Hawea Wastewater Treatment Plant

Annual Report 2019 - 2020

Prepared for

Queenstown Lakes District Council

Prepared by

L E
Environmental
Impact

December 2020

Hawea Wastewater Treatment Plant
Annual Report 2019-2020

Queenstown Lakes District Council

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1 BACKGROUND

The Hawea wastewater treatment plant (WWTP) comprising of an oxidation pond started operation in 1988 and treats wastewater originating from the Hawea township and the Timsfield subdivision. It is located adjacent to the true left bank of the Hawea River, approximately 600 metres south of the intersection of Domain Road and Cemetery Road (Figure 1.1). The legal description of the land parcel is Lot 1 DP 20555 and Lot 1 DP 24534. The map reference for the oxidation ponds is NZMS 260 G40:128-137.

Figure 1.1: Hawea Township Reticulation

An upgrade to the discharge systems was made in 2010 when the overflow to the river ceased, the trench disposal system enlarged (doubled in size) and a spray irrigation area was installed to reduce the nitrogen load entering groundwater and into the Hawea River. Discharge Permits RM10.308.01 and RM10.308.02 were issued by the Otago Regional Council (ORC) on the 15 November 2010. The consents are due to expire on the 12th November 2022.

Wastewater enters the oxidation pond (Figure 1.2) which is 1.2 m deep and 0.94 ha and maintained in an aerobic state with the assistance of three mechanical aerators. The volume of the pond is 10,250 m^3 and has a hydraulic retention time of 50 days.

The wastewater is then discharged to land via either a spray irrigation system or a low-pressure effluent disposal trench (Figure 1.2). The disposal trench is 150 metres long and 2 metres wide and is only meant to be used during periods when it is not suitable to use spray irrigation, that is when the soil is saturated, frozen, harvesting is occurring, or during periods of high wind speed. The disposal trench is to be used for a maximum of 4 months in any calendar year.

The land treatment area (LTA) on which treated wastewater is evenly applied by spray irrigation consists of a 2.33 hectares area planted with ryegrass. The LTA is also connected to a weather station that shuts it down in winds over 29.9 km/hr. The spray irrigation comprises of sprinklers on 1 m high risers with medium pressure lateral pipes at 20 m centres. The harvesting equipment drives around the risers during harvesting. The LTA is only used between the hours of 11 pm to 5 am due to the presence of an adjacent cycle/walking track (Figure 1.2).

Figure 1.2: Overview of Wastewater Treatment Plant

Veolia operates and maintains the oxidation ponds as part of the 3-Waters operations and maintenance contract.

2 PURPOSE AND SCOPE OF REPORT

The purpose of this report is to report to the Otago Regional Council (ORC) in accordance with Condition 13 of Resource Consent RM10.308.02 (Table 2.1) and covers the period 1 December 2019 to 30 November 2020.

The scope of the Annual Report comprises of the following:

- Summary of all analytical results for the year;
- Summary of the year's monitoring results and assessment against trigger levels in Resource Consent RM10.308.02, and comparison against previous year's results;
- Nitrogen Mass Balance as required by Condition 12;
- Comments on compliance with the conditions of the discharge permits;
- Summary of any malfunctions or breakdowns and the corrective action taken;
- Summary of any complaints received, the validity of each complaint and the corrective action taken; and
- Any other issues considered relevant.

Table 2.1: Discharge Permits

Consent Number	Description	Issue Date	Expiry Date	Reference
RM10.308.01	To discharge contaminants to air for the purpose of discharging treated wastewater.	15 Nov 2010	12 Nov 2022	Appendix A
RM10.308.02	To discharge contaminants to land for the purpose of discharging treated wastewater.	15 Nov 2010	12 Nov 2022	Appendix A

3 MONITORING REQUIREMENTS

An overview of the monitoring requirements for Resource Consent RM10.308.02 is given in Table 3.1. The results of the wastewater quality monitoring for the 2019-2020 sampling period are presented in tabular format in Appendix B and a copy of the laboratory results received from Watercare Laboratories for the 2019-2020 period is presented in Appendix C. The wastewater flow results are presented in Appendix D.

Table 3.1: Wastewater Quality Parameters to be Analysed

Parameter	Frequency	Resource Consent Trigger Level	Consent Conditions	Reporting Requirements
Flow (wastewater)	Daily	775 cubic metres/day	2, 9	Annual
Total Nitrogen	Monthly*	Mean**: 35 mg/L 95th percentile**: 40 mg/L	10, 11	Monthly
Ammoniacal Nitrogen	Monthly*	Mean**: 25 mg/L 95th percentile**: 30 mg/L	10, 11	Monthly
Total Phosphorus	Monthly*	Mean**: 8 mg/L 95th percentile**: 10 mg/L	10, 11	Monthly
BOD_5	Monthly*	N/A	10	Monthly
Total Suspended Solids	Monthly*	N/A	10	Monthly
Escherichia coli	Monthly*	95th percentile**: 250,000 cfu/100 mL	10, 11	Monthly
Nitrogen Loading	Annual	1,223 kg/ha/year	7, 12	Annual

**Last week of each month ** Calculated on a 12 Month Rolling Mean or 95th percentile*

All sampling is carried out by Watercare to the required Standards specified in Condition 11 (Watercare Laboratory Services is IANZ accredited to NZS/ISO/IEC 17025).

4 WASTEWATER FLOWS AND SAMPLING

4.1 Wastewater Flows

The daily wastewater flow rates (m^3/day) from the oxidation pond are tabulated in Table 4.1 and graphically represented in Figure 4.1. The total wastewater flow for the year is 104,444 m^3, up 13% or 12,111 m^3 from the 2018-19 monitoring period (92,333 m^3), and up 20% or 18,040 m^3 from the 2017-18 monitoring period (86,404 m^3).

The wastewater discharge flow rate has a consented maximum volume of 775 cubic metres per day, which was exceeded on the 7th (953 m^3) and 9th December 2019 (776 m^3). System alarms have since been reviewed and there have been no recent events exceeding the maximum discharge volume.

The average daily discharge over the 2019-2020 monitoring period was 285 m^3/day.

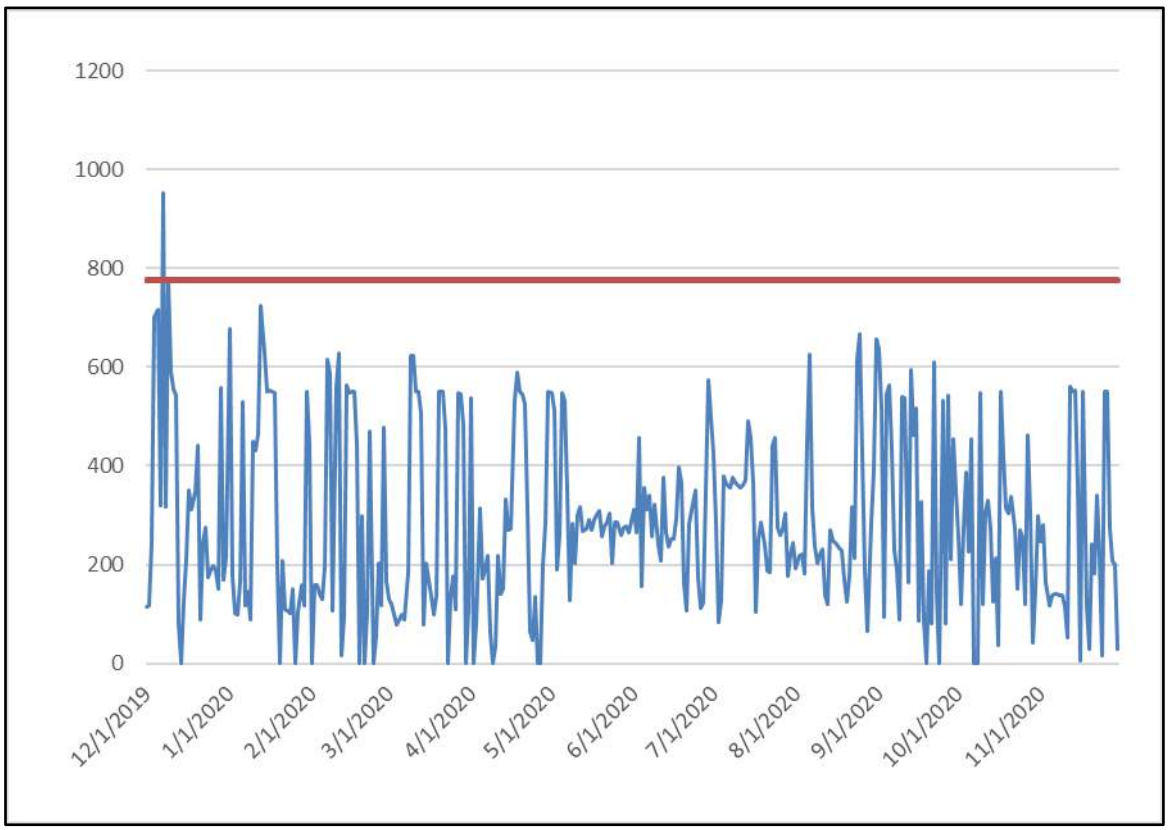


Figure 4.1: Wastewater Discharge Flows 2019-2020

Table 4.1: Wastewater Flows 2019-2020

Date	Trench Discharge Flow (m^3)	Irrigation LTA (m^3)	Irrigation (mm) *	Pond Outlet Flow Total (m^3)
December	6,372	3,900	167	10,272
January	2,776	6,479	278	9,255
February	1,351	6,600	283	7,951
March	1,796	6,448	300	8,244
April	1,876	5,457	235	7,333
May	0	9,442	395	9,442
June	8,237	483	7	8,720
July	9,426	0	0	9,426
August	8,869	1	0	8,870
September	3,388	6,420	276	9,808
October	3,195	4,729	203	7,924
November	2,670	4,529	193	7,199
Total	**49,956**	**54,488**		**104,444**

* The irrigation depth is over the 2.33 ha LTA.

The number of days (with >10 m^3 flow) during the 2019-2020 reporting period when wastewater was applied to the LTA via spray irrigation was 173 and discharged via the disposal trench was 219 (note that both the trench and irrigation can be used the same day with a total daily discharge limit of 775 m^3). This is compared to the 2018-2019 period when the spray irrigation was on 176 days and the disposal trench was 186 days.

In March 2020, it was identified that the trench was still being utilised more frequently than desired. Veolia re-programmed the Programmable Logic Controller (PLC) function in April to further favour the spray irrigation system and to avoid the use of the disposal trench, by allowing the pond level to increase and withholding discharge until suitable conditions for irrigation. This resulted in a huge improvement in May when all of the discharge went to the LTA. The disposal trench was solely used in June, July, and August due to freezing conditions. In September and October there were issues with the irrigation pump and low flow irrigation that resulted in the disposal trench being used, and in November the spray irrigation could not be used for a period of 16 days while harvest was occurring.

4.2 Wastewater Sampling

Treated wastewater from the outlet of the pond is sampled on a monthly basis. A representative sample is collected and analysed for a total of six parameters (total ammoniacal nitrogen, total phosphorus, total nitrogen, total suspended solids, BOD_5 and *E. coli*) as per Resource Consent RM10.308.02. Some of those parameters have consent limits in Resource Consent RM10.308.02 and are presented in tabular (refer to Table 4.2) and graphical (Figure 4.2 and Figure 4.7) format.

Table 4.2: Summary of Wastewater Monitoring Results for 2019-2020

Parameter	Consent Limit (calculated on a 12-month rolling period)	Rolling 95th Percentile mg/L	Annual Mean mg/L	Max mg/L	Min mg/L
BOD_5	-	-	46	110	15
Total Suspended Solids	-	-	110	400	24
Total Nitrogen	Mean: 35 mg/L 95th percentile: 40 mg/L	**78**	**59**	93	47
Total Phosphorus	Mean: 8 mg/L 95th percentile: 10 mg/L	**11.5**	7	46	30
Ammoniacal Nitrogen	Mean: 25 mg/L 95th percentile: 30 mg/L	**45**	**38**	45	30
E. coli	95th percentile: 250,000 cfu/100 mL	66,900	33,150	68,000	2,900

The rolling 12 month 95th percentile for *E. coli* remained well within the consent limit of 250,000 CFU/100 ml during the 2019-2020 monitoring period (refer to Figure 4.2). The maximum concentration of *E. coli* over the monitoring year was 68,000 cfu/100 mL (Table 4.2) with a significant reduction to 3,900 cfu/100 mL the following month. The annual mean of 33,150 cfu/100 mL was lower than the 2018-2019 annual mean of 57,308 cfu/100 mL.

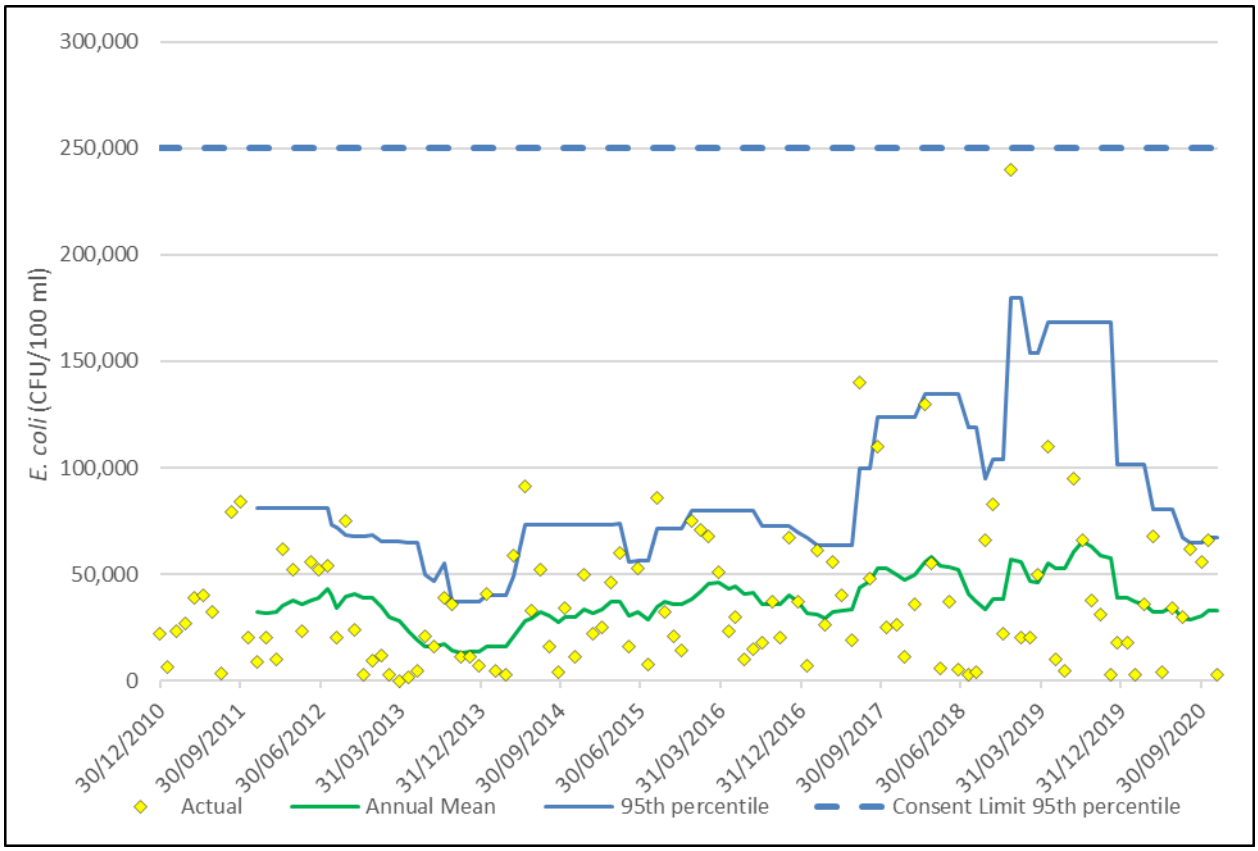


Figure 4.2: *E. coli* in Wastewater

The total ammoniacal nitrogen rolling 12 month 95th percentile was 45 g/m^3 and the rolling 12-month mean was 38 g/m^3 at the end of the 2019-2020 monitoring period; both of these exceeded the consent limits of 30 g/m^3 and 25 g/m^3 respectively (Figure 4.3). The consent limits have regularly been exceeded for the rolling 12 month 95th percentile since 28 May 2012; and the 12-month rolling mean since 21 February 2019. Measures to address this have been outlined in the sections below.

