditions. Southland Fish and Game also provide written comments on potential recreational effects arising from the proposed discharge to water and abstraction of water.

During the pre-application consultation, Southland Fish and Game made a number of specific comments on receiving water limits for periphyton, nitrate, ammoniacal-nitrogen, dissolved oxygen, E coli, clarity, temperature, pH and foams and scums. Southland Fish and Game also questioned why a 15 year delay was needed before implementing the primary wastewater treatment upgrade.

Although Southland Fish and Game recognises the priority of Alliance's water takes from the Oreti River, it was recommended that Alliance should consider voluntary water conservation measures at the 7-day Mean Annual Low Flow (MALF). Southland Fish and Game also recommended that water take screening arrangements should reflect NIWA recommendations.

Alliance considered all of these comments and made a number of adjustments including amendments to dissolved oxygen, temperature and pH limits within the receiving Makarewa River environment and committing to the implementation of an upgrade of the current fish screen for the intake structure

6.3.4 Department of Conservation

DoC was represented at all but one TWP meetings and provided written comment on the general approach and proposed conditions.

DoC observed that the New River Estuary is significant and that the Makarewa River has significant ecological values but is not outstanding. Many of the limits sought by Alliance are "bottom line limits" and do not seek to improve fresh water values. DoC however recognises that some significant improvements are being proposed. DoC also considered that the proposed consent term for the discharge to water consent is too long.

DoC pointed out that the New River Estuary is in a poor state but provides important habitat and is an important fishery nursery. The Makarewa River also provides a migratory pathway for fish. It was considered that sediment nutrient targets and monitoring should be considered by Alliance. Many of the concerns raised by DoC were similar to those identified by Southland Fish and Game and where appropriate Alliance has made amendments or refinements to the application or conditions in light of these.

6.3.5 Public Health South

Public Health South (PHS) was represented at all but one TWP meetings and provided written comments on the consultation process, *E.coli* and wastewater disinfection, the wastewater discharge permit and the proposed conditions. PHS also provided written comments on recreation effects which are discussed in section 5 of this report. PHS was supportive of the consultative approach taken by Alliance to these consent applications.

Although PHS expressed support for the proposed wastewater upgrade, PHS was very keen to see a commitment from Alliance to reduce its microbial contribution to the Makarewa River even if upstream levels were elevated. This was reiterated a number of times during the pre-application consultation.

In response Alliance has committed to undertaking a review, 10 years after the commencement of the consents, which would examine *E.coli* levels in the Makarewa River and determine the practicability of treatment e.g. disinfection. This commitment appeared to satisfy PHS concerns regarding river bacterial levels and PHS acknowledged that a delay in the review and potential *E.coli* treatment was reasonable in this case.

6.3.6 Recreational Users

Consultation with key stakeholders such as Te Ao Marama, Southland Fish and Game, DoC, PHS and the Wallacetown Community Board who also represent recreational user groups has also occurred. No significant recreational issues were raised by these stakeholders. Consultation with individual recreational users, including two commercial eelers and two recreational whitebaiters resulted in the following comments regarding the eel and whitebait fishery of the lower Makarewa River:

- The lower Makarewa River supports a productive eel and whitebait fishery alongside the discharge of treated wastewater from the Alliance Lorneville plant.
- Recreational eeling in the lower Makarewa River appears to be minor while about five whitebaiters regularly fish this area but up to 15 whitebaiters may on occasion be present.
- Physical access difficulties to the lower Makarewa River appears to limit recreational fishing while the Alliance wastewater discharge does not appear to limit recreational eeling or whitebaiting.

6.4 LORNEVILLE COMMUNITY

As part of its role as a responsible neighbour, Alliance holds an annual community consultation meeting with the residents of the Lorneville community. The purpose of these meetings is to provide Alliance with the opportunity to inform residents of any new developments or changes occurring at the Plant, and also provides residents with an opportunity to discuss any issues that they may experience from the Plant's operation. It appeared that of greatest concern to the immediate community and neighbours of the Plant related to the impacts of existing and potential odour arising from activities undertaken at the Plant. Largely through onsite process changes, in particular the upgrade to the rendering system a noticeable reduction in odour emissions from the site has occurred. This has been determined on the basis of a reduction in the number of odour complaints received by Alliance, as well as within the odour survey undertaken by Golder Associates (refer **Appendix F**).

Consultation with representatives of the Wallacetown Community Board, including its chairman, also indicated a low level of concern from the nearest settlement. This was confirmed in writing and included support for a 35 year consent term.

6.5 COMMUNITY CONSULTATION

A public information evening was held on 26th August 2015 to enable the wider community to visit the Plant and discuss the proposed applications with Alliance staff and air quality, water and planning experts. Although the event was widely publicised (invitations to surrounding community and advertisements in local newspapers), only a modest attendance at the event was recorded (six people).

Those who attended the event indicated that they felt that the evening was helpful to gain a better understanding of the applications, and were given opportunity to provide feedback.

The issues raised on the feedback forms included:

- health effects of boiler emissions;
- odour emissions;
- light pollution; and
- odour from biosolids land discharges.

Two parties required further information and one party wished to meet Alliance representatives. These actions have been attended to.

6.6 CONSULTATION OUTCOMES

Overall it is considered that the consultation process has been robust and included substantial technical consultation particularly on the proposed wastewater discharge. Agreement has been reached with key stakeholders on the proposed primary wastewater treatment upgrade and feedback from stakeholders has been instrumental in shaping the form of the assessment and

proposed conditions. Immediate neighbours have expressed concern with respect to existing and potential future odour emissions (i.e. from the biosolids discharge to land). These matters are addressed in the following section of this report. There has not been widespread community or public interest in the proposed applications to date.

7. ASSESSMENT OF ENVIRONMENTAL EFFECTS

7.1 INTRODUCTION

Under the RMA an assessment of environmental effects of the applications is required. The following sections of this report contain discussion and assessment of how the proposal might affect the natural and physical resources at the subject site, and how any potentially adverse effects will be managed in a sustainable and integrated way to ensure they are avoided, remedied or mitigated.

The proposal is considered to raise the following actual and potential effects on the environment:

- Economic and social effects;
- Effects on water quality from discharges to surface water;
- Ecological effects;
- Effects on water quantity and quality from the proposed water abstraction;
- Recreational effects;
- Effects on air quality;
- Soil and groundwater effects; and
- Cultural effects.

The nature, scale and intensity of these effects on the receiving environment are described and assessed in the sections below.

7.2 ASSESSMENT METHODOLOGY

A number of technical reports were prepared by independent technical specialists in order to inform a comprehensive assessment of the environmental effects associated with the Alliance Plant. The specialists were also engaged to provide recommendations regarding appropriate mitigation measures and environmental monitoring to be undertaken by Alliance to manage adverse effects.

While the specialists were engaged to carry out assessments within their field of expertise, there is some overlap in the information provided. An overview of the approach taken by the technical specialists in carrying out their various assessments follows. Copies of each technical report are included in the Appendices attached to this application. These reports form an integral part of the applications and this AEE.

Section 8 of this report sets out the framework by which effects (as identified in the technical reports and summarised below) will be managed during the life of the consents, including through consent conditions.

7.3 ECONOMIC AND SOCIAL EFFECTS

This section identifies and assesses the potential economic and social effects of the continued operation of the Plant for a term of 35 years. The information

contained in this section summarises the report that has been prepared by Brown, Copeland and Co Ltd and is attached as **Appendix N**.

Economic considerations are an integral element of the purpose of the RMA. In particular:

- Part 2 section 5(2) refers to enabling people and communities to provide for their economic well-being, as a component of sustainable management;
- The definition of "environment", and therefore of environmental effects, includes people and communities; and
- Section 7(b) directs that particular regard be given to the efficient use and development of natural and physical resources.

In addition to these provisions, given that this application seeks to renew consents to enable the ongoing operation of the Plant, an evaluation of the value of the existing investment of the Plant to the consent holder is required pursuant to section 104(2)(A), 124 and clause 3 of Schedule 4.

There are significant positive regional and local economic effects arising from the continued operation of the Plant.

In 2014 within the Southland region, statistics show that there were 48,460 jobs. Primary production (agriculture, forestry and fishing) and manufacturing are the two largest employment sectors in the region. These industries have been identified as the "economic drivers" of the region.

Other important sources of employment for the Southland region are retail trade, health and social assistance, education and training, and accommodation and food services. However, these sectors are to a large extent, driven by or dependent on the economic activity generated by the "economic drivers" of the region.

The Plant employs around 165 full time salaried staff and 1,702 seasonal workers at its peak in operation. This equates to 1,016 full time equivalent staff. Alliance pays out $71.4 million in wages and salaries per annum and spends an estimated additional $17.9 million per annum in the Southland region on goods and services. Goods and services to the Plant provided by local firms include engineering, plumbing, electrical and security contractors, packaging suppliers, utilities (electricity and telecommunications), providers of medical services and supplies, professional service supplies and providers of laboratory equipment and materials, clothing, fuels, knives and food. These are the direct economic impacts for the Southland region's economy from the Plant's operations.

In addition to these direct economic impacts, there are indirect impacts arising from:

- The effects on suppliers of goods and services provided to the Plant from within the region; and

- The supply of goods and services from within the region to employees at the Plant and to those engaged in supplying goods and services to the Plant (i.e. employee expenditure at supermarkets, and restaurants in the area).

The economic assessment attached as **Appendix N** quantifies the size of these indirect effects to provide the equivalent of 1,850 full time jobs and $125 million per annum in wages and salaries for Southland residents.

Furthermore, Alliance is owned by its farmer shareholders, many of whom are based in the Southland region. Increased returns to farmer shareholders in Southland will flow through to increased expenditure, employment and incomes within the Invercargill and Southland economies.

7.3.1 Economic Efficiency

The economic assessment attached as **Appendix N** identifies that there are a number of economic efficiency benefits that will arise from Alliance obtaining consents to enable the continued operation of the Plant. These include:

- The continued use of existing plant and equipment recovering significant investment costs;
- Sufficient livestock production capacity in the immediate area and wider district;
- Optimal location for livestock and processed products transportation;
- The proximity of a trained and experienced workforce;
- The proximity of supplier businesses with appropriate expertise and experience;
- The proximity of road and rail networks for Plant inputs and outputs;
- The availability of sufficient water supply from the Oreti River (and the Makarewa River if necessary) to enable livestock processing operations;
- The ability to discharge treated meat processing waste to the Makarewa River and treated wastewater to land;
- The ability to minimise or mitigate adverse environmental effects to acceptable levels for neighbours and the wider community;
- The site is of sufficient size to enable future expansion; and
- Economies of scale and scope as compared to relocating processing capacity to a number of alternative sites.

The assessment determines that the ongoing operation of the Plant will enable Alliance and its supplier shareholders to continue to benefit from these economic advantages. The closure or downsizing of the Plant due to consent applications being declined, being granted for a lesser term than required or granted with more onerous conditions would result in significant efficiency losses, higher costs and reduced returns. As a result, there would be ensuing economic costs for the broader Invercargill and Southland communities.

Financial benefits to Alliance are also relevant with respect to the 'efficient use and development of natural and physical resources' and New Zealand's export competitiveness, given the Plant's significant scale and the importance of meat and meat product exports to the New Zealand economy.

The Plant forms a significant component of lamb and sheep processing capacity in Southland. Farmers would need to truck stock out of the region for processing if the Plant's processing capacity was reduced or terminated as there is insufficient capacity at other plants within the region to absorb the quantity of lambs and sheep that are processed at the Plant. This would add to farmers' costs, reduce their disposable incomes and reduce spending and associated multiplier effects in Invercargill and other centres around the region. Furthermore, the Plant provides Alliance with its only rendering operation in the region. In addition to rendering by-product from Alliance's other plants, it renders fallen stock on a tolling basis for Slink Skins New Zealand (SSNZ). SSNZ collects fallen stock from farms in the region, skins the animals and transports skinned carcasses to the Plant to be rendered. In the absence of this service, the stock would be left on farms and need to be disposed of at the farmers' cost, with the likely result that this resource would be wasted.

It is also noted that there are economic efficiency benefits associated with consents being granted on a longer term basis (i.e. 35 years). Longer term consents avoid more frequent consent renewal costs, and provide greater certainty for investment in and management of the Plant.

7.3.2 Economic Resilience

As noted above, the Southland region and Invercargill City are dependent upon the agricultural sector, especially mutton and beef production and dairy farming. The economic assessment determines that the Plant contributes greater diversity and balance to the two economies. Having livestock processing capacity within the region provides employment opportunities and incomes that are less dependent upon direct returns to the agricultural sector. This improves the resilience of the Invercargill City and Southland economies to agricultural commodity price cycles.

The Plant also enables Invercargill City to retain and attract population, and as a consequence, the residents and businesses within Invercargill benefit from economies of scale, greater competition, increased resource utilisation and a wider range of Central Government services. This is also true for the wider Southland region, although to a lesser extent.

7.3.3 Other Direct Contributions to the Local and Regional Economy

In addition to employment and wages and flow-on effects in the local economy, the Plant pays approximately $93,000 per annum in rates to the ICC and $7,400 per annum in rates to Environment Southland. The economic assessment determines that while these payments are for Council services from which Alliance and its employees benefit, economies of scale mean that should the Councils lose this income, the range and quality of Council services would

diminish and/or payments by other ratepayers in the City and region would need to increase to maintain the current standard of service delivery.

It is also noted that the Plant currently treats and disposes of effluent generated by the Wallacetown community. Should the consents for the Plant's wastewater disposal not be granted, or be granted with more stringent conditions (ie. requiring disinfecting of the full wastewater stream, or requiring the separation of human waste) there would be significant additional capital and ongoing costs for Wallacetown and Southland ratepayers to bear.

Alliance also contributes to a number of community and national initiatives. In 2014, the Plant had made grants totalling $61,000 to various community organisations.

7.3.4 Existing Investment Value

The Plant provides Alliance with its only processing capacity for lambs and sheep within the Southland region and any reduction in the plant's capacity to process lambs and sheep would see this livestock processed outside the region. The latest estimate (December 2014) for the Lorneville plant's replacement cost is $240 million and much of this value is sunk – i.e. it could not be recovered if the plant was forced to downsize, close or be relocated.

Stock for the plant is largely sourced locally, with in 2013/14, 74.2% from Southland, 19.3% from Otago, 0.9% from the rest of the South Island and 5.6% from the North Island. Stock numbers processed in 2011/12 were 2,392,222 LE, in 2012/13, 3,001,896 lamb equivalents and in 2013/14, 3,052,354 LE. The forecast for 2014/15 is 2,902,300 lamb equivalents. Meat and meat products plus wool and pelts having a total value of $433 million were produced at the plant in 2013/14. A total of 1,471 twenty foot equivalent unit (TEU) containers of meat and meat products were shipped from the plant through SouthPort in 2013/14.

Analyses undertaken by Alliance has confirmed that there are significant advantages in retaining processing capacity at the Lorneville Plant relative to other potential new sites and/or the expansion of other existing plants. Consent renewals will therefore enable Alliance and its supplier shareholders to continue to benefit from these economic advantages of the Plant. Closure or downsizing of the plant due to consents not being renewed or with a less than 35 year consent timeframe would result in efficiency losses, higher costs and reduced returns for Alliance's farmer shareholders. Granting consent, with a 35 year timeframe also recognises the significant financial commitment that Alliance has made with regard to technological upgrades, and allows these costs to be recovered over an appropriate timeframe.

7.3.5 Overall Assessment

The New Zealand meat industry plays a major role in generating wealth for the New Zealand economy and in particular the rural communities, such as Southland, that have local economies substantially based on the agricultural production and processing sector.

Alliance is Southland's largest employer, employing around 1900 people seasonally. The Plant is therefore a key contributor to the regional economy.

The Plant plays an essential role in New Zealand's meat export sector. The meat industry is a partnership between farmers, processors and exporters. Most farms in Southland are owned and operated by farming families. Without access to a large local processing plant, costs associated with transportation and processing elsewhere would increase. There are significant regional economic benefits stemming from the cost savings for local farmers in the continued ability to utilise the Plant. Alliance is also a wholly farmer-owned company, with all profits returned to the company's farmer shareholders less a portion retained for growth. Many of these shareholders are based in Southland. Therefore, the direct and indirect positive economic and social effects arising from the ongoing operation of the Plant are significant at national, regional and local levels.

7.4 EFFECTS ON WATER QUALITY FROM DISCHARGES TO SURFACE WATER

This section identifies and assesses the direct and indirect effects of the treated wastewater discharge on the receiving environment - being the Makarewa River, Oreti River and the New River Estuary. The information contained in this section summarises the reports that have been prepared by Freshwater Solutions Limited and Aquatic Environmental Sciences and are attached as **Appendices D, K and L**. The reports provide a detailed account of the monitoring that was undertaken in order to collect the data necessary to inform an assessment of the actual and potential effects arising from the treated effluent discharge. The reports also establish the relevant discharge standards and guidelines to be adhered to and assess each of the actual or potential effects of the current discharge quality against those standards and guidelines.

7.4.1 Monitoring of the Existing Environment and Discharge

Desktop research, as well as field monitoring, has been undertaken by Freshwater Solutions and Aquatic Environmental Sciences (refer **Appendix D** attached) to inform the description of the receiving riverine environment. A description of the monitoring that has been undertaken is set out below.

Since late 2012, monitoring has been undertaken in respect of the following four topics:

- Water quality;
- Biological monitoring;
- New River Estuary; and
- Recreational values.

7.4.1.1 Makarewa River Water Quality Monitoring

Alliance undertakes regular compliance water quality monitoring at three sites (refer **Figure 9**):

- Bridge Site (upstream of the discharge);
- A site 350m downstream of the discharge; and
- Boundary Site (1,200m downstream of the discharge).

Samples are collected daily (September – April) and weekly (May – August) at these sites.

Daily samples are analysed for:

- Electrical conductivity;
- pH;
- Temperature;
- Dissolved oxygen;
- Percent dissolved oxygen saturation; and
- Total ammoniacal nitrogen.

Weekly samples collected at these three sites are analysed for the parameters listed above and the following additional parameters:

- Total nitrogen;
- Total oxidised nitrogen;
- Total phosphorous;
- Dissolved reactive phosphorous;
- Carbonaceous Biological Oxygen Demand;
- Soluble carbonaceous Biological Oxygen Demand;
- Faecal coliforms; and
- Black disk distance (clarity tube).

This monitoring data has been taken into account as part of the water quality assessment and reference to the above monitoring sites as the “Bridge Site”, “350m Site” and “Boundary Site” is made throughout this report. Refer to the figure below for the location of these sites.

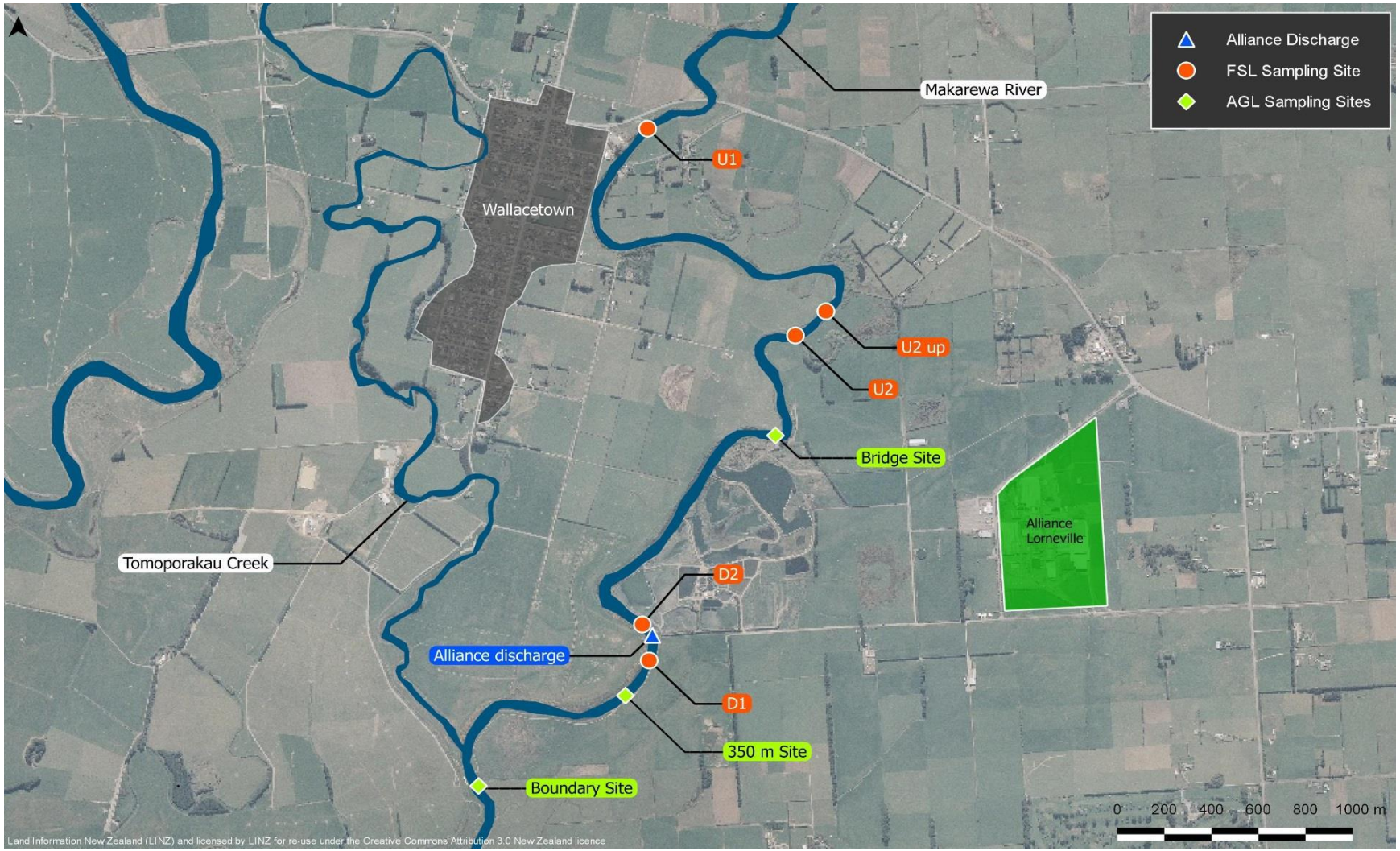


Figure 9: Makarewa River Monitoring Sites

7.4.1.2 Further Monitoring

In addition to the monitoring undertaken by Alliance as part of its current consent compliance obligations, four additional monitoring sites (Sites U1, U2, D1 and D2) on the Makarewa River were sampled in March 2013, November 2013, February 2014 and March 2014. Sites U1, U2, D1 and D2 are shown in **Figure 9** above. Site D1 is only accessible at low river flow (less than 4m^3/s) and low tide, is approximately 100–200m downstream of the discharge and is within the discharge mixing zone. In order to ensure a balanced statistical design, a second site (Site D2) was selected 70m upstream of the discharge and within the mixing zone during the incoming tide. Sites D1 and D2 are therefore both located within the mixing zone. Sites U1 and U2 are both upstream of the discharge, and outside the mixing zone. Site U1 is approximately 300m downstream of the Wallacetown Bridge Site, and was selected because it is monitored annually by Environment Southland and has a good long-term benthic invertebrate dataset with which to compare results. Site U2 is approximately 2km upstream of the discharge, and beyond the influence of the discharge and where the effect of the tide on habitat conditions and water level variations is minor.

7.4.1.3 Makarewa River Biological Monitoring

Biological surveys included assessments of habitat, aquatic plants, invertebrates and fish. A standard study design for assessing effects typically involves monitoring two to three sites, both upstream and downstream of the discharge, with sites carefully selected to minimise the potential for habitat conditions to influence survey results. In this case, the location of the discharge prevents such an approach being used, because suitable habitat downstream of the discharge is affected by the physical characteristics of the environment and tidal influences. The four biological monitoring locations were therefore chosen on the basis of providing a balanced statistical design where the effects sites (D1 and D2) provide a 'worst case' assessment, as they are located within the mixing zone and the upstream sites, being beyond the influence of the discharge, and provide good long-term benthic invertebrate datasets from which to compare results.

The Plant discharge point is located near the upper end of the tidally-influenced section of the river, with a decreasing gradient of tidal influence from Site D1 to Site U2. The tide affects river level and water velocity but not salinity. Site U1 near the Wallacetown-Lorneville Highway Bridge is unaffected by the tidal cycle. The changes that occur in an upstream direction between Sites D1 and U2 include an increase in coarse substrate, an increase in riffle habitat, decreased macrophyte cover and decreased river water level variation.

Biological monitoring at the four sites included the following parameters:

- Periphyton cover;
- Macrophyte cover;
- Macrophyte species cover;
- Benthic invertebrates; and
- Native fish.

Samples of whitebait caught from the Makarewa River in the vicinity of the discharge between 17 August and 4 November 2013 were collected from fishermen and identified and used with data from electric fishing and net surveys in 2013 and 2014 to describe the fish community.

7.4.1.4 New River Estuary

As both Invercargill City Council and the Southland Regional Council regularly and comprehensively monitor the New River Estuary, no additional sampling was considered necessary. Instead, the effect of the treated effluent discharge was assessed by Dr Shane Kelly of Coast and Catchments Ltd. Dr Kelly used the results from the Catchment Land Use for Environmental Sustainability (CLUES) model (undertaken by Wriggle Environmental) to determine the proportion of nutrients in the estuary discharged by the Plant, compared to other point and diffuse nutrient sources.

Consideration was also given to undertaking biological surveys in the lower Makarewa River beyond the mixing zone and in the lower Oreti River. However, the confounding effects of the tidal influence and other catchment-scale effects mean that monitoring further downstream is unlikely to distinguish the effects of the discharge from other influences. For this reason, biological sampling was not undertaken in the lower Makarewa or Oreti Rivers.

7.4.2 Receiving Water Quality Indicators/Parameters

Key indicators of water quality have been identified during the monitoring and assessment processes. These were derived through analysis of the discharge and receiving environment data, and through consultation with Alliance's project team, the Regional Council and the TWP. The key water quality indicators are set out in the table below.

Table 8: Key Water Quality Indicators

Parameter
Ammoniacal-N (Amm-N) toxicity
Nutrient concentrations
Bacteria concentrations
Dissolved oxygen (DO) concentrations
Colour and clarity
Foams and scums
Algal growths
Benthic invertebrate community
Fish community
Cultural and recreational values

The potential effects resulting from these indicators is set out below:

Amm-N

Elevated Amm-N has the potential to be toxic to a range of aquatic organisms and can contribute significantly to nitrogen enrichment. The most sensitive species are invertebrates including the mayfly *Deleatidium*, the amphipod *Paracalliope fluviatilis*, the stonefly *Zelandobius furcillatus* and the clam *Sphaerium novaezelandiae*. Elevated Amm-N concentrations have the potential to cause adverse effects in the mixing zone and lower Makarewa River through chronic and acute toxicity, to adversely affect fish migration in the mixing zone and to contribute to nitrogen loadings in the lower Makarewa and lower Oreti Rivers and New River Estuary.

Nutrients

Dissolved nitrogen and phosphorus can cause nuisance algal growths in some rivers, while total phosphorus (TP) and total nitrogen (TN) can result in eutrophication effects such as nuisance macrophyte and macroalgal growths in the lower reaches of rivers and in estuaries.

The nitrogen and phosphorus load in the discharge has the potential to contribute to adverse cumulative effects as a result of elevated background nutrient concentrations in the Makarewa River, the lower Oreti River and the New River Estuary. These effects are a result of the current level of nutrients in the discharge as well as the input of nutrients from the wider catchment, which will impact on the lower Makarewa and Oreti Rivers (eg. cyanobacteria blooms at the Wallacetown-Lorneville Highway Bridge) and the New River Estuary (eg. macroalgae proliferations).

The input of nutrients from the Plant includes treated domestic effluent from Wallacetown and the Plant, and the meat-processing wastewater from the Plant itself and will contribute to nutrient loads in the lower Makarewa River, lower Oreti River (below the confluence with the Makarewa River), and the New River Estuary.

Elevated sediment nutrient concentrations can lead to nuisance macrophyte growths that adversely affect aquatic biological communities through altering habitat and water quality. The elevated background water and sediment nutrient concentrations in the Makarewa River, and the high concentrations of nitrogen and phosphorus in the discharge, have the potential to cause nuisance plant growths. The nature of the habitat in the lower Makarewa River is largely fine gravels developing into fine muds and silts, which means that potential effects are on macrophyte and not periphyton growths. In the New River Estuary the potential effect is through macroalgae growth (eg. sea lettuce).

Bacterial

Bacteria have the potential to cause human health issues directly through contact recreation and indirectly through contamination of fish and shellfish. The background faecal indicator bacteria concentrations in the Makarewa River, including the upper catchment, the lower Oreti River and the New River Estuary are elevated. There are no designated bathing areas in the lower Makarewa River, but trout fishing, whitebaiting, eeling for cultural and commercial activities

and game bird hunting do occur. New River Estuary is an important area for fishing and gathering of shellfish and contact recreation and as a consequence the high faecal indicator bacteria load in the discharge has the potential to adversely affect humans.

Dissolved Oxygen

Dissolved oxygen (DO) is critical to supporting healthy aquatic ecosystems with concentrations needing to be above 5g/m^3 as a minimum average over 7 days and above a daily minimum of 4g/m^3 to avoid adverse effects. The discharge can occasionally contribute to low summer time DO concentrations below 5g/m^3 in the lower Makarewa River that has the potential to have an adverse effect on aquatic biota.

Colour, Clarity, Foams and Scums

Wastewater discharges have the potential to have aesthetic effects by altering colour and clarity and generating foams and scums. Although there is no public access or designated bathing areas in the Makarewa River downstream of the discharge, the river is used by duck hunters and fishermen and their enjoyment of fishing and hunting could be reduced by the presence of a detectable change in colour and clarity and foams and scums.

Nuisance Algal Growths

Nuisance algal growths include sewage fungus, periphyton and macrophytes. The soft bed, slow flowing, macrophyte-dominated and tidal nature of the lower Makarewa and lower Oreti Rivers means they are depositional environments, and along with the New River Estuary, they reflect the cumulative pressures of land use and drainage throughout the Makarewa and Oreti River catchments. The soft bed and tidal nature is not suited to supporting periphyton growths. The discharge has low concentrations of Biochemical Oxygen Demand (BOD) needed to sustain sewage fungus and the discharge does not cause sewage fungus growths. The discharge location and elevated nutrient concentrations in the discharge and receiving environment have the potential to elevate water and sediment nutrient levels, with the sediment levels in particular potentially leading to the proliferation of macrophytes that in turn can alter pH and DO levels and affect habitat for a range of aquatic biota.

Benthic Invertebrate Community

The benthic macroinvertebrate community (snails, bivalves, chironomid larvae, worms, caddisflies, and occasionally mayflies) in the lower Makarewa River reflects the location, land use and modification throughout the catchment. The soft bed and tidal nature of the receiving environment is not suited to water and habitat sensitive taxa (eg. the mayfly *Deleatidium*) and thus, reduces the overall sensitivity of the invertebrate community to water quality effects associated with the discharge. Despite this, the invertebrate community is an important component of the lower river ecosystem and there is potential for the discharge to result in adverse effects in the lower Makarewa River, indirectly through altered habitat (eg. increasing macrophyte cover) or directly through toxicity (eg. Amm-N effects). Available habitat for a number of macroinvertebrate taxa will be reduced or they will not be present due to the tidal nature of the lower river, irrespective of the discharge.

Fish

The lower Makarewa River supports good numbers of shortfin eel and common bully populations and provides seasonal adult habitat and feeding areas for inanga, brown trout and black flounder. The discharge has the potential to have direct effects (eg. through Amm-N toxicity) on fish diversity and abundance within the mixing zone and the lower Makarewa River downstream of the discharge and indirect effects through altered habitat (eg. macrophyte growths) and altered food sources (eg. benthic invertebrate community composition) in the mixing zone, lower Makarewa River and New River Estuary. The lower Makarewa River is a migratory pathway for a range of whitebait species including inanga, banded kokopu, giant kokopu and koaro. The Amm-N concentrations within the discharge have the potential to affect fish migration within the mixing zone during the early part of the processing season (October-December) when upstream migration of some species such as inanga and kokopu is occurring.

Recreational Use and Value

The lower Makarewa River is used for a range of activities, with the main ones being whitebaiting and game bird hunting. New River Estuary is an important area for non-contact (walking, fishing, bird watching, picnicking, etc.) and contact recreation (boating, water skiing, and bathing) and as a consequence, the high faecal indicator bacteria load in the discharge has the potential to adversely affect humans. The discharge has the potential to contribute to the cumulative adverse effects of the wider catchment on the recreational values of these waterways by altering water quality and biological communities.

7.4.3 Current Discharge Quality

Based on the monitoring described in the report attached as **Appendix D** and summarised above, the median pH of the discharge was measured at 8.2 and no trend in pH was apparent. The median conductivity was 1.9mS/m, with some seasonal trends being evident.

Alliance's existing consent (92195) requires that TSS concentration in the discharge does not exceed 300g/m^3, with an additional condition that TSS concentrations are 'consistently maintained' at or less than 200g/m^3. The monitoring indicates that the discharge is generally compliant with this requirement.

The median TN concentration in the discharge was determined to be 110g/m^3 and is dominated by Amm-N. The median TN load in the discharge was 1,320kg/day. The median TP concentration in the discharge was 11 g/m^3 and the median TP load in the discharge was 140kg/day. The greater proportion of TP is present in a soluble form (DRP). The median BOD concentration in the discharge was 16g/m^3 and the median BOD load was 120kg/day.

The median faecal coliform concentration in the discharge was 3,100 MPN/100 mL and the median faecal coliform load was 4.5 x10^{11} MPN/day. Data collected with respect to *E.Coli* indicates that the median concentration in the discharge was 2,400 cfu/100mL and the median load was 3.6 x10^{11} cfu/day.

7.4.4 Mixing Zone – Makarewa River

The section of the Makarewa River where the discharge occurs is influenced by a strong tidal flushing effect, but the river does not become significantly saline during the flush tide. This tidal influence has a bearing on the extent of the mixing zone. An assessment of the mixing zone utilised the sodium concentration of the discharge in order to determine how the discharge was mixed in the receiving environment, under both high and low tidal conditions. The key findings from this assessment were:

- At low river flow and near low tide conditions, the discharge appears well mixed transversely at the river surface, 200m downstream of the discharge;
- At low river flow and near high tide conditions, the discharge appears well mixed at the river surface and at depth from 200m downstream of the discharge, although the river is flowing 'backwards'.
- Under the same flow and tidal conditions the discharge is not fully mixed either transversely at the river surface or vertically at a point located 200m upstream of the discharge.

Modelling of the discharge plume indicated that under the low flow/low tide conditions observed during this survey, the discharge would hit the river bottom within the first 20m downstream of the discharge point. The mixing is conventional under these conditions (low flow/low tide) and the discharge appears well mixed from 200m downstream of the discharge. Modelling of a low flow/high tide condition is more complex, and under low flow/high tide conditions the discharge appears well mixed from 200m downstream of the discharge point. It is possible that under this scenario (low flow/high tide) incomplete mixing of the discharge might occur from the discharge point to points 200m downstream and 200m upstream.

The results therefore indicate that a mixing zone extending 200m upstream to 200m downstream of the discharge point is appropriate under low flow and low tide conditions, but not under low flow/high tide conditions, where a mixing zone that extends 250m upstream of the discharge to 200m downstream is considered appropriate. This is the mixing zone which has been applied when considering the water quality targets that should be applied to the current and future discharge, and in determining the extent of actual or potential environment effects on the receiving environment.

7.4.5 Receiving Water Quality Targets

As set out above, the report attached as **Appendix D** establishes the water quality targets to be achieved as a result of the discharge (following mixing). Table 3 to that report sets out the proposed target for the receiving water bodies and the reference source that has been used to derive the relevant target. Reference sources include the RMA (Class D Standards), Alliance's existing consent conditions, the Southland Regional Water Plan, NIWA National Objectives Framework, Ministry for the Environment guidelines, and the Freshwater NPS. The following table identifies the target that has been selected. It is noted that the targets that are contained in the report attached as **Appendix D**, were discussed with members of the TWP and as a result of this consultation,

some of these targets were amended. The following table reflects an updated set of targets which has been used to inform the assessment of effects of the discharge:

Table 9: Water Quality Target Limits

Parameter	Limit
Temperature	No increase by more than 3°C when the natural temperature is <16°C and not more than 1°C when the natural temperature is >16°C when compared with upstream, and shall at no time exceed a maximum temperature of 23°C
pH	6.5 – 9.0
DO	Consistency maintained at not less than 6g/m^3 and shall not on any occasion be less than 5g/m^3
Clarity	No ≥ 33% change from upstream
Foams or scums	No conspicuous foams or scums beyond the mixing zone
Amm-N	Annual median <1.9g/m^3 (at pH 8.0 and temperature 20°C) Annual 95th percentile <2.4g/m^3 (at pH 8.0 and temperature 20°C)
NO_3-N	Annual median <2.4g/m^3 95th percentile <3.5g/m^3
Nitrate and Phosphorus	≥10% reduction in rivers before January 2020
BOD-soluble	<2g/m^3
FC	<1000 cfu/100mL
E.coli	<1,000 bacteria/100mL

Further rationale for the selection of the above criteria, in particular the development of the Amm-N limit, is contained within the reports attached as **Appendices D and K**. It is noted that the Amm-N limits are lower than both the ANZECC 2000 80% trigger value and the chronic criteria for waterways with no mussels present and only slightly higher than the Freshwater NPS attribute state bottom lines which will be applied to Freshwater Management Units.

7.4.6 Existing Effects of the Discharge on the Receiving Environment

The actual and potential effects of the existing discharge on water quality based on the monitoring results obtained by Freshwater Solutions Ltd and Aquatic Environmental Services are discussed below. Effects on ecological values and parameters are discussed below in section 7.5 of this report. The following characteristics are discussed:

- pH;
- Dissolved oxygen concentrations;
- Colour and clarity;
- Amm-N and other nutrient concentrations;
- Bacterial concentrations; and
- Generation of foams and scums.

7.4.6.1 pH and Dissolved Oxygen

By way of summary, the monitoring and investigations undertaken have shown that the discharge does not adversely affect pH, temperature or dissolved oxygen values downstream of the discharge. A comparison of the Makarewa River temperature data indicates that there is little difference between upstream sites and downstream of the discharge. The summary statistics indicate a slight increase in pH downstream of the discharge, however on no occasion was the pH downstream of the discharge outside the pH range of 6.5 – 9. Dissolved oxygen concentrations are slightly lower downstream of the discharge most of the time, however this does not reach a level that is deemed to adversely impact on most invertebrates or fish species.

7.4.6.2 Colour and Clarity

The existing wastewater discharge consent requires that river water clarity not be reduced by more than 20% at the 200m Site compared with the Bridge Site. The monitoring undertaken indicates that discharge reduces clarity below the discharge by more than 20% for approximately 20% of the time, greater than 33% for approximately 5% of the time and greater than 50% for less than 1% of the time. However, it is not clear whether all of the change in clarity below the discharge results from the discharge itself or the decreasing clarity of the river as it travels downstream. It is noted that the 20% change in clarity that is currently stipulated in the existing consent conditions is to maintain visual clarity for clear river waters suitable for bathing. This is not the case with respect to the Makarewa River which is a lowland water body, and the appropriate water clarity change limit is considered to be more appropriately set at 33–50%.

