Assessment of Effects - Monitoring of the Alliance Lorneville Wastewater Discharge and the Makarewa River

Prepared for Alliance Group Ltd

Aquatic Environmental Sciences Ltd
markj@aquaticsciences.co.nz
PO Box 328, Whangamata 3643
021 0538379

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1.0 Background

Alliance Group Limited (Alliance) is seeking to lodge applications for new resource consents to discharge treated wastewater (the discharge) from its Lorneville Plant (the Plant) to the Makarewa River in 2015. The discharge from the Plant includes wastewater from the slaughter, further processing, rendering and fellmongery operations along with human wastewater generated on site and from Wallacetown. Wastewater is treated onsite via physical, anaerobic and aerobic treatment systems followed by discharge to the Makarewa River (PDP 2014).

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. Freshwater Solutions (2015a) have provided a comprehensive description of the existing receiving environment based on the work to date including the catchment wide hydrology, water quality and ecology of the Makarewa River, lower Oreti River and New River Estuary, and have reviewed relevant sediment water quality and ecology data collected under the existing treated wastewater discharge consent (Discharge Permit 92195). The report included a description of the results of the summer 2010, summer 2013 and spring 2013 biological surveys (habitat, aquatic plant, benthic invertebrates and native fish) in the Makarewa River and characteristics of the discharge from long-term monitoring.

A review of the current ammonia concentrations, description of the ANZECC approach to ammonia trigger value derivation, review of the toxicological data for ammonia, ammonia trigger value derivation using ANZECC (2000) and USEPA (2013) and recommended ammonia limits for protecting aquatic species found in the Makarewa River downstream of the discharge is provided in Freshwater Solutions (2015b).

Freshwater Solutions (2015c) presented and described the results of a mixing zone assessment based on a survey of the river in March 2014 at low river flow and during an outgoing and incoming tide using an Acoustic Doppler Current Profiler and global positioning system. This assessment essentially concluded that the river is likely to be fully mixed 200 m downstream from the discharge and during high tide was not fully mixed 200 m upstream.

An assessment of ecological and recreation effects was made (Freshwater Solutions/AES 2015) based on the work described in Freshwater Solutions (2015a) and other information sources relevant to the potential effects on river and estuarine environments that may result from the discharge of treated waste from meat processing plants and sewage treatment from small rural communities (in this case Wallacetown).

This report provides a monitoring plan to be used as the basis for the AEE and development of consent conditions.

2.0 Monitoring

2.1 Recommended Approach

The disposal of treated waste water from the Plant has the potential to cause ammonia toxicity, lower dissolved oxygen concentrations, reduce clarity, increase the chance of scums and foams, increase microbial contamination and increase nutrient loadings. Options to mitigate these effects and meet selected standards and guidelines are outlined in Freshwater Solutions/AES (2015). The purpose of the monitoring i.e whether it is compliance, state of the environment or monitoring to demonstrate effects are as predicted, will dictate the frequency and extent of monitoring required.

The purpose of this report is to outline, in general terms, the monitoring programme for physical characteristics and water quality of the discharge and physical, water quality and

biological characteristics of the receiving waters of the river, for the consent application. The proposed monitoring, outlined within this report, reflects best practice at the time of preparing this report. It is recommended that the monitoring be done in accordance with an environmental monitoring plan (EMP) agreed with the SRC and that the monitoring plan be made a condition of consent rather than 'locking' the details of the monitoring into consent conditions. This approach provides flexibility to SRC and Alliance should either wish to seek a revision or update of the monitoring requirements associated with the discharge during the life of the consent. This is particularly important in this case as there are short and long-term treatment upgrades planned. The EMP will include actions to be taken if limits are breached.

A 2-tiered approach is recommended for some parameters. Where there is an absolute limit as per accepted guidelines/standards (or site specific limits), this would be the second tier limit. To address the over-riding requirement of the NPS-FM (MFE 2014) that the overall quality of freshwater should be maintained or improved the limit would be based on measurements over the last 5 years and using the annual median and 95%ile.

2.2 Discharge Monitoring

Purpose:

The purpose of monitoring the discharge is to demonstrate compliance with consent conditions and document the contribution of the discharge to N and P loadings, dissolved nutrients, oxygen demand, microbial contaminants and TSS to the receiving waters of the lower River and the New River Estuary.