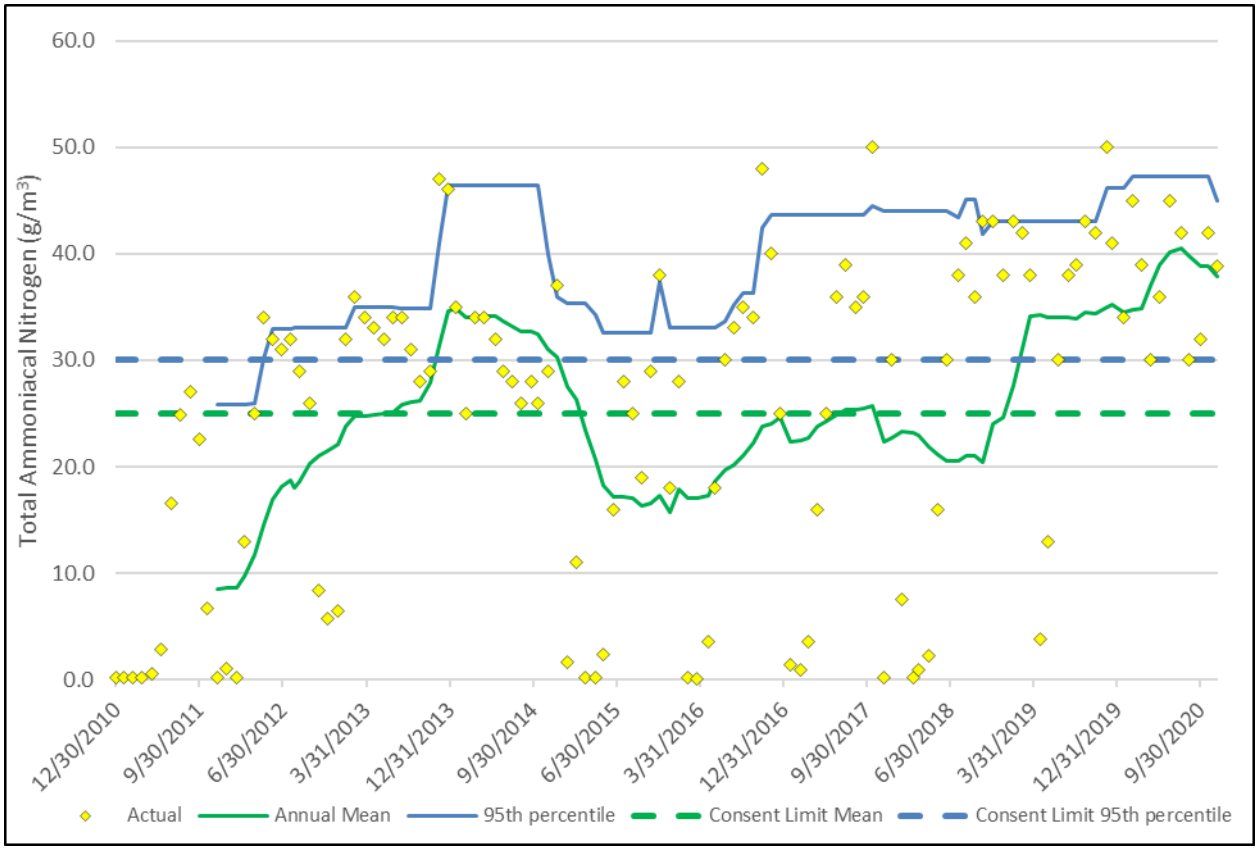


Figure 4.3: Total Ammoniacal Nitrogen in Wastewater

The total nitrogen rolling 12 month 95th percentile was 59 g/m^3 and the rolling 12-month mean was 78 g/m^3 at the end of the 2019-2020 monitoring period; both of these exceeded the consent limits of 40 g/m^3 and 35 g/m^3 respectively (Figure 4.4). The maximum concentration of total nitrogen over the year was 93 g/m^3. The rolling 12 month mean (as of 24 November 2020) was 59 g/m^3 which is up 7% from 2018-19 (55 g/m^3) and 51% from 2017-18 (39 g/m^3) monitoring periods. Measures to address this have been outlined in the sections below.

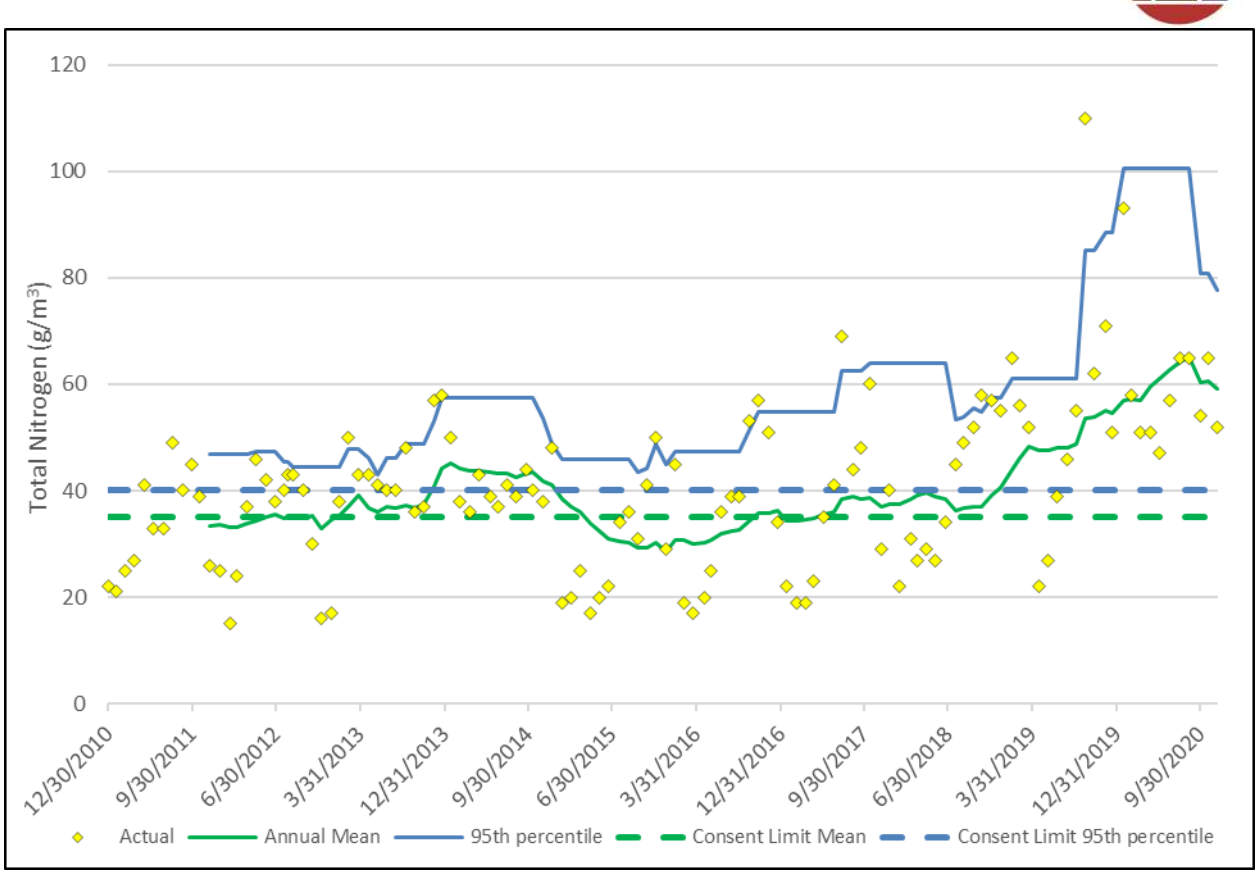


Figure 4.4: Total Nitrogen in Wastewater

There were three occasions when the rolling 12 month 95th percentile for total phosphorus exceeded the consented limit of 10 g/m^3 (Figure 4.5). However, the rolling 12 month mean remained below the consented limit throughout the 2019-2020 monitoring period.

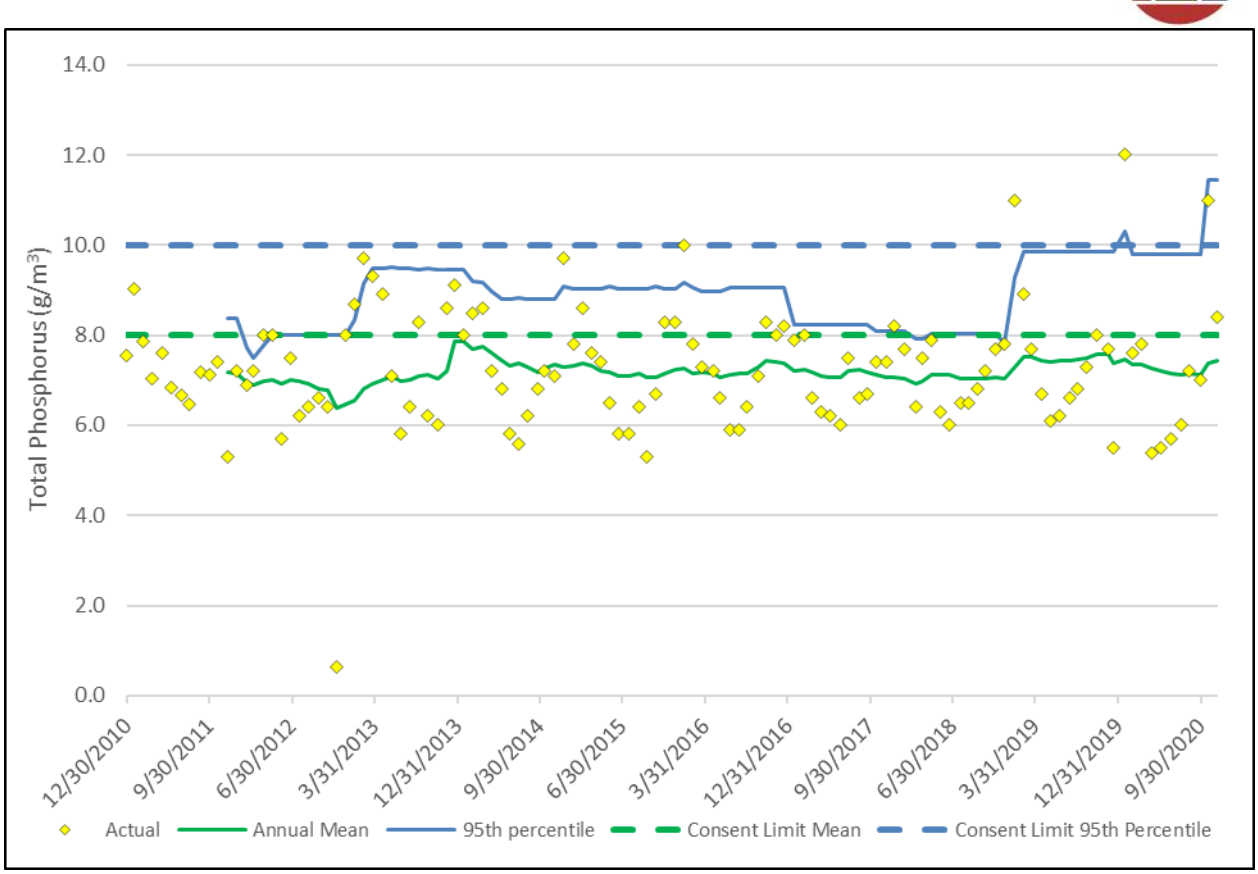


Figure 4.5: Total Phosphorus in Wastewater

Total Suspended Solids and BOD_5 are consistent with the results of previous years (refer to Figure 4.6 and Figure 4.7). There are no consent limits for total suspended solids and BOD_5.

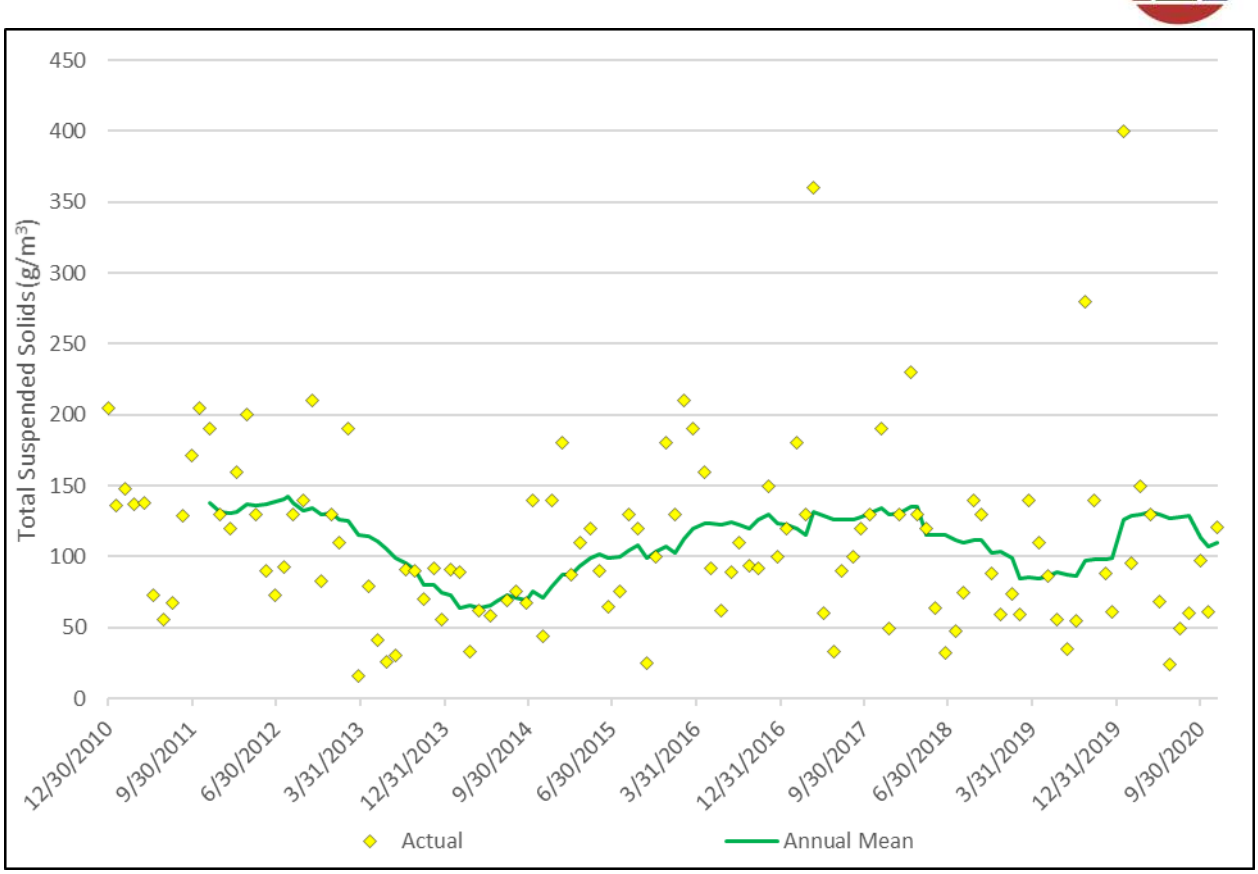


Figure 4.6: Total Suspended Solids in Wastewater

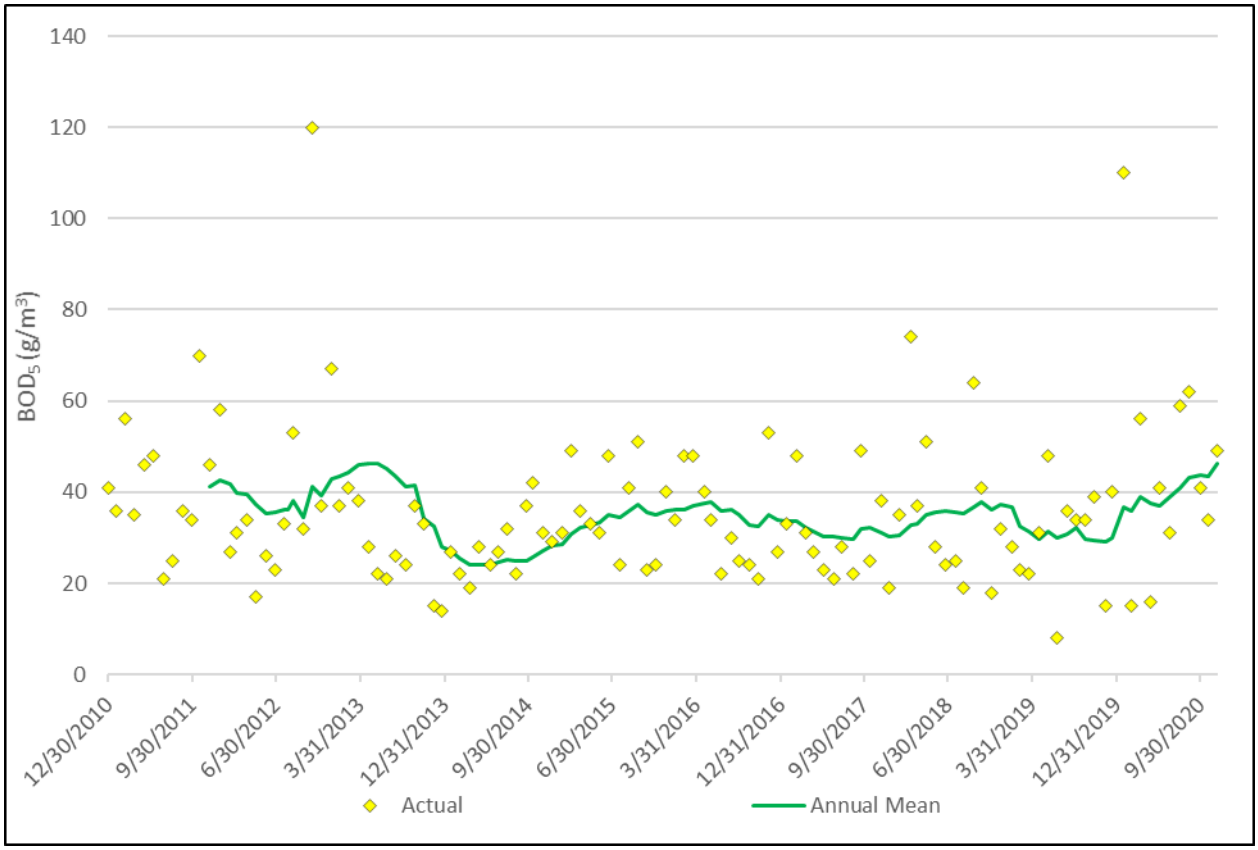


Figure 4.7: BOD_5 in Wastewater

5 NITROGEN MASS BALANCE

Treated wastewater is evenly applied by spray irrigation over 2.33 hectares area planted with ryegrass. The land management regime is cut and carry with no stock grazing.