Visual observations of foams indicate that foams are present in the river with and without the discharge, but that generally foam is limited to within the mixing zone area (above and below the discharge point).

7.4.6.3 Amm-N and Other Nutrients

An increase in total nitrogen downstream of the discharge has been measured during the monitoring programme, with total nitrogen at downstream sites being predominantly Amm-N. The median total phosphorus concentration increased between upstream and downstream monitoring sites. River sediment at sites upstream and downstream of the discharge showed elevated nutrient concentrations in the immediate vicinity of the discharge and at a site 1.5 km downstream.

The existing consent contains two Amm-N conditions, both of which were met to a high degree of compliance. The Amm-N concentrations rarely exceeded the existing consent limit, which was the limit that was set based on acute Amm-N effects. It is noted however, that the discharge consistently exceeds various chronic Amm-N limits, including that of the Freshwater NPS. Exceeding this limit means that there is potential for chronic Amm-N effects on native species, in particular within the mixing zone and lower Makarewa River.

The median concentrations of TN and TP increased downstream of the discharge point, compared to upstream records.

Further analysis of monitoring information has shown the Plant discharge contributes 53% of the total nitrogen load and 68% of the total phosphorous load in the lower Makarewa River. This gives a percentage contribution of total nitrogen and total phosphorous to the New River Estuary of 4% and 5% respectively. As such, the Plant discharge may contribute in a minor way to nuisance macroalgae cover in the New River Estuary. The tidal section of the lower Makarewa River (outside of the mixing zone) is unsuitable for periphyton growths, meaning that any effects of the discharge are considered minor in respect of periphyton. The discharge increases nitrogen concentrations in the water column and in river sediments, which is likely to stimulate macrophyte growth. Macrophytes however provide important cover for eel species, bully species and brown trout in the lower Makarewa River.

7.4.6.4 Bacterial concentrations

The background bacterial concentrations in the Makarewa River, including the upper catchment, the lower Oreti River and the New River Estuary are elevated. The discharge is a contributor to, but is not the sole generator or cause of increased faecal coliform concentrations present in the receiving river environment. Monitoring demonstrated that median faecal coliform counts were lower downstream of the discharge, compared to upstream sampling at the Bridge site, on 56% of the sampling occasions. The annual median faecal coliform count was also higher at the upstream site, compared to the downstream site on 8 out of the 14 years analysed.

It is noted that there are no designated swimming areas in the lower Makarewa River, but trout fishing, whitebaiting, eeling for cultural and commercial activities and game bird hunting do occur.

7.4.6.5 Effects of Discharge within the Mixing Zone

At monitoring site U2 (refer **Figure 9**) the physico-chemical parameters, nutrient concentrations and microbiological parameters closely matched that at the Bridge Site. Similarly, the water quality parameters at Site D1 (approximately 100–200m downstream of the discharge and within the discharge mixing zone) closely matched the results obtained from the sampling undertaken at the “200m Site”. This indicates that the effects arising within the mixing zone are likely to be no more significant than those measured beyond this area.

7.4.7 Key Effects of the Discharge and Mitigation Required

The key actual or potential effects arising from the existing discharge on water quality in the receiving environment are:

- Increased Amm-N levels which can cause toxicity effects in biota in the river;
- Increases in N and P which make a small contribution to increases in nuisance algae and eutrophication of rivers and the estuary;
- Development of foams and scums impacting on aesthetics and recreational values;
- Reduced water clarity which can impact on aesthetics, recreation, and ecological values;
- Increased microbial contamination that can impact on aquatic health, recreation and cultural values (including consumption of fish).

As noted above, the discharge currently meets the standards for temperature, pH, DO, BOD and nitrate toxicity and consequently the adverse effects on water quality is assessed as being minor with regard to these parameters.

The major contributor to potential toxicity and to the TN loadings to the lower Makarewa River, Oreti River and the New River Estuary is Amm-N, which typically contributes approximately 87% of the TN in the discharge. Currently, the concentrations in the river outside the mixing zone (200m) meet Alliance's current consent limitations 99% of the time. As noted, the concentrations do not however meet the Amm-N bottom lines in the Freshwater NPS and site-specific values derived for the lower Makarewa River. In order to achieve the recommended targets, it has been determined that if a 75% reduction in Amm-N concentrations comparative to the 2012/2013 season results is achieved over time, this will have a significant improvement on toxicity effects, and will also assist in reducing TN and therefore nutrient loadings in the Makarewa River and the New River Estuary.

A reduction in nitrogen will also reduce the contribution that the discharge makes to the overall nitrogen load going to New River Estuary. Such a reduction would mean that the discharge contribution of TN load to the estuary would be 1.3%. A reduction of this magnitude is considered to be significant in relation to the discharge, but is insignificant relative to the total reduction required to improve the trophic state of the estuary overall. It is anticipated that an overall improvement in water quality of the estuary is something that Environment Southland would look to achieve in the long term through the implementation of a catchment-wide water quality strategy, consistent with the obligations inherent within the Freshwater NPS.

On occasion the algal concentration in the discharge has reduced the existing visual clarity of the Makarewa River in the immediate vicinity of the discharge point. The clarity of the receiving river environment is however already low due to range of other catchment scale influences (ie. land uses). The low clarity of the Makarewa River therefore supports only limited primary and secondary recreational pursuits. Given this, the effect of the discharge on clarity is not

assessed as being significant. It is also likely that when mitigation is imposed to improve the overall quality of the discharge any adverse effects on visual clarity of the river will also reduce.

Scums and foams can be present as a result of the discharge. Although the lower Makarewa River (immediately below the discharge point) is not used extensively for recreational pursuits, it is considered that improvements can be made to the delivery of the discharge into the river in order to avoid, or at least minimise or mitigate the production of scums and foams. Modifications to the outfall pipe have been implemented (refer **Appendix H** attached) and this is discussed further in section 8.

The assessment in **Appendix D** attached demonstrates that there are elevated faecal coliform concentrations present in the receiving environment. Between December 2001 and June 2014 the faecal coliform counts at the Bridge Site (median 1500 MPN/100mL) and the 350m Site (median 1300 MPN/100mL) were consistently similar, but were lower at the Boundary Site (median 885 MPN/100mL), with median counts lower at the 350m Site compared to the Bridge Site on 56% of the sampling occasions. Given this, for further treatment of the microbial concentrations in the discharge to be effective, this would need to be part of a wider catchment-wide plan to reduce the faecal coliform concentrations present in the Makarewa River. Alliance is however proposing to review whether it is necessary to further treat its discharge stream in order to reduce its microbial load within 10 years of the discharge being granted. This review will take into account any changes within the receiving environment and will recommend whether upgrades are necessary for further treatment in order to reduce Alliance's contribution to the microbial load within the Makarewa River (disinfection).

7.5 ECOLOGICAL EFFECTS ARISING FROM THE DISCHARGE TO WATER

This section presents the key findings of the assessment of the treated wastewater discharge on ecological values present within the receiving environment. This assessment is based on the monitoring and assessment of effects undertaken by Freshwater Solutions and Aquatic Environmental Sciences. These reports are attached as **Appendices D and K** to this report.

7.5.1 Makarewa River Ecology

7.5.1.1 In-Stream Habitat

In-stream habitat in the vicinity and downstream of the discharge reflects the low gradient, tidal and highly modified nature of the lower Makarewa River. The habitat also reflects the influence that tides, channel gradient and morphology have between the upstream and downstream monitoring sites. The tidally influenced section of the lower Makarewa River, downstream of the discharge mixing zone, is a meandering low gradient river characterised by soft river bed and bank sediments and gently flowing run and pool habitat dominated by submerged macrophytes. The lower Makarewa River is strongly influenced by the tide and has been heavily modified by flood control works and agriculture.

The depositional nature of the tidally influenced lower Makarewa River means that thick silt and mud is very common. The riparian zone comprises grazed and rank pasture grasses.

7.5.1.2 Aquatic Plants

A survey of the periphyton community was undertaken at two sites upstream and one site downstream of the discharge point in 2010. The following summarises the key results from that survey:

- Periphyton cover was below the MfE (2000) guidelines at all sites.
- Periphyton Ash Free Dry Weight (AFDW) and chlorophyll-a exceeded the MfE (2000) guidelines for the protection of trout habitat at the site downstream of the discharge.
- Periphyton chlorophyll-a exceeded the MfE (2000) guideline for the protection of benthic biodiversity above and below the discharge site.
- Periphyton autotrophic index scores were high at all three sites but below the level that is indicative of organic enrichment.

During the more recent surveys undertaken in 2013/2014 as part of this assessment, there was insufficient algal material on substrate at two of the downstream monitoring sites (D1 and D2) to allow samples to be collected and chlorophyll-a and AFDW analysis to be undertaken. This lack of algae is deemed to be indicative of the unsuitable nature of the habitat for supporting periphyton growths, which include deep, slowing flowing habitat, poor water clarity and fine substrate. The habitat conditions at Sites D1 and D2 are much more suited to supporting a macrophyte-dominated aquatic plant community.

Periphyton cover results from Site U1 (upstream of the discharge) differed from the other sites on all four sampling occasions, with a greater cover of thick mats and long filamentous green algae compared to the thin films and macrophyte dominated community at the other monitoring locations. The MfE (2000) periphyton cover guidelines were exceed at Site U1 in the November 2013 and February 2014 surveys. The MfE (2000) long filamentous green algae cover guideline was exceeded at Site U2 in the February 2014 survey.

Total macrophyte cover was lower at Site U1 across all four surveys (range 5–22%) compared to Site U2 (range 35–85%), Site D1 (range 50–88%), Site D2 (range 50–85%) and shows that there is a significant increase in macrophyte cover between the most upstream site (Site U1) and the most downstream site (Site D1).

The submerged and surface reaching rooted macrophyte community during the February 2014 survey was dominated by introduced species that can reach nuisance levels including *Potomogeton crispus* (curly pondweed), and the native species *Photomogeton ochreatus* (blunt pondweed).

Total macrophyte cover exceeded the MfE (2012) recommended provisional guidelines of less than or equal to 50% cover of the river bed area or river surface area at Sites U2, D1 and D2 in March 2013, and November 2013. Total

macrophyte cover also exceeded the guidelines at Sites D1 and D2 in February 2014.

7.5.1.3 Benthic Invertebrates

In surveys undertaken in March 2010 it was found that the invertebrate community in the Makarewa River (near the discharge site) was dominated by water quality and habitat tolerant taxa. Surveys undertaken in 2013 determined that the benthic invertebrate community composition was similar at the upstream sites and was dominated by caddisflies (trichopterans), molluscs (snails), worms (oligochaetes) and dipterans. The dominant taxa groups at the downstream sites were molluscs, crustaceans and worms. These are all characteristic of water and habitat tolerant groups that prefer slow flowing weedy habitat. Mayflies were present at upstream sites, and made up a very small percentage of total abundance at site D2, and were absent from site D1 where habitat is not suited to this group.

Key features of the benthic invertebrate community at Site D1 in March 2013 were the high number of cladocerans and *Hydra* which can be attributed to the treated effluent discharge and the presence of a single damsel fly larvae, which is indicative of the slow flowing and weedy habitat. Other notable features of the community at Site D1 was the absence of *Deleatidium,* which is a mayfly that prefers stony, clean, fast flowing habitat and is tolerant of slow water velocities and the presence of two cased caddis taxa which are typically found in high water quality habitat, and can tolerate lower water velocities.

Another survey was undertaken in November 2013. The purpose of this survey was to determine whether the health of the invertebrate community altered during Alliance's off-season. The dominant taxa group across all the sites surveyed was oligochaetes, a water and habitat tolerant group. Molluscs were the next most dominant group at downstream sites and are considered to be reflective of the low water velocity environment in the lower river. Ephemeroptera made up a small proportion of total abundance at upstream sites but were absent or in very low numbers at downstream discharge sites. Diptera made up 26% of total abundance at Site U1 and reflecting the extensive long green filamentous algal cover. Crustacea abundance increased in a downstream direction reflecting the increased tidal effects on water velocity and habitat in a downstream direction and the proximity to the wastewater treatment ponds.

Key features of the benthic community at Site D1 in November 2013 were the absence of cladocerans and hydra (due to the lack of the treated effluent discharge) and the absence of *Deleatidium*, and caddisflies such as *Pycnocentradoes* and *Pycnocentria* that prefer high water quality rivers and a different habitat.

A later survey undertaken in March 2014 showed that the invertebrate community at Sites U1 and U2 was similar and was dominated by caddisflies, molluscs, and worms. The dominant taxa group at Site D1 was crustaceans (86%), while at Site D2 the dominant groups were molluscs (50%), crustaceans (23%) and worms (17%). Mayflies made up a small percentage (5 – 13%) of the community at the

upstream sites and were absent at Site D1 and made up 1% of the community at Site D2 in March.

Key features of the benthic community at Site D1 in March 2014 were the high numbers of cladocerans and hydra, the absence of *Deleatidium* and very low abundance of clean water caddisflies.

Based on the survey results undertaken in March 2013 and 2014, it is assessed that benthic invertebrate community health is lower at the downstream sites, compared to the upstream sites.

Surveys of large crustaceans (crayfish and shrimps) and freshwater mussels were also undertaken. A very small number of larger crustaceans were discovered during the surveys. Freshwater mussels were not found during any surveys, and because of the habitat, it is very unlikely that freshwater mussels exist in the receiving environment.

7.5.1.4 Native Fish

The native fish surveys and monitoring records show that the lower Makarewa River supports moderate to high native fish diversity, despite its highly modified state. The native fish species present include the longfin and shortfin eels, koaro, giant kokopu, banded kokopu and lamprey. The Southland Region Fish IBI score for the site immediately upstream and downstream of the treated effluent site was 58, placing both sites in the “excellent” class.

The lower Makarewa and lower Oreti Rivers support very productive shortfin eel and to a lesser extent, longfin eel fisheries with up to six commercial fishermen operating in the area. Adult shortfin eels migrate from the New River Estuary in spring and summer and drop back to the Estuary in the winter months. Longfin eels are territorial and burrow into the river bank and river bed sediments, while the extensive macrophyte beds provide important cover for shortfin eels. Juvenile longfin and shortfin eels are likely to migrate up the lower Makarewa River between July and December. Shortfin eels are likely to reside in the lower reaches of the river, and longfins eels further upstream.

The lower Makarewa and Oreti Rivers are also popular and at times productive whitebait fisheries. The most abundant species in this regard is inanga. Inanga is a diadromous species that spawn in the tidal zone near estuaries in the autumn months. Juvenile inanga are likely to migrate up the lower Makarewa River between September and November, spanning the period when there is typically low or no treated effluent discharge from Alliance’s plant, with peak migrations occurring a few days after floods in early spring. Adult inanga continue to shoal and occupy a range of freshwater habitats including pools and backwaters but preferring habitat upstream of the tidal influence. Juvenile inanga are likely to be an important seasonal food source for large eels and adult trout in the lower Makarewa River.

Other juvenile species in the whitebait run found in the Makarewa River appear to migrate up the lower Makarewa River between October and November and when the discharge from the plant is low. These species are not expected to

remain in the lower river and are likely to migrate to the headwaters of the river where there is some remnant giant kokopu, banded kokopu and koaro habitat in the streams within the Hokonui Hills.

Makarewa River, downstream of the treated effluent discharge of the plant, provides habitat for adult brown trout but is unsuitable as spawning or rearing habitat due to the lack of suitable gravel substrate and riffle habitat.

7.5.2 Oreti River Ecology

The lower Oreti River naturally meanders within a single channel characterised by a series of long runs, shallow pools and occasional riffles. River bed sediments are dominated by coarse sands. The following key points summarise the ecological data that has been recorded by the Southland Regional Council at the Wallacetown Bridge between the period 2005 and 2010:

- The median MCI score was 95 and exceeded the Southland Regional Council lowland hard bottom site guideline of greater than 90 on all sampling occasions.
- Nuisance algal growths such as cyanobacteria mats occur in the Oreti River during stable summer months. Didymo is present in the Oreti River.
- The median MCI score at the Wallacetown site decreased from 101 to 95 and is most likely attributed to upstream land use intensification.
- The chlorophyll-a level at Wallacetown Bridge exceeded the MfE (2000) guideline of less than 120mg/m^2 guideline on 40% of the sampling occasions.
- The AFDW level met the MfE (2000) guideline of less than 35g/m^2 on all sampling occasions.

The biological results from the Oreti River are indicative of the elevated nutrient concentrations, and the increasingly developed nature of the catchment.

The Oreti River supports a healthy native fish fauna classed as being “good quality” based on the Fish IBI score. Fish surveys and data show that the Oreti River supports moderate to high native fish diversity.

7.5.3 New River Estuary

The New River Estuary supports high ecological values including a diverse bird fauna and freshwater and marine fish populations. Fish include five species of flatfish, eels, brown trout, smelt, whitebait and giant kokopu. The estuary provides important spawning and rearing habitat for marine and freshwater fish including whitebait species and has the highest usage by trans-equatorial shorebirds of all Southland estuaries.

The majority of the estuary is well flushed and largely remains free of nuisance microalgae. However, parts of the estuary are severely affected by nutrients. Around 10.6% of its area is covered with high to very high percentages of nuisance macroalgae, with the dominant species being the red alga *Gracilaria chilensis* and the green alga *Ulva intestinalis*.

Overall the data indicates that large parts of the New River Estuary remain in reasonable condition, but a reasonably significant and increasing proportion of the estuary is impacted by fine sediments and elevated nutrient concentrations, primarily from diffuse discharge sources.

7.5.4 Effects on Ecological Values

7.5.4.1 Nuisance Algal Growths

Nuisance algal growths include sewage fungus, periphyton, and macrophytes. Its soft bed, slow flowing, macrophyte dominated and tidal nature means that the lower Makarewa River and lower Oreti River are depositional environments, and along with the New River Estuary, they reflect the cumulative pressures of land use and drainage throughout the Makarewa River and Oreti River catchments. The soft bed and tidal nature is not suited to supporting periphyton growths.

The treated effluent discharge from the plant has low concentrations of BOD needed to sustain sewage fungus and the discharge does not cause sewage fungus growths in the receiving environment. The discharge location and elevated nutrient concentrations do however have the potential to elevate water and sediment nutrient levels, with sediment levels in particular potentially leading to the proliferation of macrophytes that in turn can alter pH and DO levels and affect habitat for a range of aquatic biota.

7.5.4.2 Benthic Invertebrate Community

The benthic invertebrate community in the lower Makarewa River reflects the location, land use and modification throughout the catchment. The soft bed and tidal nature of the receiving environment is not suited to water and habitat sensitive taxa, and this reduces the overall sensitivity of the invertebrate community to water quality effects associated with the treated effluent discharge. Despite this, the invertebrate community is an important component of the lower Makarewa River ecosystem, and there is potential for the discharge to result in adverse effects in the river indirectly through altered habitat, or directly through toxicity effects. However, due to the tidal influence of the lower river, the available habitat for macroinvertebrate taxa is reduced or they are not present, irrespective of the treated effluent discharge.

Monitoring of the New River Estuary indicates that exposed sites with good habitat quality support moderately abundant and diverse benthic communities. In contrast, benthic communities in grossly eutrophic sites within the Waihopai Arm and Daffodil Bay are severely degraded. Benthic communities at these sites are characterised by a limited number of pollution and mud tolerant, surface feeding taxa, including the amphipod *Paracorophium excavatum*, the scavenging predator isopod *Exospheroma* sp., the small deposit feeding spionid polychaete *Sclecolepides benhami.* This is consistent with ecological responses expected for sites with muddy, anoxic and sulphide rich sediments.

7.5.4.3 Fish

As noted above the lower Makarewa River supports significant shortfin eel and common bully populations and provides seasonal adult habitat and feeding areas

of inanga, brown trout and black flounder. The discharge has the potential to have direct effects on fish diversity and abundance within the mixing zone and the lower Makarewa River downstream of the discharge, and indirect effects through altered habitat and food sources. The Amm-N concentrations within the discharge have the potential to adversely affect fish migration within the mixing zone during the early part of the Plant's processing season (October – December) when upstream migration of some species, such as inanga and kokopu, is occurring.

The monitoring demonstrates that the lower Makarewa and Oreti Rivers are typical of lowland rivers, and despite their highly modified habitat, support moderate to high native fish diversity, a whitebait fishery and a locally significant trout fishery.

The discharge has a minor short term effect on downstream DO concentrations, but concentrations are rarely below 5g/m^3 and would only be for very short durations. Median Amm-N concentrations were higher downstream of the discharge in comparison to upstream sites, however the concentrations found will not result in adverse effects on trout. This is based on the "no observable effects concentration" (NOEC) chronic level for rainbow trout at pH 8 and 20^{o}C is 4.84g/m^3. The Amm-N concentrations at the 350m Site between December 2001 and June 2014 were above this NOEC less than 4% of the time, and never for extended periods (ie. greater than four days). The assessment also determines that based on other studies, native fish species will be no more sensitive to the chronic effects of Amm-N than rainbow trout (which are not present in the Makarewa River) and brown trout.

There are no known contaminants in the discharge at levels that are expected, on their own, to result in fish in the lower Makarewa River, Oreti River or the New River Estuary being rendered unsuitable for human consumption. The discharge may contribute to higher microbial contamination on occasions, but the Makarewa River already has high microbial levels upstream of the discharge site.

The Makarewa River supports a reasonable trout population, and as such, the discharge is not considered to be adversely affecting this species.

The effects of the discharge on fish species within the New River Estuary has not been quantified, and is not likely to be significant when compared against other factors including diffuse discharges, sedimentation from land use changes, and fishing.

7.5.5 Key Effects on Ecological Values and Mitigation

As discussed in section 4 to this report, in order to improve the effects of the treated effluent discharge on water quality over time, a reduction in Amm-N levels in the discharge of approximately 75% (comparative to 2012/2013 season levels) is recommended.

Reducing nitrogen concentrations in the discharge may result in a small reduction in macrophyte growth and cover in the vicinity of the discharge, but because of the very low gradient and tidal nature of the lower river, this is not expected to

increase the amount of riffle habitat preferred by most water and habitat sensitive benthic invertebrate taxa. Consistent with this, the existing composition of the benthic invertebrate community is expected to remain similar post-upgrade of the wastewater treatment system.

The reduction in nitrogen concentrations is also unlikely to have an observable effect on nuisance macroalgae in the New River Estuary. A significant reduction in nuisance macroalgae is only likely to be achieved through a major, catchment-wide reduction in total nitrogen loads into the estuary.

The current Amm-N concentrations in the discharge are not expected to have chronic adverse effects on fish species, and none were detected through the assessment undertaken. However, a reduction in Amm-N inputs into the discharge would provide further assurance that there are no adverse effects to fish species or their ability to migrate upstream past the discharge.

The potential impacts of both existing and recommended future discharges on fish species within the New River Estuary will be relatively minor, but potentially positive after the upgrade of the wastewater treatment system.

7.6 EFFECTS OF THE WATER ABSTRACTION – ORETI RIVER

The abstraction of water from the Oreti River has the potential to affect river flow, water quality, and aquatic ecosystems. This section summarises the technical assessment that has been undertaken by Freshwater Solutions Limited which assesses the actual and potential effects arising from the proposed water abstraction. This report is attached as **Appendix O**.

7.6.1 Effects on Hydrology

Surface water abstractions for irrigation upstream of Wallacetown are subject to a minimum flow. The minimum flow that these permits must meet is 7,500L/s which is currently the Environment Southland 7DMALF at Wallacetown for abstraction consents. When flows reach this level, all abstractions for irrigation must cease. The ICC abstraction can abstract below the 7DMALF, and this abstraction along with Alliance's proposed abstraction, could take approximately 560L/s from the river in this lower reach. The cumulative effects of both the ICC abstraction and the Alliance abstraction are addressed below. It is noted however that any possible effects of the Alliance abstraction are likely to occur only in the approximately 2.8km reach downstream of the abstraction site, before tidal influence becomes dominant.

7.6.2 Effects on 7DMALF

The assessment in **Appendix O** attached determines that the natural 7DMALF at Wallacetown is 7,700L/s and the measured 7DMALF is 7,380L/s. The analysis undertaken shows that natural flows (without any abstraction) fell below the 7DMALF for an average of 19 days per year. There is an increase in the average number of days below 7DMALF to 21 days with the ICC abstraction, and a further rise to 24 days when future irrigation is combined with the ICC abstraction, and a further increase to 26 days when the Alliance abstraction is added. The

increase due to Alliance is from a total of 876 days for the Oreti River with combined irrigation and ICC abstractions to 957 days in total with the Alliance abstraction added. This is an overall increase of 9% in days less than 7DMALF compared to naturalised flows due to the Alliance abstraction.

7.6.3 Effects on Environmental Flow Variability

The key flows relating to flow variability are those equivalent to 1.5 times median flow, two times median flow and three times median flow (FRE1.5, FRE2 and FRE3). Three times median flow is usually a flow sufficient to move gravel and small stones in a riverbed. In most rivers and streams, the greater the flow, the less the frequency of each of the flows, with FRE3 flows occurring the least often. The analysis indicates that there is very little variance arising between the FRE1.5, FRE2, and FRE3 flows with respect to the naturalised flow and the effects of the existing and proposed Alliance abstraction.

7.6.4 Effects on Accrual Period Length

Accrual period between larger flow events (ie. FRE3 events) is an important determination of the potential for nuisance algal growths to occur in the river (ie. indicative of flushing). An analysis of the accrual days between FRE3 events with and without the existing and proposed abstractions was undertaken. The analysis undertaken shows that even with the existing and proposed Alliance abstraction applied, there is very little effect on the accrual periods between FRE3 environmental flows.

7.6.5 Water Quality

Water abstraction has the potential to adversely affect water quality by increasing the concentration of contaminants through a reduction in the assimilative capacity of the river, reducing dissolved oxygen concentrations through reduced re-aeration and increased water temperatures.

With respect to the proposed abstraction from the Oreti River, it is considered that the small size of the take, relative to the river flow, and the very minor variance of the take on minimum flow duration and flow variability, the adverse effects on water quality will be minor or less.

7.6.6 Aquatic Habitat

Water abstraction also has the potential to adversely affect habitat within the river for biological communities, including periphyton, benthic invertebrates, native fish and trout. It is noted that the assessment undertaken in **Appendix O** is based on a desktop analysis of existing data. A further in-river assessment and survey to determine water quality and aquatic habitat values within the Oreti River is scheduled for summer 2015. The results of this survey will be made available to the Council.

The hydrology assessment presented in **Appendix O** attached, demonstrates that the proposed abstraction has a less than minor effect on the duration of low flows, and also on environmental flow variability. Consequently, changes in the biological communities downstream are not likely to arise as a result of the abstraction.

The reach downstream of the proposed abstraction is also dominated by deep run and pool habitat with fine gravels and sand. It is not suited to periphyton growths or a diverse and abundant riffle dwelling benthic invertebrate community. The periphyton and benthic communities are therefore likely to be insensitive to the small reduction in water level associated with the take, and any effects on aquatic habitat are therefore assessed as being less than minor. This is further supported by a 2001 assessment of the effects of the ICC abstraction on aquatic habitat, and it is considered that this provides a comparable assessment from which to gauge the likely effects of the proposed abstraction on aquatic habitat within the Oreti River.

The key finding from the ICC assessment was that the abstraction of between 0.30 and 0.42m^3/s would have a negligible effect on aquatic habitat. Based on this, the effects on aquatic habitat of Alliance's proposed abstraction of 0.26m^3/s, which is considered to be located in a less sensitive reach of the river with deeper water habitat and the supplementary influence of the tide, are expected to be less than minor.

Inanga spawn on the tidal interface during spring tides. The water level downstream of the proposed abstraction site is strongly influenced by the river flow and tidal cycle, and is likely to be insensitive to the minor reduction in water level associated with the take. The abstraction is therefore not expected to have any adverse effects on inanga spawning habitat. Some native fish, such as elvers and juvenile trout, prefer riffle habitat for rearing. As outlined above, there are very few riffles downstream of the abstraction site. Therefore, the extent of any potential effects arising from the abstraction on riffle dwelling juvenile native fish or trout is likely to be minor or less.

The lower Oreti River is an important migratory pathway for a range of native fish and also for trout. Most upstream migration occurs in spring during incoming tides or during small freshes, and outside of the summer low flow period when the Alliance take has the greatest potential to influence water levels. Therefore, the effects on migration is expected to be minor or less.

The river also provides important adult fish habitat and is a highly productive area with a range of species including adult eels, flounder, inanga, smelt and trout. Most adult fish are, however, expect to utilise the deeper tidally influenced section of the lower Oreti River and away from the short section of the river influenced by the proposed abstraction.

7.6.7 Entrainment of Fish

The water take is located in an embayment on the true left bank of the river. The embayment area is characterised by a silt bed and extensive macrophyte growth. In order to prevent fish species entering the intake structure, it is currently fitted with a coarse screen with bars spaced approximately 50mm apart. A second screen with 16mm diameter mesh is positioned 2m behind the coarse screen.

Water is pumped to the water supply reservoir(s) at the Plant, where around half of it passes through the water treatment plant before being used on-site. The

water take and treatment system allow for checks for fish that have been potentially entrained at four points: the intake screen, the pump house, the reservoir and the water treatment plant. During the period 2000 and 2005, records show that on three occasions eels have entered through the screen. No fish species have been observed by water treatment operators or maintenance staff since 2005. Given the infrequent observations of a small number of eels entering the take, the potential entrainment of fish species is low and therefore only a minor effect.

Although the effects of fish entrainment are not considered to be significant, Alliance is aware that best practice for intake structures involves a smaller mesh screen size. Given this, Alliance is investigating alternative fish screens and proposes to install a smaller screen size within five years of the water permit being granted.

7.6.8 Intake Channel Maintenance

The water take is located at the head of a 45m long, 8m wide artificial intake channel. The intake channel is not subject to the scouring effects of floods and is likely to be a depositional zone for sediment and debris during such events. As a result of the low flow and sediment conditions, the intake channel supports abundant macrophyte growths. These macrophytes are likely to provide cover for eels, and the channel itself may provide a refuge for trout and native fish during flood events.

The removal of macrophytes and sediment during intake channel maintenance works has the potential to disturb the bed of the intake channel, affecting benthic communities and habitat for eels. This is however considered to be a minor disturbance, and is a necessary component of ensuring that the water take remains operational and effective. It is however recommended that if eels are observed in the channel prior to maintenance occurring, they are captured and returned to the river.

7.7 RECREATIONAL EFFECTS ARISING FROM THE DISCHARGE TO WATER

The proposed discharges to water and land, and the abstraction of water has the potential to adversely affect recreational values associated with the rivers or waterbodies. As set out above, the lower Makarewa River is used for a range of recreational pursuits, including whitebaiting, and game bird hunting. The New River Estuary is an important area for non-contact and contact recreational pursuits. Recreational activities such as whitebaiting, fishing and picnicking are also undertaken on the Oreti River.

The discharge of treated wastewater to the Makarewa River has the potential to affect anglers, hunters and whitebaiters by:

- Reducing the size or number of fish through low dissolved oxygen and elevated Amm-N concentrations;
- Reducing the size and number of fish through reduced benthic invertebrate abundance and reducing small fish abundance and size;

- Reducing the number of ducks by reducing food availability; and
- Aesthetic effects negatively affecting hunter and angler perceptions/enjoyment.

As discussed above, the current dissolved oxygen and Amm-N concentrations are not likely to be adversely affecting trout populations and abundance in the lower Makarewa and Oreti Rivers, and therefore any adverse effects on angler enjoyment and satisfaction are expected to be minor. It is also unlikely that the discharge is having an adverse effect on duck populations, as they are more likely to be affected by climate, habitat quality, predation, disease and hunting pressure. It is also noted that the wastewater treatment ponds are regularly visited by ducks.

On occasion, the discharge results in some visible foams and scums within and immediately beyond the mixing zone. This is relatively infrequent, but it may adversely affect the aesthetic enjoyment of the river. However because it only affects a relatively limited section of the river, is infrequent, and only a small number of people are exposed to it, this effect on recreational values is assessed as being minor.

Consultation with key stakeholders representing recreational interest groups such as Southland Fish and Game indicated that the Alliance discharges to the Makarewa River and the abstraction from the Oreti River do not, in themselves, deter freshwater angling and conversely if the activities ceased then current angling is unlikely to be affected. With regard to contact recreational activities, Public Health South promoted a reduction in river *E.coli* levels. In response, Alliance proposes to undertake a review 10 years from the commencement of the discharge of wastewater consent of river E.coli levels and the practicability of additional treatment (disinfection). Consultation with individual recreational and commercial fishery users also indicates that the current activities undertaken by Alliance (i.e. wastewater discharge and the abstraction from the Oreti River) are not having any noticeable impact on the existing whitebait and eel fisheries and overall recreational value of these rivers.

The relatively small contribution that the discharge makes to the overall TN load in the New River Estuary, and the small resultant effects on macroalgal growths, indicates that the effect of the discharge on recreational users of the estuary is likely to be minor.

The proposed upgrade to the wastewater system as discussed above will contribute to a significant improvement in the discharge quality, and consequently the receiving environment of the lower Makarewa River. However, because the river (both upstream and downstream of the discharge point) is also currently affected by other land uses and activities, the overall improvement or enhancement of recreational values/users is expected to be minor.

Cumulative inputs (discharges from non-point and point discharges) into the New River Estuary are also adversely affecting its recreational value, however in order to improve this (as well as the quality of the lower Makarewa River), a catchment-

wide monitoring and enhancement programme is likely to be required. This is something that needs to be initiated at the Council level, as it would be an onerous and ineffective measure to impose on a single applicant. It is likely that this will be something that is achieved via Environment Southland's obligations pursuant to the Freshwater NPS. It is anticipated that Alliance's proposed improvements to its discharge of treated wastewater will contribute to and align with this overall programme.

7.8 SOIL AND GROUNDWATER EFFECTS ARISING FROM THE DISCHARGES TO LAND

As discussed in section 3 of this report up to 3000m^3/day of treated wastewater is currently discharged onto farm land owned by Alliance. Discharge is accomplished via a K-line pod irrigation system and is used periodically as part of the current wastewater treatment disposal process in order to reduce the extent of the discharge of treated effluent to water. This consent is necessary, until such time as the proposed progressive upgrades to the wastewater treatment plant are completed.

Alliance also seeks consent for the temporary storage of wastewater on land. This is only likely to occur during an extreme summer drought when farmers are forced to de-stock their farms and discharges to the Makarewa River cannot occur due to extreme low flows.

Alliance is proposing to progressively upgrade its existing wastewater treatment plant by installing a BNR system that will result in operating any future plant as an activated sludge plant. This will produce biosolids that will need to be managed on-site or removed. Separate consents, as discussed earlier in this report, are being sought to enable the discharge of biosolids to land and to an on-site monofill.

This section addresses the potential effects on the soil and groundwater resources arising from the proposed discharges to land. The report attached as **Appendix P**, prepared by SoilWork Ltd, provides an assessment of the irrigation wastewater on the soil and groundwater resource. An investigation into the integrity of the wastewater ponds and the potential for seepage of wastewater into the groundwater system has also been completed by PDP as part of a wider investigation into effects of groundwater arising from the Plant activities. This report is attached as **Appendix Q**.

Appendix J attached contains a report prepared by PDP which addresses the effects on the soil and groundwater resource arising from the discharge of biosolids necessary as part of the future upgrade of the wastewater treatment plant. The following section provides a summary of these technical reports.

7.8.1 Effects of the Wastewater Irrigation

SoilWork Ltd is engaged by Alliance to undertake an annual performance review of the wastewater irrigation that occurs, and will continue to occur on-site as part of the current wastewater treatment facility. This report (refer **Appendix P** attached) was prepared in order to satisfy conditions of consent 20034 and is

completed on an annual basis, but also usefully informs an assessment of the effects arising from the irrigation activity generally. Overall, the report confirms that the current wastewater irrigation system is well suited to the Lorneville site and it continues to be managed well, without giving rise to adverse effects on soil and groundwater resources.

The irrigable area comprises approximately 100ha of Waikiwi, Dacre, and Edendale soils, and is divided into 32 irrigation blocks that are irrigated using a 'K-Line' system. SoilWork Ltd has classified the Alliance farm soil groups into three zones. Zone 1 areas contain Edendale, Waikiwi and Mokotua soils and are classified as "well drained to imperfectly drained" and suitable for wastewater disposal. Zone 2 soils are "poorly drained" and have in the past been used for wastewater disposal during certain climatic conditions (ie. dry weather). Zone 3 soils are "very poorly drained" soils, which are generally considered unsuitable for wastewater disposal.

Approximately 91% of the current irrigation area comprises Zone 1 soils. Water holding capacities of the soils in this zone are categorised by Landcare Research as either high or very high, and vary between 107mm and 117mm. For the Zone 2 soils, water holding capacities have been categorised as being very high (164 – 178mm). An application depth of wastewater of 50mm per irrigation event is therefore less than 50% of the water holding capacities of these soils.

Wastewater irrigation only occurs over a period of approximately 51 days each season, and occurs during the summer and early autumn period when soil moisture levels are at their lowest.

The current system is designed to apply wastewater to any particular land area at a rate of up to 5mm/hr for up to 24 hours. In the 2014–2015 season, all daily discharges of wastewater were within the consented maximum volume of 3,000m^3/day and the average wastewater application per irrigation event (48mm) remained lower than the consented maximum of 50mm. The average nitrogen loading to the irrigable area for the 2014–2015 season was 161kg N/ha (but has been up to 250kg N/ha in previous seasons). For all irrigations, there was full compliance with the minimum irrigation return time of 15 days, and also with the condition to irrigate only when soil water content is lower than the equivalent of field capacity.

Over the average irrigation period of 51 days, the amount of nitrogen taken up by pasture plants is expected to be around 160–200kg N/ha, and this amount is greater than the average amount of nitrogen applied each season in wastewater (average 106kg N/ha). Additionally, it is likely that some of the nitrogen applied in wastewater via sprinklers is lost to the atmosphere by volatilisation, because nearly all of the nitrogen is in the form of Amm-N.

There were no recorded incidents of ponding or runoff of wastewater, and no irrigation related complaints were received during the season.

Wastewater sampling and analyses occurred weekly, as required by the consent, during the period of irrigation. Most of the nitrogen in the wastewater was in

ammoniacal form. The season average for nitrogen was 172kg N/ha. Concentrations of suspended solids, BOD and total phosphorous in the wastewater were low (compared with other seasons), with average concentrations of 43g/m^3, 9g/m^3 and 14g/m^3 respectively. The average sodium adsorption ratio was 11.2, which is lower than the consent limit of 17, and considered satisfactory for wastewater irrigation on these soils. Concentrations of faecal coliforms in the wastewater varied between 80 CFU/100ml and 1,400 CFU/100ml. The maximum value recorded was significantly lower than that measured in the 2013–2014 season (15,000 CFU/100ml), and the mean value was only 295 CFU/100ml. This value is low, and with land application of wastewater on fine textured soils such as these the mortality rate of the coliforms is high and transmission rate through the soil will be very low.

