RESOURCE CONSENT APPLICATION AND ASSESSMENT OF ENVIRONMENTAL EFFECTS

TOKANUI WASTEWATER TREATMENT PLANT - DISCHARGE TO LAND AND WATER

PREPARED FOR SOUTHLAND DISTRICT COUNCIL

February 2018

Stantec

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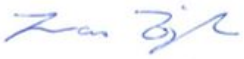
Frances Lojkine		21 Feb 2018
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Southland District Council

Tokanui Wastewater Treatment Plant - Discharge to Land and Water

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Resource Management Act 1991
Form 9

Application for Resource Consent made under section 88 of the Resource Management Act 1991

To: Environment Southland
Private Bag 90116
INVERCARGILL 9840

From: Southland District Council
P O Box 903
INVERCARGILL 9840

[Note the address for service at the end of this application form]

The Southland District Council applies for the following resource consents for the Tokanui Wastewater Treatment Plant:

- A **discharge permit** to discharge a maximum annual average volume of 55 m^3 / day of treated wastewater from the Tokanui Wastewater Treatment Plant to land and to water (groundwater and the Tokanui River). A term of **25 years** is sought.
- The **use of land** for the construction of an effluent storage facility (infiltration trench) within 50 m of a surface waterbody.

1 *The name and address of the owner and occupier of the land to which this application relates is:*

Entity	Legal Description	Address	Owner / occupier
Pjnui Farms Ltd	Section 10, Section 22-23, Sec 41-42, Part Sec 5 and 7 BLK X Toetoes SD	McEwan Street, Tokanui	Pjnui Farms Ltd
Southland District Council	Lot 1 DP 8315, BLK X Toetoes SD	11B McEwan Street, Tokanui	Southland District Council

2 *The location of the discharge is:*

The land-based discharge via the existing ponds and a proposed infiltration trench would take place on land legally described in the above table, with the ponds located at approximate map reference NZTopo50 CG12 887 354.
The surface water discharge would remain in its current location at approximate map reference NZTopo50 CG12 889 354.

3 *A description of the activities to which this application relates is:*

Resource consent is sought to authorise the discharge of a maximum annual average of 55 m^3 / day of treated wastewater from the Tokanui Wastewater Treatment Plant to land,

and to water (groundwater and the Tokanui River). The discharge permit applied for includes:

(i) a replacement for existing discharge permit 201599 which expires 8 September 2018, authorising the discharge of treated wastewater to land and to water; and

(ii) a land use consent to build the infiltration trench, being a form of effluent storage within 50 m of a waterway.

The application to discharge treated wastewater to surface water been made in respect of Section 124(1) of the Resource Management Act 1991, such that the activity may continue under the conditions of the existing resource consent until such time as this application is determined.

4 *Additional approvals are required in relation to this proposal.*

Resource consent to undertake earthworks and vegetation clearance within 20 m of the Tokanui River would be required under the Southland District Plan and the proposed Southland District Plan, however the applicant as requiring authority seeks to alter the existing WWTP designation to include the area of land where the infiltration trench is proposed to be constructed. As the new infiltration trench would be within land designated for wastewater management purposes, s9(3) of the Resource Management Act 1991 will not apply, and resource consent is not required for the trench.

Resource consent will be required under the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*) Regulations 2011 in respect of disturbing more than 25 m^3 of soil per 500 m^2 on a HAIL site, and has been applied for from the Southland District Council concurrently.

5 Attached is an assessment of the proposed activity's effect on the environment that —

a) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and
b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and
c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

6 Attached is an assessment of the proposed activity against:

a) the matters set out in Part 2 of the Resource Management Act 1991; and
b) any relevant provisions of a document referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act; and
c) the resource management matters set out in the Tasman Resource Management Plan.

No further information is required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act.

……
Signature of applicant or person authorised
to sign on behalf of the applicant

Date: 21 February 2018

Address for service:

Stantec New Zealand
P O Box 13052
Christchurch 8024

Attn: Janan Dunning

Email: janan.dunning@stantec.com
Phone: 03-341 4790

Resource Management Act 1991
Form 9

Application for Resource Consent made under section 88 of the Resource Management Act 1991

To: Southland District Council (Regulatory Authority)
P O Box 903
INVERCARGILL 9840

From: Southland District Council (Engineering Services)
P O Box 903
INVERCARGILL 9840

[Note the address for service at the end of this application form]

The Southland District Council applies for the following resource consents for the Tokanui Wastewater Treatment Plant:

- To disturb more than 25 m^3 per 500 m^2 of soil on land where an activity described in the Ministry for the Environment's Hazardous Activities and Industries List is occurring and for longer than a two month period.

1 *The name and address of the owner and occupier of the land to which this application relates is:*

Entity	Legal Description	Address	Owner / occupier
Southland District Council	Lot 1 DP 8315, BLK X Toetoes SD	11B McEwan Street, Tokanui	Southland District Council (Tokanui WWTP)

2 *The location of the activity is:*

The disturbance of land would take place within the Tokanui wastewater treatment plant site on land legally described in the above table, located at approximate map reference NZTopo50 CG12 887 354.

3 *A description of the activities to which this application relates is:*

Resource consent is sought to authorise the disturbance of up to 150 m^3 of land on the Tokanui WWTP site (a HAIL site) to construct an infiltration trench to facilitate some discharge of treated wastewater to land, and to enable treated wastewater from the Tokanui WWTP to contact land prior to discharging to the Tokanui River.

This application has been made in respect of Regulation 11 of the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*) Regulations 2011 (NES-CS).

4 *Additional approvals are required in relation to this proposal.*

A discharge permit is sought from Environment Southland concurrently, to discharge an annual average daily maximum of 55 m^3 / day of treated wastewater from the Tokanui WWTP to land and to water (groundwater and the Tokanui River). Land use consent to store sewage effluent within 50 m of a waterway is also sought.

Resource consent to undertake earthworks and vegetation clearance within 20 m of the Tokanui River would be required under the Southland District Plan and the proposed Southland District Plan, however the applicant as requiring authority seeks to alter the existing WWTP designation to include the area of land where the infiltration trench is proposed to be constructed. The Notice of Requirement to alter the existing designation accordingly is served on the consent authority concurrently with this application, and the application to Environment Southland.

5 Attached is an assessment of the proposed activity's effect on the environment that —

d) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and
e) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and
f) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

6 Attached is an assessment of the proposed activity against:

d) the matters set out in Part 2 of the Resource Management Act 1991; and
e) any relevant provisions of a document referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act; and
f) the resource management matters set out in the Tasman Resource Management Plan.

No further information is required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act.

……
Signature of applicant or person authorised
to sign on behalf of the applicant

Date: 21 February 2018

Address for service:

Stantec New Zealand
P O Box 13052
Christchurch 8024

Attn: Janan Dunning

Email: janan.dunning@stantec.com
Phone: 03-341 4790

Resource Management Act 1991
Form 20

Notice of a requirement by a requiring authority for the alteration of a designation under s181 of the Resource Management Act 1991

To: Southland District Council (Regulatory Authority)

P O Box 903

INVERCARGILL 9840

From: Southland District Council (Requiring Authority)

P O Box 903

INVERCARGILL 9840

[Note the address for service at the end of this application form]

The Southland District Council gives notice for an alteration to a designation for a public work.

1. The site to which the requirement applies is:

The Tokanui Wastewater Treatment Plant (Designation D173 in the Southland District Plan and D49 in the proposed Southland District Plan), located at 11B McEwan Street, Tokanui, on land legally described as Lot 1 DP 8315, BLK X Toetoes SD.

The alteration to the boundary of D173 / D49 is sought to include approximately 1,400 m^2 of adjacent land area currently held in land legally described as Section 10, Section 22-23, Sec 41-42, Part Sec 5 and 7 BLK X Toetoes SD.

2. The nature of the proposed public work:

The Southland District Council as requiring authority proposes to continue to operate the Tokanui wastewater treatment plant (WWTP), and to construct, maintain and operate a wastewater infiltration trench between the existing oxidation ponds and the existing outfall on the true right bank of the Tokanui River.

3. The effects that the public work will have on the environment, and the ways in which any adverse effects will be mitigated, are:

The site is currently designated as the *'Tokanui Wastewater Treatment Facility – Public Utility'.* The scale and extent of the works associated with the infiltration trench are minimal, with the works confined to the area between the oxidation ponds and the Tokanui River. The requiring authority has an agreement to purchase the land required for the infiltration trench from the existing landowner upon the applicant securing the necessary resource consents. While some of the works are within the legal boundary of the land on which the WWTP is located, they also fall outside the boundary of the existing designation. As the infiltration trench forms an integral part of the WWTP operation, it is appropriate to provide for its establishment, and ongoing operation and maintenance by altering the boundary of the existing designation to include sufficient land to build and maintain the trench.

The potential adverse effects of the proposed public work relate to the clearance of vegetation (exotic pasture) and earthworks within 20 m of the bank of the Tokanui River during construction, the potential erosion and sediment effects associated with such disturbance, and the storage of treated wastewater effluent within 50 m of a water body. The actual and potential adverse effects

of the activity are identified, and will be avoided or mitigated by the measures described in the application document attached to this notice. The measures are identified and discussed in the attached document.

4. *Alternative sites, routes, and methods have been considered to the following extent:*

See the attached document for a description of the alternatives considered.

5. *The public work and alteration to the designation are reasonably necessary for achieving the objectives of the requiring authority because:*

See the attached document for an explanation as to why the works and the designation are reasonably necessary.

6. *The following resource consents are needed for the proposed activity and have been applied for:*

A discharge permit to authorise the discharge of treated wastewater to land and to water (groundwater and the Tokanui River), a land use consent to construct and operate an effluent storage facility within 50 m of a water body (the infiltration trench) and a land use consent to disturb more than 25 m^3 of soil per 500 m^2 on land where a HAIL activity is being undertaken have been applied for concurrently with this Notice of Requirement.

7. *The following consultation (*or *No consultation) has been undertaken with parties that are likely to be affected:*

See the attached document which describes the consultation undertaken to date.

8. *The Southland District Council attaches the following information required to be included in this notice by the district plan, regional plan, or any regulations made under the Resource Management Act 1991.*

See the attached document which describes the nature of the public work and the land required, and includes all information required to be included by the district plan, regional plan, and the Resource Management Act 1991 or any regulations made under the Act.

……
Signature of applicant or person authorised
to sign on behalf of the applicant

Date: 21 February 2018

Address for service:

Stantec New Zealand
P O Box 13052
Christchurch 8024

Attn: Janan Dunning

Email: janan.dunning@stantec.com
Phone: 03-341 4790

Part Two

1. Description of the Proposal

1.1 Introduction

The Southland District Council (the Council) owns and operates the Tokanui Wastewater Treatment Plant (WWTP) which provides the town of Tokanui, Southland with wastewater treatment and disposal services. Since 2003, the Council has been operating the system under discharge permit 201599 which authorises the discharge of up to 55 m^3/day of treated wastewater to land and to water. Discharge permit 201599 (consent 201599) expires on 8 September 2018. A copy of the consent 201599 is attached to this application document in **Appendix A**.

1.2 Proposed Activity for which Consent is Sought

With the existing discharge permit due to expire, the Council needs to obtain a replacement consent in order to be able to continue to lawfully discharge treated wastewater from the WWTP and provide Tokanui with an effective and efficient system to manage, treat and dispose of its wastewater.

The discharge of treated wastewater from the WWTP will occur via the base of the oxidation ponds, through the base of a proposed infiltration trench, and at times to the Tokanui River. It is expected that in summer, a large proportion of wastewater will evaporate or will discharge to land via the base of the oxidation ponds and the proposed infiltration trench to a limited extent, such that no discharges to the Tokanui River occur. During winter due to the high groundwater levels at the site it is expected that most of the treated wastewater will be discharged directly to the Tokanui River having first passed through the infiltration trench.

Consent 201599 authorises the discharge of up to 55 m^3/day of treated wastewater to land and to the Tokanui River. The Council is applying for a replacement discharge permit to discharge a maximum annual average of 55 m^3/day to land and to water.

1.2.1 Infiltration Trench

The applicant proposes to construct a new infiltration trench between the WWTP and the Tokanui River to facilitate limited discharge to land, and to provide for land contact prior to discharge to the Tokanui River. Construction of the infiltration trench will involve up to 1,380 m^2 of vegetation clearance and earthworks, and approximately 150 m^3 of earthworks between the oxidation ponds and the Tokanui River. The actual quantities involved will be confirmed following detailed design and site investigation. The proposed infiltration trench will provide approximately 17.5 m^3 of storage capacity as well as facilitating the discharge of wastewater to land along its length.

The concept design of the trench is shown in the drawings attached in **Appendix B**. The infiltration trench design shows a meandering channel leading from the second oxidation pond to the Tokanui River via a shallow trench up to 700 mm deep. The floor of the trench would be approximately 500 mm wide, containing granular or rock material approximately 200 mm deep in the base, for the length of the trench. The concept design for the infiltration trench is based on a similar trench at the Council's Curio Bay WWTP.

1.2.2 Discharge to Land

Treated wastewater would pass through both oxidation ponds where treatment occurs. Dependent on the conditions, a portion of the wastewater will evaporate, and some will discharge to land through the base of the ponds when groundwater levels are low. The remaining treated wastewater would then enter the infiltration trench where it would pass through the granular / rock material. Where treated wastewater discharges to ground through the base of the ponds or the trench, further treatment will occur in the unsaturated soils beneath.

1.2.3 Discharge to Water

While it is expected that during summer, a large proportion of the treated wastewater will discharge to land, some indirect[1] and direct discharge to groundwater is anticipated through the base of the oxidation ponds (estimated to be approximately 10 m^3/day), and from the base of the infiltration trench when seasonal groundwater levels are sufficiently elevated such as following prolonged wet weather.

Under circumstances where incoming wastewater exceeds the volume of discharge to land from the base of the ponds and the trench and the volume of removed through evaporation from the surface of the pond, the treated wastewater would contact land by passing through the media in the infiltration trench and discharge via the existing outfall to the Tokanui River.

[1] The oxidation pond is located on a rise above the stream and therefore it is anticipated that at certain times of the year the discharge from the base of the pond and the infiltration trench will pass through an unsaturated zone before discharging to groundwater.

2. Description of the Tokanui WWTP

2.1 WWTP Location

Tokanui is a small rural service town in southeast Southland. It includes a range of land uses including approximately 67 residential and commercial properties.

The Tokanui WWTP is located at 11B McEwan Street, Tokanui, approximately 250 m north of the Niagara-Tokanui Highway, and 350 m west of the Tokanui Township. Access to the site is provided via a farm track off McEwan Street and a bridge spanning the Tokanui River.

Figure 2-1: Tokanui WWTP Location

The Tokanui WWTP is located on land legally described as Lot 1 DP 8315 BLK X Toetoe Survey District shown as the blue section in Figure 2-2 below. The land on which the WWTP is located is owned by the Council, with the land surrounding the WWTP, including the location of the proposed infiltration trench, currently owned by Pjnui Farms Limited. The land on the south eastern (opposite) banks of the Tokanui River is privately owned.

The Council has obtained agreement in principle from the land owner to purchase the land on which the infiltration trench will be situated. The proposed new property boundary is shown on the land requirement plan attached in **Appendix C**.

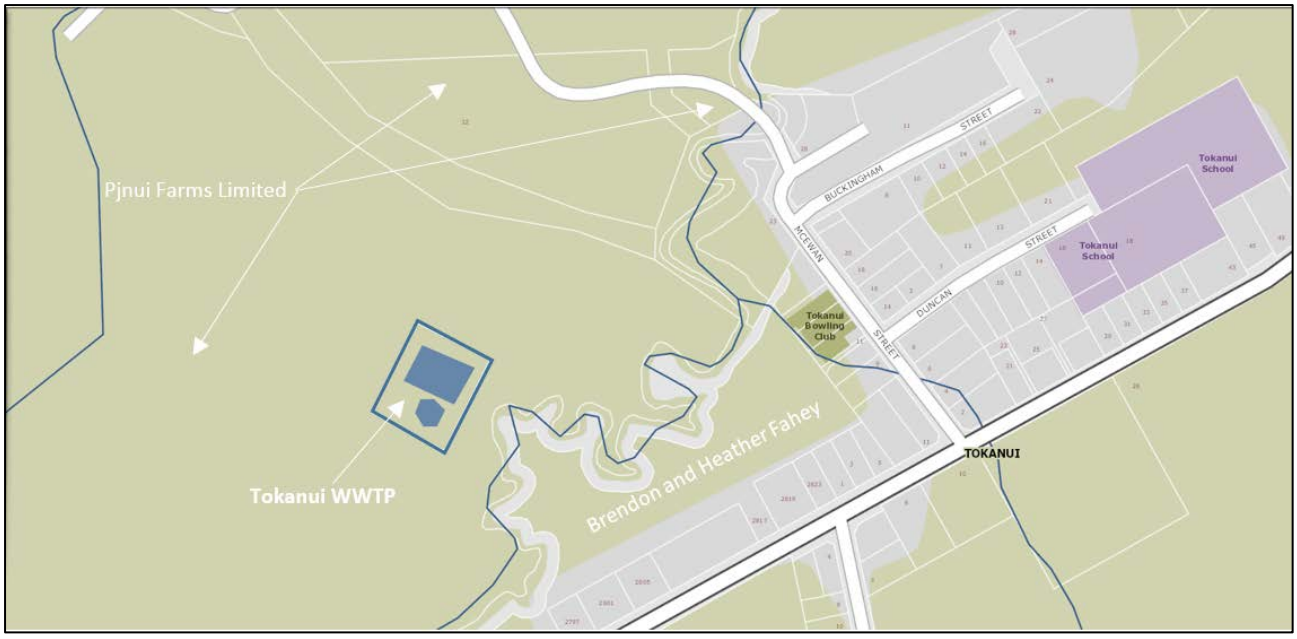


Figure 2-2: Tokanui WWTP Land Ownership

2.2 Surrounding Land Use

The land surrounding the site is primarily rural in nature (Figure 2-3) and is predominantly in pastoral farming land use. The township of Tokanui is located directly east of the WWTP. The WWTP is designated D49 as a public utility and as shown on Figure 2-3. A 150 m building restriction applies around the existing designation.

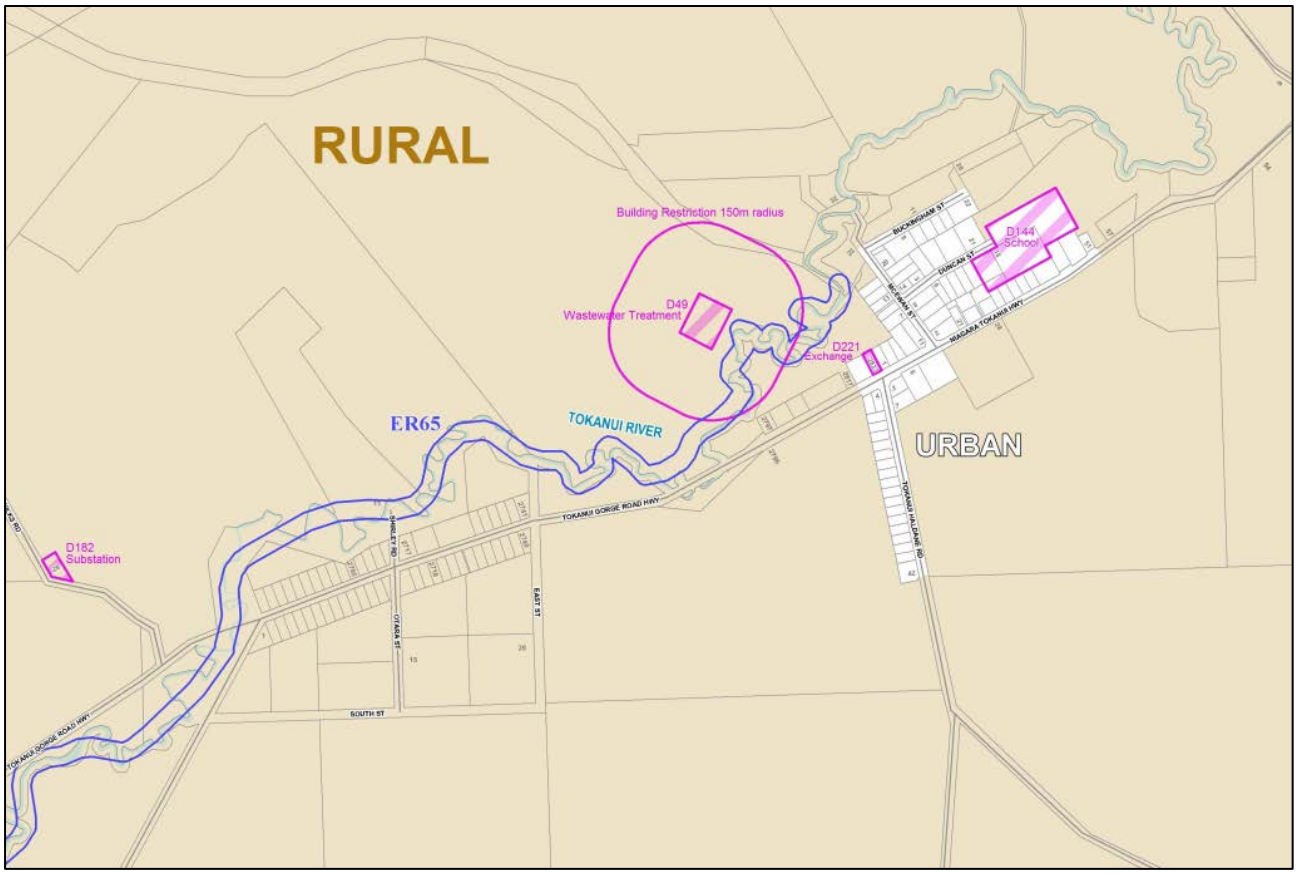


Figure 2-3: District Planning Map for Tokanui (Proposed Southland District Plan, Map 73)

2.3 Description of the Treatment Process

Wastewater from Tokanui is predominantly domestic in nature. The wastewater is collected in the Council's reticulated wastewater network and directed to the WWTP.

The scheme was originally built in 1972 through an initiative of the Southland Education Board. This was driven by the need to provide wastewater treatment for a new school and was jointly funded by the Southland County Council and the Southland Education Board.

The gravity wastewater reticulation system serves all of Tokanui and consists of service connections, mains, manholes and cleaning eyes. All of the reticulation mains and laterals comprise of uPVC pipework. A single pump station is the termination point for all of the town's gravity reticulation. The pump station transfers the wastewater to the oxidation ponds and consists of two pumps in an underground wet well. No well storage is provided outside the pump operating levels. The pump station is connected to the Council's SCADA network, which monitors a high level alarm and pump operation.

The two oxidation ponds are connected in series, the first and larger of the two is a facultative pond, and the second smaller pond is a maturation pond. There is significant evaporation from the surface of the ponds, particularly during summer. The oxidations ponds are lined with clay-like material and there is a slow rate discharge through this liner to the underlying ground or direct to groundwater if it is sufficiently elevated. Currently the residual treated wastewater is then discharged via a buried pipe to the Tokanui River.

The proposed infiltration trench will reduce the volume of the discharge to the Tokanui River to some extent, but is primarily intended to provide for land contact prior to discharge. The proposed trench will provide for wastewater to trickle through the media in the channel, partially discharging to the land beneath, with residual flow discharging to the Tokanui River via the existing outfall pipe.

A brief summary of the cost to establish a viable land disposal option in a forestry block nearby that was investigated by the Council is attached in **Appendix D.** A fuller discussion of the alternative, and why it was not preferred is contained in section 4.5.2 of this document.

2.3.1 Discharge Volume

Condition 2 of consent 201599 states that the consent authorises the discharge of up to 55 m^3/day of treated wastewater into land, via seepage from the base of the oxidation ponds, and into the Tokanui River from the secondary oxidation pond.

The volume of wastewater discharged has been assessed based on daily inflow records. Data from 01 July 2013 to 31 December 2014 is based on pump records, data from 01 January 2015 to 30 June 2017 are based on a magflow meter that was installed on the pump station. No data on the volume of outflows from the WWTP is available as there is no reliable method to accurately determine the rate of outflows.

Table 2-1 below summarises the data on inflow volumes provided from July 2013 to June 2017. This shows that in general the mean daily volume of effluent entering the Tokanui WWTP is well below the maximum daily discharge volume of 55 m^3. The total inflow into the WWTP exceeded 55 m^3/day on 59 days between July 2013 and June 2017.

Table 2-1: Tokanui WWTP Inflows Summary by Year

Year	Minimum (m^3/day)	Mean (m^3/day)	Maximum (m^3/day)	Number of days >55m^3
2013	5	15	83	5
2014	6	16	180	4
2015	9	30	299	25
2016	12	29	157	16
2017	16	31	99	9
Overall	5	24	299	59

Figure 2-4 below plots inflows into the Tokanui WWTP against rainfall[2], which indicates that as would be expected inflow volumes are influenced by rainfall events. Inflow data is derived as discussed above.

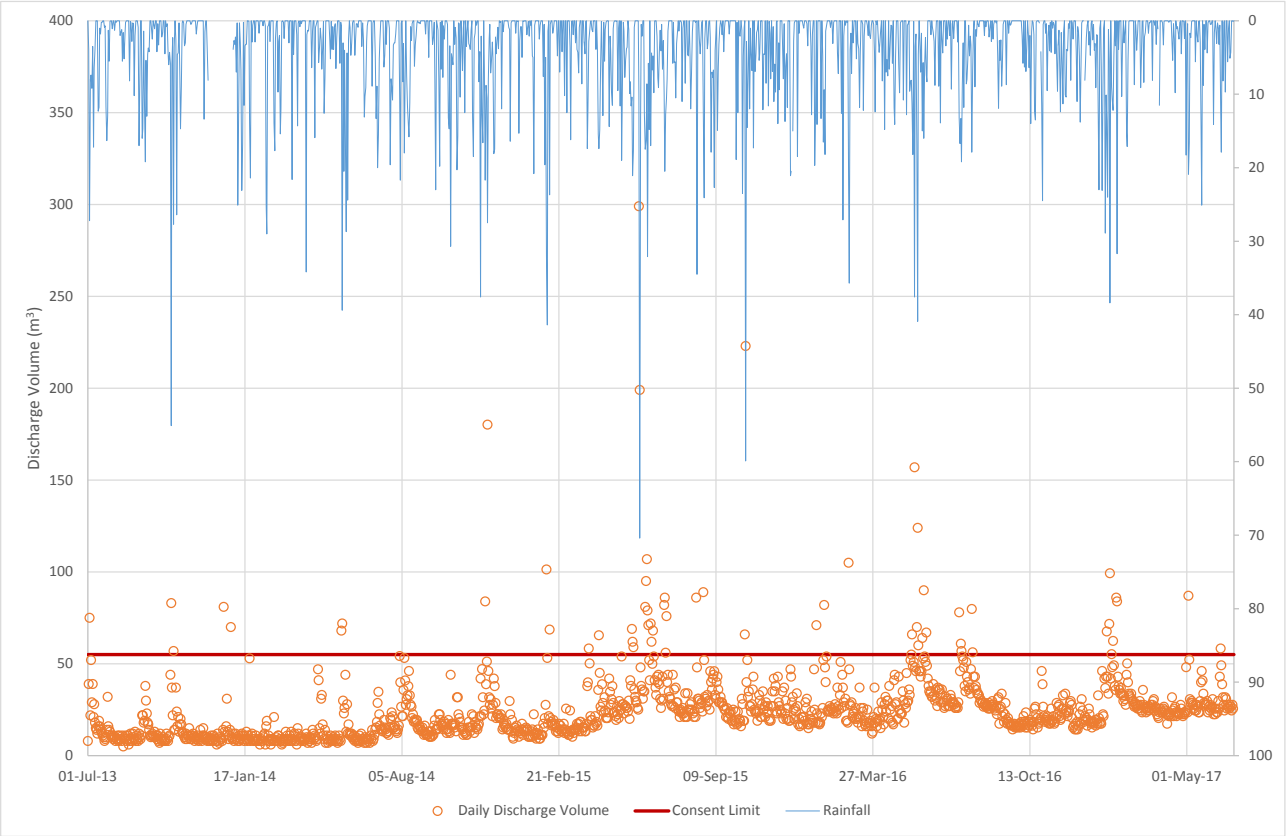


Figure 2-4: Tokanui WWTP Discharge Volume and Rainfall

Inflows will not directly equal outflows; Section 2.3.2 presents a water balance which estimates the volume of wastewater discharged via various pathways under a number of different scenarios. This water balance provides an indication of the likely volume of wastewater discharged to land, groundwater and the Tokanui River in summer and winter.

Overall, it is expected that the annual average discharge volume in combination with seepage from the base of the ponds will be no more than 55 m^3/day.

2.3.2 Discharge Pathways

A water balance model was undertaken to estimate the volume of water that may be discharged to groundwater via the base of the oxidation ponds and infiltration trench and to surface water under various scenarios. It has been assumed on a conservative basis that all treated wastewater which is discharged to land will reach underlying groundwater. Further assumptions and data sources for the model have been listed under Table 2-2.

Figure 2-5 below provides a schematic of the wastewater discharge pathways and should be read in conjunction with Table 2-2 which summarises the results of the water balance model.

The model is split into seasons, as during summer groundwater is expected to be lower and therefore there will be greater infiltration of treated wastewater. During winter, water at the site has been observed ponding on the surface and therefore it is likely that there will be some groundwater within the base of the infiltration trench during the wettest part of the year and this will significantly limit infiltration rates. During winter it has therefore been assumed that there will be no infiltration of wastewater through the base of the trench.

[2] Rainfall from NIWA station Quarry Hills manual site which is 10 km east of the Tokanui WWTP

It is expected that there will be some increase in volumes during heavy rainfall events due to rainwater falling on the surface of the oxidation ponds. This has not been included in the model as the rainwater will not include elevated contaminant levels. The load discharge via the various discharge pathways will therefore not be affected by the level of rainfall.

Six scenarios were modelled as follows.

- **Summer average discharge** – median summer inflow volume, greatest discharge rate expected from the base of the pond and mean summer evaporation rate.
- **Summer high discharge to river** – models the scenario that will result in a high discharge to the river, includes: 95th percentile summer inflows, lower discharge scenario from the base of the ponds, summer minimum evaporation and expected infiltration from the base of the infiltration trench.
- **Summer maximum discharge to river** – Uses the same inputs as the 'summer high discharge' scenario but based on the maximum recorded summer inflow volume.
- **Winter average discharge** – median winter inflow volume, greatest rate expected from the base of the pond, mean winter evaporation rate and no infiltration within the infiltration trench.
- **Winter high discharge to river** – models the scenario that will result in a high discharge to the river, includes: 95th percentile winter inflows, lower discharge scenario from the base of the ponds, winter minimum evaporation and no infiltration from the base of the infiltration trench.
- **Winter maximum discharge to river** – Uses the same inputs as the 'winter high discharge' scenario but based on the maximum recorded winter inflow volume.

Table 2-2 provides the outputs of the water balance. It is expected in summer that a large proportion of the discharge will be discharged to land and then to groundwater via the base of the ponds and the infiltration trench, with only occasional direct discharge to surface water.

The water balance indicates that during much of the summer months inflows to the WWTP of up to 20 m^3/day will not result in a discharge to the Tokanui River at all. This is because during summer, when evaporation rates are high, evaporation plus the discharge from the base of the ponds, plus the discharge from the base of the trench (8.98 m^3 + 10 m^3 + 0.75 m^3 = 19.73 m^3) will account for all of the inflow up to this volume. The median summer inflow volume since 2013 is 18 m^3/day and therefore it is expected that during the summer months for more than 50% of the time treated wastewater will be discharged solely to ground, with no residual discharge to the Tokanui River.

The water balance model supports the anecdotal evidence from the WWTP operators that indicates that the ponds only occasionally discharge to the Tokanui River during summer. Once the infiltration trench is installed the discharge to land and groundwater from the base of the infiltration trench, and evaporation from the trench will further reduce the frequency of direct discharge to the Tokanui River.

During winter when the groundwater level is high it is expected that the majority of the discharge will be to surface water.

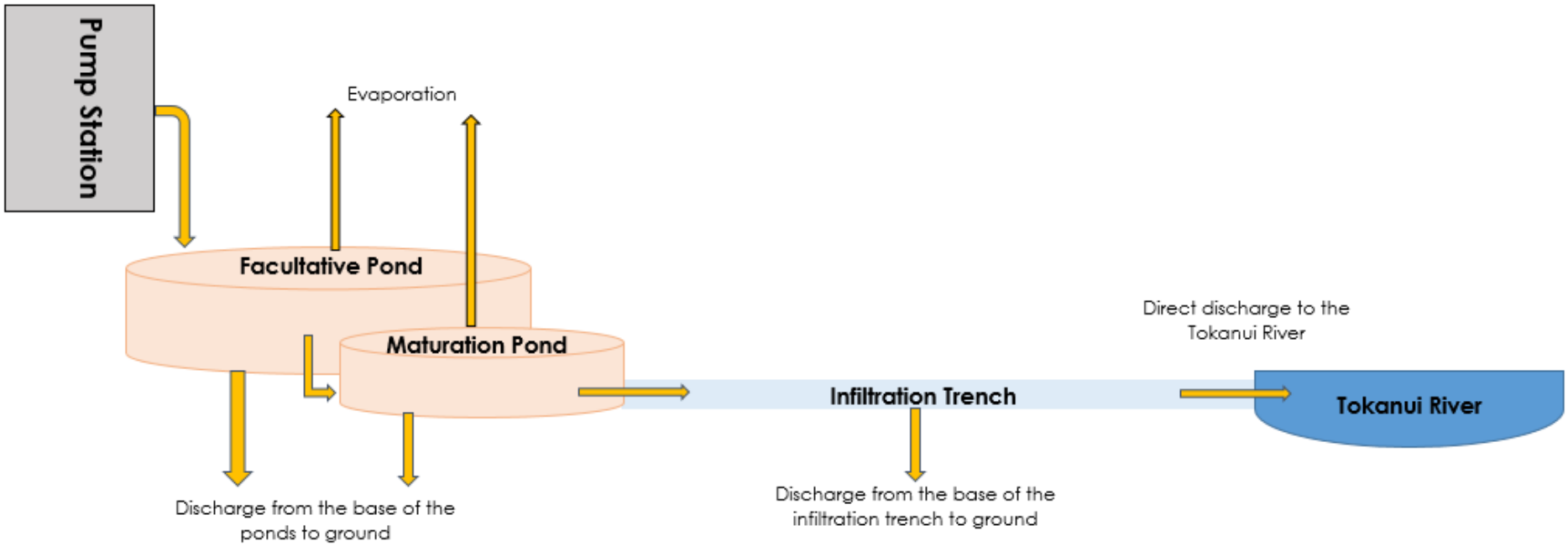


Figure 2-5: Schematic of Discharge Pathways

Table 2-2: Water Balance Summary

Scenario	Summer (December – February)			Winter (high GW level) (June – August)		
	Average Discharge	High Discharge to River	Maximum Discharge to River	Average Discharge	High Discharge to River	Maximum Discharge to River
A. Flow to WWTP	18 m^3/day	52 m^3/day	105 m^3/day	27 m^3/day	62 m^3/day	299 m^3/day
B. Discharge from base of pond	10 m^3/day	10 m^3/day	10 m^3/day	10 m^3/day	10 m^3/day	10 m^3/day
C. Evaporation from surface of pond	8.98 m^3/day	1.4 m^3/day	1.4 m^3/day	3.09 m^3/day	0 m^3/day	0 m^3/day
D. Flow to trench	0 m^3/day (A-B-C)	40.6 m^3/day (A-B-C)	93.6 m^3/day (A-B-C)	13.91 m^3/day (A-B-C)	52.0 m^3/day (A-B-C)	289.0 m^3/day (A-B-C)
E. Discharge from base of trench	0 m^3/day	0.75 m^3/day	0.75 m^3/day	0 m^3/day	0 m^3/day	0 m^3/day
F. Discharge to stream	0 m^3/day (D-E)	39.9 m^3/day (D-E)	92.9 m^3/day (D-E)	13.9 m^3/day (D-E)	52.0 m^3/day (D-E)	289.0 m^3/day (D-E)

Note:

A: Median, 95th percentile and maximum discharge volume of all relevant seasons inflow date from July 2013 to June 2017.

B: Estimated from pond drop test undertaken in 2017, full pond drop test results are attached in **Appendix E**.

C: NIWA Cliflo daily total open water evaporation rates from 1990 to 2018 for the Invercargill Aero climate station (location show in Figure 3-2). Daily evaporation rates have been summarised into median and minimum rates for winter (June – August) and summer (December – February).

D: Calculated by subtracting B and C from A.

E: Infiltration from the base of the infiltration trench has been modelled as 30 mm/hour during summer, with no infiltration in winter. Infiltration rate based on Table L1: recommended design loading rates for trenches and beds, given in the Australian / New Zealand On-Site Domestic Wastewater Management Guidelines AS/NZ 1547:2012. The rate for secondary treated effluent discharge to clay loam has been used.

F: Calculated by subtracting E from D.

2.3.3 Discharge Quality

Treated wastewater quality data has been collected twice yearly from 5 October 2005 to 28 March 2017 as required under consent 201599. Six additional samples were collected and analysed between 10 August 2017 and 14 September 2017 to provide further information on the quality of the discharge.

The long term monitoring record has been summarised in Table 2-3 and the additional sampling undertaken in August and September 2017 has been summarised in Table 2-4. The full data record is attached in **Appendix F**.

The additional discharge quality monitoring results are broadly similar to the longer term record and generally fall within the same range of concentrations.

Table 2-3: Long Term Discharge Quality Record (2005 - 2017)

Parameter	Minimum	Median	95th Percentile	Maximum
BOD_5[3] (g/m^3)	2	9	30	50
Conductivity (mS/m)	29.1	42.5	62.2	88.9
Ammoniacal-N (g/m^3)	2.1	13.8	25.4	28.8
Total nitrogen (g/m^3)	6.5	17.1	27.2	35.0
Total phosphorus (g/m^3)	2.5	6.3	15.4	22.8
Total suspended solids (g/m^3)	2	16	72	108
E.coli (cfu/100mL)	5	631	3,064	6,867

Table 2-4: Additional Discharge Quality Sampling (August 2017 - January 2018)

Parameter	Minimum	Median	95th Percentile	Maximum
BOD_5[3] (g/m^3)	6.4	19	22.9	25
Conductivity (mS/m)	26.8	29.1	35.16	35.5
Ammoniacal-N (g/m^3)	0.03	6.25	9.98	11
Total oxidised nitrogen (g/m^3)	0.01	0.21	1.161	1.7
Total nitrogen (g/m^3)	6.1	13	18.6	20
DRP[4] (g/m^3)	0.74	3.6	4.87	5.5
Total phosphorus (g/m^3)	1.6	5	6.98	7.4
Total suspended solids (g/m^3)	27	67	91.6	100
Turbidity (NTU)	16	37.5	50.75	55
pH	7.4	8.7	9.9	10.0
E.coli (cfu/100mL)	10	635	3,890	6,100
Faecal coliforms (cfu/100mL)	10	400	4,440	5,000
Bromide (g/m^3)	0.11	0.14	0.186	0.2
Chloride (g/m^3)	31	34	46.1	51
Fluoride (g/m^3)	0.026	0.05	0.22	0.22

[3] Biochemical oxygen demand
[4] Dissolved reactive phosphorus

2.4 Available Dilution

Due to the small volume of the discharge compared to the significant flows within the Tokanui River, the level of dilution available is expected to be significant.

Figure 2-6 below plots the mean daily flow in the Tokanui River derived as described in Section 3.2.1 against the mean daily inflows to the Tokanui WWTP (noting that outflow data is not available, so inflows have been used as a proxy). In Figure 2-6, the river flow is plotted along the primary (left) axis in L/s and the discharge is plotted on the secondary (right) axis also in L/s.

The available dilution has then been used in Section 5 to assess the effects of the discharge if the Tokanui River water quality upstream of the discharge improves in the future.

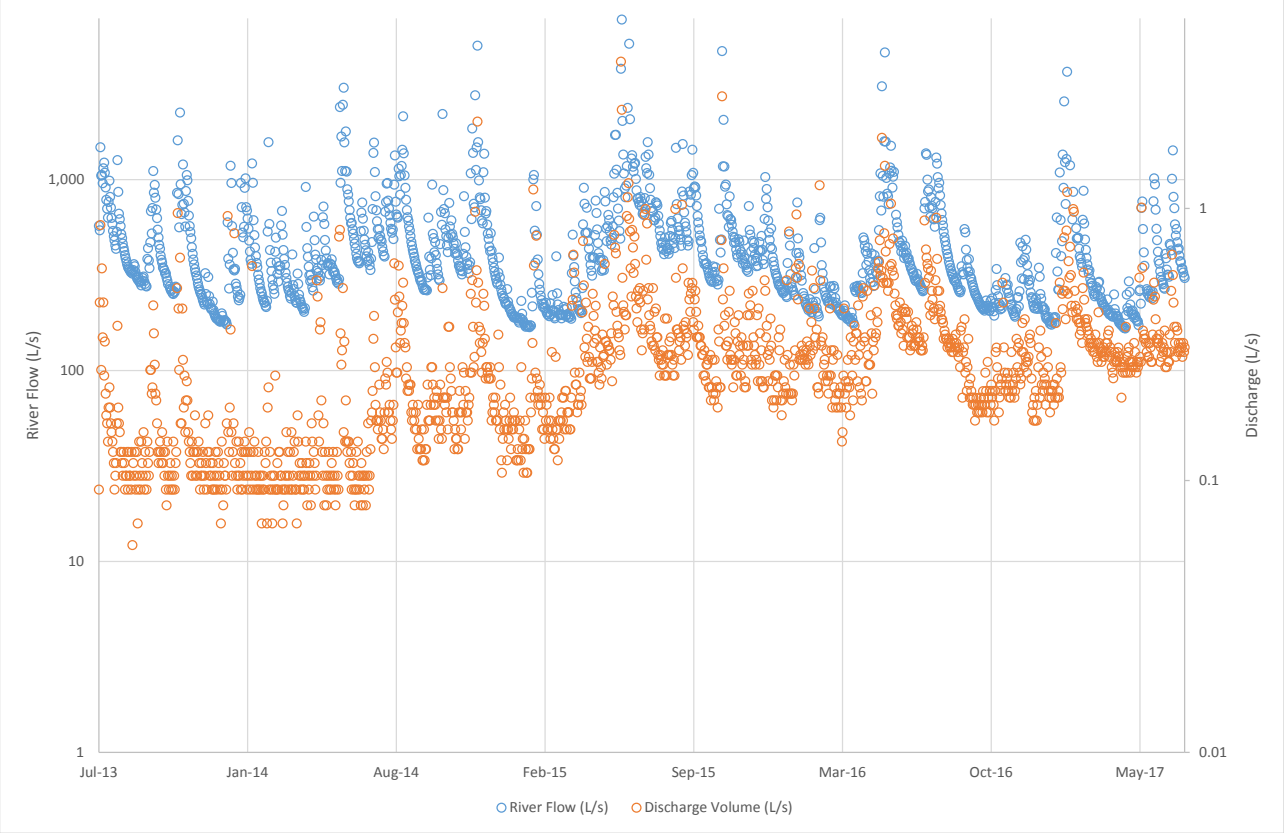


Figure 2-6: Tokanui River Flows against Tokanui WWTP Discharge (based on inflows)

The magnitude in the difference between the flows should be noted, in particular that while the discharge rate and flow rate are plotted so that they line up to give some indication of the similarity in the pattern and in particular the peaks, the wastewater discharge rate is several orders of magnitude less than the river flow. In general the discharge volume rarely exceeds 1 L/s, while the river flow always exceeds 100 L/s, which indicates that there is typically significant dilution available within the river.