Monitoring:

Conditions for the resource application are yet to be developed but key considerations are physical and chemical attributes. Limits which apply to the current consent monitoring for the discharge are volume, concentration of TSS (max 300 g/m^3) and carbonaceous BOD_5 (max 100 g/m^3). Effluent monitoring is also required under Schedule 1a and 1B for a range of other parameters as listed below.

Discharge samples are currently collected daily, when discharging, between 1 Sept and 30 April for:

- Volume.
- Electrical conductivity.
- pH.
- Total ammoniacal nitrogen (Amm-N).

And weekly for:

- Total nitrogen (TN).
- Total oxidised nitrogen (TON).
- Total phosphorus (TP).
- Dissolved reactive phosphorus (DRP).
- Total suspended solids (TSS).
- Carbonaceous BOD.
- Faecal coliforms.

During 1 May to 31 August, when discharging, flow is measured daily, total Amm-N weekly and the other parameters monthly.

It is recommended that discharge samples continue to be collected as above but that:

- E-coli be added to the weekly discharge sampling.
- That volatile TSS be added to the sampling programme and reassessed along with TSS after one year.
- TP and TN should be measured weekly when discharging to provide input to nutrient loading assessments downstream.
- The period when monitoring is reduced be changed to 1 June to 30 September which is more in keeping with current and future practices.

Limits

It is recommended that the existing limits for discharge volume, TSS and BOD in the discharge remain as they stand as per Schedule of conditions 2(b) but there be a second set of limits based on the median and 95%ile limits from the last 5 years. Breaches of this limit would be assessed annually and would have to be reported to SRC. This second set of limits would also apply to faecal coliforms and E.coli, TN TP, Amm-N and nitrate. This would ensure that the quality of the discharge will not get any worse than at present.

2.3 Monitoring of receiving waters

Purpose:

The purpose of monitoring the receiving environment is to demonstrate compliance with consent conditions, document the water quality and health of the downstream environments and to demonstrate that the adverse effects are no more than predicted.

Monitoring:

Water Sampling and Analysis

Alliance currently monitors water quality at the Pipe Bridge upstream of the discharge, a site referred to as 200 m (downstream of the discharge) and 1.2 km downstream of the discharge (Boundary Site). It should be noted that the 200 m Site is actually ~350 m downstream and thus beyond the mixing zone (Freshwater Solutions 2014c). It is recommended that:

- The Pipe Bridge Site be replaced with a site that is largely beyond the influence of tidal changes (in the vicinity of Site U2). This site would be used for comparative conditions such as <3^{o}C temperature change and changes in clarity. It is important that the final site chosen is accessible.
- The 200 m downstream site be renamed as 350 m or “compliance site” downstream of the discharge point. Sampling this site at the same time each day should be continued but noting stage of the tide should be the major site for compliance as it is beyond the mixing zone and the data provides representative conditions for receiving waters downstream. As above the site must be easily accessible for sampling.
- The Boundary Site be discontinued as a compliance site.

Samples are currently collected daily when the Plant is discharging during the peak discharge period (Sept-Apr) and weekly during the rest of the discharge period (May-Aug) and analysed for:

- Electrical conductivity.
- pH.
- Temperature.
- Dissolved oxygen concentration (DO).
- Percent dissolved oxygen saturation.
- Total ammoniacal nitrogen.

It is recommended that:

- DO saturation readings be deleted from the daily monitoring as it is the absolute concentrations that are critical to biota.
- That observations of foams and scums are made at the point of discharge, the 350 m Downstream Site and the upstream site.
- The reduced monitoring apply to the period 1 June – 30 September which is more in keeping with current and future practices.

Samples are currently collected weekly during the peak discharge period (Sept-Apr) and monthly during the rest of the discharge period (May-Aug) and analysed for:

- Electrical conductivity.
- pH.
- Temperature.
- Dissolved oxygen concentration.
- Percent dissolved oxygen saturation.
- Total ammoniacal nitrogen.
- Total nitrogen.
- Total oxidised nitrogen (nitrate and nitrite).
- Total phosphorus.
- Dissolved reactive phosphorus.
- Carbonaceous BOD.
- Soluble carbonaceous BOD.
- Faecal coliforms.
- Black disk distance.