Condition 12 of Resource Consent RM10.308.02 requires that a nitrogen mass balance for the spray irrigation land application area is prepared annually. This is to include the following:

- *The nitrogen mass balance shall consist as a minimum the total nitrogen applied to land and crop removal of nitrogen.*
- *The total nitrogen applied to the spray irrigation land shall be estimated from the total volume of wastewater applied and the average monthly concentration of total nitrogen in the land applied wastewater.*
- *The crop removal of nitrogen from the spray irrigation land shall be estimated by obtaining dry matter content and total nitrogen content after each crop/plant harvest.*
- *The nitrogen mass balance from condition 12(a) and any other factors such as ammonia volatilisation and denitrification shall be used to calculate the mass of nitrogen leached from the site, using a model acceptable to the consent authority.*

5.1 Nitrogen Loading

Influent loading, operation and performance of the oxidation pond affect the concentration of total nitrogen (TN) in the effluent. The nitrogen values used in the model (Appendix E) are the concentrations measured each month at the outlet of the oxidation pond (Appendix B). Nitrogen loading is determined based on the combination of effluent flow and the concentration of TN in the effluent (Table 5.1).

Table 5.1: Nitrogen Discharged to Trench and Applied on LTA between December 2019 - November 2020

Date	Nitrogen Concentration at Outlet (mg/L)	Monthly Nitrogen Applied by Spray Irrigation (kg/ha)	Total Nitrogen Applied by Spray Irrigation (kg)	Total Nitrogen Discharged to Trench (kg)
December	51	85.4	198.9	325.0
January	93	258.6	602.5	258.2
February	58	164.3	382.8	78.4
March	51	141.1	328.8	91.6
April	51	119.4	278.3	95.7
May	47	190.5	443.8	0.0
June	57	11.8	27.5	469.5
July	65	0.0	0.0	612.7
August	65	0.0	0.1	576.5
September	54	148.8	346.7	183.0
October	65	131.9	307.4	207.7
November	52	101.1	235.5	138.8
Total	**59 (mean)**	**1,353**	**3,152**	**3,037**

Total nitrogen loading across the LTA and disposal trench was 6,189 kg for the 2019-20 monitoring period which has increased when compared to previous monitoring periods of 4,869 kg (2018-19) and 3,414 kg (2017-18) (Table 5.5). This is due to an increase in wastewater flows

that are up 13% from 2018-19 and 20% from 2017-18; and an increase in the concentration of total nitrogen in the effluent, up 7% (55 g/m^3) from 2018-19 and 51% from 2017-18 (39 g/m^3).

5.2 Nitrogen Losses

Nitrogen loss to the ground is based on a Loss Factor (LF) and exported nitrogen. LF takes three parameters into consideration: Ammonia Volatilisation, Denitrification, and Soil Storage.

5.2.1 Ammonia Volatilisation

Nitrogen can be lost during irrigation and from the soil surface through ammonia volatilisation, which is when Ammonia gas (NH_3) returns to the atmosphere. This results in less total nitrogen in the soil that can be converted into nitrates.

The percentage of ammoniacal nitrogen (AN) in total nitrogen during the 2019-2020 reporting period showed much less variation (maximum 80.4% in December 2019 and minimum of 36.6% in January 2020) compared to previous years. Table 5.2 compares the percentage of AN in TN over the reporting period. The average over the 2019-2020 reporting period was 66%, which has increased from the 2018-2019 (63%), 2017-2018 (54.6%), and 2016-2017 (52.4%) reporting periods. The percentage of AN in the pond system remains high compared to typical municipal treated wastewater values and is likely a result of the temperature being too cold for nitrification to occur in the winter months. However, it could also be a lack of alkalinity as suggested in the ERPRO Report from the 20th September 2019 and earlier LEI Nitrogen Balance Reports.

Table 5.2: Comparison of the Percentage of Ammoniacal Nitrogen in Total Nitrogen Between 2016 and 2020

	2016-2017	2017-2018	2018-2019	2019-2020
December	73.5%	75.0%	69.1%	80.4%
January	6.4%	34.1%	66.2%	36.6%
February	5.3%	0.6%	75.0%	77.6%
March	18.9%	3.5%	73.1%	76.5%
April	69.6%	7.6%	17.3%	58.8%
May	71.4%	59.3%	48.1%	76.6%
June	87.8%	88.2%	76.9%	78.9%
July	56.5%	84.4%	82.6%	64.6%
August	79.5%	83.7%	70.9%	46.2%
September	75.0%	69.2%	39.1%	59.3%
October	83.3%	74.1%	67.7%	64.6%
November	1.4%	75.4%	70.4%	74.6%
Mean Percentage	**52.4%**	**54.6%**	**63.0%**	**66.2%**

The percentage of Ammonia volatilisation that occurs when wastewater is applied using spray irrigation is estimated at 15%. Therefore, 15% of the 2019-2020 average of 66.2% Ammonia in total nitrogen is **9.93**%. This is seen as the mid-range of what would be expected.

5.2.2 Denitrification

Denitrification has been taken as **10**% of the applied nitrogen. This is based on the Peer Reviewed Jacks Point model and is considered conservative as the whole soil profile is available here for denitrification and irrigation only occurs in the warmer months, whereas at Jacks Point, the effluent was discharged 200 mm below ground and was also applied all year round.

5.2.3 Soil Storage

The amount of nitrogen stored in the soil is negligible.

5.2.4 Total Nitrogen Loss

The total Loss Factor is calculated to be **19.9**% in the model which represents an increase of 0.4% when compared to the 2018-19 reporting period of 19.4%.

5.3 Nitrogen Removal

The amount of nitrogen taken up by the plants (ryegrass) and removed through cut & carry is calculated as a proportion of the dry matter produced, based on a percentage of utilisation. The ryegrass is cut, baled, and weighed. The Dry Matter (DM) nitrogen content is then calculated and entered in the Nitrogen Mass Balance.

Four cuts were taken offsite during the reporting period: January 2020, February 2020, April 2020, and November 2020 and are shown in Table 5.3.

Table 5.3: Nitrogen Removed by Cut and Carry

Date of Cut	Ryegrass Harvested (kg)	% Dry Matter	Nitrogen Concentration (%)	Nitrogen Removed (kg N)	Nitrogen Removed per Hectare (kg N/ha)
9-Jan-20	29,250	68%	1.8%	357.5	153.4
29-Feb-20	17,550	64%	2.0%	219.0	94.0
20-Apr-20	21,120	63%	3.6%	480.5	206.2
8-Nov-20	20,800	41%	2.4%	203.5	87.3
Total	**88,720**			**1,261**	**541**

The amount of nitrogen removed from the LTA via cut and carry was 1,261 kg for the 2019-20 monitoring period which has increased by 122% from 2018-2019 (566 kg) and 242% from 2017-2018 (of 368 kg).

5.4 Leached Nitrogen (kg/ha) from Spray Irrigation Area

The overall nitrogen balance for the site is shown in Table 5.4.

Table 5.4: Overall Nitrogen Balance for LTA

Year	Nitrogen Applied (kg N/ha/yr)	Nitrogen Losses (kg N/ha/yr)	Nitrogen Removed (kg N/ha/yr)	Nitrogen Leached (kg N/ha/yr)
2015-2016	229	42	194	0 (-7)
2016-2017	223	40	79	104
2017-2018	358	65	158	134
2018-2019	1,188	462	243	483
2019-2020	1,353	539	541	273

The nitrogen loading rate to the LTA (spray irrigation area) has significantly increased from previous years due to the increase in flow to the site (13% increase) and the increase in the concentration of nitrogen in the wastewater. However, the amount of nitrogen removed via cut and carry has also increased which has resulted in less nitrogen leaching over the LTA when compared to 2018-19.

5.5 Overall Nitrogen Mass Balance

The annual nitrogen mass balance for the LTA is calculated by multiplying the per hectare results by the area of the LTA (2.33 ha). The Nitrogen Mass Balance for the entire site also includes the amount of nitrogen applied to the discharge trench. In the discharge trench there is no nitrogen removed by cut and carry or ammonia volatisation, therefore the amount of nitrogen leaching equals the amount of nitrogen applied. A comparison of results of the Overall Nitrogen Mass Balance are shown in Table 5.5.

Table 5.5: Nitrogen Balance (kg N/yr)

Year	Land use	Nitrogen Applied (kg N/yr)	Nitrogen Losses (kg N/yr)	Nitrogen Removal (kg N/yr)	Nitrogen Leached (kg N/yr)
2016-2017	LTA	519	93	184	245
	Trench	1,652	0	0	1,652
	Total	**2,171**	**93**	**184**	**1,857**
2017-2018	LTA	834	152	369	313
	Trench	2,580	0	0	2,580
	Total	**3,414**	**152**	**369**	**2,893**
2018-2019	LTA	2,769	1077	566	1,126
	Trench	2,100	0	0	2,100
	Total	**4,869**	**1,077**	**566**	**3,226**
2019-2020	LTA	3,152	1,257	1,261	635
	Trench	3,037	0	0	3,037
	Total	**6,189**	**1,257**	**1,261**	**3,672**

The extra cut and carry removal was not enough to reduce the overall nitrogen leaching which has increased by 12% from the 2018-2019 reporting period. This increase is mainly due to the use of the disposal trench instead of spray irrigation.

6 RESOURCE CONSENT REQUIREMENTS AND COMPLIANCE

6.1 Consent Compliance for 1 December 2019 to 30th November 2020

Compliance with Resource Consents RM10.308.01 and RM10.308.02 is displayed in Table 6.1 and Table 6.2 by condition.

Veolia is the 3-waters (water, wastewater, and stormwater) operators and maintenance contractor for QLDC. In the 1 December 2019 to 30 November 2020 period, there were only minor system faults that occurred and were rectified, but no major breakdowns, as shown in Appendix F. Veolia manages programmed maintenance and work orders/ requests for service for breakdowns.

As detailed in Section 4.1 of the report, elevated volumes were recorded on two occasions in December 2019. System alarms have since been reviewed and there have been no recent events exceeding the maximum discharge volume.

In March 2020 it was identified that the trench was still being utilised more frequently than desired. Veolia re-programmed the Programmable Logic Controller (PLC) function in April to further favour the spray irrigation system and to avoid the use of the disposal trench, by allowing the pond level to increase and withholding discharge until suitable conditions for irrigation. This resulted in a huge improvement in May when all of the discharge went to the LTA. Spray irrigation was then turned off during June, July, and August due to freezing conditions. In September and October the trench was used due to issues with low flows to the irrigation pump and in November due to harvesting of the spray irrigation area.

QLDC added Zeolite in April 2020 to improve the efficiency of nitrogen and ammonia removal. However, samples collected afterwards did not indicate a noticeable improvement despite the positive indications during bench scale testing. Given the initial poor results and the high cost of dosing, QLDC is not electing to pursue this option further.

QLDC have also been working to progress the project to convey the Hawea wastewater to the Wanaka treatment plant (Project Pure). Unfortunately, this project has come against issues in regard to landowner permissions for the pipe route. These complexities have led QLDC to revisit the business case for the management of the Hawea wastewater, and ultimately will cause a delay to the decommissioning of the existing plant. As a result QLDC have commenced an options assessment for suitable short/medium term upgrade strategies to bring the existing plant into compliance.

In the meantime, QLDC are continuing to sample the Hawea River upstream and downstream to determine what the potential effects are of the total nitrogen and ammoniacal nitrogen discharge into the downstream environment. Results consistently show similar concentrations of monitoring parameters both upstream and downstream and within the relevant guideline values. There was one occasion in July when there was an unusually high *E. coli* value in the downstream sample, so re-sampling was undertaken and the results returned more consistent values.

Table 6.1: Discharge to Air Permit RM.10.308.01 Conditions

Condition	Clause Condition	Comments	Compliance
1	This consent shall only be exercised in conjunction with Discharge Permit RM10.308.02.		**Achieved**
2	The discharge to air shall be as described in the consent application submitted to the Consent Authority on 31 August 2010 and any subsequent information provided.		**Achieved**
3	Wind cloth shall be installed on the western, southern, and eastern-most boundaries of the area on which treated wastewater is to be applied by spray irrigation. This wind cloth shall be maintained until the screen foliage required under condition 4 is fully established.	The wind cloth was installed prior to 1 December 2012 and is still in place.	**Achieved**
4	Suitable screening foliage, that shall be at least 3 metres high but not exceed 6 metres in height, shall be planted on the western, southern, and eastern-most boundaries of the area on which treated wastewater is applied by spray irrigation.	The screen foliage was planted prior 1 December 2012 and is currently 3 metres in height.	**Achieved**
5	A weather station shall be installed in an appropriate location to record, as a minimum, rainfall, and wind conditions at the site where treated wastewater is to be applied by spray irrigation.	The weather station was installed in August 2011 and is in good working order.	**Achieved**
6	The spray irrigation system shall not be operated in conditions where wind speed, as measured at the on-site station installed under condition 5, exceeds 29.9 km/hour.	Control system installed to meet this condition.	**Achieved**
7	The consent holder shall keep a record of any complaints received regarding discharges of odour from the site. The record shall, as a minimum, include the following: (a) the time and place at which the complaint was generated; (b) the nature of the complaint; (c) operating conditions at the time of the complaint, including any malfunctioning or breakdown of control equipment; (d) wind and weather conditions at the time of the complaint; and (e) corrective action taken by the consent holder to minimise the risk and extent of the recurrence of the causes of the complaint. The consent holder shall submit a copy of the written record of the complaint to the consent authority within two weeks after any complaint occurring, together with the details of the corrective actions taken.	No odour complaints recorded for the 2019-2020 year.	**Achieved**
8	There shall be no discharge of odour, as a result of the exercise of this consent, that is noxious, dangerous, offensive, or objectionable to the extent that it causes an adverse effect beyond the boundary of the site, in the opinion of an authorised officer of the Consent Authority.	No odour complaints recorded for the 2019-2020 year.	**Achieved**