The available dilution has been calculated by taking, for each day, the average rate of flow in the Tokanui River (from the synthetic flow record) divided by the average rate of inflow. The flow record has been provided from 2013. Table 2-5 below shows the minimum, mean and maximum dilutions. The lowest dilution available within the Tokanui River since 2013 was 343 fold, the greatest dilution over 20,000. This indicates that the Tokanui River provides significant dilution for the volume of treated wastewater that could be discharged to the river, which is based on inflows which range from a minimum of 5 m^3/day to a maximum of 299 m^3/day.

Table 2-5: Available Dilution

Year	Minimum	Mean	Maximum
2013	413	3,041	6,383
2014	383	3,224	20,137
2015	494	1,620	5,632
2016	343	1,133	3,231
2017	468	1,097	3,288
Overall	343	2,023	20,137

3. Description of the Receiving Environments

3.1 Introduction

The WWTP is surrounded by predominantly exotic pasture and currently discharges treated wastewater to land and groundwater through the base of the oxidation ponds, and directly to the Tokanui River. The receiving environments for the wastewater discharges therefore include surface water, land and groundwater, each of which are described in detail in the following sections. Figure 3-1 shows the discharge location (post indicates point of discharge), looking downstream.

Figure 3-1: Tokanui River, at Discharge Location, Looking Downstream

A map of the land uses within the area of the WWTP and Tokanui Township is attached in **Appendix G**.

The vegetation in the vicinity of the Tokanui WWTP and the proposed infiltration trench is predominantly exotic pasture. To the north west of the WWTP is a large stand of eucalyptus trees. There are small pockets of exotic and indigenous vegetation along the Tokanui River in the vicinity of the WWTP, however the riparian margins are typically vegetated in grass, woody weed species and small shrubs.

3.2 Surface Water – Tokanui River

The Tokanui River is a minor watercourse draining foothills and farmland in southeast Southland and flowing to the sea in Toetoes Bay. The catchment is relatively small with some steep topography in the upper reaches. Rainfall in the area is regular and reasonably high, which means there is potential for regular ingress of stormwater into the wastewater network, in addition to significant rainfall falling on the surface of the ponds. The river is classified as a lowland soft bed river in the Environment Southland proposed Southland Water and Land Plan (pSWLP) and Regional Water Plan (RWP).

3.2.1 Synthetic Flow Record

Information on flow in the Tokanui River is available from the following sources:

- Environment Southland spot gauging of the Tokanui River flow at the Fortrose-Otara Road flow site (same site as the SoE monitoring)
- Environment Southland continuous flow record of the Waikawa River at Biggar Road (ID 1170719).

The locations of these sites is shown in Figure 3-2

Figure 3-2: Environment Southland Monitoring Sites

To date, the only flow recordings from the Tokanui River are 16 spot gaugings taken by Environment Southland between 2008 and 2016 at the Fortrose Otara Road gauging site (ID 1170718) shown in **Appendix H**. The site is approximately 8.5 kilometres downstream of the Tokanui WWTP.

To provide a more complete, continuous and longer flow record, flows in the Tokanui River at Fortrose Otara Road were correlated to the nearest flow monitoring site. This site is the Waikawa

River at Biggar Road (ID 1170719) (location is shown in **Appendix H**), approximately 21 km to the east. Flows in the Waikawa River at Biggar Road have been monitored by Environment Southland at 15 minute intervals from December 2007 to June 2017.

Table 3-1 shows spot gaugings of the Tokanui River compared with flows in the Waikawa River. Apart from a single gauging in May 2008, flow gaugings from the Tokanui River have been taken during times of low flows (in both the Tokanui and Waikawa Rivers) as shown in Figure 3-3.

Table 3-1: Spot Gaugings in the Tokanui River at Fortrose Otara Road Versus Daily Minimum, Mean and Maximum Flows in the Waikawa River at Biggar Road

Date	Spot Gaugings from the Tokanui River at Fortrose Otara Rd	Daily Min Flow in the Waikawa River at Biggar Rd	Daily Mean Flow in the Waikawa River at Biggar Rd	Daily Max Flow in the Waikawa River at Biggar Rd	Used in Correlation
-	L/s	L/s	L/s	L/s	-
1/05/2008	636	3,999	4,494	5,347	No
12/12/2008	1,061	1,761	1,944	2,153	Yes
15/12/2008	791	1,604	1,643	1,703	Yes
7/01/2009	555	1,031	1,126	1,220	Yes
16/01/2009	521	989	1,020	1,052	Yes
7/12/2010	427	946	1,017	1,092	Yes
30/11/2012	747	1,912	2,321	2,675	Yes
10/12/2012	860	2,460	2,587	2,701	Yes
11/02/2013	427	1,312	1,374	1,499	Yes
11/03/2013	324	902	946	983	Yes
7/04/2014	1,082	3,143	3,403	3,726	Yes
12/05/2014	707	2,265	2,347	2,403	Yes
14/01/2015	501	991	1,025	1,057	Yes
25/02/2015	469	1,057	1,133	1,212	Yes
27/03/2015	492	991	1,033	1,065	Yes
1/02/2016	651	1,925	2,041	2,114	Yes

Note: Data used for the purposes of correlation are shown in green

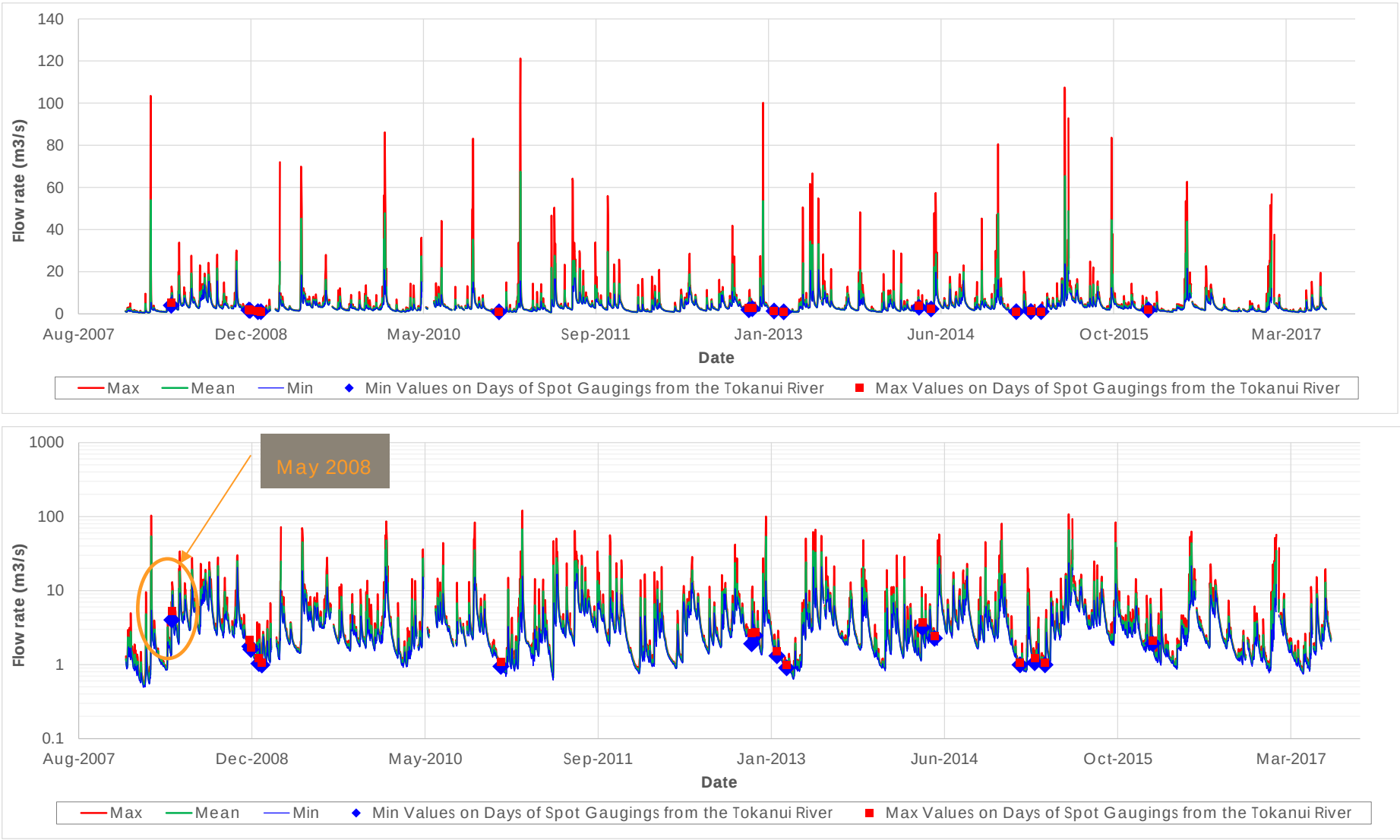


Figure 3-3: Flow rates in the Waikawa River at Biggar Road

Figure 3-3 shows the flow rate in the Waikawa River at Biggar road, with the minimum and maximum flows on days of spot gaugings from the Tokanui River at Fortrose Otara Road. Both graphs show the same data with the bottom graph showing flows on a log scale. The log scale has been presented to more clearly show the pattern at lower flows.

The Waikawa River upstream of Biggar Road has a catchment area of 165 km^2. This is approximately 2.3 times the catchment area of the Tokanui River upstream of Fortrose Otara Road (at approximately 71 km^2). This explains the higher flows shown in Table 3-1.

When correlating the flows from both sites, it was found that excluding the values on 5 May 2008 (see Figure 3-3) resulted in a much better correlation. This may be because the gauging on 5 May 2008 was carried out during less stable and higher flows as shown in Figure 3-3 and hence was a significant outlier when plotted on a linear trend line.

A linear correlation between the mean daily flow at Waikawa River (Biggar Road) and spot gaugings from the Tokanui River at Fortrose Otara on the same day using the values shown in green in Table 3-1 is shown in Figure 3-4.

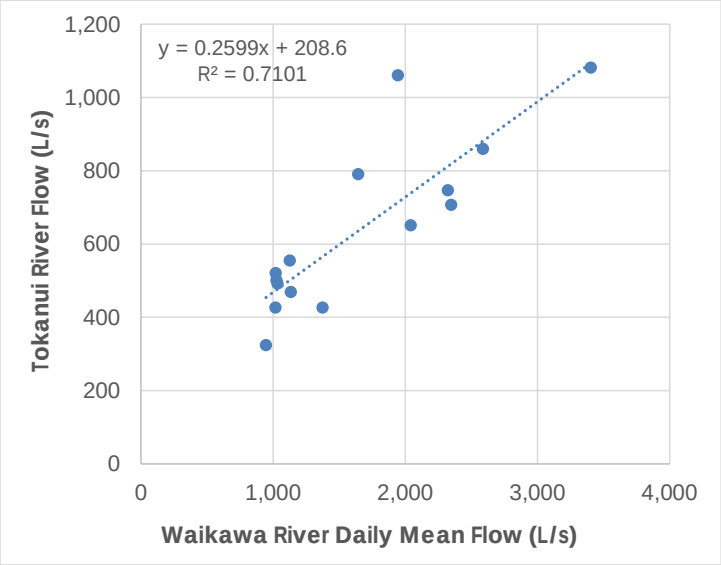


Figure 3-4: Linear regression Between Flows in the Tokanui at Fortrose Otara Road and Waikawa River at Biggar Road

The coefficient of determination (R^2) is moderately high at 0.71. A similar correlation and relationship is found when using minimum or maximum daily flows in the Waikawa River, rather than the mean daily flows.

Using the linear regression equation shown in Figure 3-4, a synthetic flow record for the Tokanui River was determined as shown in Figure 3-5.

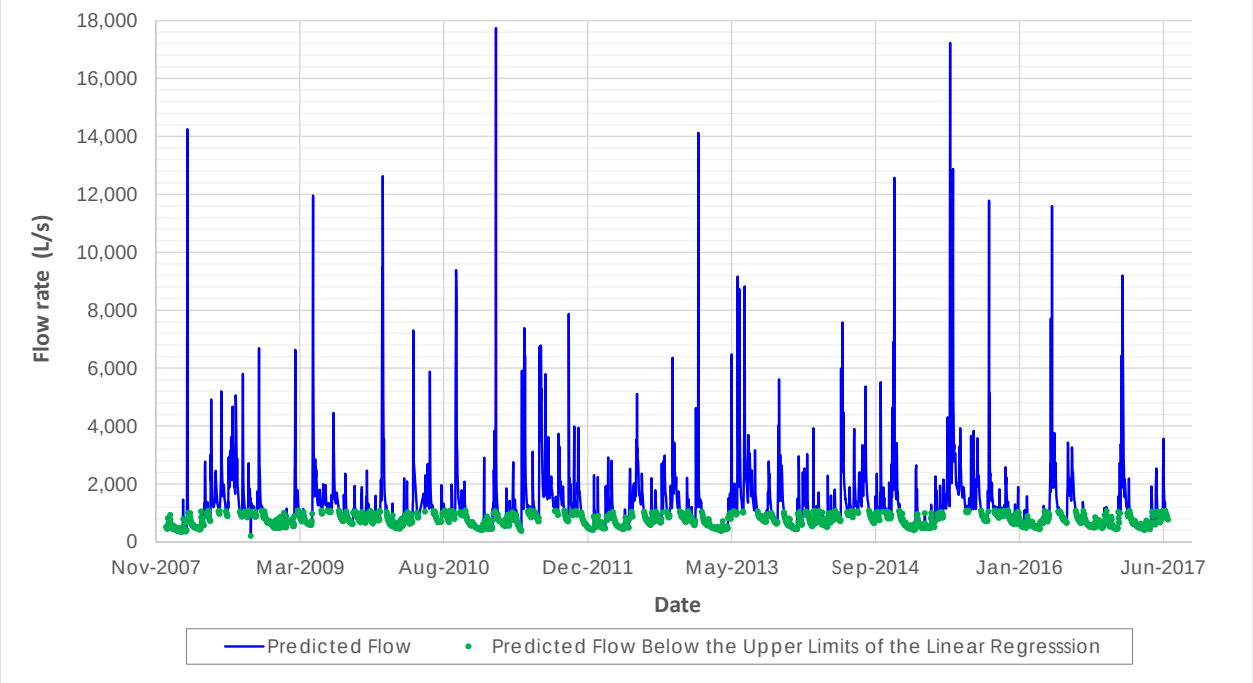


Figure 3-5: Predicted Flows for the Tokanui River (at Fortrose Otara Road) Using the Linear Regression Equation Shown in Figure 3-4

The high level of confidence attributed to the predicted flows less than 1,100 L/s is because this data occurs within the range of flows used in the correlation. Predictions of higher flows and flood flows are thus less certain. Despite this, an alternative prediction of the flows based on scaled catchment areas produced similar peak flows suggesting that the estimated higher flows are reasonably accurate.

The final step involved a prediction of the flows at the Tokanui WWTP, 8.5 kilometres upstream of the Fortrose Otara Road gauging site. This was undertaken by scaling down the flow based on the ratio of the catchment area above Tokanui WWTP to the catchment area above Fortrose Otara Road. The various catchment areas are shown in Appendix H and the workings undertaken to determine the ratios as a percentage are shown in Table 3-2.

Table 3-2: Catchment Areas in the Tokanui River above Fortrose Otara Road and the Tokanui WWTP:

Feature	Abbreviation	Value	Unit
Catchment area above Tokanui WWTP	A1	28,658,444	m^2
Catchment area above Fortrose Otara Road (not including catchment area above Tokanui WWTP)	A2	42,777,887	m^2
Total catchment area above Fortrose Otara Road	T1	71,436,331	m^2
Percentage of catchment above Tokanui at WWTP	(A1 / T1) x 100	40	%

The analysis shows that the catchment area above Tokanui WWTP is equal to 40 percent of the total catchment area above Fortrose Otara Road, therefore, the predicted flows at the Tokanui WWTP were based on 40 percent of the predicted flows at Fortrose Otara Road.

Based on the linear regression equation shown in Figure 3-4 and assuming a 40 percent reduction in the flow based on catchment area, the predicted flow statistics for the Tokanui River at the Tokanui WWTP are:

- Mean 498 L/s
- Median 365 L/s
- Minimum 83 L/s
- Maximum 7,097 L/s.

The variability of flow expressed as a percentage of the total flow record is shown in Figure 3-6. The data shows flows are usually less than 1,000 L/s but as noted in Section 2.4, is almost always greater than 100 L/s.

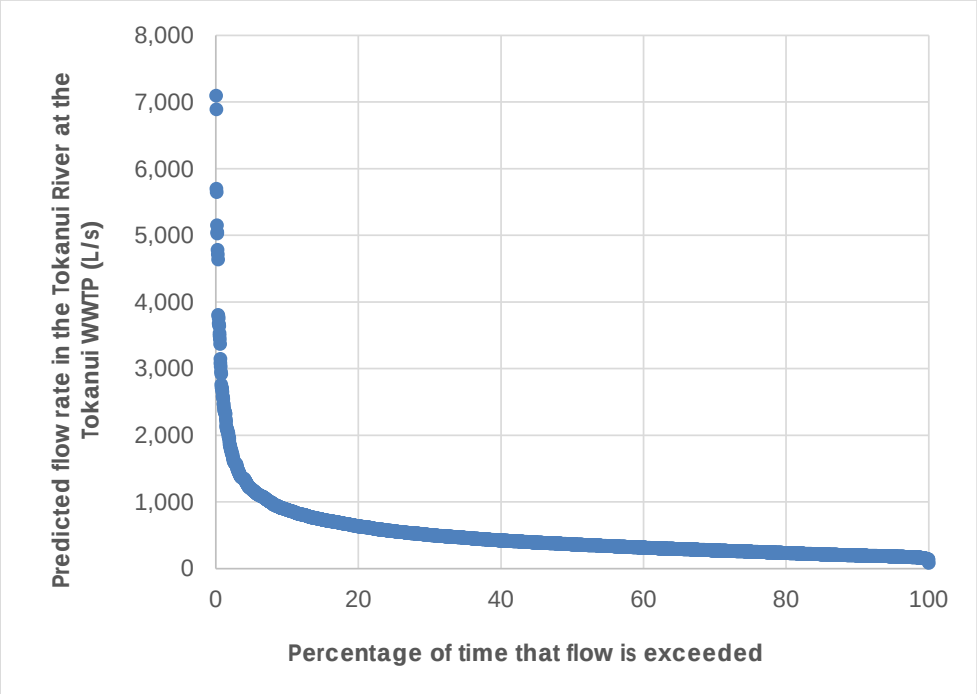


Figure 3-6: Flow Duration Curve for the Predicted Flows in the Tokanui River at the Tokanui WWTP

3.2.2 Surface Water Quality

The water quality of the Tokanui River was assessed using data collected from four sources as follows:

- Consent driven monitoring of the Tokanui River, undertaken twice a year from 5 October 2005 – 28 March 2017
    - 10 m upstream of the discharge (upstream)
    - 150 m downstream of the discharge (downstream 2)
- Additional monitoring of the Tokanui River undertaken by the Council weekly from 10 August 2017 to 14 September 2017
    - 10 m upstream of the discharge (upstream)
    - 50 m downstream of the discharge (downstream 1)
    - 150 m downstream of the discharge (downstream 2)
- Environment Southland State of the Environment (SoE) Monitoring of the Tokanui River where it crosses Fortrose-Otara Road, approximately eight kilometres south west of Tokanui Township,
- Water quality monitoring undertaken during the Ryder Consulting Ltd (Ryder) 2017 biological survey of the Tokanui River
    - 15 m upstream of the discharge (upstream)
    - 60 m downstream of the discharge (downstream 1)
    - 150 m downstream of the discharge (downstream 2).

Note that while the location of the upstream and first downstream sample locations are slightly different between the consent driven and additional monitoring and the Ryder biological survey they are sufficiently close to be represented by one point in Figure 3-7.

Figure 3-7: Monitoring Locations within the Tokanui River

Table 3-3 summarises the water quality data collected under the WWTP discharge consent within the Tokanui River. Table 3-4 summarises the additional six weeks of water quality data collected by the Council. Monitoring results have been compared against the ANZECC physical and chemical stressors trigger values for lowland rivers in New Zealand, unless otherwise stated.

Table 3-3: Tokanui River Water Quality Monitoring (2005 – 2017) (n=25)

	Minimum		Arithmetic Mean		Maximum		
Parameter	Upstream	150 m D/S	Upstream	150 m D/S	Upstream	150 m D/S	Guideline Values
Ammoniacal Nitrogen (g/m^3)	0.01	0.01	0.06	0.05	0.40	0.40	0.9[5]/1.47[6] /0.021
Conductivity (mS/m)	16.2	17.1	18.1	18.4	19.8	19.9	
Temperature (^{o}C)	8.5	9.1	11.2	11.7	16	15.1	
E.coli (cfu/100mL)	30	359	1,315	1,275	9,208	6,380	
Faecal coliforms (cfu/100mL)[7]	42	503	1,841	1,784	12,891	8,932	1000[8]
Dissolved Oxygen (mg/L)	8.9	7.1	10.5	9.7	18.7	11.9	5[9]
Dissolved Oxygen (%)[10]	79	70	95	89	162	105	80[9]
pH	6.5	6.4	7.2	7.2	7.6	7.6	7.2 – 7.8
Nitrate-Nitrogen (g/m^3)	0.21	0.29	1.02	1.03	1.40	1.39	0.444[11]
Dissolved Reactive Phosphorus (g/m^3)	0.006	0.006	0.033	0.027	0.170	0.050	0.01
Turbidity (NTU)	4.4	4.8	10.3	10.5	22.5	25.2	5.6

Note: values which do not meet the Environment Southland plan standards are highlighted in red, values that do not meet the ANZECC physical and chemical stressors trigger values are highlighted in green.

[5] Toxicity value for 95% protection level

[6] Environment Southland plan standard, based on worst case scenario (highest pH)

[7] Faecal coliforms calculated using the concentration of *E.coli* and a conversion factor derived from six weeks of additional monitoring which analysed for both *E.coli* and faecal coliforms

[8] Environment Southland plan standard

[9] National Policy Statement for Freshwater grade B 1-day minimum standard

[10] Converted from concentration using reference table 4500-O:I in *Standard Methods for the Examination of Water and Wastewater* (22nd Edition). Assumes a typical atmospheric pressure of 101.3 kPa and that chlorinity in the river is zero.

[11] Value for nitrate + nitrite – in general nitrate makes up the majority of the two and therefore in the absence of specific data the concentration of nitrate has been compared to this trigger value.

Table 3-4: Additional Tokanui River Water Quality Monitoring (August 2017 – January 2018) (n=18)

	Minimum			Arithmetic Mean			Maximum			
Parameter	U/S	50 m D/S	150 m D/S	U/S	50 m D/S	150 m D/S	U/S	50 m D/S	150 m D/S	Guideline Values
Ammoniacal Nitrogen (g/m^3)	0.01	0.01	0.01	0.04	0.04	0.04	0.4	0.4	0.4	0.9[12]/1.47[13] /0.021
Conductivity (mS/m)	15.0	17.6	15.1	18.3	19.1	18.3	19.5	28.5	19.3	
Temperature (°C)	6.9	6.9	6.9	11.2	11.1	11.1	18.6	18.6	18.6	
E.coli (cfu/100mL)[14]	40	90	10	3,910	3,439	3,147	46,000	37,000	36,000	
Faecal coliforms (cfu/100mL)	55	100	140	1,644	1,685	1,449	19,000	20,000	17,000	1000[15]
Dissolved Oxygen (mg/L)	6.9	7.0	6.9	9.4	9.4	9.3	11.3	11.2	11.1	5[16]
Dissolved Oxygen (% sat)[17]	64	68	66	84	85	84	95	95	94	80[15]
pH	7.2	7.1	7.1	7.4	7.4	7.3	7.6	7.6	7.5	7.2 – 7.8
Dissolved Reactive Phosphorus (g/m^3)	0.009	0.008	0.008	0.041	0.021	0.020	0.230	0.055	0.047	0.01
Turbidity (NTU)	3	3	3	9	11	10	18	37	20	5.6

Note: values which do not meet the Environment Southland plan standards are highlighted in red, values that do not meet the ANZECC physical and chemical stressors trigger values are highlighted in green.

[12] ANZECC 2000 toxicity trigger value for 95% protection level

[13] Environment Southland plan standard, based on worst case scenario (highest pH)

[14] The mean and maximum *E.coli* concentrations in the additional monitoring are higher than the mean and maximum concentration of faecal coliforms. *E.coli* are a sub-set of faecal coliforms and therefore the concentration of *E.coli* in a single sample will always be less than or equal to the concentration of faecal coliforms. This is not seen in the summary data because the Council has only monitored for *E.coli* and faecal coliforms on 11 out of the 14 additional monitoring rounds. The most elevated *E.coli* concentrations occurred during the monitoring rounds when only *E.coli* were analysed for

[15] Environment Southland plan standard

[16] National Policy Statement for Freshwater grade B 1-day minimum standard

[17] Converted from concentration using reference table 4500-O:I in *Standard Methods for the Examination of Water and Wastewater* (22nd Edition). Assumes a typical atmospheric pressure of 101.3 kPa and that chlorinity in the river is zero.

The long term data record and the results of the additional monitoring undertaken in August to December are broadly comparable. The river can generally meet the Environment Southland plan standards, with the exception of those for faecal coliforms consistently and occasionally those for dissolved oxygen[18]. However the ANZECC 2000 physical and chemical stressors trigger values are unable to be met upstream or downstream within the Tokanui River for ammoniacal-nitrogen, nitrate-nitrogen, dissolved reactive phosphorus and turbidity. These results indicate that nutrient concentrations within the Tokanui River are elevated to levels which may result in nuisance biological growth.

In general, dissolved oxygen (both concentration and percentage saturation) appears to be lower downstream than upstream. The recorded dissolved oxygen concentrations comply with the Grade B limit from the NPS-FM, however the data is not based on a continuous record which would include the daily minimum which would be expected to occur just before dawn. This is further discussed in Section 5.3.3.

The mass ratio between chloride and bromide can be used to give an indication of the source of contamination within a water body. Katz et al. (2011) state that chloride / bromide ratios in wastewater, such as septic-tank effluent and treated municipal wastewater, tend to have larger ranges. Thomas (2000) found that chloride / bromide ratios above 400 were correlated with chemical constituents associated with human activities. Fancy et al. (2004) found that detections of total coliforms or enteric viruses were statistically significant for ratios greater than 300.

Table 3-5 below summarises the results from monitoring events from August 2017 to January 2018 within the Tokanui River. The results indicate that the stream is minimally impacted by human wastewater. It should also be noted that the upstream and downstream results are consistent at both locations.

Table 3-5: Halide Results

Date	Chloride		Bromide		Ratio	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Minimum	25	25	0.11	0.11	180	186
Average	26	26	0.13	0.13	206	206
Maximum	28	27	0.15	0.14	236	236

As part of the biological survey undertaken in April 2017 Ryder undertook water quality assessments. Temperature, pH, dissolved oxygen, conductivity, and clarity were all analysed in the field. Water quality indicators were similar at all three sites and met the applicable standards with the exception of water clarity. Clarity results were similar at all three sites but slightly below the Environment Southland plan standard of 1.3 m. Ryder noted however that this plan standard only applies when the flow is below median flow. The median flow in the Tokanui River was not calculated as part of the Ryder survey and therefore it is unclear whether the river was below the median flow. It should be noted however that given that the results were similar between the upstream and downstream sites it is unlikely that the discharge was resulting in the reduction in water clarity observed.

Further information on the water quality of the Tokanui River is available from the Land Air Water Aotearoa (LAWA) website. LAWA is a collaboration amongst a range of organisations including regional councils, unitary authorities, Cawthron Institute, Ministry for the Environment, Massey University and the Tindall Foundation to provide information on the state of New Zealand's environment. The site includes descriptive summaries of various water quality parameters for major surface water bodies around the country.

LAWA provides information on the water quality of the Tokanui River based on data collected by Environment Southland as part of the SOE programme from the Tokanui River where the Fortrose-Otara Road crosses, approximately eight kilometres south west of Tokanui Township, and well downstream of the WWTP discharge as shown in Figure 3-2.

[18] The ANZECC guidelines include an optimal dissolved oxygen range of 99% - 105%. This range has not been used in the above assessment because it is a limited range of oxygen concentrations and significantly conservative. The 80% limit used in the Environment Southland plan is the more generally accepted standard for New Zealand surface water bodies.

A trend analysis performed by LAWA and summarised on the LAWA website indicates an indeterminate trend for all parameters. This indicates that the data does not provide a clear increasing or decreasing trend for any of the parameters assessed.

ES State of the Environment monitoring data for the Tokanui River has been requested. This will be summarised and added here once received.

3.2.3 Aquatic Ecology

The following data sources were used to assess the aquatic ecology of the Tokanui River:

- The New Zealand Freshwater Fish Database, records for the Tokanui River
- Ryder, Aquatic Invertebrate Assessment, October 2002 (attached in **Appendix I**)
- Ryder, Tokanui Wastewater Treatment System Biological Survey, April 2017 (attached in **Appendix J**).

The New Zealand Freshwater Fish Database records five fish in the Tokanui River, four of which are native and one introduced species as identified below:

- *Anguilla australis*, Shortfin eel (not threatened)
- *Anguilla dieffenbachii*, Longfin eel (At risk: declining)
- *Salmo salar*, Atlantic salmon (Introduced and naturalised)
- *Galaxias gollumoides*, Gollum galaxias (Nationally vulnerable)
- *Galaxias maculatus*, Inanga (At risk: declining).

The records also noted the presence of freshwater crayfish (koura).

Two biological surveys of the Tokanui River within the vicinity of the WWTP discharge have been undertaken by Ryder. The first was undertaken in 2002 to support the 2002 consent application and AEE.

The 2002 report assessed the following:

- Invertebrate density (number of individuals per sample)
- Number of taxa (different types of invertebrate groups)
- The Macorinvertebrate Community Index (MCI[19])
- The Semi-Qualitative Macroinvertebrate Community Index (SQMCI[20]).

Three samples were collected upstream of the WWTP discharge and three samples were collected downstream. Table 3-6 summarises the average score of the upstream and downstream sites.

Table 3-6: Ryder Invertebrate Survey Summary (2002)

Parameter	Upstream (average score of three sites)	Downstream (average score of three sites)
Number of invertebrates	116	68
Number of taxa	8	7
MCI	94	93
SQMCI	2.5	3.4

The report concluded that there was no evidence of any effect from the WWTP discharge on the invertebrate community of the Tokanui River. The invertebrate community was noted to be highly variable and included species that are both tolerant and intolerant to organic pollution.

[19] The MCI uses the occurrence of specific macroinvertebrate taxa to determine the level of organic enrichment in a stream. Taxa with a high tolerance to organic enrichment are assigned a lower value than those who are sensitive to organic enrichment. A site score is obtained by summing the scores of individual taxa and dividing this total be the number of taxa present at the site.

[20] The SQMCI is similar to the MCI but scales the individual taxa scores based on how common the taxa are.

A second biological survey was commissioned by the Council in 2017. Ryder completed this survey in April 2017 (see Figure 3-7 for sample locations). The second Ryder survey included the same parameters assessed in 2002 with the following additions:

- Number and percentage of EPT[21] taxa
- MCI-sb[22]
- SQMCI-sb[21]

Table 3-7: Summary of Macroinvertebrate Survey Results

	Upstream	Downstream 1	Downstream 2
Number of Taxa	28	29	38
Number of EPT	9	10	11
% EPT taxa	33	32	30
MCI	88 (fair)	83 (fair)	83 (fair)
SQMCI	4.1 (fair)	4.2 (fair)	4.1 (fair)
MCI-sb	93.2 (fair)	86.7 (fair)	85.3 (fair)
SQMCI-sb	3.6 (poor)	3.6 (poor)	3.8 (poor)

The overall taxonomic diversity at each site was considerably higher than the national median of 18 taxa per site. EPT taxa found at each site included the high scoring (pollution sensitive) *Deleatidium* mayflies, *Megaleptoperla* stoneflies, and *Helicopsyche* caddisflies. Freshwater crayfish (*Paranephrops zealandicus*) (koura) were found at the 'Upstream' and 'Downstream 1' sites. Freshwater crayfish are classified as at risk-declining under the New Zealand Threat Classification System (Townsend et al. 2008).

The MCI, MCI-sb, SQMCI and SQMCI-sb scores were all similarly low with average scores indicative of poor to fair water quality conditions. The macroinvertebrate communities at each site were dominated by *Potamopyrgus* (snails) and *Paracalliope* (amphipods). *Austrosimulium* (sandfly) larvae, chironomid midge larvae and oligochaete worms were also abundant at each site, all of which are reasonably pollutant tolerant.

Overall the average MCI and SQMCI scores at each site complied with the Environment Southland standards of 80 (MCI) and 3.5 (SQMCI) respectively, as defined in the RWP and the pSWLP.

The 2017 Ryder report also provided information on periphyton and macrophytes. The report stated that the Tokanui River in the vicinity of the Tokanui WWTP meanders considerably and is generally slow flowing as evidenced by the prominence of runs and small pools. The bed comprised fine silts and muds and varies in width from 3 m to 5 m. Coarser materials such as fine to medium sized gravels occur along the shallower bank margins of the faster flowing reaches.

The river is surrounded by farmland, with fencing separating riparian areas from adjacent paddocks. Riparian vegetation includes rank grass, with small areas of overhanding gorse and flax. Macrophytes include monkey musk and some watercress and creeping bent. The river flows through a deep channel with steep sides. Within the vicinity of the WWTP the channel is approximately 3 to 5 m wide and between 0.3 to 1.4 m deep.

Instream habitat comprised slow runs, with large macrophyte beds at each site. Bed substrate comprised soft sediment, with small areas of fine gravels and isolated cobbles at each site and some small patches of bedrock and isolated woody debris. An eel (unidentified species) was disturbed in macrophyte beds at 'Downstream 2' during sampling.

Ryder concluded that overall, the algal taxa found upstream and downstream of the discharge are typical of those found in similar slow flowing habitat throughout New Zealand. There were no bacterial or fungal slime growths visible to the naked eye at any of the sites. A full list of the benthic algae found in the

[21] *Ephemeroptera, Plecoptera* and *Trichoptera* make up the EPT taxa and are invertebrate groups that are generally dominated by invertebrates that are indicative of higher quality conditions.
[22] Calculated in a similar way to MCI and SQMCI but adapted to include tolerance scores derived specifically for soft-bottomed streams, such as the Tokanui River.

Tokanui River and each species abundance score is given in the Ryder report which is attached in **Appendix J**.

A macrophyte cover rapid assessment was undertaken based on the protocol outlined in *'Aquatic Plant Cover in Wadeable Streams'* (Collier et al. 2014). Macrophyte indices were then calculated from the macrophyte cover assessment.

Six different macrophyte species were found in the Tokanui River, five of which were exotic and one of which (*Potamogeton ochreatus* – blunt pondweed) was native. Macrophyte cover levels were high at all three survey sites. Macrophyte indices, calculated according to the macrophyte cover assessment (Collier et al. 2014) reveal that cover levels over the stream bed (total cover) and through the water column (channel clogginess) were highest at the 'Upstream' site, while cover of native species was highest at the 'Downstream 1' site. There were no statistically significant differences between sites in any of the macrophyte cover categories.

More detail regarding the methodology employed and a full summary of the results is provided in the full Ryder reports which are attached in Appendix I and J.

3.3 Soil and Geology

3.3.1 Topography and Geology

The WWTP is located on comparatively flat land below the Tokanui Township, which has been built on low rolling hills typical of the vicinity of the town.

The 1:250,000 geological map from Turnbull and Allibone (2003) shows the Tokanui WWTP to be located on unconsolidated modern flood plain material consisting of sand, gravel and mud.

3.3.2 Soil

Information regarding the properties of the soil likely to be underlying the WWTP have been accessed from the following sources:

- Geological bore logs from bores F47/0161 and F47/0164 provided by Environment Southland
- SMap online
- Environment Southland's physiographic zones from the Beacon mapping layer
- SDC test pit.

Geological logs from bores F47/0161 and F47/0164 at Tokanui Township describe the material from ground level down to approximately 5 m depth as silt, sandy silt and clayey silt. A test pit dug to a depth of 3.8 m on the east side of the Tokanui River showed silts and clays from 0 m to 2.5 m and gravel from 2.5 m to 3.8 m.

SMaps online indicate that the soils in the area of the WWTP are predominantly the Woodland and Waikiwi soils, which are considered to be well drained. This information was not consistent with other information sources used, including test pits dug near the site by SDC. Given this the properties of these soils has not been presented.

Environment Southland's physiographic zoning shows that the Tokanui WWTP is located in an Oxidising zone and adjacent to a Gley zone as shown in Figure 3-8. The proposed infiltration trench would traverse both zones as identified in Figure 3-8. It is noted that gley zones are generally considered to be poorly drained. Site visits have indicated that in winter the groundwater table is high and that water ponds within the site, this may indicate that the soil on site has low permeability.

Figure 3-8: Environment Southland Physiographic Zones

The soil properties of each zone are summarised in Table 3-8.

Table 3-8: Environment Southland Physiographic Zones

Characteristic	Oxidising zone	Gley zone
Land surface	Flat to gently undulating on elevated terraces along the outer margins of major rivers	Flat to gently undulating land between the major river systems
Soils	Well drained to poorly drained	Poorly drained, prone to waterlogging
Water table	High	High
Dentrification potential of groundwater and soils	Low	Moderate to high
Susceptibility to nitrate accumulation in groundwater	High	Low to moderate
Phosphorus retention	Moderate	Unknown
Streams connected to groundwater	Yes	Yes

It is considered most likely that the material beneath the WWTP and the proposed infiltration trench area is gleyed in nature and poorly drained. The information in Table 3-8 indicates that there may be some removal of nitrate in the soils prior to discharge to groundwater or as it moves through the aquifer.

3.4 Groundwater

3.4.1 Groundwater Characteristics

The only known records of the depth to groundwater within 1 km of the WWTP come from two bores listed on Environment Southland's database. These bores (F47/0161 and F47/0164) are 4.5 m and 5.5 m deep, located at Tokanui Township 400 m from the WWTP on the true left side of the Tokanui River. The bores had static water levels of 1.5 m and 1.8 m depth below ground level when drilled.

Shallow unconfined groundwater generally follows the topographic surface. In this area, the Tokanui River occurs within a depression with the land sloping slightly towards the river on both sides. The WWTP appears to be positioned on a slight topographic rise. In the absence of any piezometric data to contour groundwater levels, it is considered that the regional direction of groundwater flow is towards and generally parallel to the river.

Discharges of wastewater from the base of the WWTP ponds and/or the infiltration trench may create a localised groundwater mound resulting in groundwater flowing towards, adjacent to and slightly away from the river. Overall, any contaminants entering groundwater from the base of the ponds and trench will either discharge into the Tokanui River or be transported down-gradient of the WWTP in the general direction of the Tokanui River.

3.4.2 Groundwater Uses

Table 3-9 summarises the details of all bores listed from Environment Southland's database within 2 km of the Tokanui WWTP. The location of each bore is shown in Figure 3-9.

Table 3-9: Bores within 2km of Tokanui WWTP

Well No	Easting	Northing	Status	Primary Use	Depth (m)	Drilled Depth (m)	Top Screen (m)	Bottom Screen (m)	Initial Water Level (m)
F47/0230	1288566	4836076	Drilled	Dairy Use	60	60	54	60	-12
F47/0160	1289123	4835096	Drilled	Monitoring	4	4			
F47/0161	1289123	4835096	Drilled	Monitoring	5.5	5.5			-1.5
F47/0162	1289123	4835096	Proposed	Monitoring	10				
F47/0163	1289123	4835096	Proposed	Monitoring	10				
F47/0164	1289123	4835096	Drilled	Monitoring	4.5	4.5	1.5	4.5	-1.83
F47/0165	1289123	4835096	Proposed	Monitoring	10				

Note: Easting and northings in NZTM 2000

All shallow groundwater bores within the vicinity of the Tokanui WWTP are used for monitoring. One bore located to the north of the Tokanui WWTP (F47/0230) is listed as being used for dairy water supply and is considerably deeper.

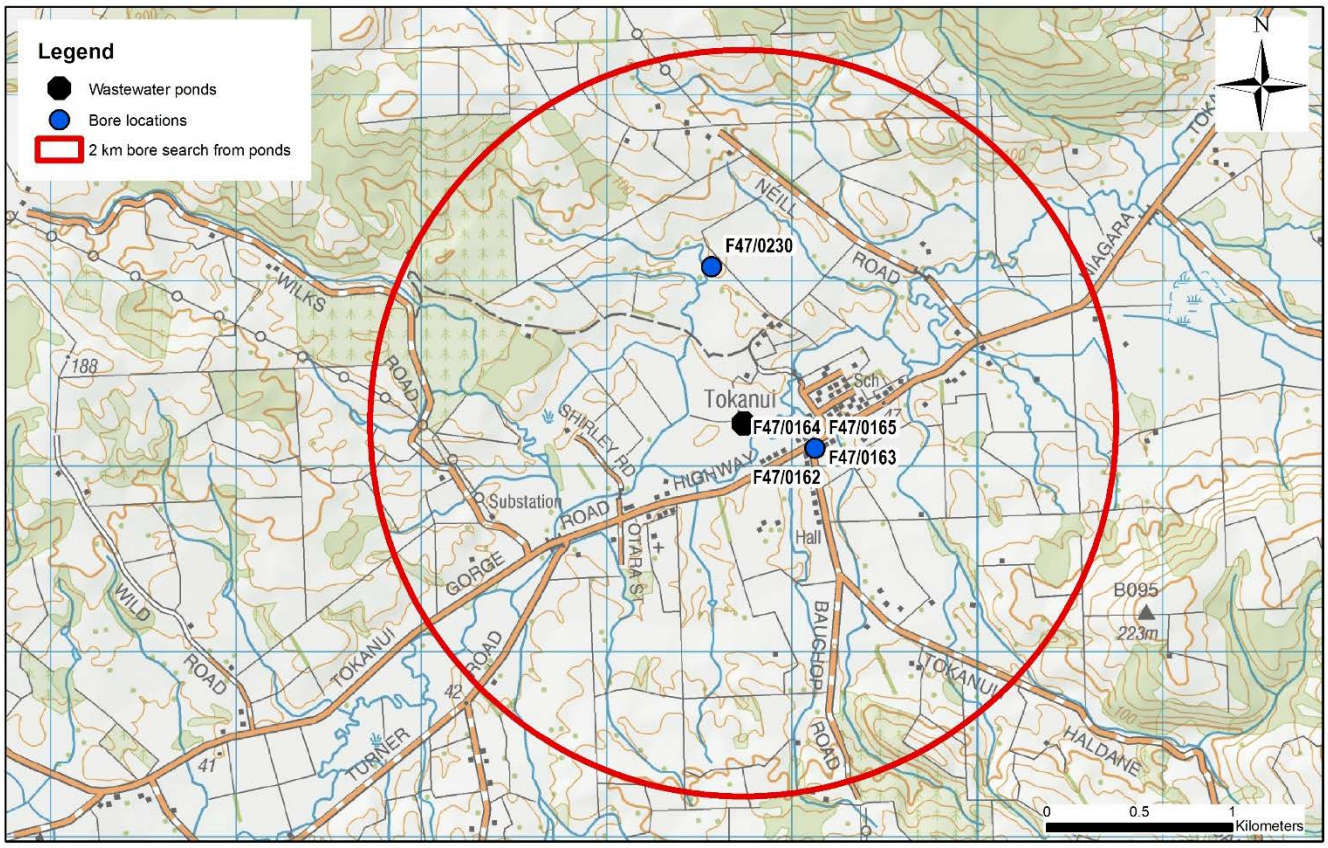


Figure 3-9: Location of Bores within 2km of Tokanui WWTP

3.5 Sensitivity of the Receiving Environments

The land, groundwater and water receiving environments are considered to be moderately sensitive to the effects of the WWTP discharges.