It is recommended that:

- Black disc readings be replaced by clarity tube readings (a continuation of a change made and agreed with SRC some time ago).
- That dissolved oxygen saturation readings be deleted from the monitoring plan as it

is ambient concentration that is most important.

- That conductivity, pH, temperature, DO, foams, Amm-N, TON, TN and TP be monitored weekly throughout the whole year as the purpose of this monitoring is to assess contribution to catchment-wide loads which are now measured at a range of time scales. The TON measurements would also provide data to compare with NPS limits for nitrate in receiving waters.
- *E-coli* and turbidity be added to the sampling as *E.coli* is becoming the accepted standard.
- It is recommended that as the discharge period varies that all parameters be measured at least monthly at the upstream site and 350 m site during the non-discharge period (some parameters will be weekly as above).
- The reduced monitoring apply to the period 1 June – 30 September which is more in keeping with current and future practices.

Receiving water limits

At present the limits on the receiving waters, as set out in the consent conditions are as follows:

a) The minimum standards for Class "D" waters.
b) Black disc distance shall not be below 20% of the value upstream.
c) No production of conspicuous oil or grease films, scums, foams, or floatable or suspended materials.
d) Dissolved oxygen concentrations beyond 200 m downstream shall be consistently maintained at not less than 6 g/m^3 (96% of samples throughout year).
e) After the first 2 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 given in the table in the consent (eg 5.6 at pH 8.0 and temperature 20^{o}C).

The site for compliance at present is stated as 200m from the confluence of the "Boiler ditch" with the Makarewa River. For practical reasons and to clarify the location it is recommended this should be renamed as the 350 m Site or Compliance Site

Other recommended changes to the existing limits are:

a) The daily maximum water temperature be set as not be more than 3^{o}C more than measured at the upstream site when the natural or existing temperature is 16^{o}C or less, 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 as a result of the discharge (as per SRWP). A maximum of 24^{o}C should not be exceeded (NIWA 2013). If this is exceeded then the cause of the high levels and upstream temperatures should be investigated. This is consistent with the B/C boundary (NIWA 2013) which is set to ensure there is no more than minor thermal stress on occasions in summer on aquatic animals.

b) Clarity tube measurements shall not be below 33% of upstream values. This is to be consistent with the clarity in the Makarewa River upstream which is considered to be Class D waters not the 20% for Class A waters of high water clarity. The SRWP provides that clarity in lowland water bodies shall not be less than 1.3 m 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.

c) It is recommended that the DO limits reflect the limits in the NPS (MFE 2014) as well as the existing consent conditions i.e consistently maintained at not less than 6 g/m^3 (96% of samples throughout year) and an absolute minimum of >5 g/m^3, which is the attribute state which causes only occasional minor stress of lowered dissolved oxygen (B/C state, NPS-FM 2014). Diurnal measurements of DO show that the minimum DO concentration occurs in mid-morning thus the daily sampling at 8-9 am would be precautionary. The pH range 6.5-9.0 be applied as it is consistent with the SRWP.

d) Alliance have carried out extensive analyses of ammonia toxicity and its application to the Makarewa River (Freshwater Solutions 2014b). After consideration of the habitat in the river downstream of the mixing zone, published standards and the recent NPS attribute states it is recommended that the most appropriate limit to avoid chronic effects on the existing biota is an annual median of <1.9 g/m^3 and a 95%-ile of <2.4 g/m^3 (both adjusted to pH 8.0). This level is only slightly above the NPS attribute state which was set to provide 80% species protection. Due to the unsuitable nature of the habitat 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 the Makarewa River. The ultimate aim should be to meet the more precautionary standard in the NPS keeping in mind that the NPS was developed for state of the environment monitoring at the larger freshwater management scale and not for point source discharges. For the reasons outlined in Freshwater Solutions/AES (2014) an annual maximum is not considered appropriate.

   Careful consideration should be given to how ammonia toxicity is measured so that it is meaningful and practical. We would recommend the following:

   1. The existing approach which is to measure Amm-N and adjust the compliance condition for pH measured daily at a point downstream and beyond the mixing zone. Compliance is to be assessed daily against the tabled limits. Sampling to remain at a set time of day (early morning) but with stage of tide recorded.