Overall, it was concluded that the quality of the wastewater that was discharged during the 2014–2015 season was satisfactory for land application, and agronomically useful amounts of the major nutrients, nitrogen and phosphorus, were applied.

7.8.2 Effects on Groundwater and Soils Arising from the Wastewater Irrigation

Groundwater monitoring occurs at three bores. One is positioned upstream of the irrigation area in order to provide a control site or baseline, one is within the irrigation area (irrigation bore) and the third is downstream of the irrigation area and is referred to as the “Ridley bore”.

Since the commencement of irrigation there have been nine periods of wastewater application. Between 2004 and 2014 there has been approximately 700kg N/ha applied to land as a result of the discharge. This total amount is small, and as a result groundwater data collected to 2012 did not show any clear trends in quality that could be attributed solely to the wastewater irrigation. For the 2012–2013 season, when the largest annual amount of nitrogen was applied, some increase in groundwater electricity conductivity and concentrations of chloride and Amm-N were reported for the irrigation bore, and these are likely to be attributable to the wastewater discharge and stocking rates on the farm. Effects on other groundwater quality indicators at the irrigation bore and the downstream Ridley’s bore, were either non-discernible or negligible.

During the 2014-2015 season, groundwater monitoring indicated that wastewater irrigation may have contributed to minor and temporary peaks in chloride and Amm-N concentrations in groundwater. However, these increases also occurred at a time when the farm was heavily stocked, and this is also likely to be a contributing factor.

Monitoring of the water quality within Bateman’s drain is also undertaken. This drain runs along the south western boundary of the irrigation area. The monitoring showed some evidence that wastewater irrigation during the 2014 – 2015 season may have resulted in temporary increases in electrical conductivity and in concentrations of total nitrogen and DRP. For the last four seasons (2010 – 2014) dates of peak total nitrogen values in the drain have corresponded with wastewater irrigation periods, and the largest and smallest seasonal peaks have also coincided with the largest and smallest seasonal wastewater applications. It

is noted however that runoff, seepage and drainage of water containing animal wastes (ie. when the land is fully stocked) could also be a major contributor.

Soil chemical monitoring during the 2014–2015 season showed that wastewater applications had no significant effect on concentrations of cations of calcium and potassium, whereas soil pH values and Olsen P concentrations are slightly higher under wastewater applications, and concentrations of magnesium are lower. The reporting concludes that all values of the measured chemical parameters remain satisfactory for further wastewater irrigation.

Over the past eight irrigation seasons, an average of 82mm of wastewater has been applied annually, and this has resulted in an annual increase in drainage of 57mm. After adjusting for different areas of Zone 1 and Zone 2 soils, this wastewater irrigation is estimated to have increased the average annual amount of nitrate-N leached by 6.6kg/ha/yr. The average amount leached from the overall irrigation area is estimated to be 10.8kg N/ha/yr.

7.8.3 Overall Effects of the Wastewater Irrigation Application to Land

The current wastewater irrigation system applies only a small amount of wastewater annually, and applications only occur during the driest months of the year when pasture nitrogen uptake exceeds the amount of nitrogen contained in the wastewater. The average amount of nitrate-N leached each season is low and it has not affected nitrate-N concentrations in groundwater.

Overall, it is considered that the current wastewater irrigation management and recording practice, together with existing monitoring requirements are appropriate for the management of any actual or potential adverse effects. It is however recommended that the following irrigation parameters are appropriate for this wastewater application:

- The depth of the wastewater irrigation shall not exceed 50mm in any 24 hour period;
- Wastewater is to be applied by K-Line irrigation, at a rate not exceeding 5mm/hr;
- The irrigation return period shall not be less than 15 days;
- The annual nitrogen loading rate shall not exceed 250kg N/ha/yr; and
- Irrigation shall only occur when soil moisture content is lower than field capacity.

It is noted that monitoring has shown that nitrate-N losses through the soil are higher in Zone 2 soils than in Zone 1 soils. Given this, it is also recommended to avoid all Zone 2 soils, as far as is practicable, when applying the wastewater irrigation.

7.8.4 Effects on Groundwater from the Wastewater Treatment Ponds

The wastewater treatment ponds were formed in approximately 1968, and it is understood that no compacted clay or synthetic liner was installed. Although the continuous use of the ponds for sludge dewatering and contingency overflow has

provided a natural sealing of the bottom of the ponds, there is still the potential for leaching of wastewater into the surrounding ground and surface water resources.

In order to determine the effects on groundwater arising from the wastewater treatment ponds (ie. potential leaching), five groundwater monitoring bores (BHA, BHB, BHC, BHD, and BHE) were installed. These were installed to complement the existing monitoring bores used in the area by Alliance and were used to determine the effects of the wastewater treatment plant on the surrounding groundwater and surface water quality. The details and location of the sample bores are contained within the report attached as **Appendix P**.

In terms of potential effects arising from the temporary storage facility, it is noted that this would only be utilised as a short term emergency contingency option when the ability to discharge treated wastewater to the Makarewa River is compromised due to drought and low flows. When river conditions return to normal (or appropriate to receive the discharge), the stored wastewater will be discharged to the river. There would be some seepage of the wastewater through to the soil and groundwater, however this is not expected to be significant. The quality of the wastewater would be the same as would otherwise be discharged to the river, and in this locality it has been determined that the groundwater resources are directed to the Makarewa River. Given that the storage activity is temporary, and is rarely utilised, the effects on the soils and groundwater resources are expected to be minor.

7.8.5 Groundwater Levels and Flow Direction

The depth to groundwater in these boreholes was measured at around 0.8–1.4m in bores near the Makarewa River and 2.0–4.1m in bores occurring at higher elevations. The mapped groundwater contours show a general south-westerly flow direction from the Plant (influenced by drainage of groundwater into Bateman's Drain). To the west of Bateman's Drain a more westerly groundwater flow component occurs (influenced by drainage of groundwater into Boiler Ditch and Makarewa River). Surface water levels in all those waterways are lower than the nearby shallow groundwater monitoring bores. Wastewater levels in the treatment ponds occur at higher levels than the adjacent groundwater, but if any significant seepage losses were occurring it seems most likely that a portion of it would be intercepted by the Boiler Ditch (due to its lower water level elevations), rather than passing through to the groundwater further south or east of the ponds.

The Plant is located approximately 10km north east from the coast. The Makarewa River flows in a south westerly direction past the wastewater treatment ponds before flowing into the Oreti River. As noted earlier in this report, this section of the Oreti River and Makarewa River are tidally influenced and groundwater levels near the rivers, as well as surface water levels in the Makarewa River at the site and the Boiler Ditch near its confluence with the Makarewa River, were monitored to determine the influence of the tidal fluctuations. The water level monitoring indicates that tidal fluctuations occur in the Makarewa River and lower reaches of the Boiler Ditch (during the higher part of the tidal cycle). This in turn induces a subdued tidal response in the adjacent groundwater levels. Despite these fluctuations, groundwater levels decline in a

south easterly and westerly direction away from the main processing Plant, due to drainage effects from Boiler Ditch, Bateman's Drain and the Makarewa River, all of which receive discharge from the groundwater system.

7.8.6 Groundwater and Surface Water Quality

Groundwater taken from the bores shows generally similar characteristics with some localised variations in particular parameters.

The Makarewa River sites also show the effect of the wastewater treatment pond discharge into the river via the Boiler Ditch. The site located downstream of the confluence of the Boiler Ditch with the Makarewa River has elevated concentrations of the same parameters that are elevated in the Boiler Ditch samples. These same parameters are also elevated above the concentrations found upstream of the wastewater treatment ponds.

The parameters analysed from the groundwater samples were generally below their respective maximum acceptable value (MAV) and guideline value (GV) in the Ministry of Health Drinking Water Standards for New Zealand 2005 (Revised 2008), with the exception of both field and laboratory pH which were below the GV range of 7.0 to 8.5 in all samples. This is, however, not uncommon as many shallow groundwaters in New Zealand have low pH due to recharge from rainfall infiltration through soil. All groundwater samples had high total suspended solid concentrations ranging between 3,000 (BHC) and 8,600 (BHA) g/m^3. The high total suspended solids concentration in all bores sampled is due to the nature of the bore screens relative to the fine particle sizes in the surrounding strata.

The groundwater samples show similar composition with the following exceptions:

- BHE has a lower bicarbonate concentration and low alkalinity;
- BHA has a higher concentration of chloride;
- BHD has higher concentration of bicarbonate, calcium, magnesium and sulphate.

With regard to nitrogen species, Amm-N was detected at low concentrations (<0.2g/m^3) in all bores, with the exception of BHE. Nitrate-N was detected in BHA and BHE at concentrations of 4.8 and 1.98g/m^3 respectively. In contrast, nitrate-N was not detected in BHB, BHC, or BHD, which may be indicative of some degree of reducing conditions around these bore locations.

With regard to the major iconic chemistry analyses undertaken, the eastern bores BHA and BHE generally show similar chemistry to surface water (spring fed) samples. There are variations with BHE showing low bicarbonate and alkalinity concentrations, and BHA having higher chloride and calcium concentrations. BHB, BHC and BHD show slightly different chemistry, with BHD in particular having the highest concentrations of bicarbonate, calcium, magnesium and sulphate and high alkalinity. However, the absence of elevated concentrations of most parameters in BHB and BHC, and the absence of elevated concentrations of chloride and nitrogen in BHD, coupled with the higher concentration of

magnesium, indicates that the groundwater at the time of sampling was not affected in any obvious way by seepage from the wastewater ponds, or by the surface discharge from the ponds. The differences in chemistry between the bores most likely results from changes in the natural hydrogeologic environment, and/or nearby land use. In particular, the absence of nitrate-N in BHB, BHC, and BHD and the occurrence of ammoniacal-N indicates that some influence from a reducing environment may occur in the area of these bores, although this is not entirely consistent with the elevated sulphate recorded in BHD.

The characteristics of Alliance's wastewater discharge are elevated bicarbonate, calcium, potassium, sodium, chloride, nitrogen, phosphorous and sulphate. The higher concentrations of some of these parameters in BHD indicates that groundwater might experience some effect from the discharge into the Boiler Ditch and/or the Makarewa River (perhaps at times of lower groundwater levels), although the absence of elevated chloride and nitrogen suggests that these parameters might also be affected by local geological and land use effects, rather than seepage effects from the wastewater ponds or the discharge.

In summary, it is considered that the wastewater discharge is primarily directed toward the Makarewa River and is not having any significant impacts on groundwater to the south of the wastewater treatment ponds. The results indicate that the ponds therefore have a reasonable barrier which is containing contaminants successfully. It is however recommended that ongoing monitoring should be undertaken to confirm the groundwater effects in the vicinity of the ponds, particularly during low flow conditions.

7.8.7 Biosolids Land Disposal

As discussed above, and in more detail in the mitigation section, Alliance is proposing to upgrade its existing wastewater treatment facility. The new BNR treatment facility would necessitate the need to dispose of biosolids to land and potentially to an on-site monofill. Soil permeability is a constraint for irrigating wet biosolids to land, and centrifuge dewatering is proposed to mitigate against water logging, ponding and nutrient runoff. The minimisation of nitrogen leaching to prevent adverse effects on receiving ground and surface water resources requires a sustainable biosolids nitrogen loading rate, consistent with the agronomic uptake of Alliance's sheep grazed pasture system.

Modelling, as discussed later in section 8 of this report, has estimated that the nitrogen leaching rate from the proposed biosolids application will be approximately 13kg N/ha/yr. The estimated nitrogen leaching rate with biosolids application is comparable to historical measured leaching rates ranging from 10.6 to 19.3kg N/ha/yr during 2011–2012 and 2012–2013 seasons when nitrogen applications via wastewater irrigation was 89kg N/ha and 236kg N/ha respectively. On this basis, a proposed biosolids nitrogen loading rate of total 250kg N/ha/yr has been derived as being appropriate, or a 140 PNA kg/ha/yr.

7.9 EFFECTS ON AIR QUALITY

This section discusses the actual and potential air quality effects arising from the Plant operations, namely the use of the two on-site coal fired steam boilers and

odours generated from activities undertaken at the site. The information contained in this section is based on the reports prepared by Golder Associates, which are attached as **Appendices G and M**.

The effects on air quality from the operation of the Plant will be influenced by a number of different factors, including:

- existing air quality;
- meteorology; and
- the location of sensitive receptors (residential dwellings).

The report attached as **Appendix E** provides a description of the background ambient air quality, meteorology and identifies location of residential dwellings within proximity to the Plant. This has been summarised with respect to the description of the existing environment in section 3 above.

7.9.1 Coal Fired Boilers

To determine the effects arising from the operation of the two coal fired boilers, a model-based assessment of short and long term air contaminant exposure concentrations (arising from the boiler discharges and background contaminant levels), combined with directly measured ambient air contaminant levels at a key off-site location, provide the necessary information to evaluate the environmental effects. To complement the modelling assessment, direct monitoring of existing air quality was undertaken.

7.9.1.1 Nature of the Discharges

As noted earlier in this report, the coal fired boilers produce hot exhaust air streams containing combustion products and particulates. The key contaminants created by the discharge and which have been assessed are SO_2, PM_{10}, NO_2, heavy metals, and dioxins/furans.

Ambient impacts of CO from coal fired boilers are typically very low when compared against ambient health guidelines and standards, and therefore have not been assessed. The emissions of greenhouse gases, such as CO_2 do not cause local health effects and are not included in this assessment. It is also noted that section 104E of the RMA, states that when considering an application for a discharge permit relating to the discharge into air of greenhouse gases, a consent authority must not have regard to the effects of such a discharge on climate change, except to the extent that the use and development of renewable energy enables a reduction in the discharge of greenhouse gases.

7.9.1.2 Assessment Methodology

The methodology to assess the air quality effects arising from the coal fired boilers used a combination of atmospheric dispersion modelling and ambient monitoring at a key location that preliminary modelling identified as being close to the most impacted neighbouring dwelling (located to the east of the coal fired boiler discharge stacks).

The atmospheric dispersion modelling predicted contaminant ground level concentrations (GLCs) over a large area that included the Alliance site and surrounding locations. The GLCs included nearby residential and urban locations (Wallacetown and Invercargill) and surrounding rural areas. The existing background air contamination concentrations were added to the predicted GLCs due to the coal fired boiler discharges. The resultant cumulative concentrations were compared with applicable health based standards and guidelines including:

- The National Environmental Standard for Air Quality (NESAQ);
- The Ministry for the Environment (MfE) Ambient Air Quality Guidelines (AAQG); and
- Other appropriate health risk criteria for cumulative long term exposure to air pollutants.

7.9.1.3 Assessment Criteria

As noted above, there are a number of criteria available for assessing the impact of discharges to air. The MfE provides recommendations as to which assessment criteria takes precedence. Where there are any national standards or guidelines, these are given highest priority, followed by any relevant regional requirements. After these, any World Health Organisation (WHO) and Californian Office of Environmental Health Hazard Assessment (Californian Office) reference levels should be used.

As noted earlier in section 5, the NES regulations are mandatory and include standards relevant to the ambient concentrations of SO_2, NO_2, CO, PM_{10} and ozone (O_3). They include concentration limits, maximum numbers of allowable exceedances, and monitoring methods.

The AAQGs applicable to this assessment have very similar limits to the NES, but also include guidelines additional to those in the NES, particularly for 24 hour NO_2 and an annual PM_{10} guideline of 20µg/m^3.

The Air Plan for Southland (Policy 4.3.1) contains a number of ambient air quality guidelines. These guidelines have been adapted from the Ministry for the Environment's "Ambient Air Quality Guidelines" dated July 1994, and therefore pre-date the NESAQ. The Proposed Air Plan (2014) also includes provisions relating to ambient air quality and seeks to improve air quality in areas where concentrations of contaminants exceed NESAQ, and to maintain or enhance ambient air quality in the areas of the region that have high ambient air quality by:

a) Improving ambient air quality to reduce adverse effects on the health of humans and the health of the environment where monitoring shows air quality has been degraded;

b) Ensuring human health and the health of the environment are protected by having regard to appropriate ambient air quality guidelines.

In addition to these national and regional standards, there are international standards relating to air quality which are also relevant. Those relevant to this application include the Californian Office and WHO standards.

A summary of the main assessment criteria and relevant source that are applicable to this application is presented in **Table 10** below:

Table 10: Main Criteria for the Air Discharge Assessment

Contaminant	Guideline/standard (µg/m³)	Averaging period	Allowable exceedances per year	Source
SO_2	350	1-hour	9	NES
	570	1-hour	0	NES
	120	24-hour	0	AAQG
	30	Annual	0	AAQG
NO_2	200	1-hour	9	NES
	100	24-hour	0	AAQG
PM_{10}	50	24-hour	1	NES
	20	Annual	0	AAQG
$PM_{2.5}$	25	24-hour	N/A	WHO
	10	Annual	N/A	WHO
Lead	0.2	3-month moving average, calculated monthly	N/A	AAQG
Arsenic	0.0055	Annual	N/A	AAQG
Cadmium	0.02	Annual	N/A	OEHHA (2012)
Chromium VI	0.0011	Annual	N/A	AAQG
Chromium metal and Chromium III	0.11	Annual	N/A	AAQG
Mercury	0.33	Annual	NA	AAQG
Dioxins	Tolerable daily intake 1 pg TEQ/kg body weight/day†	Annual	N/A	MfE (2001)

7.9.1.4 Ambient Air Monitoring

Ambient monitoring of SO_2 and PM_{10} and $PM_{2.5}$ concentrations were carried out at an adjacent residential property[19]. The ambient monitoring confirmed background air quality of key contaminants surrounding the site as well as

[19] 237 Steel Road, Lorneville – approximately 650m east of the boiler stacks.

impacts due to the coal fired boilers discharges to air. Preliminary modelling was undertaken to help establish the ambient monitoring location and to provide actual SO_2 and PM_{10} concentrations for comparison with impacts predicted to result from the coal fired boiler discharges.

The ambient monitoring found that:

- The SO_2 levels are well below the NES limits:
  - The peak hourly SO_2 concentration is 120µg/m^3, which is 21% of the NES limit for maximum SO_2 of 570µg/m^3;
  - The 99.9th percentile hourly SO_2 concentration is 108µg/m^3, which is 31% of the NES limit for the 99.9th percentile SO_2 of 350µg/m^3
- The 24 hour SO_2 levels are well below the AAQG limits:
  - The peak 24 hour SO_2 concentration is 52µg/m^3, which is 43% of the AAQG for maximum SO_2 of 120µg/m^3
  - Typically the 24 hour SO_2 concentrations are well below 20µg/m^3.

The first monitoring programme of PM_{10} (31 January to 21 May 2014) produced ambient 24 hour PM_{10} results that were compliant with, but approach the NES limit on occasions. The average of all the monitoring data showed compliance with the AAQG for annual average PM_{10}. The second monitoring programme (19 December to 16 February 2015) confirmed compliance with the relevant standards and results were generally lower than the earlier monitoring period mentioned above. In summary, the monitoring showed that:

- During the first monitoring period 96% of the days had ambient 24 hour PM_{10} concentrations less than 25µg/m^3 (being 50% of the NES limit value);
- During the subsequent monitoring period, 98% of the days had ambient 24 hour PM_{10} concentrations less than 25µg/m^3 (being 50% of the NES limit value);

It is noted that PM_{10} concentrations at the monitoring location are expected to have reduced by around 20% following the completion of the CFB 2 multi-clone upgrade, as discussed in section 4 to this report.

The ambient monitoring also confirmed that the 24 hour average $PM_{2.5}$ concentrations were all well below (29% or less) the WHO guideline value of 25µg/m^3.

The results show that compliance was achieved for all relevant SO_2, PM_{10}, and $PM_{2.5}$ standards and guidelines.

7.9.1.5 Air Discharge Modelling Results

The dispersion modelling provides estimates of GLCs resulting from the contaminant emissions discharged from the boiler stacks. The key potential effects of concern are human health effects due to the discharge of contaminants, namely $PM_{10,}$ NO_2, SO_2, metals and dioxins.

Particulate Matter

Table 11 below presents the modelled, background and cumulative PM_{10} GLCs:

Table 11: Modelled, Background and Cumulative PM_{10} GLCs

Averaging period	Maximum off-site GLC			GLC at highest impacted off-site dwelling			Assessment criterion (µg/m³)
	Modelled GLC (µg/m³)	Back-ground GLC (µg/m³)	Cumulative GLC (µg/m³)	Modelled GLC (µg/m³)	Back-ground GLC (µg/m³)	Cumulative GLC (µg/m³)	
24-hour	40	15	55	17	15	32	50
Annual	5	10	15	1.7	10	12	20

The maximum cumulative 24 hour PM_{10} GLC of 55µg/m^3 is predicted to occur at the nearest point of the site boundary. However, the modelling indicates that only one exceedance above 50µg/m^3 is predicted to occur at this location over a 2 year period. This indicates that compliance with the NESAQ limit is likely.

The GLC at the closest sensitive receiver (dwelling) located approximately 770m east from the stacks indicates a maximum cumulative PM_{10} of 32µg/m^3. The maximum cumulative annual average PM_{10} GLC at this site is predicted to be 12µg/m^3. These results are well below the limits for PM_{10} within both the NESAQ and AAQG.

The modelling also confirms that the boilers will have a negligible impact on the Wallacetown and Invercargill airshed.

Nitrogen Dioxide

Table 12 below presents the modelled, background and cumulative NO_2 GLCs:

Table 12: Modelled, Background and Cumulative NO_2 GLCs

Averaging period	Maximum off-site GLC			GLC at highest impacted off-site dwelling			Assessment criterion (µg/m³)
	Modelled GLC (µg/m³)	Back-ground GLC (µg/m³)	Cumulative GLC (µg/m³)	Modelled GLC (µg/m³)	Back-ground GLC (µg/m³)	Cumulative GLC (µg/m³)	
1-hour (99.8th percentile‡)	16	15	31	13	15	28	200
24-hour	9	15	24	6	15	21	100

As shown in the table above, the cumulative concentrations of NO_2 at the property boundary and nearest dwelling are predicted to be well below the respective 1

hour and 24 hour average assessment criteria contained within the NESAQ. The effects on human health therefore are anticipated to be minor.

Sulphur Dioxide

Table 13 below presents the modelled, background and cumulative SO_2 GLCs:

Table 13: Modelled, Background and Cumulative SO_2 GLCs

Averaging period	Maximum off-site GLC			GLC at highest impacted off-site dwelling			Assessment criterion (µg/m³)
	Modelled GLC (µg/m³)	Back-ground GLC (µg/m³)	Cumulative GLC (µg/m³)	Modelled GLC (µg/m³)	Back-ground GLC (µg/m³)	Cumulative GLC (µg/m³)	
1-hour maximum (99.9th percentile†)	290	5	295	169	5	174	570
1-hour 99.9th Percentile (99.8th percentile‡)	260	5	265	143	5	148	350
24-hour	140	5	145	62	5	67	120
Annual	18	3	21	7	3	10	30

The results show that the maximum and 99.9th percentile 1-hour average SO_2 impacts are below the applicable health standards and typical levels would be well within these. The maximum 24-hour average cumulative off-site SO_2 GLC is predicted to be 145µg/m³ (120 % of the assessment criterion). The maximum 24-hour average cumulative SO_2 GLC at the highest impacted off-site dwelling is predicted to be 67µg/m³ (56 % of the assessment criterion).

Because the maximum off-site cumulative 24-hour SO_2 concentration is predicted to be above the relevant assessment criterion, it is important to understand the spatial extent and frequency of that predicted exceedance. The off-site area which is predicted to experience exceedances of the 24-hour average SO_2 assessment criterion is limited to the western ends of the two areas of land that extend into the site boundary from the eastern side. The area impacted by 24-hour average SO_2 concentrations greater than 120µg/m³ is estimated to be less than 2ha in size. The spatial extent and frequency of these exceedances is likely to be very limited and therefore any adverse effects are anticipated to be minor. Notably, the annual average SO_2 is well below the applicable health standards.

Metals

The modelling undertaken demonstrates that the maximum annual average GLCs for various heavy metals (arsenic, cadmium, chromium and mercury) are all well below the applicable health standards and therefore unlikely to cause any adverse effects.

Dioxins

The discharge rates relating to dioxins are also well below recommended national health guidelines and therefore unlikely to cause any adverse health effects.

7.9.1.6 Soil Metal Analysis

An assessment of heavy metals in soils arising from the coal fired boiler discharges has also been undertaken (refer **Appendix M** attached). The soil sampling sites were guided by Golder Associates and six sites were selected. Three were in proximity to the coal fired boilers, and three were located at points upwind of the boiler location under prevailing wind conditions, where predicted effects were likely to be much lower (and could be considered as control sites). The assessment found that metal concentrations found in the samples are well below guideline levels and comparable with background metal concentrations found in most soils.

7.9.1.7 Summary of Effects

The key findings of the assessment of the coal fired boiler discharges are that all cumulative ambient contaminant concentrations readily meet compliance with all relevant national standards and guidelines for air quality beyond the site boundary and at locations of existing sensitive receptors (ie. dwellings). The modelling does however identify one localised area of limited extent, close to the Plant's site boundary, where ambient SO_2 and PM_{10} could, on an infrequent basis, exceed the relevant ambient criteria. However, as this is currently a small area of unoccupied rural land, the effects of these exceedances are likely to be minor or less.

Although the monitoring indicates that PM_{10} will achieve compliance with the NES and other guidelines, it is appropriate to seek to reduce emission levels on the basis that PM_{10} does not have an established threshold concentration below which there are only minor or no observable adverse health effects on humans. This is consistent with the recommendations in the AAQG and by the World Health Organisation. Therefore, it is important for Alliance to ensure that a good level of performance is achieved by the coal fired boilers with respect to PM_{10} emission control. It is recommended that PM_{10} emissions from the two boilers exceed a flow weighted concentration of 250mg/m^3 (corrected to 12 vol. % CO_2) within five years of a consent being granted.

7.9.1.8 Mitigation and Monitoring of Effects

As discussed later in this report in section 8, Alliance has imposed a number of existing measures in order to minimise the impacts of the air discharges from its coal fired boilers. This includes the current automatic control systems for ensuring steady coal combustion, the primary treatment of boiler exhaust air via multi-clones, one of which was recently upgraded for CFB2 (for PM_{10} discharges), and

discharges of these treated emissions via tall discharge stacks so as to minimise ground level contaminant concentrations.

Alliance also requires that the coal it uses in its boilers meets certain specifications in order to further minimise the adverse effects on the receiving environment.

In addition to seeking to reduce PM_{10} emissions to a flow weighted concentration of 250mg/m^3 (corrected to 12 vol. % CO_2) within a five year timeframe, Alliance will also undertake periodic technology reviews so as to ensure it is being consistent with the best practicable option for minimising particulate matters.

With respect to compliance monitoring, Alliance currently undertakes annual stack testing and reporting. Golder Associates consider that annual stack testing information does not provide a robust assessment of the actual ambient impacts arising from the coal fired boilers, and therefore recommends that stack testing is discontinued in favour of more comprehensive ambient monitoring. The use of annual ambient PM_{10} and wind monitoring at an off-site neighbouring location would provide vastly more useful and robust information on the actual impacts of particulate discharges from the coal fired boilers. Stack testing would be undertaken for compliance purposes if the ambient monitoring resulted in an exceedance of specified ambient concentration limits, in order to understand whether there is an issue with the operation of the one or either of the boilers that needs to be addressed.

7.9.2 Odours

As discussed above (section 3), a number of on-site processes can cause, or have the potential to generate odours. A description of these activities is contained in section 3. Golder Associates (refer **Appendix F** attached) has undertaken an evaluation of the extent of these potential odour sources in order to determine the magnitude of the effect beyond the property boundary in particular and identify if further mitigation is required. The following presents a summary of these findings.

7.9.2.1 Process Odour and Effects

With respect to the stockyards, soup stock, and wool hydrolysing processes undertaken on-site, the assessment determined that there were no adverse odour effects arising beyond the boundary of the site. The current process and practices employed by Alliance appear to be effective in managing any potential odours associated with these activities, and therefore no specific mitigation or further management has been recommended.

Blood processing can be a potentially odorous activity. However, the assessment found that the current system operates effectively and blood drying odours are therefore not considered likely to create any issues outside the property boundary.

The rendering process is a potentially significant odour source and without mitigation, offensive or objectionable odours could be generated outside the

property boundary as a result. The assessment found that the current odour control system and biofilter were working very effectively to contain and then fully treat all process/cooking type odours and only meal type odour was liberated from the current system. The discharge of meal processing odours is controlled by the filtering of meal dust and the significant buffer distance between this aspect of the facility and the property boundary. The effective and efficient operation of the current rendering and odour control system, coupled with the distance of the rendering plant from any sensitive receptors, is considered appropriate to manage any potential adverse effects arising with respect to off-site odours.

The key odour arising from the fellmongery activity on-site is the process drum emissions. However, due to the large buffer distance from the fellmongery to the property boundary, the treatment of the process drum discharges is not likely to be necessary to avoid any significant off-site odour effects. The mixing of lime liquors and acidic waste streams could potentially generate off-site odour effects that are objectionable, therefore mitigation in the form of pre-oxidation or other treatment may be necessary to consistently maintain minor odour effects beyond the Plant's property boundary. This is discussed further in section 8.

7.9.2.2 Current Wastewater System Odours

As discussed above, the existing wastewater treatment facility could generate odours. The existing system has an initial anaerobic pond stage which removes in excess of 80% of the inlet organic material. This is followed by treatment within mechanically, then naturally, aerated ponds before discharging to the Makarewa River. The odour generated from the anaerobic pond, and to a lesser extent the first stage of the aerated ponds, has reduced by an order of magnitudes since the late 1990s. The anaerobic pond however, remains as the main source of potential odours from the facility.

A community survey based assessment of all process and wastewater treatment related odour effects was undertaken during 2013 and 2014. This survey concluded that for some residents (in particular those living closest to the southern property boundary of the Alliance site), there are some isolated occasions when the odour discharges from the anaerobic pond could be causing objectionable and/or offensive effects. This effect appears to be most profound in the autumn when the anaerobic pond is still relatively active, and when more calm atmospheric conditions are establishing.

The survey also indicated that local residents in Wallacetown, and dwellings to the northeast and south to southeast of the wastewater treatment facility are likely to experience occasional odours that are mainly generated from the anaerobic pond. However, it has been determined that these residents and properties are generally not exposed to objectionable or offensive odours. Specifically, it was concluded that because odours are detected on a sufficiently low frequency, their duration and intensity cannot be considered to be objectionable or offensive.

7.9.2.3 Mitigation of Wastewater Treatment Odours

The assessment in **Appendix R** attached identifies that there are three areas where the current odour emissions arising from the wastewater treatment plant

could be reduced. These include achieving practical reductions in organic loading to the ponds, a reduction in sulphide and sulphate loadings to the wastewater treatment facility and maintenance of optimal pond conditions in order to minimise the discharge of odours. These are discussed later in section 8 of this report.

7.9.2.4 Upgraded Wastewater Treatment Facility Odours

As discussed earlier in this report, Alliance has recently installed additional primary treatment technology to treat the wastewater discharge into the ponds. In addition to this, a planned upgrade in order to reduce the contribution of nitrogen within the treated discharge to the river environment, will also likely improve the impact of the existing wastewater treatment facility with respect to odour generation. However, the upgraded system could also give rise to potential new odour sources. The potential impact of the proposed upgrade on the current system and the potential new odour sources are discussed here.

The upgraded wastewater treatment facility as described in **Appendix I** attached to this report, will significantly reduce the loading of biological oxygen demand (BOD) to the existing anaerobic pond and also effectively eliminate the loading of sulphides due to the use of sodium sulphide within the fellmongery. The reduction in odour generation from the existing pond is likely to be significant, that is in the order of 80% reduction or more. It is noted however that there is a chance that as a result of the reduced organic load in the wastewater, the pond's natural crust layer could disintegrate. If this were to occur it would counter the substantive gains made in respect to reducing odour emissions as part of the overall wastewater upgrade. However, the likelihood of this occurring is expected to be low, given that Alliance regularly monitors the pond surface as fat loads are reduced over time. Furthermore, it is likely that a significant reduction in the existing biological loading to the pond can occur whilst the crust remains stable as the existing loading of fat is high. In addition, measures to prevent the crust from disintegrating can also be employed, as discussed later in section 8.

The proposed upgrade is also likely to be in conjunction with the use of standard sulphide oxidation technology being employed for sulphide bearing fellmongery waste liquors, which will also mitigate the potential for sulphide odours to be released.

Components of the proposed system upgrade could also give rise to odours. The new sources include the anaerobic lagoon, the BNR pond and secondary clarifier. These odours are however not anticipated to be significant, and measures such as capturing off-gas and burning it in either a biogas flare, or for energy recovery use can be employed to ensure any adverse odour effects are appropriately mitigated.

The management and disposal of biosolids generated from the upgraded facility could also generate adverse odour effects. This could arise from the storage of biosolids, land spreading and monofill.

Raw and dewatered biosolids, if stored for a long period of time, could become anaerobic and odorous. Operational experience will be necessary to establish suitable maximum storage limits and stabilisation procedures of raw and

dewatered biosolids ahead of land spreading and monofill operations to ensure the appropriate management of potential odour effects. It is likely that this will be a strong function of the extent of agitation/aeration that is installed into the raw biosolids storage lagoon.

It will be important then to only land spread biosolids that have not become anaerobic and odorous. This will require the adoption of good practice management techniques, for example restrictions on storage time, accounting for forecast wind conditions during the day of spreading, and appropriate buffer zones to help prevent adverse odour effects. Given the separation distances between areas that could receive biosolids and adjacent sensitive receptors and local meteorology, should the use of these measures not be sufficient to avoid adverse odour effects beyond the boundary of the site, then contingency measures would need to be considered. This could include alternative biosolid management/disposal options.

The design of the monofill and ability to cover and contain odours will be key in mitigating adverse odour effects. Ensuring that the active face at the monofill can be covered, the use of lime to neutralise anaerobic odours from uncovered material, as well as soil to ensure odorous gas leaks are not significant, are all standard odour management techniques that can be employed.

It is concluded that odours from these operations can be effectively controlled via appropriate management with respect to the storage of the biosolids, and retention times of raw and dewatered biosolids, in conjunction with an adaptive management approach that reviews the environmental performance of the land spreading of biosolids and the adequacy of operational procedures.

7.10 CULTURAL EFFECTS

In order to determine and assess the cultural effects of the ongoing operation of the Plant, and in particular its discharges to water, land and air, Alliance asked Te Ao Marama to prepare a Cultural Values Report. This is attached as **Appendix C** to this report. More specifically, the purpose of this report was to help quantify the Ngai Tahu ki Murihiku values within the Makarewa River and lower Oreti River that are affected or potentially affected by the Plant activities, with particular regard to their wastewater discharge to the Makarewa River. The following provides a summary of this report and details with respect to the consultation outcomes between Alliance and Te Ao Marama.

7.10.1 Cultural Values and Uses of Freshwater

In the traditional Maori worldwide, water is viewed as a taonga or treasure. It sustains life and is central to Maori life and wellbeing. Cultural use is often defined as the collection of plants, fish and other natural resources for cultural purposes. This also includes the activities relating to or visiting a place or landscape, such as campsites or settlements. However, this definition is too narrow to express the numerous and diverse elements of cultural use and values associated with Murihiku waterways.

Both tangible and intangible aspects of water and waterways feature in all aspects of Ngai Tahu culture. Waterways feature in stories, place names and waiata which consistently reflect symbolic and important messages. Each whanau has its own traditions associated with areas, the characteristics of which can vary greatly. Specific waterways can be valued and protected for particular cultural reasons. Waterways provide a range of resources including food and cultural materials that sustain cultural functions. In some cases, specific resources (eg. tuna/eels) serve as cultural symbols valued through a region, while others can be significant to specific groups.

Ngai Tahu also share the use and values for a range of uses in common with other members and groups in the community, including:

- Domestic supply – for home and marae
- Stock water
- Fishing
- Swimming, boating and other recreational activities
- Agriculture and other economic developments.

Therefore, Ngai Tahu whanau values include both 'out of stream' and 'in stream' values.

A key Ngāi Tahu resource management principle is the maintenance and enhancement of mauri or life force/life principle.

Promoting the mauri of a river will sustain healthy ecosystems, support a range of cultural uses (including mahinga kai), and reinforce the cultural identity of the people.

While there are many intangible elements associated with the mauri of a waterbody, there are elements of physical ecosystem health which Ngāi Tahu use to reflect the state of mauri. These include aesthetic qualities, e.g. natural character, indigenous flora and fauna; life supporting capacity and ecosystem robustness; the continuity of flow of water (of high quality) from the mountain source of a river to the sea; fitness for cultural usage; and productive capacity.

7.10.2 Key Values of Importance and Potential Effects

The mauri of water can be compromised by the mistreatment of natural water resources through contamination of springs, groundwater, rivers, and the coastal environment by way of uncontrolled discharges. This in turn can have a significant impact on aquatic life traditionally sourced for food and other cultural purposes.

Maintaining an appropriate level of water quality in the environment is fundamental to Maori spiritual values and Te Ao Marama are concerned that the discharges to water may have potential impacts on local aquatic life in particular.

With respect to the water resource, the Cultural Values Report and consultation with Te Ao Marama has identified the following values of importance with respect to iwi:

- Ki Uta Ki Tai – the need to consider the effects of the applications from ki uta ki tai (from the mountains to the sea), and that activities in the lower part of the catchment can impact on the cultural values of those further up the catchment.
- Mahinga kai is central to Ngai Tahu wellbeing and identity.
- The rich cultural landscape of the Makarewa and Lower Oreti catchment. These include some of the oldest settlements in New Zealand (adjacent to the New River Estuary), the cultural stories of the travels of Tamatea and his waka Takitimu; the number and significance of wahi tapu and archaeological sites; the large amount of Maori land, and the mahinga kai resources of this area.
- The kaitiaki responsibility of tangata whenua to continue to protect cultural associations and values. These values are also protected via numerous legal mechanisms.

The Cultural Values Report also identified the human effluent component of the wastewater discharge as being of concern to iwi, and impacts of ammonia discharges to water.

As with water, the mauri of air can also be compromised by inappropriate or uncontrolled discharges. Air pollution can have a significant impact on the health of people, in particular the elderly or those with respiratory illnesses. Iwi therefore have an interest in the discharges to air relating to this proposal.

The potential effects that of particular concern to iwi therefore include:

- Adverse effects on water quality, aquatic ecology and habitats arising from the discharge of treated wastewater to water;
- Adverse effects on fish health arising from the discharge of treated wastewater to water;
- Adverse effects on air quality arising from discharges from the Plant's coal fired boilers;
- Economic and social effects arising from the ongoing use of the Plant, noting that it is a significant employer of Maori within the Southland Region.