Water quality in the Tokanui River is impacted by upstream land uses. There are limited opportunities for public access to the Tokanui River, and consequently the river is rarely used recreationally in the vicinity of the WWTP. The Ryder report notes that the river is home to a number of native species and that improvements in water quality would likely lead to improvements in the quality of the habitat for those species, and potentially enable the abundance of less pollution-tolerant species to increase.

While groundwater is not used consumptively in the vicinity of the WWTP and is not used for potable supply it is understood to flow towards the Tokanui River and will therefore contribute to the overall water quality of the river. The sensitivity of the groundwater in this location is also considered to be moderate, because of the lack of consumptive uses within the area, which means the groundwater should not be considered to be highly sensitive. However the potential for the groundwater to influence the surface water of the Tokanui River indicates that the environment should be considered to have some sensitivity to the discharge.

The soils beneath the WWTP are not considered to be highly sensitive to the discharge given that the depth of the pond invert is well below the typical depth of topsoil in this location. The infiltration trench will facilitate a limited discharge of treated wastewater to land over a confined area (within the trench and the immediately adjacent soils), and will not adversely affect the soils of the wider site. Given the nature of the wastewater sourced from Tokanui and treated at the site, the presence of persistent contaminants is limited, and is not considered likely to render the site or surrounding soils as unable to be used for future activities in the long term.

4. Statutory Approvals

4.1 Introduction

The Council is applying for:

- A **discharge permit** to replace resource consent 201599 with a new discharge permit to discharge treated wastewater to land and water. The applicant seeks authorisation to discharge treated wastewater up to an annual average daily volume of 55 m^3 / day:
  - (i) to land via the base of the oxidation ponds and the proposed infiltration trench; and
  - (j) to water (groundwater and surface water);
- **Land use consent** to disturb soil on land where a hazardous activity or industry is occurring or has occurred (a HAIL[23] site); and
- **Land use consent** to authorise the construction of the infiltration trench, as it will provide approximately 17.5 m^3 of treated wastewater effluent storage within 50 m of the Tokanui River.

This document also serves as a **Notice of Requirement** (NoR) to alter the boundary of the existing designation over the WWTP, to incorporate the land upon which the proposed infiltration trench would be constructed, being an essential component of the WWTP operation.

A term of 25 years is sought for the discharge permit. The approvals sought for the proposed activity are described in detail in the following sections.

4.2 National Environmental Standards

The construction of the infiltration trench will involve earthworks within the WWTP site. The Ministry for the Environment has compiled the Hazardous Activities and Industries List (the HAIL) which specifies a range of activities and industries which would typically result in residual soil contamination. Wastewater treatment plants are included on the list, and consequently activities that disturb soil on WWTP sites are subject to consideration under Regulation 5(7)(a) of the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*) Regulations 2011 (NES-CS).

Regulation 8(3)(c) of the NES-CS sets a volume limit for soil disturbance on a HAIL site of 25 m^3 per 500 m^2, and requires all works to be complete within two months. The earthworks required to construct the proposed infiltration trench are likely to exceed 25 m^3 per 500 m^2, and may take longer than two months to complete, therefore resource consent is required under Regulation 11 of the NES-CS as a discretionary activity. The Southland District Council is the consent authority responsible for administering the NES-CS. The application to the Southland District Council in respect of the NES-CS is included as part of this document.

4.3 Regional Council Approvals

Resource consent for the discharge of contaminants to land and to water are required from the Southland Regional Council under s15 of the RMA, as the existing discharge permit expires on 8 September 2018, and the discharge is not otherwise provided for as a permitted or prohibited activity under the relevant regional plans. Section 124(1) of the RMA provides for the Council to continue to operate under the conditions of the existing consent until the application for the new consent is determined, where an application for a replacement consent is lodged more than six months prior to the expiry of the existing consent.

Resource consent for the construction of the infiltration trench, including vegetation clearance and the disturbance of soil within 20 m, and for the consequential storage of wastewater effluent within 50 m of a water body is required. The consents required under s9(2) (in respect of regional plan rules) are sought as part of this application.

4.3.1 Regional Water Plan for Southland

The Regional Water Plan for Southland (RWP) was made operative by Environment Southland in April 2010. The current version incorporates a number of plan changes, and has been operative since 2014.

[23] The Ministry for the Environment's *Hazardous Activities and Industries List* (HAIL)

The RWP promotes, in accordance with the RMA, the sustainable management of Southland's water resources, and contains objectives, policies and rules that are fundamental to this proposal. The relevant rules are set out in Table 4-1 below:

Table 4-1: Regional Water Plan Rules

Rule	Assessment
Rule 1 – Discharges to surface water bodies that meet water quality standards.	Under Rule 1, the discharge of water or a contaminant into water, or to land where it may enter water requires resource consent as a discretionary activity provided that, after reasonable mixing the discharge does not reduce receiving water quality below the water quality standards set out in Appendix G of the RWP. The discharge does not cause the water quality of the Tokanui River to fall below the standards set out in Appendix G. The discharge to the Tokanui River is therefore a **discretionary activity** under Rule 1.
Rule 3 – *(a)* Except as provided for elsewhere in the Plan, the discharge of any contaminant or water into water is a discretionary activity.	Rule 3 provides for discharges of contaminants or water into water that are not otherwise provided for by other RWP rules as discretionary activities. The discharge of treated wastewater to ground water will occur via: - the base of the oxidation ponds; and - the proposed infiltration trench when groundwater levels become sufficiently elevated that there is no unsaturated zone beneath the point of discharge (i.e. the base of the oxidation pond or the trench invert). The discharge to groundwater is a **discretionary activity** under Rule 3.
Rule 14 – Discharge of raw sewage, foul water or untreated agricultural effluent	The discharge of raw sewage, foul water or untreated agricultural effluent into water is a prohibited activity for which no resource consent application can be made. As there are no such discharges from the Tokanui WWTP, this rule does not apply.

4.3.2 Regional Effluent Land Application Plan for Southland

The Regional Effluent Land Application Plan (RELAP) became operative in May 1988. It contains provisions relating to the management of effects from effluent and sludge discharges. While it will ultimately be replaced by the Southland Land and Water Plan, the RELAP currently remains the operative document for these activities. The relevant rule is set out in Table 4-2 below:

Table 4-2: Regional Effluent Land Application Plan Rules

Rule	Assessment
Rule 5.2.1 – The discharge of effluent onto or into land from a community sewage scheme is a discretionary activity.	Consent is sought to authorise the discharge of treated wastewater to land from the oxidation ponds and via the infiltration trench. The discharge activity is therefore a **discretionary activity** under Rule 5.2.1.

4.3.3 Proposed Southland Water and Land Plan

The proposed Southland Water and Land Plan (pSWLP) was notified in June 2016, receiving a substantial number of submissions resulting in a long hearing process which closed in November 2017. A decision is not expected to be released until early 2018, however the rules have legal effect and the provisions as notified must be taken into consideration when determining applications for resource consent, as directed by s104(1) of the RMA. While the rules have been substantially modified in proposed amendments presented by reporting officers in the s42A report, and in response to submissions, only the notified versions of the rules apply until any amendments are confirmed and beyond challenge.

The relevant rules as notified in June 2016 are set out in Table 2-3 below:

Rule	Assessment
Rule 5 – Discharges to surface waterbodies that meet water quality standards.	Under Rule 5, the discharge of water or contaminants into water, or to land where it may enter water requires resource consent as a discretionary activity provided that, after reasonable mixing the discharge does not reduce receiving water quality below the water quality standards set out in Appendix E of the pSWLP. The discharge does not cause the water quality in the Tokanui River to fall below the standards set out in Appendix E. The discharge to the Tokanui River is therefore a **discretionary activity** under Rule 5.
Rule 7 – Other discharges to water	Rule 7 addresses other discharges to water that are not otherwise addressed by other rules. Rule 7 applies to the discharge of treated wastewater directly to groundwater in circumstances where there is no unsaturated zone beneath the ponds and the infiltration trench. Under this rule, the discharge is a **discretionary activity**.
Rule 32 – Effluent Storage	Rule 32 applies to the use of land to construct any effluent storage facility, including for the storage of wastewater, sludge or effluent from an industrial or trade process (which includes wastewater treatment plants). The existing WWTP ponds are within 50 m of the Tokanui River. The proposed infiltration trench will provide for up to 17.5m^3 of treated wastewater storage within 50 m of the river, failing Rule 32(a)(ii). The proposed infiltration trench is therefore a **non-complying activity** under Rule 32(b).
Rule 33 – Community sewage schemes	The oxidation ponds were built according to accepted construction practices at the time of construction (circa. 1972), but the design and quality of the ponds have not been certified by a Chartered Professional Engineer. It is extremely unlikely that a CPEng would be prepared to retrospectively certify the integrity of structures such as the ponds given their inability to confirm the design and construction details given the passage of time. It should be noted that the pSWLP s42A officers recommended this requirement be deleted from the rule as a result of submissions to that effect, however the notified version above has legal effect and currently applies. Further, while the applicant undertook a pond drop test, they did not de-sludge the pond in accordance with the methodology set out in Plan Appendix P, and therefore did not comply with Rule 33(a)(2). As it is not possible to obtain certification under Rule 33(a)(i)(1), and the pond drop test was not consistent with the requirements In Appendix P, the discharge of treated effluent onto or into land where it may enter water is a **non-complying activity** under Rule 33(b).

4.3.4 Southland Regional Air Quality Plan

The Southland Regional Air Quality Plan (RAQP) became operative in 1999. It is currently under review through the Southland Regional Air Plan 2016, which is in its first stage of review. Rules and provisions relating to discharges to air from industrial and commercial activities are to be reviewed in Stage 2 of the Air Plan review which has yet to commence, so the provisions of the operative RAQP prevail.

Rule	Assessment
Rule 5.5.3(9)	The WWTP provides wastewater treatment with a design capacity population equivalent of less than 10,000 people, and therefore the discharge of contaminants (odour) to air from the WWTP is a **permitted activity** under this rule.

4.3.5 Regional Council Resource Consents Required

Other than Rule 5.5.3(9) of the RAQP, there are no permitted activity rules upon which the applicant can rely for the discharges from the Tokanui WWTP, so resource consents are therefore needed under the RWP, RELAP and the pSWLP. The resource consents required are summarised in Table 4-3:

Table 4-3: Resource Consents Required

Authority	Plan	Activity	Status
Environment Southland	RWP (operative)	To discharge water and contaminants to land, and to water.	Discretionary
	RELAP (operative)	To discharge treated wastewater to land.	Discretionary
	pSWLP (proposed)	To use land to construct an effluent storage facility.	Non-complying
	pSWLP (proposed)	To discharge treated wastewater water.	Discretionary
	pSWLP (proposed)	To discharge treated wastewater to land where it may enter water.	Non-complying

As the proposed activity cannot otherwise be lawfully undertaken without resource consents being granted, it is appropriate to 'bundle' the applications together such that the proposal as a whole adopts the most stringent activity status, and becomes a **non-complying activity**.

A term of 25 years is sought for the discharge permit, with no limit to the term sought for the land use consent.

4.4 District Council Approvals

Section 9(3) of the RMA prevents the use of land that contravenes a rule in a district plan unless it is otherwise authorised by resource consent, or is an existing use covered by s10 or s10A. The Southland District Plan (SDP) was made operative in 2001, and has largely been replaced by the proposed Southland District Plan[24] (pSDP), other than for a small number of provisions which remain under appeal. None of the relevant rules of the pSDP are under appeal, therefore the rules of the SDP are not considered further. The WWTP site is designated in both the SDP[25] and pSDP[26]. The designation is limited to the immediate vicinity

[24] The proposed Southland District Plan was notified in 2012, and is effectively operative other than for the few appeals that remain to be resolved.
[25] D173 – *Tokanui Sewerage Pond Site*; Map 52, Tokanui Gorge Road, Lot 1 DP 8315 Blk X Toetoes SD
[26] D49 - *Tokanui Wastewater Treatment Facility – Public Utility;* Map 73, 11B McEwan Street Tokanui, Lot 1 DP 8315

of the existing oxidation ponds as shown on Planning Map 73 of the pSDP (attached in **Appendix K** of this document).

Under the current proposal, most of the proposed infiltration trench would be constructed on land that is within 25 m of the Tokanui River, and is outside the boundary of the current designation, consequently rules of the pSDP would apply. Rule INF.4 identifies new wastewater treatment facilities that comply with the standards of Rule INF.4(5) as discretionary activities. As the proposal involves an upgrade of an existing wastewater treatment facility however, Rule INF.4 does not apply. The proposed activity therefore falls to be considered under Rule INF.6 – General Infrastructure Activities, in respect of the earthworks conditions under INF.6(3).

The earthworks associated with the construction of the infiltration trench will take place on land within 5 m of the Tokanui River, on land that is potentially contaminated (a HAIL site), contravening Rules INF.6(3)(iv)[27] and requiring resource consent as a discretionary activity under Rule INF.4. Section 176 of the RMA however sets aside the application of s9(3) in regard to any public work undertaken by a requiring authority within land designated in the district plan, where it is consistent with the purpose of the designation. The proposed alteration of the existing designation is discussed in section 4.5.

4.5 Alteration of the Designation

Included within this application document is a Notice of Requirement (NoR) served by the Southland District Council as the requiring authority, on the Southland District Council as the territorial authority (Form 20, Part One of this document). The NoR describes the requirement to alter the boundary of the existing designation to incorporate the land needed for the infiltration trench, given its importance as an integral part of the WWTP operation. The alteration would set aside the application of s9(3) of the RMA such that resource consent under Rule INF.4 of the pSDP would not be required.

Section 181 of the RMA allows territorial authorities to alter designations in their district plans where such alterations:

(i) Involve only a minor change to the environmental effects associated with the use of the land or water concerned; or

(ii) Involves no more than a minor change to the boundary of the existing designation; and

(iii) Owners and occupiers of any affected land have been advised in writing and agree with the alteration; and

(iv) The territorial authority and the requiring authority agree with the alteration.

The matters that are required to be addressed under s181 of the RMA are set out in the following sections.

4.5.1 Extent of the Boundary Change

The proposed infiltration trench is described in detail in Section 1.2.1, and shown in the Land Requirement plan attached in Appendix C of this document. The proposed alteration to the boundary of the existing designation would involve minor changes to incorporate approximately 1,400 m^2 of additional land as shown in the attached plans.

The purpose of the infiltration trench is to facilitate partial land-based disposal of treated wastewater subject to receiving environment capacity, and to ensure that treated wastewater contacts land prior to discharging to the Tokanui River. The construction of the infiltration trench will involve some removal of vegetation (primarily exotic pasture grass) and earthworks associated with the excavation and construction of the trench. The use of land for the infiltration trench would be entirely consistent with the existing use of the site as a WWTP, and the purpose of the existing designation. The infiltration trench would become an integral part of the WWTP operation serving the Tokanui community.

The environmental effects of the boundary alteration sought are considered in Section 5.12 of this document.

4.5.2 Alternative Sites or Methods Considered

The Council as requiring authority considered several practicable alternatives to the proposal:

[27] Note that due to an apparent drafting error, there are two rules numbered INF.6(3)(iv) however both apply in this case.

- *Continuing with the existing surface water discharge*

Continuing with the existing discharge was considered by the Council, particularly noting the low adverse effects on the quality of the Tokanui River identified by monitoring undertaken under the existing consent conditions. Upgrading the WWTP with the infiltration trench was favoured as a possible means of addressing effects on Maori cultural values.

- *Discharging to land in an alternative location*

Several options for land disposal were considered, including disposal on land adjacent to the WWTP (discounted due to soil and groundwater properties) and disposal to a plantation block nearby.

Disposal to the plantation block was not preferred because of the costs associated with conveying wastewater to a distant disposal area, which would have been economically unsustainable. The current proposal enables treated wastewater to flow by gravity from the oxidation ponds to the infiltration trench, and to the Tokanui River (if need be) avoiding the substantial cost of installing, operating and maintaining pumps and equipment to discharge at the plantation (see Appendix D). The cost noted in the appendix is to establish the infrastructure to enable the discharge to land, and for operational costs for one summer. Given the nature of the soils in the forestry block, winter irrigation is not considered feasible as the soils are described as 'heavy' and are unlikely to be able to receive and absorb wastewater irrigation without surface ponding. This would mean the WWTP discharge would need to be redirected to the river until such time as conditions permitted land irrigation to recommence. The plantation block is also due to be harvested in the near future, and would not have been available in the long term. Other land in the area has been deemed as unsuitable due to topography, or groundwater characteristics.

4.5.3 Outline Plan

Section 181(3) notes that sections 168 to 179 do not apply to the alterations of designation boundaries. Section 176A (Outline plan) therefore does not apply, however the information shown in the plans and described in this document addresses the relevant matters identified in s176A(3) of the RMA, and provides the necessary information for the territorial authority to identify and understand the potential effects of the proposed alteration.

4.6 Soil Disturbance on a HAIL Site

The Southland District Council is the regulatory authority responsible for administering the Resource Management (*National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health*) Regulations 2011 (NES-CS) in Southland. As wastewater treatment plants are identified on the Ministry for the Environment's HAIL, consideration of the NES-CS provisions is necessary.

The development of the infiltration trench would disturb up to 150 m^3 of land on the WWTP site, which exceeds the limit of 25 m^3 per 500 m^2 set under Regulation 8(3)(d). Further, there is the potential for construction to exceed a period of two months, which would require consent under Regulation 8(3)(f). Consent is therefore required under Regulation 11 as a discretionary activity.

5. Assessment of Environmental Effects

5.1 Introduction

The potential effects associated with the proposal, including the discharge of treated wastewater to land and to water, earthworks to construct the infiltration trench, and the alteration of the existing designation include both positive and adverse effects which are discussed in the following sections.

5.2 Positive Effects

The continued operation of the WWTP is the most significant positive effect in terms of the economic, social, cultural and environmental benefits associated with effective community wastewater treatment. They include:

- The effective management of risks to human health achieved by using the town's reticulated wastewater system, and the centralised wastewater treatment plant
- A reduced risk to the biophysical environment, including terrestrial and aquatic ecology resulting from centralised wastewater treatment, and the discharge of a proportion of the treated wastewater to land
- Enabling the ongoing levels of service required of the Council under the Local Government Act 2002 to be achieved. It will also enable the Council to meet the community's expectations, including fostering a positive relationship between the Council and the community by avoiding adverse effects on the community and the environment
- Allowing the Council to manage Tokanui's wastewater in an integrated and affordable manner with long term certainty, while achieving consistently high quality treatment outcomes and avoiding or mitigating adverse environmental effects
- Reducing adverse cultural effects resulting from discharges to water by discharging a proportion of the wastewater to land, and ensuring that the effects on the receiving environments are minimised
- Providing (through the alteration to the designation, for the ongoing operation of a key community infrastructure asset, and safeguarding it from future incompatible land use activities that could affect its ongoing operation and maintenance.

5.3 Effects on Surface Water Quality

5.3.1 Introduction

The effects on surface water quality from the direct discharge of treated wastewater from the WWTP to the Tokanui River have been assessed in the following sections. This assessment has been based on a worst case scenario which assumes that inflows into the WWTP equal the discharge to the Tokanui River. As discussed in Section 2.3.2 there are a number of additional discharge pathways and therefore this assessment is conservative.

An assessment of compliance with the conditions of consent 201599 is attached in **Appendix L**. An assessment of whether the discharge results in any exceedances of the current plan standards or NPS-FM standards is attached in Appendix L. A summary of the discharge and Tokanui River water quality data is attached in Appendix F.

5.3.2 Physio-Chemical Parameters

Section 3.2.2 summarises the water quality data upstream and downstream of the WWTP discharge; a spreadsheet of the full data record is attached in Appendix F. Overall there is little difference between the pH, conductivity or temperature of the Tokanui River between the upstream and downstream locations.

The results are consistent with the relatively small size of the discharge compared to the flow within the river and the consequential high levels of dilution available. Therefore, the discharge of treated wastewater is not anticipated to change the physico-chemical properties of the Tokanui River.

5.3.3 Dissolved Oxygen

The percentage saturation of dissolved oxygen in surface water is important for the ecosystem because sufficient oxygen is required for many of the species that inhabit the river. Low dissolved oxygen concentrations can stress both fish and macroinvertebrates and may result in changes in community composition to more tolerant species, or in extreme cases a loss of biodiversity within the water body.

Table 3-3 and Figure 5-1 indicate that while the concentration and percentage saturation of dissolved oxygen is variable, there are occasions in the long term record when the downstream site is recording lower dissolved oxygen than the upstream site. On three occasions, the percentage saturation of dissolved oxygen in the downstream site was less than the Environment Southland plan standard which requires it to be greater than 80%sat. In the monitoring programme from August 2017, the oxygen concentration at all three sites are generally similar and from December 2017 over the summer, the plan standard is not complied with at any site.

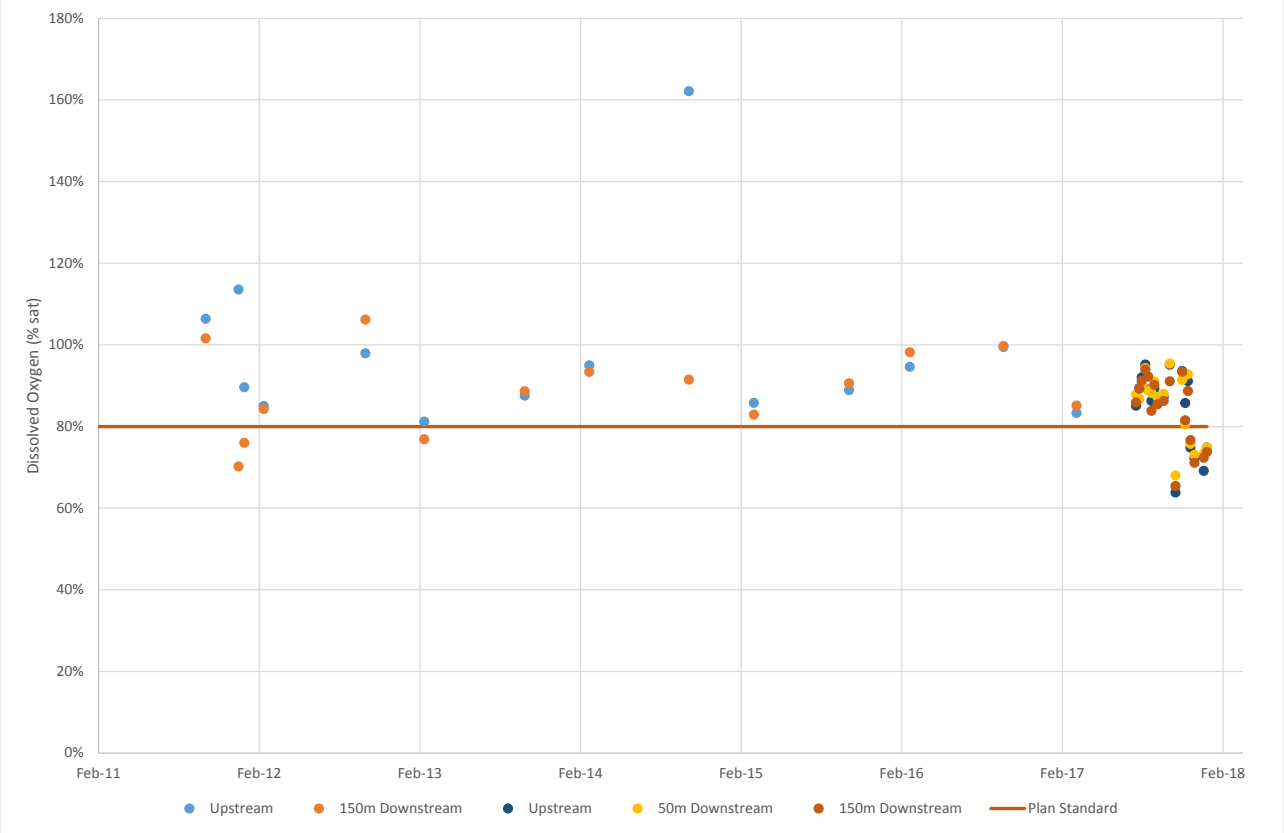


Figure 5-1: Dissolved Oxygen Percentage Saturation in the Tokanui River

The monitoring programme undertaken from August 2017 records concentration of dissolved oxygen (mg/L). These results were converted to percentage saturation using reference table 4500-O:I in *Standard Methods for the Examination of Water and Wastewater* (22nd Edition). A typical atmospheric pressure of 101.3kPa and a chlorinity of the Tokanui River of zero have been assumed. The assessment against the current Environment Southland plan standard is therefore based on converted data which is likely to result in some margin of error. In addition the results are based on two grab samples per year. Dissolved oxygen levels fluctuate throughout the day and therefore grab samples do not provide a whole picture of the health of the river.

A number of factors can affect the level of dissolved oxygen within a river. The 2017 Ryder report noted that the downstream site contained a number of deeper areas within the channel than the upstream site. Recharge of oxygen within surface water is predominantly achieved through the surface of the water body, as well as photosynthesis of any plants, and therefore the deeper the water and less turbulent the flow, the lower the expected dissolved oxygen. The deeper water at the downstream site is considered to

be the primary cause of the lower dissolved oxygen concentration at the downstream sites as compared to the upstream site. The increased temperatures and hence weed growth and respiration is considered to be the primary cause of the lowered dissolved oxygen concentrations in the river in the summer.

It is considered unlikely that the decrease in dissolved oxygen is as a result of the WWTP discharge as the biochemical oxygen demand (BOD_5) of the discharge is low in comparison to typical oxidation pond discharges, with a median BOD_5 (between 2005 – 2017) of 12 g/m^3. This is the oxygen that is required to consume the organic material in the discharge over a five day period, during which time the discharge will have fully mixed with the stream and will have travelled a considerable distance (more than 6km) downstream. The lowest dilution calculated as being available after full mixing is 343 fold. After full mixing, the BOD_5, from the discharge, would be 0.03 g/m^3. A reduction in dissolved oxygen as a result of a BOD_5 discharge at this level would not be detectable.

The effect of the discharge on the dissolved oxygen concentration and percentage saturation within the Tokanui River is therefore expected to be minimal (less than minor) on the basis of existing performance.

5.3.4 Toxicity

The primary contaminant of concern in the treated wastewater with respect to toxicity is ammoniacal-nitrogen. The ANZECC trigger value for ammoniacal-nitrogen toxicity at 95% protection is 0.9 g/m^3, and is considered appropriate for assessing effects on the Tokanui River, as the trigger value should be applied to slightly to moderately disturbed ecosystems. The trigger value for ammoniacal nitrogen is based on chronic rather than acute toxicity and therefore elevations above this concentration for short durations are considered unlikely to cause toxicity effects.

The maximum concentration of ammoniacal-nitrogen recorded in the receiving environment over the monitoring period available (2005-2017) was 0.4 g/m^3, which is well below the ANZECC toxicity trigger value. The maximum concentration of ammoniacal-nitrogen recorded in the discharge since 2005 was 28.8 g/m^3; the minimum dilution available (as discussed in Section 2.3.1) was 343. This would have resulted in a concentration within the receiving environment of 0.08g/m^3. This is consistent with the Tokanui River water quality results summarised in Section 2.3.3 which indicate that there is little difference in the concentration of ammoniacal-nitrogen between the upstream and downstream monitoring locations.

The catchment of the WWTP is domestic and hence the concentrations of metals and synthetic contaminants which can result in toxicity effects would be expected to be relatively low.

It is expected therefore that the discharge will not result in toxicity effects within the Tokanui River.

5.3.5 Nutrient Effects

Elevated nutrient concentrations can result in changes in the ecosystem, such as overgrowth of periphyton, algal blooms, and changes to the structure of biological communities. The concentration of nitrate-nitrogen and dissolved reactive phosphorus upstream and downstream of the WWTP discharge have been monitored twice a year since 2005. In general the results between upstream and downstream are comparable, with both locations exceeding the ANZECC trigger values for physical and chemical stressors in lowland rivers.

Within the discharge the concentration of total nitrogen and total phosphorus have been measured. The minimum dilution available over the available record (343 fold) has been used to assess the concentration of total nitrogen and phosphorus under a worst case scenario (lowest dilution, maximum discharge concentration). The maximum total nitrogen concentration measured in the discharge since 2005 was 35 g/m^3, which equates to a concentration after dilution of 0.1 g/m^3. The maximum concentration of total phosphorus measured in the discharge since 2005 was 22.8g/m^3, which equates to a concentration after dilution of 0.08 g/m^3.

The ANZECC trigger value for total nitrogen in lowland rivers is 0.614 g/m^3, the trigger value for total phosphorus is 0.033 g/m^3. Given this, after dilution, the discharge could meet the ANZECC trigger value for total nitrogen, but not total phosphorus. It should be noted however that this is a worst case scenario which will only occur when the concentration in the discharge is most elevated and available dilution is at its lowest. This is expected to occur in summer during prolonged periods of dry weather. As discussed in Section 2.3.2, it is expected that for more than half the time, there will be no direct discharge to the Tokanui River under these conditions due to evaporation and as there will be sufficient depth to groundwater to maximise the discharge to ground.

Given the above nutrient effects within the Tokanui River are not expected as a result of the discharge.

5.3.6 Microbiological

5.3.6.1 Stock Drinking Water

The ANZECC 2000 stock drinking water standard indicates that a median of 100 cfu/100mL and an 80th percentile of 400 cfu/100mL is protective of stock health. This standard has therefore been used to assess the impact on stock drinking water as a result of the discharge.

The ANZECC stock drinking water standard is based on faecal coliforms. Monitoring of the discharge and receiving water quality to date has been undertaken using *E.coli* which are a sub-set of faecal coliforms. All the samples collected between 10 August 2017 and the 19 January 2018 were analysed for both *E.coli* and faecal coliforms. A ratio of 1.22:1 has been derived using the ratio of the results to give a factor to enable the conversion of the historic *E.coli* results to faecal coliforms.

Figure 5-2 plots the faecal coliform concentrations at the upstream and downstream locations within the Tokanui River (for data prior to August 2017 this is based on *E.coli* results converted as discussed above). The graph indicates that the majority of samples in both the upstream and downstream location exceed the 80th percentile ANZECC guideline value. The Tokanui River therefore does not currently meet the ANZECC stock drinking water standard. The results are variable but generally consistent between the upstream and downstream locations and indicate that the discharge does not result in elevated microbiological contaminants.

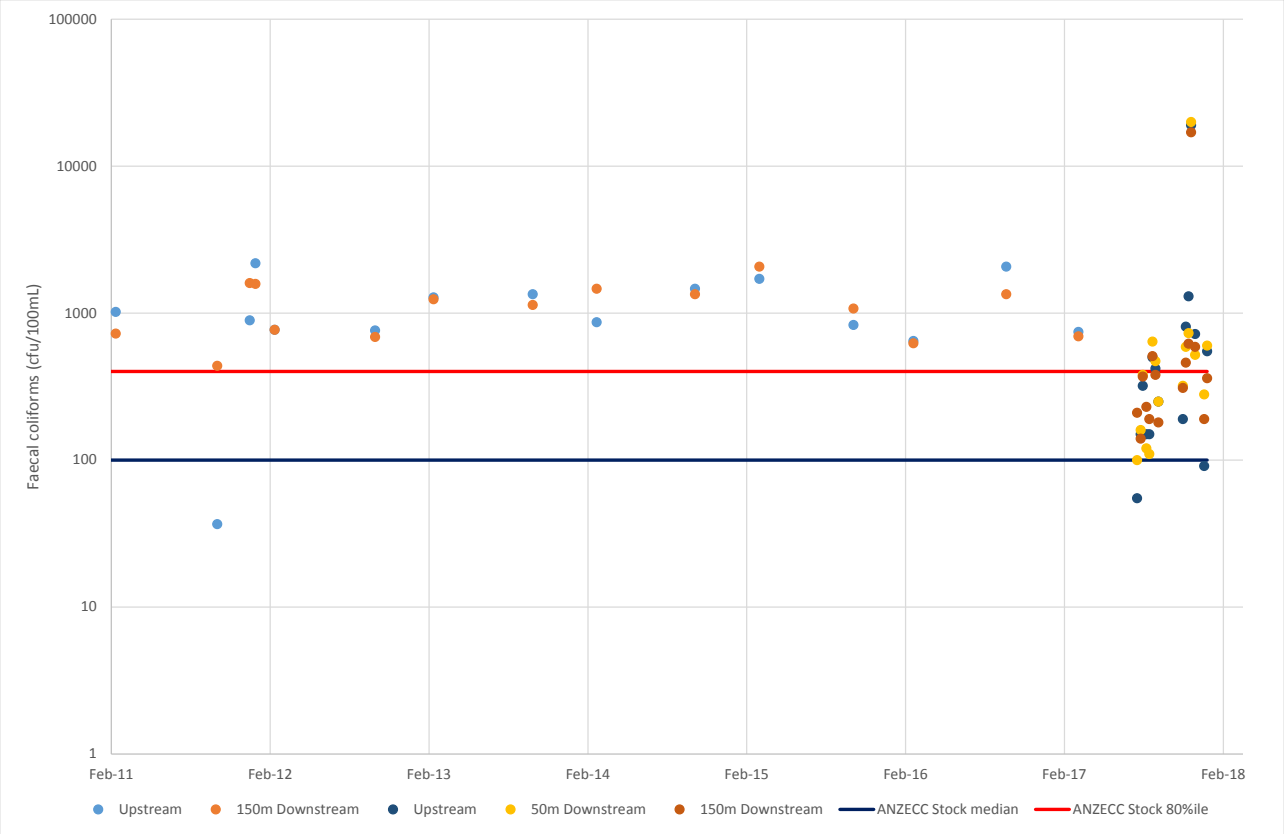


Figure 5-2: Faecal Coliform Concentration in the Tokanui River

The RWP and the pSWLP include a standard for faecal coliforms being a maximum of 1,000 cfu/100mL unless the water body is defined as a popular bathing site (as defined in Appendix K of the RWP). The Tokanui River is not a popular bathing site and therefore the 1,000 cfu/100mL standard applies. It is noted that this is based on the stock drinking water standard from the 1992 ANZECC guidelines, which required that the geometric mean of the faecal coliforms concentrations be less than 1,000. The Plan standard is more stringent as this limit is applied as a maximum.

Figure 5-3 plots the range of concentrations of faecal coliforms from the long term record (converted from *E.coli* as discussed above) against the plan standard of 1,000 cfu/100mL. This indicates that the Plan

standard has not been met either upstream or downstream of the discharge. However, in general, the downstream water quality is comparable to the upstream water quality and therefore the exceedances of the plan standard is not considered to be as a result of the WWTP. It should also be noted that the concentration of faecal coliforms within the discharge is comparable to the concentration upstream of the WWTP. In the more frequent data set collected from August 2017 to January 2018 shown in Figure 5-4, the discharge quality is similar, but the surface water quality has generally complied with the Plan standard except for some specific events. As for the long term record, the upstream and downstream results are similar.

Given this while the relevant stock drinking water standards are exceeded within the Tokanui River, which represents a risk to stock drinking from the river, this is not as a result of the WWTP discharge.

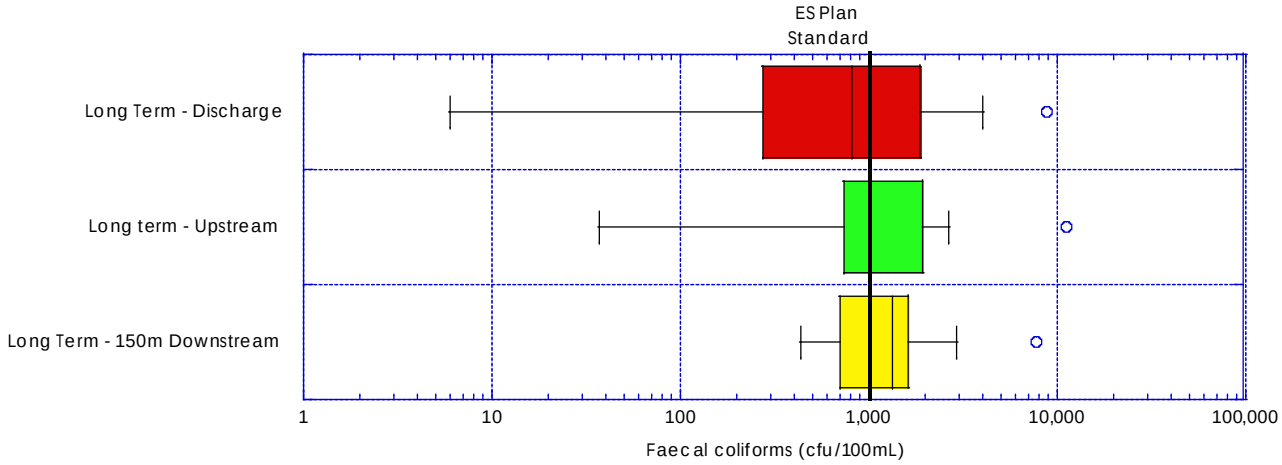


Figure 5-3: Box Plot of Faecal Coliform Concentrations in Long Term Record (2005 to 2017)

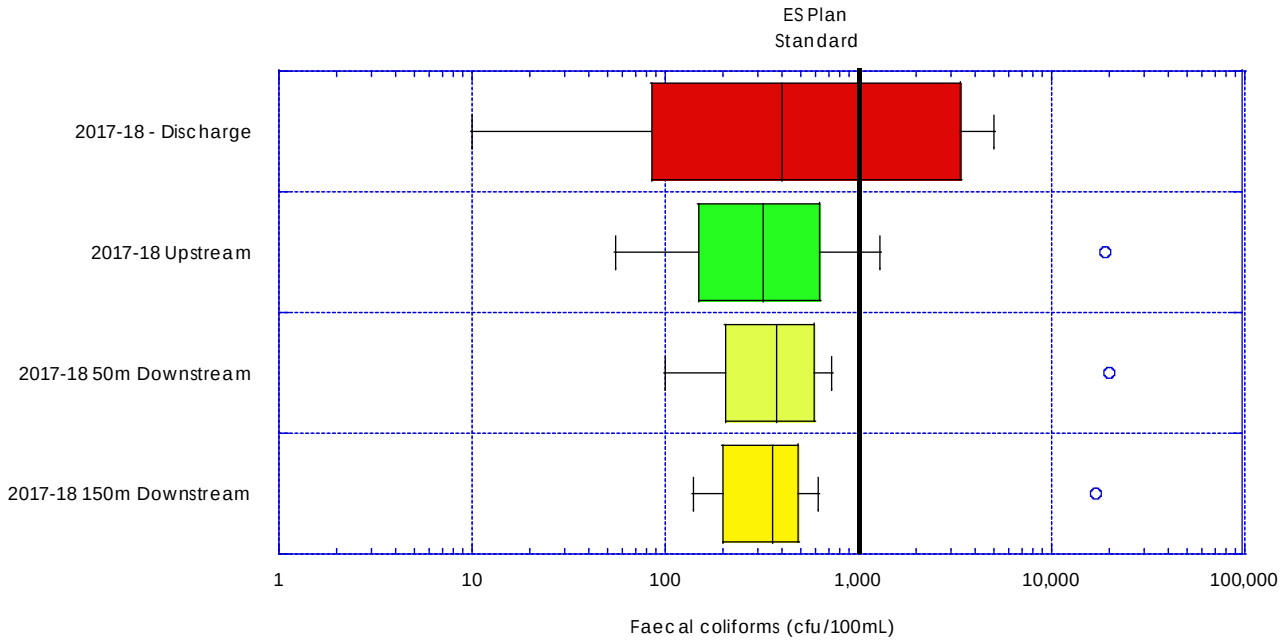


Figure 5-4: Box Plot of Faecal Coliform Concentrations in Intensive Record (2017 to 2018)

5.3.6.2 Contact Recreation

Elevated microbiological contaminants within water bodies used for contact recreation can result in effects on human health. The RWP and pSWLP state that popular bathing sites identified in the plan must meet a water quality standard of 130 *E.coli* per 100mL. There are no popular bathing sites listed for the Tokanui River and therefore this standard is not applicable to the river.

The NPS-FM identifies five standards for freshwater for contact recreation as identified in Table 5-1 below.

Table 5-1: NPS-FM Contact Recreation Standards

Grade	Median *E.coli* Concentration	95th Percentile *E.coli* Concentration
A	≤130	≤540
B	≤130	≤1,000
C	≤130	≤1,200
D	>130	>1,200
E	>260	>1,200

Figure 5-5 plots the concentration of *E.coli* upstream and downstream of the discharge against the NPS-FM Grade C standard (median ≤130 and 95th percentile ≤1200). The red line represents the 95th percentile and the black lines represents the median concentration. The results indicate that the river cannot meet the Grade C standard. As outlined in Appendix L (NPS-FM standards summary table) the results cannot meet the national bottom line (Grade D).

It is understood however that the river is not used extensively for recreation in the vicinity of the surface water discharge, or the area likely to be affected by the discharge. In general the downstream results are either comparable or less than the upstream results which indicates that the WWTP is not resulting in the exceedances of the contact recreation standards.