   2. The most appropriate ecologically measure for compliance would be based on the annual median value of 1.9 g/m^3 compared with the rolling average over a 30 day period adjusted for pH and temperature, which is consistent with the USEPA (2013) approach and the way that chronic toxicity is assessed in laboratory experiments. This may also be a more practical way to assess compliance than waiting for the annual values.

   3. To address more acute and short-term effects a maximum ammonia level should be a maximum of 2.5 times the standard (2.5 x 1.9 = 4.7 g/m^3) for a 4-day average over any 30 day period and not to be exceeded more than once over a 3 year period. This is consistent with the latest and very comprehensive USEPA report (USEPA 2013).

e) The assessment of ecological effects (Freshwater Solutions/AES 2014) recommended that a 75% reduction in ammonia would be required to meet the site specific ammonia levels developed by Freshwater Solutions (Freshwater Solutions 2014b) and the NPS attribute bottom line for ammonia toxicity. To make such a reduction is a major undertaking and investment by Alliance and thus is recommended as a long-term target within 15 years. In the interim the existing compliance level of 5.6 g/m^3 should be applied but comparisons with the new targets

reported annually. It should also be noted that the faunal community at present is what we would expect of such an environment and there is no evidence of a toxic effect. The new targets would be brought in as compliance levels after the completion of upgrades expected within 15 years.

f) The assessment of ecological effects (Freshwater Solutions/AES 2015) also noted the policy in the SRWP (2013) to reduce nitrate and phosphorus by >10% by 2020. Alliance has a programme in place for continual 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 major improvement will be within 15 years when the aim is to reduce TN by 75% and TP by a significant amount (>10%).

g) Nitrate can be toxic to humans and aquatic biota at high levels. It is recommended that the NPS (MFE 2014) limits for Band B/C of an annual median of <2.4 g/m^3 and 95th%-ile of <3.5 g/m^3 (measured as TON-nitrate and nitrite) be adopted as a limit for consent purposes. It should be noted that total oxidised nitrogen (nitrate and nitrite) contributes only 1% of TN on average in the discharge and thus is not considered significant for nutrient loads to the estuary.

h) Target microbial attribute states are provided in the NPS (MFE 2014) and SRWP (SRWP 2013) 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 because of the high levels in the upper catchment. Annual medians for the upstream Bridge site have ranged from 800-9600 cfu/100 ml and would only have met this criteria in one of the last 15 years. Such a target should be considered in the long-term (i.e at least 15-20 years) as catchment-wide plans are implemented.

Sediment sampling was required within 18 months of the existing consent being granted to survey sediments 200m upstream and 200 m downstream of the discharge for TN, TP and TOC. It is recommended that this should be repeated every 5 years as levels appear to be elevated within the mixing zone and potentially stimulate macrophyte growth.

At present all measurements are made from grab samples. As best practice, monitoring approaches and technology develop, continuous monitoring of key parameters in the receiving waters should be considered by Alliance. It should also be noted that there is little change over a day in quality of the discharge thus the value of continuous measurements would have to be considered.

Biological Sampling and Analysis

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 draining agricultural catchments benthic invertebrate monitoring is highly unlikely to be a useful long term tool for monitoring the discharge. Biological monitoring may be useful in the first 3 years following major wastewater treatment system upgrade to determine what if any improvement in benthic invertebrate community health occurs. Baseline surveys would have to be carried out before major upgrades.

As discussed in Section 3 of the Freshwater Solutions/AES 2015 report it is not considered appropriate to apply biological standards or targets because of the different and unusual habitat in the lower tidal reaches of the Makarewa River, compared with upstream, and after considering the biological standards that have been developed for different habitats. The

NPS-FM (MFE 2014) provides attribute states for periphyton but these are not intended for soft-bottom lowland streams (Snelder et al. 2013). It was noted in recent surveys that the substrate around and below the discharge is not suitable for algal growth and insufficient material was available to measure biomass (Freshwater Solutions 2015a). It is not anticipated that there will be significant changes in the macrophyte and macroinvertebrate communities as a result of proposed improvements to the quality of the discharge however consideration should be given to monitoring a baseline and then annually for 3 years after major upgrades are in place to quantify any changes, if they were to take place. If major adverse changes were observed in water quality parameters that could impact on the benthic communities then ongoing biological monitoring should be considered.