7.10.3 Consultation with Te Ao Marama

Alliance has engaged with Te Ao Marama as part of the formation of the TWP described in section 6. This enabled Alliance to share information with Te Ao Marama and to seek feedback. Alliance met with Te Ao Marama on 18 May 2015 on an individual basis. Te Ao Marama provided a presentation to Alliance summarising the content of the Cultural Values Report, and an outline of key concerns to iwi.

As part of this presentation it was emphasised that iwi have core values that need to be recognised and appropriately managed as part of the consenting and mitigation package developed for the Plant. These core values include:

- Kaitiakitanga
  - Protection, restoration and reciprocity
  - Participation and connection
  - Best practices, involvement and in a timely manner
- Mahinga Kai
  - Desirable conditions – environment and condition of species
  - Habitat
  - Life stages and co-dependent species present
  - Access
- Ki uta ki tai
  - Linkage to the wider catchment and processes
- Whanaungatanga
  - Health and wellbeing of Maori people

These core values have been taken into account in developing the mitigation, as set out in section 8. A key aspect of this mitigation is Alliance's commitment to prepare and implement, in consultation with Te Ao Marama, a habitat enhancement management plan. The purpose of this plan is to take a holistic view of the Plant's activities and operations, and identify areas of the property which can be enhanced from an ecological perspective. This might include measures such as increased riparian planting around the Plant's waterways.

8. MITIGATION METHODS AND MONITORING OF ENVIRONMENTAL EFFECTS

8.1 INTRODUCTION

The assessment of effects in section 7 identifies a range of positive and adverse actual and potential environmental effects that will, or are likely to arise as a result of the ongoing operation, maintenance and upgrading of the Plant. This section describes the measures that are currently undertaken by Alliance, and those measures that have been recommended by the various technical specialists to manage the actual and potential adverse effects of the Plant.

8.2 CURRENT ENVIRONMENT MONITORING AND MANAGEMENT

In accordance with its environmental policy and current consent obligations, Alliance currently implements a range of environmental management and monitoring initiatives at its Lorneville Plant.

These include:

- A monitoring programme
- Environment Management Systems, Manuals and Plans including:
    - Environmental Impact Assessment
    - Emergency Spill Plan
    - Wastewater Treatment Plant Operating Procedure
    - Soil Waste Management Plan
- A Wastewater Irrigation Management Plan
- A Low Flow Contingency Management Plan – Oreti River
- Air Discharge Management Plan

The relevant monitoring and management initiatives are discussed below.

8.2.1 Monitoring Programme

In accordance with its current conditions of consent to discharge to water, land and air, Alliance undertakes extensive monitoring for its Plant operations. The monitoring undertaken includes:

- Monitoring of the wastewater stream prior to discharge into the Makarewa River;
- Monitoring of the receiving Makarewa River at three locations (one upstream and two downstream) for various parameters including DO, ammonia, conductivity and pH;
- Monitoring of soil and groundwater resources in the vicinity of the discharges to land;

- Monitoring of particulates from the boilers;
- Process control monitoring;
- Odour monitoring and community complaints.

8.2.2 Environmental Management Systems, Manuals and Plans

Alliance has environmental management systems, manuals, procedures and plans in place that describe the Plant's operational and environmental activities and the systems employed to ensure compliance with regulatory resource consent conditions and internationally recognised environmental management standards. These plans for the Plant will be updated to ensure all new monitoring and management requirements imposed by any future consents are adhered to.

8.2.3 Wastewater Irrigation Management Plan

The purpose of this plan is to detail the operating procedures, monitoring and reporting requirements that are to be followed for irrigation of treated wastewater onto the designated irrigation zones on Alliance's farm land. The plan includes a description of the action and responsibilities associated with the irrigation system and the discharge to land. It references the current conditions attached to Consent 200034 and describes the methods and procedures that are undertaken in order to fulfil those obligations. The plan also sets out the monitoring and reporting requirements.

8.2.4 Low Flow Contingency Management Plan

Alliance currently has in place a Low Flow Contingency Plan applicable to its abstraction from the Oreti River. In accordance with this Plan the following measures apply, based on the 7DMALF at the time the existing consent was granted:

Table 14: Low Flow Contingency Measures

7 Day Low Flow	% MALF (7 day)	Average Frequency	Conservation Measures
4.2m^3/sec	50%	1 in 6 years	i. Notify all Plant personnel of low flow conditions and the need to reduce water use. ii. Cease supplementary supply of potable water to Wallacetown iii. Commission an independent audit to identify specific water conservation measures iv. Establish a Water Conservation Task Force to implement water conservation measures including those identified by the water use audit v. Redirect stock and / or redirect further processing to

			other Alliance plants if practicable vi. Participate in Environment Southland drought response measures including daily reporting on achievements in water conservation
3.3m^3/sec	39%	1 in 12 years	i. Measures at 4.2 m3/sec listed above ii. Redirect partially processed products to other Alliance plants or independent processors where this will reduce water use. iii. Reduce water use in conveyance of products between departments

8.2.5 Air Discharge Management Plan

Alliance also currently has in place an Air Discharge Management Plan which sets out the current air discharge permit conditions and the measures required to achieve each condition requirement. It is proposed to prepare an updated Air Discharge Management Plan and this is attached in draft form as **Appendix U** to this report

8.3 WATER QUALITY

Based on the water quality assessments undertaken by Aquatic Environmental Sciences and Freshwater Solutions Limited, a draft Environmental Monitoring Plan (EMP) has been prepared. This plan is attached as **Appendix T** to this report. The purpose of this plan is to set out the frequency of the monitoring, along with the parameters and limits that should be achieved based on the assessment undertaken and mitigation required or anticipated to be achieved.

8.3.1 Discharge Monitoring

Monitoring of the quality of the wastewater stream prior to discharge to the Makarewa River is recommended. The key considerations in this regard are the physical and chemical attributes of the wastewater prior to entering the receiving river environment. With respect to ongoing and future monitoring of the wastewater stream, the frequency and parameters monitored are to remain largely consistent with the requirements of Alliance's existing discharge permit (92195). In addition to these it is recommended that *E.coli* sampling be added to the weekly discharge sampling and that volatile TSS be added to the sampling programme and reassessed along with TSS after one year. It is also recommended that TN and TP are measured weekly during the discharge period, to provide input nutrient loading assessments downstream. It is also recommended that changes are made to the monitoring season in order to better align with the actual processing season.

The discharge will be required to comply with the following specified limits for BOD, TSS, TN, and TP:

Parameter	Limit
Carbonaceous BOD_5	30 g/m^3
Total Suspended Solids	110 g/m^3
Total Nitrogen	180 g/m^3
Total Phosphorous	20 g/m^3

In circumstances when one or more of the prescribed limits are exceeded on two consecutive sampling occasions, Alliance will be required to notify the Council and prepare a report which sets out the likely cause of the limit exceedance, the resulting effects on the receiving environment likely to arise because of the discharge and the management and any remedial action that has been undertaken. These limits will apply until such time as the wastewater treatment plant upgrade has been implemented.

Post the upgrade of the wastewater treatment plant, the limits for TN and TP will be reduced reflective of Alliance's commitment to achieve a 75% reduction in TN in the discharge stream and a reduction of around 45% of TP. The revised limits are set out below:

Parameter	Limit
Carbonaceous BOD_5	30 g/m^3
Total Suspended Solids	110 g/m^3
Total Nitrogen	45 g/m^3
Total Phosphorous	11 g/m^3

Within twelve months of the upgraded wastewater plant being fully commissioned and operational, Alliance will undertake a review of the above limits. This review will set out any recommended changes to the prescribed limits for TN and TP in particular. The results of this review will be sent to the Council, who upon receiving this report will be able to initiate a review to ensure the limits specified are appropriate.

With regard to Faecal Coliforms, the pre upgrade limit that will be adhered to in the discharge stream is proposed to be 45,000 cfu/100mls. Within 10 years of the commencement of any consent granted for the wastewater discharge to water, Alliance will undertake a review to determine whether it is necessary and practicable to further treat the discharge stream in order to reduce the microbial load. If the results of this assessment determine that further treatment and a new limit for Faecal Coliform is required, then the proposed conditions enable the Council to undertake a review in order to determine whether this should be implemented and a revised limit set. If the assessment does not recommend that

any further treatment in order to reduce the microbial load is necessary or practicable, then Alliance will be undertake a similar review every five years for the life of the consent.

8.3.2 Monitoring of the Receiving Water

Monitoring of the Makarewa River is also recommended in order to demonstrate compliance with derived limits, and document the water quality and health of the downstream river environments in order to demonstrate that the effects of the discharge are no more than predicted.

Alliance currently monitors water quality at the Pipe Bridge upstream of the discharge, a site referred to as 200m downstream of the discharge and at a site 1.2km downstream of the discharge (Boundary Site). It is noted however that the 200m Site is approximately 350m downstream of the discharge, which is appropriate given that it is outside the mixing zone (200m). It is therefore recommended that the following sites are to be the future compliance monitoring points for the discharge:

- The Pipe Bridge Site is replaced with a site that is largely beyond the upstream influence of tidal changes (in the vicinity of Site U2 refer to **Figure 9**). This site would be used for comparative baseline conditions;
- The 200m downstream site be named as the “350m site”, and sampling should occur at the same time each day and record the state of the tide at the time;
- The Boundary Site should be discontinued as a monitoring site. Given the mixing characteristics of the river it is not necessary to have this 1.2km downstream monitoring site.

It is noted that in selecting the monitoring and compliance sites, an important consideration is the practicality of access to the river for samples to be collected. Due to constraints in the locality of the discharge point (ie. access, flooding, and tidal influence), continuous monitoring is not considered to be a viable option.

8.3.3 Receiving Water Limits and Management Responses

The monitoring plan (refer **Appendix L** attached) notes that under the framework of the existing consent there are limits on the receiving waters. These limits require compliance with the following:

- The minimum standards for Class ‘D’ waters
- Black disc distance shall not be below 20% of the value upstream;
- No production of conspicuous oil or grease films, scums, foams, or floatable or suspended materials;
- Dissolved oxygen concentrations beyond the 200m downstream site shall be consistently maintained at not less than 6g/m^3 (96% of the samples throughout the year);

- After the first two years the concentration of total ammonia in the Makarewa River, beyond the zone of reasonable mixing, may not exceed values at the appropriate temperature and pH set out in the consent (92195).

As noted above, the existing compliance site is located approximately 350m downstream of the discharge point, below the mixing zone boundary and at a appoint where access to the river for sampling is practicable. The monitoring plan recommends this site is retained (and renamed) and also recommends the following additional changes to the current limits set out within the consent (92195):

- When the natural or existing temperature measured at the upstream site is 16^{o}C or less, water temperature be increased by no more than 3^{o}C as a result of the discharge. If the natural or existing temperature is above 16^{o}C then the natural or existing water temperature shall not be exceeded by more than 1^{o}C. A maximum of 24^{o}C should not be exceeded. If this is exceeded then the cause and comparison with upstream temperatures should be investigated.
- Clarity tube measurements shall not be below 33% of upstream values. This is to be consistent with the clarity in the Makarewa River upstream and reflective of the receiving river environment in terms of its overall quality and use (ie. lowland water body). The Regional Water Plan provides that clarity in lowland water bodies shall be not less than 1.3m when below median flow. The upstream river environment would not be able to achieve this limit and therefore it is not considered appropriate to apply as a compliance limit downstream of the discharge site.
- It is recommended that the DO limits be changed to reflect the limits in the Freshwater NPS as well as the existing consent conditions, ie. consistently maintained at not less than 6g/m^3 (96% of samples throughout year) and an absolute minimum of >5g/m^3, which is the attribute state which causes only occasional minor stress of lowered dissolved oxygen (B/C state, Freshwater NPS). Diurnal measurements of DO show that the minimum DO concentration occurs in mid-morning, thus the daily sampling at 8.00-9.00am would be precautionary.
- The pH range 6.5-9.0 be retained as it is consistent with the Regional Water Plan.

A potential effect of the wastewater discharge is increased Amm-N levels which can be toxic to biota in the river. Although the monitoring and assessment of the receiving river environment has not identified any measurable adverse toxicity effects directly attributable to the discharge, it has been determined that the current discharge needs to be improved to meet a site–specific, in-river ammonia target. It is anticipated that this will in turn contribute to the achievement of the bottom line value contained in the Freshwater NPS within the wider catchment. These assessments indicate that a 75% reduction (from 2012-2013 season concentrations) in discharge Amm-N concentration is the appropriate target. In order to achieve the future limits for Amm-N a comprehensive upgrade to the existing wastewater treatment system is required. A progressive implementation

programme is proposed which aligns temporally with the achievement of national and regional objectives for improvements in water quality.

In the interim the existing compliance level of 5.6g/m^3 at pH 8 and 20^{o}C should be applied, but comparisons with the new targets (discussed below) be reported annually, as part of the Annual Discharge Monitoring Report to Environment Southland. As noted above, this limit is considered appropriate given that there is currently no evidence that the discharge is having a chronic toxicity effect on any species present within the Makarewa River.

The major contributor to potential toxicity and the TN loadings in the receiving river environment is Amm-N, which typically contributes approximately 87% of the TN in the discharge. A site-specific Amm-N limit has been established for the Makarewa River and the Alliance discharge. It is considered the most appropriate ammonia limits for the Makarewa River downstream of the Alliance discharge that should be achieved in the longer term are:

- The 30 day rolling average concentration of total ammonia nitrogen shall not exceed 1.9g/m^3 (adjusted to pH 8).
- The rolling 4 day average over any 30 day period shall not exceed a maximum of 4.75g/m^3 (adjusted to pH 8) within the receiving water more than once over a three year period.
- The concentration of total ammonia nitrogen shall not exceed an annual 95th percentile of 2.4g/m^3 (adjusted to pH 8).

These limits are lower than both the ANZECC (2000) 80% trigger value and the USEPA (2013) chronic criteria, and only slightly higher than the Freshwater NPS attribute state, which was set to provide 80% species protection. Due to the unsuitable nature of the habitat within the Makarewa River, most sensitive species are not commonly found, if at all, below the mixing zone, and thus the site-specific value is considered an appropriate limit for this river.

It is also noted that the application of an annual maximum (as set out in the Freshwater NPS) is not considered appropriate for limits resulting from individual point source discharges. This is largely because the limits in the Freshwater NPS have been derived for state of the environment, catchment monitoring and are appropriate in the management of acute effects, but not the chronic effects of ammonia toxicity.

The assessment of ecological effects (refer **Appendix K** attached) refers to the policy in the Regional Water Plan to reduce nitrate and phosphorus by >10% by 2020. An assessment of this policy is undertaken later in this report. Alliance has a programme in place for progressive wastewater treatment upgrades which would be expected to deliver a reduction in TN (and thus a similar level for nitrate), however the magnitude of this reduction is unknown at present. The primary upgrades already implemented by Alliance (i.e. separation of waste streams) are likely to assist in achieving this reduction. As part of the planned upgrade to the wastewater system a significant reduction of both TN and TP is expected.

In addition to the pre and post upgrade Amm-N limits, it is proposed to prepare an Annual Monitoring Report which will include:

- A summary of the receiving water monitoring results and assessment of compliance with the limits;
- An assessment of the annual median and 95%ile of the total Amm-N concentrations in the receiving water against an annual median of 1.9 g/m^3 and an annual 95%ile of 2.4g/m^3 (both at pH 8.0);
- An assessment of the annual median and 95%ile of the total oxidised nitrogen concentrations in the receiving water against an annual median of 2.4 g/m^3 and an annual 95%ile of 3.5 g/m^3; and
- A calculation of the annual discharged loads of Amm-N, total oxidised nitrogen, TN and TP and a comparative analysis of these loads against preceding seasons.

The purpose of this Annual Monitoring Report will be to assess overall compliance with the limits set out in the conditions of the consent, as well as to track improvements in the receiving water environment with respect to total Amm-N and total oxidised nitrogen concentrations. This will ensure that the discharge from the Plant is not causing any deterioration to the current state of the receiving water environment, and will act as a record against which improvements in the discharge quality arising from upgrades to the Wastewater Treatment Plant can be determined.

Target microbial attribute states are provided in the Freshwater NPS and Regional Water Plan as <1000 cfu/100ml for *E.coli* and <1000 MPN/100ml for faecal coliforms (more recently measured as cfu). While these are considered appropriate for lowland streams, they are more aspirational in the context of rivers like the Makarewa and Lower Oreti because of the high levels in the upper catchment. Such a target should be considered in the long-term as catchment-wide plans are implemented. It is noted, however, that monitoring of *E.coli* and faecal coliforms is proposed in order to understand the contribution within the river environment from Alliance's discharge and Alliance proposes to undertake a review of the need to include further treatment (disinfection) within ten years of commencement of the discharge to water consent. If such a review considers that further treatment of microbial levels is required, Alliance will be required to implement such an upgrade (refer to the proposed conditions) and the Council will be able to initiate a review of the consent in order to impose new limits for *E.coli* either on the discharge load or in river.

Sediment sampling was required within 18 months of the existing consent being granted to survey sediments 200m upstream and 200m downstream of the discharge for TN, TP and TOC. It is recommended that this should be repeated every five years, as levels appear to be elevated within the mixing zone and could potentially stimulate macrophyte growth.

8.3.4 Ecological Effects

Given the highly modified and tidal nature of the habitat, and the type of water and habitat tolerant benthic invertebrate community that naturally exists in tidal

sections of lowland rivers, benthic invertebrate monitoring is not expected to be a useful long term tool for monitoring the effects of the discharge. Biological monitoring may be usefully employed in the first three years post the wastewater treatment facility upgrade. The purpose of this monitoring would be to determine whether the upgrade has any positive effects on benthic invertebrate community health. In order to undertake this monitoring successfully, a baseline for future comparison would need to be taken. The proposed conditions require baseline surveys to be undertaken prior to implementation of the wastewater treatment upgrade, and then afterwards. The results will be reported to Environment Southland.

It is noted that fish do not currently appear to be adversely affected by the discharge, however it has been recommended to undertake a fish health survey prior to the wastewater treatment upgrade and then afterwards, in order to determine whether there has been any detectable improvement in fish health due to a reduction in Amm-N and nitrate in particular.

8.3.5 Habitat Enhancement Management Plan

Alliance also proposes to prepare and implement, in consultation with Te Ao Marama, a Habitat Enhancement Management Plan. The purpose of this plan is to identify opportunities to improve the habitat within certain areas of the Alliance Lorneville property. This is likely to apply to areas such as the Oxbow Area, and river riparian margins throughout the property. It will be used as a further measure in order to mitigate or offset any adverse effects on water quality and iwi values arising as a result of the proposed discharge to the Makarewa River, and abstraction of water from the Oreti River.

8.3.6 Foams

As noted earlier in this report, Alliance has identified that a potential contributor to the creation of foams within the mixing zone and downstream of the discharge point is the design of the outfall. Alterations to the discharge pipes and outfall have been implemented in order to improve this. The plans are attached to this application as **Appendix H**. In addition, Alliance will continue to make visual and written observations of the presence of foams and scums and report these to Environment Southland.

8.4 WATER QUANTITY

The water quantity assessment (refer **Appendix O** attached) has determined that the proposed water abstraction from the Oreti River (up to 22,500m^3/day at a maximum rate of 260L/s) will have a less than minor effect on the low flow duration, flow variability and water quality in the Oreti River. Similarly, the assessment found that any effects on biological communities, including fish spawning and rearing habitat, food production, adult habitat and cover, fish movement and passage are also expected to be less than minor. Management of the abstraction will however be necessary to ensure these effects remain minor or less. This involves the use and maintenance of a fish screen to prevent fish entrainment in the intake structure. It is proposed to upgrade the existing fish screen to a smaller mesh size within five years of the consent being granted. This

proposal is based on a commitment to best practice and is not indicated on the basis of any significant observed fish entrainment.

As noted above, Alliance currently implements a Low Flow Contingency Management Plan with respect to its water take from the Oreti River. Alliance will continue to adhere to the requirements of this plan during times of specified low flow conditions in the Oreti River. This will further mitigate or minimise any adverse effects arising at a time when the river levels are low, but Alliance must continue to abstract in order to maintain the operational efficiency of the Plant, primarily for stock welfare purposes.

It is also recommended that during channel maintenance associated with the intake structure, that the channel is checked for eels prior to works commencing, and if found they would be transferred to the main body of the river. Other measures such as avoiding scheduled works during key fish migration times and ensuring that the worked area is kept to an appropriate minimum are also proposed.

8.5 WASTEWATER DISCHARGES

Although the monitoring of the receiving river environment has not identified any significant adverse toxicity effects arising, it has been determined that the current discharge will not be able to meet Amm-N bottom lines set out in the Freshwater NPS or the site-specific values derived by Freshwater Solutions for the Makarewa River. An assessment of the estimated compliance site-specific Amm-N limits developed for the Makarewa River indicate that a 75% reduction (from 2012 - 2013 season concentrations) in discharge Amm-N is therefore required. This would provide a significant improvement in water quality in the Makarewa River downstream of the discharge, and it is anticipated that this would contribute to achieving the NPS Freshwater bottom line limits within the wider Freshwater Management Unit.

Alliance sought advice from PDP as to what methods and technology could be potentially employed in order to reduce the nitrogen loads within its treated wastewater discharge to the Makarewa River (refer **Appendix I** attached).

The options identified and shortlisted were as follows:

1. ***Primary Treatment System Upgrade***

   This involves the separation of high strength nitrogenous waste streams. It also includes a front end retrofit involving the upgrade of the existing DAF plant, and installing a new decommissioned DAF plant from Alliance's Mataura Plant. Since this upgrade requirement was common to all other options, Alliance commenced the implementation of a modified version of this upgrade during the non-processing season in 2014 (the Mini-AF). It is expected that the total nitrogen reduction from the site as a result of this primary treatment system upgrade will be around 10 – 20%.

2. ***High Strength Flow Separation – Ammonia Stripping***

This option includes the upgrade to the primary treatment system, as well as separating high strength effluent streams for targeted nitrogen removal. Treatment of the separated stream includes anaerobic treatment, filtration, and ammonia striping before discharge to the existing wastewater treatment plant after the anaerobic lagoon. The overall nitrogen removal from high strength flow separation, anaerobic treatment of this waste stream and implementation of ammonia stripping is likely to result in approximately 60% reduction of nitrogen from current levels.

3. ***Medium Strength Flow Separation – New BNR Plant***

This option includes the upgrade to the primary treatment system, as well as separating high and medium strength effluent streams for targeted nitrogen removal. Treatment of this stream includes anaerobic treatment, aerobic treatment via a BNR reactor, secondary clarification, and discharge of treated effluent back into the existing wastewater treatment system after the anaerobic lagoon. An assessment indicated that the overall nitrogen concentration in the wastewater discharge could be reduced by approximately 75% (from 2012/2013 season levels).

Assuming a further nitrogen removal rate of 25% through the existing wastewater treatment plant, implementing this option could reduce the final discharge Amm-N concentration to approximately 50g/m^3.

4. ***Half Flow Separation – New BNR Plant***

This option includes the upgrade to the primary treatment system, as well as separating the high concentrated stream making up approximately half of the discharge. Treatment would include anaerobic treatment, aerobic treatment via BNR reactor, secondary clarification, and discharge of treated effluent back to the existing wastewater treatment plant. This option indicates that overall nitrogen concentration in the wastewater discharge could be reduced by approximately 82% (from 2012/2013 season levels).

Assuming a further nitrogen removal rate of 25% through the existing wastewater treatment plant, implementing this option could reduce the final discharge of Amm-N concentration to approximately 30g/m^3.

5. ***Complete Replacement – New BNR Treatment Plant***

This option incorporates a complete wastewater treatment plant replacement targeting nitrogen removal for the full flow and load generated from the processing plant. The upgrade would include the primary treatment system, followed by anaerobic treatment, aerobic treatment via two BNR reactors, secondary clarification, and the discharge of treated effluent direct to the river bypassing the existing wastewater treatment plant. This option allows for the removal of approximately 90% of nitrogen from existing discharge concentration levels and the final discharge would be have an Amm-N concentration in the order of 15g/m^3.

In order to achieve the required reduction in Amm-N concentrations (from 2012/2013 season levels) in the discharge by around 75%, and taking into

consideration costs and application of the best practicable option, Alliance considers the preferred upgrade is the Medium Strength Flow Separation – New BNR Plant, described above.

8.5.1 Upgrade Methodology and Wastewater Treatment Upgrade Plan

The upgrade of the wastewater treatment plant is a substantial capital undertaking (in 2015 monetary terms total costs around $17 - $18 million) and is therefore proposed to be undertaken in a staged manner.

A staged implementation programme will also ensure that the wastewater discharge is achieving nationally and regional water quality objectives, consistent with the timeframes specified within those policy documents (ie. Freshwater NPS).

It is proposed that within five years of the date of any consent granted for the wastewater discharge, a Wastewater Treatment Upgrade Plan is prepared and submitted to Environment Southland for approval. This plan will identify the technology and wastewater treatment plant upgrades that are necessary and will be implemented in order to improve the quality of the wastewater discharged to the Makarewa River, comparative to concentrations of the 2012/2013 processing season. The purpose of the plan will be to identify and then implement an upgrade plan that is able to achieve a measurable reduction in the amount of nitrogen discharged into the Makarewa River sufficient to meet the water quality standards and limits set out above.

The plan will set out the proposed technology and upgrades that will be installed, the methodology of how the upgrade will be installed and a staged work plan describing the timing associated with the progressive upgrade and key implementation milestones. The conditions will require that within fifteen years of commencement of the consent an upgraded wastewater treatment plant is implemented on-site. It is noted that technology or the receiving river environment may change and therefore Alliance seeks that it has sufficient flexibility within this plan in order to implement the best practicable option at that time.

A bi-annual report will be provided to Environment Southland describing Alliance's progress towards implementation and commissioning of the wastewater treatment upgrade.

An indicative upgrade plan is set out below:

1. Establishment of the primary treatment upgrades as required for the waste streams that require improved management of solids, oil, grease and protein recovery. As noted, some of these upgrades have been implemented in 2014;
2. Separation of the waste streams from existing common north and south drains into a separate pump station to allow the diversion of the high strength waste streams to a new treatment facility;
3. Confirmation of the waste streams and corresponding loads to ensure that the required level of nitrogen removal can be achieved with the development of a parallel treatment plant;

4. Separation of the stockyard solid wastes and diverting to direct land disposal and/or composting;
5. Establishment of a new covered anaerobic reactor for the reduction of the organic load and mineralisation of organic nitrogen into ammoniacal nitrogen;
6. Targeted chemical treatment of fellmongery wastewater containing a large sulphide load;
7. Management of the biogas generated from the new covered anaerobic reactor through flaring and future energy recovery. If required, management of hydrogen sulphide in the biogas stream prior to combustion;
8. Establishment of an activated sludge system with BNR capability and clarifier for solids separation;
9. Diversion of high strength rendering plant condensates into the BNR to assist with nitrogen removal;
10. Diversion of treated wastewater from the new BNR plant into the aerobic part of the existing treatment plant;
11. Establishment of a biosolids management system and solids dewatering facility for land disposal and/or land filling;
12. If required, start investigations to determine the extent of further chemical phosphorous removal;
13. If required, determine the requirements for disinfection from existing and/or the upgraded treatment plant; and
14. Once the new wastewater treatment plant is established and operating for at least one processing season, if required, investigate waste streams that contribute to high nitrogen loads to be diverted to the new BNR plant for treatment to meet future limits.

An indicative timeline setting out how these steps might progress is set out below:

	Years From the Commencement of Consent														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Primary treatment improvements															
Optimisation of primary upgrades,															
Confirm strategy, and preliminary design															
Confirm source separation															
Detailed design															
Complete stream separation work															
Land use permits															
Tender and procurement works															
Pipe work, anaerobic pond, gas recovery and use															
BNR and sludge handling plant construction															
Commissioning															
Compliance															

8.6 SOIL AND GROUNDWATER

8.6.1 Discharge to Land – Irrigation

With respect to the irrigation component of the wastewater discharge, it is recommended that Alliance continue to prepare and implement a Wastewater Irrigation Management and Monitoring Plan, as discussed above. The purpose of this plan is to guide the way in which wastewater is to be discharged via irrigation, ie. the irrigation area, the frequency, the application and duration, and to ensure adverse effects are appropriately managed via a robust monitoring system. The Plan also requires Alliance to undertake monitoring of the wastewater prior to discharge to land, and then ground and surface water and soil monitoring to determine whether there are any adverse effects arising as a result of the discharge to land. An annual report presenting the results of the monitoring will be prepared and issued to the Council for review.

In terms of management of the irrigation and ongoing monitoring it is recommended that:

- The depth of wastewater irrigation shall not exceed 50mm in any 24 hour period;
- Wastewater is applied by K-Line irrigation, at a rate not exceeding 5mm/hr;
- The irrigation return period shall not be less than 15 days;
- The annual nitrogen loading rate for wastewater and fertilisers shall not exceed 250kg N/ha/yr;
- No irrigation is to occur when the soils are at or above 80% water filled pores as recorded at the Wallacetown- Price Road soil moisture monitoring site as shown on the Environment Southland website.
- Zone 2 soils shall be avoided where practicable;
- The current groundwater and soil monitoring system remains in place.

The proposed conditions also recommended an appropriate trigger limit should the monitoring identify an exceedance of nitrate-nitrogen concentrations compared with upstream levels. If such an exceedance is detected, Alliance will be required to investigate the likely cause, report it to the Council and apply mitigation or remedial action if this is possible.

8.6.2 Ponds

An assessment has been undertaken in order to determine whether potential leaching from the wastewater ponds could be having an adverse effect on surrounding ground and surface water bodies. The assessment determined that discharges from the wastewater ponds are not affecting groundwater.

8.6.3 Discharges to Land – Post Wastewater Treatment Facility Upgrade

Land disposal is the preferred approach to manage biosolids generated from the upgraded wastewater treatment facility, likely in combination with an on-site monofill operation.

The key effect arising from the disposal of biosolids to land is the potential for nitrogen leaching into the surrounding ground and surface water bodies. Soil permeability is a constraint to wet biosolids irrigation to land, and therefore centrifuge dewatering will be imposed to mitigate against water logging, ponding and nutrient runoff. Minimising nitrogen leaching also requires a sustainable biosolids nitrogen loading rate, consistent with the agronomic uptake of the sheep grazed pasture system at the Plant. The assessment (refer **Appendix J** attached) has determined that the appropriate biosolids loading rate for the site is 250kg/N/ha/yr or 140kg PAN/ha/yr. This has been modelled to have an expected nitrogen leaching rate of 13kg/N/ha/yr from the site. This leaching rate is comparable to existing nitrogen leaching arising from the irrigated wastewater discharges from the site, and similar to the leaching rates from pastures grazed by sheep.

It is proposed that the application of biosolids to land is managed via a Biosolids Management Plan. This plan will include a description of the solid waste generation and volumes, including solid generation from the upgraded wastewater treatment plant, sheep stock yards, and any other sources of waste to be disposed of to land; and details of the nutrient loads to be applied to land. The plan will also describe the managerial procedures and physical mechanisms that will be adopted by Alliance to avoid, remedy or mitigate adverse effects arising, including the management of odour, which is discussed further below. The plan will also provide a description of the on-site contingency monofill including the location, capacity, management and operational requirements.

The assessment recommends that groundwater quality monitoring and lysimeter nitrogen leaching monitoring, with an annual review, similar to the monitoring that is undertaken with respect to the current wastewater irrigation system continues.

The assessment (refer **Appendix S** attached) also recommends ongoing monitoring and reporting relating to the potential future use of an on-site monofill. The assessment recommends monitoring with respect to:

- Daily recordings of the volume of material disposed;
- Visual surveys to provide an indication of the rate of fill into the monofill;
- Regular surface water quality will be undertaken as part of the above schedule of monitoring with respect to water quality in the Makarewa River.

The proposed conditions also recommended an appropriate trigger limit should the monitoring identify an exceedance of nitrate-nitrogen concentrations compared with upstream levels. If such an exceedance is detected, Alliance will be required to investigate the likely cause, report it to the Council and apply mitigation or remedial action if this is possible.

It is also recommended that the operational monitoring regime set out above will continue on an annual basis for approximately three years following closure of the monofill. A final capping survey will also be undertaken after three years to ensure an appropriate capped surface is developed so that it does not provide an opportunity for rainwater to pond or otherwise seep into the monofill. In

addition, three years after closure, a report shall be prepared detailing cover stability of the monofill and the drainage system. At that time, a decision can then be made as to whether there is a need to undertake any further monitoring associated with the monofill operation.

8.7 AIR DISCHARGES

8.7.1 Coal Fired Boilers

As described in the report in **Appendix M** attached, the modelling and monitoring of air quality undertaken by Golder Associates has indicated that the ambient concentrations of certain contaminants (SO_2, NO_2) that are discharged from the coal fired boilers are well below health effect threshold guidelines and limits. Therefore, these discharges will have only minor effects, or in many cases, a less than minor potential to cause adverse effects. The discharge of contaminants is also further mitigated by the location of the activity and the separation distances between the coal fired boilers and any off-site sensitive receptors.

With the exception of incremental ambient PM_{10} concentrations due to the coal fired boiler emissions, it is concluded that the existing restrictions on coal sulphur levels, the output capacity (MW) of the boilers, and the existing stack heights provide adequate and effective mitigation of potential adverse environmental effects.

Regarding PM_{10} concentrations, compliance with the NESAQ for PM_{10} for all areas surrounding the site boundary is achieved, however this does not ensure only minor, or less than minor effects on human health. This is because PM_{10} does not have an established threshold concentration below which there are only minor or no observable adverse effects on humans. Therefore, it has been recommended that Alliance ensure that a good level of performance is achieved at all times by its coal fired boilers with respect to PM_{10} emission control. In this regard, Golder Associates have recommended that Alliance achieve a flow weighted PM_{10} discharge concentration of 250mg/m^3 (corrected to 12 vol. % CO_2) within five years of a consent being issued.

The existing measures for mitigating air contaminant emissions include the existing automatic controls for ensuring steady coal combustion, the primary treatment of boiler exhaust air via multi-clones and discharge of these pre-treated emissions via tall discharge stacks, in order to aid dispersal and minimise elevated ground level contaminant concentrations.

Alliance requires various specifications for the coal that it uses, including specifying and controlling the maximum level of coal fines. This is important, as excessive fines within the coal supply can cause partial blockages within the grates, inducing uneven airflows and increased back pressures across the burning coal bed. This causes less even combustion conditions and an associated increase in particulate emissions.

As noted earlier in this report, Alliance has recently installed a new multi-clone system on CFB2. Prior to this upgrade, the flow weighted PM_{10} concentrations from the two Plant boilers was estimated to be close to 400mg/m^3. Following the

installation of the new multi-clone system, the flow weighted PM_{10} discharge concentration for both boilers has reduced below 300mg/m^3.

To achieve the flow weighted discharge concentration of 250mg/m^3 as a total from both boilers within five years, it is recommended that Alliance continues to implement the use of modern boiler combustion control and may also need to undertake other measures such as the installation of a multi-clone upgrade to CFB1. Alliance will investigate and implement the technology upgrades needed to ensure its commitment to a reduction in PM emissions is achieved.

8.7.2 Monitoring

Monitoring of air quality effects and/or compliance with discharge limits is also proposed. Currently Alliance undertakes annual stack measuring in order to determine the particulate discharge rate from the coal fired boilers. The stack testing methods currently being used provide a gross value for all particulate (including those larger than 10 microns) but these methods are being superseded by USEPA methods for measuring stack concentrations of PM_{10}, $PM_{2.5}$ and condensables. The costs of correctly implementing these newer stack testing methods are relatively high and comparable to operating short ambient monitoring campaigns. Ambient monitoring is also considered to provide vastly more robust information regarding actual impacts, background concentrations and the potential cumulative effects of coal fired boiler discharges to air.

It is therefore recommended that Alliance discontinues stack testing, and instead rely on more comprehensive ambient monitoring data. The use of ambient PM_{10} and wind monitoring at the property boundary would provide useful and sound information on the actual impacts of the coal fired boilers. It is proposed that the limits in **Table 15** (below) would be set, and if there is an exceedance of either of the 95th or the maximum percentile limits of 2µg/m^3 or more and when the monitoring site is downwind of the boilers, this would provide a trigger for undertaking stack emissions testing in order to confirm if there is a fault or issue with the boilers, or whether the exceedance was triggered by some other (off-site) event. Ambient monitoring will also be extended to include the time at which stack testing is undertaken.

Table 15: Proposed Ambient PM_{10} Monitoring Trigger Values

	300mg/m^3 at 12 vol.% CO2, STP (Consent Year 0 -5)	**250mg/m^3 at 12 vol.% CO2, STP (Consent Years 5+)**
Maximum limit	122µg/m^3	117µg/m^3
95th percentile concentration limit	37µg/m^3	35µg/m^3

8.7.3 Odours

Golder Associates has also undertaken a review of the potential odour sources generated at the Plant from processing related activities and the wastewater treatment facility, both existing and post-upgrade (refer **Appendices G** and **R** attached). These assessments also identified the mitigation that is currently

undertaken and recommend additional mitigation, where appropriate and necessary, to ensure adverse effects with respect to odour are appropriately managed. This is summarised below.

It is noted that in large part, odours from the Plant processing activities are effectively mitigated by the distance between the Plant operations and neighbouring sensitive receptors. In addition, many of the operating systems have mitigation systems installed in order to minimise odours to the extent practicable. These systems are to be managed in accordance with an overarching site Air Quality Discharge Management Plan (refer **Appendix U**).

8.7.3.1 Stockyards

Odour from the stockyards is mitigated by the cleaning and spraying of chlorine dioxide when appropriate to reduce the ammonia concentrations in the air. Cleaning is a necessary requirement of the Plant operations and will continue as part of the regular functioning of the Plant.

8.7.3.2 Blood Processing

Odours from blood processing activities are mitigated by the extraction of the odorous non-condensable air stream to the coal fired boiler house for odour destruction via combustion. The existing system operates effectively and blood drying odours are not considered likely to create any odour issues off-site. Annual checks upon the effectiveness of the water cooled heat exchanger for cooling / condensing the blood dryer exhaust are recommended. These inspections should include checking the inlet and exit cooling temperature and non-condensable air stream temperatures and confirming that the extraction of odours is working effectively.

8.7.3.3 Rendering

There are two main sources of odour associated with the rendering plant; those relating to the receipt of raw material and concentrated sources arising from the use of the rendering plant.

The off-site raw material reception building is a potential source of odour emissions during unloading operations. This has been mitigated by installing a building air extraction system that discharges to the rendering plant's bark bed filter.

All significant process related odours arising from the rendering plant operations are currently contained by an extraction system, which then cools vapours and discharges these to a bark bed biofilter. A description of these components is contained in **Appendix G** attached. The assessment found that the odour control system and biofilter beds are working effectively to contain and fully treat all process/cooking type odours arising from the rendering plant operations. Ongoing performance monitoring is however recommended to ensure that this system is effective in the long term. The assessment (refer **Appendix G** attached) also contains typical target operating parameters for different components of the odour control system. These are set out in Table 3 of **Appendix G**.