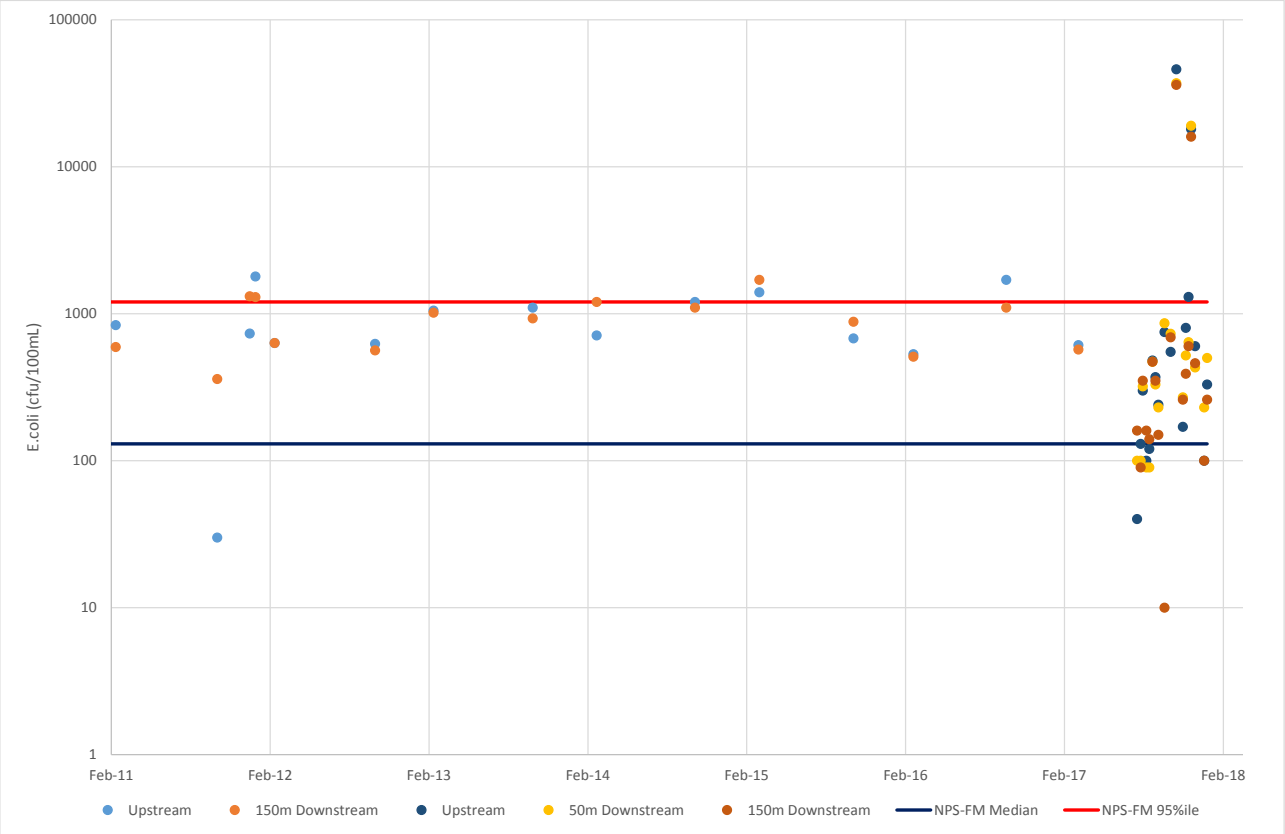


Figure 5-5: *E.coli* Concentration Compared to Recreational Water Guideline

5.3.6.3 Microbiological Summary

The discussion above indicates that the Tokanui River is impacted by sources of microbiological contaminants outside of the WWTP discharge. The concentration of faecal coliforms expected after

dilution was assessed on a monitoring event by monitoring event basis (using the dilution available on the day of sampling) to provide an indication of the contribution to the Tokanui River from the WWTP discharge. All results returned derived concentrations in the Tokanui River after mixing of 1 cfu/100mL or less resulting from the treated wastewater discharge. This assessment is based on a limited number of data points and therefore to give a more conservative estimate the highest recorded concentration of faecal coliforms in the discharge (9,614 cfu/100 mL) was divided by the lowest available dilution in the River (343). This results in a maximum faecal coliform concentration in the Tokanui River resulting from the treated wastewater of 28 cfu/100mL, after full mixing.

This indicates that given the small volume of the discharge and significant dilution available within the Tokanui River, the discharge would be able to meet the applicable standards in the receiving environment if the upstream concentration was not already elevated. The objectives and policies within the pSWLP and the RWP aim to improve water quality progressively within the region. As water quality within the Tokanui River improves, the WWTP discharge would have minimal impact on the degree of compliance in the Tokanui River with the relevant stock drinking water and contact recreation standards.

The effect of the discharge of treated wastewater to the Tokanui River in regard to microbial contamination is therefore considered to be low (minor). An assessment of the effect on public health, including from microbial contamination is outlined in Section 5.8, the effect on ground water is discussed in Section 5.4.4.

5.3.7 Mixing Zone

The pSWLP states that:

When determining the size of the zone of reasonable mixing, minimise the size of the area where the relevant water quality standards are breached. The zone shall not be larger than:

(a) For river and artificial water locations with flowing water present at all times:

(i) No longer than 10 times the width of the wetted channel or 200 metres along the longest axis of the zone (whichever is lesser), and

(ii) Occupies no greater than two-thirds of the wetted channel width at the estimated Q95 for that location;

(b) For river and artificial watercourse locations, with intermittent flows, no longer than 20 metres at times of flow and 0 metres at no flow;

(c) When within a drinking water supply site identified in Appendix J, 0 metres.

The site is not located within a drinking water supply site and the Tokanui River does not have intermittent flows. The zone of reasonable mixing under the definition in the pSWLP has therefore been calculated, based on a wetted width of the channel of approximately two metres. This calculation gives a zone of reasonable mixing of 200 m.

Condition 5(b) however requires the collection of representative samples within the Tokanui Stream, upstream of the discharge and at approximately 150 m downstream of the discharge. Compliance with the standards set out in Appendix 1 of consent 201599 can therefore only be determined at the 150 m downstream point.

A 150 m mixing zone is therefore proposed because all consent driven receiving environment data collected so far (since 2005) has been collected at this point and therefore continuing to collect monitoring data at this point will enable comparisons with the historic monitoring data. In addition as discussed in the assessment of effects above, the monitoring data to date indicates little difference between the upstream and downstream locations which indicates that the effects of the discharge are minimal (less than minor) at this point. It is also noted that the proposed mixing zone is 50 m shorter than the mixing zone determined under the pSWLP definition.

It is understood that the current consent required sample collection 150 m downstream to incorporate some migration of the discharge from land through groundwater to the stream. As discussed in Section 5.4 it is expected that the underlying groundwater will meet relevant guidelines before mixing with surface water. It is expected that impacted groundwater will mix with surface water along an arc from the location of the direct discharge to surface water, to approximately 300 m downstream of this point.

5.3.8 Summary

The major contaminant of concern within the Tokanui River is microbiological contamination. The upstream samples indicate that the stream is heavily impacted by upstream land uses and cannot meet the national bottom line for freshwater for contact recreation. Despite this the quality of the discharge is such that it is expected that even when dilution levels are lowest, the discharge should not impact on compliance with the relevant standards within the Tokanui River.

The discharge will not contribute significantly to the cumulative effect of all point and non-point source discharges to the Tokanui River. The assessment discussed above demonstrates that the effects on surface water quality in the Tokanui River resulting from the discharge of treated wastewater will be minimal (less than minor).

5.4 Effects on Groundwater

5.4.1 Introduction

The effects on water quality from the discharge of treated wastewater from the WWTP to land and then into groundwater has been assessed in the following sections. This assessment has been based on a worst case scenario which assumes that inflows into the WWTP equal the discharge to land. As discussed in Section 2.3.2 there are a number of additional discharge pathways and therefore this assessment is conservative.

A summary of the discharge and Tokanui River water quality data is attached in Appendix F. There is no available data on the concentrations in the groundwater in the vicinity of the discharge.

This section considers the effects from the discharge to land from the base of the ponds and from the base of the infiltration trench.

5.4.2 Groundwater Modelling

Modelling has been undertaken to assess the concentrations of total nitrogen and bacterial contaminants in groundwater as a result of the discharge of treated wastewater. The model focusses on nitrogen and bacterial contaminants because these are likely to be the most mobile contaminants through the soil profile.

A full description of the models and the results is attached in Appendix M. It should be noted that the models assume a background concentration of zero, as there is no available site specific information regarding background water quality within the area.

The model includes the length of the infiltration trench as the width of the plume (given that the channel runs generally perpendicular to the indicative groundwater flow). The concentrations of nitrogen in the plume in the groundwater is modelled assuming the nitrogen is conserved unchanged in the groundwater, and is subject to dispersion only. The bacterial contaminants model also models dispersion but includes a probable decay rate based on fields in similar aquifer conditions.

The model assumes all the inflow received at the WWTP is discharged through the infiltration trench only. This provides an extremely conservative estimate (i.e. higher than expected) of resultant concentrations in the underlying aquifer given the other pathways for the treated wastewater as discussed in Section 2.3.2. It is expected that the quality of the discharge from the base of the ponds will be better (i.e. cleaner) than the wastewater discharged to the trench due to the removal of contaminants through the sludge layer and clay liner at the base of the ponds.

As noted in Section 3.4.1 the discharge from the base of the WWTP ponds and/or infiltration trench may create localised groundwater mounding resulting in groundwater flowing towards, adjacent to and slightly away from the river. It is considered however that in general any contaminants entering groundwater will be transported in the general direction of the Tokanui River.

5.4.3 Nitrogen

The model for total nitrogen was based on a discharge concentration of 17g/m^3, which was the median concentration recorded in the discharge between 2013 and 2017 (available data record). The model assumes a direct discharge to groundwater with no removal of nitrogen through an unsaturated zone. Concentrations in groundwater after discharge were assessed at a range of depths, with the highest concentrations observed at the top of the water table as would be expected. At the top of the water

table the concentration was modelled as decreasing to around 6 g/m^3 within 50 m and to below 1g/m^3 within 200 m.

While there are no drinking water sources in the vicinity of the WWTP, the New Zealand Drinking Water Standards 2005 (amended 2008) (NZDWS) provide an indication of the standard of the groundwater quality. The NZDWS does not have a maximum acceptable value (MAV) for total nitrogen, however the MAV for nitrate-nitrogen[28] is 11.3g/m^3. If it is assumed that all of the nitrogen is in nitrate-nitrogen form (which is conservative) the groundwater model indicates that this standard can be met in less than 50 m of the infiltration trench.

Groundwater at the site is expected to be flowing south parallel to the Tokanui River. The Tokanui River begins to flow west approximately 300 m from the infiltration trench and therefore it is likely that at this point the groundwater will at least partially discharge to the river. The ANZECC default trigger values for physical and chemical stressors in New Zealand, within lowland rivers, provides a trigger value of 0.614 g/m^3 for total nitrogen. This concentration can be met at the top of the water column within 300 metres of the infiltration trench. Therefore, the nutrient concentrations discharged to the Tokanui River from this pathway will be less than the nutrient based trigger values.

5.4.4 Microbiological

The groundwater model for microbiological contaminants used *E.coli* as an indicator. The model used the 95th percentile and maximum concentrations from the data record provided (3,300 cfu/100mL and 7,000 cfu/100mL, respectively). The model scenarios included a range of removal rates under three unsaturated zone scenarios (2 m zone, 1 m zone and no unsaturated zone).

The model included a 'best concentration', 'middle concentration' and 'worst concentration' scenario. The 'middle concentration' scenario is considered to be the most likely scenario for the site. The 'worst 'concentration' scenario is conservative and while theoretically this scenario could occur, it is considered unlikely. All scenarios modelled give the expected concentration 200 m down-gradient of the infiltration trench.

The 'middle concentration' resulted in a range of *E.coli* concentrations of between 0 and 35 cfu/100mL. The results indicate that there will be significant removal and decay of *E.coli* in the unsaturated zone and underlying aquifer. Under all 'middle concentration' scenarios all guideline values and plan standards would be able to be met 200 m downgradient of the infiltration trench, with the exception of the NZDWS.

There are no drinking water sources in the vicinity of the WWTP and it should be noted that the NZDWS is generally applied to treated water sources, rather than raw water sources.

As discussed above a worst case scenario was also modelled which is highly conservative. This model indicated that the maximum concentration expected 200 m down-gradient of the infiltration trench would be 2,214 cfu/100mL. This concentration is based on the maximum concentration of *E.coli* recorded in the discharge and no unsaturated zone. Using the 95th percentile concentration of *E.coli* measured in the discharge the maximum predicted concentration would be 1,044 cfu/100mL. These concentrations would not meet the stock drinking water standards, however it is noted that this model is very conservative and the 'worst concentration' scenario is considered unlikely to occur.

5.4.5 Summary

As noted above the model assumes a background concentration of zero, this means the modelled concentration downstream within the groundwater is likely to be higher due to background influences. The model therefore only gives an indication of the contribution of the discharge to the contaminant concentrations in groundwater. The applicant is proposing to install two bores, one upstream of the ponds and infiltration trench and one downstream. These groundwater bores will be monitored six monthly, in conjunction with the surface water monitoring to enable the characterisation of actual groundwater concentrations.

The discharge is expected to have a small effect on the cumulative concentration of contaminants in groundwater within the area. This effect is likely to be limited to the area immediately surrounding the discharge.

The groundwater models indicate that the concentration of total nitrogen is expected to be such that the groundwater will meet the applicable standards for nitrate-nitrogen within 200 m of the infiltration trench.

[28] The NZDWS MAV is given for nitrate (NO_3), the MAV for nitrate-nitrogen is therefore derived by multiplying the nitrate value (50mg/L) by the atomic mass of nitrogen divided by the atomic mass of nitrate (14/62).

In addition under the most likely scenario modelled the *E.coli* concentration is expected to decrease significantly within a short distance from the infiltration trench.

The effects on groundwater quality from the discharge of treated wastewater will be low (minor).

5.5 Effects on Soil Quality

In assessing the effects of the discharge on soil quality, the fate of the discharge from each part of the WWTP system needs to be considered. The discharge from the base of the ponds is likely to be directly to groundwater, particularly during winter when groundwater levels at the site are known to be high. The discharge to land via the infiltration trench is not a traditional discharge to land which generally involves irrigating the wastewater to soils which may potentially be utilised for other uses, such as cut and carry operations. The infiltration trench will occupy a defined area of land and that area of land will only be used for limited infiltration of wastewater.

Given the nature of the wastewater sourced from Tokanui Township and treated at the site, the presence of persistent contaminants is limited, and it is not considered likely that the discharge will render the site or surrounding soils as unable to be used for future activities in the long term.

The effect on soil quality from the proposed discharge to land will be negligible (less than minor).

5.6 Effects of Disturbing Soil on a HAIL Site

A preliminary site investigation (PSI) undertaken to assess the effect on human health from disturbing soil on the site has been attached in **Appendix N**. The site has been used as a wastewater treatment plant for over 20 years and given the domestic nature of the sewage is unlikely to have resulted in significant contamination of the site soils. The PSI therefore concluded that the risk to human health posed was negligible.

The land surrounding the WWTP is currently used as a dairy farm. Approximately 50% of the land for the infiltration trench will be located within the neighbouring farm property, although it is noted that this area will be purchased by the Council. For the purpose of the PSI this land was considered to form part of a dairy farm. Environment Southland records did not identify any contaminating activities associated with the property and therefore it was concluded that the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (the NES) did not apply.

Given the low level of contamination expected the effect on the environment and in particular surface water quality will be minimal (less than minor). In particular the area of disturbance will be minimised and erosion control measures will be implemented prior to commencement and only removed once the disturbed areas are stabilised.

5.7 Effects on Aquatic Ecology

Sources of data used to assess the effects on the aquatic ecology of the Tokanui River include:

- Ryder, Aquatic Invertebrate Assessment, October 2002 (attached in Appendix I)
- Ryder, Tokanui Wastewater Treatment System Biological Survey, April 2017 (attached in Appendix J)
- Consent driven water quality monitoring of the Tokanui River, undertaken twice a year from 5 October 2005 – 28 March 2017
    - 10 m upstream of the discharge (upstream)
    - 150 m downstream of the discharge (downstream 2)
- Additional water quality monitoring of the Tokanui River undertaken by the Council weekly from 10 August 2017 to 14 September 2017
    - 10 m upstream of the discharge (upstream)
    - 50 m downstream of the discharge (downstream 1)
    - 150 m downstream of the discharge (downstream 2).

Ryder undertook a biological survey of the Tokanui River on 12th April 2017. Sampling was undertaken at one site upstream and two sites downstream of the discharge point to the Tokanui River. The upstream sampling site was located approximately 15 m upstream of the discharge point, while the downstream

sampling sites were located at approximately 60 and 150 m downstream of the discharge point (Figure 5-6).

Figure 5-6: Biological Survey Sampling Locations

The 2017 Ryder report concludes that overall conditions throughout the river were similar, indicating that the WWTP discharge is not adversely affecting the ecosystems of the river. Overall, periphyton communities upstream and downstream of the discharge were similar and typical of those found in similar slow flowing habitat throughout New Zealand. Macrophyte community composition and cover were also similar at each site, indicating that the WWTP is not adversely affecting the aquatic plant communities in the Tokanui River.

Benthic macroinvertebrate communities were similar throughout the river and characterised by high diversity and composition typical of soft bottomed lowland rivers. Macroinvertebrate community health indices were consistent across all sites and were low at each site, with scores upstream and downstream of the discharge indicative of 'poor' to 'fair' quality conditions. These scores are typical of the type of habitat found in the Tokanui River and it should be noted that the Environment Southland 'lowland soft bed' standards were met at all three sites. Overall, the similarities in macroinvertebrate communities upstream and downstream of the discharge indicate that the discharge is not adversely affecting benthic macroinvertebrate communities of the Tokanui River.

These results are consistent with the results of the macroinvertebrate sampling undertaken by Ryder in 2002, which also indicated that there was no statistically significant difference between the upstream and downstream sample locations.

These results are also supported by the water quality results which indicate little difference in concentration between the upstream and downstream locations. In particular ammoniacal-nitrogen is a toxicant which is harmful to fish. The ANZECC 95% trigger level was not exceeded during any of the monitoring rounds at any of the locations and therefore the toxicant effect from ammoniacal-nitrogen will be low (less than

minor). Other toxicants such as heavy metals would not be expected to be found in the discharge in substantial concentrations given the domestic nature of the wastewater.

5.7.1 Aquatic Ecology Summary

The aquatic invertebrate assessment undertaken by Ryder in 2002 and 2017 and the assessment of effects on surface water quality indicate that the effect of the discharge will continue to be negligible, with the adverse effects detected from the discharge on the aquatic ecosystems of the Tokanui River being less than minor. This finding was based on a lack of variation observed in invertebrate taxa richness, MCI or SQMCI scores between the upstream site and the downstream sites and is supported by the assessment of the water quality against the relevant guidelines as discussed in Section 5.3.

The effects on aquatic ecology from the discharge of treated wastewater to the Tokanui River are expected to be minimal (less than minor).

5.8 Public Health

The effect on public health from the discharge from the WWTP can be broken into two categories, the risk to public health from contact recreation and the risk to public health from the use of the groundwater as a drinking water source.

As discussed in Sections 5.3 and 5.4 the discharge may result in an increase in the concentration of microbiological contaminants in the groundwater above the NZDWS. It is noted however that the NZDWS are generally used to assess treated water supplies and that there are no sources of potable water within the vicinity of the WWTP.

The assessment of effects on surface water indicates that the discharge has minimal impact on the degree of non-compliance of the Tokanui River with the contact recreation guidelines.

The WWTP and the discharge from the WWTP are located within private land which is fully fenced. In addition the Tokanui River within the vicinity of the discharge is also fenced and there is a sign in place to warn people of the discharge. There is therefore limited access to the Tokanui River within the vicinity of the discharge and it is understood that this area of the river is generally not used for recreation. Therefore, the actual impact of the discharge on public health is considered minimal.

5.9 Effects on Cultural Values

The actual and potential effects on Maori cultural values from discharging treated wastewater to water must be recognised and provided for as a matter of national importance under section 6 of the RMA.

Wastewater discharged to land via the base of the oxidation ponds and the infiltration trench will enter land (unsaturated soils) before entering water, other than when groundwater levels are elevated and underlying soils are saturated. Discharging a proportion of the treated wastewater to land and groundwater is expected to go some way towards addressing the cultural offense derived from direct discharges to surface water, and will enable Papatūānuku[29] to cleanse the treated wastewater before it discharges to the Tokanui River.

Regardless of the quality of the treatment process and the land-based disposal of some of the discharge, the remaining discharge will be to water, and the applicant acknowledges this will be culturally offensive, even where the effects of the discharge on the biophysical quality of the environment are very low.

To help provide an appropriately qualified perspective, the applicant has approached Te Ao Marama Inc requesting the preparation of a Cultural Impact Assessment (CIA). The CIA (attached to this document as **Appendix O**) noted that the treatment and disposal of human effluent and wastewater to water is of major concern to Ngāi Tahu, particularly in relation to the resultant physical and spiritual contamination of any waterway. The need to protect mahinga kai and wāhi tapu, and the occurrence of cultural and physical contamination are identified as particular issues in the CIA. The CIA outlines that the proposal to discharge wastewater to land, groundwater and to the Tokanui River would impact on Ngāi Tahu values and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga, and has the ability to impact on kaitiakitanga. The CIA recognises that the Council is applying to improve the current discharge, and in general supports the proposed consent conditions. The CIA provides a series of recommendations for the proposal, which are the subject of ongoing discussion between the Council and Te Ao Marama Inc.

[29] Papatūānuku (Earth Mother)

5.10 Natural Hazards

Despite the high level of engineering design standards, the possibility of failure of one or more of the scheme structures during a large earthquake cannot be discounted. In the event of complete (catastrophic) failure, discharge to groundwater and potentially surface water would occur. However, the ponds were constructed to the relevant standards that applied when they were built, and have not been subject to significant damage from natural hazard events since.

The relevant design codes and established engineering guidelines seek to minimise damage to infrastructure such as the WWTP, and risks to adjacent property and the Tokanui River during a natural hazard event such as a large earthquake. The only proposed changes to the construction of the WWTP infrastructure relate to the formation of the infiltration trench, which would be formed by excavating and lining a shallow trench, rather than a built structure. Damage to the trench resulting from an earthquake would likely be limited to cracks in the base and would be easily and rapidly repairable.

The WWTP site is elevated above known flood levels of the Tokanui River, and has not been inundated in previous flood events. Given the location of the infiltration trench in the area between the ponds and the riverbank, it is feasible that part of the trench could be inundated in a significant flood event. While the low structure of the trench would not exacerbate any natural hazard or flood risk currently posed by the river, they may be overtopped in an extreme event. If so, some damage to the trench may be likely, and any wastewater present in the trench would have already been treated in the WWTP oxidation ponds, and would be subject to significant dilution by flood waters. The environmental effects of the trench being inundated in a flood event would therefore be minimal (less than minor).

5.11 Climate Change

The MfE has documented projected New Zealand climate change effects based on results from twelve global climate models, with additional information on extremes and other physical climatic elements provided from NIWA's regional climate model.

Projected rainfall and wind patterns show a more marked seasonality than was evident in models used in the IPCC Third Assessment, 2001. Westerlies are projected to increase in winter and spring, along with more rainfall in the west of both the North and the South Island and drier conditions in the east and north.

Conversely, the models suggest a decreased frequency of westerly conditions in summer and autumn, with drier conditions in the west of the North Island and possible rainfall increases in Gisborne and Hawke's Bay.

Other expected changes include decreased frost risk, increased frequency of high temperatures, increased frequency of extreme daily rainfalls, decreased seasonal snow cover, and a possible increase in strong winds.

These predicted changes suggest that at a local level rainfall in the winter and spring can be expected to increase with an associated increase in the frequency of extreme daily rainfalls and strong winds. In the long term these factors could have an influence on the operation of the WWTP especially on a seasonal basis.

More rain within the Tokanui area may increase discharge volumes, but is also likely to increase dilution of the wastewater which will reduce the load of contaminants discharged to groundwater and surface water.

It is recognised that there is potential for increased frequency of high groundwater levels could increase the incidence of direct discharge to the Tokanui River, however the wastewater in the trench will have already passed through the WWTP, and if it discharges to the Tokanui River, will be subject to significant dilution such that the environmental effect would be minimal (less than minor).

5.12 Effects of Altering the Boundary of the WWTP Designation

The Council proposes to alter the boundary of the designation to incorporate the area of land between the WWTP and the Tokanui River that will contain the infiltration trench. The effect of the alteration would be to enable the infiltration trench to be developed and operated as an integral part of the WWTP, without being subject to the applicable district plan rules. The Council as requiring authority would be responsible for addressing any potential adverse effects that could result from developing and operating the trench. The proposed trench will not result in a substantial change to the scale or nature of the existing WWTP, or the associated effects.

With any earthworks and vegetation clearance in proximity to water bodies, there is potential for the mobilisation of disturbed material into surface water, including as a result of stormwater flows. This can result in adverse effects on amenity, the quality and life-supporting capacity of receiving waters, and downstream activities that rely on the quality of the water body being maintained. The disturbance of any vegetation or soil on the site will be preceded by erosion and sediment control measures necessary to minimise the potential for significant soil or sediment-laden stormwater to enter the Tokanui River. All such measures will be maintained in effective working order until disturbed areas have been stabilised. Construction effects will otherwise be temporary, and minor considering the scale of the trench and its proximity to the river.

The development of the infiltration trench will result in a minor increase in the scale of WWTP-related infrastructure on the WWTP site, and its visibility. The location proposed for the infiltration trench however will not be prominent from any public vantage point, and is not in proximity to sensitive receivers such as private residential dwellings. The trench will be most visible during and following construction, however it will not be a visually prominent part of the WWTP, and over time it is expected that grass will grow within the trench, further reducing any visual effect.

Overall, the alteration of the designation to facilitate the establishment and use of the infiltration trench will not result in significant adverse effects, but rather is expected to result in positive effects by enabling the development of the infiltration trench which will help to reduce the frequency and volume of discharges to the Tokanui River. No landscaping is proposed as part of the works, and is not considered necessary to mitigate the visual effects of the trench.

The alteration is essentially sought to include the area of land for the trench, being a significant part of the operation of the WWTP. The alteration has been discussed with the landowner and occupier (the same), who has agreed in principal to sell the land to the requiring authority (see consultation outcomes discussed in Section 7 of this document).

5.13 Summary of Effects

The adverse effects of the discharge of treated wastewater to land, and to ground and surface water will be minimal, with the exception of the effect on Maori cultural values associated with surface water as assessed above.

In particular the quality of water in the Tokanui River is likely to be maintained beyond a zone of reasonable mixing and the effect on groundwater is also expected to be minimal due to the small discharge volumes and infiltration through the unsaturated zone.

Overall, the effects of the proposed activity will be very low (less than minor).

6. Proposed Mitigation Measures and Consent Conditions

6.1 Proposed Mitigation Measures

The Council proposes the following mitigation measures to avoid, remedy or mitigate the actual and potential adverse effects of the activities for which consent is sought. These measures are reflected in proposed consent conditions.

6.1.1 Discharges to Land

Approximately 10 m^3/day of treated wastewater is understood to discharge to land and groundwater beneath the oxidation ponds. In addition, the infiltration trench is expected to facilitate the discharge to land of up to 0.75 m^3 / day of treated wastewater to land while optimal conditions prevail (e.g. low groundwater, low levels of soil saturation, etc.). While the trench will facilitate infiltration to some degree, it is primarily a land contact trench, and will be designed to avoid over-topping by discharging excess wastewater that cannot infiltrate to land, to the Tokanui River via the existing outfall.

6.1.2 Discharges to Water

The primary mitigation measure in regard to surface water effects is the discharge of treated wastewater to land, with no discharges to the Tokanui River under certain conditions. High evaporation rates in combination with the discharge from the base of the ponds and the infiltration trench is expected to result in little to no discharge during dry weather. During wet weather, and in particular when the groundwater table is elevated the resulting surface water discharge will consist of treated, diluted wastewater and will discharge to the Tokanui River until such time as groundwater levels recede. Under such conditions, it is likely that the river will be in a high flow state, with high available dilution and dispersion, further reducing the potential adverse effects of the discharge on the quality of the river.

6.1.3 Disturbance of Land

The construction of the infiltration trench will involve vegetation clearance and soil disturbance which could result in soil or sediment-laden stormwater migrating off-site, including into the Tokanui River. These risks will be mitigated by:

- Establishing erosion and sediment control measures as necessary to contain stormwater and sediment within the construction site, and to minimise the discharge of soil and soil-laden stormwater to land beyond the construction footprint, or to water during works;
- Stabilising all disturbed areas not included in the trench as soon as practicable following the completion of construction;
- Minimising the area of vegetation clearance and ground disturbance to the extent necessary to construct the trench by defining it prior to works commencing;
- Minimising the extent of any stockpiling of disturbed soils, and retaining all disturbed soil on the site unless it is first tested as necessary to characterise the type and extent of contamination to the extent necessary to define a disposal pathway or confirm appropriateness for alternative use;
- Ensuring that all necessary personal protective equipment is provided and appropriate safety measures are applied as necessary to minimise the risk to human health from disturbing soil on the WWTP.

6.2 Proposed Consent Conditions

The applicant has proposed a set of consent conditions that are appropriate to enable the actual and potential adverse effects of the discharge to land and water to be managed, and suitably mitigated. The conditions are attached in **Appendix P** of this document.

The conditions include a comprehensive monitoring and reporting programme that will ensure that the WWTP continues to be operated in a manner that maximises the effectiveness of the treatment process, and that the discharge of treated wastewater avoids or mitigates adverse effects on the receiving environment.

7. Consultation

Prior to planning the proposed activity, the applicant approached the landowner and discussed the proposed infiltration trench and the alteration of the designation, with the landowner indicating their approval in principal (**Appendix Q**). The landowner has agreed in principal to sell the land to the Council upon the issue of all necessary resource consents. No other private land owners or occupiers are considered to be affected by the proposal, with the remaining land involved in the proposal owned and occupied by the applicant.

A summary of the proposal was prepared and circulated to the following parties prior to meeting with them:

- The Department of Conservation
- Fish and Game New Zealand
- Te Ao Marama Inc
- Public Health South.

The applicant then met with those parties to discuss the proposal. All parties attended the meeting, the minutes of which are attached as Appendix Q to this document. The proposal was well received, in particular the addition of the infiltration trench. Fish and Game noted that while there are recreational values of this part of the Tokanui River, they are limited, and concluded that there was no significant effect from the discharge on recreational values downstream. Public Health South questioned the potential effects on public health where people may come into contact with water contaminated with wastewater, and noted the presence of signage in the area, the inaccessibility of the river throughout the likely mixing zone, and the community preference for other areas parts of the river for recreation. The Department of Conservation did not express any particular concerns regarding the proposal, and Te Ao Marama were supportive of the proposal to discharge to land (via the ponds and trench), noting that discharges to the river would still occur in some circumstances.

All parties expressed an interest in receiving copies of this application document concurrently with its lodgement, and a copy will be provided to each.

8. Statutory Assessment

This section considers the application in the context of the applicable statutory framework under the RMA, and the relevant provisions of each planning document.

8.1 Resource Management Act 1991

8.1.1 Section 104

Section 104 of the RMA sets out the matters that decision makers must have regard to when considering applications for resource consent. Section 104(1) states:

(1) When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to–

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

(ab) any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result from allowing the activity; and

(b) any relevant provisions of—

(i) a national environmental standard:

(ii) other regulations:

(iii) a national policy statement:

(iv) a New Zealand coastal policy statement:

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

(vi) a plan or proposed plan; and

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

The actual and potential effects of the proposal, including the positive effects are described in Section 5 of this document.

The applicable documents set out in Section 104(1)(b) are described in the following sections. Where those documents have been prepared to give effect to Part 2 of the RMA, the plan provisions take precedence, with the provisions of Part 2 providing higher level guidance in the event of incomplete, conflicting or unclear plan-level provisions.

Section 104(2A) also applies in respect of this application. Section 104(2A) states:

> *When considering an application affected by section 124 or 165ZH(1)(c), the consent authority must have regard to the value of the investment of the existing consent holder.*

As the application has been made in accordance with s124 of the RMA, the consideration of the application must have regard to the value of the investment that the Council has already made in establishing and operating the WWTP, and the associated network infrastructure. The Council estimates the value of the WWTP and network assets at approximately $1.5 M, a substantial investment taking into account that it serves a small township of approximately 67 connections.

8.1.2 Section 104D RMA

As the application is for a non-complying activity under the rules of the relevant regional plans, section 104D applies. The consent authority must first determine whether the activity passes at least one of the 'gateway tests', being whether the adverse effects on the environment will be minor (s104D(1)(a)), or whether the application is for an activity that is not contrary to the objectives and policies of the relevant operative and proposed plans.

In the event that an application does not pass at least one of these tests, the application cannot be granted, however if one or both of the tests are passed, the application may then be considered under s104B, and may be refused, or granted along with any appropriate conditions imposed under s108 of the RMA.

The environmental effects of the activity have been considered in Section 5 of this application, and have been found to be very low (less than minor) on the quality of the receiving environment, with the exception of the cultural offence associated with the discharge of contaminants to water.

The proposed activity has also been assessed in the context of the relevant objectives and policies of the relevant statutory plans as required by s104D(1)(b), and as set out in **Appendix R** of this application.

On the basis of the assessment of environmental effects and the assessment of the relevant objectives and policies, the activity is considered to satisfy both gateway tests of s104D, and can therefore be considered further under s104 and if appropriate, granted under s104B. Section 104D therefore does not prevent the application from being granted, and the application may be considered on its merits and determined in accordance with s104B of the RMA.

8.1.3 Section 105 RMA

Section 105 requires decision makers, when determining an application for a discharge permit that contravenes section 15 or 15B of the RMA, to have regard to:

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

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

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

Each of these matters are discussed in turn below.

- *The nature of the discharge and the sensitivity of the receiving environment*

The nature of the discharge is described in detail in Section 2 of this document, and a description of the receiving environment and an assessment of its sensitivity to the effects of the discharge is made in Section 3. The assessment found that given the characteristics of the treated wastewater discharge, the effects on the receiving environment are very low (less than minor - with the exception of the effects on cultural values). The Tokanui River as the likely final receiving environment for discharges to groundwater, and the receiving environment for discharges to surface water was found to be moderately sensitive to the potential effects of the discharges, given the aquatic habitat values.

- *The applicant's reasons*

The reasons why this application has been made are set out in Section 1 of this application document. Primarily, the applicant seeks a replacement resource consent to authorise the continued discharge of treated wastewater to land and water, for permit 201599 which expires in September 2018. Given the scale of the discharges, and the minimal adverse effects that the current discharge has on the receiving environment, the applicant is applying for resource consent to discharge treated wastewater to land and to water. The infiltration trench has been developed to facilitate limited land discharge, and also to provide land contact to address concerns regarding the effects on Maori cultural values. The approach also minimises the frequency and volume of discharges to water to the extent practicable.

- *Alternative methods of discharge*

The alternative methods of discharge considered by the applicant are discussed in Part 4.5.2 of this application, and include retaining the current discharge to the Tokanui River in full, as well as land disposal at an alternative site. The current proposal however is the most practicable option to manage Tokanui's wastewater as it is affordable to the community, and will result in adverse effects that are minimal.

8.1.4 Section 107 RMA

Section 107(1) of the RMA prevents the granting of applications to discharge contaminants to land or water that would otherwise contravene s15 of the RMA, if after reasonable mixing, the water or contaminant that is discharged results in the following effects on the receiving environment:

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

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

(e) any emission of objectionable odour:

(f) the rendering of fresh water unsuitable for consumption by farm animals:

(g) any significant adverse effects on aquatic life.

The assessment of the effects of the discharges on the receiving water is set out in Section 5.3 of this document, and concludes that the discharge will not, in isolation result in any of the effects identified in s107(1)(c) – (g) on the underlying groundwater or the Tokanui River. Consequently, the application is not prevented by s107 from being granted.

Despite the restrictions set out in s107(1), the consent authority may grant applications for resource consent for activities that result in the effects in s107(1)(c) – (g) in circumstances that meet the exceptions set out in s107(2), being:

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

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

(c) that the discharge is associated with necessary maintenance work—

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

There are no exceptional circumstances that apply in regard to the proposed activity, and the discharges are neither temporary, nor a result of necessary maintenance work. The exceptions in s107(2) are not considered to apply, however neither are the exceptions necessary for the application to be granted, given that the discharge does not result in the effects identified in s107(1)(c) – (g).

8.1.5 Part 2 of the Resource Management Act 1991

Section 104 of the RMA directs that applications for resource consent are to be considered subject to Part 2 of the RMA. Part 2 contains section 5 which sets out the purpose and principles of the RMA, which fundamentally is to promote the sustainable management of natural and physical resources, with sustainable management defined as:

" ... managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

Part 2 also contains section 6 – *Matters of National Importance* which decision makers must recognise and provide for, section 7 – *Other Matters* which decision makers must have particular regard to, and section 8 – *Treaty of Waitangi*, the principles of which decision makers shall take into account.

The provisions of Part 2 have been taken into account and are reflected in the NPS-FM and the regional and district planning documents relevant to this application. The assessment of those provisions as contained in Appendix R shows that the proposal is consistent with the sustainable management purpose of the RMA. Specific consideration of the individual provisions of Part 2 is therefore not necessary[30] and no further analysis of the proposed activity under Part 2 has been undertaken.

8.2 Other Planning Instruments

8.2.1 National Environmental Standards

WWTP sites are included on the HAIL. The volume of soil to be disturbed in building the infiltration trench exceeds the trigger values in the NES-CS of 25 m^3 per 500 m^2, and a two month maximum period of disturbance. Resource consent is therefore required from the Southland District Council for the construction of the infiltration trench, under Regulation 11 of the NES-SC as a discretionary activity. The actual and potential effects of the proposed soil disturbance on human health are considered in Section 5.6 of this document, and are found to be minimal (less than minor). Regardless, the mitigation measures appropriate to the potential risk are set out in Section 6.1 of this document.

[30] As per *R J* **Davidson** *Family Trust v Marlborough District Council [2017] NZHC 52*

8.2.2 National Policy Statements

The NPS-FM sets out a framework of objectives and policies requiring and guiding local government to manage water in an integrated and sustainable manner. The NPS-FM seeks to achieve this sustainable management while providing for cultural and social values, and enabling economic growth within water quality and quantity limits. The NPS-FM was updated in August 2017 to incorporate amendments from the National Policy Statement for Freshwater Amendment Order 2017.

The provisions of the NPS-FM relevant to this proposal are Objectives A1 – A4. A full assessment of the proposal in the context of the relevant provisions of the NPS-FM is included in Appendix R to this document. Overall, the assessment finds that the proposal will achieve the relevant objectives, and is consistent with the policies of the NPS-FM in providing for the maintenance and improvement of water quality and achieving the sustainable management of water.

8.2.3 Southland Regional Policy Statement 2017

The Southland Regional Policy Statement (RPS) became operative in October 2017. It identifies the resource management issues currently facing the region and sets out objectives and policies to guide the development of Southland's regional and district plans to address those issues.

The proposal was considered in the context of the relevant provisions of the RPS, in the assessment contained in Appendix R of this document. The assessment shows that the proposal will generally achieve the objectives of the RPS, and be consistent with the relevant policies.

8.2.4 Regional Water Plan for Southland

The purpose of the RWP is to promote the sustainable management of Southland's freshwater resources. It was made operative in April 2010, and is currently the operative plan for Southland that sets out objectives, policies and rules for the sustainable management of water resources.

The proposal has been considered against the relevant objectives and policies of the RWP in Appendix R. The assessment found that the proposed activity will generally achieve the objectives and be consistent with the relevant policies.

8.2.5 Regional Effluent Land Application Plan

The RELAP was made operative in May 1998, and currently remains operative until it is superseded by the pSWLP becoming operative. The provisions of the RELAP have been established to help Environment Southland to manage the effects of effluent and sludge discharges in the Southland region. The plan sets out objectives, policies, and rules that apply to the management and discharge of such contaminants. As was determined from the assessment of the activity in the context of the RELAP's policy framework in Appendix R of this document, the proposal will generally achieve the RELAP's objectives, and will be consistent with the relevant policies.

8.2.6 Regional Air Quality Plan

The Southland Regional Air Quality Plan (RAQP) was made operative in 1999, and is currently being updated through a two-part review which commenced in 2016. Air quality matters applicable to this application are still addressed in the RAQP as the first stage of the 2016 review did not address matters relating to odour. Under the RAQP, the discharge of odour from the WWTP is a permitted activity as it serves less than 10,000 people. As the activity is permitted and no consent is require, the policy framework of the RAQP has not been considered further.

8.2.7 Proposed Southland Water and Land Plan

The pSWLP is part of Environment Southland's suite of regulations aimed at managing activities which can have adverse effects on the quality and quantity of Southland's freshwater resources. The pSWLP was notified in June 2016, with hearings closing in November 2017. At the time of preparing this application document, the hearings had been completed, but decisions on the pSWLP had not yet been released, and the plan was not operative. While the rules of the pSWLP have immediate legal effect upon notification, little weight can initially be placed on the objectives and policies as most provisions are subject to submission. This application however must still consider the proposed activity in the context of the plan's policy framework.

The proposal is assessed in the context of the pSWLP's policy framework in Appendix R of this document. The assessment finds that the proposed activity will generally achieve the objectives, and will be consistent with the relevant policies.

8.2.8 Operative and Proposed Southland District Plans

An assessment of the proposal in the context of the objectives and policies of the operative and proposed Southland District Plans is contained in Appendix R. The assessment is limited to those parts of the activity that occur outside the boundary of the existing designation, and that would require resource consent if the boundary of the designation is not otherwise altered to incorporate the area of the infiltration trench. As, at the time of writing the proposed plan was still not operative, both the operative and proposed plans have been considered. The assessment finds that the proposal will generally meet the objectives set out in both the operative and proposed District Plans, and is consistent with the relevant policies.

8.2.9 Te Tangi a Tauira – Ngai Tahu ki Murihiku Natural Resources and Environmental Iwi Management Plan 2008

Te Tangi a Tauira is the iwi management plan prepared by the four Rūnanga Papatipu o Murihiku; Te Rūnanga o Awarua, Te Rūnanga o Oraka/Aparima, Te Rūnanga o Hokonui and, Te Rūnaka o Waihōpai. The Rūnanga Papatipu collectively developed the plan to assist Ngāi Tahu ki Murihiku to participate in resource management policy and planning processes, including resource consent processes. The document also provides councils with a reference to draw on when developing plans under the RMA, undertaking consultation, and determining resource consent applications.

The relevant provisions of *Te Tangi a Tauira* have been assessed and are set out along with the conclusions in Appendix R of this document. The assessment finds that the proposed activity will achieve most of the objectives, and will be consistent with the majority of the relevant policies. The proposed activity however will be inconsistent with some and contrary to several provisions, as a result of the offensiveness to Maori of discharging human sewage to water. In particular, the proposal is at odds with the direction in those provisions to avoid using water as receiving environments for contaminants.

9. Conclusion

The Southland District Council seeks to replace an expiring discharge permit authorising the discharge of up to 55 m^3 / day to the Tokanui River, with a permit authorising an annual average daily discharge of up to 55 m^3 / day of treated wastewater to land and to water. An infiltration trench will be built between the WWTP and the Tokanui River to facilitate some land discharge and provide land contact prior to surface water discharge. The effects of the current discharges to the river have been shown to be minimal (less than minor) and will not increase as a result of this proposal.

Most of the treated wastewater from the WWTP will evaporate and discharge to land during summer. However when groundwater levels are elevated, predominantly in winter, the direct discharge to surface water will remain. Under such conditions the dilution and dispersion provided by the receiving waterbody is expected to be high, and the resulting adverse effects on surface water quality will be minimal (less than minor). Existing surface water quality will be maintained, and will be enhanced to the extent that discharges to the Tokanui River are avoided.

Overall, the proposal is consistent with the objectives and policies of the relevant statutory instruments, and therefore passes both limbs of s104D of the RMA. Further, the discharge to water will not result in any of the effects described in s107(1)(c) - (g) of the RMA, and therefore there is no regulatory barrier to the applications being granted under s104B of the RMA.

The applicant recognises the directive under the NPS-FM and the relevant Southland regional plans to maintain and improve the quality of Southland's water resources in a sustainable way, and hence the proposal to provide for partial land disposal and contribute to improvements to the water quality of the Tokanui River. The applicant proposes a suite of mitigation and monitoring conditions to ensure that the proposed activity is carried out in a manner that achieves the Council's objectives as asset owner and requiring authority, as well as the objectives of the consent authority.