Table 6.2: Discharge to Land Permit RM10.308.02 Conditions

Condition	Clause Condition	Comments	Compliance
1	The discharge shall only be treated wastewater, as described in the consent application submitted to the Consent Authority on 31 August 2010 and any subsequent information provided.		**Achieved**
2	The volume of effluent discharged shall not exceed 775 cubic metres per day.	Refer to Appendix D. The daily volume of effluent exceeded the maximum consented volume on the 7th and 9th December 2019.	**Not Achieved**
3	The distance the site boundary from any part of the wastewater treatment and disposal system shall no less than 5 metres.	Compliant.	**Achieved**
4	By no later than 1 December 2012, the consent holder shall ensure that the trench utilised for wastewater disposal: a) is at least 150 metres long and 2 m wide in total; and b) is intermittently dosed; and c) is not used for the disposal of wastewater for more than 4 months in total in any one calendar year.	The trench has been used on 219 days during the 2019-2020 monitoring period which exceeds 4 months in one calendar year.	**Not Achieved**
5	By no later than 1 December 2012, the consent holder shall install and commission a spray irrigation system for the land application of treated wastewater. The spray irrigation system shall meet the following criteria: (a) the total area on which treated wastewater is applied by spray irrigation shall be no less than 2.33 hectares; (b) treated wastewater shall be applied evenly by spray irrigation to the area defined in appendix I only; (c) the area on which treated wastewater is applied by spray irrigation shall be fenced with a 2 metre high deer fence with appropriate signage warning the general public of the hazard; (d) a weather station shall be installed in an appropriate location to record, as a minimum, rainfall and wind conditions at the site where treated wastewater is to be applied by spray irrigation; (e) wastewater shall not be applied to land by spray irrigation system during the hours outside of 11 pm to 5 am; (f) nozzle pressure must not exceed 400 kilopascals (kPa); (g) there shall be no irrigation of treated wastewater using k-line irrigation systems.	The spray irrigation continues to operate within these criteria. (a) and (b) Spray irrigation is applied to 2.33 hectares in the area shown on the plan; (c) The deer fencing is in place and still intact; (d) The weather station is in good working order; it records as a minimum rainfall and windspeed; (e) Wastewater is not applied during these hours; (f) The nozzle pressure is alarmed so that it does not exceed 400 kPa; (g) There is no k-line used for irrigating.	**Achieved**

Condition	Clause Condition	Comments	Compliance
6	The area on which treated wastewater is to be applied using spray irrigation shall be planted in high growth and nitrogen uptake vegetation (such as lucerne or ryegrass) and shall be managed as far as practicably possible to optimise nutrient removal. A minimum of three harvests per year shall be undertaken.	Four harvests were undertaken in January, February, April, and November 2020.	**Achieved**
7	The total nitrogen applied to the spray irrigation area shall not exceed 1,223 kilograms of nitrogen per hectare per year.	The total nitrogen applied to the spray irrigation area was 1,353 kg/ha for the 2019-2020 year. The nitrogen mass balance is provided in Section 5.	**Not Achieved**
8	The treatment and disposal system shall be constructed and installed in accordance with the details and plans supplied with the consent application submitted to the consent authority on 31 August 2010, and attached to this consent as appendix I.	Spray irrigation system installed 5 December 2012.	**Achieved**
9	The consent holder shall install a flow meter on the outlet pipe from the treatment system and continually measure and record the daily volume (based on a no more than weekly average) of effluent being discharged to the disposal field. The consent holder shall forward the record for the previous 12-month period to the consent authority by 1 December each year, and upon request.	The recorded daily volume is provided in Appendix D.	**Achieved**

<table>
<tr><th>Condition</th><th>Clause Condition</th><th>Comments</th><th>Compliance</th></tr>
<tr><td>10</td><td>(a) from the first exercise of this consent, the consent holder shall collect representative samples of the treated wastewater from the outlet of the oxidation pond in the last week of each month. The samples shall be analysed for: (i) Five-day total biochemical oxygen demand (BOD_5); and (ii) Total Suspended Solids; and(iii) Total Nitrogen; and (iv) Total Ammoniacal Nitrogen; and (v) Total Phosphorous; and (vi) Escherichia coli
(b) from the first exercise of this consent, wastewater discharged from the oxidation pond shall comply with the following criteria:
<table>
<tr><td></td><td>Mean*</td><td>95th percentile (mg/l) *</td></tr>
<tr><td>Ammoniacal nitrogen</td><td>25 (mg/l)</td><td>30 (mg/l)</td></tr>
<tr><td>Total nitrogen</td><td>35 (mg/l)</td><td>40 (mg/l)</td></tr>
<tr><td>Total phosphorous</td><td>8 (mg/l)</td><td>10 (mg/l)</td></tr>
<tr><td>Escherichia coli</td><td>-</td><td>2.5 x 10^5 cfu/100 ml</td></tr>
</table>
*the mean and 95th percentile apply to a rolling 12-month period.

(c) the analytical sample results from the sampling under condition 9(a) of this consent shall be submitted to the consent authority by 1 December each year and upon request.</td><td>Samples have been collected every month.

Section 4 above summarises the results for each of the determinants. Refer to Appendices B and C for full results.

Elevated results have been recorded for the rolling 12 month mean and 95th percentile for both total nitrogen and ammoniacal nitrogen; and the rolling 12 month 95th percentile for total phosphorus during the 2019-2020 monitoring period.</td><td>Not Achieved</td></tr>
<tr><td>11</td><td>All sampling techniques shall be acceptable to the consent authority. All analysis carried out in connection with this consent shall be performed by a laboratory that meets ISO 17025 standards, or otherwise as specifically approved by the consent authority.</td><td>Sampling and lab analysis performed monthly by Watercare Laboratories to meet the required standards. Full PDF's of the results are provided in Appendix C.</td><td>Achieved</td></tr>
</table>

Condition	Clause Condition	Comments	Compliance
12	The following information shall be provided in writing to the consent authority by 1 December each year, and upon request, following the commencement of the exercise of the consent: (a) The nitrogen mass balance for the spray irrigation land application area, which shall be determined annually. The nitrogen mass balance shall consist as a minimum the total nitrogen applied to land and crop removal of nitrogen. (b) The total nitrogen applied to the spray irrigation land shall be estimated from the total volume of effluent applied and the average of monthly concentration of total nitrogen in the land applied effluent. (c) The crop removal of nitrogen from the spray irrigation land shall be estimated by obtaining dry matter content and total nitrogen content after each crop/plant harvest. (d) The nitrogen mass balance from condition 12(a) and any other factors such as ammonia volatilisation and denitrification shall be used to calculate the mass of nitrogen leached from the site, using a model acceptable to the consent authority	The nitrogen mass balance is presented in Section 5 and covers requirements outlined in the consent condition.	**Achieved**
13	The consent holder shall forward an annual report in writing to the consent authority by 1 December each year. The annual report shall cover the preceding 12-month period (from 1 December the preceding year until 30 November of the current year) and shall report on compliance with this consent. As a minimum, the report shall include: (a) A summary of all analytical results for the year; and (b) A summary of the year's monitoring results, in context of previous years' results; and (c) Comments on compliance with the conditions of this discharge permit; and (d) A summary of any complaints received, the validity of each complaint and the corrective action taken; and (e) A summary of any malfunctions of breakdowns and the corrective action taken; and (f) Details of the cut and carry operation, including the calculations for nitrogen loading in the spray irrigation land, number of harvests, dry matter and total nitrogen content of the harvest and nitrogen balance for this site. (g) Any other issues considered relevant by the consent holder.	Annual Report submitted for the period 1 December 2019 – 30 November 2020 in December 2020. Please note that the wording of this condition requires an annual report to be submitted only one day following the end of the monitoring period. This is impractical because if sampling is undertaken in the last week of the month as required by the condition 10a, the results would not be available for reporting before the end of November. Furthermore, the report incorporates the flow results right up to the end of November.	**Achieved**

Condition	Clause Condition	Comments	Compliance
14	By no later than 1 December 2012, the consent holder shall prepare and forward to the consent authority an operations and management manual for the wastewater treatment and disposal system to ensure its effective and efficient operation at all times. The system shall be operated in accordance with this manual, which shall be updated as appropriate. The manual and include, as a minimum: (a) A brief description of the treatment and disposal system, including a site map indicating the location of the treatment and disposal system, points of discharge and any monitoring sites; (b) Key operational matters, including weekly, monthly, and annual maintenance checks; (c) Monitoring requirements and procedures including a nitrogen balance sheet for the purpose of managing nitrogen inputs and outputs including nitrogen leaching losses; (d) A management plan for the cut and carry operation including procedures for harvesting grass from the site, and maximising grass growth and nitrogen uptake by grass such as soil tests, supplementary nutrient additions and pest and weed control; (e) Management and dosing of trenches (f) Contingency plans in the event of system malfunctions or breakdowns; and (g) The means of receiving and dealing with any complaints; and (h) Emergency contact phone numbers.	The first Operation and Maintenance manual was sent to the ORC on the 7 May 2008, with revisions/updates on the 8th August 2008, April 2010, and 6th December 2017. The have been no further updates to the O&M. Maintenance has been undertaken in accordance with the O&M on a weekly, monthly, and yearly basis.	**Achieved**
15	No ponding or surface run-off of effluent shall occur as a result of the exercise of this consent.	No ponding or surface run-off of wastewater.	**Achieved**
16	There shall be no odour emission resulting from the treatment and disposal system that is offensive or objectionable to such an extent that it has an adverse effect on the environment beyond the boundary of the property on which the consent is exercised.	No odour complaints received within the 2019-2020 year.	**Achieved**
17	This permit does not authorise the discharge of sludge to land or water.	No sludge discharged to land or water.	**Achieved**

6.2 Consent Compliance Improvement Progress

The previous Annual Report (2018-19) outlined that the Hawea WWTP had regularly not been complying with the conditions of the consent to discharge wastewater to land and that the ORC had issued a formal warning letter dated 17th June 2019. In response, QLDC prepared a proposal which included improvements and additional monitoring to transition to compliance which was accepted by ORC. The changes that QLDC have made include:

- Re-programming the Programmable Logic Controller (PLC) function in April to further favour the spray irrigation system and to avoid the use of the disposal trench, by allowing the pond level to increase and withholding discharge until suitable conditions for irrigation. This resulted in a huge improvement in May with all of the discharge going to the LTA. However, the disposal trench was used during winter months of June, July, and August due freezing temperatures and then more frequently in September, October, and November due to irrigation pump issues and harvest time.
- The addition of Zeolite to the ponds was trialled to improve the efficiency of nitrogen and ammonia removal. However, this did not result in any noticeable improvement in the quality of the effluent,
- Reduce the amount of nitrogen leaching by undertaking an extra cut and carry on the LTA,
- Undertaking regular concurrent sampling of the Hawea River upstream and immediately downstream of the treatment plant to test for the presence and concentration of ammoniacal nitrogen, total nitrogen and *E. coli* and report the results of this sampling to ORC; and
- Reporting to the ORC on a quarterly basis progress towards consent compliance.

QLDC have also been working to progress the project to convey the Hawea wastewater to the Wanaka treatment plant (Project Pure). Unfortunately, this project has come against issues in regard to landowner permissions for the pipe route. These complexities have led QLDC to revisit the business case for the management of the Hawea wastewater, and ultimately this will cause a delay in decommissioning of the existing plant.

On the 4th November 2019, the Otago Regional Council issued an abatement notice on the QLDC to cease discharging wastewater to land without complying with Conditions 4(c) and 10(b) of Resource Consent RM10.308.02.V1. The compliance date of the abatement notice is the 26th March 2021.

By early March 2021, QLDC expect to have a technical solution identified and an implementation timeline confirmed for a short/medium term upgrade to the plant to address the non-compliant conditions. Detail on this will be provided to the ORC at that time.

7 SUMMARY AND CONCLUSIONS

The interpretation of and conclusion about, the monitoring results for 1st December 2019 to 30th November 2020 reporting period from the Hawea WWTP and consent compliance are as below.

The total wastewater flow for the year is 104,444 m^3, up 12,111 m^3 (13%) from the 2018-2019 period of 92,333 m^3 and up 18,040 m^3 (20%) from 86,404 m^3 during the 2017-2018 period.

The annual average was 285 m^3/day. The volume of wastewater discharged generally remained below the consent limit of 775 m^3/day, with only two days recorded in excess of this, on the 7th and 9th December 2019. This issue has since been resolved with no further exceedances of discharge volume for the remainder of the reporting year.

The number of days during the 2019-2020 reporting period where wastewater was applied to the LTA via spray irrigation was 173 and discharged via the disposal trench was 219 (note that both the trench and irrigation can be used the same day with a total daily discharge limit of 775 m^3). This is compared to the 2018-2019 period when the spray irrigation was on 176 days and the disposal trench was 186 days. The discharge via the disposal trench is non-compliant with Condition 4(c) of RM10.308.02.

Wastewater quality was monitored on a monthly basis at the outlet of the pond. The rolling 12 month 95th percentile of 45 g/m^3 and annual mean 38 g/m^3 for total ammoniacal nitrogen exceeded the consent limit (30 g/m^3 and 25 g/m^3, respectively) throughout the 2019-2020 monitoring period.

The rolling 12 month 95th percentile of 59 g/m^3 and the rolling 12 month mean of 78 g/m^3 for total nitrogen exceeded the consent limit (40 g/m^3 and 35 g/m^3, respectively) in the 2019-2020 monitoring period. The 12-month rolling mean for total nitrogen in the effluent (59 g/m^3 as of 24 November 2020) has increased by 7% (55 g/m^3) from 2018-19 and 51% from 2017-18 (39 g/m^3).

There were three occasions when the rolling 12 month 95th percentile for total phosphorus exceeded the consented limit of 10 g/m^3, but the rolling 12 month mean remained below the consented limit throughout the 2019-2020 monitoring period.

The results for *E. coli* remained below the consent limit; and total suspended solids and BOD_5 were consistent with results from previous years.

Total nitrogen loading across the LTA and disposal trench was 6,189 kg for the 2019-20 monitoring period which has increased when compared to previous monitoring periods of 4,869 kg (2018-19) and 3,414 kg (2017-18). This is due to an increase in wastewater flows and the concentration of total nitrogen in the effluent.

During the 2019-2020 reporting period, four cuts of baleage were undertaken with an estimated 1261 kg of nitrogen removed from the LTA through the cut and carry of the ryegrass which has increased by 122% from 2018-2019 (566 kg) and 242% from 2017-2018 (of 368 kg).

There have been some improvements in the operation of the spray irrigation which has resulted in a 16% increase in the loss of nitrogen (denitrification and gaseous losses) and an 122% increase in nitrogen removed via an extra cut and carry operation in 2019-20.

This extra cut and carry operation has resulted in less nitrogen leaching from the LTA which was 273 kg N/ha/yr when compared to 483 kg N/ha/yr in 2019-19. However, the overall nitrogen leaching across the site (3,672 kg N/yr) has increased by 14% from the 2018-2019 (3,226 kg

N/yr) reporting period due to an increase in the use of the disposal trench; and 26% from the 2017-2018 (2893 kg N/yr) reporting period due to an increase in flows and the concentration of total nitrogen in the effluent.

Resource Consent RM10.308.01 was compliant with all of its conditions. There were some non-compliant conditions for resource consent RM10.308.02 and in November 2020 the ORC issued an Abatement Notice requiring compliance with Conditions 4(c) and 10(b) before the 26 March 2021.

By early March 2021, QLDC expect to have a technical solution identified and an implementation timeline confirmed for a short/medium term upgrade to the plant to address the non-compliant conditions. Detail on this will be provided to the ORC at that time.

8 REFERENCES

Lowe Environmental Impact (2019) Hawea Wastewater Treatment Plant Annual Report 2018-2019.

Otago Regional Council (2010) Discharge Permit RM10.308.01. V1.

Otago Regional Council (2010) Discharge Permit RM10.308.02. V1.

Otago Regional Council (2020) Hawea Wastewater Treatment Plant. Abatement Notice.

Otago Regional Council (2020) Compliance Monitoring Report. Reference Number A1321929.

Queenstown Lakes District Council (2020) RM10.308.02.V1 Hawea WWTP action status report – March.

Queenstown Lakes District Council (2020) RM10.308.02.V1 Hawea WWTP action status report – June.

Queenstown Lakes District Council (2020) RM10.308.02.V1 Hawea WWTP action status report – September.

9 APPENDICES

Appendix A Discharge Permits RM10.308.01 and RM10.308.02
Appendix B Wastewater Quality Monitoring Results
Appendix C Watercare Laboratory Results 2019-2020
Appendix D Daily Wastewater Flow Results
Appendix E Nitrogen Mass Balance Spreadsheet
Appendix F Maintenance Records
Appendix G Hawea River Water Sampling Results

APPENDIX A

Discharge Permits RM10.308.01 and RM10.308.02

Discharge to Air Permit RM10.308.01

Conditions

Specific

1. This consent shall only be exercised in conjunction with Discharge Permit RM10.308.02.

2. The discharge to air shall be as described in the consent application submitted to the Consent Authority on 31 August 2010 and any subsequent information provided

3. Wind cloth shall be installed on the western, southern, and eastern-most boundaries of the area on which treated wastewater is to be applied by spray irrigation. This wind cloth shall be maintained until the screen foliage required under Condition 4 is fully established.