The target values provide general guideline values that can be incorporated into an odour control system management plan. Additional performance monitoring should also be incorporated into the management plan and include observations relating to:

- Daily – records of any significant process emissions (evident by steamy discharge);
- Weekly – observations of any odour from the biofilter bed;
- Monthly – biofilter and raw material reception building fan motor current draw (amps) and motor and cooling fan hours;
- Monthly – biofilter bed flow distribution (assessed visually on cool mornings);
- Annually – undertake downwind assessments of odour from the rendering plant; and
- Annually – review odour complaint records.

8.7.3.4 Fellmongery

The main sources of odour from the fellmongery arise from discharges from the processing drums, and fugitive emissions from the fellmongery's wastewater reticulation system.

In the short term, mitigation of odour emissions from the fellmongery operations is being achieved by procedural changes that avoid all processing drums being discharged on Monday mornings.

A potential long term solution with respect to managing the site's fugitive emissions from the wastewater reticulation system could be the pre-oxidation of the sulphides within the waste lime wash liquors. This would significantly reduce the discharge of hydrogen sulphide from within the wastewater reticulation system. This option would however be best implemented as part of any future wastewater treatment plant upgrade. This is because, even with the oxidation of the lime wash, all of the oxidized sulphides will convert back to odorous sulphides within the existing anaerobic ponds. Therefore, this oxidation process is not likely to be effective unless there are alternative aerobic type wastewater treatment processes employed to treat lime wash and other waste streams. These changes will be considered at the time of the potential wastewater upgrade discussed above.

Another potential long term option for pre-treatment of lime liquors is to remove sulphide from this stream by strong oxidation or chemically assisted precipitation. The economic feasibility of these options and cost benefits compared to conventional catalytic oxidation processes, is being investigated by Alliance, and the preferred option will be implemented as part of the wastewater treatment upgrade.

8.7.3.5 Existing Wastewater Treatment System

The total wastewater flow is made up of both low and high strength wastewater streams. Rendering and some other processing wastewater streams are treated to remove fat and oil via a DAF system (referred to as primary treatment). The primary treated wastewater, with wastewater from other processes, arrives at the existing wastewater treatment plant via two separate pipe lines (north and south lines), with relatively high loads of organic material and suspended solids.

The existing wastewater treatment system has an initial anaerobic pond stage which removes in excess of 80% of the inlet organic material. This is followed by treatment with mechanically, then naturally, aerated ponds before discharging to the Makarewa River. The odour generated from the anaerobic pond, and to a lesser extent the first stage of the aerated ponds, has reduced by an order of magnitude since the late 1990s. The anaerobic pond remains as the main source of odour from the treatment system. The first stage of the aerated pond system is also likely to be another contributor to wastewater odour emissions.

There are three main areas where odour emissions arising from the wastewater treatment plant can be reduced. These include:

- achieving practical reductions in organic loading to the ponds by waste separation and primary treatment;
- reduced sulphide and sulphate loadings to the treatment plant by the direct discharge of acid pickling liquors from the fellmongery to the aerated loop section of the wastewater treatment system; and
- maintenance of optimal pond conditions that help to minimise the discharge of odours (sludge management and sulphide stripping).

8.7.3.6 Upgraded Wastewater Treatment Plant

It is anticipated that the upgrade to the existing wastewater treatment plant is likely to be associated with a significant reduction in odour emissions from the anaerobic pond in particular. The upgrade is also likely to be in conjunction with the use of standard sulphide oxidation technology being employed for sulphide bearing fellmongery waste liquors, which will also mitigate the potential for sulphide odours to be liberated from the aerated loop section of the wastewater treatment plant.

The upgrade could however give rise to potential new odour sources including the new anaerobic lagoon, the BNR pond and secondary clarifier, and the generation and management of biosolids. With regard to odour mitigation, the anaerobic lagoon will be enclosed by an engineered cover and odours will need to be managed via capturing the off gas and burning it either in a biogas flare, or for energy recovery such as cogeneration. The options for biogas odour management will be considered closer to the intended implementation of the upgrade.

The management of biosolids is likely to be the greatest potential source of odours from the upgraded wastewater system. Such effects can however be managed through appropriate operational and management procedures such as

restrictions on storage times, accounting for forecast wind condition during the day of spreading, and appropriate buffer zones to help avoid adverse effects arising. A Biosolids Management Plan will be prepared that will include provision for monitoring and management of odours from on-site biosolid disposal.

8.8 SUMMARY OF MITIGATION, MONITORING AND OTHER MEASURES TO MANAGE ADVERSE EFFECTS

A range of mitigation, remediation, management and monitoring measures are either occurring at the Plant, or are recommended as part of this consent process. These measures are summarised in **Table 16** below:

Table 16: Summary of Recommended Mitigation, Monitoring and Reporting

Actual or Potential Effect Identified	Mitigation Recommended	Monitoring and Reporting Recommended
Increased Amm-N levels which can cause toxicity in biota in the river.	To improve the effects of the treated wastewater discharge on water quality over time, a reduction in Amm-N levels in the discharge of approximately 75% is recommended. Wastewater Treatment Upgrade Plan to be prepared within five years of consent commencement and implemented within 15 years of commencement of consent.	Monitoring of discharge quality and receiving river environment as part of Environmental Monitoring Plan and Annual Monitoring Plan. Limits on Amm-N concentrations pre and post wastewater upgrade. Biological monitoring and fish health surveys pre- and post-wastewater upgrade.
Increases in N and P which make a small contribution to increases in nuisance algae and eutrophication of rivers and estuary.	Contributions of N and P will be reduced over time as part of the wastewater treatment progressive upgrade.	Monitoring of discharge quality and receiving river environment as part of Environmental Monitoring Plan. Limits on TN and TP concentrations on the discharge stream pre and post wastewater upgrade. Conditions enable Council to initiate a review of the consent with regard to whether the limits TN and TP within the discharge stream post upgrade are appropriate or should be revised.
Development of foams.	Modifications to the wastewater outfall. Refer **Appendix H** attached for plans.	Visual and written observations of foams recorded.
Reduced water clarity.	The clarity of the receiving river environment is already low due to a range of other catchment scale influences, however the treated wastewater upgrade is also likely to improve water clarity in the long term.	Monitoring of discharge quality and receiving river environment as part of Environmental Monitoring Plan. Limits on the extent of visual clarity change from upstream of the discharge and below.
Increased microbial contamination.	The background bacterial concentrations in the Makarewa River are already elevated. The discharge is a contributor, but not the sole generator or cause of increased faecal coliform concentrations (and sometimes the discharge results in a reduction in bacterial concentrations downstream compared with those upstream of the discharge). However, Alliance will undertake a review of whether or not further treatment for *E.coli* is necessary within 10 years of the commencement of this consent.	Monitoring of discharge quality and receiving river environment as part of Environmental Monitoring Plan. Specific consideration of further treatment (eg. disinfection) as part of wastewater treatment upgrade and any catchment-wide improvement.
Changes to other water quality indicators or parameters downstream of the discharge.		Monitoring of the discharge quality and receiving river environment as part of Environmental Monitoring Plan. Compliance with discharge and in river limits pre upgrade, and revised in river limits post upgrade.
Changes to the benthic invertebrate community downstream of the discharge.		Monitoring of the discharge quality and receiving river environment as part of Environmental Monitoring Plan. Biological monitoring and fish health surveys pre- and post-wastewater upgrade.
Discharge has the potential to affect fish diversity and abundance within the mixing zone and downstream of the discharges, and indirect effects through altered habitat and food sources arising from changes or increases in contaminant levels.	The current Amm-N concentrations in the discharge are not expected to be having chronic adverse effects on fish species, however a reduction in Amm-N inputs into the discharge will provide further assurance that there are no adverse effects arising on fish species or their ability to migrate upstream past the discharge.	Monitoring of the discharge quality and receiving river environment as part of Environmental Monitoring Plan. Biological monitoring and fish health surveys pre- and post-wastewater upgrade.

Potential effects on recreational users by: • Reducing the size or number of fish through low dissolved oxygen and Amm-N concentrations. • Reducing the size and number of fish through reduced benthic invertebrate abundance and reducing small fish abundance and size. • Reducing the number of ducks by reducing food availability. • Aesthetic effects negatively affecting hunter and angler perceptions/ enjoyment.	It has been assessed that current dissolved oxygen and Amm-N concentrations are not adversely affecting trout populations and abundance in the lower Makarewa and Oreti Rivers, and therefore the adverse effects on angler satisfaction are expected to be minor. It is also unlikely that the discharge is having an adverse effect on duck populations. At times the clarity and presence of foams could reduce the overall amenity value of the Makarewa River within the mixing zone and downstream, and changes are being made to the outfall to assist in the reduction of the creation of such foams. The proposed upgrade to the wastewater system in order to achieve regional and national water quality bottom lines will contribute to a significant improvement in the discharge quality and the receiving environment of the Makarewa River immediately within and downstream of the discharge point. However, because the river is also affected by other existing land use and activities, the overall improvement (unless a catchment-wide enhancement is achieved), or enhancement of recreational values, is expected to be minor. It is also noted that are most affected by the proposed discharge currently has poor access and corresponding low usage, so recreational use is relatively limited in the area regardless of the discharge.	Monitoring of the discharge quality and receiving river environment as part of Environmental Monitoring Plan. Limits on Amm-N concentrations pre and post wastewater upgrade in order to achieve regional and national bottom lines. Biological monitoring and fish health surveys pre and post wastewater upgrade. Ongoing consultation with key stakeholders throughout the life of the consent.
Contribution of contaminants to loads within the lower Oreti River and the New River Estuary.	Timing of the proposed wastewater upgrade to align with the implementation of national and freshwater objectives within the Oreti FMU.	Monitoring of the discharge quality and receiving river environment as part of Environmental Monitoring Plan. Participation in any catchment-wide monitoring programme. Ongoing consultation with key stakeholders throughout the life of the consent.
Potential effects arising from the proposed abstraction on key environmental flow characteristics of the Oreti River such as 7DMALF, environmental flow variability, and accrual period between flood events have been assessed as being minor or less.	Continued implementation of the Low Flow Contingency Management Plan.	
Potential for fish entrainment in water intake structure.	• Embayment area (location of intake structure) does not provide suitable habitat for fish species which reduces likelihood of fish entering the intake. • Two screens further prevent the entrainment of fish in the intake. • Upgrade of the existing fish screens to a smaller mesh size within five years of commencement of the consent.	
Potential effects on aquatic habitat and water quality arising from the channel maintenance activities.	• Prior to undertaking any channel maintenance activities, the channel will be inspected for the presence of any eels and if found, they will be appropriately relocated to the main channel prior to undertaking the works. • Timing of scheduled works to avoid key fish migration times. • Adherence to best practice when undertaking channel maintenance activities including minimising the work area to the extent practicable, ensuring vehicles are cleaned and regularly maintained.	

Potential effects on soil arising from the irrigation of wastewater.	• Avoiding the discharge of irrigated wastewater to unsuitable soils (soils which have poor draining ability) and limiting the discharge to less suitable soils. • Maintaining the annual nitrogen load to the irrigable area to less than 250kg N/ha. • Preparation and implementation of a Wastewater Irrigation Management and Monitoring Plan.	Soil chemical monitoring. Preparation and implementation of a Wastewater Irrigation Management and Monitoring Plan. Exceedance of specified limits would trigger a requirement to undertake further investigation and implement further mitigation. Annual Reporting.
Potential effects on water resources (ground and surface) arising from the irrigation of wastewater.	• Avoiding the discharge of irrigated wastewater directly to surface waterways, drains and relict stream channels within irrigable areas. • Maintaining the annual nitrogen load to the irrigable area to less than 250kg N/ha. • Preparation and implementation of a Wastewater Irrigation Management and Monitoring Plan.	Groundwater monitoring. Preparation and implementation of a Wastewater Irrigation Management and Monitoring Plan. Exceedance of specified limit of nitrate-N concentrations would trigger a requirement to undertake further investigation and implement further mitigation. Annual Reporting.
Post wastewater upgrade there is potential for the disposal of biosolids to land and to an on-site monofill to contribute to nitrogen leaching into soil and water resources.	• Avoiding the discharge of biosolids to unsuitable soils. • Maintaining a sustainable biosolids nitrogen loading rate of 250kg N/ha/yr or 140 PAN/ha/yr. • Preparation and implementation of a Biosolid Management Plan.	Groundwater and soil monitoring. Monitoring, closure and rehabilitation of monofill sites.
Potential adverse effects arising from discharges from the coal fired boilers: • The modelling and monitoring assessment show that the ambient concentrations of SO_2, NO_2 and other contaminants are well below health effect concentrations or thresholds.	• Restrictions on coal sulphur levels - sulphur content of fuel used for the boilers shall not exceed an annual average of 0.5 %. • Maintenance of output capacity – 18 MW Babcock and Wilcox Boiler, and 12.7 MW Foster-Wheeler Boiler. • Stack height of 30.9m for the Babcock and Wilcox Boiler. • Stack height of 34.1m for the Foster-Wheeler Boiler.	
Potential adverse health effects arising from the discharge of particulate emissions (PM_{10} and $PM_{2.5}$) from the coal fired boilers.	• Restrictions on coal sulphur levels - sulphur content of fuel used for the boilers shall not exceed an annual average of 0.5%. • Maintenance of output capacity – 18 MW Babcock and Wilcox Boiler, and 12.7 MW Foster-Wheeler Boiler. • Stack height of 30.9m for the Babcock and Wilcox Boiler • Stack height of 34.1m for the Foster-Wheeler Boiler. • Current limit of 300mg/N^3, achieving a flow weighted PM_{10} discharge concentration limit of 250mg/m^3 (corrected to 12 vol. % CO_2) within five years of consent being granted through operational and technological upgrades.	Annual ambient PM_{10} and wind monitoring. Exceedance of specified ambient limits would provide a trigger for undertaking stack testing to determine if the coal fired boilers are the contributor to the exceedance detected. Periodic review of environmental regulations and limits for air discharge contaminants.

Potential odours from Plant processing.	Mitigated by the distance between the Plant operations and neighbouring sensitive receptors. • Many of the operating systems have mitigation systems installed in order to minimise odours to the extent practicable.	Requirement to operate the Plant and processes in a manner which does not give rise to odours which are noxious, dangerous, offensive or objectionable to the extent that it causes an adverse effect at or beyond the boundary of the site. Odour complaint procedures.
Potential odours from the stockyards.	Cleaning and spraying of chlorine dioxide when appropriate in order to reduce the ammonia concentrations in the air.	Requirement to operate the Plant and processes in a manner which does not give rise to odours which are noxious, dangerous, offensive or objectionable to the extent that it causes an adverse effect at or beyond the boundary of the site. Odour complaint procedures.
Odours from blood processing.	Only fresh blood is to be processed and the extraction of the odorous non-condensable air stream to the coal fired boiler house for odour destruction via combustion.	Annual checks upon the effectiveness of the water cooled heat exchanger for cooling / condensing the blood dryer exhaust are recommended. These inspections should include checking the inlet and exit cooling temperature and non-condensable air stream temperatures and confirming that the extraction of odours is working effectively.
Odour from rendering activities.	The off-site raw material reception building is a potential source of odour emissions during unloading operations. This has been mitigated by installing a building air extraction system that discharges to the rendering plant's bark bed filter. All significant process related odours arising from the rendering plant operations are currently contained by an extraction system, which then cools vapours and discharges these to a bark bed biofilter.	Maintenance of an effective odour control and biofilter system as part of the rendering system.
Odour from the fellmongery.	Improvements in the odour emissions from the fellmongery operations has been achieved by procedural changes that avoid all processing drums being discharged together on a Monday morning. A more long term solution with respect to managing the site's fugitive emissions from the wastewater reticulation system could be the pre-oxidation of the sulphides within the waste lime wash liquors. This would significantly reduce the discharge of hydrogen sulphide from within the wastewater reticulation system. This option would however be best implemented as part of any future wastewater treatment plant upgrade.	Requirement to operate the Plant and processes in a manner which does not give rise to odours which are noxious, dangerous, offensive or objectionable to the extent that it causes an adverse effect at or beyond the boundary of the site. Odour complaint procedures. Wastewater Treatment Upgrade Plan including appropriate methods that will be undertaken as part of the overall plant upgrade in order to reduce fugitive odour emissions from the existing wastewater treatment system.
Potential odour from the existing wastewater treatment system.	There are three main areas where odour emissions arising from the wastewater treatment plant can be reduced. • achieving practical reductions in organic loading to the ponds by waste separation and primary treatment; • reduced sulphide and sulphate loadings to the treatment plant by the direct discharge of acid pickling liquors from the fellmongery to the aerated loop section of the wastewater treatment system; and • maintenance of optimal pond conditions that help to minimise the discharge of odours (sludge management and sulphide stripping).	Requirement to operate the Plant and processes in a manner which does not give rise to odours which are noxious, dangerous, offensive or objectionable to the extent that it causes an adverse effect at or beyond the boundary of the site. Odour complaint procedures. Wastewater Treatment Upgrade Plan including appropriate methods that will be undertaken as part of the overall plant upgrade in order to reduce fugitive odour emissions from the existing wastewater treatment system.

Potential odour from the upgraded wastewater system.	The upgrade is likely to improve odour when compared to the existing wastewater system, however it could give rise to potential new odour sources including the new anaerobic lagoon, the BNR pond and secondary clarifier, and the generation and management of biosolids. With regard to odour mitigation, the anaerobic lagoon will be enclosed by an engineered cover and odours will need to be managed via capturing the off gas and burning it either in a biogas flare, or for energy recovery such as cogeneration. The options for biogas odour management will be considered closer to the intended implementation of the wastewater upgrade. The management of biosolids is likely to be the greatest potential source of odours from the upgraded wastewater system. Odour from this potential source can be managed through: • appropriate operational and management procedures such as restrictions on storage times, maximum instantaneous BOD loading rates, accounting for forecast wind condition during the day of spreading, and appropriate buffer zones to help avoid adverse effects arising.	Wastewater Treatment Upgrade Plan including appropriate methods that will be undertaken as part of the overall plant upgrade in order to reduce fugitive odour emissions from the existing wastewater treatment system. A Biosolids Management Plan will be prepared that will include provision for monitoring and management of odours from onsite biosolid disposal.
Impacts on the cultural landscape including archaeological sites, landscape values, sites of significance.	Alliance recognises that actions taken at the Plant can affect the whole Oreti River catchment eg. a reduction in nutrient discharges contribute (in a small way) to improvements in the estuary and avoidance of impacts on migratory fish has upstream benefits. Alliance also acknowledges that iwi believe that a positive action at the Plant (eg. oxbow habitat improvement) will result in benefit to the wider region.	Preparation and implementation of a Habitat Enhancement Management Plan. Preparation and implementation of the Wastewater Upgrade Plan. Ongoing consultation with iwi and other key stakeholders.
Potential effects on the environment and biodiversity including: • Impacts on water quality • Impacts on fish health	• Setting limits on wastewater discharge and receiving water to protect existing Makarewa River ecosystem to ensure no reduction in water and habitat quality. • Wastewater treatment upgrade to provide further protection for Makarewa River ecosystem and to substantially reduce Alliance's contribution of nutrients to the lower Makarewa and Oreti Rivers and estuary. • Pre- and post-upgrade water quality, habitat and fish health surveys to be undertaken to determine overall improvement of the wastewater discharge following the upgrade. • Restoration of oxbow habitat and riparian planting where appropriate along Makarewa River and identification of further opportunities to restore habitat and improve biodiversity on Alliance's land. These habitat enhancements offset potential wastewater discharge including human sewage and water take effects. To be described and implemented via the Habitat Enhancement Management Plan that will be prepared in consultation with Te Ao Marama.	Preparation and implementation of a Habitat Enhancement Management Plan. Preparation and implementation of the Wastewater Treatment Upgrade Plan. Ongoing consultation with iwi and other key stakeholders.

Economic Effects		
Direct positive economic benefits arising from the ongoing operation of the Plant including: • Employment • Salaries and wages • Shareholder returns inputs into Southland Regional economy.		
Indirect positive economic benefits arising from the ongoing operation of the Plant including: • the effects on suppliers of goods and services provided to the Plant from within the region The supply of goods and services from within the region to employees at the Plant and to those engaged in supplying goods and services to the Plant (ie. employee expenditure at supermarkets, restaurants, other activities in the area).		
Economic efficiency benefits from the ongoing operation of the Plant.		
Greater economic resilience.		
Direct contributions to the local and regional economy.		
Value and significance of investment to existing consent holder.		

8.9 PROPOSED CONDITIONS

Based on the mitigation and monitoring measures summarised in Table 16, a suite of conditions is proposed to manage the effects of the ongoing use, upgrading and maintenance of the Plant. The conditions proposed attach to the relevant consents being sought as follows:

- Discharge of wastewater to the Makarewa River;
- Discharge of wastewater to land via irrigation;
- Discharge of wastewater to land as part of the disposal of biosolids, following the wastewater treatment upgrade;
- Discharge of contaminants to air (i.e. odour and particulate) from the Plant and its activities;
- Discharge of wastewater to land for short term contingency purposes;
- Water abstraction and land use channel maintenance from within the Oreti River.

The proposed conditions are attached to this application as **Appendix V**.

9. CONSIDERATION OF ALTERNATIVES AND BEST PRACTICABLE OPTIONS

9.1 INTRODUCTION

Under the RMA, a consideration of alternative locations and methods is relevant in certain specific respects:

- Schedule 4 requires an AEE to include a description of any possible alternative locations or methods for undertaking the activity where it is likely that the activity will have a significant adverse effect on the environment;
- Where an activity includes the discharge of a contaminant, schedule 4 also imposes an obligation on an applicant to provide a description of any possible alternative methods of discharge, including discharge into any other receiving environment;
- Similarly, section 105 of the RMA requires decision makers to have regard to various matters including "*any possible alternative methods of discharge, including discharge into any other receiving environment*"; and
- Section 108 of the RMA also sets out that a condition may be imposed on a discharge permit requiring the consent holder to adopt the best practicable option in order to prevent or minimise any actual or likely adverse effects on the environment of the discharge.

As defined in section 2 of the RMA, the best practicable option in relation to a discharge of a contaminant means:

> *The best method for preventing or minimising the adverse effects on the environment having regard, among other things, to—*
>
> *(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and*
>
> *(b) the financial implications, and the effects on the environment, of that option when compared with other options; and*
>
> *(c) the current state of technical knowledge and the likelihood that the option can be successfully applied*

As part of its preliminary resource consent investigations, Alliance has undertaken an extensive assessment into the availability and practicalities of alternative methods and technologies in order to minimise any actual or potential adverse effects arising from its discharges to water, land and air. This section of the report summaries these investigations and determination of the best practicable options available to be implemented now and in the future.

9.2 DISCHARGES TO WATER AND LAND

As explained earlier in this report, Alliance currently treats waste generated from the processing activities and discharges the majority of this treated wastewater to the Makarewa River. A key constraint, as identified earlier, is the discharge of nitrogen from the wastewater into the river. Alliance has therefore investigated a range of wastewater treatment upgrading options in order to understand the best practicable treatment option of nitrogen reduction. The report attached as **Appendix I** describes in detail the options and alternatives considered. A summary of these investigations is provided below.

9.2.1 Environmental Investigations Undertaken

Recently, and over the past 10 years, Alliance has undertaken a number of investigations and studies with respect to the on-site wastewater treatment facility as production increases have occurred.

The specific investigations related to wastewater treatment system improvements are as follows:

- June 2002 – Lorneville Wastewater Treatment Plant Review, Stage 1 Report undertaken by Harrison Grierson. This investigation examined the issues related to wastewater treatment system odour and the recommendations on odour reduction.
- December 2002 – Lorneville Wastewater Treatment Plant Options Study undertaken by Harrison Grierson. This investigation examined the issues and options for the wastewater treatment system improvements to meet future consent limits. The options investigated included conventional activated sludge treatment, sequencing batch reactors, membrane bioreactors, trickling filters and submerged aerated filters. As a result of the recommendations, pilot plant trials using activated sludge plant operated as sequencing batch reactor (SBR) were established in 2004 for the treatment of the anaerobic effluent. The main outcome of the pilot plant trials was poor maintenance of steady state conditions resulting in unreliable operation and no further progress was made.
- December 2004 – Review of Options for Treatment and Disposal of Human Waste (Sewage) undertaken by MWH. This investigation related to examination of options for the domestic effluent generated at the site as well as the management of Wallacetown sewage
- August 2006 – Anaerobic Wastewater Treatment – Issues and Options undertaken by Pattle Delamore Partners Ltd. This investigation addressed the sludge accumulation in the site's anaerobic lagoon and the management of sludge. It also examined the options for the covering of the anaerobic lagoon and the management of the biogas.
- 2010 – High Rate Algal Pond (HRAP) Trial undertaken by NIWA. This investigation was establishing two adjoining 1,000m^2 trial ponds to determine the suitability of HRAP for wastewater treatment.

More recently, and as part of the reconsenting programme, the following assessments and investigations have been undertaken:

- **Lorneville Plant Wastewater Generation – Baseline Survey**. A comprehensive wastewater survey including flow monitoring and characterisation of 15 separate waste streams from specific processing areas was undertaken in February 2013. In addition, this survey undertook validation sampling of the combined waste streams. This work allowed identification of the sources of key contaminants, namely solids, organic material, oil and grease, nitrogen and phosphorus. The sulphide load assessment was not undertaken during this survey, but was identified as a key waste stream that needed further investigation. During this survey, the newly established low temperature rendering plant was being commissioned and the loads discharged from the rendering plant were not consistent, as a result of poor waste heat evaporator performance.

- **Lorneville Plant Wastewater Treatment – Issues and Options**. Following on from the baseline survey, Alliance progressed to determining the issues and the options related to the wastewater generated from the site. This investigation detailed the wastewater treatment technologies and the shortlisted options to allow flow separation that would target overall nitrogen removal for high strength nitrogenous waste streams. In addition, the options for phosphorus reduction and microbial disinfection were examined. Also, the domestic effluent (sewage) separation and segregated treatment options were investigated. The management of solids generated as a result of improved wastewater treatment was also considered as part of this assessment. Rough order options, capital costs and operating costs for the shortlisted options were determined.

- **Primary Wastewater Treatment Upgrade – Design Basis and Technical Specifications**. Waste surveys identified two waste streams as significant nitrogen load contributors contained within a relatively small volume. Bench-scale testing in February 2014 confirmed that high rates of nitrogen removal could be achieved using an acid–DAF process, and the expected chemical dosing rates and nitrogen removal performance was determined. Preliminary design and equipment specifications were subsequently developed for an upgrade of the primary wastewater treatment system, which included installation of a new screen, DAF plant and reconfiguration of the existing solids dewatering system. Using this preliminary design, Alliance's Engineering team then developed the detailed design and procured the upgrade works, which were commissioned in late 2014.

- **Lorneville Plant Wastewater – Land Treatment and Disposal Pre-Feasibility Study**. The feasibility of a land disposal system to accommodate all wastewater generated from the site was investigated. The study considered discharging treated effluent from the existing wastewater treatment plant, as well as from an upgraded plant, with contaminant loads evaluated for each scenario. Soil characteristics within a 10km radius of the site were investigated, and areas containing soils potentially suitable for wastewater disposal were identified, along with

recommended hydraulic loading rates and irrigation infrastructure. Feasible nutrient loading rates were also evaluated for a grazed pasture system. Land disposal system sizing for the two options was determined to be 2,000ha and 1,000ha respectively, and CAPEX (Capital Expenditure) estimates were $115M and $80M respectively, indicating that a land disposal system is not a financially viable approach for the site.

- **Lorneville Plant Wastewater Generation – Waste Survey February 2014**. Following processing changes at the site in 2013 (namely commissioning of the new rendering plant and introduction of casings processing), a second waste survey was undertaken during peak processing in February 2014. More accurate flow metering and composite wastewater sampling procedures were developed for this survey, including re-characterising the high load waste streams identified in the first survey. Bench scale dissolved air flotation trials and jar testing was also undertaken to investigate primary treatment options of selected waste streams. Testing included evaluating contaminant removal with chemical assisted settling and DAF treatment.

- **Lorneville Plant Biosolids Management Options**. Options for managing significant quantities of waste activated sludge (WAS) generated from an upgraded biological nutrient removal (BNR) wastewater treatment plant were investigated. Quantities of primary solids and anaerobic lagoon solids were also identified, and the preferred approach for managing these solids was determined. The expected quantity of WAS generated under various BNR upgrade scenarios was determined, and six shortlisted options for solids treatment and disposal were investigated, with four options involving land disposal to the Alliance Lorneville land holdings and adjacent grazed pastoral sites. Criteria for biosolids disposal were examined, and benefits and risks for each option were presented in a multi-criteria options assessment. Cost estimates for each option were also determined. Based on this assessment, the preferred biosolids management approach is disposal to Alliance's farm land, supplemented with a composting or monofill operation.

- **Biosolids Land Disposal Assessment**. A comprehensive assessment of environmental effects for biosolids disposal at the Alliance Lorneville land holdings was undertaken. Expected biosolids characteristics were identified, based on analysis from a similar site (as biosolids from an upgraded BNR wastewater treatment facility at Alliance Lorneville is currently unavailable), indicating that contaminant concentrations are likely to be within limits recommended in the guidelines for safe application of biosolids to land in New Zealand. Centrifuge dewatering prior to land application to areas of lower permeability soils was recommended to mitigate against waterlogging, ponding and nutrient runoff. A comprehensive nitrogen mass balance model was then developed to estimate the nitrogen leaching rates at the site. The model utilised historical stocking rates, as well as monitored groundwater leaching rates with nitrogen applications from wastewater irrigation. This assessment concluded that a biosolids loading rate of 250kg N/ha/yr to the grazed

pasture system would likely result in a nitrogen leaching rate comparable to a Southland sheep farm, and was therefore considered to be acceptable. Monitoring of biosolids characteristics, groundwater characteristics and nitrogen leaching (using lysimeters) was recommended, along with an annual review of this data.

- **Sulphide Removal from Wastewater – Pre-Feasibility Investigations**. The feasibility of removing sulphide from a high-sulphide waste stream from the fellmongery prior to discharging to the biological wastewater treatment process was investigated. Previous options studies assumed that this waste stream would discharge direct to the BNR system (bypassing the anaerobic treatment process), however, providing upstream sulphide removal would reduce the risk of odour issues (and also potentially improve the biological treatment performance of the BNR system). Various sulphide removal technologies are being investigated, and infrastructure items, CAPEX and OPEX (operational expenditure) requirements being determined, along with the expected sulphide removal performance for each option. Catalytic oxidation, using air oxygen and manganese salts, is the most commonly used treatment, which could be supplemented with hydrogen peroxide dosing downstream of the oxidation tank to remove any residual sulphides, if found to be required. The high sulphate waste stream from the fellmongery (pickle liquor) could also be directed to the BNR reactor, to prevent conversion of already oxidised sulphate species to sulphides species in the anaerobic lagoon system.

9.2.2 Waste Minimisation Targeted Approach

Targeting Nitrogen Sources

One of the key issues for the discharge of wastewater is the management of nitrogen, especially Amm-N once passed through the wastewater treatment plant. In order to reduce the amount of nitrogen in the discharge, Alliance has investigated the sources of the nitrogen in the waste streams generated by its processing operations. In general terms, the waste streams from casings, stockyards, lime wash, soup stock, and the raw material bins contribute to 34% of the total daily volume of the discharge, but contribute to 75% of the nitrogen load. Within these waste streams, there is an opportunity to divert some clean water to reduce the volume.

Sulphide Management

The lime wash and pickle liquors from the fellmongery contribute to the largest sulphur based load from the processing operations. Alliance is investigating the feasibility of options to separate these waste streams and to employ chemically assisted sulphide removal.

Preliminary Treatment from Specific Waste Streams

Following the waste surveys undertaken, it was recognised that some additional performance could be achieved from the existing DAF plant. In addition, some waste streams were identified that could be treated using another DAF unit. Alliance has already started implementing some of these upgrades. This has included separation of some of the high strength sources and treating through a separate chemical assisted DAF unit. The estimated nitrogen reduction from

improvements in the primary treatment as part of this upgrade is expected to be between 10 – 20%.

9.2.3 Domestic Effluent

The Plant wastewater collection system also collects domestic effluent (sewage) from various areas within the Plant site, as well as receiving domestic effluent from the Wallacetown community. Alliance has undertaken investigations to determine the feasibility of separating the domestic effluent from the meat processing wastewater to a dedicated treatment and disposal process. Given the very low contribution that the effluent makes to the overall discharge, and the potential increase in costs to the community if the discharge were to be disposed of elsewhere, it has been determined that the best practicable option is to continue to treat domestic effluent as part of the overall wastewater treatment process.

As a key cultural issue, Alliance has discussed this aspect of the proposal with Te Ao Marama. The practical difficulties of achieving separation and the potential increase in costs to the community to achieve it are recognised. In order to offset some of the effects arising from the disposal of domestic effluent to water, a habitat enhancement management plan is proposed. This will enable Alliance to work together with Te Ao Marama to develop a site-wide plan (excluding the processing areas) to enhance the overall ecological values (ie. riparian margins) within the site.

9.2.4 Alternatives for Wastewater Treatment

A comprehensive assessment of the wastewater treatment technologies that would enable the reduction of key contaminants in the discharge, namely nitrogen, phosphorous and *E.coli* has been undertaken by Alliance. The table below provides a summary of the treatment technologies considered, the target contaminant removal and advantages and disadvantages of each option:

Table 17: Summary of the Treatment Technologies Considered

Treatment Method	Contaminants Targeted	Advantages	Disadvantages
Primary Treatment	Solids, fats, oils & grease, proteins	Bolt on solutions to existing waste streams, allowing for some product recovery.	Additional chemical use for protein recovery.
Anaerobic	$cBOD_s$, solids	Substantial solids and organic load reduction, minimises sludge generation, biogas generation for potential energy recovery.	No nitrogen removal, management of hydrogen sulphide required in the biogas by-product stream, odour management required.
Aerobic – Biological Nitrogen Removal	$cBOD_s$, nitrogen, phosphorus (minor)	Treated wastewater in aerobic state allowing for surface water discharge. Very low level of odour during treatment.	High energy use for mechanical aeration and biosolids generation requiring solids management.
Ammonia Stripping	Nitrogen	Small footprint, by-product can be utilised as fertiliser.	High chemical usage.

Chemical Phosphorus Removal	Phosphorus	Bolt-on solution for phosphorus removal to high levels.	High chemical usage and solids management required.
Sulphide Chemical Treatment	Sulphide	Bolt-on for sulphide removal.	Moderate chemical usage.
UV Disinfection	*E.coli*	Bolt-on solution to manage microbial contaminants.	Requires very high clarity and transmittance to be effective.
Land Treatment	Nitrogen	Utilise wastewater for resource reuse.	Land area can be significant and depends on hydraulic and/or nutrient limits. May require high degree of treatment to minimise odour effects.

Prior to arriving at the preferred method (Medium Strength Flow Separation – New BNR Plant, coupled with primary treatment upgrades) an assessment of the viability of each of these options was undertaken. This is summarised below.

9.2.4.1 Primary Treatment

The primary treatment involves use of screens to remove gross solids, and dissolved air flotation (DAF) for further solids, fats, oil and grease removal. A chemically assisted DAF treatment system can also assist in considerable reduction of solids, organic load and proteins. When appropriate chemicals are utilised, some phosphorus can also be removed.

Alliance has a wide range of screening units utilised in various processing areas. DAF plant is utilised for the management of fats, oil and grease recovery. The recovered material from the DAF system form part of the renderable raw material.

Continued waste stream separation and targeted primary treatment has also been considered for the Plant.

9.2.4.2 Anaerobic Lagoon

Anaerobic lagoons provide simple, robust and cost effective removal of degradable solids and organic matter. The by-product from anaerobic treatment is biogas (mixture of methane, carbon dioxide and other gases). Other odorous gases like hydrogen sulphide (H_2S) are also produced.

Typically anaerobic lagoons for this type of application are designed for a lagoon hydraulic retention time of 4-5 days and a depth of 4.0-5.0m. Newly constructed anaerobic lagoons generally also have artificial covers for the collection and combustion of the biogas.

Alliance has a large anaerobic lagoon with natural crust cover, however, no biogas management system is in place.

9.2.4.3 Aerobic Systems for Nitrogen Removal

Nitrogen removal can be undertaken in activated sludge systems with provision for BNR. The key process is enabling the biological nitrification (ammoniacal

nitrogen oxidation) and denitrification (oxidised nitrogen reduction) with the by-product of nitrogen gas discharged to atmosphere.

BNR activated sludge process options typically comprise of suspended growth treatment processes utilising tank or lagoon based reactors, which can be operated on a continuous or batch basis (sequencing batch reactors).

Membrane bioreactor (MBR) processes are a form of suspended growth activated sludge process, utilising a fine membrane to separate treated effluent from the biomass, allowing for high biomass concentrations for smaller reactor sizing, and also preventing the need for a secondary clarifier.

The simplest and most robust suspended growth BNR processes is the simultaneous nitrification de-nitrification process (SND) involving maintaining an acceptable pH range, dissolved oxygen concentration and ratio of carbon to nitrogen constituents within the reactor. This process has been successfully implemented at many meat processing facilities in New Zealand, including Alliance Pukeuri.

9.2.4.4 Land Treatment Systems

Land treatment of wastewater involves the controlled application of effluent to land at a rate that allows organic constituents and nutrients to be assimilated by vegetation and by micro-organisms within the soil biomass. Application rates for land treatment are generally based on the hydraulic loading capacity of the soil, as well as on the nitrogen loading rate which is dependent on the land use.

The wastewater from meat and by-products processing plant generally contains a large amount of nitrogen and this becomes the key constraint to land based application of effluent. However, for Alliance Lorneville, the soils in the vicinity of the Plant also have a considerable hydraulic loading capacity constraint.

A pre-feasibility assessment of the land treatment requirements for wastewater from the existing wastewater treatment plant has been undertaken. Up to 2,000ha of land will be required if nitrogen loading is at levels of 150kg N/ha/yr. The procurement of land and establishment of a new land treatment system is likely to cost in excess of $115M, with the land purchase estimated at $70M.

If the wastewater treatment plant is upgraded to significantly reduce nitrogen and then the treated wastewater is disposed to land, the amount of land area required reduces to 1,100ha. The procurement of land and establishment of a new land treatment system is likely to cost in excess of $82M, with land purchase estimated at $39M.

Although a land treatment system is technically feasible, with sufficient areas of suitable land within a 5km radius of the site, the difficulties in land procurement and/or access mean that this option is not practicable. Further, the capital costs associated with land treatment at around $45M is considerably higher than full treatment and continued discharge to the Makarewa River. Full discharge to land is therefore not considered to represent the best practicable option in this regard.

9.2.4.5 Ammonia Stripping for Nitrogen Removal

Conventional ammonia stripping involves shifting the pH of the wastewater to favour dissolved ammonia (NH_3) over soluble ammonium ions (NH_4^+), and then transfer of NH_3 from the liquid phase to the gas phase by contacting the wastewater with air. This is usually carried out in a packed-bed tower in which the wastewater is sprayed over the packing media at the top of the tower, with air entering via the bottom of the tower. Disposal of NH_3 gas can be by dispersal to the atmosphere, or by a second closed loop reabsorption tower utilising sulphuric acid and recovery of ammonium salts.