Appendices

Appendix A Discharge Permit 201599

environment SOUTHLAND

Application No: S122-020
Consent No:201599

Cnr North Road and Price Street
(Private Bag 90116)
Invercargill

Telephone (03) 215 6197
Fax No. (03) 215 8081
Southland Freephone No. 0800 76 88 45

Discharge Permit

Pursuant to Section 105(1) of the Resource Management Act 1991, a resource consent is hereby granted by the Southland Regional Council (the "Council") to **Southland District Council** (the "consent holder") of **P O Box 903, Invercargill** from **8 September 2003**.

Please read this Consent carefully, and ensure that any staff or contractors carrying out activities under this Consent on your behalf are aware of all the conditions of the Consent.

Details of Permit

Purpose for which permit is granted:		To discharge treated wastewater to the ground and to water
Location	- site locality	Tokanui
	- map reference	I47:986:973
	- receiving environment	Tokanui River and land
	- catchment	Tokanui River
Legal description of land at the site:		Lot 1 DP 8315 Blk X Toetoe SD
Expiry date:		8 September 2018

Schedule of Conditions

1. The consent period is 15 years.

(Note: Pursuant to Sections 123 and 124 of the Resource Management Act 1991, a new consent will be required at the expiration of this consent. The application will be considered in accordance with the plans in effect at that time, and the adverse effects of the proposed activity).

2. This consent authorises the discharge of up to 55 m^3/day treated sewage effluent from the Tokanui oxidation pond into land, via seepage from the base of the oxidation ponds, and into the Tokanui Stream from the surface of the secondary treatment pond, at about map reference NZMS 260 F47:986:973.

(Note: In the event of an emergency or accidental discharge of sewage or partially treated sewage to land or water, other than is authorised by this consent or a rule in a regional plan, the consent holder (or the consent holder's agent) shall, without undue delay, notify:

- *the Medical Officer of Health (or Health Protection Officer)*
- *Te Ao Marama Inc*
- *the Council's Environmental Compliance Manager)*

3. This consent does not authorise the disposal of sludges or wastes collected from any point in the reticulation or treatment systems.

(Note: This condition does not refer to wastewater seepage from the base of the ponds).

Monitoring

4. The consent holder shall monitor the daily rate of effluent discharge from the oxidation pond to the stream for at least four one-week periods each calendar year.

5. The consent holder shall monitor:

(a) the treated effluent discharge from the oxidation pond by collecting representative samples of the discharge and having those samples analysed for:

- electrical conductivity
- total suspended solids concentration (TSS)
- carbonaceous biochemical oxygen demand concentration (BOD_5)
- ammoniacal nitrogen concentration
- total nitrogen concentration (TN)
- total phosphorus concentration (TP)
- Escherichia coli concentration

(b) the Tokanui Stream by collecting representative samples from the stream, upstream of the discharge and approximately 150 metres downstream, and having those samples analysed for:

- temperature
- pH
- electrical conductivity
- turbidity
- dissolved oxygen concentration (DO)
- total ammoniacal nitrogen concentration
- nitrate nitrogen concentration
- dissolved reactive phosphorus concentration
- Escherichia coli concentration

6. (a) The monitoring specified in Condition 5:

(i) shall occur at least twice during the period 1 September to 30 April each year. Each monitoring occasion shall be separated by at least ten days; and

(ii) shall occur when flow in the river is very low, as indicated by flow in the Mokoreta River at Environment Southland's McKays Road river flow monitoring site being less than 1.2 cumecs. This additional monitoring shall occur at least once per month while low flow conditions persists. *Note: Monitoring under this condition may make up one or both of the seasonal monitoring events required by Condition 6(a)(i), but will be in addition where the requirements of Condition 6(a)(i) have already been fulfilled for the season.*

(b) Sample collection, preservation and analysis, as required by Condition 5, shall be carried out in accordance with the most recent edition of APHA "Standard Methods for the Examination of Water and Wastewater".

(c) The monitoring and analyses specified in Condition 5 are to be carried out by a laboratory with IANZ registration or equivalent, or as agreed to, in writing, by the Council's Director of Environmental Management.

(d) The consent holder shall report:

(i) the results of analysis, carried out in accordance with Condition 5, to the Council's Environmental Compliance Manager no later than 20 working days from the end of the month in which the samples are taken. The methods of analysis are to be specified with the results; and

(ii) a summary of the flow monitoring data, recorded in accordance with Condition 4 of this consent, to the Council's Environmental Compliance Manager by 30 June each year. The first summary is to be supplied on 30 June 2004.

7. The consent holder (or the consent holder's agent) shall maintain a log of inspections and works carried out on the treatment system and make the log available, upon request, to the Council's Director of Environmental Management or a Health Protection Officer, and the Area Manager Murihiku, Department of Conservation.

Land Disposal Investigation

8. The consent holder shall:

(a) undertake an investigation of the options for land treatment and disposal of the effluent in consultation with the local community and Iwi, though a working part including representatives of the consent holder, Iwi and the local community;

(b) provide to the Southland Regional Council, by 30 June each year until, at the latest, 30 June 2008, an annual progress report by the working party on the investigation required by Condition 8(a);

(c) provide a final report to the Southland Regional Council on the investigation required by Condition 8(a) by 30 June 2008.

Signage

9. The consent holder shall, within one month of the date of commencement of this consent, erect and maintain signage, in a prominent position at or near the point of discharge to the Tokanui Stream, informing the public of food gathering hazard due to the discharge of treated human effluent.

Receiving Water Limits

10. The minimum standards for Class D waters, as described in Appendix 1, shall apply and be maintained in the Tokanui Stream, in respect of any discharge made pursuant to this consent, beyond 50 metres from the point of discharge.

Odour

11. There shall not be any discharge of odour from the sewage treatment system that is noxious, offensive or objectionable to such an extent that it has an adverse effect on the environment beyond the boundary of the consent holder's property.

Review of Consent Conditions

12. In accordance with Section 127 of the Resource Management Act, the consent holder may apply to the Council for the change or cancellation of any of the conditions of this consent, other than Condition 1, in the month of June each year.

13. Southland Regional Council may in accordance with the conditions of this resource consent and Sections 128 and 129 of the Resource Management Act 1991, serve notice of its intention to review the conditions of this consent, in the month of June each year, for the purposes of:

    (i) dealing with any minor additions or alterations to the sewage treatment and discharge system;
    (ii) dealing with any adverse cumulative effects on the environment which may arise from the exercise of this consent; or
    (iii) complying with the requirements of a regional plan.

for the **Southland Regional Council**

W J Tuckey
Director of Environmental Management

Appendix 1
Standards for Class D Waters

The quality of Class D waters shall conform to the following requirements:

a) The natural water temperature shall not be changed by more than 3 degrees Celsius.

b) The acidity or alkalinity of the waters as measured by the pH shall be within the range of 6.0 to 9.0 except when due to natural causes.

c) The waters shall not be tainted so as to make them unpalatable, nor contain toxic substances to the extent that they are unsafe for consumption by farm animals, nor shall they emit objectionable odours.

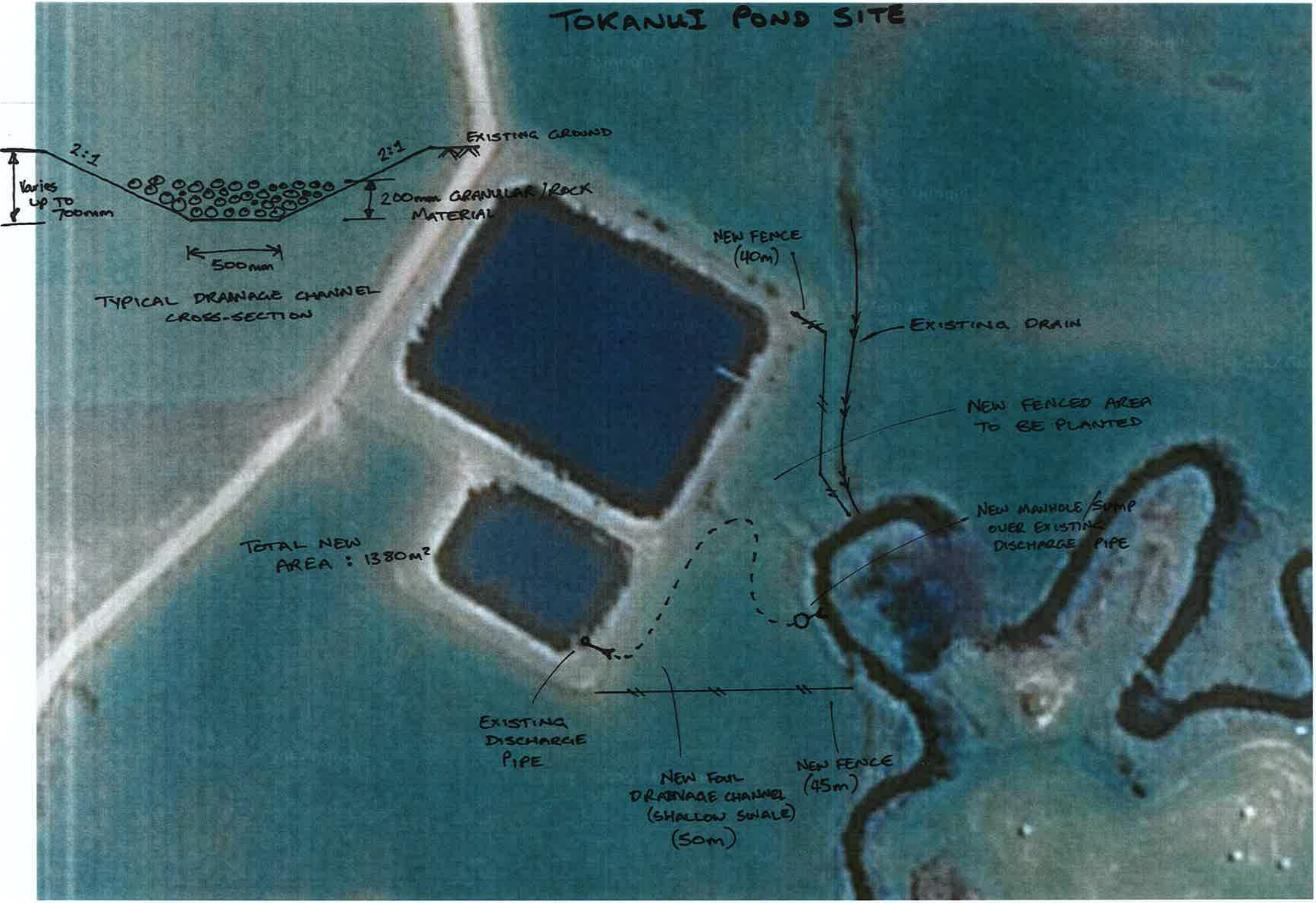
d) There shall be no destruction of natural aquatic life by reason of a concentration of toxic substances.

e) The natural colour and clarity of the waters shall not be changed to a conspicuous extent.

f) The oxygen content in solution in the waters shall not be reduced below 5 milligrams per litre.

Appendix B Infiltration Trench Concept Design

TOKANUI POND SITE

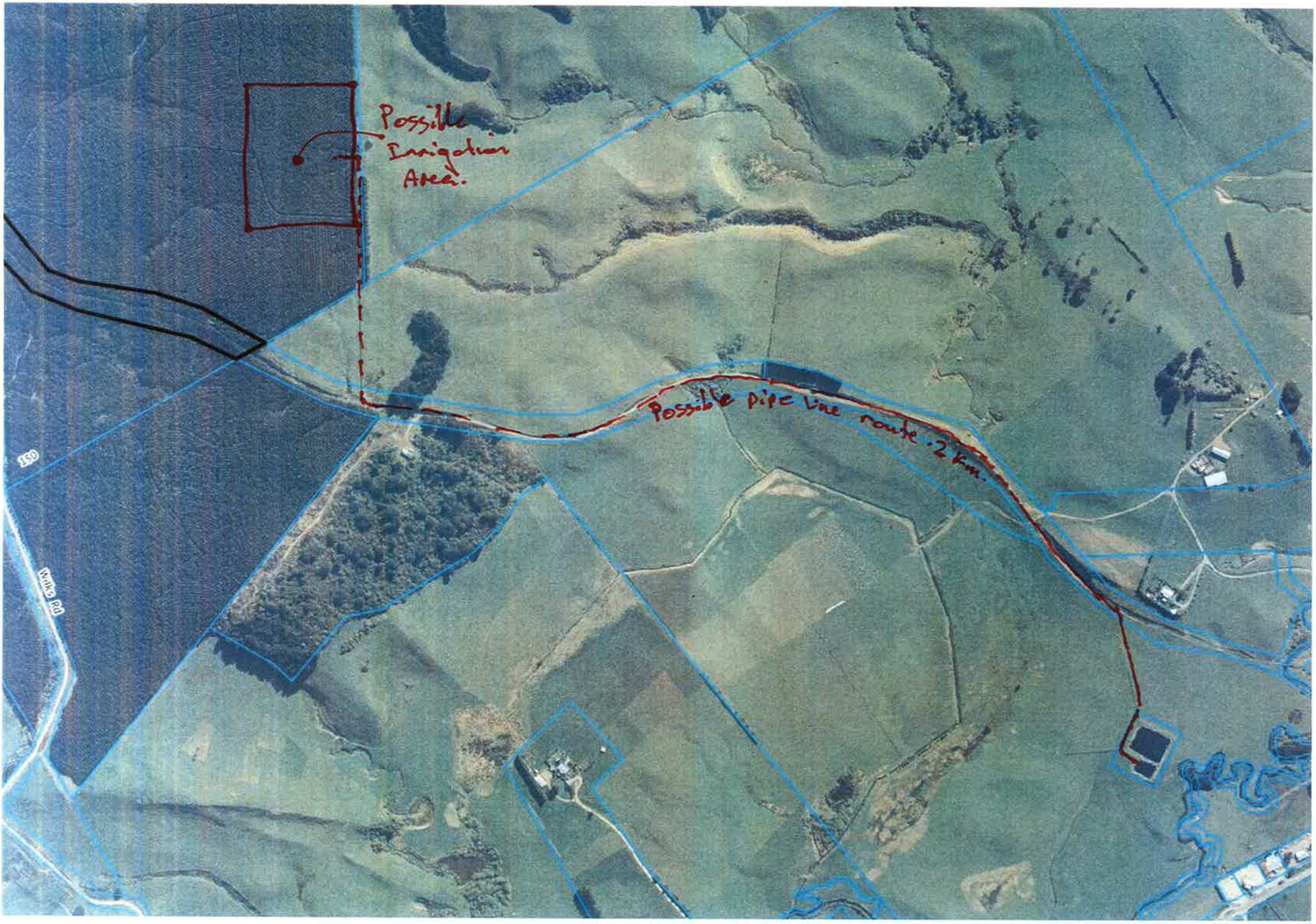


Appendix C Land Requirement Plan

New Drainage Channel
NewBoundary
D49 Wastewater Treatment Designation
New Fence Line
Primary Parcels

Areas
Existing D49 WWTP Designation: 7068.5 Sq m
Additional area to be included in the designation: 1318.1 Sq m
New boundary incorportating exisiting and new area: 8386.6 Sq m

Appendix D Land Disposal Options Report


Possible Irrigation Area.
Possible pipe line route. 2 Km.
250
Wilks Rd

Tokanui WWTP Upgrade Schedule - Discharge to Forest					
Item	Description	Unit	Quantity	Rate	Amount
1.0	Pipework				
1.1	Supply, lay in suitable embedment material and backfill 63 mm ID Alkathene. Minimum cover to be 800 mm. To include all fittings and connections.	m	2,100	*$ 30.00*	$ 63,000.00
1.2	Supply and lay 40mm OD Alkathene on ground surface, including all fittings and connections.	m	2000	*$ 15.00*	$ 30,000.00
1.3	Supply and lay 32mm ID Alkathene on ground surface, including all fittings and connections.	m	100		$ -
1.4	Supply and lay 25mm ID Alkathene on ground surface, including all fittings and connections.	m	60		$ -
1.5	Supply and lay 25mm OD Alkathene on ground surface, including all fittings and connections.	m	10,000	*$ 8.00*	$ 80,000.00
1.6	Supply, install and backfill 50 mm Hanson ball valves , including Tee and all pipe connections. To include 150mm PVC riser and standard round valve cover and marker post	ea	6	*$ 500.00*	$ 3,000.00
1.7	Supply and install 32mm valves, including all pipe connections. To be laid on ground surface.	ea	50	$ 400.00	$ 20,000.00
1.8	Auto rotation valves, supply, install, cover over valves, bends and fittings & marker posts	ea	22	$ 1,300.00	$ 28,600.00
2.0	Other				
2.1	3 phase power to the Pond site	ea	1		$ 55,000.00
2.2	Transformer	ea	1		$ -
2.3	Cabinet Power Switch Board	ea	1		$ 15,000.00
2.4	Control, SCADA and Programming	ea	1		$ 16,000.00
2.5	Pump shed	ea	1		$ 12,000.00
2.6	Pump (1.5 L/s high head)	ea	2		$ 12,000.00
2.7	50 Ø Valves + pipe & fittings - non return (in building)	ea			$ 10,000.00
2.8	50 Magflow meter + pressure switch contol and programming	ea	1		$ 10,000.00
2.9	Pressure relief valve back into ponds	ea	1		$ 4,000.00
	Sub Total (ex GST)				**$ 358,600.00**
	Contingency (15%)				**$ 53,790.00**
	Subtotal				**$ 412,390.00**
	Design, Contact Documents tendering contact Management Approx 10 - 15%				**$ 50,000.00**
	Project Total:				**$ 462,390.00**

This is the cost for irrigation over the summer. More field area would be needed over the winter. May not be possible over the winter as probably heavy soils.

More field area would be a higher cost, more pipes, valves, auto vales etc.

Estimate provided by SDC.

Appendix E Pond Drop Test

Tokanui Waste water oxidation ponds
Pond water level drop test.

Methodology

The outlet pipe from the ponds was plugged off.

The pond level was measured with a INW AquiStar PT2X integrated data logger and pressure transducer

The inflow into the ponds was measured recorded with a ABB MAG FLOW water meter recording a pulse every 1 cubic meter of inflow.

Test set up by SDC, Bevan McKenzie and Paul Reid
Write up checked by Sue Bennett (Stantec)
Write up reviewed by Roger Oakley (Stantec)

Test start date and time 14/08/2017 11:00
Test end date and time 16/08/2017 15:06
Period of test: 2.17 days
52.1 hours

Data

Inflow to Ponds

Day	Date	Time Period	Cubic Meters
Monday	14/08/2017	11:00 - 23:59	21
Tuesday	15/08/2017	00:00 - 23:59	35
Wednesday	16/08/2017	00:00 - 15:06	19
	Total	**52 hours**	**75**

Actual Measured Pond water level rise 454 - 437.4 = **16.6** mm
Pond depth 1.2 -1.3 meters Pond area is 2700 square meters
Volume of pond level change 44.82 m^3

Weather Conditions

Max Temp during the days, approx. 15 degree C
No rain over the 3 days, light wind

Pond area 2700 square meters

Calculated pond rise due to inflow 75 cu.m / 2,700 = 0.028 meters 28 mm

Less Evaporation

Evaporation	3.7	mm	: based on average of open water evaporation data for relevant stations
Period of evaporation record	72	hours	
Average evaporation over period	0.051	mm/hour	
Evaporation over test:	2.65	mm	: assuming constant evaporation over period

Therefore the total calculated pond rise (excl evaporation) is 25.13 mm

Assume that difference between observed (actual) pond level rise and calculated pond level rise is due to seepage through base

Calculated pond seepage loss over the 52 hours

8.5	mm	: over whole period of test
0.2	mm/hour	: rate over test
3.9	**mm/day**	: daily rate of seepage

Proposed allowable loss Rule 33 Southland land and Water Plan 1.6 mm per 24 hours : which is exceeded

Therefore daily rate of loss through the base of the pond during test were : 10.61 : m^3/day

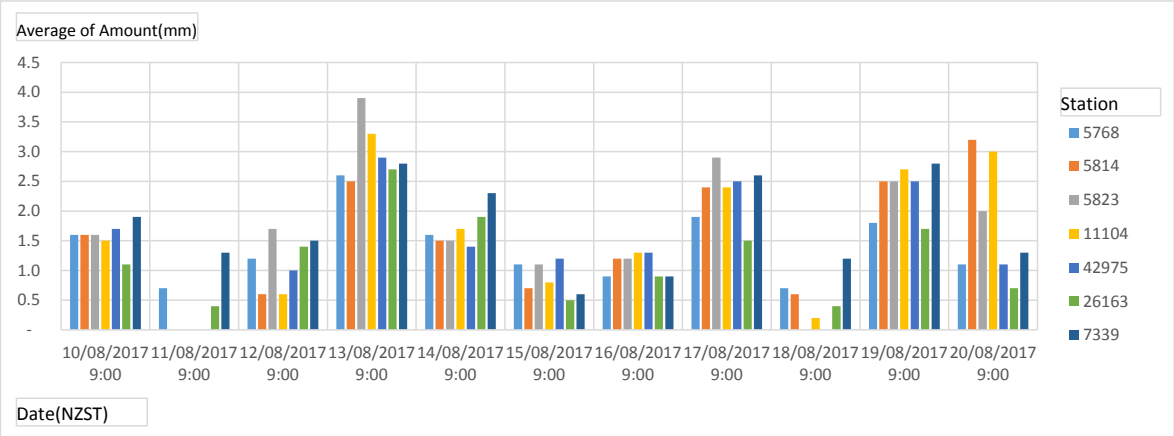
In water balance for discharge routes will use pond seepage rate of 10m^3/day

Experimental Set Up

Station information:

Name	Agent Number	Network Numl	Latitude (dec.d	Longitude (dec	Height (m)	Posn_F	Observing Authority
Balclutha, Telford Ews	26163	I69276	-46.29282	169.7315	11	H	Niwa
Dunedin Aero Aws	7339	I50922	-45.927	170.197	1	G	Metservice
Invercargill Aero Aws	11104	I68435	-46.411	168.318	1	G	Metservice
Five Rivers Cws	40845	I58632	-45.6259	168.36702	260	H	Niwa
Gore Ews	42975	I68197	-46.12375	168.91938	60	H	Niwa
Manapouri Aero Aws	5430	I57563	-45.533	167.642	209	G	Metservice
Winton 2	5768	I68133	-46.157	168.328	44	G	N/A
Gore Aws	5778	I68182	-46.115	168.887	123	G	N/A
Invercargill Aero	5814	I68433	-46.41741	168.33052	1	H	N/A
Tiwai Point Ews	5823	I68533	-46.587	168.376	5	G	N/A

Average of Amount(mm)	**Column Labels**							
Row Labels	**5768**	**5814**	**5823**	**11104**	**42975**	**26163**	**7339**	**Grand Total**
10/08/2017 9:00	1.6	1.6	1.6	1.5	1.7	1.1	1.9	1.6
11/08/2017 9:00	0.7	-	-	-	-	0.4	1.3	0.3
12/08/2017 9:00	1.2	0.6	1.7	0.6	1.0	1.4	1.5	1.1
13/08/2017 9:00	2.6	2.5	3.9	3.3	2.9	2.7	2.8	3.0
14/08/2017 9:00	1.6	1.5	1.5	1.7	1.4	1.9	2.3	1.7
15/08/2017 9:00	1.1	0.7	1.1	0.8	1.2	0.5	0.6	0.9
16/08/2017 9:00	0.9	1.2	1.2	1.3	1.3	0.9	0.9	1.1
17/08/2017 9:00	1.9	2.4	2.9	2.4	2.5	1.5	2.6	2.3
18/08/2017 9:00	0.7	0.6	-	0.2	-	0.4	1.2	0.4
19/08/2017 9:00	1.8	2.5	2.5	2.7	2.5	1.7	2.8	2.4
20/08/2017 9:00	1.1	3.2	2.0	3.0	1.1	0.7	1.3	1.8
Grand Total	**1.4**	**1.5**	**1.7**	**1.6**	**1.4**	**1.2**	**1.7**	**1.5**



Appendix F Data Record

Consent limit		55		
Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
1/07/2013	Pump records	8	0	0
2/07/2013	Pump records	39	3.9	3.1
3/07/2013	Pump records	75	27.2	2.2
4/07/2013	Pump records	22	8	1.1
5/07/2013	Pump records	52	7.4	1.6
6/07/2013	Pump records	29	9.2	0
7/07/2013	Pump records	39	3.5	1.7
8/07/2013	Pump records	21	17.2	2.8
9/07/2013	Pump records	28	6.4	1.9
10/07/2013	Pump records	18	3.8	0.8
11/07/2013	Pump records	15	0	1.1
12/07/2013	Pump records	14	0	0.9
13/07/2013	Pump records	12	0	0.8
14/07/2013	Pump records	16	12.3	1.9
15/07/2013	Pump records	19	11.8	0.9
16/07/2013	Pump records	16	1	0.7
17/07/2013	Pump records	14	1.8	1.2
18/07/2013	Pump records	13	0.2	1.6
19/07/2013	Pump records	12	0.2	0.7
20/07/2013	Pump records	11	0	0.9
21/07/2013	Pump records	10	0	1.4
22/07/2013	Pump records	8	0.9	1.9
23/07/2013	Pump records	9	0.7	1.5
24/07/2013	Pump records	10	11.7	1.3
25/07/2013	Pump records	14	16.3	2.7
26/07/2013	Pump records	32	12.9	3.1
27/07/2013	Pump records	16	1.3	1.3
28/07/2013	Pump records	14	5.5	0.3
29/07/2013	Pump records	13	0.1	3.2
30/07/2013	Pump records	11	0	0.6
31/07/2013	Pump records	11	0	1.5
1/08/2013	Pump records	10	1.1	2.3
2/08/2013	Pump records	9	0	0.9
3/08/2013	Pump records	11	0	1
4/08/2013	Pump records	10	1.3	1
5/08/2013	Pump records	8	0	0.4
6/08/2013	Pump records	9	0.2	1.3
7/08/2013	Pump records	9	0	0.8
8/08/2013	Pump records	11	0	1.4
9/08/2013	Pump records	8	0	2.3
10/08/2013	Pump records	11	0	1.4
11/08/2013	Pump records	9	2	0.9
12/08/2013	Pump records	9	1.5	0.7
13/08/2013	Pump records	8	1.2	0.6
14/08/2013	Pump records	11	5.5	2.1
15/08/2013	Pump records	5	1.6	2
16/08/2013	Pump records	10	5.2	0.8
17/08/2013	Pump records	9	2.1	1
18/08/2013	Pump records	11	0.2	2.4
19/08/2013	Pump records	8	0	2.2
20/08/2013	Pump records	9	0	1.8
21/08/2013	Pump records	11	0	2
22/08/2013	Pump records	6	0	2
23/08/2013	Pump records	8	8.2	1.6
24/08/2013	Pump records	12	0.1	1.8
25/08/2013	Pump records	9	0.3	1.7
26/08/2013	Pump records	8	2.8	0.8
27/08/2013	Pump records	12	0.3	3.4
28/08/2013	Pump records	10	0.4	2.4
29/08/2013	Pump records	9	10.2	1.7
30/08/2013	Pump records	13	2	2.4
31/08/2013	Pump records	8	0	2
1/09/2013	Pump records	11	0	1.3
2/09/2013	Pump records	9	0	1
3/09/2013	Pump records	8	0.9	1.8
4/09/2013	Pump records	12	17	1
5/09/2013	Pump records	10	10.1	1.7
6/09/2013	Pump records	9	0	1.5
7/09/2013	Pump records	11	0	4
8/09/2013	Pump records	22	16	4
9/09/2013	Pump records	22	14.7	4.3
10/09/2013	Pump records	18	1.4	3.7
11/09/2013	Pump records	19	11.5	3.3

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
12/09/2013	Pump records	38	19.2	2.8
13/09/2013	Pump records	30	5.4	2.4
14/09/2013	Pump records	23	13	0.4
15/09/2013	Pump records	18	4.6	1.4
16/09/2013	Pump records	17	3.7	4.7
17/09/2013	Pump records	14	4.2	1.9
18/09/2013	Pump records	11	0	2.9
19/09/2013	Pump records	10	0	1.6
20/09/2013	Pump records	11	1	2
21/09/2013	Pump records	12	2.5	1.6
22/09/2013	Pump records	11	0	0.9
23/09/2013	Pump records	10	0.6	0.9
24/09/2013	Pump records	13	1.1	1.5
25/09/2013	Pump records	10	0	2
26/09/2013	Pump records	11	0	2.4
27/09/2013	Pump records	9	4.2	0.6
28/09/2013	Pump records	11	0.4	2.3
29/09/2013	Pump records	8	3.3	0.9
30/09/2013	Pump records	7	0	1.5
1/10/2013	Pump records	12	0	1.3
2/10/2013	Pump records	9	0	5.7
3/10/2013	Pump records	8	2.2	5.8
4/10/2013	Pump records	9	1.6	2.2
5/10/2013	Pump records	10	0	2.8
6/10/2013	Pump records	8	0	2.7
7/10/2013	Pump records	9	4.5	5.1
8/10/2013	Pump records	8	0	4.9
9/10/2013	Pump records	12	0.8	1.9
10/10/2013	Pump records	9	0.4	2.3
11/10/2013	Pump records	8	4.4	3.7
12/10/2013	Pump records	10	6	3
13/10/2013	Pump records	11	4.3	2.7
14/10/2013	Pump records	44	5.8	1.2
15/10/2013	Pump records	83	55.1	1.2
16/10/2013	Pump records	37	6	1.8
17/10/2013	Pump records	22	2.3	3
18/10/2013	Pump records	57	27.7	4.5
19/10/2013	Pump records	14	3.6	2.4
20/10/2013	Pump records	14	0	3.5
21/10/2013	Pump records	37	2.6	4.4
22/10/2013	Pump records	24	26.4	1
23/10/2013	Pump records	16	4.6	4.2
24/10/2013	Pump records	21	4.4	2.8
25/10/2013	Pump records	13	0.3	3.3
26/10/2013	Pump records	17	7.8	4.7
27/10/2013	Pump records	20	14.7	2
28/10/2013	Pump records	17	9	2.5
29/10/2013	Pump records	13	0.3	3
30/10/2013	Pump records	12	0	1.8
31/10/2013	Pump records	11	0.3	3.1
1/11/2013	Pump records	10	3.4	2.1
2/11/2013	Pump records	9	3	3.7
3/11/2013	Pump records	12	0.5	3.6
4/11/2013	Pump records	9	0	2.9
5/11/2013	Pump records	11	0	4.2
6/11/2013	Pump records	11	0	2.4
7/11/2013	Pump records	15	0	4.1
8/11/2013	Pump records	9	0	3
9/11/2013	Pump records	11	0.5	1.1
10/11/2013	Pump records	9	0.4	3.1
11/11/2013	Pump records	11	0	1.2
12/11/2013	Pump records	12	0	4
13/11/2013	Pump records	10	0	3.3
14/11/2013	Pump records	8	0	2.3
15/11/2013	Pump records	9	0	2.5
16/11/2013	Pump records	10	1.8	2.4
17/11/2013	Pump records	9	0.6	3
18/11/2013	Pump records	11	0	4.4
19/11/2013	Pump records	8	0	4.1
20/11/2013	Pump records	9	0	3.4
21/11/2013	Pump records	14	0	4.3
22/11/2013	Pump records	10	0	5.5
23/11/2013	Pump records	8	0	3.3
24/11/2013	Pump records	11	0	3.5

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
25/11/2013	Pump records	15	0	3.7
26/11/2013	Pump records	11	13.4	4.3
27/11/2013	Pump records	9	1.5	5.6
28/11/2013	Pump records	10	0	4.8
29/11/2013	Pump records	9	0	3.1
30/11/2013	Pump records	8	4	6.1
1/12/2013	Pump records	10	8.1	5.6
2/12/2013	Pump records	8		7.8
3/12/2013	Pump records	9		4.9
4/12/2013	Pump records	8		4.7
5/12/2013	Pump records	11		2.2
6/12/2013	Pump records	9		2.6
7/12/2013	Pump records	8		2.1
8/12/2013	Pump records	11		2.9
9/12/2013	Pump records	10		3.3
10/12/2013	Pump records	9		3.3
11/12/2013	Pump records	8		2.7
12/12/2013	Pump records	6		3.9
13/12/2013	Pump records	12		0.9
14/12/2013	Pump records	8		3.9
15/12/2013	Pump records	7		4.6
16/12/2013	Pump records	10		4.4
17/12/2013	Pump records	9		3.3
18/12/2013	Pump records	9		5.5
19/12/2013	Pump records	8		3.6
20/12/2013	Pump records	14		5.6
21/12/2013	Pump records	81		6
22/12/2013	Pump records	13		3.7
23/12/2013	Pump records	11		6
24/12/2013	Pump records	16		2.8
25/12/2013	Pump records	31		3.3
26/12/2013	Pump records	13		0.9
27/12/2013	Pump records	9		3.5
28/12/2013	Pump records	11		5.8
29/12/2013	Pump records	14		4.1
30/12/2013	Pump records	70		4.3
31/12/2013	Pump records	10		2.3
1/01/2014	Pump records	9		4.4
2/01/2014	Pump records	12	3.9	3.7
3/01/2014	Pump records	8	2.7	2.9
4/01/2014	Pump records	9	3.2	4.9
5/01/2014	Pump records	12	2.2	4.3
6/01/2014	Pump records	9	7	5
7/01/2014	Pump records	10	0.3	4.9
8/01/2014	Pump records	8	25.1	2.8
9/01/2014	Pump records	11	12.7	2.8
10/01/2014	Pump records	8	0.3	5.3
11/01/2014	Pump records	9	3	2.2
12/01/2014	Pump records	11	6.7	5.4
13/01/2014	Pump records	12	23.1	5
14/01/2014	Pump records	11	16.7	6.1
15/01/2014	Pump records	9	0.2	6.2
16/01/2014	Pump records	8	11.5	7.7
17/01/2014	Pump records	11	3.4	2.6
18/01/2014	Pump records	9	3.2	4.2
19/01/2014	Pump records	13	3.2	4.6
20/01/2014	Pump records	8	0	5.4
21/01/2014	Pump records	11	0	4.6
22/01/2014	Pump records	9	0.1	3.2
23/01/2014	Pump records	53	13.9	4.6
24/01/2014	Pump records	8	21.4	4.2
25/01/2014	Pump records	11	0	4.7
26/01/2014	Pump records	12	2.9	3.3
27/01/2014	Pump records	9	0.6	4.7
28/01/2014	Pump records	8	0	3.3
29/01/2014	Pump records	9	0	4.4
30/01/2014	Pump records	8	2.9	3.9
31/01/2014	Pump records	11	0	3.7
1/02/2014	Pump records	8	0	2.9
2/02/2014	Pump records	9	0	3.4
3/02/2014	Pump records	8	0	4.1
4/02/2014	Pump records	9	1.7	4.3
5/02/2014	Pump records	6	0	3.5
6/02/2014	Pump records	8	0	2.9

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
7/02/2014	Pump records	9	0	3.2
8/02/2014	Pump records	8	0	2.1
9/02/2014	Pump records	11	0.7	1.4
10/02/2014	Pump records	10	0	4.1
11/02/2014	Pump records	12	0	3.3
12/02/2014	Pump records	6	0.7	1.1
13/02/2014	Pump records	16	25.3	3.1
14/02/2014	Pump records	19	29	1.6
15/02/2014	Pump records	8	0.8	3.2
16/02/2014	Pump records	11	0.6	1.2
17/02/2014	Pump records	9	0	3.8
18/02/2014	Pump records	8	2.8	1.9
19/02/2014	Pump records	6	0	3.1
20/02/2014	Pump records	9	0	2.1
21/02/2014	Pump records	8	0	2.1
22/02/2014	Pump records	9	0	2.5
23/02/2014	Pump records	21	13.9	8.5
24/02/2014	Pump records	8	17.7	3.1
25/02/2014	Pump records	8	2.4	6.8
26/02/2014	Pump records	10	0.3	4.1
27/02/2014	Pump records	8	0	3.8
28/02/2014	Pump records	11	9.7	4.6
1/03/2014	Pump records	11	2.8	3.6
2/03/2014	Pump records	9	2	4.9
3/03/2014	Pump records	9	15.4	2.1
4/03/2014	Pump records	8	12	3.1
5/03/2014	Pump records	6	0.1	3.8
6/03/2014	Pump records	7	0	3.3
7/03/2014	Pump records	8	0.2	1.2
8/03/2014	Pump records	9	2.4	1.9
9/03/2014	Pump records	8	0	3.7
10/03/2014	Pump records	13	0	3.5
11/03/2014	Pump records	9	0	3.6
12/03/2014	Pump records	11	0	2.9
13/03/2014	Pump records	8	0	2.3
14/03/2014	Pump records	9	3	3.3
15/03/2014	Pump records	11	0	3.5
16/03/2014	Pump records	8	0	1.5
17/03/2014	Pump records	13	0	2.3
18/03/2014	Pump records	8	21.6	1.7
19/03/2014	Pump records	9	0	2.8
20/03/2014	Pump records	11	4.6	2.3
21/03/2014	Pump records	12	0	3.4
22/03/2014	Pump records	8	0	2.5
23/03/2014	Pump records	8	0	2
24/03/2014	Pump records	6	1.9	1.5
25/03/2014	Pump records	15	14.3	1.8
26/03/2014	Pump records	12	0.3	2.3
27/03/2014	Pump records	9	0	1.5
28/03/2014	Pump records	10	0.8	4.3
29/03/2014	Pump records	8	0	3.2
30/03/2014	Pump records	9	0.4	2.1
31/03/2014	Pump records	10	0	2.6
1/04/2014	Pump records	8	0	2.2
2/04/2014	Pump records	9	0	2.2
3/04/2014	Pump records	8	0	3
4/04/2014	Pump records	9	0	1.3
5/04/2014	Pump records	12	34.2	0.5
6/04/2014	Pump records	10	1.9	1.1
7/04/2014	Pump records	7	1.3	1
8/04/2014	Pump records	9	1.4	2.5
9/04/2014	Pump records	8	0	1.8
10/04/2014	Pump records	10	0	1.5
11/04/2014	Pump records	9	0	1.4
12/04/2014	Pump records	7	6.4	1.4
13/04/2014	Pump records	14	1.4	4
14/04/2014	Pump records	12	0	3.2
15/04/2014	Pump records	9	0	2.1
16/04/2014	Pump records	11	15.9	1.1
17/04/2014	Pump records	10	0.9	2.6
18/04/2014	Pump records	8	0.5	4
19/04/2014	Pump records	9	0	2.4
20/04/2014	Pump records	47	0	2.5
21/04/2014	Pump records	41	5.7	2.1

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
22/04/2014	Pump records	15	3.7	3.2
23/04/2014	Pump records	12	1	2
24/04/2014	Pump records	31	2.6	1.9
25/04/2014	Pump records	33	6.6	1.3
26/04/2014	Pump records	17	3.8	1.4
27/04/2014	Pump records	11	0.1	1.4
28/04/2014	Pump records	9	12.6	1.5
29/04/2014	Pump records	14	7.8	1.7
30/04/2014	Pump records	7	0	1.2
1/05/2014	Pump records	11	0	1.4
2/05/2014	Pump records	9	0	1.7
3/05/2014	Pump records	7	0	1.2
4/05/2014	Pump records	8	0	1.7
5/05/2014	Pump records	9	2.6	1.3
6/05/2014	Pump records	11	5.2	1.4
7/05/2014	Pump records	8	0.1	2.2
8/05/2014	Pump records	9	3.9	1.9
9/05/2014	Pump records	8	0.8	0.7
10/05/2014	Pump records	10	3.9	0.9
11/05/2014	Pump records	9	0.9	3.1
12/05/2014	Pump records	11	0.4	1.9
13/05/2014	Pump records	8	6.5	1
14/05/2014	Pump records	9	2.3	0.5
15/05/2014	Pump records	7	0	0.9
16/05/2014	Pump records	8	0	0.5
17/05/2014	Pump records	11	0	3
18/05/2014	Pump records	9	5.8	1.5
19/05/2014	Pump records	8	0.2	1
20/05/2014	Pump records	68	0.7	2.3
21/05/2014	Pump records	72	39.4	0.1
22/05/2014	Pump records	30	3	0.9
23/05/2014	Pump records	23	20.5	3.1
24/05/2014	Pump records	26	4	1.3
25/05/2014	Pump records	44	16	4.2
26/05/2014	Pump records	13	28.7	0.7
27/05/2014	Pump records	28	4.4	1
28/05/2014	Pump records	12	24.4	1.9
29/05/2014	Pump records	17	2.5	2.2
30/05/2014	Pump records	12	0	1.4
31/05/2014	Pump records	11	0.9	2
1/06/2014	Pump records	12	4.7	2.3
2/06/2014	Pump records	12	3	0.3
3/06/2014	Pump records	10	0.3	0.6
4/06/2014	Pump records	9	0	1.1
5/06/2014	Pump records	11	0	1.4
6/06/2014	Pump records	8	4.7	0.7
7/06/2014	Pump records	9	2.2	0.6
8/06/2014	Pump records	10	0.4	1.1
9/06/2014	Pump records	8	0.4	1.3
10/06/2014	Pump records	7	0.9	1.7
11/06/2014	Pump records	8	0	1.8
12/06/2014	Pump records	11	0	2.2
13/06/2014	Pump records	8	0	1.4
14/06/2014	Pump records	12	0	1
15/06/2014	Pump records	9	3.5	1.7
16/06/2014	Pump records	8	0.3	0
17/06/2014	Pump records	9	2.6	0.9
18/06/2014	Pump records	7	13.1	1
19/06/2014	Pump records	10	10.3	2
20/06/2014	Pump records	9	9.1	3.1
21/06/2014	Pump records	7	2.8	2.8
22/06/2014	Pump records	9	0.7	1.8
23/06/2014	Pump records	8	0	1.7
24/06/2014	Pump records	9	0	1.2
25/06/2014	Pump records	7	0	2.3
26/06/2014	Pump records	11	0	0.6
27/06/2014	Pump records	9	0	1.8
28/06/2014	Pump records	14	8.9	1.8
29/06/2014	Pump records	8	0.3	0.6
30/06/2014	Pump records	9	0	2.1
1/07/2014	Pump records	11	0	1.7
2/07/2014	Pump records	14	4.7	0.7
3/07/2014	Pump records	15	13.3	0.4
4/07/2014	Pump records	18	8.9	1.8