4. Suitable screening foliage, that shall be at least 3 metres high but not exceed 6 metres in height, shall be planted on the western, southern, and eastern-most boundaries of the area on which treated wastewater is applied by spray irrigation.

5. A weather station shall be installed in an appropriate location to record, as a minimum, rainfall, and wind conditions at the site where treated wastewater is to be applied by spray irrigation.

6. The spray irrigation system shall not be operated in conditions where wind speed, as measured at the on-site station installed under Condition 5, exceeds 29.9 km/hour;

Performance Monitoring

7. The consent holder shall keep a record of any complaints received regarding discharges of odour from the site. The record shall, as a minimum, include the following:
   (a) The time and place at which the complaint was generated;
   (b) The nature of the complaint;
   (c) Operating conditions at the time of the complaint, including any malfunctioning or breakdown of control equipment;
   (d) Wind and weather conditions at the time of the complaint; and
   (e) Corrective action taken by the consent holder to minimise the risk and extent of the recurrence of the causes of the complaint.

   The consent holder shall submit a copy of the written record of the complaint to the Consent Authority within two weeks after any complaint occurring, together with the details of the corrective actions taken.

General

8. There shall be no discharge of odour, as a result of the exercise of this consent, that is noxious, dangerous, offensive, or objectionable to the extent that it causes an adverse effect beyond the boundary of the site, in the opinion of an authorised officer of the Consent Authority.

9. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
   (a) Determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or

(b) Ensuring the conditions of this consent are consistent with any National Environmental Standards; or
(c) Requiring the consent holder to adopt the best practicable option to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

Notes to Consent Holder

1. *If you require a replacement consent/permit upon the expiry date of this permit, any new application should be lodged at least 6 months prior to the expiry date of this permit. Applying at least 6 months before the expiry date may enable you to continue to exercise this permit until a decision is made, and any appeals are resolved, on the replacement application.*

Discharge to Land Permit RM10.308.02

Conditions

Specific

1. The discharge shall only be treated wastewater, as described in the consent application submitted to the Consent Authority on 31 August 2010 and any subsequent information provided.

2. The volume of effluent discharged shall not exceed 775 cubic metres per day.

3. The distance the site boundary from any part of the wastewater treatment and disposal system shall no less than 5 metres.

4. By no later than 1 December 2012, the consent holder shall ensure that the trench utilised for wastewater disposal:
a) is at least 150 metres long and 2 m wide in total; and
b) is intermittently dosed; and
c) is not used for the disposal of wastewater for more than 4 months in total in any one calendar year.

5. By no later than 1 December 2012, the consent holder shall install and commission a spray irrigation system for the land application of treated wastewater. The spray irrigation system shall meet the following criteria:
(a) The total area on which treated wastewater is applied by spray irrigation shall be no less than 2.33 hectares;
(b) Treated wastewater shall be applied evenly by spray irrigation to the area defined in Appendix I only;
(c) The area on which treated wastewater is applied by spray irrigation shall be fenced with a 2-metre-high deer fence with appropriate signage warning the general public of the hazard;
(d) A weather station shall be installed in an appropriate location to record, as a minimum, rainfall, and wind conditions at the site where treated wastewater is to be applied by spray irrigation;
(e) Wastewater shall not be applied to land by spray irrigation system during the hours outside of 11 pm to 5 am; (f) Nozzle pressure must not exceed 400 kilopascals (kPa);
(g) There shall be no irrigation of treated wastewater using K-Line irrigation systems.

6. The area on which treated wastewater is to be applied using spray irrigation shall be planted in high growth and nitrogen uptake vegetation (such as Lucerne or Ryegrass) and

shall be managed as far as practicably possible to optimise nutrient removal. A minimum of three harvests per year shall be undertaken.

7. The total nitrogen applied to the spray irrigation area shall not exceed 1,223 kilograms of nitrogen per hectare per year.

Performance Monitoring

8. The treatment and disposal system shall be constructed and installed in accordance with the details and plans supplied with the consent application submitted to the Consent Authority on 31 August 2010, and attached to this consent as Appendix I.

9. The consent holder shall install a flow meter on the outlet pipe from the treatment system and continually measure and record the daily volume (based on a no more than weekly average) of effluent being discharged to the disposal field. The consent holder shall forward the record for the previous 12-month period to the Consent Authority by 1 December each year, and upon request.

10. (a) From the first exercise of this consent, the consent holder shall collect representative samples of the treated wastewater from the outlet of the oxidation pond in the last week of each month. The samples shall be analysed for:
(i) Five-day total biochemical oxygen demand (BOD_5); and
(ii) Total suspended solids; and (iii) Total nitrogen; and (iv) Total Ammoniacal nitrogen; and (v) Total phosphorous; and (vi) *Escherichia coli.*

(b) From the first exercise of this consent, wastewater discharged from the oxidation pond shall comply with the following criteria:

	Mean*	95th Percentile (mg/L) *
Ammoniacal Nitrogen	25 (mg/L)	30 (mg/L)
Total Nitrogen	35 (mg/L)	40 (mg/L)
Total Phosphorous	8 (mg/L)	10 (mg/L)
Escherichia coli	-	2.5 x 10^5 cfu/100 mL

*The mean and 95th percentile apply to a rolling 12-month period.

(c) The analytical sample results from the sampling under Condition 9(a) of this consent shall be submitted to the Consent Authority by 1 December each year, and upon request.

11. All sampling techniques shall be acceptable to the Consent Authority. All analysis carried out in connection with this consent shall be performed by a laboratory that meets ISO 17025 standards, or otherwise as specifically approved by the Consent Authority.

12. The following information shall be provided in writing to the Consent Authority by 1 December each year, and upon request, following the commencement of the exercise of the consent:
    (a) The nitrogen mass balance for the spray irrigation land application area, which shall be determined annually. The nitrogen mass balance shall consist as a minimum the total nitrogen applied to land and crop removal of nitrogen.
    (b) The total nitrogen applied to the spray irrigation land shall be estimated from the total volume of effluent applied and the average of monthly concentration of total nitrogen in the land applied effluent.
    (c) The crop removal of nitrogen from the spray irrigation land shall be estimated by obtaining dry matter content and total nitrogen content after each crop/plant harvest.
    (d) The nitrogen mass balance from Condition 12(a) and any other factors such as ammonia volatilisation and denitrification shall be used to calculate the mass of nitrogen leached from the site, using a model acceptable to the Consent Authority

13. The consent holder shall forward an annual report in writing to the Consent Authority by 1 December each year. The annual report shall cover the preceding 12-month period (from 1 December the preceding year until 30 November of the current year) and shall report on compliance with this consent. As a minimum, the report shall include:

    (a) A summary of all analytical results for the year; and
    (b) A summary of the year's monitoring results, in context of previous years' results; and
    (c) Comments on compliance with the conditions of this discharge permit; and
    (d) A summary of any complaints received, the validity of each complaint and the corrective action taken; and
    (e) A summary of any malfunctions of breakdowns and the corrective action taken; and
    (f) Details of the cut and carry operation, including the calculations for nitrogen loading in the spray irrigation land, number of harvests, dry matter and total nitrogen content of the harvest and nitrogen balance for this site.
    (g) Any other issues considered relevant by the consent holder.

14. By no later than 1 December 2012, the consent holder shall prepare and forward to the Consent Authority an Operations and Management Manual for the wastewater treatment and disposal system to ensure its effective and efficient operation at all times. The system shall be operated in accordance with this manual, which shall be updated as appropriate. The manual and include, as a minimum,
    (a) A brief description of the treatment and disposal system, including a site map indicating the location of the treatment and disposal system, points of discharge and any monitoring sites;
    (b) Key operational matters, including weekly, monthly, and annual maintenance checks;
    (c) Monitoring requirements and procedures including a nitrogen balance sheet for the purpose of managing nitrogen inputs and outputs including nitrogen leaching losses;
    (d) A management plan for the cut and carry operation including procedures for harvesting grass from the site, and maximising grass growth and nitrogen uptake by grass such as soil tests, supplementary nutrient additions and pest and weed control;
    (e) Management and dosing of trenches
    (f) Contingency plans in the event of system malfunctions or breakdowns; and
    (g) The means of receiving and dealing with any complaints; and
    (h) Emergency contact phone numbers.

General

15. No ponding or surface run-off of effluent shall occur as a result of the exercise of this consent.

16. There shall be no odour emission resulting from the treatment and disposal system that is offensive or objectionable to such an extent that it has an adverse effect on the environment beyond the boundary of the property on which the consent is exercised

17. This permit does not authorise the discharge of sludge to land or water.

18. If the consent holder:
    (a) discovers koiwi tangata (human skeletal remains), waahi taoka (resources of importance), waahi tapu (places or features of special significance) or other Maori artefact material, the consent holder shall without delay:
    (i) notify the Consent Authority, Tangata whenua and New Zealand Historic Places Trust and in the case of skeletal remains, the New Zealand Police.
    (ii) stop work within the immediate vicinity of the discovery to allow a site inspection by the New Zealand Historic Places Trust and the appropriate runanga and their advisors, who shall determine whether the discovery is likely to be extensive, if a thorough site investigation is required, and whether an Archaeological Authority is required.
    Any koiwi tangata discovered shall be handled and removed by tribal elders responsible for the tikanga (custom) appropriate to its removal or preservation.

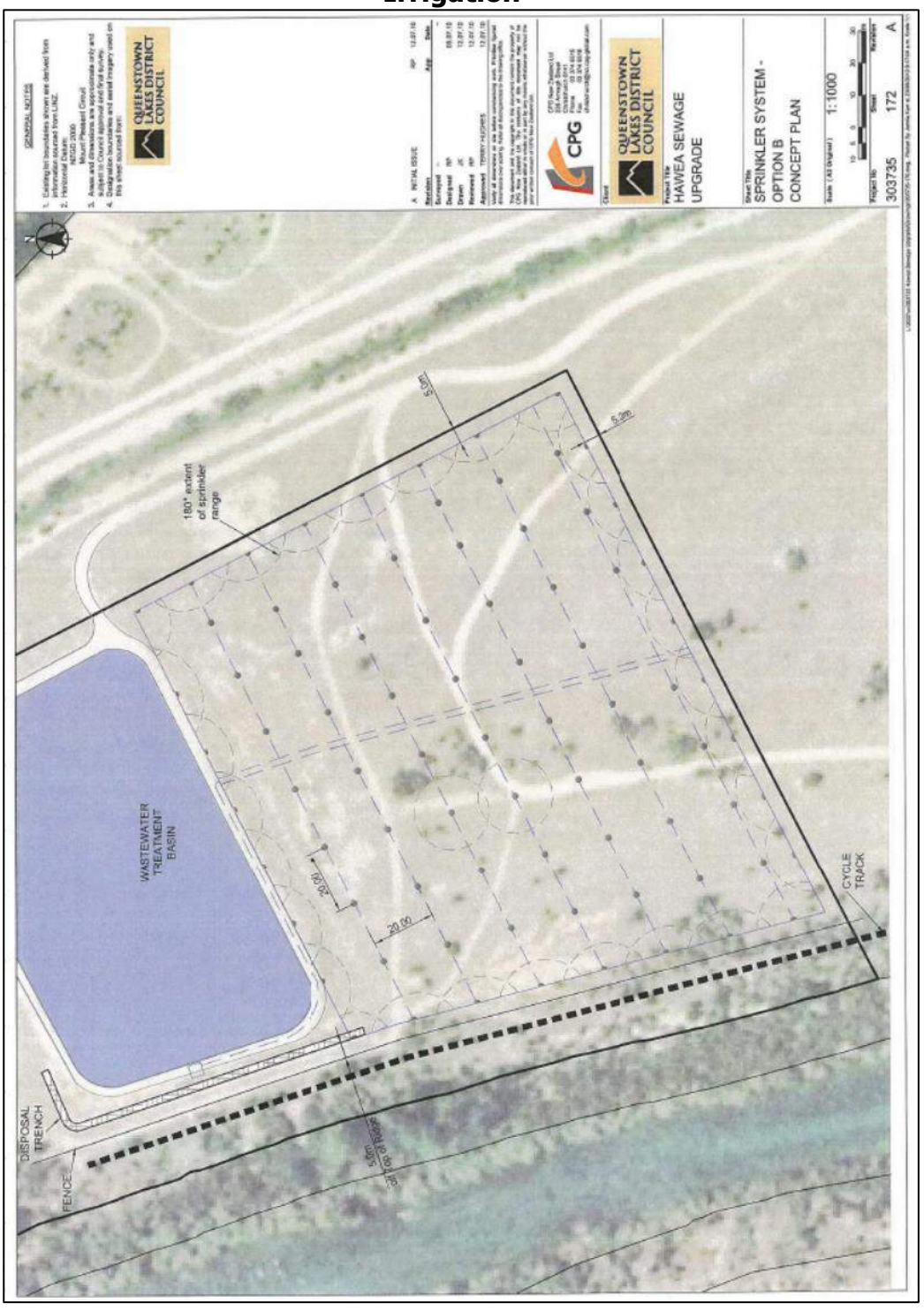
Site work shall recommence following consultation with the Consent Authority, the New Zealand Historic Places Trust, Tangata whenua, and in the case of skeletal remains, the New Zealand Police, provided that any relevant statutory permissions have been obtained.
(b) discovers any feature or archaeological material that predates 1900, or heritage material, or disturbs a previously unidentified archaeological or heritage site, the consent holder shall without delay:
(i) stop work within the immediate vicinity of the discovery or disturbance and
(ii) advise the Consent Authority, the New Zealand Historic Places Trust, and in the case of Maori features or materials, the Tangata whenua, and if required, shall make an application for an Archaeological Authority pursuant to the Historic Places Act 1993 and
(iii) arrange for a suitably qualified archaeologist to undertake a survey of the site.
Site work shall recommence following consultation with the Consent Authority.

19. The Consent Authority may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within three months of each anniversary of the commencement of this consent, for the purpose of:
(a) determining whether the conditions of this consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the consent and which it is appropriate to deal with at a later stage, or which become evident after the date of commencement of the consent; or
(b) ensuring the conditions of this consent are consistent with any National Environmental Standards; or
(c) requiring the consent holder to adopt the best practicable option, in order to remove or reduce any adverse effect on the environment arising as a result of the exercise of this consent.