For this Plant, the ammonia gas would need to be recovered in a closed loop system to minimise any discharges to air. The use of an ammonia stripper tower would be a new technology for the Plant and this requires substantial waste separation, dedicated anaerobic treatment and filtration for this waste stream prior to implementation. Further pilot testing and quantifying the risks would be required if this alternative is considered any further.

9.2.4.6 Phosphorous Removal

There are two main methods of phosphorus removal. These are enhanced biological phosphorus removal (EBPR) and chemical precipitation.

EBPR can prevail under certain conditions in activated sludge systems, but can be difficult to manage and EBPR performance is generally at the expense of BNR. For this reason, biological treatment systems often focus on BNR and utilise chemical precipitation to supplement removal of phosphorus.

Chemical phosphorus removal includes precipitation with metal salts such as ferric chloride, aluminium sulphate, or lime, as well as via the physico-chemical DAF-in-series system. Solids removal following chemical precipitation is most often via primary or secondary clarification or DAF.

The DAF-in-series system utilises acid and lime dosing to release and subsequently precipitate phosphorus, which can be more cost effective than utilising metal salts or lime alone. However, this would involve construction of significant additional infrastructure at the site. Alliance Mataura operate a DAF-in-series system for the high phosphorus laden waste stream.

9.2.4.7 Sulphide Removal

Some of the processes at the fellmongery utilise sulphur-based chemicals that result in the discharge of sulphate as well as sulphides. High sulphide concentrations in wastewater can inhibit biological processes, and can also generate odour nuisance under anaerobic treatment conditions.

Oxidation of sulphides to sulphates can be achieved via aeration in the presence of a metal catalyst, or using chemical oxidisers such as hydrogen peroxide. Iron salts can also be used for chemical precipitation of sulphide to form insoluble iron sulphide salts.

Sulphide can be converted to H_2S gas under anaerobic conditions which then requires gas phase treatment to avoid odour generation and air emissions problems. Treatment of H_2S can be achieved via conventional wet-scrubbing systems, biological scrubbing systems, biological filter or activated carbon filtering. Combustion of biogas oxidises H_2S into sulphide dioxide and this needs to be managed appropriately.

Alliance is further assessing appropriate treatment solutions for the waste streams that have high sulphur loads.

9.2.4.8 Disinfection

There are a number of available microbial disinfection technologies, however, Alliance has determined that ultraviolet (UV) disinfection is the most suitable method of disinfection after the successful implementation of this system at its Pukeuri Plant.

UV disinfection is the most common wastewater disinfection method in New Zealand as it is a relatively simple technology to install and operate. It also results in no harmful chemical by-products.

The down side of UV disinfection system is that the effectiveness is highly dependent on the level of TSS in the wastewater. Solids in the wastewater can shield the bacteria from the UV light, reducing the rate of disinfection. To overcome suspended solids issues, filtration systems can be installed prior to the UV plant or alternatively an increased level of UV intensity can be provided.

If disinfection is required in future for the final discharge out of existing lagoons, then filtration would need to be implemented to improve the transmittance of the final discharge.

As noted earlier in this report, if disinfection is a feasible option, it would also need to be undertaken as part of a wider catchment initiative to improve microbial levels in the receiving waters. Given the current microbial levels within the Makarewa River upstream of the discharge point, treating the discharge in isolation of such an initiative would have little benefit to the receiving waters and would not currently represent the best practicable option. Alliance is however proposing to undertake a specific assessment within ten years of commencement of the wastewater discharge consent to determine if disinfection is required as part of its proposal to upgrade its wastewater treatment system. If this assessment determined that disinfection was a necessary and practicable inclusion, then Alliance would be committed to including this as part of the wastewater upgrade. If this assessment determined that disinfection was not required and/or practicable at that time, Alliance would continue to review this every five years throughout the remaining life of the consent.

9.2.5 Preferred Wastewater Upgrade

Prior to the completion of the ecological assessments and the assessment and development of the relevant criteria, in terms of managing the effects of the wastewater discharge to the Makarewa River, Alliance investigated the

wastewater treatment plant upgrade options to meet certain nitrogen targets in the final discharge. Following the outcomes of the ecological assessments it has been identified that the discharge requires a reduction in existing Amm-N concentrations by around 75%. This level of reduction would ensure that the continued discharge to the Makarewa River can comply with site-specific ammonia limits and it is anticipated that it will assist in achieving future overall catchment objectives contained within the Freshwater NPS and Oreti River FMU established by the Council.

The preferred treatment option is therefore the Medium Strength Flow Separation – New BNR Plant, coupled with primary treatment upgrades. It is also noted that following the installation of the new wastewater system, additional treatment processes, if they represent the best practicable option at that time, could achieve a reduction of microbial contaminants and further reduction of phosphorous.

Alliance is committed to undertaking work in order to improve the quality of its wastewater discharges to water. The capital costs to install the necessary technology is however significant, and therefore Alliance proposes to implement this progressively. A progressive implementation programme aligns with the requirements of the Freshwater NPS, and enables Alliance to undertake the necessary research efforts into suitable technology, undertake detailed design of the facility and financially commit to the upgrades without jeopardising the current economic viability of the Plant. Alliance's commitment to undertaking this upgrade is secured via the proposed conditions as set out in section 8 above. This option therefore represents the best practicable option for managing the current and ongoing discharges to the Makarewa River and to land.

9.3 DISCHARGES TO AIR

9.3.1 Coal Fired Boilers

The existing measures for mitigating air contaminant emissions from the coal fired boilers include controls on the sizing and composition of coal supplied to the boilers, the existing automatic controls for ensuring steady coal combustion, the primary treatment of boiler exhaust air via multi-clones and discharge of these pre-treated emissions via tall discharge stacks in order to minimise ground level contaminants concentrations.

It is considered that these existing engineering and operational controls represent the best practicable option for managing the discharge of SO_2, NO_2, metals and dioxins from the coal fired boilers. The modelling and monitoring assessment undertaken indicates that the presence of these contaminant levels are well below relevant standards and guideline values and therefore the adverse effects on air quality and human health is less than minor.

Regarding ambient PM_{10} concentrations, compliance with the NESAQ is achieved, however this does not ensure only minor, or a less than minor potential for adverse effects. This is because PM_{10} does not have an established threshold concentration below which there are only minor or no observable adverse effects on human health. Therefore it is important for Alliance to ensure that a good level

of performance is achieved by the coal fired boilers with respect to PM_{10} emission control.

In the last two years, a number of initiatives by Alliance have been implemented to reduce PM_{10} emissions from the two coal fired boilers. This has included trialling an alternative coal grade, an investigation into the coal fired boilers' operating efficiency, review of combustion control measures, boiler combustion air settings and engineering upgrades to ash handling and multi-clone equipment on CFB 2. The replacement of the existing multi-clone equipment in CFB 2 reduced the concentration of PM_{10} within this boiler's discharge by approximately 40%.The result has been a significant reduction in the flow weighted PM_{10} discharge concentration from the coal fired boilers.

As set out earlier in this report, it has been recommended that Alliance commits to achieving a flow weighted PM_{10} discharge concentration limit of 250mg/m^3 (corrected to 12 vol.% CO_2) within five years. Achieving this limit within five years is considered to represent the best practicable option for managing the discharge of particulates from the coal fired boilers, taking into consideration current compliance with national and regional regulations and cost implications of more extensive measures to achieve emission reduction. In order to achieve this limit, it is likely that Alliance will need to implement the use of modern boiler combustion control and may also need to undertake other measures, such as a multi-clone upgrade to CFB 1.

9.3.2 Odours

The process odour assessment (refer **Appendix G** attached) has been based on a consideration of the best practicable option for minimising the potential or actual odour emissions.

From this assessment it is evident that the best practicable option is effectively employed for the main odour producing processes at the site. In general, the level of odour control for each process is consistent with the level of actual or potential odour effect. The rendering plant is the main potential source of odour and this employs a robust odour control system.

The discharge of cooking type odours from the rendering plant is minimised and treated by air extraction and treatment of the extracted air by biofiltration. The system operates effectively with a sufficient level of cooling and an appropriately sized and efficient biofilter. The level of odour control with respect to the rendering plant readily meets the best practicable option, and as noted in the assessment, the controls employed in this regard would be one of the best examples within the New Zealand rendering industry.

The discharge of meal processing odours is controlled by the filtering of meal dust and the significant buffer distance between the new meal processing plant (as part of the rendering plant) and the property boundary. This represents the best practicable option for managing meal odour emissions.

The level of odour control adopted for the fellmongery process is less than at some other processing sites in New Zealand, however the buffer distance from

the fellmongery to the property boundary is large compared with most other processing sites. Therefore, the current level of control is considered to be the best practicable option for the Plant. However, it is noted that at times odours generated from mixing of lime liquors and acidic waste streams can be detected off-site and that these may be considered to be objectionable. As noted above, Alliance is investigating the feasibility of removing sulphides from the waste stream, as discussed above, and this in turn would reduce potential odours. This will be undertaken as part of the upgrade to the wastewater treatment facility as noted above.

For all the other key odour producing activities and processes at the site, including blood drying and wool hydrolysing, it is considered that the best practicable option for odour control is effectively achieved by the extraction of odour emissions, cooling and combustion of the gas stream within the coal fired boilers. For the odours generated from soup stock production at the site, there is adequate control of odours via the buffer distance between this process and the adjacent property boundary.

9.3.3 Wastewater

The anaerobic pond can, on an intermittent basis, create odours which may be considered to be objectionable outside the property boundary. The best practicable option for managing odour effects from the pond is considered to result from the practical reduction of organic loads via the upgrading of the primary wastewater treatment systems discussed earlier in this report. The direct discharge of acid picking liquors from the fellmongery to the aerated loop section of the wastewater treatment facility is also considered to represent part of the overall best practicable option. Further measures, such as anaerobic effluent sulphide stripping, and pre-oxidation of sulphide bearing fellmongery liquors, do not represent the best practicable option for controlling odours at this stage. It is noted, however, that these may be undertaken after the upgrade of the wastewater system, should it be considered appropriate to do so at that time. The effects of odour during the term of the consent will be monitored via on-site surveys and a community complaint register.

The proposed upgrade to the wastewater system is also likely to generate a significant reduction in the odour with respect to the anaerobic pond. The new system does, however, have the potential to generate new odours which will also need to be managed in accordance with the best practicable option. The potential odour sources and the best practicable options for managing these are discussed below:

9.3.3.1 Existing Anaerobic Pond

Should the existing anaerobic pond's organic crust layer begin to disintegrate and release odour, then the best practicable option for mitigation could be to conduct this stage within a smaller pond and install an artificial cover and flare system. Another available option would be to manipulate the floating fat loading to the existing pond so that the existing crust layer is maintained or re-established.

9.3.3.2 Aerated Loop

The upgraded wastewater system is likely to result in odour from this secondary wastewater source, being effectively eliminated by the removal of reduced sulphide loads to the aerated loop.

9.3.3.3 New Covered Anaerobic Pond

Any odour emissions from this source would be managed by capturing the off gas and burning it in either a biogas flare, or for use in energy recovery such as cogeneration. This would effectively incinerate odorous compounds and could provide a localised biogas energy source for Alliance. This is considered the best practicable option for managing biogas odours.

9.3.3.4 Biosolids Management

The management of biosolids generated from the upgraded wastewater treatment facility includes dewatering, storage, and land disposal. It is considered that odours from these operations can be effectively controlled via appropriate management of the storage of the material, and appropriate retention times of raw and dewatered biosolids in conjunction with an adaptive management approach that reviews environmental performance and the adequacy of operational procedures.

10. STATUTORY ASSESSMENT

10.1 INTRODUCTION

The assessment of the activities to enable the ongoing operation, maintenance and upgrading of the Plant against relevant statutory documents generally follows the hierarchy of applicable planning documents, and concludes with an assessment against Part 2 of the RMA.

10.2 NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT 2014

The Freshwater NPS took effect in August 2014. It has sections relating to the following:

- Water quality.
- Water quantity.
- Integrated management.
- National Objectives Framework.
- Monitoring Plans.
- Accounting for freshwater takes and contaminants.
- The role and interests of tangata whenua.
- Progressive implementation programme.

10.2.1 Water Quality

Objective A1 recognises the role fresh water plays in sustaining life, both for people and for ecosystems more generally. Recognising this role, and safeguarding the ability of fresh water to support life and human health through the sustainable management of water quality, is an important part of recognising the national importance of freshwater and Te Mana o te Wai.

Objective A2 seeks that overall water quality within a region is maintained or improved. Objective A2 sets three additional, specific requirements that must be met while maintaining or improving overall water quality:

(a) Protecting the significant values of outstanding freshwater bodies

(b) Protecting the significant values of wetlands; and

(c) Improving the quality of freshwater in water bodies that have been degraded by human activities to the point of being over-allocated.

Policy A1(a) requires regional councils to set freshwater objectives and quality limits, and (b) to establish methods to avoid over-allocation. This policy is closely linked to Policy A2, which sets out a process for setting freshwater objectives. The process involves identifying values that are relevant to a Freshwater Management Unit (FMU), identifying attributes that provide for those values, and setting freshwater objectives for those attributes. Setting limits for water quality

involves determining the maximum resource use that will enable a chosen freshwater objective to be met.

Policy A3(a) requires conditions to be imposed on discharge permits to ensure the limits and targets can be met. Once objectives, limits and targets made under Policies A1 and A2 are adopted in a regional plan, they will be relevant when determining the conditions to impose on discharge permits. In addition, proposals will need to be assessed to determine whether additional 'best practicable option' (BPO) provisions are needed to prevent or minimise adverse effects on the environment, to give effect to Policy A3(b).

It is acknowledged in Policy CA2 of the Freshwater NPS that the process and timeframes for setting freshwater objectives and limits may be significant for some regions. Policy A4 allows regional councils to consider water quality matters in consent decisions in the interim, to ensure the objectives of the Freshwater NPS for water quality can still be achieved. Policy A4 requires a regional council to have regard to certain matters when assessing and determining an application for a discharge permit. It applies once a plan is amended to include the transitional policy. Policy A4 applies to decisions on discharge permits required under the current regional plan involving new discharges or changes/increases in any discharge.

It is noted that it does not apply to:

- land-use (or other) consents that involve a discharge that is authorised by a permitted activity rule in a regional plan unless, or until, additional or new consents are required
- consents for an existing consented discharge where there is no change or increase in the discharge.

Alliance undertakes regular compliance monitoring, and additional field monitoring has been undertaken as part of this assessment. There is a good understanding of the existing water quality both upstream and downstream of the current discharge of treated wastewater from the Plant.

The lower Makarewa River (below Wallacetown) has also been modified by historical river drainage and flood protection works. Makarewa River water and sediment quality in the region of the Plant (immediately upstream and downstream of the Plant) is characterised by high nutrient concentrations, high faecal indicator bacteria counts, low visual clarity, high Amm-N concentrations, generally moderate but occasionally low summer dissolved oxygen concentrations, and pH that is suitable for supporting healthy biological communities. The soft sediment and tidal nature of the lower Makarewa River renders the river environs near the wastewater discharge unsuitable for sensitive invertebrate species.

Overall, the assessment determines that the discharge is not having a significant adverse effect on the quality of water downstream of the Plant, when compared to upstream results. There is a slight reduction in water clarity downstream of the discharge, however there is no evidence from fish, algae and benthic invertebrate

surveys that the discharge is having any adverse effect on downstream water quality.

The monitoring and assessment of the receiving river environment has not identified any measurable adverse toxicity effects that are directly attributable to the discharge. However, it has been determined that the current discharge needs to be improved to be able to meet a site-specific in-river ammonia target and enable the achievement of the bottom line value contained in the Freshwater NPS within the wider catchment. These assessments indicate that a 75% reduction (from 2012-13 season concentrations) in discharge Amm-N concentration is the appropriate target.

In order to achieve the future limits for Amm-N, a comprehensive upgrade to the existing wastewater treatment system is required. A progressive implementation programme is proposed which aligns temporally with the achievement of Freshwater NPS objectives for improvements in water quality. In addition to seeking to improve the quality of the discharge over time, Alliance is committed to ensuring that the quality of the discharge and receiving river environment does not deteriorate from current conditions. This will be achieved by establishing limits on both the discharge and receiving water, assessing compliance with such limits and also tracking progress of compliance with revised Amm-N and total oxidised nitrogen limits on an annual basis.

The current discharge can elevate faecal bacteria concentrations in the lower Makarewa River on occasions, but in other years it appears to dilute the contamination from microbial sources upstream. Further treatment would reduce the overall loading and would, on occasion, ensure compliance with relevant national and regional standards. However, it is noted that generally these standards would not be met because of the high levels in the upper catchment, and given this, for any further treatment of the microbial concentrations in Alliance's discharge to be effective, this would need to be undertaken as part of a wider catchment plan to reduce the overall faecal coliform concentrations in the Makarewa River. Alliance is also not aware of any reported public health issues as a result of secondary contact with the lower Makarewa River.

Overall, it is considered that the discharge of treated wastewater to the Makarewa River, and to land is consistent with the water quality objectives and policies of the Freshwater NPS. The assessment has demonstrated that there are no adverse effects on the life supporting capacity of the water downstream of the discharge, as the habitat is consistent with that found in other typical lowland river environments. Alliance is also committed to maintaining and improving the quality of its treated wastewater discharge stream to the Makarewa River over time and this is entirely consistent with the intent of the Freshwater NPS in relation to water quality.

10.2.2 Water Quantity

The Freshwater NPS sets out objectives for water quantity, which are aimed at:

- Sustainably managing the taking, using, damming or diverting of freshwater to safeguard the life supporting capacity, ecosystem processes and indigenous species;

- Avoiding any further over-allocation of fresh water and phase out existing over-allocation;
- Improving and maximising the efficient allocation and efficient use of water; and
- Protecting significant values of wetlands and outstanding freshwater bodies.

The ensuing policies require regional councils to establish freshwater objectives and to set environmental flows and/or levels for all FMUs, to ensure that the efficient allocation of water resources is achieved, and that over-allocation is avoided.

Policy B7 applies to consideration of applications where a resource consent for an activity is required under the current regional plan. It applies to a new activity and any change to the character, intensity or scale of any established activity that is likely to result in more than minor adverse change in the natural variability of flows or levels of fresh water. It is again noted that this policy does not apply to:

- permitted activities or existing activities unless, or until, they require additional or new consents
- new consents or replacement consents for the same consented activity where there is no change in character, intensity or scale.

Alliance is seeking to continue to abstract water from the Oreti River of up to 22,500m^3/s/day, at a maximum rate of 260 L/s. The current permit, which does not expire until 2037, is not currently subject to any minimum flow restrictions, but there is an obligation to impose water conservation initiatives, where practicable, in accordance with its Low Flow Contingency Management Plan when flows in the Oreti River reach certain levels (4.2m^3/s and 3.3m^3/s).

Surface water allocation in the Southland Region is currently managed according to the Regional Water Plan policies and rules. The current allocation in the Lower Oreti Catchment is close to 75% of the primary allocation (largely due to the ICC take). This allocation includes Alliance's take. Alliance is not seeking to increase the amount of water that is taken under its current permit and therefore the take will not contribute to the over-allocation of the surface water resource within the Lower Oreti River.

The ongoing abstraction effects on the hydrology of the Oreti River, water quality, and aquatic habitat have been assessed and are considered to be minor. The only identified effect on the river due to this abstraction was a likely increase in the number of days that flows were below the natural 7DMALF. This is however considered to have a minor effect.

As a consequence of the less than minor effect of the take on low flow duration, flow variability and water quality, and the lack of sensitivity of the receiving environment to water level changes, any effects on biological communities (including fish spawning and rearing habitat, food production, adult habitat and cover, access to spawning and rearing areas and fish passage) are expected to

be less than minor. However it is noted that an additional survey is set to be undertaken during summer 2015. This will provide a further evaluation of the existing Oreti River environment and assessment of the likely effects the existing take is having on the values within this river system.

10.2.3 Integrated Management

Part C of the Freshwater NPS emphasises the importance of integrated management. Objective C1 seeks:

> *To improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment.*

While this objective and the corresponding policies C1 and C2 are particularly relevant for regional authority policy development, there is direction that this objective is taken into account when considering resource consent applications. The relationship between land use, freshwater and the effects on the ultimate receiving environment (being the coast) has been taken into account when assessing the impacts of the ongoing operation and upgrading of the Plant.

The Plant's discharge point is located near the upper end of the tidally influenced section of the Makarewa River, just above the confluence with the Oreti River. The downstream effects of the discharge on the lower Oreti River and the New River Estuary have therefore been assessed. The New River Estuary is a large, shallow tidal lagoon, which is the ultimate receiving environment for the treated wastewater discharge. It is situated within a catchment that consists largely of agricultural land, but it is also subject to stormwater and wastewater discharges from ICC. Existing monitoring data indicates that large parts of the estuary remain in reasonable quality, but a significant and increasing proportion of the estuary is being impacted by fine sediments and elevated nutrient concentrations.

The assessment finds that the existing wastewater discharge from the Plant is contributing around 4% of the total nitrogen load into the New River Estuary. As set out above, Alliance is committed to improving the quality of its discharge and the proposed wastewater upgrade will reduce the contribution that the discharge makes to the overall nitrogen load going to the New River Estuary. As a result, the estimated contribution of total nitrogen load would reduce to around 1.3%. A reduction of this magnitude is significant, in relation to the discharge, however it is acknowledged that it is insignificant relative to the total reduction required to improve the overall trophic state of the estuary. An integrated catchment-wide approach to achieving this level of reduction is therefore required. This is consistent with the objectives and policies of the Freshwater NPS.

10.2.4 Part CA – National Objectives Framework

Objective CA1 provides a nationally consistent approach to setting freshwater objectives, but with flexibility for recognising regional circumstances. Supporting Policies CA1-4 provide an approach to setting freshwater objectives which relate to achieving national values as well as any other values that tangata whenua and the community desire for the region's freshwater resources. The national and local values for freshwater are to drive the freshwater objective setting processes.

The Freshwater NPS values tables in Appendix 1, and the attributes tables in Appendix 2, provide the link between national values and the attributes from which freshwater objectives must be derived.

Policy CA1 requires every regional council to identify FMUs covering all freshwater bodies within the region. Policy CA2 outlines the process for setting freshwater objectives for each FMU and the matters to consider when doing so.

Objective A2 requires that overall water quality within each region is maintained or improved. Therefore, regional councils are expected to set freshwater objectives that generally reflect existing water quality or better. Limited balancing of particular aspects of water quality is acceptable, although not to the extent that any aspect of water quality of any FMU would be managed to be below a national bottom line or to a point where it failed to safeguard life-supporting capacity or human health.

National bottom lines will only be a matter for consideration if the current water quality is below a bottom line or trending towards it. Freshwater objectives must be set above the bottom lines. If water quality for a compulsory value attribute is currently below a bottom line (or trending that way), it must be improved over time to achieve a freshwater objective above the bottom line.

"National bottom line" values are specified for the following water quality parameters in Appendix 2 of the Freshwater NPS:

- Periphyton (trophic state).
- Nitrate (toxicity).
- Ammonia (toxicity).
- Dissolved oxygen.
- Escherichia coli.
- Cyanobacteria – planktonic.

The policies also set out the timeframe in which the limits are to be imposed within each FMU.

Environment Southland has identified that the Plant is situated within the Oreti FMU. The objectives and limits for this FMU are still to be investigated and determined. As such, the bottom line limits set out within the Freshwater NPS have been applied in order to undertake an assessment of the discharge.

As noted above, it has been determined that the current discharge needs to be improved to be able to meet a site-specific, in-river ammonia target and contribute to achieving the bottom line value contained in the Freshwater NPS within the wider catchment. These assessments indicate that a 75% reduction (from 2012-13 season concentrations) in discharge Amm-N concentration is the appropriate target. In order to achieve the proposed limits for Amm-N a comprehensive upgrade to the existing wastewater treatment system is required. A progressive implementation programme to upgrade the wastewater system is proposed, which aligns temporally with the achievement of national and regional objectives for improvements in water quality. The upgrade is also expected to achieve a

reduction in TP. The proposed reduction in both TN and TP is expected to have significant positive effects on water quality in the immediate receiving environment, and will likely assist in meeting the future water quality targets set by the Freshwater NPS and Environment Southland for the Oreti FMU.

In addition to implementing a progressive upgrade of the wastewater treatment system, Alliance is also proposing to undertake a review of the performance of the upgraded system, the effects of the discharge and receiving water quality and the overall catchment water quality improvements that may have occurred post-implementation of the regional objectives for maintaining and improving water quality. If the review indicates that water quality has improved to a point where the discharge is an obvious outlier, then Alliance would be committed to investigating further technological advances and adopting the best practicable option to further improve the quality of its discharge. This is proposed as a condition of consent.

It is also noted that the application of an annual maximum (as set out in the Freshwater NPS) is not considered appropriate for limits resulting from individual point source discharges. This is largely because the ammonia limits in the Freshwater NPS have been derived for state of the environment, catchment monitoring and do not apply to point source discharges. A specific assessment relating to the development of the ammonia standards has been prepared and is attached to the report in **Appendix K**.

Overall, it is considered that Alliance has had appropriate regard to, and achieves the intent of the Freshwater NPS with respect to the implementation of the National Objectives Framework for maintaining and improving overall water quality.

Parts CB and CC of the Freshwater NPS set out the requirements that councils must implement with regard to water quality monitoring and accounting. Alliance is proposing an extensive monitoring regime, as set out in the Environmental Monitoring Plan with respect to the quality of its discharge, and the receiving water environment. The results of the monitoring will be reported back to Environment Southland. The results of the monitoring will also be used to inform the council where exceedances of any specified limits might occur, and to enable Alliance to undertake analysis of the discharge and receiving water quality to ensure that the current conditions are maintained and improved, in line with the progressive upgrades to the existing wastewater treatment system.

10.2.5 Tangata Whenua Roles and Interests

Part D of the Freshwater NPS seeks:

> *To provide for the involvement of iwi and hapū, and to ensure that tāngata whenua values and interests are identified and reflected in the management of fresh water including associated ecosystems, and decision-making regarding freshwater planning, including on how all other objectives of this national policy statement are given effect to.*

Part D requires local authorities to take reasonable steps to work with iwi and hapu and to reflect tangata whenua interests (Policy D1). Consultation with tangata whenua represented by Te Ao Marama has occurred as part of the TWP and on an individual basis.

Te Ao Marama has been informed of the results of the water quality and ecology assessment and how the existing discharges to water and land may affect freshwater systems and ecology. Te Ao Marama has expressed support for Alliance's proposal to upgrade the existing wastewater system. Although it has been expressed that there is a preference that the human effluent element is separated from the discharge stream to the river, Te Ao Marama acknowledge that there would be difficulties in doing this and it is noted that the costs for the Wallacetown community could be reasonably significant in finding an alternative disposal method. An outcome of the consultation with Te Ao Marama has been the proposal to develop and implement the Habitat Enhancement Management Plan.

10.2.6 Implementation

Policy E1 outlines the expectations and timeframes for regional councils to implement the policies in the Freshwater NPS. All implementation is expected as promptly as is reasonable in the circumstances. Where it is impracticable for a regional council to fully implement the Freshwater NPS by the end of 2015, it may develop or update a formal progressive implementation programme (PIP). The PIP will outline the planned progress toward meeting the 31 December 2025 deadline. However, the policy allows for the implementation timeframe to be extended to 2030 if the 2025 timeframe will affect plan quality or it would be impracticable for the council to complete implementation of a policy by 2025.

A potential effect of the treated wastewater discharge has been identified as the discharge of ammoniacal nitrogen, which can cause toxicity effects to biota in the river. It is noted that the fauna within the mixing zone and downstream of the discharge point is characteristic of a lowland river environment, and there is no evidence that the discharge is having any adverse or toxic effect on the species likely to be found within this environment. Regardless of this, Alliance is cognisant of the national and regional mandate to maintain and improve water quality over time. Given this, the assessment of water quality and ecological effects recommends that a reduction in ammonia would be required to meet the site-specific ammonia levels and contribute to the achievement of the Freshwater NPS attribute bottom line for ammonia toxicity in the wider catchment.

To achieve such a reduction, an upgrade to the wastewater treatment facility is necessary. Such an upgrade is a major undertaking and investment by Alliance, and thus is recommended as a long-term target, consistent with the implementation requirements of the Freshwater NPS. In order to ensure that Alliance is committed to an upgrade, it is proposed that within five years of any consent being granted Alliance will prepare a Wastewater Treatment Upgrade Plan. The Plan will set out the proposed technology and upgrades that will be installed, the methodology of how the upgrade will be installed and a staged work plan. The conditions will then require that the Plan is progressively implemented to be fully operational by the end of Year 15 of the consent.

A key aspect of the mitigation with respect to water quality is to ensure that prior to the implementation of the wastewater upgrade, the conditions within the Makarewa River receiving environment are maintained, and that there is no deterioration of existing water quality, or ecological health that is directly attributable to the Plant's discharge. To achieve this, Alliance is proposing discharge and in-river limits that are to be achieved pre and post-upgrade, which are reflective of Alliance's commitment to maintain and improve its discharge quality. Alliance is also proposing the preparation of an Annual Monitoring Report which will provide a summary of the receiving water monitoring and assessment of compliance with the prescribed limits, as well as an assessment to track compliance progress against achieving the revised total Amm-N and total oxidised nitrogen limits.

Alliance is also committed to keeping abreast of any improvements to the overall quality of the Oreti Catchment which may be achieved through implementation of the NPS Freshwater obligations. It will do this by undertaking at Year 10 of the consent, a review of whether it is necessary to further treat the microbial load in the discharge stream, and repeating this review every 5 years for the life of the consent. At Year 25 of the consent Alliance will undertake a review of the performance of the upgraded wastewater treatment system in order to identify any further improvements in the receiving water environment, and identify whether there are any practicable technological advances that Alliance should be adopting to further improve the quality of its discharge.

10.3 NEW ZEALAND COASTAL POLICY STATEMENT 2010

The New Zealand Coastal Policy Statement 2010 (NZCPS) provides policy guidance and direction on management of the coastal environment. The ultimate receiving environment for the Plant's discharge to the Makarewa River is the New River Estuary. The Plant's discharge point is also located near the upper end of the tidally influenced section of the Makarewa River.

Matters addressed in the NZCPS include:

- Preservation of the natural character of the coastal environment;
- Protection of those characteristics of the coastal environment of special value to tangata whenua;
- Provision of appropriate subdivision, use and development of the coastal environment; and
- The Crown's interest in the coastal marine area.

10.3.1 NZCPS Objectives

There are seven overarching objectives of the NZCPS, of which Objectives 1, 2, 3 and 6 are most relevant to these applications, in particular the proposed discharge of treated wastewater to water. These set out the high level direction for management of the coastal marine area, and the policies seek to give effect to that direction. The following assessment considers both the relevant objectives and policies together.

10.3.2 The Extent and Characteristics of the Coastal Environment (Objectives 1 and 2, and Policy 1 and 4)

Policy 1 of the NZCPS describes the extent and characteristics of the coastal environment. As noted, the ultimate receiving environment for the Plant's discharge is the New River Estuary, and the discharge point is located near the upper end of the tidally influenced section of the Makarewa River.

The proposed discharge does not require resource consent under section 12 of the RMA (restrictions on use of coastal marine area), or under the Regional Coastal Plan. However, the discharge does have the potential to have adverse effects on the coastal environment, with regard to the tidally influenced section of the Makarewa River, and the ultimate receiving environment being the New River Estuary.

The Plant's discharge point is located near the upper end of the tidally influenced section of the Makarewa River. The instream habitat in the vicinity and downstream of the proposed discharge reflect the low gradient, tidal and highly modified nature of the lower Makarewa River. The tide also affects water levels and velocity in this section of the Makarewa River.

New River Estuary is a large, shallow 'tidal lagoon' estuary, situated at the confluence of the Oreti and Waihopai Rivers. The estuary forms part of the Awarua Plains Wetland complex. Its catchment largely consists of agricultural land, but it is also subject to stormwater and wastewater discharges from Invercargill City. The estuary contains a range of habitats including extensive mudflats, seagrass and relatively large saltmarsh areas. Overall, the available data indicates that large parts of New River Estuary remain in reasonable condition, but a significant and increasing proportion of the estuary is seriously impacted by fine sediments and elevated nutrient concentrations. The New River Estuary supports high ecological values, including a diverse bird fauna and freshwater and marine fish populations. The estuary provides important spawning and rearing habitat for fish. The estuary provides a wide range of recreational opportunities including game bird hunting, fishing, bird-watching, power boating, rowing, bathing, walking and picnicking.

10.3.3 Treaty of Waitangi, Tangata Whenua and Maori (Objective 3 and Policy 2)

Through engagement with tangata whenua, and by making key decisions in consultation with tangata whenua, matauranga Maori (Maori customary knowledge, traditional knowledge or intergenerational knowledge) has been incorporated into the consideration of the proposed Plant activities, in particular the discharge to water.

10.3.4 Water Quality (Objectives 1 and 6, and Policies 21, 22 and 23)

Policy 21 requires that where water quality in the coastal environment has deteriorated such that it is having a significant adverse effect on ecosystems, natural habitats, or water based recreational activities, or is restricting existing uses and cultural activities, priority is to be given to enhancing it. Policy 22 requires consideration of controls to manage the effects of sedimentation on the coastal environment. Policy 23(1) seeks to manage the discharge of contaminants to the coastal environment by having particular regard to:

(a) *The sensitivity of the receiving environment;*

(b) *The nature of the contaminants to be discharged, the particular concentration of contaminants needed to achieve the required water quality in the receiving environment, and the risks if that concentration of contaminants is exceeded; and*

(c) *The capacity of the receiving environment to assimilate the contaminants; and*

(d) *Avoid significant adverse effects on ecosystems and habitats after reasonable mixing;*

(e) *Use the smallest mixing zone necessary to achieve the required water quality in the receiving environment; and*

(f) *Minimise adverse effects on the life supporting capacity of water within a mixing zone.*

With respect to water quality, the assessment (refer **Appendix D** attached) has found that the current discharge does not significantly adversely affect downstream water quality indicators when comparatively assessed against the overall quality within the Makarewa River. The assessment also concluded that the water quality in and around the discharge point contributes to a habitat that is similar to other Southland tidally influenced river sites.

Although there are no significant adverse effects arising from the current quality of the discharge, it is recognised that there is a national and regional directive to maintain and enhance water quality within both freshwater and coastal environments. Alliance is committed to ensuring the current quality of its discharge does not deteriorate and is improved by the comprehensive upgrade to its wastewater treatment system. Although the upgraded wastewater treatment system is expected to improve the water quality in the Makarewa River, it is noted that this alone is unlikely to have an observable effect on nuisance macroalgae in New River Estuary. In this regard, a significant improvement in water quality in the New River Estuary is only likely to be achieved through a major catchment-wide reduction in total nitrogen loads. Alliance is committed to doing its part, and will keep abreast of the Council Land and Water Plan initiatives and the overall improvements in the water quality of the receiving catchment.

10.4 NATIONAL ENVIRONMENTAL STANDARDS

As described in section 5 of this report, there are three NESs that are of relevance to the consideration of these applications.

10.4.1 National Environmental Standard for Air Quality

The NES Air Quality regulations are mandatory and include standards related to the ambient concentrations of SO_2, NO_2, CO, PM_{10} and ozone (O_3). They include concentration limits, maximum numbers of allowable exceedances, and monitoring methods. Regulation 13 sets the ambient air quality standards and Regulation 14 sets out the locations that such standards apply, which includes at any place –

(a) *That is in an airshed; and*

(b) *That is in the open air; and*

(c) Where people are likely to be exposed to the contaminant.

"Airsheds" include parts of the region that are specifically gazetted as airshed, and any remaining areas of the region which are not gazetted. This means that the standards apply in all areas of New Zealand, in the open air, wherever people may be exposed over the relevant time averaging period for the standards specified. The main exception is that if the discharge is authorised by a resource consent, then the standards do not apply on the site to which that consent applies. Therefore, the key areas in terms of the NES compliance for these applications are the residential and amenity areas around the Plant boundary. The effects on the proposed air discharges on the Invercargill gazetted airshed also need to be considered.

The ambient monitoring set out in **Appendix E** attached, shows that the discharges from the coal fired boilers achieve the ambient air quality standards set out in the NES and are unlikely to have any compliance issue in this regard. The modelling analysis undertaken in **Appendix M** attached also confirms that the discharges from the boilers are likely to have only a negligible impact on Wallacetown and the Invercargill airshed.

10.4.2 National Environmental Standard for Sources of Drinking Water

This NES requires regional councils to ensure that effects on drinking water sources are considered in decisions on resource consents and regional plans. The potential effects on groundwater arising from the proposed discharges to land have been considered in the assessment attached as **Appendix Q**.

Groundwater monitoring undertaken around the site indicates that samples were generally below their respective maximum acceptable value and guideline value set out in the Drinking Water Standards for New Zealand, with the exception of both field and laboratory pH which were below the guideline value of 7–8.5. This is however not considered to be uncommon, as many shallow groundwaters in New Zealand have low pH due to recharge from rainfall infiltration through soil.

Overall, the monitoring data confirms that the discharges to land are not giving rise to adverse effects on the groundwater resource and are therefore unlikely to be having any adverse effects on any groundwater sources that might be used for drinking water purposes.

10.4.3 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

This NES provides a mix of permitted activities and resource consent requirements for certain activities on land affected or potentially affected by contaminants in soil. As the Plant's activities are listed on the Hazardous Activities and Industries List (HAIL) the NES Regulations apply to this land area. However, for the purposes of these applications, Alliance is not proposing to disturb any land or soil and therefore the provisions of the NES are not triggered at this time. If any soil disturbance is required as part of the wastewater upgrade, this will be assessed against any relevant NES requirement and necessary applications made at that later date, if required.

10.5 REGIONAL POLICY STATEMENT

With the exception of the biodiversity chapter of the Proposed RPS, this policy statement is considered to carry greater weight than the operative RPS. Nevertheless, the Operative RPS contains similar themes and topic areas, and the assessment of the proposal against the objectives and policies of the Proposed RPS (decision version) is considered to cover these issues as well.

10.5.1 Proposed Southland Regional Policy Statement

Chapter 3 of the Proposed RPS relates to tangata whenua. Objective TW.1 and Policy TW.1 seek that the principles of the Treaty of Waitangi / Te Tiriti o Waitangi are taken into account in a systematic way through effective partnerships between tangata whenua and local authorities, which provide for the capacity for tangata whenua to be fully involved in council decision making processes.

Objective TW.2 seeks that iwi management plans are taken into consideration in resource management processes and decisions. Objective TW.3 seeks that mauri and wairua are sustained and improved where degraded, and mahinga kai and customary resources are healthy, abundant and accessible.

Relevant policies seek that tangata whenua are involved in resource management decision making in order to recognise and provide for places, sites and values that are of cultural, spiritual or historic significance.