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
5/07/2014	Pump records	29	20	4.2
6/07/2014	Pump records	35	15.5	0.6
7/07/2014	Pump records	23	5.2	1
8/07/2014	Pump records	16	2.7	0.9
9/07/2014	Pump records	14	0	0.7
10/07/2014	Pump records	14	0	0.8
11/07/2014	Pump records	13	0	1.3
12/07/2014	Pump records	14	0	1.3
13/07/2014	Pump records	19	6.3	0.8
14/07/2014	Pump records	15	4.7	0.2
15/07/2014	Pump records	14	0	1.7
16/07/2014	Pump records	12	3.2	0.9
17/07/2014	Pump records	12	0	1
18/07/2014	Pump records	13	0	1.1
19/07/2014	Pump records	11	0	1
20/07/2014	Pump records	15	1	0.6
21/07/2014	Pump records	20	19.6	0.5
22/07/2014	Pump records	19	7.9	1.4
23/07/2014	Pump records	24	9	0.8
24/07/2014	Pump records	21	10.8	1.7
25/07/2014	Pump records	15	3.3	3.9
26/07/2014	Pump records	15	3	2.1
27/07/2014	Pump records	16	3	1.4
28/07/2014	Pump records	14	1.8	1.2
29/07/2014	Pump records	13	0	1.9
30/07/2014	Pump records	12	0	0
31/07/2014	Pump records	14	0	2.3
1/08/2014	Pump records	16	0	1.7
2/08/2014	Pump records	54	10.8	3.7
3/08/2014	Pump records	40	21.7	0.5
4/08/2014	Pump records	27	0.3	1.7
5/08/2014	Pump records	21	0	1.7
6/08/2014	Pump records	21	8.3	2.2
7/08/2014	Pump records	36	3.1	3.5
8/08/2014	Pump records	53	18	4.1
9/08/2014	Pump records	41	7.2	1.3
10/08/2014	Pump records	28	0	1.9
11/08/2014	Pump records	31	7.5	1.4
12/08/2014	Pump records	33	11.7	0.6
13/08/2014	Pump records	38	14	1.8
14/08/2014	Pump records	46	15.8	2.3
15/08/2014	Pump records	33	11.1	3.4
16/08/2014	Pump records	28	0.8	1.3
17/08/2014	Pump records	27	2.7	1.4
18/08/2014	Pump records	20	0.4	1.4
19/08/2014	Pump records	23	0	1.3
20/08/2014	Pump records	18	0	1.7
21/08/2014	Pump records	19	6.2	1.3
22/08/2014	Pump records	18	3.3	2.5
23/08/2014	Pump records	19	2	2.6
24/08/2014	Pump records	19	0.3	0.7
25/08/2014	Pump records	15	0	1.3
26/08/2014	Pump records	14	0.3	1.3
27/08/2014	Pump records	16	0.2	1.6
28/08/2014	Pump records	15	0.4	1.7
29/08/2014	Pump records	14	0	0.7
30/08/2014	Pump records	13	0	1.5
31/08/2014	Pump records	15	0	1
1/09/2014	Pump records	13	0	0.6
2/09/2014	Pump records	11	0	1.4
3/09/2014	Pump records	16	0	1.8
4/09/2014	Pump records	12	1.8	1.9
5/09/2014	Pump records	11	0	0.6
6/09/2014	Pump records	11	0	1.2
7/09/2014	Pump records	11	0	1.1
8/09/2014	Pump records	13	5	2.1
9/09/2014	Pump records	10	0	3.1
10/09/2014	Pump records	10	0	1.7
11/09/2014	Pump records	13	0	1.9
12/09/2014	Pump records	10	0	3.4
13/09/2014	Pump records	11	3.2	1.7
14/09/2014	Pump records	11	2.3	2
15/09/2014	Pump records	16	0.2	2.2
16/09/2014	Pump records	19	8.1	1.5

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
17/09/2014	Pump records	14	23	1.3
18/09/2014	Pump records	14	0	1.9
19/09/2014	Pump records	14	0.7	1.4
20/09/2014	Pump records	16	1.3	2.1
21/09/2014	Pump records	23	8.2	1.9
22/09/2014	Pump records	23	19.8	2.1
23/09/2014	Pump records	19	0.2	4.5
24/09/2014	Pump records	16	6.6	0
25/09/2014	Pump records	17	0	2.7
26/09/2014	Pump records	16	7.7	4.5
27/09/2014	Pump records	14	0.7	4.8
28/09/2014	Pump records	18	2.5	2
29/09/2014	Pump records	17	0	3.8
30/09/2014	Pump records	14	0	2.8
1/10/2014	Pump records	12	0	3.2
2/10/2014	Pump records	14	0.5	2.9
3/10/2014	Pump records	19	13.2	4.2
4/10/2014	Pump records	13	14.7	3.4
5/10/2014	Pump records	12	3.4	3.5
6/10/2014	Pump records	44	30.7	2.4
7/10/2014	Pump records	17	4.5	2.9
8/10/2014	Pump records	17	5.3	4.1
9/10/2014	Pump records	16	6	4.2
10/10/2014	Pump records	17	0	3.2
11/10/2014	Pump records	15	3.2	3.7
12/10/2014	Pump records	17	0.9	1.4
13/10/2014	Pump records	13	2.3	3.4
14/10/2014	Pump records	32	20.3	3.8
15/10/2014	Pump records	32	15.6	1.3
16/10/2014	Pump records	23	0.3	1.4
17/10/2014	Pump records	20	0.4	2.2
18/10/2014	Pump records	18	10.4	1.6
19/10/2014	Pump records	15	0	1.8
20/10/2014	Pump records	15	2.1	2.3
21/10/2014	Pump records	14	6.8	2.9
22/10/2014	Pump records	11	1	2.3
23/10/2014	Pump records	13	0	3.8
24/10/2014	Pump records	12	12.5	4
25/10/2014	Pump records	12	0	3.2
26/10/2014	Pump records	11	3.5	2.8
27/10/2014	Pump records	11	1.5	3.7
28/10/2014	Pump records	15	0	3.4
29/10/2014	Pump records	18	3.1	1.6
30/10/2014	Pump records	15	3.4	3.2
31/10/2014	Pump records	13	3.9	5.4
1/11/2014	Pump records	15	1.3	3.2
2/11/2014	Pump records	23	0	4.6
3/11/2014	Pump records	16	13.1	6.7
4/11/2014	Pump records	21	18.5	2.3
5/11/2014	Pump records	12	2.4	2
6/11/2014	Pump records	18	1.7	2.8
7/11/2014	Pump records	15	0	2.8
8/11/2014	Pump records	15	0.6	1.9
9/11/2014	Pump records	14	0	1.8
10/11/2014	Pump records	16	0	3.7
11/11/2014	Pump records	17	8.3	2.5
12/11/2014	Pump records	21	4.2	2
13/11/2014	Pump records	42	37.6	2.3
14/11/2014	Pump records	21	2.1	3.8
15/11/2014	Pump records	47	12.7	3.5
16/11/2014	Pump records	32	16.6	3.8
17/11/2014	Pump records	23	0	4.4
18/11/2014	Pump records	25	6.3	3.4
19/11/2014	Pump records	84	21.7	5.1
20/11/2014	Pump records	39	8.8	1.9
21/11/2014	Pump records	51	10.5	4.7
22/11/2014	Pump records	180	27.5	2
23/11/2014	Pump records	46	8	1.3
24/11/2014	Pump records	32	2.4	2.1
25/11/2014	Pump records	28	0.5	2
26/11/2014	Pump records	31	7.1	3.7
27/11/2014	Pump records	26	5.4	6.1
28/11/2014	Pump records	21	2.9	5
29/11/2014	Pump records	28	5.1	3.7

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
30/11/2014	Pump records	42	18.1	5.7
1/12/2014	Pump records	38	17.5	3
2/12/2014	Pump records	29	2.2	2.8
3/12/2014	Pump records	20	4.5	2.9
4/12/2014	Pump records	23	2.8	3.7
5/12/2014	Pump records	23	0.9	2.2
6/12/2014	Pump records	21	3.8	4.4
7/12/2014	Pump records	20	0	2.1
8/12/2014	Pump records	20	0.2	2.3
9/12/2014	Pump records	23	0.1	3.2
10/12/2014	Pump records	20	12	4.2
11/12/2014	Pump records	14	0	5.8
12/12/2014	Pump records	15	1.5	3.8
13/12/2014	Pump records	17	0	6.1
14/12/2014	Pump records	16	0	4.3
15/12/2014	Pump records	15	0	2.9
16/12/2014	Pump records	17	0	2.8
17/12/2014	Pump records	14	0	3.5
18/12/2014	Pump records	14	0	2.1
19/12/2014	Pump records	14	0.9	3.4
20/12/2014	Pump records	30	1.2	2.4
21/12/2014	Pump records	23	16.4	0.6
22/12/2014	Pump records	13	0.3	2.6
23/12/2014	Pump records	19	0	5
24/12/2014	Pump records	10	0	4.1
25/12/2014	Pump records	9	0	2.6
26/12/2014	Pump records	12	0	3.1
27/12/2014	Pump records	15	0	5.2
28/12/2014	Pump records	13	1.7	9.9
29/12/2014	Pump records	16	0	4.8
30/12/2014	Pump records	14	0.1	3.9
31/12/2014	Pump records	13	0	2.9
1/01/2015	Pump records	10	15.3	4.8
2/01/2015	Pump records	13	2.7	5.5
3/01/2015	Pump records	12	0.8	3.9
4/01/2015	Pump records	14	0.8	5.1
5/01/2015	Pump records	17	5	6.9
6/01/2015	Pump records	11	0	5.8
7/01/2015	Pump records	13	0.1	7.1
8/01/2015	Pump records	14	0	5.3
9/01/2015	Pump records	13	0	3.9
10/01/2015	Pump records	15	0	5.3
11/01/2015	Pump records	14	1.9	5.3
12/01/2015	Pump records	14	1	2.8
13/01/2015	Pump records	10	0.1	7.8
14/01/2015	Pump records	10	2.1	3.6
15/01/2015	Pump records	11	0	3.5
16/01/2015	Pump records	10	0.6	3.2
17/01/2015	Pump records	13	0	5.1
18/01/2015	Pump records	14	4.8	5.8
19/01/2015	Pump records	10	5	4.5
20/01/2015	Pump records	23	20.8	3.2
21/01/2015	Pump records	11	0.6	3.3
22/01/2015	Pump records	12	0	4.4
23/01/2015	Pump records	9	0	3.4
24/01/2015	Pump records	12	0	2.7
25/01/2015	Pump records	14	0	4.2
26/01/2015	Pump records	11	0	5.9
27/01/2015	Pump records	9	2.5	2.1
28/01/2015	Pump records	9	0.6	2.1
29/01/2015	Pump records	11	0	2
30/01/2015	Pump records	11	0	3.2
31/01/2015	Pump records	11	0	2.8
1/02/2015	Pump records	17	7.6	4.4
2/02/2015	Pump records	15	0.5	2.3
3/02/2015	Pump records	20	19.6	1.9
4/02/2015	Pump records	28	5	5.2
5/02/2015	Pump records	101	32	6
6/02/2015	Pump records	53	41.4	
7/02/2015	Pump records	17	1.4	
8/02/2015	Pump records	21	0	
9/02/2015	Pump records	69	23.7	
10/02/2015	Pump records	20	0.5	
11/02/2015	Pump records	18	0	

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
12/02/2015	Pump records	16	0	
13/02/2015	Pump records	17	1.7	
14/02/2015	Pump records	19	1.2	
15/02/2015	Pump records	16	0	
16/02/2015	Pump records	17	0	
17/02/2015	Pump records	13	0	
18/02/2015	Pump records	15	0	
19/02/2015	Pump records	13	4.8	
20/02/2015	Pump records	12	0	
21/02/2015	Pump records	17	0	2.1
22/02/2015	Pump records	14	7	1.4
23/02/2015	Pump records	16	0	3.2
24/02/2015	Pump records	13	0	2
25/02/2015	Pump records	13	4.2	2.8
26/02/2015	Pump records	14	0	3.3
27/02/2015	Pump records	17	0	3.2
28/02/2015	Pump records	12	10.2	1.4
1/03/2015	Pump records	14	0	1.6
2/03/2015	Pump records	26	0	2.7
3/03/2015	Pump records	13	12.5	3.5
4/03/2015	Pump records	12	0	2.5
5/03/2015	Pump records	11	0	2.6
6/03/2015	Pump records	11	0	3.9
7/03/2015	Pump records	25	3.6	3
8/03/2015	Pump records	13	16.2	1.8
9/03/2015	Pump records	13	0.1	2.2
10/03/2015	Pump records	10	0	1.3
11/03/2015	Pump records	14	1.9	2.4
12/03/2015	Pump records	12	0	2.1
13/03/2015	Pump records	14	0	2.9
14/03/2015	Pump records	14	3	0
15/03/2015	Pump records	15	0	2.6
16/03/2015	Pump records	17	3.9	
17/03/2015	Pump records	14	4.3	
18/03/2015	Pump records	17	7.1	2.5
19/03/2015	Pump records	13	0.9	3.1
20/03/2015	Pump records	18	0	3.1
21/03/2015	Pump records	18	0	2.8
22/03/2015	Pump records	13	8.6	0.5
23/03/2015	Pump records	15	0	3
24/03/2015	Pump records	15	0	1.6
25/03/2015	Pump records	15	2.9	0.9
26/03/2015	Pump records	13	4.5	0.4
27/03/2015	Pump records	13	0.1	0.9
28/03/2015	Pump records	17	0	1.4
29/03/2015	Pump records	38	17.4	1
30/03/2015	Pump records	40	12	1.7
31/03/2015	Pump records	58	2.8	1
1/04/2015	Pump records	50	1.5	1.6
2/04/2015	Pump records	21	0.1	2.3
3/04/2015	Pump records	19	0	2.3
4/04/2015	Pump records	19	1.2	3.6
5/04/2015	Pump records	15	1.5	1.4
6/04/2015	Pump records	16	0	2.3
7/04/2015	Pump records	16	0	4.2
8/04/2015	Pump records	21	0	2.2
9/04/2015	Pump records	17	3.9	1.5
10/04/2015	Pump records	18	0	2.3
11/04/2015	Pump records	16	3.8	2.4
12/04/2015	Pump records	36	15.4	3
13/04/2015	Pump records	66	17.4	1.3
14/04/2015	Pump records	45	14.9	1.6
15/04/2015	Pump records	27	6.5	2.4
16/04/2015	Pump records	25	0.1	2.4
17/04/2015	Pump records	39	4	2.2
18/04/2015	Pump records	29	12.9	0.1
19/04/2015	Pump records	24	0.2	1.8
20/04/2015	Pump records	32	5.5	2.7
21/04/2015	Pump records	25	1.2	0.9
22/04/2015	Pump records	20	0.2	0.7
23/04/2015	Pump records	20	0	1
24/04/2015	Pump records	20	0	0.6
25/04/2015	Pump records	24	0	1.7
26/04/2015	Pump records	42	14.4	2.3

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
27/04/2015	Pump records	35	2.1	1.1
28/04/2015	Pump records	28	4	1.1
29/04/2015	Pump records	31	9.8	2.9
30/04/2015	Pump records	38	11.5	1
1/05/2015	Pump records	29	1.1	4.7
2/05/2015	Pump records	24	0.2	3.9
3/05/2015	Pump records	24	0	3.4
4/05/2015	Pump records	21	0	1.2
5/05/2015	Pump records	19	0.1	1.9
6/05/2015	Pump records	27	0	1.2
7/05/2015	Pump records	23	9.5	0.9
8/05/2015	Pump records	20	1	2.9
9/05/2015	Pump records	30	0	1.7
10/05/2015	Pump records	25	11.6	0.2
11/05/2015	Pump records	25	0	2
12/05/2015	Pump records	54	19	1.9
13/05/2015	Pump records	28	8.1	0.8
14/05/2015	Pump records	28	0.2	1.4
15/05/2015	Pump records	23	1.4	2.2
16/05/2015	Pump records	27	7.7	0
17/05/2015	Pump records	27	5.3	1.5
18/05/2015	Pump records	26	3.8	3.5
19/05/2015	Pump records	26	3.6	0.7
20/05/2015	Pump records	24	0	2.1
21/05/2015	Pump records	30	1.2	2.5
22/05/2015	Pump records	20	9.9	1.6
23/05/2015	Pump records	41	8.3	1.9
24/05/2015	Pump records	38	11.6	1.9
25/05/2015	Pump records	69	10.4	1.8
26/05/2015	Pump records	62	21.1	2.4
27/05/2015	Pump records	59	17.7	1
28/05/2015	Pump records	36	0.9	1.2
29/05/2015	Pump records	32	0	1.1
30/05/2015	Pump records	30	0	1.8
31/05/2015	Pump records	29	0	0.6
1/06/2015	Pump records	26	0	1.3
2/06/2015	Pump records	25	0	2.9
3/06/2015	Pump records	299	10	0.1
4/06/2015	Pump records	199	70.4	0.3
5/06/2015	Pump records	48	13.3	1.5
6/06/2015	Pump records	38	0.5	2
7/06/2015	Pump records	36	2.1	2
8/06/2015	Pump records	31	0	0.8
9/06/2015	Pump records	35	0	2.3
10/06/2015	Pump records	35	12.6	3.6
11/06/2015	Pump records	81	17.5	1.4
12/06/2015	Pump records	95	16.3	2.9
13/06/2015	Pump records	107	8.6	0.5
14/06/2015	Pump records	79	32.1	1.6
15/06/2015	Pump records	71	5.8	1.4
16/06/2015	Pump records	52	14.8	1.7
17/06/2015	Pump records	41	0	3.2
18/06/2015	Pump records	72	17	3.5
19/06/2015	Pump records	62	4.4	1
20/06/2015	Pump records	50	6.7	0.9
21/06/2015	Pump records	68	4.8	1.8
22/06/2015	Pump records	54	9.8	0.6
23/06/2015	Pump records	41	0	0.9
24/06/2015	Pump records	37	0	0.9
25/06/2015	Pump records	33	0	1.4
26/06/2015	Pump records	43	2.1	1.4
27/06/2015	Pump records	40	7.8	0
28/06/2015	Pump records	44	9.1	2.5
29/06/2015	Pump records	39	4.3	3.9
30/06/2015	Pump records	31	1.3	1.9
1/07/2015	Pump records	26	4.1	1.3
2/07/2015	Pump records	30	0.5	2.4
3/07/2015	Pump records	43	6.6	2.5
4/07/2015	Pump records	31	2.7	2.5
5/07/2015	Pump records	82	10.1	2.6
6/07/2015	Pump records	86	20.5	1.7
7/07/2015	Pump records	56	12.7	0.5
8/07/2015	Pump records	76	10.6	0.9
9/07/2015	Pump records	40	8	0.7

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
10/07/2015	Pump records	44	1.4	0.8
11/07/2015	Pump records	35	0	0.5
12/07/2015	Pump records	32	0	0.9
13/07/2015	Pump records	31	0	0.9
14/07/2015	Pump records	28	0	1.3
15/07/2015	Pump records	27	0	2.7
16/07/2015	Pump records	44	5.8	1.4
17/07/2015	Pump records	27	0.2	0.9
18/07/2015	Pump records	36	5.7	1.5
19/07/2015	Pump records	26	5.6	0.8
20/07/2015	Pump records	37	10.5	1.8
21/07/2015	Pump records	29	3.1	3.4
22/07/2015	Pump records	29	1.6	0
23/07/2015	Pump records	25	0	1.5
24/07/2015	Pump records	24	1.4	2.5
25/07/2015	Pump records	21	0	1
26/07/2015	Pump records	25	0	2
27/07/2015	Pump records	24	0.2	0.8
28/07/2015	Pump records	23	11	1.2
29/07/2015	Pump records	26	1	1.4
30/07/2015	Pump records	23	0	1.6
31/07/2015	Pump records	21	0	1.4
1/08/2015	Pump records	34	8.5	2
2/08/2015	Pump records	21	0	1
3/08/2015	Pump records	21	0	0.8
4/08/2015	Pump records	34	4.6	1.9
5/08/2015	Pump records	25	4.8	0.4
6/08/2015	Pump records	25	0	1.9
7/08/2015	Pump records	28	4.9	1.7
8/08/2015	Pump records	25	12	1.1
9/08/2015	Pump records	29	7	0.9
10/08/2015	Pump records	25	1.5	1
11/08/2015	Pump records	23	0	1.2
12/08/2015	Pump records	21	0	1.1
13/08/2015	Pump records	24	0	1.2
14/08/2015	Pump records	21	0.2	2.4
15/08/2015	Pump records	86	0	1.1
16/08/2015	Pump records	48	34.5	0.4
17/08/2015	Pump records	31	0	2.3
18/08/2015	Pump records	31	0	1.8
19/08/2015	Pump records	30	2.5	0.9
20/08/2015	Pump records	26	4.5	1.1
21/08/2015	Pump records	28	2.4	2.7
22/08/2015	Pump records	29	0.2	1
23/08/2015	Pump records	24	0	1.7
24/08/2015	Pump records	89	12.7	1.9
25/08/2015	Pump records	52	24.1	0.9
26/08/2015	Pump records	32	2.5	2.8
27/08/2015	Pump records	31	0	2.6
28/08/2015	Pump records	27	0	1.7
29/08/2015	Pump records	33	3.8	1.9
30/08/2015	Pump records	29	3	0.3
31/08/2015	Pump records	30	0.1	1.3
1/09/2015	Pump records	25	0	2.1
2/09/2015	Pump records	46	2.3	2.7
3/09/2015	Pump records	40	17.9	0.1
4/09/2015	Pump records	36	7	1.5
5/09/2015	Pump records	42	7.7	2.7
6/09/2015	Pump records	44	6.7	0
7/09/2015	Pump records	46	22.7	2.1
8/09/2015	Pump records	33	4	2.9
9/09/2015	Pump records	31	1.8	1.9
10/09/2015	Pump records	40	0	3.1
11/09/2015	Pump records	43	14.9	0.7
12/09/2015	Pump records	36	6.3	0.7
13/09/2015	Pump records	29	3.2	3.5
14/09/2015	Pump records	29	1	1.6
15/09/2015	Pump records	32	0	2.1
16/09/2015	Pump records	29	0.5	0.5
17/09/2015	Pump records	29	1.9	1.2
18/09/2015	Pump records	27	0	3
19/09/2015	Pump records	27	4.2	1.4
20/09/2015	Pump records	25	0.9	2.2
21/09/2015	Pump records	25	0	2.1

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
22/09/2015	Pump records	21	0	2.2
23/09/2015	Pump records	26	0	2.5
24/09/2015	Pump records	21	0	1.6
25/09/2015	Pump records	20	0	2.7
26/09/2015	Pump records	23	1.8	1
27/09/2015	Pump records	23	0	1.2
28/09/2015	Pump records	24	0	1.9
29/09/2015	Pump records	19	0	1.4
30/09/2015	Pump records	19	0	1.1
1/10/2015	Pump records	25	0	1.9
2/10/2015	Pump records	17	0	2.6
3/10/2015	Pump records	19	0	2.9
4/10/2015	Pump records	24	0	7.1
5/10/2015	Pump records	18	18.9	4.1
6/10/2015	Pump records	17	0.2	4.3
7/10/2015	Pump records	24	12.5	3.6
8/10/2015	Pump records	18	0	8.3
9/10/2015	Pump records	20	2	4.3
10/10/2015	Pump records	19	2.1	3
11/10/2015	Pump records	16	0	4.8
12/10/2015	Pump records	31	1.3	5.4
13/10/2015	Pump records	28	23.5	4.8
14/10/2015	Pump records	19	4.8	3.6
15/10/2015	Pump records	19	0.9	2.7
16/10/2015	Pump records	66	0	4.4
17/10/2015	Pump records	223	59.9	4.6
18/10/2015	Pump records	40	2.8	2.1
19/10/2015	Pump records	52	14.5	2.7
20/10/2015	Pump records	32	8.3	3
21/10/2015	Pump records	35	0	2.7
22/10/2015	Pump records	27	12	7.1
23/10/2015	Pump records	27	1	4.6
24/10/2015	Pump records	24	4.3	3.8
25/10/2015	Pump records	28	6.8	5.2
26/10/2015	Pump records	36	0	4.2
27/10/2015	Pump records	43	17.3	3
28/10/2015	Pump records	25	0	3.1
29/10/2015	Pump records	24	6.9	3.4
30/10/2015	Pump records	23	4.5	3.9
31/10/2015	Pump records	24	1.6	4.6
1/11/2015	Magflow	19	1.2	4.4
2/11/2015	Magflow	24	0	4.1
3/11/2015	Magflow	33	5.4	4.6
4/11/2015	Magflow	30	4.4	1.7
5/11/2015	Magflow	21	0	3.6
6/11/2015	Magflow	21	0	5
7/11/2015	Magflow	28	0	4.2
8/11/2015	Magflow	35	12.1	1.8
9/11/2015	Magflow	25	4.5	0.9
10/11/2015	Magflow	27	4.6	2.4
11/11/2015	Magflow	21	0	1.7
12/11/2015	Magflow	29	8.5	4.3
13/11/2015	Magflow	23	0	3.1
14/11/2015	Magflow	27	0	3.1
15/11/2015	Magflow	24	11.6	6.3
16/11/2015	Magflow	19	0.1	4.2
17/11/2015	Magflow	20	1.7	6.9
18/11/2015	Magflow	19	7.9	4.7
19/11/2015	Magflow	27	0	4.3
20/11/2015	Magflow	35	6.9	2.8
21/11/2015	Magflow	27	0.8	3.2
22/11/2015	Magflow	42	11	4
23/11/2015	Magflow	35	5.9	4.2
24/11/2015	Magflow	38	9.7	3.5
25/11/2015	Magflow	24	0.2	5.3
26/11/2015	Magflow	23	0	4.9
27/11/2015	Magflow	43	14	8.5
28/11/2015	Magflow	29	3	4.7
29/11/2015	Magflow	27	9.4	3.4
30/11/2015	Magflow	25	0	3.4
1/12/2015	Magflow	23	0	3.1
2/12/2015	Magflow	24	0	3.6
3/12/2015	Magflow	35	3	4
4/12/2015	Magflow	20	7.9	4.6

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
5/12/2015	Magflow	37	0.4	6.9
6/12/2015	Magflow	23	13.7	1.9
7/12/2015	Magflow	30	6.2	6.2
8/12/2015	Magflow	20	4.5	5.4
9/12/2015	Magflow	26	11.8	3.1
10/12/2015	Magflow	20	0	4.4
11/12/2015	Magflow	19	0	4.7
12/12/2015	Magflow	19	0	5.3
13/12/2015	Magflow	47	21.1	3.4
14/12/2015	Magflow	43	20.5	6
15/12/2015	Magflow	29		1.1
16/12/2015	Magflow	32	15	
17/12/2015	Magflow	25	2.7	
18/12/2015	Magflow	20	0.3	3.7
19/12/2015	Magflow	26	0	3.9
20/12/2015	Magflow	24	0	5.1
21/12/2015	Magflow	34	0	6.1
22/12/2015	Magflow	27	18.5	13
23/12/2015	Magflow	17	0	7.3
24/12/2015	Magflow	20	1.7	6.3
25/12/2015	Magflow	16	0	8.5
26/12/2015	Magflow	17	0	3.9
27/12/2015	Magflow	21	0	4.8
28/12/2015	Magflow	21	0	2.6
29/12/2015	Magflow	17	0.5	3.2
30/12/2015	Magflow	21	1	1.4
31/12/2015	Magflow	19	0	3.7
1/01/2016	Magflow	29	0	4.4
2/01/2016	Magflow	26	0	3.9
3/01/2016	Magflow	31	0.4	3
4/01/2016	Magflow	17	3.4	4.5
5/01/2016	Magflow	15	0	5.7
6/01/2016	Magflow	17	0	4.3
7/01/2016	Magflow	18	0	4
8/01/2016	Magflow	20	3.5	6
9/01/2016	Magflow	24	12.8	9.6
10/01/2016	Magflow	19	1.9	8.9
11/01/2016	Magflow	18	0	7.3
12/01/2016	Magflow	47	0	6
13/01/2016	Magflow	25	19.7	6.5
14/01/2016	Magflow	18	12.5	5.3
15/01/2016	Magflow	71	0	4.7
16/01/2016	Magflow	23	14.1	2
17/01/2016	Magflow	18	0	4.2
18/01/2016	Magflow	18	0	3.5
19/01/2016	Magflow	17	0	3.7
20/01/2016	Magflow	18	0	0.6
21/01/2016	Magflow	23	13.3	3.5
22/01/2016	Magflow	21	0	2.5
23/01/2016	Magflow	26	4.7	2.7
24/01/2016	Magflow	52	16.5	2
25/01/2016	Magflow	82	9.4	2.8
26/01/2016	Magflow	48	18.2	1
27/01/2016	Magflow	40	1.4	3.6
28/01/2016	Magflow	54	0.7	6
29/01/2016	Magflow	24	0	4.3
30/01/2016	Magflow	25	0	3.3
31/01/2016	Magflow	24	0	3.8
1/02/2016	Magflow	27	0	2.2
2/02/2016	Magflow	24	0.9	3.6
3/02/2016	Magflow	26	0	2.5
4/02/2016	Magflow	25	0	5
5/02/2016	Magflow	24	3.1	5.6
6/02/2016	Magflow	23	0.2	8.1
7/02/2016	Magflow	26	0	4.6
8/02/2016	Magflow	28	0	3.5
9/02/2016	Magflow	24	0	4.8
10/02/2016	Magflow	23	0	4.6
11/02/2016	Magflow	37	4.3	5.8
12/02/2016	Magflow	27	7.2	2.9
13/02/2016	Magflow	25	0	3.2
14/02/2016	Magflow	33	0	3.7
15/02/2016	Magflow	51	0	5.5
16/02/2016	Magflow	26	12.6	3.8

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
17/02/2016	Magflow	44	0	6.1
18/02/2016	Magflow	37	27.1	3.2
19/02/2016	Magflow	29	2.1	2.9
20/02/2016	Magflow	27	0	5.7
21/02/2016	Magflow	31	0.6	6.1
22/02/2016	Magflow	19	0	5.6
23/02/2016	Magflow	19	0.2	5.4
24/02/2016	Magflow	18	0	4.8
25/02/2016	Magflow	105	22.3	6.8
26/02/2016	Magflow	47	35.7	1.8
27/02/2016	Magflow	28	4	3.4
28/02/2016	Magflow	27	1.7	8.7
29/02/2016	Magflow	29	7.2	8
1/03/2016	Magflow	21	0	
2/03/2016	Magflow	23	3	3.5
3/03/2016	Magflow	24	0	3.6
4/03/2016	Magflow	20	0	4.8
5/03/2016	Magflow	26	0	1.7
6/03/2016	Magflow	21	5.2	6.4
7/03/2016	Magflow	20	0	5.4
8/03/2016	Magflow	18	3.1	3.6
9/03/2016	Magflow	21	3.8	7.3
10/03/2016	Magflow	37	11.8	5.7
11/03/2016	Magflow	21	4.9	4.4
12/03/2016	Magflow	26	0	4.6
13/03/2016	Magflow	16	0	3.6
14/03/2016	Magflow	24	0.5	1.2
15/03/2016	Magflow	26	12.2	4
16/03/2016	Magflow	19	2.1	1.9
17/03/2016	Magflow	17	0	4.1
18/03/2016	Magflow	16	0	2.5
19/03/2016	Magflow	18	0	3.2
20/03/2016	Magflow	25	0.6	2.7
21/03/2016	Magflow	16	2	2.5
22/03/2016	Magflow	18	0	2.1
23/03/2016	Magflow	18	2	3.1
24/03/2016	Magflow	19	2.4	1.9
25/03/2016	Magflow	16	0.6	3
26/03/2016	Magflow	12	0	2.7
27/03/2016	Magflow	13	0	0.7
28/03/2016	Magflow	21	0.5	2.2
29/03/2016	Magflow	37	4.4	4.7
30/03/2016	Magflow	18	12.4	2.4
31/03/2016	Magflow	20	0	3.1
1/04/2016	Magflow	16	0.5	2
2/04/2016	Magflow	19	0	1.5
3/04/2016	Magflow	24	2.4	2.4
4/04/2016	Magflow	20	4.3	2.4
5/04/2016	Magflow	19	2.8	3.6
6/04/2016	Magflow	15	1.4	1
7/04/2016	Magflow	29	0	4.1
8/04/2016	Magflow	25	8.2	0
9/04/2016	Magflow	21	0	4.8
10/04/2016	Magflow	17	0	4
11/04/2016	Magflow	28	14.8	7
12/04/2016	Magflow	32	0	5.5
13/04/2016	Magflow	24	7	5.2
14/04/2016	Magflow	30	5.3	5.8
15/04/2016	Magflow	30	7.5	5.6
16/04/2016	Magflow	20	0	3
17/04/2016	Magflow	38	6.6	2.7
18/04/2016	Magflow	25	3.5	6.5
19/04/2016	Magflow	19	0.6	4.6
20/04/2016	Magflow	27	0.7	4.7
21/04/2016	Magflow	18	5.8	0.5
22/04/2016	Magflow	17	0	2.8
23/04/2016	Magflow	41	11.8	3.1
24/04/2016	Magflow	44	14.1	6.3
25/04/2016	Magflow	28	4.8	4.6
26/04/2016	Magflow	29	0	6.7
27/04/2016	Magflow	20	0	3.2
28/04/2016	Magflow	20	0	4
29/04/2016	Magflow	43	5.9	4.8
30/04/2016	Magflow	25	9.8	0.5

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
1/05/2016	Magflow	23	0.3	1.5
2/05/2016	Magflow	23	0.1	0.8
3/05/2016	Magflow	23	0	5.3
4/05/2016	Magflow	35	0	4.7
5/05/2016	Magflow	30	10.8	6
6/05/2016	Magflow	18	0	3.3
7/05/2016	Magflow	28	0	3.8
8/05/2016	Magflow	26	0	2
9/05/2016	Magflow	45	12.8	2.7
10/05/2016	Magflow	29	0.6	1.6
11/05/2016	Magflow	30	0.4	2.1
12/05/2016	Magflow	36	0	2.8
13/05/2016	Magflow	33	9.6	4.9
14/05/2016	Magflow	52	8.2	5
15/05/2016	Magflow	55	8.1	4
16/05/2016	Magflow	66	11.3	2.7
17/05/2016	Magflow	49	18.2	1
18/05/2016	Magflow	51	0.1	2.1
19/05/2016	Magflow	157	37.6	4.1
20/05/2016	Magflow	48	3.5	2
21/05/2016	Magflow	46	1.8	2
22/05/2016	Magflow	70	16.8	2.3
23/05/2016	Magflow	124	40.9	5.3
24/05/2016	Magflow	60	4.6	2
25/05/2016	Magflow	46	0	1.2
26/05/2016	Magflow	46	3.5	1.3
27/05/2016	Magflow	43	7	1
28/05/2016	Magflow	46	1.7	1.5
29/05/2016	Magflow	64	15	0.3
30/05/2016	Magflow	53	5.7	1.6
31/05/2016	Magflow	90	16	1.5
1/06/2016	Magflow	54	6.2	3.3
2/06/2016	Magflow	51	2.3	2.1
3/06/2016	Magflow	67	7.4	0
4/06/2016	Magflow	49	8.3	1.3
5/06/2016	Magflow	42	0	3.5
6/06/2016	Magflow	38	0	1.2
7/06/2016	Magflow	35	0	1.6
8/06/2016	Magflow	34	0	1.3
9/06/2016	Magflow	35	1.9	1.9
10/06/2016	Magflow	32	0	1.1
11/06/2016	Magflow	32	0.9	4.8
12/06/2016	Magflow	39	1.6	4.4
13/06/2016	Magflow	33	2.8	4.4
14/06/2016	Magflow	30	8.8	3.9
15/06/2016	Magflow	36	2.6	4
16/06/2016	Magflow	31	0	6.6
17/06/2016	Magflow	27	0	2.3
18/06/2016	Magflow	37	0	2.1
19/06/2016	Magflow	36	8.9	3.8
20/06/2016	Magflow	36	0	2.7
21/06/2016	Magflow	34	13.9	1.3
22/06/2016	Magflow	29	0	0
23/06/2016	Magflow	36	2.4	2.4
24/06/2016	Magflow	29	4.4	0.8
25/06/2016	Magflow	29	0	1.5
26/06/2016	Magflow	26	0	0.7
27/06/2016	Magflow	27	0	0
28/06/2016	Magflow	32	3.4	0.4
29/06/2016	Magflow	30	0	1.2
30/06/2016	Magflow	31	2.5	3.3
1/07/2016	Magflow	27	0	2.8
2/07/2016	Magflow	27	0	1.7
3/07/2016	Magflow	27	2	2.3
4/07/2016	Magflow	33	0	3.2
5/07/2016	Magflow	31	9.3	3.5
6/07/2016	Magflow	29	0.4	3.3
7/07/2016	Magflow	28	0	3
8/07/2016	Magflow	29	2.4	1.2
9/07/2016	Magflow	28	0	1.2
10/07/2016	Magflow	26	0	0.7
11/07/2016	Magflow	26	0	1.6
12/07/2016	Magflow	27	0	1.7
13/07/2016	Magflow	26	2.9	3.3

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
14/07/2016	Magflow	29	0	3.6
15/07/2016	Magflow	78	13.2	2
16/07/2016	Magflow	46	16.7	3.5
17/07/2016	Magflow	61	13.3	5
18/07/2016	Magflow	57	19.2	2.9
19/07/2016	Magflow	54	8.8	2
20/07/2016	Magflow	52	3	2.9
21/07/2016	Magflow	48	11.8	5.4
22/07/2016	Magflow	38	0	5.5
23/07/2016	Magflow	35	0	4.4
24/07/2016	Magflow	51	8.6	4.4
25/07/2016	Magflow	43	8	1.2
26/07/2016	Magflow	40	5.3	4
27/07/2016	Magflow	36	0.6	3.3
28/07/2016	Magflow	37	4.8	2.3
29/07/2016	Magflow	34	2.1	2.1
30/07/2016	Magflow	47	3.3	4.5
31/07/2016	Magflow	80	17.9	1.6
1/08/2016	Magflow	56	7	3.5
2/08/2016	Magflow	43	1.2	1.6
3/08/2016	Magflow	37	0	1.9
4/08/2016	Magflow	43	9	0.7
5/08/2016	Magflow	38	1.2	1.8
6/08/2016	Magflow	36	2.1	1.4
7/08/2016	Magflow	34	0	1.5
8/08/2016	Magflow	34	0.5	1.5
9/08/2016	Magflow	33	0.8	0
10/08/2016	Magflow	29	0	1.6
11/08/2016	Magflow	31	0	2.7
12/08/2016	Magflow	30	0	4.8
13/08/2016	Magflow	29	0	2.2
14/08/2016	Magflow	29	0	2.1
15/08/2016	Magflow	27	0	2.7
16/08/2016	Magflow	28	2	3.3
17/08/2016	Magflow	29	0	3
18/08/2016	Magflow	27	0.8	3
19/08/2016	Magflow	28	0	2.3
20/08/2016	Magflow	27	0	2.6
21/08/2016	Magflow	26	0	3.1
22/08/2016	Magflow	29	2.2	1.3
23/08/2016	Magflow	26	0.9	2.8
24/08/2016	Magflow	28	0	2.8
25/08/2016	Magflow	27	2.8	1.9
26/08/2016	Magflow	30	0	1.6
27/08/2016	Magflow	28	2.5	0.1
28/08/2016	Magflow	27	0.5	3.8
29/08/2016	Magflow	26	0	3.9
30/08/2016	Magflow	25	0	4.7
31/08/2016	Magflow	27	0.3	4.2
1/09/2016	Magflow	23	0	2.8
2/09/2016	Magflow	31	4.7	4.2
3/09/2016	Magflow	32	11.9	4.3
4/09/2016	Magflow	17	2.7	2.7
5/09/2016	Magflow	26	5.4	2.9
6/09/2016	Magflow	27	2.6	4
7/09/2016	Magflow	34	8.9	6.6
8/09/2016	Magflow	21	6.3	2.4
9/09/2016	Magflow	24	0.5	3.5
10/09/2016	Magflow	18	0	2.7
11/09/2016	Magflow	23	0	2.3
12/09/2016	Magflow	29	0	2.3
13/09/2016	Magflow	19	8.7	3.1
14/09/2016	Magflow	17	0	6.2
15/09/2016	Magflow	20	0	5.2
16/09/2016	Magflow	18	1.7	3.5
17/09/2016	Magflow	17	0	2
18/09/2016	Magflow	16	0.6	1.7
19/09/2016	Magflow	17	0.5	3.4
20/09/2016	Magflow	16	0	2.7
21/09/2016	Magflow	14	0	3.1
22/09/2016	Magflow	16	0	2.8
23/09/2016	Magflow	17	0	
24/09/2016	Magflow	15	0	1.3
25/09/2016	Magflow	16	0	1.5

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
26/09/2016	Magflow	15	0	3.1
27/09/2016	Magflow	16	0	2.3
28/09/2016	Magflow	15	0	1.1
29/09/2016	Magflow	17	0	1.5
30/09/2016	Magflow	16	0	1.7
1/10/2016	Magflow	15	0	0.8
2/10/2016	Magflow	18	0	0.9
3/10/2016	Magflow	17	2	1
4/10/2016	Magflow	16	5.8	1.9
5/10/2016	Magflow	21	0	1.7
6/10/2016	Magflow	18	6.3	1.7
7/10/2016	Magflow	15	0	3.4
8/10/2016	Magflow	24	6.9	5.5
9/10/2016	Magflow	17	3.7	4.3
10/10/2016	Magflow	15	0	3.3
11/10/2016	Magflow	18	2.1	5.7
12/10/2016	Magflow	16	6.4	1.6
13/10/2016	Magflow	19	2	2.6
14/10/2016	Magflow	17	14	2.1
15/10/2016	Magflow	18	1.5	5.5
16/10/2016	Magflow	16	0	4.4
17/10/2016	Magflow	14	0.2	6.8
18/10/2016	Magflow	18	1.9	7.5
19/10/2016	Magflow	26	12.3	0.9
20/10/2016	Magflow	27	13.5	3.1
21/10/2016	Magflow	23	0.2	2.9
22/10/2016	Magflow	20	0	2.9
23/10/2016	Magflow	15	0	4.4
24/10/2016	Magflow	17	0	3.4
25/10/2016	Magflow	18	0.3	2.8
26/10/2016	Magflow	19		3.2
27/10/2016	Magflow	20	4.2	2.2
28/10/2016	Magflow	46	11.5	1.9
29/10/2016	Magflow	39	24.5	1.5
30/10/2016	Magflow	27	0.5	3.7
31/10/2016	Magflow	21	0	2.5
1/11/2016	Magflow	18	0	4.3
2/11/2016	Magflow	19	1.7	3.8
3/11/2016	Magflow	20	0.4	3.2
4/11/2016	Magflow	21	9.5	4.3
5/11/2016	Magflow	18	2	3.2
6/11/2016	Magflow	17	0.6	4
7/11/2016	Magflow	19	4.1	2.6
8/11/2016	Magflow	17	0.2	4.5
9/11/2016	Magflow	26	4.3	5
10/11/2016	Magflow	18	0	3.8
11/11/2016	Magflow	19	1	4.2
12/11/2016	Magflow	21	0.2	4.7
13/11/2016	Magflow	17	0.6	4.7
14/11/2016	Magflow	18	4.5	3
15/11/2016	Magflow	20	0	2
16/11/2016	Magflow	29	5	1
17/11/2016	Magflow	23	9.6	2.7
18/11/2016	Magflow	27	3.3	4.3
19/11/2016	Magflow	28	1.3	6.4
20/11/2016	Magflow	21	6.9	8.8
21/11/2016	Magflow	19	12.4	4.9
22/11/2016	Magflow	20	1.6	0.8
23/11/2016	Magflow	26	5.7	9
24/11/2016	Magflow	33	11.3	3.4
25/11/2016	Magflow	26	1.5	1.5
26/11/2016	Magflow	23	0	5.4
27/11/2016	Magflow	34	10.1	5.9
28/11/2016	Magflow	25	10.4	4.4
29/11/2016	Magflow	24	3.9	5.7
30/11/2016	Magflow	21	4.1	3.5
1/12/2016	Magflow	24	0.4	4.8
2/12/2016	Magflow	25	1	3.6
3/12/2016	Magflow	29	0	4.3
4/12/2016	Magflow	30	8.1	2.9
5/12/2016	Magflow	28	0	4.8
6/12/2016	Magflow	20	0.3	3.7
7/12/2016	Magflow	15	2.5	5.3
8/12/2016	Magflow	16	0	2.8