Notes to Consent Holder

1. *If you require a replacement consent/permit upon the expiry date of this permit, any new application should be lodged at least 6 months prior to the expiry date of this permit. Applying at least 6 months before the expiry date may enable you to continue to exercise this permit until a decision is made, and any appeals are resolved, on the replacement application.*

Appendix I – Area on which Treated Wastewater is to be applied using Spray Irrigation



APPENDIX B

Wastewater Quality Monitoring Results

	Total Suspended Solids g/m³		BOD_5 g/m³		Total Phosphorus g/m³			Total Nitrogen g/m³			Ammoniacal Nitrogen g/m³			*E. Coli* cfu/100 mL		
	Actual Measured	Rolling 12 Month Annual Mean	Actual Measured	Rolling 12 Month Annual Mean	Actual Measured	Rolling 12 Month Annual Mean	Rolling 12 Month 95th percentile	Actual Measured	Rolling 12 Month Annual Mean	Rolling 12 Month 95th percentile	Actual Measured	Rolling 12 Month Annual Mean	Rolling 12 Month 95th percentile	Actual Measured	Rolling 12 Month Annual Mean	Rolling 12 Month 95th percentile
Consent Trigger Values						8	10		35	40		25	30			250,000
12/16/2019	61	99	40	30	5.5	7	9.8	51	55	89	41	35	46	18,000	38,808	101,750
1/23/2020	400	126	110	37	12.0	7	10.3	93	57	101	34	34	46	18,000	38,642	101,750
2/19/2020	95	129	15	36	7.6	7	9.8	58	57	101	45	35	47	3,000	37,225	101,750
3/19/2020	150	130	56	39	7.8	7	9.8	51	57	101	39	35	47	36,000	36,058	101,750
4/20/2020	130	131	16	38	5.4	7	9.8	51	60	101	30	37	47	68,000	32,558	80,150
5/20/2020	68	130	41	37	5.5	7	9.8	47	61	101	36	39	47	3,900	32,067	80,150
6/22/2020	24	127	31	39	5.7	7	9.8	57	63	101	45	40	47	34,000	34,492	80,150
7/27/2020	49	128	59	41	6.0	7	9.8	65	64	101	42	41	47	30,000	29,075	66,900
8/24/2020	60	129	62	43	7.2	7	9.8	65	65	101	30	40	47	62,000	28,742	64,700
9/30/2020	97	114	41	44	7.0	7	9.8	54	60	81	32	39	47	56,000	30,242	64,700
10/26/2020	61	107	34	43	11.0	7	11.5	65	61	81	42	39	47	66,000	33,158	66,900
11/24/2020	121	110	49	46	8.4	7	11.5	52	59	78	39	38	45	2,900	33,150	66,900

APPENDIX C

Watercare Laboratory Results 2019-2020

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Certificate of Analysis
Laboratory Reference:191216-132

Attention:	Operations .	*Final Report:*	**346957-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**23-Dec-2019**
Address:		*Received Date:*	**17-Dec-2019**
Client Reference:	**Hawea Ponds Monthly Dec 2019**	*Sampled By:*	**CB**
Purchase Order:	**PO7300082554**	*Quote Reference :*	**42**

Sample Details		WATERS
Lab Sample ID:		**191216-132-1**
Client Sample ID:		
Sample Date/Time		16/12/2019 10:17
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	41
CBOD5 (as O2)	mg/L	40
Total Nitrogen (as N)	mg/L	51
Total Phosphorus (as P)	mg/L	5.5
Total Suspended Solids	mg/L	61
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	18000

*Results marked with * are not accredited to International Accreditation New Zealand*

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Michelle Donovan
KTP Signatory

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Certificate of Analysis
Laboratory Reference:191216-129

Attention:	Jennifer Mcgirr	*Final Report:*	**347114-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**24-Dec-2019**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**17-Dec-2019**
Client Reference:	**Hawea River**	*Sampled By:*	**Watercare**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**191216-129-1**	**191216-129-2**
Client Sample ID:			
Sample Date/Time		16/12/2019 12:33	16/12/2019 12:45
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.92	8.00
Total Nitrogen (as N)	mg/L	0.08	0.01
Total Oxidised Nitrogen (as N)	mg/L	0.01	0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<1.0	6.3

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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Certificate of Analysis
Laboratory Reference:200123-093

Attention:	Jennifer Mcgirr	*Final Report:*	**352064-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**02-Feb-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**25-Jan-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**Watercare**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200123-093-1**	**200123-093-2**
Client Sample ID:			
Sample Date/Time		23/01/2020	23/01/2020
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	0.005
pH (at room temp c. 20 °C)	pH unit	7.73	7.70
Total Nitrogen (as N)	mg/L	0.11	0.14
Total Oxidised Nitrogen (as N)	mg/L	<0.01	<0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<10	<10

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

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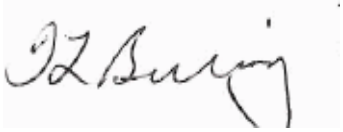

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Certificate of Analysis
Laboratory Reference:200122-187

Attention:	Operations .	*Final Report:*	**351839-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**31-Jan-2020**
Address:		*Received Date:*	**24-Jan-2020**
Client Reference:	**Hawea Ponds Monthly Jan 2020**	*Sampled By:*	**Watercare**
Purchase Order:	**PO7300085674**	*Quote Reference :*	**42**

Sample Details	WATERS
Lab Sample ID:	**200122-187-1**
Client Sample ID:	
Sample Date/Time	23/01/2020
Description:	Hawea Effluent (RM 10.308.02)

General Testing		
Ammoniacal Nitrogen (as N)	mg/L	34
CBOD5 (as O2)	mg/L	110
Total Nitrogen (as N)	mg/L	93
Total Phosphorus (as P)	mg/L	12
Total Suspended Solids	mg/L	400

Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	18000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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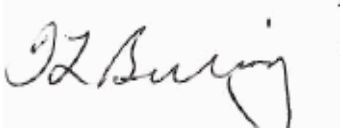

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Certificate of Analysis
Laboratory Reference:200219-097

Attention:	Jennifer Mcgirr	*Final Report:*	**355659-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**28-Feb-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**19-Feb-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**Watercare**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200219-097-1**	**200219-097-2**
Client Sample ID:			
Sample Date/Time		19/02/2020 12:05	19/02/2020 11:50
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.98	8.03
Total Nitrogen (as N)	mg/L	0.04	0.06
Total Oxidised Nitrogen (as N)	mg/L	<0.01	<0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<4.2	<4.2
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<10	<10

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Reference Methods
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Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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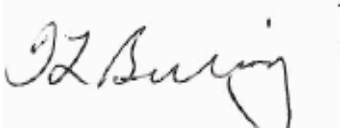

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Certificate of Analysis
Laboratory Reference:200219-096

Attention:	Operations .	*Final Report:*	**355696-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**28-Feb-2020**
Address:		*Received Date:*	**19-Feb-2020**
Client Reference:	**Hawea Ponds Monthly Feb 2020**	*Sampled By:*	**Watercare**
Purchase Order:	**PO7300088033**	*Quote Reference :*	**42**

Sample Details	WATERS
Lab Sample ID:	**200219-096-1**
Client Sample ID:	
Sample Date/Time	19/02/2020 11:25
Description:	Hawea Effluent (RM 10.308.02)

General Testing		
Ammoniacal Nitrogen (as N)	mg/L	45
CBOD5 (as O2)	mg/L	15
Total Nitrogen (as N)	mg/L	58
Total Phosphorus (as P)	mg/L	7.6
Total Suspended Solids	mg/L	95

Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	3000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

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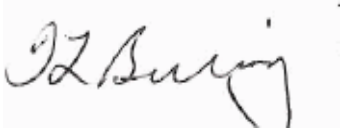

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Certificate of Analysis
Laboratory Reference:200319-080

Attention:	Jennifer Mcgirr	*Final Report:*	**359741-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**01-Apr-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**19-Mar-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**Watercare**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200319-080-1**	**200319-080-2**
Client Sample ID:			
Sample Date/Time		19/03/2020 15:40	19/03/2020 15:23
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	2.2	2.2
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.41	7.42
Total Nitrogen (as N)	mg/L	0.07	0.16
Total Oxidised Nitrogen (as N)	mg/L	<0.01	<0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	3.1	17

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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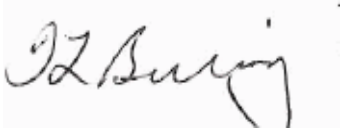

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Certificate of Analysis
Laboratory Reference:200319-079

Attention:	Operations .	*Final Report:*	**359806-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**01-Apr-2020**
Address:		*Received Date:*	**19-Mar-2020**
Client Reference:	**Hawea Ponds Monthly March 2020**	*Sampled By:*	**Watercare**
Purchase Order:	**PO7300090755**	*Quote Reference :*	**42**

Sample Details	WATERS
Lab Sample ID:	**200319-079-1**
Client Sample ID:	
Sample Date/Time	19/03/2020 12:57
Description:	Hawea Effluent (RM 10.308.02)

General Testing		
Ammoniacal Nitrogen (as N)	mg/L	39
CBOD5 (as O2)	mg/L	56
Total Nitrogen (as N)	mg/L	51
Total Phosphorus (as P)	mg/L	7.8
Total Suspended Solids	mg/L	150

Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	36000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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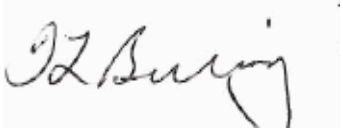

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Certificate of Analysis
Laboratory Reference:200420-092

Attention:	Jennifer Mcgirr	*Final Report:*	**362852-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**30-Apr-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**20-Apr-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**Watercare**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200420-092-1**	**200420-092-2**
Client Sample ID:			
Sample Date/Time		20/04/2020 10:53	20/04/2020 10:40
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.52	7.67
Total Nitrogen (as N)	mg/L	0.08	0.09
Total Oxidised Nitrogen (as N)	mg/L	<0.01	<0.01
Total Phosphorus (as P)	mg/L	0.35	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	1.0	1.0

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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Samples, with suitable preservation and stability of analytes, will be held by the laboratory for a period of two weeks after results have been reported, unless otherwise advised by the submitter.

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Certificate of Analysis
Laboratory Reference:200420-091

Attention:	Operations .	*Final Report:*	**362872-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**30-Apr-2020**
Address:		*Received Date:*	**20-Apr-2020**
Client Reference:	**Hawea Ponds Monthly April 2020**	*Sampled By:*	**Watercare**
Purchase Order:	**PO7300094123**	*Quote Reference :*	**42**

Sample Details		WATERS
Lab Sample ID:		**200420-091-1**
Client Sample ID:		
Sample Date/Time		20/04/2020 10:20
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	30
CBOD5 (as O2)	mg/L	16
Total Nitrogen (as N)	mg/L	51
Total Phosphorus (as P)	mg/L	5.4
Total Suspended Solids	mg/L	130
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	68000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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Certificate of Analysis
Laboratory Reference:200520-092

Attention:	Jennifer Mcgirr	*Final Report:*	**365800-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**30-May-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**20-May-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**RML & CS**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200520-092-1**	**200520-092-2**
Client Sample ID:			
Sample Date/Time		20/05/2020 14:30	20/05/2020 14:45
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.65	7.48
Total Nitrogen (as N)	mg/L	0.14	0.14
Total Oxidised Nitrogen (as N)	mg/L	<0.01	<0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<1.0	7.4

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Reference Methods
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Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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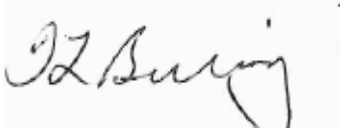

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Certificate of Analysis
Laboratory Reference:200520-088

Attention:	Operations .	*Final Report:*	**365803-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**30-May-2020**
Address:		*Received Date:*	**20-May-2020**
Client Reference:	**Hawea Ponds - April 2020**	*Sampled By:*	**RML**
Purchase Order:	**PO7300095907**	*Quote Reference :*	**42**

Sample Details		WATERS
Lab Sample ID:		**200520-088-1**
Client Sample ID:		
Sample Date/Time		20/05/2020 14:05
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	36
CBOD5 (as O2)	mg/L	41
Total Nitrogen (as N)	mg/L	47
Total Phosphorus (as P)	mg/L	5.5
Total Suspended Solids	mg/L	68
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	3900

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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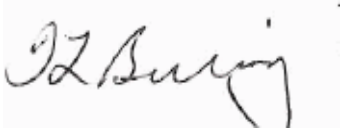

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Certificate of Analysis
Laboratory Reference:200622-117

Attention:	Jennifer Mcgirr	*Final Report:*	**369788-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**01-Jul-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**23-Jun-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**HM & CS**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200622-117-1**	**200622-117-2**
Client Sample ID:			
Sample Date/Time		22/06/2020 12:40	22/06/2020 12:58
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.80	7.69
Total Nitrogen (as N)	mg/L	0.08	0.07
Total Oxidised Nitrogen (as N)	mg/L	0.01	0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	2.7	2.8
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<10	<10

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

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Certificate of Analysis
Laboratory Reference:200622-116

Attention:	Operations .	*Final Report:*	**369836-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**01-Jul-2020**
Address:		*Received Date:*	**23-Jun-2020**
Client Reference:	**Hawea Ponds - June 2020**	*Sampled By:*	**HM**
Purchase Order:	**PO7300098935**	*Quote Reference :*	**42**

Sample Details	WATERS
Lab Sample ID:	**200622-116-1**
Client Sample ID:	
Sample Date/Time	22/06/2020 12:06
Description:	Hawea Effluent (RM 10.308.02)

General Testing		
Ammoniacal Nitrogen (as N)	mg/L	45
CBOD5 (as O2)	mg/L	31
Total Nitrogen (as N)	mg/L	57
Total Phosphorus (as P)	mg/L	5.7
Total Suspended Solids	mg/L	24

Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	34000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher. For more information please contact the Operations Manager.

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Certificate of Analysis
Laboratory Reference:200722-095

Attention:	Jennifer Mcgirr	*Final Report:*	**374119-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**03-Aug-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**23-Jul-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**CS & CB**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200722-095-1**	**200722-095-2**
Client Sample ID:			
Sample Date/Time		27/07/2020 14:08	27/07/2020 14:22
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.61	7.56
Total Nitrogen (as N)	mg/L	0.03	0.09
Total Oxidised Nitrogen (as N)	mg/L	0.02	0.02
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<10	460

*Results marked with * are not accredited to International Accreditation New Zealand*

Where samples have been supplied by the client they are tested as received. A dash indicates no test performed.

Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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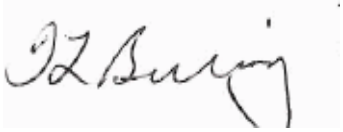

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Certificate of Analysis
Laboratory Reference:200722-093

Attention:	Operations .	*Final Report:*	**374183-0**	*Replaces Report*	**374172-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**03-Aug-2020**		
Address:		*Received Date:*	**28-Jul-2020**		
Client Reference:	**Hawea Ponds - July 2020**	*Sampled By:*	**CB**		
Purchase Order:	**PO7300102008**	*Quote Reference :*	**42**		

Sample Details

WATERS

Lab Sample ID:	**200722-093-1**
Client Sample ID:	
Sample Date/Time	27/07/2020 13:50
Description:	Hawea Effluent (RM 10.308.02)

General Testing

Ammoniacal Nitrogen (as N)	mg/L	42
CBOD5 (as O2)	mg/L	59
Total Nitrogen (as N)	mg/L	65
Total Phosphorus (as P)	mg/L	6.0
Total Suspended Solids	mg/L	49

Microbiology

Escherichia coli by Membrane Filtration

Escherichia coli	cfu/100 mL	30000

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Reference Methods

The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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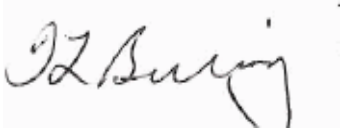

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Certificate of Analysis
Laboratory Reference:200803-178

Attention:	Jennifer Mcgirr	*Final Report:*	**375195-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**10-Aug-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**04-Aug-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**MA**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200803-178-1**	**200803-178-2**
Client Sample ID:			
Sample Date/Time		04/08/2020 12:40	04/08/2020 12:50
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.64	7.62
Total Nitrogen (as N)	mg/L	0.1	0.05
Total Oxidised Nitrogen (as N)	mg/L	0.02	0.02
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<10	<10

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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Certificate of Analysis
Laboratory Reference:200824-123

Attention:	Jennifer Mcgirr	*Final Report:*	**377694-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**31-Aug-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**25-Aug-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**MA**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200824-123-1**	**200824-123-2**
Client Sample ID:			
Sample Date/Time		24/08/2020	24/08/2020
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.61	7.59
Total Nitrogen (as N)	mg/L	0.11	0.06
Total Oxidised Nitrogen (as N)	mg/L	0.02	0.02
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<10	<10

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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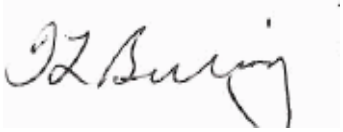

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Certificate of Analysis
Laboratory Reference:200824-125

Attention:	Operations .	*Final Report:*	**379209-0**	*Replaces Report*	**377816-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**11-Sep-2020**		
Address:		*Received Date:*	**25-Aug-2020**		
Client Reference:	**Hawea Ponds**				
Purchase Order:	**PO7300104982**	*Quote Reference :*	**42**		

Amended Report: E.coli result amended due to Typographical error.

Sample Details		WATERS
Lab Sample ID:		**200824-125-1**
Client Sample ID:		
Sample Date/Time		24/08/2020
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	30
CBOD5 (as O2)	mg/L	62
Total Nitrogen (as N)	mg/L	65
Total Phosphorus (as P)	mg/L	7.2
Total Suspended Solids	mg/L	60
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	62000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

The method detection limit (MDL) listed is the limit attainable in a relatively clean matrix. If dilutions are required for analysis the detection limit may be higher.
For more information please contact the Operations Manager.