Te Ao Marama is an appointed agent of iwi, representing tangata whenua in the area. Considerable effort has been made by Alliance through consultation and the preparation of a cultural values report to understand the Maori values of the area and natural resources. The key cultural impacts arising from the Plant's discharges to land, water and air have been identified, and measures to avoid, remedy or mitigate adverse effects have been developed. The key mitigation relates to Alliance's commitment to improve the overall quality of the Plant's treated wastewater discharge to water, as well as the preparation and implementation of an on-site habitat enhancement management plan.

Chapter 4 provides for the management of water within the region. Part A relates to water quality. Objective WQUAL.1 sets out the water quality goals and seeks that water quality safeguards the life supporting capacity of water and related ecosystems; safeguards the health of people and communities; is maintained or improved in accordance with the objectives developed in accordance with the Freshwater NPS; and is managed to meet the reasonably foreseeable needs of social, economic and cultural needs of future generations.

Objective WQUAL.2 seeks to halt the decline and improve water quality in lowland water bodies and estuaries in accordance with objectives formulated in accordance with the Freshwater NPS.

Relevant policies seek to identify values of the various freshwater bodies within the region, and to develop freshwater objectives in accordance with the

Freshwater NPS[20]. In managing water quality in the region, particular regard will be had to the following contaminants – nitrogen; phosphorus; sediment; and microbiological contaminants[21]. Policy WQUAL.4 seeks to improve water quality in the region. Policy WQUAL.6 recognises the social, economic and cultural benefits that may be derived from the use, development or protection of water resources.

As set out above, the discharge of treated wastewater to water is not giving rise to any adverse effects on the current life supporting capacity of the Makarewa River. However, it is recognised that the current discharge is unable to comply with the national bottom line limit for ammonia. Given this, Alliance is committed to maintaining the existing quality of its discharges and the receiving water, and progressing with a comprehensive upgrade of the Plant's wastewater treatment facility in order to achieve a significant reduction in ammonia. Primary treatment upgrades are also likely to achieve a reduction in nitrogen, and the long term improvements will also provide a reduction in phosphorus. Enabling Alliance to implement the upgrade and improve its discharge quality progressively recognises the importance of the Plant to the social and economic wellbeing of the community, and enables the significant expenditure to be provided for and recovered within a reasonable timeframe, without risking the economic viability of the Plant.

In terms of safeguarding peoples' and the community's health, it is noted that the current quality of the Makarewa River is high in faecal coliforms, and although at times the discharge can contribute to an increased level downstream, it can also have a reducing (dilution) effect at other times. Given this, a catchment-wide improvement would be required in order for Alliance's discharge contribution to have any noticeable impact on faecal coliforms. If consent is granted, Alliance will review the water quality of the catchment on a regular basis, and if an improvement in faecal coliform upstream is observed, then Alliance is committed to reviewing whether it is necessary and practicable to install further treatment as part of the wastewater treatment upgrade, in order to achieve a measurable reduction in faecal coliforms.

Alliance's commitment to maintaining and improving the quality of the Plant's discharges to water is consistent with the objectives and policies relating to water quality.

Part B relates to water quantity. Objectives seek to sustainably manage the region's freshwater resources by safeguarding the life supporting capacity of water, catchments and related ecosystems; support the maintenance improvement of water quality; meets the needs of a range of uses; and comply with limits or targets set out to achieve freshwater objectives. Objective WQUAN.2 seeks that the allocation and use of water is efficient.

Relevant policies seek that water quantity maintains instream values and to avoid over-allocation.

[20] Policy WQUAL.1.
[21] Policy WQUAL.2.

Policy WQUAN.3 seeks to recognise the finite nature of water resources and to provide for freshwater objectives that derive from flow and levels of water; avoid as far as practicable, and where it is not, remedy or mitigate adverse effects of activities on flows and levels; provide for the current and reasonably foreseeable future needs, and the social, economic and cultural wellbeing of people and communities, and recognise the potential effects of climate change on flows and levels of water and on water availability.

Policy WQUAN.6 requires that water that is taken is used efficiency, and that where fresh water bodies are approaching full allocation, consideration is given to establishing management provisions to maximise the benefits of using any available water. Policy WQUAN.7 seeks to recognise the social, economic, and cultural benefits that may be derived from the use, development or protection of water resources.

As noted above, the proposed abstraction from the Oreti River will not give rise to adverse effects on allocation, nor is it assessed as having a significant impact on river hydrology, flows and levels. Given this, the proposed abstraction from the Oreti River to provide a reliable water supply for the Plant's operations is considered to be consistent with achieving the objectives and policies of the Proposed RPS.

Part C relates to the management of beds of lakes and rivers. Objectives seek that all significant values of lakes and rivers are maintained and enhanced and that public access is maintained and enhanced where necessary, to ensure a level of public access appropriate to the values of the area. The existing level of public access in and around Alliance's activities will remain unaltered.

Policy BRL.1 is directed at regional councils and requires that regional plans include policies and methods that avoid, as far as is practicable, and only where avoidance is not practicable, remedy or mitigate natural character; instream ecological values; historic heritage and cultural values; spiritual values; amenity values; and recreational values. Other policies seek to recognise the benefits of existing structures and activities, while avoiding, wherever practicable, mitigating or remedying any adverse effects.

Minor channel maintenance and clearance to ensure Alliance's water take structure is functioning efficiently and effectively is required. In order to avoid, remedy or mitigate any adverse effects, Alliance is proposing to implement appropriate management measures, including the timing of any proposed works, to effectively avoid, remedy or mitigate any adverse effects.

Chapter 5 relates to rural land/soils. Objective RURAL.1 seeks to achieve the sustainable use of Southland's rural land resource in respect of, among other matters, on-site wastewater systems. Objective RURAL.2 seeks that the life supporting capacity of soils is safeguarded. Relevant policies recognise that the use and development of Southland's rural land resource enables people and communities to provide for their social, economic and cultural wellbeing. Policy RURAL.6 seeks to make provision for the use of on-site wastewater systems in

rural areas, provided new systems are not located within a site that is culturally sensitive to tangata whenua, and adverse effects including cumulative effects, are avoided or mitigated.

The existing Plant and land within the jurisdiction of the Southland District Council is zoned industrial. It is a significant existing use of the area and this is recognised via this zone, which appropriately allows for the ongoing use and expansion of the Plant activities and equipment.

The discharges of treated wastewater to land are proposed to be undertaken so that the sustainable management of the land and soil resource is achieved. This has included determining the most appropriate nitrogen loads and application rates for both the irrigated discharges and application of biosolids. The proposed management regime will ensure that there are no adverse effects on the soil or land resource as a result of the proposed discharges to land.

Chapter 7 provides for activities in the coast. Relevant to this project is Objective COAST.3, which seeks that coastal water quality and its ecosystems are maintained or enhanced, and Policy COAST.5, which seeks to avoid, remedy or mitigate adverse effects of land based activities on coastal water and ecosystems. As set out above, the New River Estuary forms part of the coastal environment and is the ultimate receiving environment for the discharges into the Makarewa River. The quality of the New River Estuary is being impacted upon due to the cumulative effects of non-point and point source discharges throughout the catchment. Given this, although Alliance is seeking to improve the quality of its discharges to the Makarewa River, in order to see an improvement in the quality of the New River Estuary, a whole-of-catchment improvement is necessary. It is likely that this might be achieved via implementation of the national and regional objectives which seek to improve water quality in the region.

Chapter 8 relates to natural hazards. Objective NH.1 seeks that the risks to people, communities, property and infrastructure from natural hazards are understood, and avoided, remedied or mitigated. In terms of potential natural hazard risk to the Plant's activities, operations and discharges, these stem primarily from the risk of drought and flooding. During drought conditions, animal welfare is at stake so the Plant has to keep operating, which in turn produces waste which must be treated and discharged. During such extreme events low river flows restrict the ability of the Plant to discharge to the river, and as such, Alliance has identified that as a short term contingency option there is the ability to store treated wastewater on land adjacent to the river and return it to the river when conditions are more appropriate. Alliance is mindful that its wastewater treatment pond assets are located near to the river, and undertakes management in order to ensure that the treatment ponds are adequately protected from any potential flood risk.

Chapter 9 provides for air quality in the region. Objective AQ.1 seeks to enable the discharge of contaminants into air, while managing the adverse effect of those contaminants on human health, wellbeing and the environment. Policy AQ.1 seeks to avoid, remedy or mitigate adverse effects of discharges of contaminants to air, Policy AQ.3 seeks to improve areas with poor air quality, and Policy AQ.4

seeks to maintain or enhance air quality in areas where compliance with national environmental standards or guidelines for ambient air quality has been achieved or surpassed. Policy AQ.5 seeks to promote and facilitate the adoption of the best practicable option to improve air quality.

The coal fired boilers operating at the Plant emit particulates ($PM_{10,}$ $PM_{2.5}$), nitrogen dioxide/oxide, sulphur dioxide, dioxins and heavy metals into the air. Modelling and monitoring of the discharge emissions from the coal fired boilers has been undertaken, and the results assessed against relevant national and international standards and guidelines for air quality and human health. The key findings of the assessment are that all cumulative ambient contaminant concentrations achieve compliance with all relevant standards and guidelines for air quality beyond the property boundary and at locations where people are likely to be exposed.

The assessment also indicates that PM_{10} discharges generally comply with the national guidelines for ambient particulate concentrations, however because compliance with these thresholds is achieved, the assessment states that this does not ensure only minor, or less than minor effects on human health. This is because PM_{10} does not have an established threshold concentration below which there are only minor or no observable adverse effects on human health. It is therefore recommended that Alliance seek to reduce boiler particulate emissions to achieve a flow weighted PM_{10} limit of 250mg/m^3 (corrected to 12 vol.% CO_2) in the discharge within five years. This would ensure that the best performance of the control systems for managing particulate emissions is achieved, and potential health effects arising from potential exposure to particulate emissions are as low as is reasonably achievable. Alliance will also undertake periodic technology reviews so as to be well informed of the best practicable option in the future for managing PM_{10} and $PM_{2.5}$ emissions.

A number of on-site processes, as well as the wastewater treatment system itself can cause, or have the potential to generate odour discharges. Overall, the assessment with respect to odours concludes that with the continuation of appropriate management practices and technology employed by Alliance with respect to the management of potential on-site odours, coupled with the buffer distance of the Plant from any sensitive receptor, the adverse effects arising from odour emissions will be minor. The upgraded wastewater system is anticipated to also reduce odour emissions from that source, and the application of biosolids to land will be managed to also take into account potential odour effects.

Chapter 13 relates to solid waste management. Objective WASTE.2 seeks to avoid, mitigate or where appropriate, remedy the adverse environmental effects of solid waste storage, disposal, processing, handling and transportation. Policy WASTE.1 seeks to avoid, mitigate and where appropriate, remedy adverse effects from solid waste through the development of appropriate rules and methods in regional and district plans.

Biosolids generated following the proposed wastewater treatment upgrade will comprise of anaerobic lagoon solids and waste activated sludge. Disposal of biosolids to Alliance's land is the preferred method. Under this scenario, land

would no longer be utilised for wastewater disposal (ie. via irrigation) and discharge of all (higher quality) wastewater would be to the Makarewa River. Biosolids generated by the upgraded wastewater treatment system would be dewatered and then disposed of onto land at sustainable nitrogen loading rates.

It is noted that on occasions, the ability to dispose of biosolids to land may be limited due to rainfall events resulting in saturated soil conditions, or conversely when the farmland is required to hold large numbers of overflow stock when farmers are destocking their land due to drought. To allow for an alternative biosolids disposal site under these circumstances, an on-site monofill will operate as a contingency disposal site. It is proposed that the monofill will utilise existing redundant wastewater treatment ponds. The integrity of the ponds has been checked to ameliorate the risk of seepage arising as a result of these being used as a monofill storage facility.

10.6 REGIONAL PLANS

10.6.1 Southland Regional Water Plan

The Water Plan applies to freshwater resources of the Southland Region. It also applies to all land in river and lake beds, and to all types of activities that use freshwater, or discharge to freshwater, or that are in the beds of rivers and lakes. Alliance's proposed discharges to water and to land, where it may enter water, and its proposed abstraction trigger consenting requirements under the Water Plan.

10.6.1.1 Water Quality Objectives

Objective 2 of the Water Plan seeks to manage water quality so that there is no reduction in the quality of the water in any surface water body, beyond the zone of reasonable mixing for discharges, below that of the date the Plan became operative (January 2010).

Work associated with the assessment of the current and possible future discharges on the Makarewa River, Oreti River and New River Estuary began in 2012 (refer **Appendix D** attached). In undertaking this assessment, analysis of monitoring data taken for consent compliance purposes, as well as data from extensive additional monitoring, has been carried out in order to inform the assessment of effects of the discharge on surface water. The quality of the discharge and its influence on the receiving environment is well known and understood.

Given that the quality of the discharge from the Plant has remained relatively constant, there has not been any significant reduction in water quality downstream of the discharge since 2010. However, there has been a decreasing trend in the overall water quality in both the upper and lower Makarewa River, Oreti River and the New River Estuary over time, and this is largely attributable to other non-point source discharges into the catchment.

As set out earlier, Alliance is also committed to improving the quality of its treated wastewater discharge through a comprehensive upgrade which will primarily

target a reduction in Amm-N. It is anticipated that this will achieve a significant improvement in the water quality within the immediate receiving river environment. Prior to installing the proposed upgrade, Alliance is also committed to ensuring that the quality of its discharge and the water quality in the receiving Makarewa River environment does not deteriorate. In this regard, Alliance has proposed limits on the discharge and limits to be achieved within the receiving Makarewa River. On an annual basis Alliance will also monitor progress of achieving compliance with revised Amm-N and total oxidised limits. This approach is considered to be consistent with Objective 2.

The Water Plan identifies the Makarewa River as "lowland (soft bed) water quality" (Map 11). Objective 3 seeks to maintain and enhance the quality of surface water bodies so certain values (as outlined below) are protected where water quality is already suitable for them, and where water quality is currently not suitable, measurable progress is achieved towards making it suitable for them.

For rivers classified as lowland (soft bed) the following values are identified:

- Bathing, in those sites where bathing is popular;
- Trout where present, otherwise native fish;
- Stock drinking water;
- Ngai Tahu cultural values, including mahinga kai;
- Natural character including aesthetics.

Objective 4 aims to improve water quality over time, and seeks to manage the discharge of contaminants and encourage best environmental practice to improve the water quality in surface water bodies classified as lowland (soft bed), and in particular to achieve a minimum of 10% improvement in levels of the following water quality parameters over 10 years from the date the Water Plan became operative (January 2010):

- Microbiological contaminants;
- Nitrate;
- Phosphorous;
- Clarity.

As noted above, the assessment in **Appendix D** attached, determines that the Makarewa River upstream and downstream of the discharge point, is characteristic of a low-land river body. The overall river water quality is characterised by high nutrient concentrations, high faecal indicator bacteria counts, low visual clarity, high ammoniacal nitrogen concentrations, and generally moderate but occasionally low summer dissolved oxygen concentrations. The Makarewa River is therefore not a popular bathing site.

The water temperatures and pH are however suitable for supporting healthy biological communities. Benthic invertebrate and aquatic plant communities in the lower Makarewa River change in response to the substrate, channel gradient, water velocity, tidal influence, and water quality. Key features of the biological communities in the Makarewa River immediately above and below the discharge

point is the dominance of macrophytes, water and habitat tolerant benthic invertebrate taxa, and a diverse fish community. The Makarewa River also supports a locally significant brown trout fishery with low-moderate recreational use.

Foams occur at times in the Makarewa River below the discharge, however they have also been observed upstream of the Plant. It is likely that a contributing factor to the generation of foams is the physical delivery of the discharge to the Makarewa River. Modifications to the outfall structures have been implemented at the Plant in order to reduce the likelihood of foams being created. The modifications installed have already proven to be successful in reducing the creation and presence of foams and monitoring of foams will continue to confirm this.

As discussed, a potential effect of the treated wastewater discharge has been identified as the discharge of Amm-N, which can cause toxicity effects to biota in the river. It is noted that the fauna within the mixing zone and downstream of the discharge point is characteristic of a lowland river environment, and there is no evidence that the discharge is having any adverse or toxic effect on the species likely to be found within this environment. Regardless of this, Alliance is cognisant of the national and regional mandate to maintain and improve water quality over time. Given this, the assessment of water quality and ecological effects recommends that a reduction in ammonia would be required to meet the site-specific ammonia levels and to assist in achieving the Freshwater NPS attribute bottom line for ammonia within the wider catchment.

To achieve such a reduction, an upgrade to the wastewater treatment facility is proposed. Such an upgrade is a major undertaking and investment by Alliance, and thus is recommended as a long-term target, consistent with the implementation requirements of the Freshwater NPS. In order to ensure that Alliance is committed to an upgrade, it is proposed that within five years of any consent being granted Alliance would prepare a Wastewater Treatment Upgrade Plan. The Plan will set out the proposed technology and upgrades that will be installed, the methodology of how the upgrade will be installed and a staged work plan. The conditions then require that the Plan is progressively implemented and operational by the end of Year 15 of the consent.

Alliance has also already commenced installing components that are necessary to give effect to the comprehensive upgrade that is proposed. The separation and further treatment of high nitrogen loading waste streams occurred in 2014, when the mini-DAF unit was installed. This upgrade is expected to achieve a reduction in nitrogen load within the wastewater stream of around 10 – 20%, consistent with the intent of Objective 4. With regard to the other parameters identified in Objective 4, phosphorous is anticipated to be significantly reduced with the overall wastewater treatment upgrade, and Alliance will investigate whether it is necessary to further treat its microbial load in order to contribute to a reduction in microbial contaminants within the wider catchment at Year 10 of the consent. Clarity may also be improved as a result of the overall wastewater treatment upgrade, and Alliance is committed to ensuring its discharge does not contribute to a decrease in clarity beyond the mixing zone of greater than 33% comparative

to upstream levels at any time. As discussed elsewhere the 33% indicator is considered to be appropriate for a lowland river body.

The upgrades that have been completed, the ongoing monitoring and compliance, and the planned Plant upgrades are expected to deliver significant improvements in the quality of discharges from the Plant to the Makarewa River. This is considered to be consistent with the outcomes intended to be achieved via the relevant water quality objectives.

With regard to Ngai Tahu cultural values of the Makarewa River, an improvement in water quality is anticipated as part of the progressive upgrade to the wastewater treatment system. In addition to this, Alliance also proposes to develop and implement a Habitat Enhancement Management Plan in consultation with Te Ao Marama which will look to enhance key areas of ecological importance within the Plant boundary (ie. riparian planting and oxbow habitat). The purpose of this plan is also to assist in mitigating or offsetting adverse effects arising on cultural values associated with the proposed discharge of treated wastewater to the Makarewa River and the abstraction of water from the Oreti River.

Although there is currently no indication that the discharge is having an adverse effect on fish health, Alliance will undertake a fish health survey prior to the implementation of the wastewater upgrade, which will be repeated post implementation in order to identify whether there has been any change (improvement) in fish health.

10.6.1.2 Water Quantity Objectives

Objective 5 relates to water quantity and aims to have sufficient water to support the reasonably foreseeable needs of current and future generations, and enable people and communities to provide for their social, economic and cultural wellbeing while protecting ecosystem health, life supporting capacity, natural character and historic heritage values of surface water bodies. Objective 7 seeks to maximise the efficiency of water.

Alliance proposes to abstract water from the Oreti River. The assessment in **Appendix O** attached determines that the take is of a scale that will have a less than minor effect on the hydrology, water quality and biological communities and fish species within the Oreti River. The nature of Alliance's water take means it is necessary to continue to abstract water during low flow conditions. Alliance does, however, seek to impose as many water conservation practices within its Plant as practicable via the Low Flow Contingency Plan.

10.6.1.3 Groundwater Objectives

Objective 8 seeks to maintain groundwater quality in aquifers that already meet the Drinking Water Standards for New Zealand, and to enhance those that are degraded by land use and discharge activities that do not meet the standards by the year 2010. The objective does, however, provide an exception for those aquifers where ambient water quality is naturally less than the Standards.

Alliance proposes to discharge treated wastewater to land, firstly via irrigation as is the current practice, and subsequently as a dewatered biosolid after the upgrade of the wastewater treatment system. Monitoring of the soil and groundwater is currently undertaken and is proposed to ensure there are no adverse effects arising from any discharges to land from the Plant.

As noted above, groundwater monitoring indicates that samples were generally below their respective maximum acceptable value and guideline value set out in the Drinking Water Standards, with the exception of both field and laboratory pH, which were below the guideline value of 7–8.5. This is likely to be due to natural occurrences and is not attributable to the discharge of the wastewater. Ongoing monitoring of the soil and groundwater resources will ensure there are no adverse effects arising from the proposed discharges to land. This is consistent with Objective 8.

10.6.1.4 Land and Soil Objectives

Objective 9A seeks to maintain soil quality. Objective 9B seeks to manage discharges onto or into land so that adverse effects on human health are avoided, and Objective 9C seeks to manage discharges onto or into land so that any adverse effects on the diversity and integrity of habitats and ecosystems, and that amenity and historic heritage values are avoided, remedied or mitigated to ensure that these values are maintained or enhanced.

The effects of the wastewater irrigation application to land are well understood, as monitoring of the soil and groundwater resources has been undertaken by Alliance since 2001. The results of this monitoring are reported in an annual report which is submitted to Environment Southland. The latest annual monitoring report indicates that there have been no significant adverse effects on the environment that can be clearly attributed to wastewater irrigation application to land. Over the monitoring period, concentrations of contaminants in soil and groundwater resources remain relatively consistent and low. Certain areas of the Plant land are avoided, as these soils have been identified as not being suitable for receiving irrigated wastewater.

As set out earlier, Alliance is proposing to upgrade its existing wastewater treatment facility. The new treatment facility would necessitate the need to dispose of biosolids to land and to an on-site monofill as a contingency option. Prior to land disposal, the biosolids will be dewatered to mitigate against water logging, ponding and nutrient runoff. A proposed biosolids nitrogen loading rate of 250kg N/ha/yr or a plant available nitrogen rate of 140kg N/ha/yr has been derived as being appropriate. This would likely result in a nitrogen leaching rate of approximately 13kg N/ha/yr, which is equivalent to the nitrogen leaching rate from sheep grazed pastures. Areas of soil that are unsuitable for the discharge of biosolids will be avoided, and monitoring of the soil and groundwater resource will continue to ensure there are no adverse effects on these resources.

10.6.1.5 River and Lake Bed Objectives

Objective 10 seeks to maintain or enhance the diversity and integrity of aquatic and riverine habitats and ecosystems. As discussed above, the assessment in

Appendix D attached determines that the fauna within the mixing zone, and downstream of the discharge point, is characteristic of a lowland river environment, and there is no evidence that the discharge is having any adverse or toxic effect on the species likely to be found within this environment. Regardless of this, Alliance is committed to improving its discharge quality via a comprehensive wastewater treatment upgrade, and this is likely to result in significant benefits for the quality of the receiving water and potentially riverine habitats and ecosystems.

The continued abstraction of water from the Oreti River is also unlikely to have any significant adverse effects on aquatic and riverine habitats given the volume of the take, the abstraction point and the use of a suitable fish screen to prevent entrainment effects.

Objective 12 relates to the maintenance and enhancement of public access to river beds and lake beds, except in circumstances where public health and safety are at risk. Alliance is not seeking to prevent public access, however due to health and safety regulations, it is not actively promoted in the vicinity of its discharges or water abstraction. Alliance notes that with respect to the discharge point into the Makarewa River, there are a number of physical constraints which also restrict public access in the immediate area.

Objective 13 seeks to protect natural character and outstanding natural features of rivers and lakes from inappropriate use and development. There are no outstanding natural features identified as being affected by the proposed Plant discharges and activities. The natural character of the Makarewa River environment has already been altered by historical modification and current flood control and land use practices. The proposed discharges to water and to land will maintain the quality of the existing riverine environment, and in time, the recent and planned Plant upgrades will improve the quality of the discharge and immediate Makarewa River receiving environment.

The proposed abstraction from the Oreti River is minor, and will not adversely affect the river's hydrology, water quality or fish species which contribute to its overall natural character.

10.6.1.6 Water Policies

Policy 1A seeks to take into account iwi management plans. Consultation with iwi relating to Alliance's proposal to renew its key discharge and abstraction consents commenced in 2013, and will continue post-lodgement of the consent. Mitigation including the proposed wastewater upgrade and the proposed Habitat Enhancement Management Plan, has been developed in consultation with Te Ao Marama. The provisions within the relevant iwi management plan have also been taken into account by Alliance and an assessment of the proposal against these is undertaken later.

A number of the policies relate to the management of water quality, including:

- Policy A4 of the Water Plan has been inserted from a direction from the Freshwater NPS. It requires that when considering any application for a discharge, the consent authority must have regard to the following matters:
  - The extent to which the discharge would avoid contamination that will have an adverse effect on the life supporting capacity of fresh water, including on any ecosystem associated with fresh water; and
  - The extent to which it is feasible and dependable that any more than minor adverse effects on fresh water, and on any ecosystem associated with fresh water resulting from the discharge, would be avoided.
- Policy 1 seeks to recognise the different characteristics of surface water body classes (ie. natural state, lowland, etc) when managing discharges.
- Policy 3 sets out that no discharge to surface water that will result in a reduction of water quality beyond the zone of reasonable mixing shall be allowed, unless it is consistent with the promotion of the sustainable management of natural and physical resources to do so.
- Policy 4 relates to surface water bodies outside natural state waters. It seeks to manage point and non-point source discharges to meet or exceed the water quality standards set out in Rule 1, and specified in Appendix G of the Water Plan. The policy also sets out that these standards are to be achieved, unless it is consistent with the promotion of the sustainable management of natural and physical resources to breach the standards to do so, and so avoid the levels of contaminants in water and sediments that could harm the health of humans, domestic animals including stock and/or aquatic life.

The water quality standards that are applicable for surface water bodies classified as “lowland soft bed” are set out in **Table 18** below:

Table 18: Lowland Soft Bed Water Quality Standards

Water Quality Indicator	Standard
Temperature	• Shall not exceed 23^{o}C • The daily maximum ambient water temperature shall not be increased by more than 3^{o}C when the natural or existing water temperature is 16^{o}C or less, as a result of any discharge. • If the natural or existing water temperature is above 16^{o}C, the natural or existing water temperature shall not be exceeded by more than 1^{o}C as a result of any discharge.
pH	Within the range of 6.5 – 9 and there shall be no pH change in water due to a discharge that results in a loss of biological diversity or a change in a community abundance and composition.

Dissolved Oxygen	Shall exceed 80% of saturation concentration.
Growths	No bacterial or fungal slime growths visible to the naked eye as obvious plumose growths or mats.
Visual Clarity	When flow is below the median flow, the visual clarity of the water shall not be less than 1.3m.
Total Ammonia	Refer to table below (**Table 19**).
Faecal Coliforms	Shall not exceed 1,000 coliforms per 100 millilitres, except for popular bathing sites.
Macroinvertebrate Community Index	Shall not exceed 80.
Semi Quantitative Macroinvertebrate Community Index	Shall exceed 3.5.
Fish	Shall not be rendered unsuitable for human consumption by the presence of contaminants.

The limits for total ammonia are set in **Table 19** below:

Table 19: Total Ammonia Limits

pH	NH4+-N + NH3-N mg/m3
6.0	2570
6.1	2555
6.2	2540
6.3	2520
6.4	2490
6.5	2460
6.6	2430
6.7	2380
6.8	2330
6.9	2260
7.0	2180
7.1	2090
7.2	1990
7.3	1880
7.4	1750
7.5	1610
7.6	1470

7.7	1320
7.8	1180
7.9	1030
8.0	900
8.1	780
8.2	660
8.3	560
8.4	480
8.5	400
8.6	340
8.7	290
8.8	240
8.9	210
9.0	180

Rule 1 requires that the discharge of any contaminant or water into a surface water body, or into land where it may enter water, is a discretionary activity provided it can comply with the above standards. Failure to comply with the above standards results ordinarily in a non-complying activity status. As discussed earlier in this report, there is however an exemption for the discharge of treated wastewater from the Plant to the Makarewa River. This is because the nature of the receiving waters means that even a discharge of wastewater that has been treated to a standard that substantially reduces the biological content of the wastewater would not be able to meet some of the water quality standards at present. Notwithstanding this exemption, Alliance has sought to align its proposed discharge quality and receiving river limits with the Water Plan where it is practicable to do so. This is discussed further below.

The water quality downstream of the discharge point is generally consistent with water quality parameters measured upstream, however there is a reduction in water clarity of greater than 20% at times, and an increase in TN and TP downstream of the discharge. The assessment and monitoring report (refer **Appendices D and L** attached) indicates that the current measure of 20% reduction for water clarity is too onerous and this should be amended so that clarity tube measurements shall not be below 67% of upstream values. This is considered to better reflect the overall clarity and use of the Makarewa River. A reduction of 20% in water clarity is considered more significant for those rivers which are managed as Class A, being waterways of high water clarity. This would be consistent with Policy 1, which seeks to recognise the different characteristics of surface water body classes. It is noted that Appendix G provides that clarity in lowland water bodies shall not be less than 1.3m when below median flow. This cannot be applied to the area below the discharge because the minimum clarity upstream would not have met this over the last 15 years.

As set out in the monitoring report (refer **Appendix L** attached) the Water Plan standards for water temperature and pH have been adopted as compliance measurements for the proposed discharge and receiving water quality monitoring. The DO limits proposed reflect the limits in the Freshwater NPS, as well as the existing consent conditions, ie. consistently maintained at not less than 6g/m^3 (96% of samples throughout year) and an absolute minimum of >5g/m^3, which is the attribute state which causes only occasional minor stress of lowered dissolved oxygen.

Although the current discharge quality is not assessed as having any adverse effects on the Makarewa River biota, and therefore its life supporting capacity, it is recognised that the discharge is unable to achieve compliance with a site-specific ammonia standard that has been derived, taking into account various sources including the Water Plan (refer **Appendices D and K** attached). In order to achieve a site-specific ammonia nitrogen value, a measurable reduction in nitrogen is required.

Alliance is committed to undertaking work in order to improve the quality of its wastewater discharges to water, specifically its nitrogen loads, and therefore an upgrade to its current wastewater treatment system is proposed.

The capital cost to install the necessary technology is significant, and therefore Alliance proposes to implement this progressively. A progressive implementation programme takes into account the level of effects arising from the current discharge quality, and will align with the requirements of the Freshwater NPS, and enable Alliance to undertake the necessary research efforts into suitable technology, undertake detailed design of the facility and financially commit to the upgrades without jeopardising the current economic viability of the Plant. A progressive implementation option for the upgrade therefore represents the best practicable option and most sustainable option for managing the current and ongoing discharges to the Makarewa River.

It is also acknowledged that the current discharge can elevate faecal bacteria concentrations in the lower Makarewa River on certain occasions, but on others appears to dilute the contamination from microbial sources. Further treatment would reduce the overall loading and would on occasion ensure compliance with relevant Water Plan standards. However, it is noted that generally these standards would not be met because of the high levels in the upper catchment, and given this, for any further treatment of the microbial concentrations in Alliance's discharge to be effective, this would need to be undertaken as part of a wider catchment plan to reduce the overall faecal coliform concentrations in the Makarewa River.

Policy 7 seeks to encourage discharges to land instead of water where it is practicable and the effects are less adverse. As noted, a portion of the treated wastewater is currently disposed of via irrigation to land. The soils in the vicinity of the Plant also have hydraulic loading capacity constraints, and this limits how much can be applied at any one time. An option to discharge all of the wastewater to land has been considered (refer **Appendix I** attached). The

wastewater from the Plant contains a large amount of nitrogen and this is the key constraint to land based application. The assessment of alternatives found that a large amount of land would be needed if land based disposal for the entirety of the treated waste stream was pursued. Procurement of the land and upgrading of the system to full land disposal would be cost prohibitive for Alliance, and this option is therefore not considered to be practicable.

Policy 8 prefers that point source discharges of contaminants to water occur at times of high flow, rather than discharges at normal or low flows, and ensure that where discharging does take place at low flows, the effects that could not be practically avoided, are minimised.

Alliance is aware that during times of low river flows and/or elevated temperatures, the discharge of wastewater needs to be reduced in order to maintain the river water quality. When peak processing corresponds with extreme summer river conditions, the rate of discharge from the wastewater treatment system to the river is less than the incoming wastewater from the Plant. The discharge of treated wastewater to land assists to reduce the deficit, but does not eliminate it. In most seasons surplus wastewater can be stored within the wastewater treatment system for later release. In seasons with a prolonged dry spell, and consequent prolonged low river flows exacerbated by high temperatures, storage capacity within the wastewater treatment system may not be sufficient, and the potential need for farmers to destock their properties means that production from the Plant may be high. In order to provide for these circumstances, Alliance proposes contingency short term storage of treated wastewater. When the river conditions improve the discharge can be released back into the river via the pond system. Having this short term contingency option in place ensures consistency with Policy 8.

Policy 9 provides guidance as to the size of the zone of reasonable mixing. It seeks to minimise the size of the area where the relevant water quality standards are breached and that consideration should be given to, but not limited to, the following matters:

- The aquatic ecosystem values in the affected reach;
- The need for fish passage;
- The uses of the water body adjacent to and downstream of the point of discharge.

The zone of reasonable mixing has been determined, taking into account the requirements of Policy 9. The assessment contained in **Appendix D** attached describes how the mixing zone for the discharge was determined.

10.6.1.7 Water Quantity Policies

Policy B7 of the Water Plan has also been inserted from a direction from the Freshwater NPS and relates to water quantity. The policy requires that when considering any application for the taking, using, damming or diverting of fresh water, the consent authority must have regard to the following matters:

- The extent to which the discharge would adversely affect safeguarding the life-supporting capacity of freshwater and of any associated ecosystem; and
- The extent to which it is feasible and dependable that any adverse effect on the life supporting capacity of freshwater and of any associated ecosystem resulting from the discharge would be avoided.

Policy 14 recognises the positive effects resulting from the use and development of water resources, while managing the taking, use, damming or diversion of surface water so as to avoid, where practicable, remedy or mitigate significant adverse effects. Specifically, Policy 14 seeks to manage the effects on:

- The quality and quantity of aquatic habitat;
- Natural character;
- Areas of significant indigenous vegetation and significant habitats of indigenous fauna;
- Recreational values;
- The spiritual and cultural values and beliefs of the tāngata whenua;
- Water quality, including temperature;
- The rights of lawful existing users;
- Groundwater quality and quantity; and,
- Historic Heritage.

Policy 14B applies to considering a water permit application for a previously authorised activity. This policy applies if there is a change in activity status solely as a consequence of subsequent permits being granted to increase allocation. This is not the case with regard to Alliance's proposed abstraction, which has retained an activity status of discretionary.

Policy 15 sets out the management approach for the allocation of surface water within the region. It requires, among other matters, consideration of the different characteristics of surface water management units (ie. lowland, natural, etc), allocation and minimum flow regimes established under any Water Conservation Order and requires council to establish an appropriate rule framework for water abstraction.

The current allocation in the Lower Oreti catchment is close to 75% of the primary allocation (largely due to the ICC take). This allocation includes Alliance's current abstraction. Alliance is not seeking to increase the amount of water that is taken under its current permit and therefore the take will not contribute to the over-allocation of the surface water resource within the Lower Oreti River. Nor will it have any effects on existing users of the water resource given its location downstream of other significant abstractors in the catchment (ie. ICC). It is also noted that the location of the take is not subject to any Water Conservation Order.

The ongoing abstraction effects on the hydrology of the Oreti River, water quality, and aquatic habitat have been assessed and are considered to be minor. As a consequence of the less than minor effect of the take on low flow duration, flow variability and water quality, and the lack of sensitivity of the receiving environment to water level changes, any effects on biological communities, (including fish spawning and rearing habitat, food production, adult habitat and cover, access to spawning and rearing areas and fish passage) are expected to be less than minor. Potential entrainment issues are also further mitigated by the location of the intake structure, and the use of fish screens to prevent both large and smaller species from entering.

Policy 16 seeks that appropriate environmental flow and level regimes are established via consent conditions for any surface water abstraction. Given the essential nature of Alliance's abstraction (ie. for animal welfare), it is not considered appropriate to impose a minimum flow requirement on the abstraction. Alliance is, however, committed to imposing water conservation measures where it is practicable to do so when river flows become low.

Policy 21 seeks to ensure that the rate of abstraction and abstraction volumes specified on water permits are not more than is reasonably required for the intended end use. Alliance is seeking to renew its existing abstraction volume of 22,500m^3/day. Water is utilised in all facets of the Plant's operations. This volume represents the total capacity of the Plant's processing ability and it is necessary that this volume is maintained to ensure that the Plant is able to operate without undue constraint when demand is at its highest.

10.6.1.8 Groundwater Policies

Policy 25 relates to groundwater and seeks to avoid, remedy or mitigate the adverse effects arising from point source and non-point source discharges, so that there is no deterioration in groundwater quality after reasonable mixing, unless it is consistent with the promotion of the sustainable management of natural and physical resources to do so. The Plant is located within the Makarewa groundwater zone.

The monitoring indicates that there have been no significant adverse effects on the groundwater resource that can be clearly attributed to wastewater irrigation application to land. Concentrations of contaminants in soil and groundwater resources remain relatively consistent and low.

As noted, the new treatment facility would necessitate the disposal of biosolids to land and to an on-site monofill as a contingency option. Prior to land disposal, the biosolids will be dewatered to mitigate against water logging, ponding and nutrient runoff. The leaching of nitrogen is a key concern with respect to the application of biosolids to land, as this could give rise to adverse effects on the groundwater and surface water resources, and will require application rates consistent with maintaining sustainable biosolids nitrogen loading rate. A proposed biosolids nitrogen loading rate of 250kg N/ha/yr or a plant available nitrogen rate of 140kg N/ha/yr has been derived as being appropriate. This would likely result in a nitrogen leaching rate of approximately 13kg N/ha/yr, which is

equivalent to the nitrogen leaching rate from sheep grazed pastures, and is therefore not anticipated to give rise to adverse effects on groundwater.

10.6.1.9 Land and Soil Policies

Policy 31A seeks to match the level of management that is required for discharges of contaminants to land to the level of environmental risk that is posed by the following risk factors:

(a) Nature and quantity of contaminants in the discharge;
(b) Sloping land;
(c) Soils with artificial drainage or coarse structures;
(d) Soils with impeded drainage or low infiltration rates;
(e) Well drained soils;
(f) Climate;
(g) Proximity to groundwater;
(h) Proximity to surface water;
(i) Soil's current physical, chemical and biological characteristics and its potential to leach nutrients; and
(j) Natural hazards (for example, flooding and erosion).

Policy 31C seeks to manage discharge of contaminants to land to avoid, remedy or mitigate adverse effects, including on:

(a) Soil quality;
(b) Amenity values;
(c) Habitats, ecosystems and indigenous biological diversity ;
(d) Historic heritage, cultural and traditional values;
(e) Natural character; and
(f) Outstanding natural features.

As set out above, long term soil and groundwater monitoring has confirmed that there are no adverse effects that are directly attributable to the application of wastewater to land. It is therefore recommended that the current management regime, and application rates of irrigated wastewater to certain areas of Alliance's land continues, coupled with an ongoing obligation to monitor soil and groundwater resources. In addition, it is proposed that if the groundwater monitoring shows that any two consecutive samples record a nitrate-nitrogen concentration of greater than 6.9g/m^3 when it was not recorded in the control upstream bore, Alliance shall be required to investigate the likely cause, notify the council and implement mitigation or remedial measures if necessary.