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
9/12/2016	Magflow	14	0	3.5
10/12/2016	Magflow	17	0	5.4
11/12/2016	Magflow	14	4.2	5.6
12/12/2016	Magflow	18	11	6
13/12/2016	Magflow	14	0.8	7.1
14/12/2016	Magflow	16	1.6	4.7
15/12/2016	Magflow	23	4.9	8.9
16/12/2016	Magflow	27	13.8	7.6
17/12/2016	Magflow	17	7.4	1.8
18/12/2016	Magflow	31	0.3	5.1
19/12/2016	Magflow	25	0	5.7
20/12/2016	Magflow	19	0	6.7
21/12/2016	Magflow	18		5.7
22/12/2016	Magflow	21	8.1	9.3
23/12/2016	Magflow	19	4.9	6
24/12/2016	Magflow	20	2.3	4.9
25/12/2016	Magflow	16	0.6	2.6
26/12/2016	Magflow	19	0	4.8
27/12/2016	Magflow	26	3.3	4.6
28/12/2016	Magflow	23	1.5	6.1
29/12/2016	Magflow	18	4.7	5.5
30/12/2016	Magflow	17	0.3	4.9
31/12/2016	Magflow	15	0	4.1
1/01/2017	Magflow	18	2.6	3.2
2/01/2017	Magflow	17	0.5	3.3
3/01/2017	Magflow	18	4	5.4
4/01/2017	Magflow	19	3.1	3
5/01/2017	Magflow	16	9.1	6
6/01/2017	Magflow	19	1.9	6.5
7/01/2017	Magflow	17	2	5.9
8/01/2017	Magflow	33	11.3	3.4
9/01/2017	Magflow	20	23	0.9
10/01/2017	Magflow	17	1	5.4
11/01/2017	Magflow	18	0	4.1
12/01/2017	Magflow	17	6.4	5.9
13/01/2017	Magflow	46	23.1	7.3
14/01/2017	Magflow	23	9	3.4
15/01/2017	Magflow	21	1	6
16/01/2017	Magflow	42	0	7.4
17/01/2017	Magflow	37	28.9	4.2
18/01/2017	Magflow	43	10.1	2.2
19/01/2017	Magflow	68	13.6	4.3
20/01/2017	Magflow	43	24	3.2
21/01/2017	Magflow	34	1.2	4.1
22/01/2017	Magflow	72	5.5	3.6
23/01/2017	Magflow	99	38.4	1.7
24/01/2017	Magflow	42	0	7.1
25/01/2017	Magflow	55	9	6.5
26/01/2017	Magflow	48	10.7	4.6
27/01/2017	Magflow	62	12.2	3.8
28/01/2017	Magflow	49	4.5	4.7
29/01/2017	Magflow	38	0	6.9
30/01/2017	Magflow	36	3.4	3.9
31/01/2017	Magflow	86	0	6.3
1/02/2017	Magflow	84	31.7	2.5
2/02/2017	Magflow	43	0	6.4
3/02/2017	Magflow	38	3.9	2.6
4/02/2017	Magflow	36	0	5.9
5/02/2017	Magflow	34	0	5.3
6/02/2017	Magflow	37	0	7.7
7/02/2017	Magflow	34	10.3	4.6
8/02/2017	Magflow	33	3	5.9
9/02/2017	Magflow	30	0	4.2
10/02/2017	Magflow	33	3	4.3
11/02/2017	Magflow	31	1.4	4.2
12/02/2017	Magflow	28	0	3.1
13/02/2017	Magflow	44	15.2	1.5
14/02/2017	Magflow	50	17.1	3
15/02/2017	Magflow	40	5.3	3.9
16/02/2017	Magflow	34	0.1	3.9
17/02/2017	Magflow	33	0	3.6
18/02/2017	Magflow	32	0	3.9
19/02/2017	Magflow	34	0	2.8
20/02/2017	Magflow	31	0	3.5

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
21/02/2017	Magflow	30	0	1.9
22/02/2017	Magflow	28	0	1.6
23/02/2017	Magflow	27	8.7	3.9
24/02/2017	Magflow	29	0	3.9
25/02/2017	Magflow	28	0.6	3.5
26/02/2017	Magflow	27	4	1.2
27/02/2017	Magflow	26	1.9	4.9
28/02/2017	Magflow	28	0	4.1
1/03/2017	Magflow	26	0	3.4
2/03/2017	Magflow	30	0	4.7
3/03/2017	Magflow	28	9.1	1.5
4/03/2017	Magflow	25	5.7	5.6
5/03/2017	Magflow	24	0.1	6
6/03/2017	Magflow	36	0	3.9
7/03/2017	Magflow	28	8.4	4.7
8/03/2017	Magflow	27	2.2	4.3
9/03/2017	Magflow	26	1.6	2.7
10/03/2017	Magflow	24	0	2.9
11/03/2017	Magflow	26	0	0
12/03/2017	Magflow	25	0	2.8
13/03/2017	Magflow	27	1.7	0.7
14/03/2017	Magflow	25	0.2	3.2
15/03/2017	Magflow	26	0.3	1.5
16/03/2017	Magflow	28	0	2.9
17/03/2017	Magflow	26	0	2.7
18/03/2017	Magflow	28	8.1	3
19/03/2017	Magflow	30	0	4.6
20/03/2017	Magflow	31	0	5.5
21/03/2017	Magflow	25	0.6	2.8
22/03/2017	Magflow	27	0	5.5
23/03/2017	Magflow	26	3.2	3.3
24/03/2017	Magflow	23	0	4.9
25/03/2017	Magflow	21	1.1	4.6
26/03/2017	Magflow	20		5.2
27/03/2017	Magflow	24	11.5	1.1
28/03/2017	Magflow	26	0	2.8
29/03/2017	Magflow	25	0	2.2
30/03/2017	Magflow	24	0	1.4
31/03/2017	Magflow	24	0.3	2.9
1/04/2017	Magflow	26	3.3	1.2
2/04/2017	Magflow	27	0.1	4.5
3/04/2017	Magflow	25	0	4.1
4/04/2017	Magflow	24	0	2.8
5/04/2017	Magflow	23	0	2.5
6/04/2017	Magflow	17	0	4.7
7/04/2017	Magflow	23	0	3.6
8/04/2017	Magflow	22	0.2	2.1
9/04/2017	Magflow	24	0	2.5
10/04/2017	Magflow	23	0	3.3
11/04/2017	Magflow	21	0	2.3
12/04/2017	Magflow	32	3.1	2.7
13/04/2017	Magflow	25	5.4	0.5
14/04/2017	Magflow	21	0.4	1.5
15/04/2017	Magflow	26	2.5	0.2
16/04/2017	Magflow	27	9.8	2.2
17/04/2017	Magflow	24	0	2.7
18/04/2017	Magflow	21	1.1	1.5
19/04/2017	Magflow	24	0.8	2.9
20/04/2017	Magflow	23	1.5	1.8
21/04/2017	Magflow	24	2.5	2.8
22/04/2017	Magflow	23	0.2	3.6
23/04/2017	Magflow	28	0	3.9
24/04/2017	Magflow	26	4.5	2.6
25/04/2017	Magflow	23	0	1.9
26/04/2017	Magflow	21	0	1
27/04/2017	Magflow	24	0.1	2.2
28/04/2017	Magflow	23	2.4	2.3
29/04/2017	Magflow	24	0	4
30/04/2017	Magflow	48	18.3	2.3
1/05/2017	Magflow	25	2.8	2.9
2/05/2017	Magflow	24	0.4	2.2
3/05/2017	Magflow	87	20.9	3.7
4/05/2017	Magflow	52	16.6	0
5/05/2017	Magflow	31	1.7	2.6

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Date	Source	Daily Recorded Inflow to WWTP (m^3/day)	Rainfall (mm/day)	Evaporation - Open Water (mm/day)
6/05/2017	Magflow	29	2.3	2.3
7/05/2017	Magflow	30	0.1	1.5
8/05/2017	Magflow	29	0	1.6
9/05/2017	Magflow	28	0	1.6
10/05/2017	Magflow	26	0	1.8
11/05/2017	Magflow	25	0	1.7
12/05/2017	Magflow	28	5.6	0.8
13/05/2017	Magflow	25	0	1.5
14/05/2017	Magflow	28	2	1.7
15/05/2017	Magflow	27	2.9	0.9
16/05/2017	Magflow	24	0.1	1.6
17/05/2017	Magflow	24	0	0.8
18/05/2017	Magflow	30	2.9	1.2
19/05/2017	Magflow	40	14.9	3.1
20/05/2017	Magflow	46	25.1	1.6
21/05/2017	Magflow	41	0	1.5
22/05/2017	Magflow	34	8.8	1.1
23/05/2017	Magflow	29	0.5	2.2
24/05/2017	Magflow	28	3.9	0
25/05/2017	Magflow	29	0	2.2
26/05/2017	Magflow	28	0	1.4
27/05/2017	Magflow	30	4.4	0.8
28/05/2017	Magflow	24	0.3	2
29/05/2017	Magflow	27	0	1.2
30/05/2017	Magflow	25	0	1.3
31/05/2017	Magflow	28	0.5	0.5
1/06/2017	Magflow	26	0.5	0.2
2/06/2017	Magflow	27	0	0.5
3/06/2017	Magflow	31	0	0.6
4/06/2017	Magflow	23	14.1	1.7
5/06/2017	Magflow	26	1.6	1.1
6/06/2017	Magflow	23	0	0.8
7/06/2017	Magflow	26	0.9	1.5
8/06/2017	Magflow	24	3.1	0
9/06/2017	Magflow	24	0.3	0.7
10/06/2017	Magflow	30	1	3.3
11/06/2017	Magflow	26	3.2	2.6
12/06/2017	Magflow	43	0.6	2.2
13/06/2017	Magflow	58	11.9	1.4
14/06/2017	Magflow	49	17.9	1.3
15/06/2017	Magflow	39	0	2.9
16/06/2017	Magflow	32	8.2	2.6
17/06/2017	Magflow	28	0.2	1.2
18/06/2017	Magflow	25	0	1.4
19/06/2017	Magflow	32	9.7	2
20/06/2017	Magflow	31	0	0.8
21/06/2017	Magflow	26	0	1.5
22/06/2017	Magflow	28	5.6	2.5
23/06/2017	Magflow	27	1.2	1.7
24/06/2017	Magflow	26	0	0.7
25/06/2017	Magflow	28	5.1	1.9
26/06/2017	Magflow	27	4.3	0.4
27/06/2017	Magflow	25	0	1.9
28/06/2017	Magflow	28	0	0.2
29/06/2017	Magflow	26	0.1	0.9
30/06/2017	Magflow	27	0	0.9

Rainfall as recorded at NIWA Quarry Hill Site, 10km east of WWTP
Evaporation (Open Water) from the NIWA station at Tiwai Point 50km west of the WWTP

Long Term Discharge Quality

Date	BOD_5 (g/m^3)	Conductivity (mS/m)	NH_4-N (g/m^3)	TN (g/m^3)	TP (g/m^3)	TSS (g/m^3)	E.Coli (CFU/100mL)	Converted Faecal Coliforms (CFU/100mL)
05-Oct-05	12	37.2	14.94		22.80	26	1080	1382
05-Oct-05	18	4050.0	13.80	18.00	6.50	23	790	1011
06-Mar-06	4	38.5	13.63	20.60	16.50	6	3130	4006
04-Oct-06	17	36.1	8.95	15.00	5.87	37	1259	1612
19-Mar-07	3	51.5	19.53	27.20	7.43	2	410	525
16-Oct-07	12	39.5	13.31	17.10	6.74	12	2282	2921
28-Aug-08	50		2.12	12.20	7.87	79	2909	3724
07-Apr-09	2	48.1	18.25	24.60	6.96	4	631	808
28-Oct-09	19	29.1	2.62	13.50	6.44	108	1633	2090
10-Mar-10	3	43.3	11.74	14.80	6.12	4	218	279
18-Nov-10	7	88.9	20.00	24.00	7.70	3	256	328
21-Dec-10	16	53.0	18.00	21.00	8.90	24	200	256
08-Mar-11	5	36.8		6.50		26	108	138
27-Oct-11	3	42.8	14.00			7	613	785
10-Jan-12	17	62.3	26.50			54	2307	2953
23-Jan-12	7	62.0	28.80	35.00	7.43	15	6867	8790
07-Mar-12	6	46.1	15.10	19.40	6.68	9	58	74
24-Oct-12		42.1	13.80	19.00	5.86	24	84	108
07-Mar-13	9	49.2	16.90	26.50	6.16	25	1076	1377
21-Oct-13	19	38.8	14.00	17.00	4.90	16	5	6
17-Mar-14	6	42.2	7.70	12.00	3.80	10	950	1216
29-Oct-14	7	41.5	9.60	17.00	4.50	23	1300	1664
26-Mar-15	10	44.2	7.70	16.00	5.70	7	210	269
28-Oct-15	34	29.6	4.10	13.00	4.50	49	1600	2048
14-Mar-16	8	52.0	22.00	27.00	4.40	5	470	602
13-Oct-16	9	34.3	9.80	15.00	3.30	9	200	256
28-Mar-17	12	40.5	11.00	17.00	2.50	39	410	525

Converted Faecal coliforms calculated using ratio of E.coli to FC of 1.28 determined from the 2017/18 additional data record

2017 Intensive Discharge Quality

Date	Temp (^{o}C)	pH	Conductivity (uS/cm)	Conductivity (mS/m)	DO (g/m^3)	Turbidity (NTU)	TSS (g/m^3)	BOD_5 (g/m^3)	NH_4-N (g/m^3)	Total Oxidised N (g/m^3)	TN (g/m^3)	DRP (g/m^3)	TPs (g/m^3)	E.Coli (CFU/100mL)	Faecal coliforms (cfu/100mL)	Converted Faecal coliforms (cfu/100mL)	Bromide (g/m^3)	Chloride (g/m^3)	Fluoride (g/m^3)	Comments
10-Aug-17	7.2	8.22	328	32.8		16	30	18	3.9	1.7	14	0.74	1.6	10	10	13	0.13	34	0.045	
18-Aug-17	7.7	8.7	275	27.5		40	73	25	8	0.12	16	0.76	1.9	3,500	4,000	4,480	0.12	34	0.22	
23-Aug-17	7.8	8.66	277	27.7		50	88	21	8	0.21	17	0.96	2.1	2,700	4,200	3,456	0.11	33	0.16	
31-Aug-17	9.3	8.73	278	27.8		37	72	19	8	0.34	18	1.6	2.7	1,200	1,600	1,536	0.12	34	0.026	
07-Sep-17	9.2	8.97	268	26.8		55	100	22	6.8	0.13	20	1.1	2.7	2,000	2,800	2,560	0.12	34	0.22	High Flow
14-Sep-17	9.9	8.43	284	28.4		40	74	22	7.7	0.19	18	1.2	2.2	2,300	4,200	2,944	0.12	32	0.04	
21-Sep-17	11.3	8.34	275	27.5		25	42	17	7.9	0.39	13	2	3.5	2,300	5,000	2,944	0.13	31	0.045	
28-Sep-17	11.8	7.38	326	32.6		24	27	7.1	9.8	0.15	14	4.5	6.5	10	10	13	0.14	32	0.05	
12-Oct-17	10.9		355	35.5	5.1	22			11					890		1,139				Dead ducklings in discharge well
26-Oct-17	11.1		320	32	7.4	45			8.9					3,500		4,480				
08-Nov-17	11.2		291	29.1	4	45			5.7					6,100		7,808				
23-Nov-17	18.8	9.76	272	27.2		50	79	6.4	1.2	0.93	11	3.8	6.1	260	310	333	0.17	41	0.049	
30-Nov-17	19.4	10.01	275	27.5		30	67	14	0.03	0.53	13	4.6	6.8	18	18	23	0.17	42	0.057	No discharge
06-Dec-17	19.9	9.39	310	31		32	50	12	0.38	0.52	8.5	5.5	7.4	150	170	192	0.15	37	0.086	No discharge
12-Dec-17	15.8	9.29	291	29.1		31	77	12	0.72	0.12	8.9	4.4	5.9	380	400	486	0.18	42	0.058	
21-Dec-17	18.4	9.94	292	29.2		38	51	21	0.22	0.25	6.7	4	6.1	130	150	166	0.18	44	0.026	
11-Jan-18	19	8.38	332	33.2		40	60	22	0.15	0.01	7.9	4	5.7	320	400	410	0.18	44	0.043	No discharge
18-Jan-18	20.8	8.34	351	35.1		23	33	19	0.25	0.05	6.1	3.6	5	20	20	26	0.2	51	0.063	No discharge

Converted Faecal coliforms calculated using ratio of E.coli to FC of 1.28 determined from the above data record

Long Term Receiving Water Quality

ANZECC Physical & Chemical Stressors		7.2 - 7.8				5.6			0.021	0.444	0.01
ANZECC Toxicity									0.9		
ES Plan Standards					80%			1000	1.47		
NPS-FM (95th percentile)				7.5			540.0		0.1	1.5	

Date	Location	Temp (°C)	pH	Conductivity (mS/m)	DO (g/m³)	Converted DO (% sat)	Turbidity (NTU)	E.Coli (CFU/100mL)	Converted Faecal coliforms (cfu/100mL)	NH_4-N (g/m3)	Nitrate-N (g/m³)	DRP (g/m³)
05-Oct-05	Upstream	9.0	7.38	17.5	10.7	93%	19.9	2187	2668	0.04	1.14	0.02
05-Oct-05	Upstream	9.0	7.40	16.8	11.1	96%	16.8	1700	2074	0.4		
05-Oct-05	150m Downstream	9.0	7.37				18.7	1669	2036	0.06	1.12	0.03
05-Oct-05	150m Downstream	9.0	7.50				14.7	1300	1586	0.4	1.06	
16-Mar-06	Upstream	10.0	6.83	16.5	9.5	84%	5.8	395	482	0.01	1.30	0.02
16-Mar-06	150m Downstream	10.0	6.82				5.9	364	444	0.01	1.28	0.02
04-Oct-06	Upstream	8.5	7.05	18.3	10.4	89%	6.6	345	421	0.01	1.22	0.03
04-Oct-06	150m Downstream	8.5	6.99				6.9	517	631	0.01	1.12	0.03
19-Mar-07	Upstream	10.0	6.71	16.2	8.9	79%	8.5	9208	11234	0.05	0.21	0.04
19-Mar-07	150m Downstream	10.0	6.69				8.4	6380	7784	0.09	0.29	0.05
16-Oct-07	Upstream	9.0		17.6	11.8	102%	10.6	1576	1923	0.03	1.14	0.02
28-Oct-08	Upstream	11.5	7.42	18.5				63	77	0.03		
28-Oct-08	150m Downstream	11.5	7.36				25.2	1354	1652	0.03	1.17	0.04
07-Apr-09	Upstream	10.5	7.62	17.8	8.9	80%	8.2	1722	2101	0.01	0.86	0.04
07-Apr-09	150m Downstream	10.5	7.64				9.3	1722	2101	0.01	0.98	0.04
28-Oct-09	Upstream	9.0	7.19	17.3	10.5	91%	22.5	1540	1879	0.02	1.01	0.03
28-Oct-09	150m Downstream	9.0	7.18				13.9	2406	2935	0.03	1.01	0.03
10-Mar-10	Upstream	16.0	7.33	19.6	9.3	94%	6.7	522	637	0.01	1.04	0.05
10-Mar-10	150m Downstream	16.0	7.37				6.7	1112	1357	0.02	0.98	0.04
08-Mar-11	Upstream			18.7				836	1020	0.02		0.04
08-Mar-11	150m Downstream			18.7				594	725	0.024		0.04
27-Oct-11	Upstream	11.5	7.26	17.8	11.6	106%	11.0	30	37	0.028		0.02
27-Oct-11	150m Downstream	11.8	7.29	17.8	11.0	102%	11.0	359	438	0.026		0.04
10-Jan-12	Upstream	14.8	7.27	19.8	11.5	114%		733	894	0.086		0.03
10-Jan-12	150m Downstream	14.9	7.34	19.9	7.1	70%		1314	1603	0.032		0.04
23-Jan-12	Upstream	10.5	7.37	19.6	10.0	90%	6.7	1789	2183	0.032	0.75	0.03
23-Jan-12	150m Downstream	10.9	7.38	19.4	8.4	76%	7.5	1296	1581	0.033	0.82	0.03
07-Mar-12	Upstream	12.3	7.18	17.8	9.1	85%	6.3	631	770	0.014	1.00	0.03
07-Mar-12	150m Downstream	12.4	7.28	17.8	9.0	84%	4.8	631	770	0.017	0.84	0.02
24-Oct-12	Upstream	10.2	7.14	17.1	11.0	98%	16.0	624	761	0.015	1.40	0.02
24-Oct-12	150m Downstream	10.3	7.12	17.2	11.9	106%	14.0	563	687	0.016	1.39	0.02
07-Mar-13	Upstream	10.8	7.31	18.4	9.0	81%	6.5	1050	1281	0.123	1.13	0.02
07-Mar-13	150m Downstream	10.9	7.25	18.6	8.5	77%	6.8	1017	1241	0.056	0.98	0.02
21-Oct-13	Upstream	10.8	7.25	17.0	9.7	88%	17.0	1100	1342	0.27	1.10	0.01
21-Oct-13	150m Downstream	10.9	7.16	17.1	9.8	89%	20.0	930	1135	0.04	1.10	0.01
17-Mar-14	Upstream	14.9	7.51	18.6	9.6	95%	10.0	710	866	0.1	1.00	0.01
17-Mar-14	150m Downstream	15.1	7.56	18.6	9.4	93%	10.0	1200	1464	0.06	0.90	0.01
29-Oct-14	Upstream	9.1	7.28	18.0	18.7	162%	8.9	1200	1464	0.01	1.20	0.03
29-Oct-14	150m Downstream	9.7	7.26	17.9	10.4	91%	8.8	1100	1342	0.01	1.30	0.02
26-Mar-15	Upstream	13.2	6.49	19.3	9.0	86%	7.7	1400	1708	0.08	0.58	0.04
26-Mar-15	150m Downstream	13.2	6.43	19.3	8.7	83%	7.3	1700	2074	0.06	1.10	0.03
28-Oct-15	Upstream	8.9	7.24	17.5	10.3	89%	12.0	680	830	0.02	0.98	0.02
28-Oct-15	150m Downstream	9.7	7.19	17.4	10.3	91%	12.0	880	1074	0.02	1.20	0.02
14-Mar-16	Upstream	15.2	7.00	19.3	9.5	95%	5.6	530	647	0.05	0.94	0.17
14-Mar-16	150m Downstream	15.0	7.38	19.1	9.9	98%	4.9	510	622	0.03	0.96	0.03
13-Oct-16	Upstream	10.5	7.43	18.5	11.1	99%	10.0	1700	2074	0.02	1.30	0.02
13-Oct-16	150m Downstream	9.1	7.48	18.4	11.5	100%	10.0	1100	1342	0.03	1.20	0.02
28-Mar-17	Upstream	10.5	7.35	19.4	9.3	83%	4.4	610	744	0.02	1.00	0.02
28-Mar-17	150m Downstream	10.5	7.37	19.4	9.5	85%	5.0	570	695	0.02	0.89	0.02

Converted Faecal coliforms calculated using ratio of E.coli to FC of 1.22 determined from this short term 2017 data record
Converted DO calculated from concentration using equation in Note 2 to the reference table 4500-O:I in Standard Methods for the Examination of Water and Wastewater (22nd Edition). Assumes a typical atmospheric pressure of 101.3 kPa and that chlorinity in the river is zero.

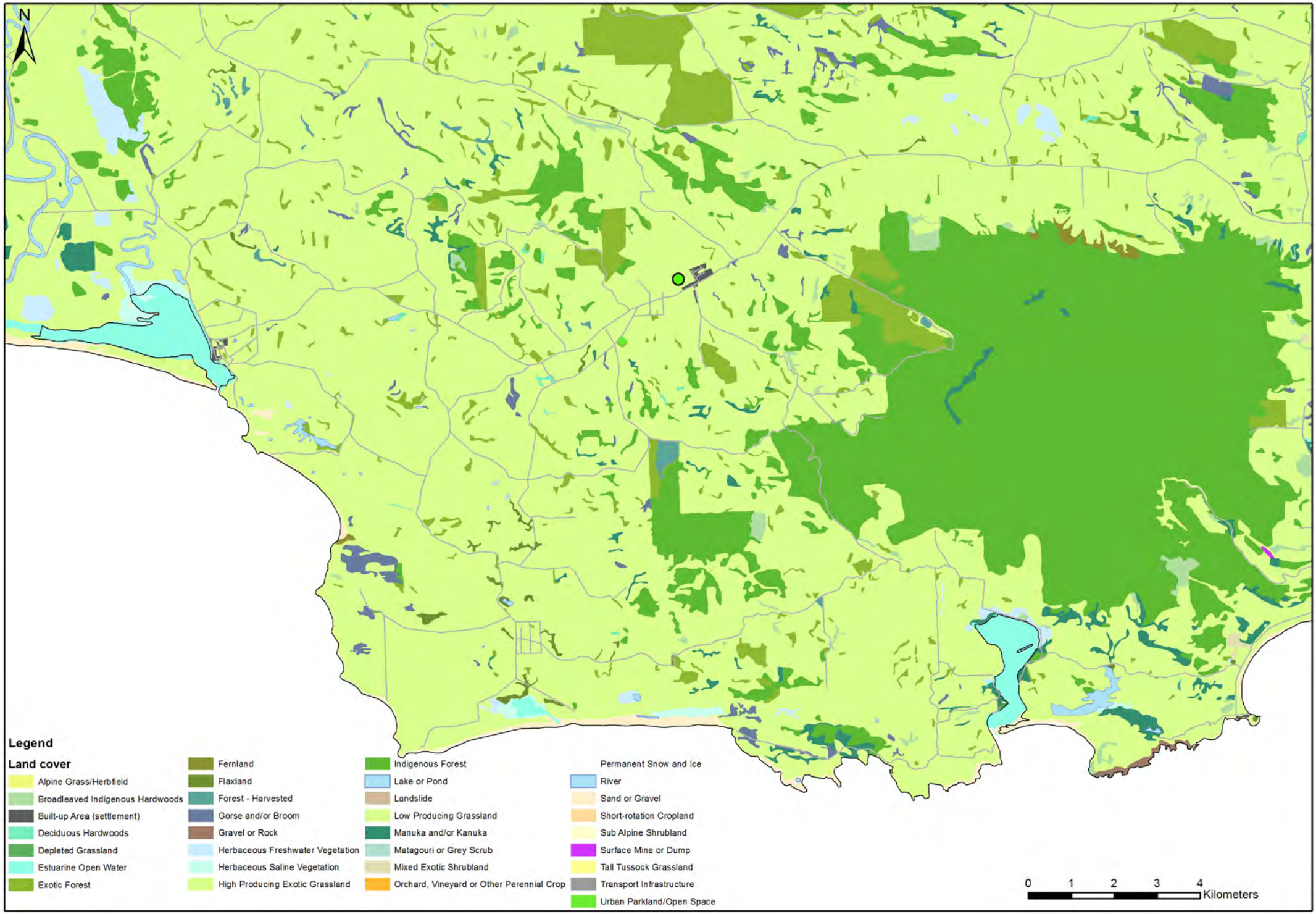
2017 Additional Receiving Water Quality

ANZECC Physical & Chemical Stress		7.2 - 7.8					5.6					0.021		0.614	0.01					
ANZECC Toxicity												0.9								
ES Plan Standards						80%				1,000	1,000	1.47								
NPS-FM (95th percentile)					7.5				540			0.1								

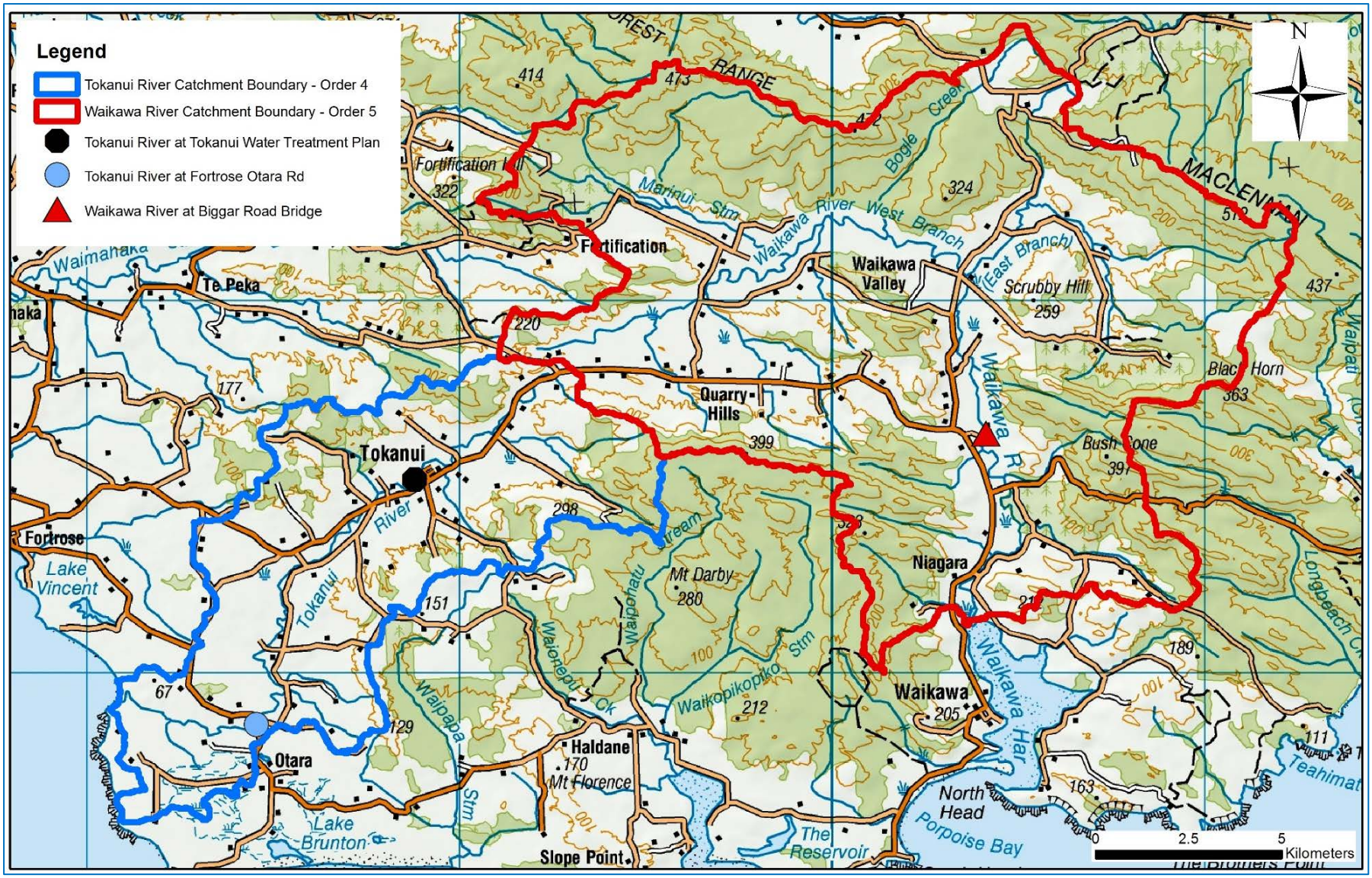
Date	Location	Temp (°C)	pH	Conductivity (uS/cm)	Conductivity (mS/m)	DO (g/m3)	Converted DO (% sat)	Turbidity (NTU)	TSS (g/m3)	E.Coli (cfu/100mL)	Faecal Coliforms (cfu/100mL)	Converted Faecal coliforms	NH4-N (g/m3)	Total Oxidised N (g/m3)	TN (g/m3)	DRP (g/m3)	TP (g/m3)	Bromide (g/m3)	Chloride (g/m3)	Fluoride (g/m3)	Comment
10-Aug-17	Upstream	7.9	7.33	186	18.6	10.1	85%	15	21	40	55	49	0.02	0.96	1.4	0.012	0.25	0.14	26	0.059	High
10-Aug-17	50m Downstream	8	7.36	188	18.8	10.4	88%	16	20	100	100	122	0.02	0.95	1.6	0.008	0.13	0.14	26	0.06	High
10-Aug-17	150m Downstream	7.9	7.3	186	18.6	10.2	86%	14	19	160	210	196	0.02	1.5	1.6	0.008	0.11	0.14	26	0.059	High
18-Aug-17	Upstream	7.6	7.42	184	18.4	10.7	89%	16	21	130	150	159	0.02	1.6	1.8	0.047	0.08	0.13	26	0.054	
18-Aug-17	50m Downstream	7.5	7.28	183	18.3	10.4	87%	17	22	100	160	122	0.03	1.6	1.6	0.055	0.06	0.13	26	0.054	
18-Aug-17	150m Downstream	7.5	7.25	182	18.2	10.7	89%	16	22	90	140	110	0.02	1.6	1.8	0.047	0.07	0.13	26	0.053	
23-Aug-17	Upstream	6.9	7.25	186	18.6	11.2	92%	14	18	300	320	367	0.02	1.5	1.5	0.014	0.06	0.13	27	0.052	
23-Aug-17	50m Downstream	6.9	7.33	186	18.6	11	90%	13	18	320	380	391	0.01	1.5	1.5	0.018	0.06	0.13	27	0.053	
23-Aug-17	150m Downstream	6.9	7.35	189	18.9	11.1	91%	15	19	350	370	428	0.01	1.5	1.5	0.013	0.05	0.13	27	0.053	
31-Aug-17	Upstream	7.9	7.37	186	18.6	11.3	95%	13	16	100	150	122	0.02	1.1	1.7	0.026	0.05	0.13	26	0.064	
31-Aug-17	50m Downstream	7.9	7.45	186	18.6	11.2	94%	13	15	90	120	110	0.01	1.3	1.7	0.019	0.05	0.13	27	0.065	
31-Aug-17	150m Downstream	8.1	7.43	186	18.6	11.1	94%	13	16	160	230	196	0.01	1	1.6	0.018	0.05	0.13	27	0.065	
07-Sep-17	Upstream	7.8	7.62	189	18.9	10.6	89%	10	13	120	150	147	0.02	1.5	1.6	0.014	0.05	0.13	27	0.056	
07-Sep-17	50m Downstream	7.7	7.6	190	19	10.6	89%	11	12	90	110	110	0.01	1.5	1.6	0.016	0.04	0.13	27	0.056	
07-Sep-17	150m Downstream	7.7	7.52	189	18.9	11	92%	11	12	140	190	171	0.01	1.5	1.6	0.015	0.04	0.13	27	0.056	
14-Sep-17	Upstream	9.3	7.31	180	18	9.9	86%	13	18	480	500	587	0.01	1.1	1.5	0.011	0.05	0.12	25	0.058	High & dirty
14-Sep-17	50m Downstream	9.4	7.31	180	18	10.1	88%	14	17	470	640	575	0.03	1.4	1.6	0.011	0.07	0.12	25	0.058	High & dirty
14-Sep-17	150m Downstream	9.4	7.26	180	18	9.6	84%	14	17	470	510	575	0.01	1.3	1.5	0.011	0.06	0.12	25	0.058	High & dirty
21-Sep-17	Upstream	8.7	7.18	177	17.7	10.4	89%	15	19	370	420	452	0.01	1.4	1.5	0.009	0.04	0.13	26	0.059	
21-Sep-17	50m Downstream	8.7	7.29	177	17.7	10.6	91%	16	19	330	470	403	0.01	1.3	1.5	0.012	0.06	0.12	25	0.058	
21-Sep-17	150m Downstream	8.7	7.22	176	17.6	10.5	90%	16	21	350	380	428	0.01	1.2	1.6	0.013	0.07	0.13	26	0.059	
28-Sep-17	Upstream	9	7.39	184	18.4	10	86%	9.7	12	240	250	293	0.01	1.4	1.4	0.014	0.04	0.14	26	0.068	
28-Sep-17	50m Downstream	8.9	7.36	184	18.4	10.1	87%	11	13	230	250	281	0.01	1.4	1.5	0.015	0.05	0.14	26	0.067	
28-Sep-17	150m Downstream	8.9	7.35	185	18.5	9.9	85%	10	12	150	180	183	0.01	1.4	1.5	0.016	0.05	0.15	27	0.069	
12-Oct-17	Upstream	8.9		181	18.1	10.1	87%	7.6		750		917	0.4								Normal & clear
12-Oct-17	50m Downstream	8.9		182	18.2	10.2	88%	7.9		860		1,051	0.4								Normal & clear
12-Oct-17	150m Downstream	8.9		181	18.1	10	86%	8		10		12	0.4								Normal & clear
26-Oct-17	Upstream	9		181	18.1	11	95%	5.9		550		672	0.01								High
26-Oct-17	50m Downstream	9.1		183	18.3	11	95%	6.8		730		892	0.01								High
26-Oct-17	150m Downstream	9.1		181	18.1	10.5	91%	5.7		690		843	0.01								High
08-Nov-17	Upstream	8.9		150	15	7.4	64%	18		46,000		56,230	0.04								High & dirty
08-Nov-17	50m Downstream	8.8		285	28.5	7.9	68%	37		37,000		45,228	0.04								High & dirty
08-Nov-17	150m Downstream	8.8		151	15.1	7.6	65%	20		36,000		44,006	0.05								High & dirty
23-Nov-17	Upstream	14.7	7.51	186	18.6	9.5	94%	3.3	2.6	170	190	208	0.01	0.51	0.85	0.046	0.02	0.13	26	0.069	
23-Nov-17	50m Downstream	14.6	7.48	181	18.1	9.3	91%	3.4	2.8	270	320	330	0.01	0.56	0.88	0.019	0.07	0.13	26	0.069	
23-Nov-17	150m Downstream	14.6	7.5	185	18.5	9.5	93%	3.2	2.7	260	310	318	0.01	0.62	0.9	0.016	0.01	0.13	26	0.069	
30-Nov-17	Upstream	15.8	7.45	187	18.7	8.5	86%	3	2.7	800	810	978	0.01	0.58	0.89	0.064	0.07	0.12	26	0.064	
30-Nov-17	50m Downstream	15.7	7.47	186	18.6	8	81%	2.9	2.6	520	590	636	0.01	0.61	0.91	0.017	0.03	0.12	27	0.063	
30-Nov-17	150m Downstream	15.7	7.45	185	18.5	8.1	82%	2.8	2.6	390	460	477	0.01	0.53	0.84	0.015	0.03	0.13	27	0.063	
06-Dec-17	Upstream	16.5	7.56	190	19	8.9	91%	3.7	2.7	1,300	1,300	1,589	0.01	0.71	0.86	0.022	0.04	0.13	25	0.067	
06-Dec-17	50m Downstream	16.3	7.51	187	18.7	9.1	93%	3.3	2.6	640	730	782	0.02	0.71	0.84	0.02	0.04	0.13	24	0.069	
06-Dec-17	150m Downstream	16.3	7.48	190	19	8.7	89%	3.2	2.6	600	620	733	0.07	0.71	0.81	0.019	0.06	0.13	26	0.069	
12-Dec-17	Upstream	12.9	7.17	173	17.3	7.9	75%	8.7	4.2	18,000	19,000	22,003	0.04	0.77	1.4	0.045	0.12	0.11	26	0.068	
12-Dec-17	50m Downstream	12.9	7.1	176	17.6	8	76%	9	5.8	19,000	20,000	23,225	0.03	0.78	1.3	0.036	0.1	0.11	26	0.069	
12-Dec-17	150m Downstream	12.9	7.1	173	17.3	8.1	77%	9.6	5.6	16,000	17,000	19,558	0.04	0.77	1.3	0.032	0.11	0.11	26	0.071	
21-Dec-17	Upstream	14.9	7.31	192	19.2	7.3	72%	4.2	2.5	600	720	733	0.02	0.67	0.87	0.23	0.23	0.13	27	0.075	
21-Dec-17	50m Downstream	14.8	7.39	191	19.1	7.4	73%	4.2	3.1	430	520	526	0.02	0.5	0.84	0.029	0.04	0.13	27	0.077	
21-Dec-17	150m Downstream	14.8	7.31	191	19.1	7.2	71%	4.5	3.2	460	590	562	0.03	0.63	0.82	0.025	0.04	0.13	27	0.075	
11-Jan-18	Upstream	15.5	7.41	192	19.2	6.9	69%	3.9	2.5	100	91	122	0.03	0.42	0.64	0.021	0.05	0.11	25	0.065	Low Flow
11-Jan-18	50m Downstream	15.6	7.37	190	19	7.3	73%	4.1	2.7	230	280	281	0.02	0.4	0.63	0.02	0.04	0.12	26	0.067	Low Flow
11-Jan-18	150m Downstream	15.6	7.35	190	19	7.2	72%	4	3.4	100	190	122	0.02	0.38	0.64	0.02	0.04	0.11	25	0.065	Low Flow
18-Jan-18	Upstream	18.6	7.32	195	19.5	7	75%	4.2	2.6	330	550	403	0.03	0.39	0.65	0.036	0.04	0.13	27	0.066	Low Flow
18-Jan-18	50m Downstream	18.6	7.36	194	19.4	7	75%	4.2	3.3	500	600	611	0.03	0.36	0.61	0.025	0.04	0.12	27	0.066	Low Flow
18-Jan-18	150m Downstream	18.6	7.29	193	19.3	6.9	74%	4.5	2.9	260	360	318	0.02	0.35	0.6	0.032	0.04	0.13	28	0.07	Low Flow

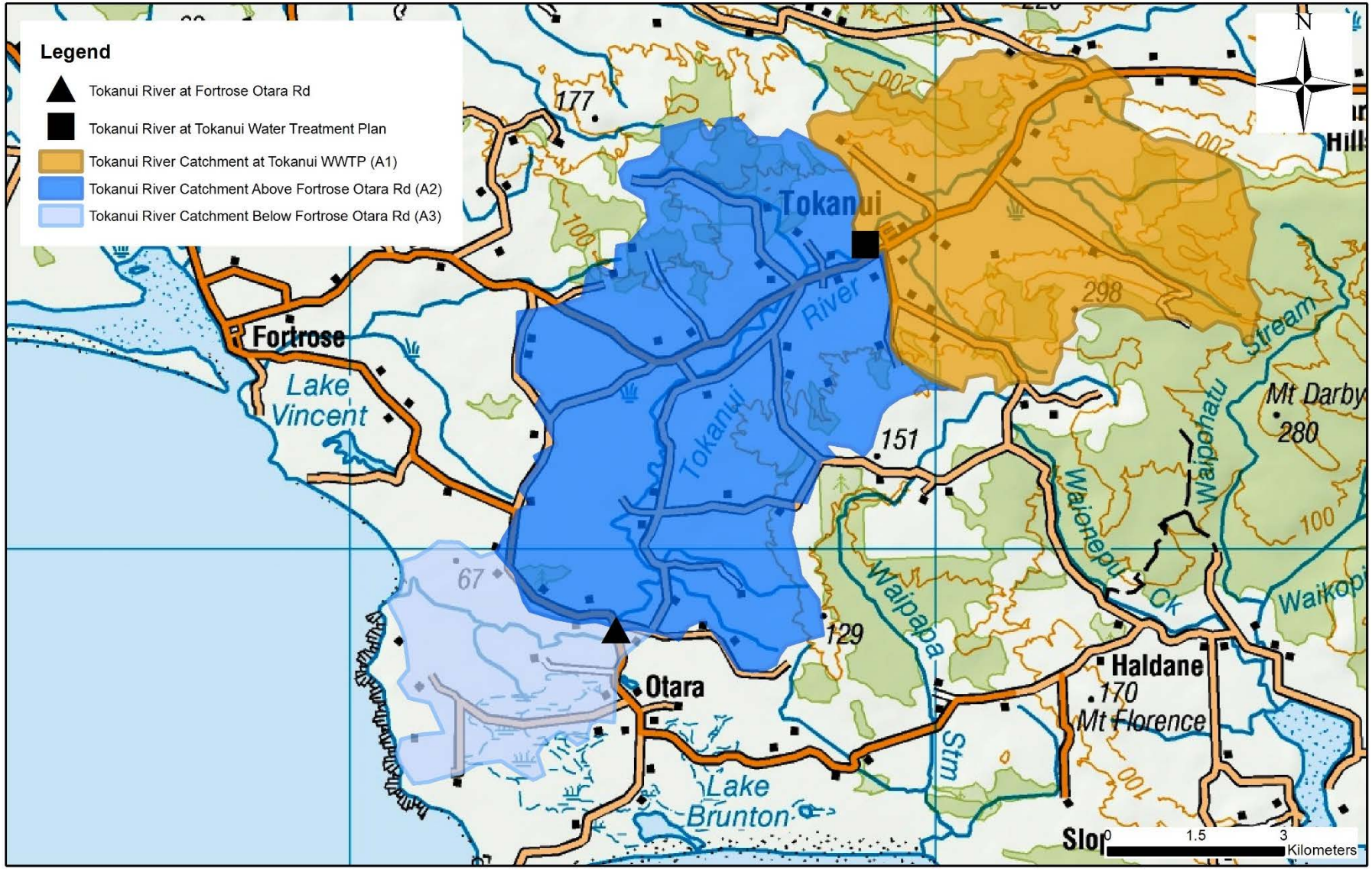
Converted DO calculated from concentration using equation in Note 2 to the reference table 4500-O:I in Standard Methods for the Examination of Water and Wastewater (22nd Edition). Assumes a typical atmospheric pressure of 101.3 kPa and that chlorinity in the river is zero.
Converted Faecal coliforms calculated using ratio of E.coli to FC of 1.22 determined from this short term 2017 data record

Appendix G Map of Land Uses


N
Legend
Land cover
Alpine Grass/Herbfield
Broadleaved Indigenous Hardwoods
Built-up Area (settlement)
Deciduous Hardwoods
Depleted Grassland
Estuarine Open Water
Exotic Forest
Fernland
Flaxland
Forest - Harvested
Gorse and/or Broom
Gravel or Rock
Herbaceous Freshwater Vegetation
Herbaceous Saline Vegetation
High Producing Exotic Grassland
Indigenous Forest
Lake or Pond
Landslide
Low Producing Grassland
Manuka and/or Kanuka
Matagouri or Grey Scrub
Mixed Exotic Shrubland
Orchard, Vineyard or Other Perennial Crop
Permanent Snow and Ice
River
Sand or Gravel
Short-rotation Cropland
Sub Alpine Shrubland
Surface Mine or Dump
Tall Tussock Grassland
Transport Infrastructure
Urban Parkland/Open Space
0 1 2 3 4
Kilometers

Appendix H Synthetic Flow Record Maps


Legend
Tokanui River Catchment Boundary - Order 4
Waikawa River Catchment Boundary - Order 5
Tokanui River at Tokanui Water Treatment Plan
Tokanui River at Fortrose Otara Rd
Waikawa River at Biggar Road Bridge
N
Te Peka
Tokanui
Fortrose
Lake Vincent
Otara
Lake Brunton
Slope Point
Haldane
Mt Florence
Quarry Hills
Fortification
Waikawa Valley
Scrubby Hill
Niagara
Waikawa
North Head
Porpoise Bay
The Reservoir
Mt Darby
Bush Zone
Black Horn
MACLENNAN
RANGE
Tokanui River
Waikawa River
West Branch
(East Branch)
Marinui Stm
Waikopikopiko Stm
Waipapa Stm
Waiorepu Ck
Waipohatu
Bogle Creek
Longbeach Cr
Teahimat
0
2.5
5
Kilometers


Legend
Tokanui River at Fortrose Otara Rd
Tokanui River at Tokanui Water Treatment Plan
Tokanui River Catchment at Tokanui WWTP (A1)
Tokanui River Catchment Above Fortrose Otara Rd (A2)
Tokanui River Catchment Below Fortrose Otara Rd (A3)
N
Tokanui
Fortrose
Lake Vincent
Otara
Lake Brunton
Haldane
Mt Florence
Mt Darby
Tokanui River
Waipapa Stm
Waionepu Ck
Waipohatu Stream
177
298
151
129
67
280
170
100
200
0
1.5
3
Kilometers

Appendix I Ryder Biological Survey 2002

Aquatic Invertebrate Assessment

Results for Tokanui Stream, October 2002

Prepared for

Montgomery Watson Harza

By

R.M.Thompson, BSc (Hons), PhD. and B.G.Ludgate MSc.