As outlined within this report biological monitoring in the vicinity of the discharge is complicated by the influence that the tide has on the river. If biological monitoring is required then it should be undertaken, during summer, following a period of at least 20 days below annual median river flow at two sites upstream (Site U1 and U2) and two sites near the discharge (D1 and D2) for comparison with previous surveys. .

It is recommended that the monitoring comprise the following:

- Description of the physical habitat.
- Quantitative assessment of periphyton (if present), macrophyte cover and species diversity.
- Quantitative assessment of benthic invertebrates living on the substrate and semi-quantitative sampling of invertebrates on submerged macrophytes.

Other considerations:

Fish health

Fish health is still under consideration but as a minimum Alliance should be part of any catchment-wide monitoring programmes developed for the Makarewa Catchment. This will be essential as although a number of species use the Makarewa River in the region of the discharge they are often mobile and will often be in transit through this part of the River as part of annual migrations to sea (in the case of diadromous species) or to the upper catchment.

A fish health survey for resident species such as tuna should be made within the first 5 years of consent being granted and then before and after the major upgrade, using appropriate measures of fish health. Guidelines for monitoring tuna health are still being developed but it is recommended that consideration be given to the approach taken by Richardson (1998) which is the basis for monitoring around the Huntly Power Station. This would involve the following:

- Collection of a minimum of 10 fish of similar size and age.
- Recently killed fish are processed and the following measurements taken:
    - Length and weight.
    - External examination and assessment of eyes, fins, opercules, gills, pseudobranchs and thymus (see Richardson (1998) for parameters/features to assess)
    - Internal examination of liver, spleen, hind gut, kidney, mesenteric fat, bile, parasites and gonad stage (see Richardson (1998) for parameters/features to assess)
- Blood samples for haematocrit (% red cells), leuocrit (white cells) and plasma protein (weight/volume).
- Data is processed and indices developed for each component as per Richardson (1998) and compared with acceptable values tabulated by Richardson (1998) which

includes acceptable values for long and short-fin eels.

Full procedures and protocols are provided in Richardson (1998).

Habitat enhancement

Habitat enhancement has been suggested as part of mitigation eg enhancement of the oxbow area. A habitat enhancement plan should be developed as part of the EMP.

3.0 References

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Freshwater Solutions (2015b). Makarewa River Site Specific Ammonia Receiving water Evaluation. Report prepared for Alliance Group Ltd. October 2013

Freshwater Solutions (2015c). Makarewa River Mixing Zone Assessment. Report prepared for Alliance Group Ltd. September 2014.

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SRWP (2013). Southland Regional Council Water Plan.

USEPA, 2013. Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater. United States Environmental Protection Agency Office of Water 4304 EPA- EPA-822-R-13-001 April 2013.

Appendix 1. Existing consent monitoring schedules for the discharge and receiving waters for each time period.

Schedule A1. Treated Wastewater Discharge Monitoring Schedule for the Period 1 September to 30 April each year

Parameter	Daily (When discharging)	Weekly (when discharging)
Volume	X	
Electrical Conductivity	X	
pH	X	
Temperature	X	
Total ammoniacal nitrogen	X	
Total nitrogen		X
Total oxidised nitrogen		X
Total phosphorus		X
Dissolved reactive phosphorous		X
Total suspended solids		X
Carbonaceous BOD		X
Faecal coliforms		X

Schedule A2. Treated Wastewater Discharge Monitoring Schedule for the Period 1 May to 31 August each year when discharging

Parameter	Daily (When discharging)	Weekly (when discharging)	Monthly (when discharging)
Volume	X		
Electrical Conductivity			X
pH			X
Temperature			X
Total ammoniacal nitrogen		X	

Total nitrogen			X
Total oxidised nitrogen			X
Total phosphorus			X
Dissolved reactive phosphorous			X
Total suspended solids			X
Carbonaceous BOD			X
Faecal coliforms			X