The application of biosolids is to be managed via the preparation of a Biosolids Management Plan that will include a description of the biosolids generation, volumes and land application details (ie. nitrogen loads) to ensure adverse effects do not arise. The plan will also describe the managerial procedures to ensure the biosolid spreading does not give rise to adverse odour effects beyond the site boundary. This plan will be coupled with soil and groundwater monitoring and

report requirements, as well as the same groundwater trigger and actions set out above.

The approach proposed by Alliance in managing its ongoing and future discharges to land is considered to be commensurate with the likely environmental risk, and is appropriate to avoid, remedy or mitigate adverse effects on the receiving environment.

10.6.1.10 River and Lake Bed Policies

Alliance is also seeking consent to enable channel maintenance and clearance associated with its water intake structure. Policy 32 is relevant as this seeks to manage bed disturbance activities in the beds of rivers and lakes, to avoid, remedy or mitigate adverse effects on:

(a) Water quality and quantity;

(b) Habitats, ecosystems and fish passage where this is normally expected to occur;

(c) Indigenous biological diversity;

(d) Historic heritage, and the spiritual and cultural values and beliefs of the tangata whenua;

(e) Public access (except in circumstances where public health and safety are at risk) and amenity values;

(f) Natural character and outstanding natural features;

(g) River morphology and dynamics, including erosion and sedimentation;

(h) Flood risk;

(i) Infrastructural assets; and

(j) Navigational safety

The water take structure is positioned at the head of a large embayment area. The channel is not subject to the scouring effects of floods and is likely to be a depositional zone for sediment and debris during such events, and as such, supports abundant macrophyte growth. The efficacy of the intake structure can be adversely affected by the accumulation of such material and as such it is necessary to undertake channel clearance activities from time to time. It is noted that the removal of macrophytes and sediment has the potential to disturb the bed of the channel affecting benthic communities and habitat for eels. In order to manage the potential adverse effects, Alliance proposes to schedule all planned maintenance work to occur outside the period 1 October to 31 August of each year to avoid key fish spawning and migration seasons. Other measures to avoid or mitigate adverse effects include:

- Keeping the affected work area of a practicable minimum;
- Ensuring all plant and machinery is cleaned so it is free of weeds and other pest species;
- The removal of any material from the channel does not result in the passage of fish being impeded, and nor does it result in fish or eel stranding within the channel or on the riverbanks; and

- Checking the channel prior to work commencing for the presence of eels, and if found, removing and returning them to the main stem of the Oreti River.

10.6.2 Southland Regional Air Quality Plan

10.6.2.1 General Objectives and Policies

The general objectives and policies of the Air Plan relate to ambient air quality and seek to maintain good ambient air quality for Southland by having regard to ambient air quality guidelines[22]. The coal fired boilers emit particulates (PM_{10}, $PM_{2.5}$), nitrogen dioxide/oxide, sulphur dioxide, dioxins and heavy metals into the air. The assessments in **Appendices E and M** attached describes how the relevant national standards, guidelines and regional requirements have been used to determine the assessment criteria and consideration of adverse effects arising from the proposed discharges to air from the coal fired boilers. The key findings of the assessment are that all cumulative ambient contaminant concentrations in the air discharges readily achieve compliance with the relevant national standards and guidelines for air quality beyond the site boundary and at locations of existing sensitive receptors.

Policy 4.3.2 requires the measurement of ambient air quality. The explanatory text notes that this policy is directed at the regional council to ensure that ambient air quality sampling is undertaken, and the maintenance of a database as part of its state of the environment monitoring under the RMA. As part of the assessment in **Appendix M** attached, it is recommended that Alliance discontinues current stack testing, and instead relies on more comprehensive ambient monitoring data for PM_{10}. This will provide Alliance and the council with greater understanding of the effects of the boiler discharges on ambient air quality, which is consistent with the intent of Policy 4.3.2.

Policies 4.3.4 and 4.3.5 seek to promote the enhancement of ambient air quality in areas where it has been degraded, and to protect ambient air quality throughout the Southland Region. As noted above, modelling and monitoring of the effects of the coal fired boiler air discharges has been undertaken, and compliance with the relevant national and regional ambient air quality standards is achieved. The assessment concludes therefore that for all contaminants, with the exception of particulates, achieving compliance with the standards and guidelines indicates that an appropriate level of protection for human health and the environment is achieved.

The assessment also indicates that PM_{10} discharges generally comply with the national guidelines for ambient particulate concentrations, however because compliance with these thresholds is achieved, the assessment states that this does not ensure only minor, or less than minor effects on human health. This is because PM_{10} does not have an established threshold concentration below which there are only minor or no observable adverse effects on human health. It is therefore recommended that Alliance seek to reduce boiler particulate emissions to achieve a flow weighted PM_{10} limit of 250mg/m^3 (corrected to 12 vol.% CO_2) in the discharge within five years. This would ensure that the best performance of

[22] Objective 4.2.1 and Policy 4.3.1.

the control systems for managing particulate emissions is achieved, and potential health effects arising from potential exposure to particulate emissions are as low as is reasonably achievable. This is considered to be consistent with relevant policies which seek to enhance and protect ambient air quality.

10.6.2.2 Air Discharges from Industrial and Trade Premises

The objectives which relate to the management of discharges of contaminants into air from industrial and trade premises (or processes) seek to avoid, remedy or mitigate any adverse effects upon the environment from such discharges[23]. Objective 5.2.2 seeks to ensure that Maori cultural and traditional beliefs are recognised and provided for when dealing with discharges of contaminants into air.

Relevant policies seek to protect the environment from adverse effects from the discharge of contaminants into air from industrial or trade premises. Policy 5.3.2 requires the upgrading or change in process of existing industrial and trade processes where they are having significant adverse effects on ambient air quality. Policy 5.3.5 seeks to recognise Maori cultural and traditional values with regard to the air environment and ensure that these are taken into account with regard to discharges to air from industrial or trade premises.

As noted above, it is considered that compliance with the national standards and guidelines for ambient air quality for all contaminants emitted from the coal fired boilers, with the exception of particulates, will ensure that adverse effects on human health and the environment are minor or less. Air discharges from the coal fired boilers are also mitigated by the stack height, coal quality, operational measures and the buffer distance between the boilers and any sensitive receptors.

Particulate emissions from the coal fired boilers will be managed via a requirement to reduce flow weighted PM_{10} discharge concentrations to 250mg/m^3 within five years. This is considered to represent the best practicable option with respect to particulate emissions control. Alliance will also undertake periodic technology reviews so as to be well informed of the best practicable option in the future for further mitigating PM_{10} and $PM_{2.5}$ emissions. This is considered to be consistent with relevant objectives and policies.

Consultation with iwi has occurred with regard to both the proposed wastewater discharges and discharges to air. No significant concerns have been raised with respect to the proposed air discharges with respect to cultural effects.

10.6.2.3 Odour

Objective 7.2.1 seeks to protect the health of people and communities from any adverse effects from odour discharges. Objective 7.2.2 seeks to protect areas of cultural and amenity value from any adverse effects from odour discharges.

[23] Objective 5.2.1.

Policies seek to avoid, remedy or mitigate the impact on the health of people, communities and on areas of cultural and amenity value from offensive or objectionable odours.

The assessment in **Appendix F** attached determines that there are a number of activities undertaken by Alliance which could give rise to potential odours. Overall, it is concluded that these odours are sufficiently controlled with appropriate operational procedures and technology employed by Alliance, coupled with the buffer distance of the Plant from any sensitive receptor. These factors assist in avoiding or mitigating any objectionable or offensive adverse effects arising from potential odour emissions. It is also anticipated that the wastewater treatment upgrade, including the separation of waste streams and further treatment, will further assist in mitigating potential on-site odour effects.

To ensure odours are appropriately managed after the wastewater upgrade, including the disposal of biosolids to land, Alliance will prepare a Wastewater Treatment Odour Control Plan. The purpose of this plan will be to ensure that any adverse effects on sensitive receptors arising from discharges from the wastewater treatment upgrade are appropriately avoided, remedied or mitigated. It shall include a description of the nature of the odours that might arise from the upgrade and set out the methods in which to avoid, remedy or mitigate any potential odour sources, including the storage and application of biosolids and the design of monofill sites.

10.6.3 Southland Proposed Regional Air Plan

Objectives 2.1 to 2.3 relate to ambient air quality. These objectives seek to maintain and enhance ambient air quality in Southland where ambient air quality is high, and improve air quality in areas where concentrations of contaminants exceed NESAQ. Associated polices primarily relate to domestic home heating and outdoor burning and are therefore not relevant to this application. As set out above, the modelling and monitoring assessment (refer **Appendix M** attached) has confirmed that the proposed discharges to air from the coal fired boilers will not, either on an individual or cumulative basis, exceed the air quality standards set out within the relevant national standard or guidelines.

Localised, area specific air quality is addressed via Objective 2.4, which aims to avoid, remedy or mitigate any adverse effects upon the localised air quality environment (including health, nuisance and amenity effects) from the discharge of contaminants to air. Policy 3.9 requires activities that result in odorous discharges to mitigate emissions or provide buffer zones to avoid offensive or objectionable odour beyond the property boundary. The assessment of actual and potential odours (refer **Appendix G** attached) has determined that there are no adverse effects arising from odours that are more than minor, and a key mitigating factor is the distance between the Plant activities and any sensitive receptors.

Policy 12 imposes a general obligation that any discharge of contaminants to air avoid, remedy or mitigate adverse effects on:

(a) The receiving environment

(b) Human health and wellbeing

(c) Cultural, spiritual and traditional values

(d) Water quality

Air discharges from the coal fired boilers are mitigated by the stack height, selected coal quality, operational measures and the buffer distance between the boilers and any sensitive receptors. Potential odour emissions are also either avoided, or mitigated through operational procedures, odour eliminating technology and again the buffer distance between the Plant activities and any sensitive receptors.

Policy 13 requires applications that seek to discharge contaminants to air, to comply with the NESAQ and have regard to the appropriate ambient air quality guidelines.

As discussed earlier, it has been confirmed that the proposed discharges to air from the coal fired boilers will comply with the relevant national standards and guidelines. Alliance is also committed to adhering to the best practicable option with regard to particulate emission control, and is proposing to reduce flow weighted PM_{10} discharge concentrations to 250mg/m^3 within five years of any consent being granted. This will further assist to mitigate any potential adverse effects on the receiving environment and human health, consistent with the objectives and policies of the Proposed Air Plan.

Policy 15 of the Proposed Air Plan seeks to discourage the establishment of sensitive activities near existing activities that discharge to air, unless the new activity can avoid or mitigate the adverse effects of the existing discharge[24]. As discussed earlier, there is a reasonably large buffer area between the Plant's operations and processes and any sensitive land use activities, and this acts to mitigate any potential adverse effects arising from discharges to air and odours. This policy seeks to protect existing activities that discharge to air, and given this, it is likely that this buffer area will remain in the long term.

10.6.4 Southland Regional Effluent Land Application Plan

Relevant objectives of the Effluent Plan seek to ensure that water quality and the life supporting capacity of the soil and water ecosystems are safeguarded from the adverse effects of discharges of effluent and sludge onto or into land, and where it may enter water[25]. Other objectives seek to recognise and provide for the relationship of tangata whenua with ancestral sites, wahi tapu and other taoka, and to ensure that effluent or sludge discharges onto or into land do not adversely affect areas of significant indigenous vegetation and significant habitats of indigenous fauna[26].

Relevant policies seek to protect the sustainability of the soil ecosystem from adverse effects of effluent and sludge discharges onto or into land, and seek to

[24] It is noted that the decisions version of the Proposed Air Plan has sought to delete this policy, however it is understood that this is subject to an appeal.

[25] Objectives 4.1.1 and 4.1.2.

[26] Objectives 4.1.5 and 4.1.6.

utilise land treatment of effluent and sludge where this can be undertaken in a sustainable manner and without significant adverse effects[27]. Policy 4.2.3 seeks to avoid, where practicable, remedy or mitigate adverse effects on water quality, water ecosystems and potability from effluent and sludge discharges onto or into land. Policy 4.2.7 seeks to promote good practice and regular maintenance of effluent and sludge systems. Policy 4.2.8 seeks to recognise and provide for tangata whenua concerns related to the discharge of effluent and sludge onto or into land.

Other policies seek to avoid, where practicable, remedy or mitigate any adverse effects on amenity values from discharges of effluent or sludge systems onto or into land[28].

As part of the current wastewater treatment, Alliance discharges a portion of its treated wastewater to land. The effects of the wastewater irrigation application to land are well understood, as monitoring of the soil and groundwater resources has been undertaken since 2001. The results of this monitoring are reported in an annual report which is submitted to Environment Southland. The latest annual monitoring report indicates that there have been no significant adverse effects on the environment that can be clearly attributed to wastewater irrigation application to land. Over the monitoring period, concentrations of contaminants in soil and groundwater resources remain relatively consistent and low. The monitoring indicates that the Zone 1 soil remains in good condition. Zone 2 soils, which are poorly draining soils, are to be avoided where practicable.

Alliance is proposing to upgrade its existing wastewater treatment facility. The new treatment facility would necessitate the disposal of biosolids to land and to an on-site monofill as a contingency option. Prior to land disposal, the biosolids will be dewatered to mitigate against water logging, ponding and nutrient runoff. The leaching of nitrogen is a key concern with respect to the application of biosolids to land, as this could give rise to adverse effects on the groundwater and surface water resources, and will require application rates consistent with maintaining sustainable biosolids nitrogen loading rate. A proposed biosolids nitrogen loading rate of 250kg N/ha/yr or a plant available nitrogen rate of 140kg N/ha/yr has been derived as being appropriate. This would likely result in a nitrogen leaching rate of approximately 13kg N/ha/yr, which is equivalent to the nitrogen leaching rate from sheep grazed pastures.

Amenity effects (ie. odour) arising from the discharge of biosolids to land will be managed via the adoption of measures such as restrictions on storage times.

10.6.5 Southland Regional Coastal Plan

Section 3.8 of the Coastal Plan sets out the values of identified areas within the coastal marine area. The New River Estuary is among these areas. The Coastal Plan sets out that the New River Estuary is the largest estuary in Southland and that it has been significantly modified. However, despite this modification the estuary still provides considerable environmental, social and economic benefits

[27] Policies 4.2.1 and 4.2.2.
[28] Policy 4.2.9.

to Invercargill and the wider region. The Coastal Plan identifies that the estuary is rated as a nationally important habitat for wader bird species, as well as a nationally important nursery area for numerous fish and invertebrate species, including galaxiids and toheroa. The Coastal Plan also identifies that the estuary holds a number of heritage and archaeological values. The estuary is part of the Awarua Plains wetland complex, which is identified in the Coastal Plan as the most important habitat for birds in Southland. The estuary also provides extensive rearing and spawning habitat for marine and freshwater species, including native fish such as the giant kokopu, lamprey and the long finned eel.

The Coastal Plan also identifies the principal issues that are affecting the New River Estuary. Poor water quality is listed among the issues identified.

There are specific objectives and policies relating to estuaries in the Coastal Plan. Objective 6.1.1 seeks to maintain and enhance the natural values of estuarine areas and Policy 6.1.1 seeks to protect the uniqueness of estuarine ecosystems. Policies also seek to recognise and protect the values that estuaries provide and to protect the cumulative habitat value of the New River Estuary and others to bird species[29].

Objective 6.2.1 is specific to the New River Estuary and seeks to maintain and enhance those values that contribute to the mauri of the estuary and provide for its use as:

- A city playground (recreational values);
- A symbol for Invercargill (amenity, visual values);
- A significant habitat;
- A retreat for families to escape the pressures of the city and an opportunity to experience a natural setting;
- A place of learning (heritage values, natural ecosystem values);
- A food basket (recreational fishing and shellfish gathering);
- An opportunity for commercial use; and
- A place with historical and geological values.

Policy 6.2.1 seeks to maintain and enhance the natural character of the New River Estuary. The explanatory text notes that, although the estuary is a modified ecosystem, it still retains a diverse range of values for the people and vegetation and fauna of Southland.

As set out above, Alliance's wastewater discharge is a contributor to the nitrogen loading within the New River Estuary. The proposed wastewater treatment upgrade is likely to significantly improve the quality of the discharge and immediate receiving river environment. However, in order to achieve an improvement in the quality of the New River Estuary, a catchment-wide approach to water quality improvement is necessary.

[29] Policies 6.1.3 and 6.1.4.

10.7 DISTRICT PLANS

10.7.1 Southland District Plan

The Plant is located within the Industrial Zone of the Southland District. The objectives relating to this zone seek that subdivision, land use and development occurs in an integrated and sustainable manner. Policy IND.1 seeks to recognise the benefits of locating industrial activity within the Industrial Zone. Policy IND.2 seeks to recognise and provide for the growth and development of industrial activities within the Industrial Zone, while avoiding, remedying or mitigating adverse effects on the environment.

The positive effects arising from the continued operation of the Plant are significant and this is recognised by the objectives and policies of the Industrial Zone. Alliance is committed to ensuring that potential or actual adverse effects arising from its operations and activities are appropriately avoided, mitigated or remedied, and a range of measures and monitoring is proposed to ensure that this is the case. Key mitigation, particularly for amenity related matters (ie. noise, odour) is the appropriate location of the Plant, and provision of appropriate buffers, operational measures and mitigation to reduce potential environmental effects on adjacent land use activities.

The Plan also contains district wide objectives and policies, including provisions that are relevant to the Plant operations: tangata whenua, biodiversity, waste, contaminated land and hazardous substances. With respect to these matters, the following assessment is made:

- As determined earlier, Alliance has recognised the relationship that iwi has with the land, water and air and has engaged iwi via consultation and a cultural values report in order to understand the potential or actual effects on these cultural values. As a result, Alliance has worked with Te Ao Marama to develop an appropriate response in terms of mitigation, including adherence to water quality limits, a commitment to upgrade its wastewater system, and the preparation and implementation of a Habitat Enhancement Management Plan.
- The assessments demonstrate that the Plant's activities do not adversely affect the overall life supporting capacity of ecosystems in which it operates.
- As set out above, Alliance is committed to maintaining and improving, in the long term, the quality of its discharges and impacts on the receiving environments, land, air and water.
- Solid waste generated from the Plant's operations and activities is managed in an appropriate way so as to minimise any adverse effects arising on human health and the environment.

10.7.2 Invercargill City District Plan

The relevant objectives and policies within the ICC Operative District Plan relate to recognising and providing for manawhenua; preserving the natural character of wetlands and rivers; and maintaining and enhancing amenity values. It is considered that the proposal is consistent with achieving these matters on the basis that:

- Cultural values have been recognised and provided for by Alliance in assessing the effects of its discharges and activities, and engagement with iwi has resulted in a mitigation package which also addresses cultural effects.
- Alliance is committed, through appropriate limit setting, to an assurance that the current quality of its discharge to water and land will not deteriorate. This will ensure that the life supporting capacity of the soil, water and air resources will be sustained. The existing natural character of the river in terms of its water quality and amenity values will also be maintained, and through Plant upgrades, now and in the future, it will be enhanced.
- Potential effects on amenity values arising from discharges of odour will be managed through onsite operational procedures, mitigation and maintenance of the buffer distance between on-site activities and sensitive receptors.

In terms of the Proposed District Plan, relevant objectives and policies relate to biodiversity, management of outstanding natural features (New River Estuary), management of the city's soils, water quality, and matters relating to the rural zone.

Objectives and policies seek to maintain, restore, and where appropriate, enhance indigenous vegetation and habitats and indigenous biodiversity values, to encourage and support biodiversity initiatives. As noted above, the assessments have determined that the current discharges from the Plant to land, air and water, and abstraction from the Oreti River, are not having an adverse effects on existing ecosystems and the overall life supporting capacity of such systems. However, Alliance is committed to maintaining and improving the quality of its discharges to water in the long term, and this is likely to have a positive effect on the overall ecological functioning in the immediate receiving environment of the Makarewa River. Alliance is also proposing to prepare and implement a site-wide Habitat Enhancement Management Plan which will seek to identify and enhance ecosystems and biodiversity values throughout the Plant's property.

The Proposed District Plan identifies the New River Estuary as being an outstanding natural feature, and policies seek to provide for the protection of such features from activities that could adversely affect their intrinsic value and identity, and associated vegetation and habitats. The Proposed District Plan also seeks that water quality is not significantly adversely affected by land use, development and subdivision activities.

The value of the New River Estuary to the region has been recognised in the assessment, and it is noted that over time the water quality of the New River Estuary has been deteriorating. The assessment determines that the main contributors to water quality are upstream land uses and non-point diffuse discharges to land and water. Although Alliance is proposing a significant improvement in water quality arising from its discharges, this will not have any significant impact on the water quality within the New River Estuary, unless it is undertaken as part of an overall catchment-wide initiative to improve water

quality. It is likely therefore that an improvement might be achieved as a result of the development and implementation of the regional objectives for water quality. Given this, it is considered that Alliance's commitment to ensuring the existing quality of its discharge, and the receiving river is maintained and improved in the longer term, is consistent with protecting the outstanding values of the New River Estuary.

Objectives and policies also seek that Invercargill's soils is managed sustainably and that on-site wastewater disposal systems are designed, sited, operated and maintained in such a way to avoid adverse environmental and public health effects. The existing and proposed level of treatment for wastewater, the location of the Plant and the operational procedures are considered to be appropriate, and suitably manages any adverse effects on the environment and human health, to a point where they are minor or less.

Rural Zone objectives and policies seek that the amenity values of the Rural Zone are maintained and enhanced, and seek to provide for rural activities to establish and operate, and to avoid the adverse effects of non-rural activities on the character and amenity of the Rural Zone. As noted earlier, part of Alliance's land holdings are within the jurisdiction of the ICC. The surrounding land is zoned for rural purposes. As noted, Alliance is seeking via a submission on the Proposed District Plan, that its land within the ICC boundary be rezoned for industrial purposes, as this would better recognise the existing use of this land and provide for cross boundary consistency between the Southland District and ICC boundary, which currently runs through the site.

It is noted that although the land is used as part of the overall industrial operations and activities (ie. the disposal of wastewater to land), it does continue to appear to be rural in character. The potential adverse effects of using this land as part of the industrial activity which relate to odour, runoff from irrigation, effects on soil and groundwater, are also suitably managed, as has been discussed earlier, and do not compromise the surrounding rural character and amenity values.

10.8 OTHER RELEVANT MATTERS

The relevant other matters have been identified in section 5. An assessment of these is provided below.

10.8.1 ANZECC Guidelines

As set out in **Appendix D** attached, the ANZECC guidelines values have been taken into account when developing and undertaking the assessment of the discharge on aquatic ecosystem and water quality values of the Makarewa River. The site-specific standards that have been derived as indicators of ecosystem health and water quality within the Makarewa River have had specific regard to the ANZECC guidelines values, particularly with respect to the development of the Amm-N target. This is discussed in **Appendix K** attached. The ANZECC guidelines have therefore been used to inform the assessment and this is considered appropriate given the nature and intent of these guidelines.

10.8.2 AAQG and other Air Quality Guidelines

The three main regulations that have relevance with respect to the assessment of air quality are:

- National Environmental Standard for Air Quality;
- The AAQGs; and
- The Regional Ambient Air Quality Targets for Southland.

There are also international standards and guidelines for managing air quality.

The Ministry for the Environment provides recommendations as to which assessment criteria take precedence. This is as follows:

(a) National environmental standards for air quality;

(b) National ambient air quality guidelines;

(c) Regional provisions (unless more stringent than national requirements);

(d) World Health Organisation (WHO) air quality guidelines; and

(e) Other international air quality criteria including Californian Office reference levels and guidelines from the Texas Commission of Environment Quality.

The Air Quality NES has been discussed above. The AAQGs have similar limits to the Air Quality NES, but also include guidelines that are additional, including a 24 hour NO_2 (100µg/m^3) and an annual PM_{10} guideline of 20µg/m^3. The relevant limits within the AAQG have been taken into account when assessing the impacts of the Plant's coal fired boiler discharges to air. The assessment, as set out earlier, has determined that compliance with the AAQG for all contaminants is achieved. As set out in **Appendix M** attached, the assessment of air quality has also taken into account international criteria and limits, and applied these where appropriate.

10.8.3 Proposed Conservation Management Strategy (CMS)

The value of the New River Estuary is identified in the CMS. It is recognised in the assessment of water quality and ecology (refer **Appendix K** attached) that the New River Estuary is the ultimate receiving enviroment for the Plant's discharge to water. The assessment has demonstrated that the water quality of the New River Estuary is deteriorating, and as acknowledged in the CMS, this is largely due to surrounding and upstream land use intensification and development pressures.

Maintenance of existing values of the estuary and an improvement to the water quality is an ultimate objective of the CMS. Alliance is aware of this and is proposing to upgrade its wastewater treatment system in order to improve the quality of its wastewater discharge to the Makarewa River, particularly with regard to ammonia. It is proposed to align this improvement with the preparation and implementation of the regional objectives which will seek an overall improvement in water quality in the wider catchment. This is considered to be consistent with the intent of the CMS which seeks to protect and enhance the values of the New River Estuary.

10.8.4 Ngai Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan 2008

There is an overarching theme within the Iwi Management Plan which seeks to adopt a collaborative, holistic approach to the management of activities affecting cultural resources (land, water and air), particularly for industry activities. Alliance has engaged with iwi in order to identify the effects of its activities and discharges on cultural values through the preparation of the Cultural Values Report, and consutlation as part of the TWP on a one-on-one basis with iwi represenatives. Mitigation to address effects on cultural values identified through this process as set out in **Table 16**, has been developed in consultation with iwi.

The Cultural Values Report (refer **Appendix C** attached) has identified the aim of the policies contained wihtin the Iwi Management Plan with respect to wastewater management and water quality. There is an expectation within the Iwi Management Plan that wastewater disposal practice will improve over time with the adoption of improved technology. With regard to water quality, there is a focus on improving water quality,and striving to achieve the highest possible standards, whilst still being effective and practical. There is a preference in the Iwi Management Plan for discharges of wastewater to land, rather than water, and preference for shorter duration consent terms. The Iwi Management Plan also contains a number of policies relating to water quantity which seek to protect the instream values of waterways through the appropriate management of abstractions.

As set out above, Alliance is committed to ensuring that the current quality of the discharge and receiving water is maintained in the short term, and is improved overtime through the adoption of a wastewater treatment upgrade. A thorough evaluation of alternatives, including complete land disposal, has been considered in landing on this option. A habitat enhancement plan is also proposed that will identify areas with the property that hold ecological value, and can be enhanced in order to further mitigate the effects of the wastewater discharge and abstraction from the Oreti River. This will be developed and implemented with Te Ao Marama.

With regard to air discharges, the Iwi Management Plan also promotes the review and adoption, where practicable, of new technology in order to reduce adverse effects on air quality. As set out above, Alliance is also comitted to reducing its particulate emissions within five years, and will undertake periodic reviews of technology to ensure it is adopting the best practicable option with regard to air quality mangement for the Plant and surrounding area.

Overall it is considered that Alliance has had appropriate regard to the relevant matters contained in the Iwi Management Plan, and this is reflected in the mitigation that has been developed in consultation with iwi in order to address the effects on cultural values.

10.9 SECTION 105

Section 105(1) of the RMA sets out the matters that a consent authority must have regard to when considering a resource consent application for a discharge permit. In particular, consideration needs to be given to the nature of the discharge and the sensitivity of the receiving environment to adverse effects, the Applicant's reasons for the proposed choice, as well as any possible alternative methods of discharge, including discharge into any receiving environment.

The discharges to air, land and water arise from the activities on-site and operation of the Plant. The discharge of treated wastewater also comprises effluent from the nearby Wallacetown community. The discharge's characteristics have been described earlier in this report, and in detail in the technical assessments that are attached to this report.

In terms of the sensitivity of the receiving environment, the Plant is located in an appropriately zoned industrial area of the Southland District. The surrounding area is zoned for rural purposes, and a buffer exists between the on-site activities and any sensitive off-site receptors. This is a key mitigation method for air discharges and associated potential amenity effects. The discharges either on an individual basis, or a cumulative basis, do not exceed any national or regional air standard or guideline. However, as outlined above, Alliance is committed to reducing its particulate emissions.

The nature of the soils surrounding the Plant limits the extent to which discharges to land can occur. Therefore, only a limited amount of the treated wastewater can be discharged to land via irrigation, and only to certain areas of the property where the soil type is appropriate and it is conducted at a sustainable nitrogen loading rate.

The majority of the treated wastewater is discharged to the Makarewa River. The nature of the receiving environment has been described earlier and in detail in **Appendix D** attached. This observes that the lower Makarewa River is characteristic of a lowland river environment, and while there are elevated nutrient concentrations, the river still exhibits a reasonable degree of ecological health. This indicates that the species are tolerant of the nature of the existing environment, including the effects of the existing discharge from the Plant. It has been identified, however, that the current discharge quality cannot achieve the national and possibly the likely regional water quality limits for ammonia. Given this, it is proposed to upgrade the wastewater treatment system in order to achieve a measurable reduction in ammonia within the receiving environment. This is likely to have a positive effect on species sensitive to ammonia toxicity.

Alliance is proposing a reduction in particulate emissions from its coal fired boilers within five years, and a progressive upgrade to its wastewater system in order to reduce the contaminant loads within its discharges to water and land. These measures are considered to represent the best practicable option, as they take into account the actual effects on the receiving environment, and significant costs associated with upgrading the existing on-site technology.

10.10 SECTION 107

Section 107 of the RMA places a restriction on the grant of discharge permits to water if, after reasonable mixing, the contaminant or water discharged is likely to give rise to all or any of the following effects in the receiving waters:

(a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

(b) Any conspicuous change in the colour or visual clarity;

(c) Any emissions of objectionable odour;

(d) The rendering of freshwater unsuitable for consumption by farm animals;

(e) Any significant adverse effects on aquatic life.

It is not considered that the proposed discharges to water and to land will give rise to any of the effects listed above. This is on the basis that the assessment has determined that the discharges of treated wastewater to water, after reasonable mixing will result in the following:

- Dissolved oxygen concentrations in the immediate vicinity of the discharge are at times lowered by the discharge but not to a level that would impact on most invertebrates or fish.
- The TSS load to the river and estuary from point sources is very low and the contribution the discharge makes to sedimentation is insignificant.
- The tidal section of the lower Makarewa River, which includes the region where the discharge occurs, is unsuitable for periphyton growths because of unsuitable substrate and physical characteristics and any potential effect of the discharge on periphyton is assessed as minor.
- The habitat in the tidally influenced section of the Makarewa River is also not suitable for the mayfly *Deleatidium*. The macroinvertebrate community and MCI score at the monitoring site within the mixing zone, is similar to other Southland tidally influenced river sites. Given the highly modified state of the habitat, poor background water quality, and the dominance of water and habitat tolerant taxa within the Makarewa River (including around the discharge), the effect of the discharge on benthic invertebrates is not assessed as significant.
- Monitoring demonstrates that fish species and abundance in the Makarewa and Oreti Rivers are typical of lowland rivers, and despite the highly modified habitat, support moderate to high native fish diversity, a whitebait fishery and a locally significant trout fishery.
- There are no measurable adverse toxicity effects arising that are directly attributable to the discharge.
- The discharge can reduce visual clarity downstream, however because the Makarewa River is already characterised as being of low visual clarity, the change is not considered to be conspicuous, and an allowable reduction of no more than 33% is proposed to manage this.
- Foams occur at times in the Makarewa River below the discharge, however they have also been observed upstream of the Plant. It is likely however that a contributing factor to the generation of foams was the physical

delivery of the discharge to the Makarewa River. Modifications to the outfall structures have been implemented and these have been successful in reducing the amount of foam created by the discharge structure. Ongoing monitoring will be undertaken to ensure that this remains the case.

- Provisions are in place during emergency situations where discharge of the treated wastewater cannot be made to the river due to issues of low flow and quality.

Channel maintenance work associated with the Oreti intake structure may give rise to potential sediment discharges, however the work is relatively minor and will be contained within the intake embayment area. These works will therefore not give rise to any of the matters identified above, beyond a reasonable mixing area.

The assessment and mitigation that is proposed ensure that the matters identified in section 107 are not triggered, and further evaluation of the tests in section 107(2)(b) is not required.

10.11 OVERALL PART 2 EVALUATION

Section 104(1)(b) of the RMA sets out the planning documents that decision makers are required to have regard to when considering an application for resource consent. Any such consideration is, however, subject to Part 2 of the RMA which sets out the purpose and principles of the RMA. This is described in section 5 to this report.

The promotion of sustainable management often requires a balance between competing resource values and the benefits and adverse effects associated with a proposal.

In terms of section 5 of the RMA, enabling the ongoing operation, maintenance and upgrading of the Plant will enable people and communities to provide for their social, economic and cultural wellbeing and for their health and safety, by:

- Providing for the economic wellbeing and growth of the Southland Region by contributing the following direct and indirect economic benefits including:
  - Employment.
  - Shareholder returns.
  - Effects on suppliers of goods and services within the region.
  - Other contributions made by the company within the region – sponsorships, donations.
- Providing community and social benefits including:
  - Economic resilience.
  - Efficiencies with existing rural and agricultural sector in Southland, having an experienced workforce, and proximity of the Plant to established infrastructure (eg. road networks).
  - Providing a vital service to the Southland agricultural sector.

- Providing a treatment and disposal facility for domestic effluent generated by Wallacetown.

- Recognising the significant investment that exists with respect to the existing Plant equipment and activities.

In balancing these considerations with the matters in section 5(2)(a)–(c) of the RMA, the following conclusions are derived:

- In terms of sustaining the potential of natural and physical resources for future generations, enabling the Plant to continue to operate will recognise the significant positive community and economic benefits, and recognise that the current operation is not adversely affecting the existing environment, and mitigation in the form of Plant upgrades in particular, will ensure that the operation of the Plant is sustainable in the long term.
- The ongoing operation and upgrading of the Plant will safeguard the life supporting capacity:
  - Of air, by complying on an individual and cumulative basis with national and regional air quality standards, and by implementing a measurable reduction in particulate emissions to further protect human health and safety;
  - Of water, by achieving discharge and water quality limits that have been deemed appropriate to continue to support the ecological and biological characteristics of the receiving water environments, and by implementing a progressive upgrade in order to reduce ammonia and achieve national and future regional water quality standards.
  - Of soils, by managing discharges to land so that vulnerable soils are avoided, and by ensuring that the discharges to land adopt a sustainable nitrogen loading rate. Ongoing management and monitoring of discharges to land is also proposed.
  - Of ecosystems, by understanding the sensitivity of the receiving ecosystems and managing the discharges in particular, in order to achieve the appropriate water quality and ecosystem limits. Adopting a holistic approach to the management of potential effects of the Plant operation and implementing, where appropriate, a programme to enhance on-site habitats and ecosystems values (ie. riparian margins).
- Measures to avoid, remedy or mitigate potential or actual adverse effects arising from the ongoing operation of the Plant have been identified. These are set out in **Table 16** and will be achieved via the implementation of appropriate conditions (refer **Appendix V**).

The ongoing operation of the Plant also provides for the matters in section 6 of the RMA, particularly in the following aspects:

- The Makarewa River is a highly modified river with substantially reduced natural character. The assessment has determined that overall the discharge is not adversely affecting the existing water quality and ecosystem health, which are components of natural character. In the long term the proposed upgrade will improve the water quality and ecosystem health within the immediate riverine environment.

- The effects of the proposed water abstraction from the Oreti River are considered to be minor, and will therefore not have any significant impact on the existing natural character of the river in terms of its hydrological functions, water quality and ecosystem health.
- The New River Estuary has been identified as an outstanding natural feature. The values for which it is considered to be significant (i.e. waterfowl), will not be directly impacted upon as a result of the ongoing operation of the Plant. Water quality in the New River Estuary is declining, and Alliance is committed, through its proposed upgrade, to contribute to any catchment-wide initiatives to make improvements in this regard.
- Aside from the New River Estuary, the assessments have not found there to be any significant indigenous vegetation or significant habitats within the immediate receiving environment of the Plant. That said, the mitigation including the Plant upgrade is likely to result in improvements in water quality and habitat within the immediate Makarewa River environment, and an improvement in downstream sites, such as the New River Estuary, could be achieved as a result of an overall catchment-wide initiative.
- The existing level of public access to and around the rivers within the vicinity of the Plant will not be affected by the activities proposed.
- The relationship with Maori and their culture and traditions with their ancestral lands, water, sites, Wahi tapu, and other taonga has been recognised by Alliance through the engagement with Te Ao Marama, the preparation of the cultural values report, and the development of mitigation measures in response to any potential cultural effects.
- The activities do not impact on historic heritage or any recognised customary rights.

In preparing the applications particular regard has been given to, and has appropriately responded to the matters in sections 7 and 8 of the RMA, as follows:

- The kaitiakitanga of tangata whenua has been recognised in seeking the preparation of a cultural values report and engagement with Te Ao Marama.
- The ethic of stewardship has been recognised through:
    - Engagement with and participation of tangata whenua in the TWP and through consultation;
    - Engagement with key stakeholders (DoC, Fish and Game) who have specific interest in, and who have exercised stewardship over, particular resources.
- There are a number of efficiency benefits including:
    - The Plant is existing, and there is significant investment costs in the location and equipment at the site;
    - The Plant has access to a skilled labour force of sufficient scale to ensure that it operates effectively;
    - The Plant is appropriately located to receive livestock that is within the immediate and surrounding area;

- The Plant has appropriate infrastructure support including access to road and rail networks;
- There is sufficient land to enable future expansion of the site.

- Compliance with proposed and future limits will ensure that the intrinsic values of ecosystems present within the receiving environments are maintained and potentially enhanced with the proposed mitigation in the form of Plant upgrades.
- The Plant is located within a site that is appropriately zoned for industrial purposes and a buffer between the on-site activities and sensitive receptors exists to avoid or mitigate any potential effects on amenity values. Odour is a potential issue that could affect amenity values of surrounding land uses, however this is mitigated via the buffer zone, operational procedures and the adoption of the best practicable option in order to manage any potential odour issues.
- A Habitat Enhancement Management Plan is proposed which will identify areas within the Plant property that could be enhanced in an ecological sense (ie. riparian planting around waterways). This and the other mitigation (including upgrades), is expected to result in an overall improvement in the current quality of the environment in which the Plant exists.
- The assessment of water quality and ecological effects has determined that the lower Makarewa River supports a significant trout population, and the discharges and abstraction is therefore not likely having any adverse effects on trout. A fish health survey is also proposed as part of the conditions of consent, to determine whether the upgrade of the wastewater treatment plant will have a positive effect on current fish health.

Overall, when the benefits that will be realised from the ongoing operation of the Plant are considered, alongside the effects of the Plant on the existing environment, and the measures that Alliance is proposing to avoid, remedy and mitigate these, the proposal will promote sustainable management of natural and physical resources and is consistent with the purpose and principles of the RMA.