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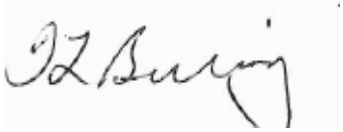

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Certificate of Analysis
Laboratory Reference:200930-086

Attention:	Jennifer Mcgirr	*Final Report:*	**382695-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**09-Oct-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**30-Sep-2020**
Client Reference:	**Hawea River**	*Sampled By:*	**CS & MS**
Purchase Order:	**PO028787**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**200930-086-1**	**200930-086-2**
Client Sample ID:			
Sample Date/Time		30/09/2020 09:30	30/09/2020 09:57
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.73	7.79
Total Nitrogen (as N)	mg/L	0.12	0.14
Total Oxidised Nitrogen (as N)	mg/L	0.02	0.02
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<2.5	<2.5
Microbiology			
Escherichia coli by MPN(Colilert-18)			
Escherichia coli (Colilert-18)	MPN/100 mL	<1.0	5.2

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by MPN(Colilert-18)				
Escherichia coli (Colilert-18)	APHA (online edition) 9223 B Colilert Quantitray	1 MPN/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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Certificate of Analysis
Laboratory Reference:200930-085

Attention:	Operations .	*Final Report:*	**382694-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**09-Oct-2020**
Address:		*Received Date:*	**30-Sep-2020**
Client Reference:	**Hawea Ponds Monthly September 2020**	*Sampled By:*	**CS**
Purchase Order:	**PO7300108781**	*Quote Reference :*	**42**

Sample Details		WATERS
Lab Sample ID:		**200930-085-1**
Client Sample ID:		
Sample Date/Time		30/09/2020
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	32
CBOD5 (as O2)	mg/L	41
Total Nitrogen (as N)	mg/L	54
Total Phosphorus (as P)	mg/L	7.0
Total Suspended Solids	mg/L	97
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	56000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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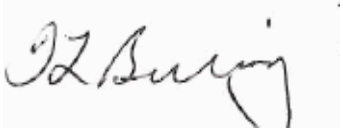

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Certificate of Analysis
Laboratory Reference:201026-014

Attention:	Jennifer Mcgirr	*Final Report:*	**385974-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**03-Nov-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**27-Oct-2020**
Client Reference:		*Sampled By:*	**ES & CS**
Purchase Order:	**Not Available**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**201026-014-1**	**201026-014-2**
Client Sample ID:			
Sample Date/Time		26/10/2020 10:55	26/10/2020 11:17
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	<0.01	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.63	7.36
Total Nitrogen (as N)	mg/L	0.12	0.08
Total Oxidised Nitrogen (as N)	mg/L	0.03	0.02
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<4.2	<4.2
Microbiology			
Escherichia coli by Membrane Filtration			
Escherichia coli	cfu/100 mL	<1.0	<1.0

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill
Preparations				
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)		All	Invercargill

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Certificate of Analysis
Laboratory Reference:201026-016

Attention:	Joel Dykstra	*Final Report:*	**385976-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**03-Nov-2020**
Address:		*Received Date:*	**27-Oct-2020**
Client Reference:	**Hawea Pond**	*Sampled By:*	**cs & es**
Purchase Order:	**PO7300112032**	*Quote Reference :*	**42**

Sample Details		WATERS
Lab Sample ID:		**201026-016-1**
Client Sample ID:		
Sample Date/Time		26/10/2020 10:38
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	42
CBOD5 (as O2)	mg/L	34
Total Nitrogen (as N)	mg/L	65
Total Phosphorus (as P)	mg/L	11
Total Suspended Solids	mg/L	61
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	66000

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill

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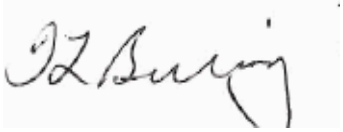

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Certificate of Analysis
Laboratory Reference:201123-020

Attention:	Jennifer Mcgirr	*Final Report:*	**390043-0**
Client:	**QUEENSTOWN LAKE DISTRICT COUNC**	*Report Issue Date:*	**03-Dec-2020**
Address:	**PO Box 50072, Queenstown, 9348**	*Received Date:*	**24-Nov-2020**
		Sampled By:	**ES**
Client Reference:			
Purchase Order:	**Not Available**	*Quote Reference :*	**10284**

Sample Details		WATERS	WATERS
Lab Sample ID:		**201123-020-1**	**201123-020-2**
Client Sample ID:			
Sample Date/Time		24/11/2020 11:00	24/11/2020 11:15
Description:		Hawea River Upstream	Hawea River Downstream
General Testing			
Ammoniacal Nitrogen (as N)	mg/L	0.02	<0.01
CBOD5 (as O2)	mg/L	<2.0	<2.0
Dissolved Reactive Phosphorus (as P)	mg/L	<0.005	<0.005
pH (at room temp c. 20 °C)	pH unit	7.40	7.48
Total Nitrogen (as N)	mg/L	0.05	0.1
Total Oxidised Nitrogen (as N)	mg/L	0.02	0.01
Total Phosphorus (as P)	mg/L	<0.01	<0.01
Total Suspended Solids	mg/L	<5.0	<5.0
Microbiology			
Escherichia coli by Membrane Filtration			
Escherichia coli	cfu/100 mL	3.0	140

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	ISBN 0117516139 (modified)	0.010 mg/L	All	Invercargill
Carbonaceous Biochemical Oxygen Demand, CBOD5 (as O 2) by Electrode	APHA (online edition) 5210 B	2 mg/L	All	Invercargill
Dissolved Reactive Phosphorus (as P) by Colorimetry/ Discrete Analyser	APHA (online edition) 4500-P E	0.005 mg/L	All	Invercargill
pH (at room temp c. 20 °C) by Electrode	APHA (online edition) 4500-H B (Tested beyond 15 minute APHA holding time)	0.1 pH unit	All	Invercargill
Total Nitrogen (as N) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J, 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Oxidised Nitrogen (as N) by Colorimetry/Discrete Analyser	APHA (online edition) 4500-NO3 H	0.010 mg/L	All	Invercargill
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P B, J (modified)	0.010 mg/L	All	Invercargill
Total Suspended Solids by Gravimetry	APHA (online edition) 2540 D	2.5 mg/L	All	Invercargill
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603 (2002)	2 cfu/100 mL	All	Invercargill
Preparations				

Preparations			
Membrane Filtration (0.45 µm)	APHA (online edition) 4500-P B (preliminary filtration)	All	Invercargill

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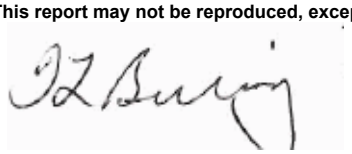

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Certificate of Analysis
Laboratory Reference:201123-023

Attention:	Joel Dykstra	*Final Report:*	**389768-0**
Client:	**VEOLIA WATER**	*Report Issue Date:*	**01-Dec-2020**
Address:		*Received Date:*	**24-Nov-2020**
		Sampled By:	**ES**
Client Reference:	**Hawea Pond**		
Purchase Order:	**7300114528**	*Quote Reference :*	**42**

Sample Details		WATERS
Lab Sample ID:		**201123-023-1**
Client Sample ID:		
Sample Date/Time		24/11/2020 10:30
Description:		Hawea Effluent (RM 10.308.02)
General Testing		
Ammoniacal Nitrogen (as N)	mg/L	38.8
CBOD5	mg/L	49
Total Nitrogen (as N)	mg/L	52
Total Phosphorus (as P)	mg/L	8.4
Total Suspended Solids	mg/L	121
Microbiology		
Escherichia coli by Membrane Filtration		
Escherichia coli	cfu/100 mL	2900

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Reference Methods
The sample(s) referred to in this report were analysed by the following method(s)

Analyte	Method Reference	MDL	Samples	Location
General Testing				
Ammoniacal Nitrogen (as N) by Colorimetry/Discrete Analyser	HMSO (1981) ISBN 0117516139	0.4 mg/L	All	Auckland
Carbonaceous Biochemical Oxygen Demand, CBOD5 by Electrode	APHA (online edition) 5210 B (modified)	0.5 mg/L	All	Auckland
Total Nitrogen (as N) by Persulphate Digestion and Flow Analysis	APHA (online edition) 4500-P J (modified), 4500-NO3 I	0.010 mg/L	All	Auckland
Total Phosphorus (as P) by Persulphate Digestion and Colorimetry/Discrete Analyser	APHA (online edition) 4500-P J (modified) (Discrete Analyser)	0.004 mg/L	All	Auckland
Total Suspended Solids by Gravimetry	In House based on APHA (online edition) 2540 D, E	1 mg/L	All	Auckland
Microbiology				
Escherichia coli by Membrane Filtration				
Escherichia coli	USEPA Method 1603	2 cfu/100 mL	All	Auckland

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APPENDIX D

Daily Wastewater Flow Results

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
1-Dec-19	114	0	114
2-Dec-19	117	0	117
3-Dec-19	223	21	244
4-Dec-19	700	0	700
5-Dec-19	716	0	716
6-Dec-19	225	95	320
7-Dec-19	498	455	953
8-Dec-19	225	93	318
9-Dec-19	225	551	776
10-Dec-19	48	543	591
11-Dec-19	0	555	555
12-Dec-19	0	543	543
13-Dec-19	0	80	80
14-Dec-19	0	1	1
15-Dec-19	124	0	124
16-Dec-19	214	0	214
17-Dec-19	274	77	351
18-Dec-19	260	53	313
19-Dec-19	274	73	347
20-Dec-19	322	119	441
21-Dec-19	90	0	90
22-Dec-19	244	0	244
23-Dec-19	276	0	276
24-Dec-19	174	0	174
25-Dec-19	189	0	189
26-Dec-19	198	0	198
27-Dec-19	188	0	188
28-Dec-19	51	100	151
29-Dec-19	104	453	557
30-Dec-19	170	0	170
31-Dec-19	129	88	217
1-Jan-20	136	541	677
2-Jan-20	113	63	176
3-Jan-20	102	1	103
4-Jan-20	99	0	99
5-Jan-20	86	80	166
6-Jan-20	136	393	529
7-Jan-20	116	0	116
8-Jan-20	145	0	145
9-Jan-20	90	0	90
10-Jan-20	450	0	450
11-Jan-20	353	79	432
12-Jan-20	224	242	466
13-Jan-20	172	551	723
14-Jan-20	80	549	629
15-Jan-20	3	548	551
16-Jan-20	0	553	553
17-Jan-20	0	551	551
18-Jan-20	0	549	549
19-Jan-20	0	193	193
20-Jan-20	0	0	0
21-Jan-20	207	0	207
22-Jan-20	0	109	109

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
23-Jan-20	0	108	108
24-Jan-20	0	103	103
25-Jan-20	0	151	151
26-Jan-20	0	0	0
27-Jan-20	104	0	104
28-Jan-20	160	0	160
29-Jan-20	0	117	117
30-Jan-20	0	551	551
31-Jan-20	0	447	447
1-Feb-20	0	1	1
2-Feb-20	160	0	160
3-Feb-20	160	0	160
4-Feb-20	141	0	141
5-Feb-20	128	3	131
6-Feb-20	91	107	198
7-Feb-20	65	549	614
8-Feb-20	16	571	587
9-Feb-20	2	106	108
10-Feb-20	15	546	561
11-Feb-20	51	576	627
12-Feb-20	17	0	17
13-Feb-20	0	95	95
14-Feb-20	0	563	563
15-Feb-20	0	549	549
16-Feb-20	0	550	550
17-Feb-20	0	551	551
18-Feb-20	0	445	445
19-Feb-20	0	0	0
20-Feb-20	0	298	298
21-Feb-20	0	1	1
22-Feb-20	0	105	105
23-Feb-20	0	470	470
24-Feb-20	0	0	0
25-Feb-20	55	0	55
26-Feb-20	203	0	203
27-Feb-20	0	116	116
28-Feb-20	81	398	479
29-Feb-20	166	0	166
1-Mar-20	131	0	131
2-Mar-20	119	0	119
3-Mar-20	98	0	98
4-Mar-20	79	0	79
5-Mar-20	88	0	88
6-Mar-20	98	0	98
7-Mar-20	90	0	90
8-Mar-20	72	114	186
9-Mar-20	73	549	622
10-Mar-20	71	551	622
11-Mar-20	0	551	551
12-Mar-20	0	550	550
13-Mar-20	0	506	506
14-Mar-20	27	51	78
15-Mar-20	138	65	203

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
16-Mar-20	169	0	169
17-Mar-20	135	0	135
18-Mar-20	98	0	98
19-Mar-20	0	139	139
20-Mar-20	0	550	550
21-Mar-20	0	551	551
22-Mar-20	0	476	476
23-Mar-20	0	0	0
24-Mar-20	132	0	132
25-Mar-20	178	0	178
26-Mar-20	0	109	109
27-Mar-20	0	549	549
28-Mar-20	0	546	546
29-Mar-20	0	482	482
30-Mar-20	0	0	0
31-Mar-20	0	109	109
1-Apr-20	0	538	538
2-Apr-20	0	0	0
3-Apr-20	0	81	81
4-Apr-20	157	157	314
5-Apr-20	173	0	173
6-Apr-20	192	0	192
7-Apr-20	219	0	219
8-Apr-20	62	0	62
9-Apr-20	0	0	0
10-Apr-20	33	0	33
11-Apr-20	218	0	218
12-Apr-20	140	0	140
13-Apr-20	150	0	150
14-Apr-20	333	0	333
15-Apr-20	2	268	270
16-Apr-20	0	274	274
17-Apr-20	0	533	533
18-Apr-20	0	589	589
19-Apr-20	0	550	550
20-Apr-20	0	546	546
21-Apr-20	0	525	525
22-Apr-20	0	312	312
23-Apr-20	0	66	66
24-Apr-20	0	46	46
25-Apr-20	0	135	135
26-Apr-20	0	0	0
27-Apr-20	0	0	0
28-Apr-20	197	0	197
29-Apr-20	0	286	286
30-Apr-20	0	551	551
1-May-20	0	548	548
2-May-20	0	511	511
3-May-20	0	191	191
4-May-20	0	261	261
5-May-20	0	548	548
6-May-20	0	532	532
7-May-20	0	348	348

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
8-May-20	0	128	128
9-May-20	0	284	284
10-May-20	0	203	203
11-May-20	0	301	301
12-May-20	0	318	318
13-May-20	0	267	267
14-May-20	0	274	274
15-May-20	0	290	290
16-May-20	0	270	270
17-May-20	0	290	290
18-May-20	0	302	302
19-May-20	0	310	310
20-May-20	0	258	258
21-May-20	0	278	278
22-May-20	0	285	285
23-May-20	0	304	304
24-May-20	0	203	203
25-May-20	0	286	286
26-May-20	0	286	286
27-May-20	0	260	260
28-May-20	0	276	276
29-May-20	0	277	277
30-May-20	0	264	264
31-May-20	0	289	289
1-Jun-20	0	311	311
2-Jun-20	183	83	266
3-Jun-20	369	88	457
4-Jun-20	156	0	156
5-Jun-20	355	1	356
6-Jun-20	313	0	313
7-Jun-20	341	0	341
8-Jun-20	258	0	258
9-Jun-20	321	0	321
10-Jun-20	238	0	238
11-Jun-20	208	0	208
12-Jun-20	376	0	376
13-Jun-20	266	0	266
14-Jun-20	236	0	236
15-Jun-20	251	0	251
16-Jun-20	252	0	252
17-Jun-20	293	0	293
18-Jun-20	398	0	398
19-Jun-20	366	0	366
20-Jun-20	162	0	162
21-Jun-20	108	0	108
22-Jun-20	283	0	283
23-Jun-20	324	0	324
24-Jun-20	351	0	351
25-Jun-20	174	0	174
26-Jun-20	111	0	111
27-Jun-20	123	0	123
28-Jun-20	347	0	347
29-Jun-20	575	0	575

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
30-Jun-20	499	0	499
1-Jul-20	424	0	424
2-Jul-20	282	0	282
3-Jul-20	84	0	84
4-Jul-20	127	0	127
5-Jul-20	379	0	379
6-Jul-20	364	0	364
7-Jul-20	356	0	356
8-Jul-20	376	0	376
9-Jul-20	365	0	365
10-Jul-20	362	0	362
11-Jul-20	356	0	356
12-Jul-20	362	0	362
13-Jul-20	371	0	371
14-Jul-20	492	0	492
15-Jul-20	456	0	456
16-Jul-20	364	0	364
17-Jul-20	105	0	105
18-Jul-20	252	0	252
19-Jul-20	286	0	286
20-Jul-20	238	0	238
21-Jul-20	187	0	187
22-Jul-20	186	0	186
23-Jul-20	441	0	441
24-Jul-20	457	0	457
25-Jul-20	275	0	275
26-Jul-20	261	0	261
27-Jul-20	274	0	274
28-Jul-20	303	0	303
29-Jul-20	176	0	176
30-Jul-20	220	0	220
31-Jul-20	245	0	245
1-Aug-20	192	0	192
2-Aug-20	218	0	218
3-Aug-20	221	0	221
4-Aug-20	181	0	181
5-Aug-20	448	0	448
6-Aug-20	626	0	626
7-Aug-20	314	0	314
8-Aug-20	236	0	236
9-Aug-20	204	0	204
10-Aug-20	222	0	222
11-Aug-20	231	0	231
12-Aug-20	137	0	137
13-Aug-20	120	1	121
14-Aug-20	271	0	271
15-Aug-20	249	0	249
16-Aug-20	241	0	241
17-Aug-20	235	0	235
18-Aug-20	230	0	230
19-Aug-20	170	0	170
20-Aug-20	125	0	125
21-Aug-20	179	0	179