Schedule B1. Receiving Water Monitoring Schedule for the Period 1 September to 30 April each year: Upstream Control site, Compliance site and Boundary Site

Parameter	Daily	Weekly
Electrical Conductivity	X	
pH	X	
Temperature	X	
Dissolved oxygen concentration	X	
Percent dissolved oxygen	X	
Total ammoniacal nitrogen	X	
Total oxidised nitrogen		X
Total nitrogen		X
Total phosphorous		X
Dissolved reactive phosphorous		X
Carbonaceous BOD		X
Soluble carbonaceous BOD		X
Faecal coliforms		X
Black disk distance		X

Schedule B2. Receiving Water Monitoring Schedule for the Period 1 May to 31 August each year: Upstream Control site, Compliance site and Boundary Site

Parameter	Weekly	Monthly
	Discharge / No discharge	
Electrical Conductivity	X	
pH	X	
Temperature	X	
Dissolved oxygen concentration	X	
Percent dissolved oxygen saturation	X	
Total ammoniacal nitrogen	X	
Total oxidised nitrogen		X
Total nitrogen		X
Total phosphorous		X
Dissolved reactive phosphorous		X
Carbonaceous BOD		X
Soluble carbonaceous BOD		X
Faecal coliforms		X
Black disk distance		X

Appendix 2. Proposed monitoring schedules for the discharge and receiving waters for each time period. Highlighted parameters in yellow are new ones, blue for changed.

Schedule A1. Treated Wastewater Discharge Monitoring Schedule for the Period 1 October to 31 May each year when discharging

Parameter	Daily (When discharging)	Weekly (when discharging)
Volume	X	
Electrical Conductivity	X	
pH	X	
Temperature	X	
Dissolved oxygen concentration	X	
Total ammoniacal nitrogen	X	
Total nitrogen		X
Total oxidised nitrogen		X
Total phosphorus		X
Dissolved reactive phosphorous		X
Total suspended solids		X
Volatile suspended solids		X
Carbonaceous BOD		X
Faecal coliforms		X
E-coli		X

Schedule A2. Treated Wastewater Discharge Monitoring Schedule for the Period 1 June to 30 September each year when discharging

Parameter	Daily (When discharging)	Weekly (when discharging)	Monthly (when discharging)
Volume	X		
Electrical Conductivity		X	

pH		X	
Temperature		X	
Dissolved oxygen concentration		X	
Total ammoniacal nitrogen		X	
Total nitrogen		X	
Total oxidised nitrogen		X	
Total phosphorus		X	
Dissolved reactive phosphorous			X
Total suspended solids			X
Volatile suspended solids			X
Carbonaceous BOD			X
Faecal coliforms			X
E-coli			X

Schedule B1. Receiving Water Monitoring Schedule for the Period 1 October to 31 May each year: Upstream Control site and Compliance site

Parameter	Daily	Weekly	Weekly	Monthly
	When discharging		No discharge	
Electrical Conductivity	X		X	
pH	X		X	
Temperature	X		X	
Dissolved oxygen concentration	X		X	
Foams and scums	X		X	
Total ammoniacal nitrogen	X		X	
Total oxidised nitrogen		X	X	
Total nitrogen		X	X	
Total phosphorous		X	X	
Dissolved reactive phosphorous		X		X

Total suspended solids		X		X
Carbonaceous BOD		X		X
Soluble carbonaceous BOD		X		X
Faecal coliforms		X		X
E-coli		X		X
Turbidity		X		X
Clarity Tube		X		X

Schedule B2. Receiving Water Monitoring Schedule for the Period 1 June to 30 September each year: Upstream Control site and Compliance site

Parameter	Weekly	Monthly
	Discharge / No discharge	
Electrical Conductivity	X	
pH	X	
Temperature	X	
Dissolved oxygen concentration	X	
Foams and scums	X	
Total ammoniacal nitrogen	X	
Total oxidised nitrogen	X	
Total nitrogen	X	
Total phosphorous	X	
Dissolved reactive phosphorous		X
Total suspended solids		X
Carbonaceous BOD		X
Soluble carbonaceous BOD		X
Faecal coliforms		X
E-coli		X
Turbidity		X
Clarity Tube		X

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