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
22-Aug-20	316	0	316
23-Aug-20	213	0	213
24-Aug-20	614	0	614
25-Aug-20	668	0	668
26-Aug-20	423	0	423
27-Aug-20	187	0	187
28-Aug-20	66	0	66
29-Aug-20	282	0	282
30-Aug-20	392	0	392
31-Aug-20	658	0	658
1-Sep-20	637	0	637
2-Sep-20	517	0	517
3-Sep-20	0	95	95
4-Sep-20	0	544	544
5-Sep-20	164	399	563
6-Sep-20	435	0	435
7-Sep-20	228	0	228
8-Sep-20	154	37	191
9-Sep-20	0	90	90
10-Sep-20	0	541	541
11-Sep-20	0	537	537
12-Sep-20	0	163	163
13-Sep-20	0	595	595
14-Sep-20	0	462	462
15-Sep-20	0	518	518
16-Sep-20	0	86	86
17-Sep-20	0	328	328
18-Sep-20	0	90	90
19-Sep-20	0	0	0
20-Sep-20	188	0	188
21-Sep-20	0	81	81
22-Sep-20	0	609	609
23-Sep-20	0	140	140
24-Sep-20	0	0	0
25-Sep-20	0	532	532
26-Sep-20	0	81	81
27-Sep-20	327	216	543
28-Sep-20	190	21	211
29-Sep-20	200	255	455
30-Sep-20	348	0	348
1-Oct-20	256	0	256
2-Oct-20	121	0	121
3-Oct-20	269	4	273
4-Oct-20	214	173	387
5-Oct-20	226	0	226
6-Oct-20	451	3	454
7-Oct-20	0	0	0
8-Oct-20	0	0	0
9-Oct-20	0	549	549
10-Oct-20	0	121	121
11-Oct-20	307	0	307
12-Oct-20	328	2	330
13-Oct-20	270	2	272

Date	Discharge to trench (m^3)	Irrigation discharge (m^3)	Total discharge (m^3)
14-Oct-20	124	0	124
15-Oct-20	135	79	214
16-Oct-20	0	36	36
17-Oct-20	0	550	550
18-Oct-20	0	420	420
19-Oct-20	0	315	315
20-Oct-20	0	304	304
21-Oct-20	0	337	337
22-Oct-20	0	272	272
23-Oct-20	0	150	150
24-Oct-20	0	270	270
25-Oct-20	0	254	254
26-Oct-20	0	121	121
27-Oct-20	0	462	462
28-Oct-20	0	305	305
29-Oct-20	42	0	42
30-Oct-20	152	0	152
31-Oct-20	300	0	300
1-Nov-20	246	0	246
2-Nov-20	281	0	281
3-Nov-20	165	0	165
4-Nov-20	118	0	118
5-Nov-20	137	0	137
6-Nov-20	140	0	140
7-Nov-20	140	0	140
8-Nov-20	139	0	139
9-Nov-20	139	0	139
10-Nov-20	114	0	114
11-Nov-20	33	20	53
12-Nov-20	11	550	561
13-Nov-20	0	550	550
14-Nov-20	0	553	553
15-Nov-20	0	362	362
16-Nov-20	0	5	5
17-Nov-20	0	550	550
18-Nov-20	0	115	115
19-Nov-20	29	0	29
20-Nov-20	242	0	242
21-Nov-20	182	0	182
22-Nov-20	340	0	340
23-Nov-20	214	0	214
24-Nov-20	0	16	16
25-Nov-20	0	550	550
26-Nov-20	0	550	550
27-Nov-20	0	272	272
28-Nov-20	0	208	208
29-Nov-20	0	199	199
30-Nov-20	0	29	29

APPENDIX E

Nitrogen Mass Balance Spreadsheet

Total N_{tot} input on LTA (kg/ha)	1,353
Total N_{tot} input on LTA (kg)	3,152

Mean % NH4-N in tot N	66%
Ammonia Volatilisation (%)	15
Soil Loss Factor	19.9
Nitrogen Losses (kg)	1,257

Total N_{tot} discharged into Trench (kg)	3,037

N exported (Dry Matter) kg/ha - 1st cut	153.4
N exported (Dry Matter) kg/ha - 2nd cut	94.0
N exported (Dry Matter) kg/ha - 3rd cut	206.2
N exported (Dry Matter) kg/ha - 4th cut	87.3
N exported (Dry Matter) kg - 1st cut	357.5
N exported (Dry Matter) kg - 2nd cut	219.0
N exported (Dry Matter) kg - 3rd cut	480.5
N exported (Dry Matter) kg - 4th cut	203.5

	Yes	No
Number days of trench discharge	219	143
Number days of irrigation	173	181

Quantity WW discharged to trench (m^3)	49,956
Quantity of Tot. Nitrogen discharged to trench (kg)	3,037
Quantity WW irrigated (m^3)	54,488
Total Volume (m^3)	104,444

Date	Outlet Total Nitrogen (g/m^3)	Hawea WWTP Irrigation LTA (m^3)	Monthly Nitrogen applied by Irrigation (kg/ha)	Total Nitrogen applied by Irrigation (kg)	Ammoniacal Nitrogen Outlet (g/m^3)	Monthly Ammoniacal Nitrogen applied by Irrigation (kg/ha)
Dec-19	51	3,900	85.4	198.9	41.0	68.6
Jan-20	93	6,479	258.6	602.5	34.0	94.5
Feb-20	58	6,600	164.3	382.8	45.0	127.5
Mar-20	51	6,448	141.1	328.8	39.0	124.5
Apr-20	51	5,457	119.4	278.3	30.0	70.3
May-20	47	9,442	190.5	443.8	36.0	145.9
Jun-20	57	483	11.8	27.5	45.0	9.3
Jul-20	65	0	0.0	0.0	42.0	0.0
Aug-20	65	1	0.0	0.1	30.0	0.0
Sep-20	54	6,420	148.8	346.7	32.0	88.2
Oct-20	65	4,729	131.9	307.4	42.0	85.2
Nov-20	52	4,529	101.1	235.5	38.8	75.4
Average	**59.1**	**4,541**	**113**	**262.7**	**37.9**	**74.1**

Date	Daily Average Total Nitrogen applied by irrigation (kg/ha/d)	Daily Average Ammoniacal Nitrogen applied by irrigation (kg/ha/d)	Daily Median Total Nitrogen applied by irrigation (kg/ha/d)	Daily Median Ammoniacal Nitrogen applied by irrigation (kg/ha/d)	Hawea WWTP Trench Discharge (m^3)	Nitrogen discharged to trench (kg)
Dec-18	2.8	2.21	0.46	0.37	6,372	325.0
Jan-19	8.3	3.05	4.31	1.58	2,776	258.2
Feb-19	5.7	2.73	2.64	2.05	1,351	78.4
Mar-19	4.6	4.02	1.42	1.26	1,796	91.6
Apr-19	4.0	2.34	1.23	0.72	1,876	95.7
May-19	6.1	4.71	5.75	4.40	0	0.0
Jun-19	0.4	0.31	0.00	0.00	8,237	469.5
Jul-19	0.0	0.00	0.00	0.00	9,426	612.7
Aug-19	0.0	0.00	0.00	0.00	8,869	576.5
Sep-19	5.0	2.94	2.14	1.27	3,388	183.0
Oct-19	4.3	2.75	2.20	1.42	3,195	207.7
Nov-19	3.4	2.51	0.06	0.04	2,670	138.8
Average	**3.70**	**2.3**	**1.7**	**1.1**	**4,163**	**253.1**

Date	Ammoniacal Nitrogen discharged to trench (kg)	Ammoniacal Nitrogen / Total Nitrogen	Nitrogen losses (SLF) (kg)
Dec-18	261.3	80.4%	39.6
Jan-19	94.4	36.6%	120.1
Feb-19	60.8	77.6%	76.3
Mar-19	70.0	76.5%	65.5
Apr-19	56.3	58.8%	55.5
May-19	0.0	76.6%	88.5
Jun-19	370.7	78.9%	5.5
Jul-19	395.9	64.6%	0.0
Aug-19	266.1	46.2%	0.0
Sep-19	108.4	59.3%	69.1
Oct-19	134.2	64.6%	61.3
Nov-19	103.6	74.6%	46.9
Average	**160.1**	**66.2%**	**628.4 (Total)**

APPENDIX F

Maintenance Records

Preventative Maintenance Task Schedule

PM Schedule	PM Description	Perform Every	Period
QTN-HWA-R-0006	1 Monthly Inspection - Hawea WWTP effluent irrigation inspection	1	Months
QTN-QTN-R-0064	1 Monthly Inspection Maintenance - Grounds	1	Months
QTN-QTN-R-0110	1 Weekly Inspection/Validate - Online Analysers - Hawea WWTP	7	Days
QTN-HWA-R-0008	1 Weekly Inspections - Hawea WWTP	7	Days
QTN-HWA-R-0001	6 Monthly Inspection - Hawea WWTP effluent irrigation	6	Months
QTN-QTN-R-0038	1 Yearly Compliance - Service Fire Extinguisher	1	Years
QTN-HWA-R-0002	1 Yearly Inspection - Hawea WWTP effluent irrigation	1	Years
QTN-QTN-R-0049	1 Yearly Inspection - Site Safety	1	Years
QTN-HWA-R-0003	1 Yearly Maintenance - Commission Hawea WWTP effluent irrigation	1	Years
QTN-HWA-R-0004	1 Yearly Maintenance - Decommission Hawea WWTP effluent irrigation	1	Years
QTN-WKA-R-0040	1 Yearly Maintenance - Hawea WWTP Ponds Aerator	1	Years
QTN-QTN-R-0003	2 Yearly Inspection - Electrical Panel	2	Years

Manual Maintenance Tasks

Type	Date Completed	Description
Manual	12/3/2019 13:46	Hawea cut and carry harvest Nov 2019
Manual	1/26/2020 12:50	Hawea Ponds - high level alarm 4/1/20
Manual	2/3/2020 15:47	Hawea Ponds - investigate faulty aerator August 2019
Manual	2/3/2020 15:48	Hawea Ponds - replace DO probe Dec 2019
Manual	2/10/2020 8:17	Hawea WWTP - low flow to irrigation alarm 21/11/19
Manual	3/13/2020 11:37	Hawea WWTP - All Costs 2018
Manual	3/14/2020 15:10	Hawea Ponds - irrigation pump faults 8/2/20
Manual	3/19/2020 10:50	Hawea cut and carry harvest Feb 2020
Manual	4/20/2020 14:17	Hawea cut and carry harvest March 2020
Manual	4/29/2020 11:18	Hawea Ponds - replace faulty winch April 2020
Manual	5/19/2020 14:52	Hawea WWTP - Zeolite trial
Manual	7/9/2020 12:16	Hawea cut and carry harvest April 2020
Manual	7/9/2020 12:23	Hawea Ponds - cut back and mulch broom April 2020
Manual	7/31/2020 14:56	Hawea Ponds - high level alarm 22/7/20
Manual	8/13/2020 15:12	Hawea Ponds - Investigate faulty aerator June 2020
Manual	8/25/2020 7:42	Hawea Ponds - replace aerator coupling 6/12/19
Manual	9/18/2020 8:03	Hawea Ponds - low flow irrigation 8/9/20
Manual	9/18/2020 8:11	Hawea Ponds - high level alarm 30/8/20

Manual	9/18/2020 8:29	Hawea Ponds - check pond level sensor 19/8/20
Manual	9/22/2020 9:16	Hawea WWTP - PLC upgrades
Manual	9/28/2020 12:46	Hawea Ponds - pump 2 irrigation fault 21/9/20
Manual	10/20/2020 9:56	Hawea Ponds - low flow irrigation 11/9/20 +
Manual	10/21/2020 14:50	Hawea Ponds - camera disbursement field pipe and jet Aug 2020
Manual	11/3/2020 8:16	Hawea Ponds - low flow irrigation 13/10/20
Manual	11/4/2020 14:30	Hawea Ponds - clean irrigation lines Oct 2020
Manual	12/21/2020 10:21	Hawea cut and carry harvest Nov 2020

APPENDIX G

Hawea River Water Sampling Results

Hawea River sample results

Note: Sampling of the river commenced in May 2019 in response to wastewater concentration non-compliances and subsequent discussions with the ORC

Date and Time	Ammoniacal Nitrogen mg/L	Total Nitrogen mg/L	Dissolved Reactive Phosphorus mg/L	E. *coli* cfu/100mL	pH	Total Oxidised N mg/L	Total Suspended Solids mg/L	BOD_5 mg/L	Total Phosphorus mg/L
DWSNZ Guideline Value	1.24								
ANZECC physicochemical (upland river)	0.01	0.295							
ANZECC toxicity 95%ile trigger level	0.9								
Microbiological Guidelines - Recreational				260					
Schedule 15 - ORC Regional Plan: Water for Otago. Table 15.2.3 Receiving Water Group 3	0.01		0.005	50					
NPS-FM (2020) – National Bottom Line (median)	1.3		0.018	540					
Upstream Hawea River									
12/16/2019	<0.01	0.08	<0.005	<1.0	7.92	0.01	<2.5	<2.0	<0.01
1/23/2020	<0.01	0.11	<0.005	<10	7.73	<0.01	<2.5	<2.0	<0.01
2/19/2020	<0.01	0.04	<0.005	<10	7.98	<0.01	<4.2	<2.0	<0.01
3/19/2020	<0.01	0.07	<0.005	3.1	7.41	<0.01	<2.5	<0.01	<0.01
4/20/2020	<0.01	0.08	<0.005	1	7.52	<0.01	<2.5	<2.0	0.35
5/20/2020	<0.01	0.14	<0.005	<1.0	7.65	<0.01	<2.5	<2.0	<0.01
6/22/2020	<0.01	0.08	<0.005	<10	7.8	0.01	2.7	<2.0	<0.01
7/27/2020	<0.01	0.03	0.005	<10	7.61	0.02	<2.5	<2.0	<0.01
8/4/2020	<0.01	0.1	<0.005	<10	7.64	0.02	<2.5	<2.0	<0.01
8/24/2020	<0.01	0.11	<0.005	<10	7.61	0.02	<2.5	<2.0	<0.01
9/30/2020	<0.01	0.12	<0.005	<1.0	7.73	0.02	<2.5	<2.0	<0.01
10/26/2020	<0.01	0.12	<0.005	<1.0	7.63	0.03	<4.2	<2.0	<0.01
11/24/2020	0.02	0.05	<0.005	3	7.4	0.02	<5.0	<2.0	<0.01
Downstream Hawea River									
12/16/2019	<0.01	0.01	<0.005	**6.3**	8	0.01	<2.5	<2.0	<0.01
1/23/2020	<0.01	**0.14**	0.005	<10	7.7	<0.01	<2.5	0.005	<0.01
2/19/2020	<0.01	**0.06**	<0.005	<10	8.03	<0.01	<4.2	<2.0	<0.01
3/19/2020	<0.01	**0.16**	<0.005	**17**	7.42	<0.01	<2.5	**2.2**	<0.01

4/20/2020	<0.01	**0.09**	<0.005	1	7.67	<0.01	<2.5	<2.0	<0.01
5/20/2020	<0.01	0.14	<0.005	**7.4**	7.48	<0.01	<2.5	<2.0	<0.01
6/22/2020	<0.01	0.07	<0.005	<10	7.69	0.01	**2.8**	<2.0	<0.01
7/27/2020	<0.01	**0.09**	<0.005	**460**	7.56	0.02	<2.5	<2.0	<0.01
8/4/2020	<0.01	**0.05**	<0.005	<10	7.62	0.02	<2.5	<2.0	<0.01
8/24/2020	<0.01	0.06	<0.005	<10	7.59	0.02	<2.5	<2.0	<0.01
9/30/2020	<0.01	**0.14**	<0.005	**5.2**	7.79	0.02	<2.5	<2.0	<0.01
10/26/2020	<0.01	0.08	<0.005	<1.0	7.36	0.02	<4.2	<2.0	<0.01
11/24/2020	<0.01	**0.1**	<0.005	**140**	7.48	0.01	<5.0	<2.0	<0.01

Downstream samples that are highlighted red are because they are higher than the upstream sample value (except for pH unless it is outside the 7-8 range).

Figure G.1: Map Indicating Location of Upstream and Downstream Sampling Point