Ryder Consulting Ltd.

October 2002

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Dunedin
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Introduction:

The following report describes the methods used in processing macro-invertebrate samples gathered by Montgomery Watson Harza in October 2002. Summaries of invertebrate species found and preliminary analysis and interpretation provided.

Methods:

Sample Processing and Sample Analysis:

Samples were sieved through a 600μm sieve to remove fine material and ethanol residual. Contents of the sieves were then placed in a white tray and macroinvertebrates removed. The macroinvertebrate samples were then identified under dissecting microscope (10-40X) and binocular microscopes (100-400X) using criteria from Winterbourn *et al.* (2000).

Data Analysis:

In addition to invertebrate density (number of individuals per sample) and number of taxa (different types of invertebrate groups), the Macroinvertebrate Community Index (MCI) and Semi-Quantitative MCI (SQMCI) (Stark 1993) were calculated. The MCI uses the occurrence of specific macroinvertebrate taxa to determine the level of organic enrichment in a stream.

$$\text{MCI} = \left(\frac{\sum \text{of taxa scores}}{\text{Number of scoring taxa}} \right) \text{X } 20$$

A site score is obtained by summing the scores of individual taxa and dividing this total by the number of taxa present at the site. Taxon scores are between 1 and 10, with low scores indicating high tolerance to organic pollution and high scores indicating the taxa that will only be found in "pristine rivers" (Stark 1993). The SQMCI is similar, but scales the individual taxa scores based on how common the taxa are. A five-point scale of coded abundances is used (i.e. rare = 1-4 animals per sample, common = 5-19, abundant = 20-99, very abundant 100-499, very very abundant = >500). These metrics can be interpreted in the context of national standards and can be used to assess habitat quality (Table 1). Often a more useful approach however is to use the MCI and SQMCI to compare the

invertebrate communities upstream and downstream of an impact such as a discharge.

Table 1: ***Interpretation of metrics used to assess invertebrate communities in stony streams (after Stark 1993).***

Interpretation	MCI	SQMCI
Clean water	>120	>6
Doubtful quality or possible mild pollution	100-119	5-5.99
Probably moderate pollution	80-99	4-4.99
Probable severe pollution	<80	<4

Differences between number of taxa, density, MCI and SQMCI above and below the discharge were analysed using one factor analysis of variance. In analyses of this type a 'p' value of <0.05 indicates a significant difference between the results from the different locations.

Results and Discussion:

Invertebrate densities (number per sample) were low overall in comparison to similar rivers in Southland (Southland Regional Council 1999). Densities appeared to be higher above the discharge (Figure 1), although variability was generally high (Table 2), meaning that there was no statistically significant difference between the control and impact sites ($F_{1,4}$= 1.89, p=0.24). The largest number of invertebrates was found in a control sample (149) and the lowest in an impact sample (32), but within each location numbers varied by 2-3 times (Table 2).

The number of taxa found above and below the discharge was low by New Zealand standards, where on average 14 taxa are found in a site (Quinn and Hickey 1990) (Table 2, Figure 1). However there was no evidence for lower numbers of taxa below the discharge ($F_{1,4}$=0.16, p=0.71). The lowest number of taxa (5) was found at a control location (C3). Again however, variability was high, with another control sample (C3) having twice that number of taxa.

Table 2. ***Number of invertebrates per sample found in samples taken from Tokanui Stream in October 2002. Samples marked C# are from upstream of the Tokanui sewage treatment plant discharge, while those marked T# are from downstream of the discharge.***

TAXON	MCI score	C1	C2	C3	T1	T2	T3
CRUSTACEA							
Isopoda	5	2	3	1	2	3	3
Ostracoda	3	1		1			
Paracalliope fluviatilis	5			1		6	1
DIPTERA							
Austrosimulium species	3			1	1		6
Chironomidae	2	38	66	28	7	37	4
EPHEMEROPTERA							
Deleatidium species	8	1		3		3	
MOLLUSCA							
Potamopyrgus antipodarum	4	37	8	19	6	36	24
OLIGOCHAETA	1	66	55	9	14	24	14
PLECOPTERA							
Megaleptoperla diminuta	9	1					
Megaleptoperla grandis	9					1	1
Zelandobius species	5	1				2	
TRICHOPTERA							
Aoteapsyche species	4			1			
Helicopsyche species	10	2	1	1	2		6
Number of invertebrates		149	133	65	32	112	59
Number of taxa		9	5	10	6	8	8
MCI		104	88	90	83	98	98
SQMCI		2.7	2.0	2.8	2.9	2.8	4.4
Average MCI			94			93	
Average SQMCI			2.5			3.4	

The invertebrate community was numerically dominated by oligochaetes (worms), chironomids (midges) and the pond snail, *Potamopyrgus antipodarum* at all locations. Communities of this type are typical of those found in moderately degraded lowland streams in Southland (Southland Regional Council 1999). A variety of other taxa were present including caddisflies, stoneflies, crustaceans and mayflies, but were neither common nor abundant (Table 2).

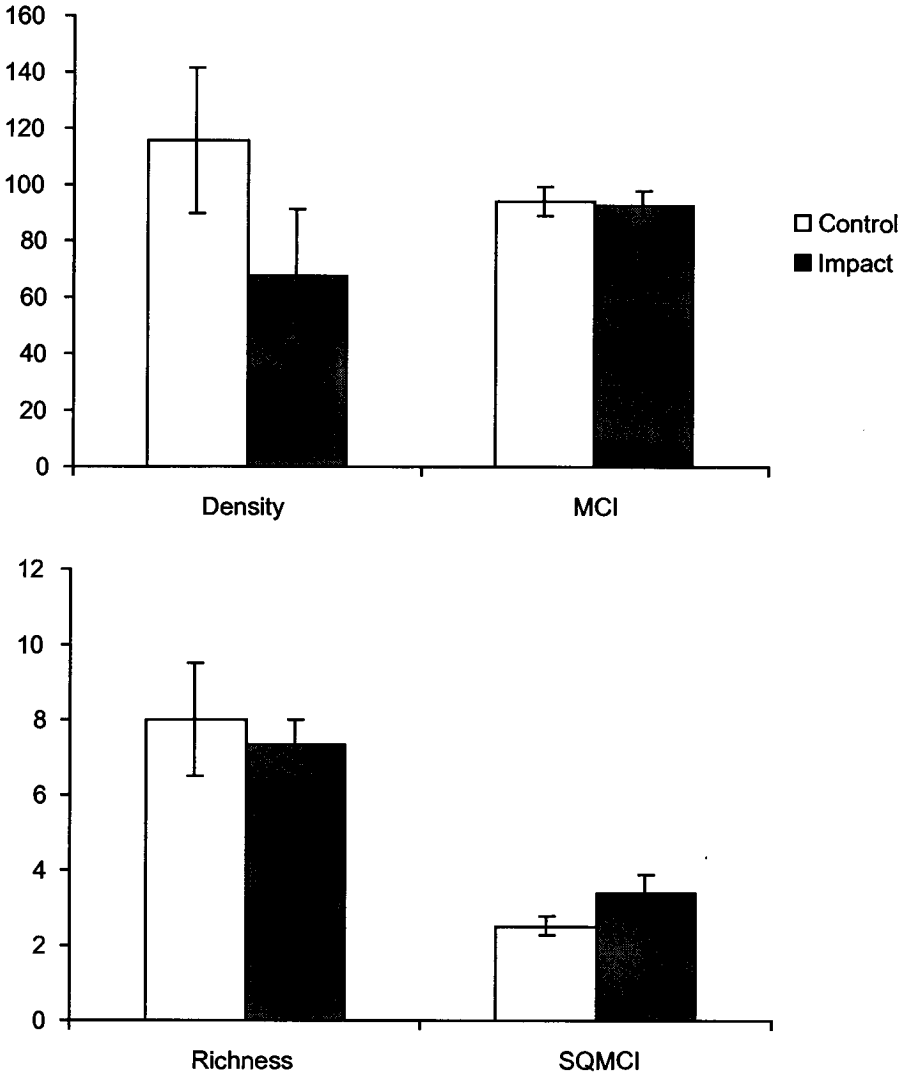

Figure 1: ***Values for invertebrate metrics from sites on Tokanui Stream above (Control) and downstream (Impact) of the Tokanui sewage treatment plant discharge.***

There was a large spread in the MCI scores for the species present ranging from species which are very tolerant of organic pollution (MCI score of 1, e.g. oligochaetes) to species which are considered intolerant (MCI score = 10; *Helicopsyche albescens*) (Table 2). The MCI scores were indicative of probable moderate pollution, but were inflated by the presence of rare, high scoring taxa (for example *Megaleptoperla* stoneflies). SQMCI scores, which take into account abundance of taxa, were lower, and indicative of probable severe pollution **for both the control and the impact sites**. This is likely to reflect land use impacts in the catchment or periodic drying of the stream. For that reason, the most valid use of MCI and SQMCI scores in this study is not by comparison with national standards, but rather comparisons made between the upstream Control samples and the downstream Impact samples. These comparisons reveal no statistically significant difference between Control and Impact samples for either MCI ($F_{1,4}$=0.04, p=0.85) or SQMCI scores ($F_{1,4}$=2.31, p=0.20) (Figure 1). The lowest SQMCI score was recorded from a Control sample (C2), and the highest from an Impact sample (T3). This, and the presence of relatively sensitive species below the discharge (Table 2) suggest no appreciable impact of the Tokanui discharge.

There is no evidence of any effect of the Tokanui sewage treatment plant discharge on the invertebrate community of Tokanui Stream. The inverterbate community present is highly variable, and includes species that are intolerant and tolerant of organic pollution. There is no evidence of any differences in invertebrate taxa richness, density, MCI or SQMCI scores between the Control site upstream of the discharge and the Impact site below the discharge.

References:

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Quinn, J.M. and Hickey, C.W. 1990: Characterisation and classification of benthic invertebrate communities in 88 New Zealand rivers in relation to environmental factors. *New Zealand Journal of Marine and Freshwater Research* ***24***: 387-409.

Southland Regional Council, 1999. Annual Water Quality Monitoring Report for Southland 1998/99. Southland Regional Council Publication N0. 1999-10.

Stark, J.D. 1993: Performance of the Macroinvertebrate Community Index: effects of sampling method, sample replication, water depth, current velocity, and substratum on index values. *New Zealand Journal of Marine and Freshwater Research* ***27***: 463-478.

Winterbourn, M.J., Gregson, K.L.D. and Dolphin, C.H. 2000: Guide to the aquatic insects of New Zealand. *Bulletin of the Entomological Society of New Zealand* ***13.***

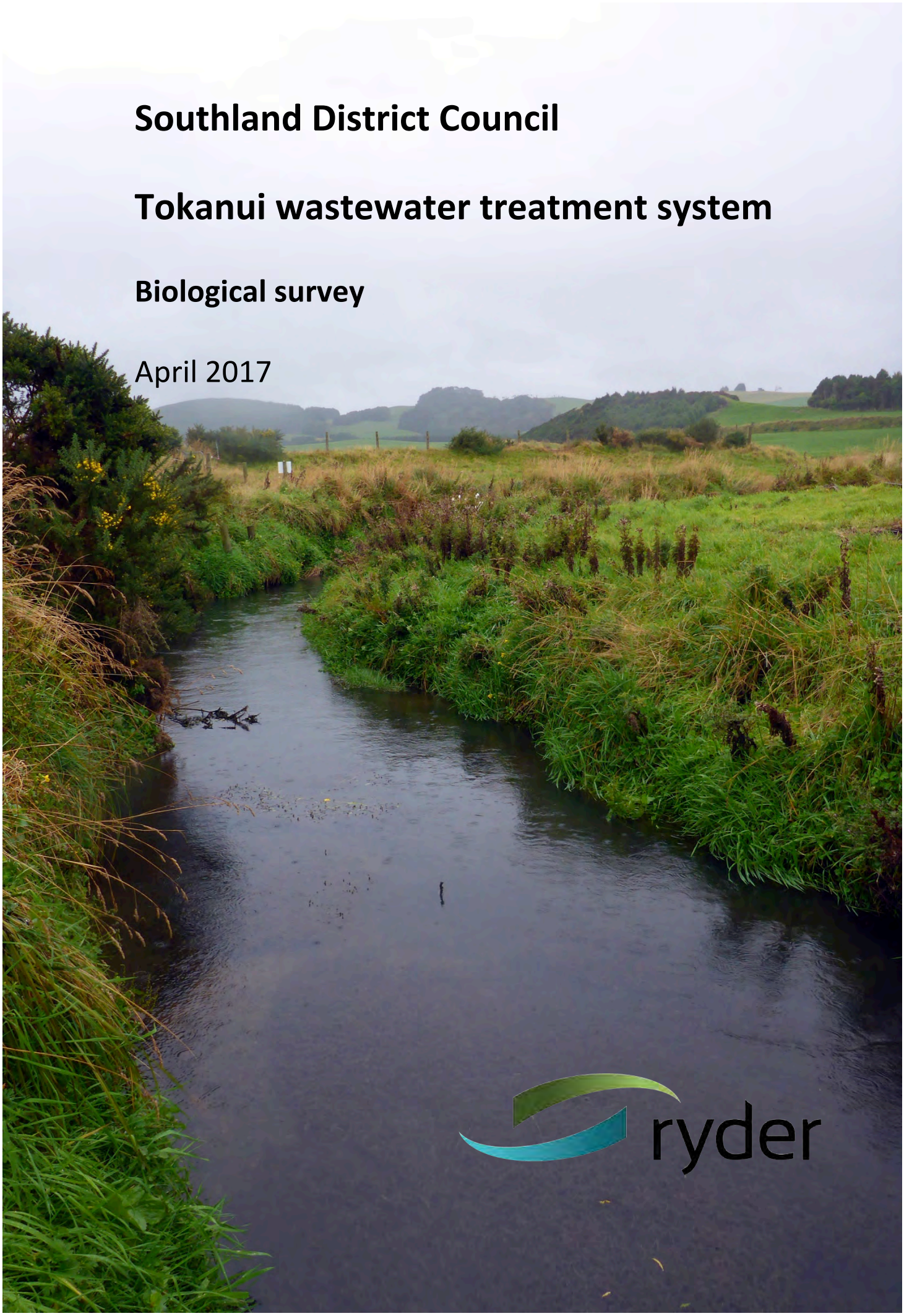
Appendix J Ryder Biological Survey 2017

Southland District Council

Tokanui wastewater treatment system

Biological survey

April 2017



Tokanui wastewater treatment system

Biological survey

April 2017

Prepared for Southland District Council by Ryder Consulting Limited

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Document version: 31/08/17

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Table of Contents

1. Introduction

Southland District Council (SDC) have a discharge permit (Environment Southland consent 201599) authorising the discharge of treated wastewater from the Tokanui wastewater treatment system to the ground and to water (the Tokanui River). The permit authorises the discharge of up to 55 m^3/day of treated sewage effluent from the Tokanui oxidation pond into land via seepage from the base of the oxidation ponds, and into the Tokanui River from the surface of the secondary treatment pond. This permit expires in September 2018.

SDC requested a biological survey be completed in the Tokanui River to assist with the reconsenting process. SDC engaged Ryder Consulting to undertake the required survey. This report summarises the April 2017 biological survey.

2. Survey sites

Sampling was undertaken at one site upstream and two sites downstream of the discharge point to the Tokanui River (Figure 1). The upstream sampling site was located approximately 15 m upstream of the discharge point, while the downstream sampling sites were located at approximately 60 and 150 m downstream of the discharge point.

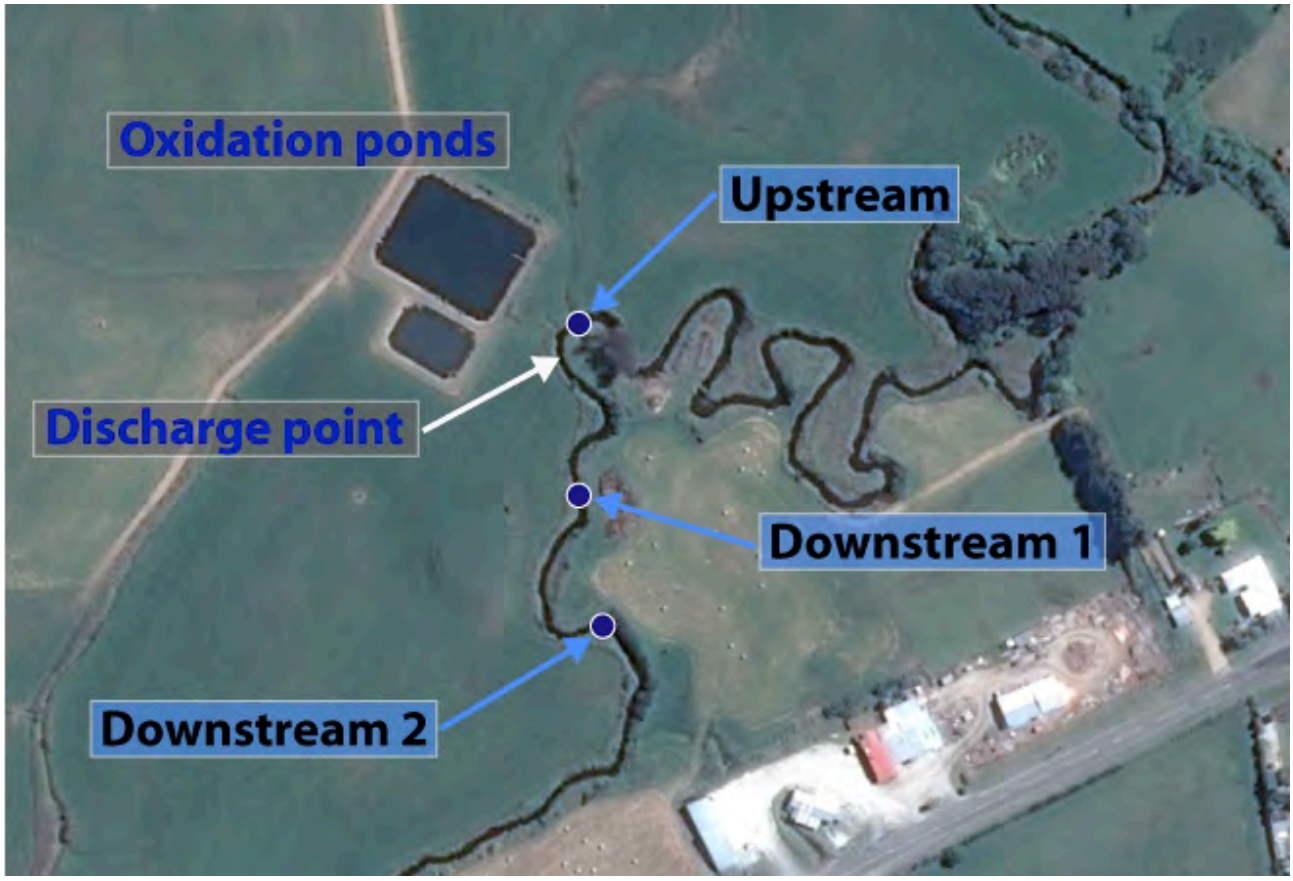

Figure 1 *Map showing the location of Tokanui River survey sites, April 2017.*

3. Survey and Analysis Techniques

3.1 General

The survey included assessments of water quality, periphyton, macrophytes, and benthic macroinvertebrates. SDC are required to undertake separate regular water quality assessments in the Tokanui River, however the basic water quality assessments undertaken during this survey help characterise general conditions at the time of sampling and allow comparisons with relevant standards.

The Tokanui River is classed in the Environment Southland Water Regional Plan (2014) and in Environment Southland's Proposed Southland Water and Land Plan (3 June 2016), as a 'lowland soft bed' river. The relevant 'lowland soft bed' standards are outlined in Table 1.

Table 1 *Water quality standards for surface water bodies classified as 'Lowland soft bed' in Environment Southland Water Regional Plan (2014) and in Environment Southland's Proposed Southland Water and Land Plan (3 June 2016).*

Surface water bodies classified as 'Lowland soft bed'	
Water temperature	• Shall not exceed 23 °C. • When the natural or existing water temperature is 16 °C or less: o The daily maximum ambient water temperature shall not be increased by more than 3 °C as a result of any discharge. • If the natural or existing water temperature is above 16 °C: o The natural or existing water temperature shall not be exceeded by more than 1 °C as a result of any discharge.
pH	• Shall be within the range 6.5 to 9. • There shall be no pH change in water due to a discharge that results in a loss of biological diversity or a change in community abundance and composition.
Dissolved oxygen	• Concentration of dissolved oxygen in water shall exceed 80% of saturation concentration.
Bacterial or fungal slime growths	• There shall be no bacterial or fungal slime growths visible to the naked eye as obvious plumose growths or mats. Note that this standard also applies to within the zone of reasonable mixing for a discharge.
Visual clarity	• When the flow is below the median flow, the visual clarity of the water shall not be less than 1.3 metres.
Macroinvertebrates	• MCI shall exceed 80 and SQMCI shall exceed 3.5.

3.2 Water quality

Water quality measurements were taken at each site for temperature (°C), pH, dissolved oxygen (% and mg/L) and conductivity (µS/cm) using a calibrated handheld YSI Professional Plus multi-probe field meter. Water clarity was measured at each site using a WET Labs C-star 532 nm transmissometer, and turbidity was measured using a Hach 2100Q turbidimeter. Measurements were assessed against Environment Southland water quality standards for 'lowland soft bed' water bodies (Table 1) and against water quality guidelines for New Zealand streams (e.g., ANZECC 1992).

3.3 Periphyton

Periphyton (algae, fungi and bacteria that form a growing biofilm) was visually assessed at each site. Different substrates available for periphyton growth (e.g., gravels, cobbles, macrophytes, woody debris) were inspected. Samples of representative algal cover were collected from each site and returned to the laboratory for further identification.

In the laboratory, each periphyton sample was thoroughly mixed and three aliquots removed to an inverted microscope settling chamber then allowed to settle for 10 minutes. Samples were analysed according to the "relative abundance using an inverted microscope" method outlined in Biggs and Kilroy (2000). Samples were inspected under 200-400x magnification to identify algal species present using the keys of Biggs and Kilroy (2000), Entwisle *et al.* (1988) and Moore (2000). Algae were given an abundance score ranging from 1 (rare) to 8 (dominant) based on the protocol of Biggs and Kilroy (2000).

3.4 Macrophytes

An aquatic plant (macrophyte) assessment was undertaken using the macrophyte cover rapid assessment protocol outlined in 'Aquatic Plant Cover in Wadeable Streams' (Collier *et al.* 2014). Five evenly-spaced transects were assessed at each site. The percentage cover of macrophytes in a 1 m wide belt across the entire wetted width of the stream was estimated at each transect. Macrophytes were divided into emergent macrophytes and submerged macrophytes. Emergent macrophytes are those with parts clearly rising above the water whereas submerged macrophytes are those that occur beneath the water surface or extend to the surface.

Macrophyte indices were calculated from the macrophyte cover assessment (Collier *et al.* 2014):

Macrophyte total cover (MTC): extent of cover over the bottom.
= {(SUM (% emergent + % submerged)} / 5

Macrophyte channel clogginess (MCC): extent of cover through the water column.

= (SUM (% emergent + % surface reaching) + (% below surface * 0.5)) / 5

Macrophyte native cover (MNC): naturalness of the rooted macrophyte community.

= (SUM % native species) / 5

3.5 Macroinvertebrates

Field collection

Benthic macroinvertebrates were sampled using a kicknet (500 µm mesh) according to collection protocol 'C2: soft-bottomed semi-quantitative', as described in the Ministry for the Environment's 'Protocols for sampling macroinvertebrates in wadeable streams' (Stark *et al.* 2001). Samples were collected by disturbing macrophyte beds, bank margins, woody debris, and gravel substrates. Three samples were collected from each site. Samples were preserved in 70% ethanol for later identification.

Laboratory assessment

In the laboratory, samples were processed following "Protocol 'P1: Coded abundance", outlined in Stark *et al.* (2001). Samples were sieved through a 500 µm sieve to remove fine material and residual ethanol. Contents of the sieve were then placed in a white tray. Each taxon present in the sample was assigned to one of five coded abundance categories (Table 2). Up to 20 individuals representative of each taxon were removed from each sample to confirm identifications under a dissecting microscope (10-40x) using criteria from Winterbourn *et al.* (2006).

Table 2 *Coded abundance scores used to summarise macroinvertebrate data (after Stark 1998).*

Abundance	Coded abundance	Weighting factor
1 – 4	Rare (R)	1
5 – 19	Common (C)	5
20 – 99	Abundant (A)	20
100 – 499	Very abundant (VA)	100
> 500	Very very abundant (VVA)	500

Data presentation and analyses

For each site, benthic macroinvertebrate community health was assessed by determining the following characteristics:

Number of taxa: A measurement of the number of taxa present.

Number of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa, and percentage of the total number of taxa comprising EPT taxa (% EPT taxa): These insect groups are generally dominated by invertebrates that are indicative of higher quality conditions. In stony bed rivers, these indexes usually increase with improved water quality and increased habitat diversity.

Macroinvertebrate Community Index (MCI) (Stark 1993): The MCI uses the occurrence of specific macroinvertebrate taxa to determine the level of organic enrichment in a stream. Taxon scores are between 1 and 10, 1 representing species highly tolerant to organic pollution (e.g., worms and some dipteran species) and 10 representing species highly sensitive to organic pollution (e.g., most mayflies and stoneflies). A site score is obtained by summing the scores of individual taxa and dividing this total by the number of taxa present at the site. These scores can be interpreted in comparison with national standards (Table 3) and with Environment Southland standards for 'lowland soft bed' water bodies (Table 1). For example, a low site score (e.g., 40) represents 'poor' conditions and a high score (e.g., 140) represents 'excellent' conditions.

$$MCI = \left(\frac{\text{Sum of taxa scores}}{\text{Number of scoring taxa}} \right) \times 20$$

Semi-quantitative MCI (SQMCI) (Stark 1998): The SQMCI uses the same approach as the MCI but weights each taxa score based on how abundant the taxa is within the community. Abundance of all taxa is recorded using a five-point scale (Table 2). As for MCI, SQMCI scores can be interpreted in the context of national standards (Table 3) and with Environment Southland standards for 'lowland soft bed' water bodies (Table 1).

$$SQMCI = \frac{\text{Sum of (Taxa coded abundance x Taxa score)}}{\text{Sum of coded abundances for sample}}$$

Macroinvertebrate Community Index for soft-bottomed streams (MCI-sb) and semi-quantitative MCI for soft-bottomed streams (SQMCI-sb) (Stark and Maxted 2007): These biotic indices have been developed specifically for use in soft-bottomed streams. The original MCI and SQMCI were developed for use in hard-bottomed streams based on sampling macroinvertebrates from riffle or run habitats, however their use has often been extended through a wide range of habitats including soft-bottomed areas. The soft-bottomed indices use the same principles as the hard-bottomed MCI and SQMCI indices, however new taxon-specific tolerance scores (between 1 and 10) have been derived specifically for soft-bottomed streams (Stark and Maxted 2007). As for MCI and SQMCI, MCI-sb and SQMCI-sb scores can be interpreted in the context of national standards (Table 3).

Table 3 *Interpretation of macroinvertebrate community index values from Boothroyd and Stark (2000) (Quality class A) and Stark and Maxted (2007) (Quality class B).*

Quality Class A	Quality Class B	MCI, MCI-sb	SQMCI, SQMCI-sb
Clean water	Excellent	≥ 120	≥ 6.00
Doubtful quality	Good	100 – 119	5.00 – 5.99
Probable moderate pollution	Fair	80 – 99	4.00 – 4.99
Probable severe pollution	Poor	< 80	< 4.00

3.6 Data presentation and analyses

Data has been presented graphically as means +/- one standard error. A one-way Analysis of Variance (ANOVA) was used to test for differences between sites using the statistical package Data Desk®. Macrophyte cover data was first transformed (arcsine square root transformation) to meet the assumptions of normal distribution of data required for ANOVA. Where ANOVA tests indicated a significant difference between sites (i.e., $p<0.05$), Bonferroni post hoc testing was employed to determine which sites differed significantly from others.

4. Results and Discussion

4.1 General

Sampling was undertaken on the 12th of April 2017. Weather conditions were overcast and steady rain was falling during sampling. Flow monitoring is not undertaken in the Tokanui River catchment, but Environment Southland has a permanent flow monitoring site in the adjacent Waikawa River catchment. The Waikawa River at Biggar Road site therefore provides a useful indication of flow conditions in the Tokanui River. River flows had been dropping following a high flow period in early 2017, but the steady rain on the day of the survey resulted in Waikawa River flows increasing slightly, from an average hourly flow of approximately 0.9 m^3/s to 1.1 m^3/s during the period the survey was undertaken (Figure 2). The corresponding minor flow increase therefore expected in the Tokanui River would not have resulted in any changes to biological communities.

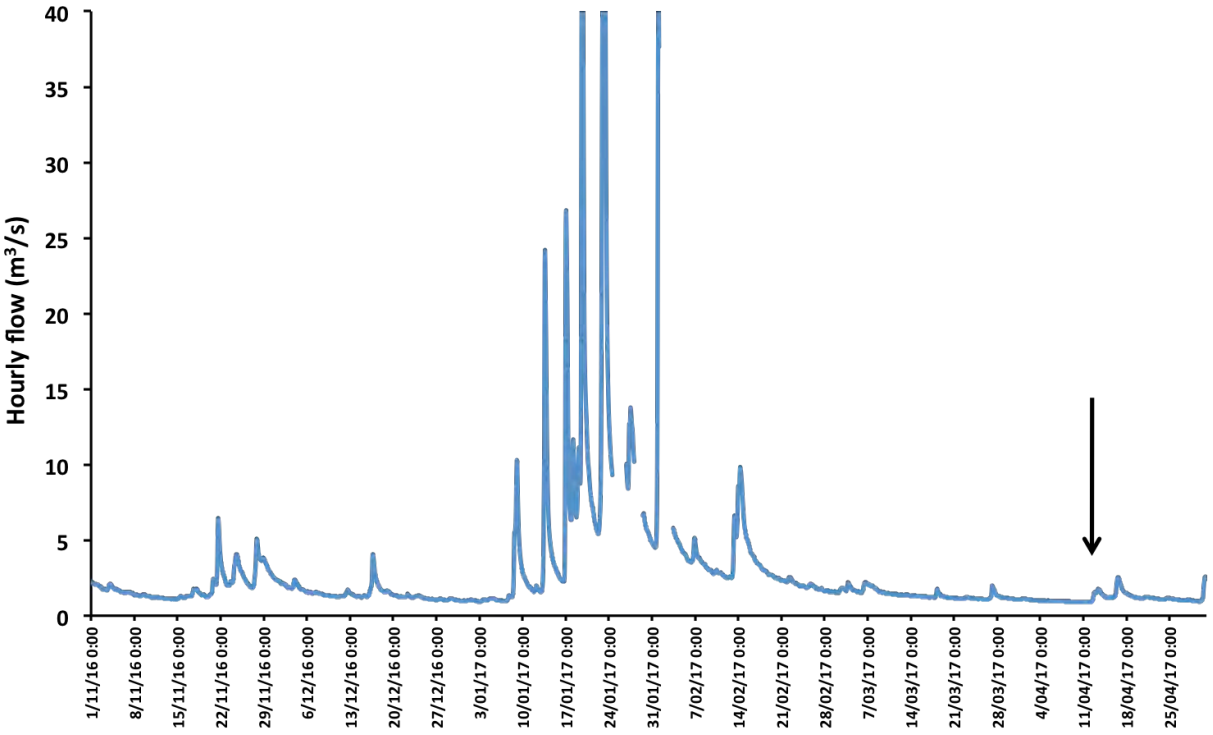

Figure 2 *Mean hourly flow (m^3/s) of the Waikawa River at Biggar Road. (Data source: Environment Southland). The vertical arrow indicates the timing of the survey in the Tokanui River.*

4.2 Survey site descriptions

The Tokanui River at the three survey sites (Figures 1 and 3) was surrounded by farmland, with fencing separating riparian areas from adjacent paddocks. Riparian vegetation comprised rank grass, with small areas of overhanging gorse and flax, particularly at Downstream 2. Macrophytes included monkey musk (*Erythranthe guttata*), which was present along the banks in many areas, with some watercress (*Nasturtium officinale*) and creeping bent (*Agrostis stolonifera*). The river flows through a deep channel with steep sides, with areas of bank erosion evident at all three sites. The channel was between approximately 3 and 7 m wide, and between approximately 0.3 m and 1.4 m deep, with some deeper areas at Downstream 2.

Instream habitat comprised slow runs, with large macrophyte beds at each site (Figure 3). Bed substrate comprised beds of soft sediments, with small areas of fine gravels and isolated cobbles at each site and some small patches of bedrock and isolated woody debris. An eel (unidentified species) was disturbed in macrophyte beds at Downstream 2 during sampling.

Figure 3 *Survey sites, April 2017.*
Top: Upstream. Bottom: Downstream 1 (left), Downstream 2 (right).

4.3 Water quality

Steady rain was falling on the day of the survey and a slight flow increase was therefore expected during the day. Subsequently, water quality sampling was undertaken over a period of one hour at the beginning of the survey to minimise differences between sites due to any changes in river conditions.

Water quality indicators were similar at all three survey sites (Table 4). Temperatures at all three sites were low and there was no temperature change as a result of the discharge, therefore meeting the standard in the Environment Southland Water Plan (2014) and Environment Southland's Proposed Southland Water and Land Plan (3 June 2016) (Table 1).

pH levels were similar at all three sites (Table 4) and within the range 6 to 9, as specified by Environment Southland in the 2014 Water Plan and the Proposed Southland Water and Land Plan (3 June 2016) (Table 1). This range is also typically cited as being appropriate for freshwater bodies of New Zealand (ANZECC 1992).

Dissolved oxygen saturation at all three sites was higher than the minimum standard of 80% specified by Environment Southland in the 2014 Water Plan and the Proposed Southland Water and Land Plan (3 June 2016) (Tables 1 and 4). Saturation of 80% is also an acceptable minimum standard for lowland river environments and protects trout, which is the fish species most sensitive to low dissolved oxygen in New Zealand waters (Third Schedule of the Resource Management Act 1991, Dean and Richardson 1999). Dissolved oxygen concentrations were above 9 mg/L at all three sites.

Conductivity can provide a useful indicator of nutrient enrichment in freshwater environments. Conductivity levels were similar at all three sites (Table 4).

Water clarity was similar at all three sites, with slightly lower turbidity at downstream sites. The Environment Southland standard for water clarity for 'lowland soft bed' water bodies is '*When the flow is below the median flow, the visual clarity of the water shall not be less than 1.3 metres*'. The median flow in the Tokanui River has not been calculated, but water clarity at all three sites was slightly less than 1.3 m. However, as clarity was similar at all three sites, including upstream

of the discharge point, the discharge was not affecting water clarity at the time of sampling.

Table 4 *Water quality in the Tokanui River, April 2017.*

Parameter	Upstream	Downstream 1	Downstream 2
Time	1045	1025	1000
Temperature (°C)	11.1	11.1	11.1
pH	7.19	7.24	7.34
Dissolved oxygen (%)	84.8	84.4	84.0
Dissolved oxygen (mg/L)	9.33	9.26	9.22
Conductivity (µS/cm)	147.6	147.5	148.3
Turbidity (NTU)	6.62	6.34	5.92
Clarity (m)	1.08	1.08	1.09

4.4 Periphyton

Periphyton was observed on macrophyte beds and solid substrates (e.g., woody debris) at each site, with mat and short filamentous algae covering large areas of the macrophyte beds at all three sites. The composition of the communities was very similar at each site, with mats and filaments dominated by the filamentous diatom *Melosira* (Table 5). *Melosira* is probably the most common filamentous diatom in New Zealand (Moore 2000), is found throughout the country in slow to medium flowing open lowland streams, and can dominate communities in moderately enriched situations (Biggs and Kilroy 2000). Other diatoms found in the river, including *Frustulia*, are commonly found in a range of conditions throughout New Zealand. The single celled *Closterium* is commonly found in slow flowing waters in weedy habitats (Moore 2000) and can be quite common in moderately enriched streams (Biggs and Kilroy 2000).

Overall, the algal taxa found upstream and downstream of the discharge are typical of those found in similar slow flowing habitat throughout New Zealand. There were no bacterial or fungal slime growths visible to the naked eye at any of the sites.

Table 5 *Benthic algae found in the Tokanui River, April 2017. Abundance scores range from 1 (rare) to 8 (dominant) based on the protocol of Biggs and Kilroy (2000).*

Filamentous diatoms	Upstream	Downstream 1	Downstream 2
Melosira	8	8	7
Diatoms			
Cocconeis	2	1	2
Frustulia	5	5	6
Gomphonema		2	
Naviculoid diatom	3	3	3
Synedra	2	2	1
Phytoplankton			
Closterium	4	4	3

4.5 Macrophytes

Six different macrophyte species were found in the Tokanui River: the exotic *Agrostis stolonifera* (creeping bent), *Elodea canadensis* (Canadian pondweed), *Erythranthe guttata* (monkey musk), *Nasturtium officinale* (watercress), and *Ranunculus tricophyllus* (water buttercup), and the native *Potamogeton ochreatus* (blunt pondweed). Macrophytes were observed throughout the channel at all three sites and along the edges. Raw macrophyte cover data can be found in Appendix One.

Macrophyte cover levels were high at all three survey sites. Macrophyte indices, calculated according to the macrophyte cover assessment (Collier *et al.* 2014), reveal that cover levels over the stream bed (total cover) and through the water column (channel clogginess) were highest at the Upstream site, while cover of native species (i.e., *Potamogeton ochreatus*) was highest at Downstream 1 (Table 6).

Submerged macrophytes dominated the communities at all three sites, with cover levels of emergent macrophytes low at all three sites. There were no statistically significant differences between sites in any of the macrophyte cover categories ($p>0.05$, Table 7, Figure 4).

Table 6 *Macrophyte indices calculated for the Tokanui River, April 2017.*

	Upstream	Downstream 1	Downstream 2
Macrophyte total cover (%)	73.8	68.4	69.4
Macrophyte channel clogginess (%)	46.1	42.4	43.9
Macrophyte native cover (%)	46	53	46

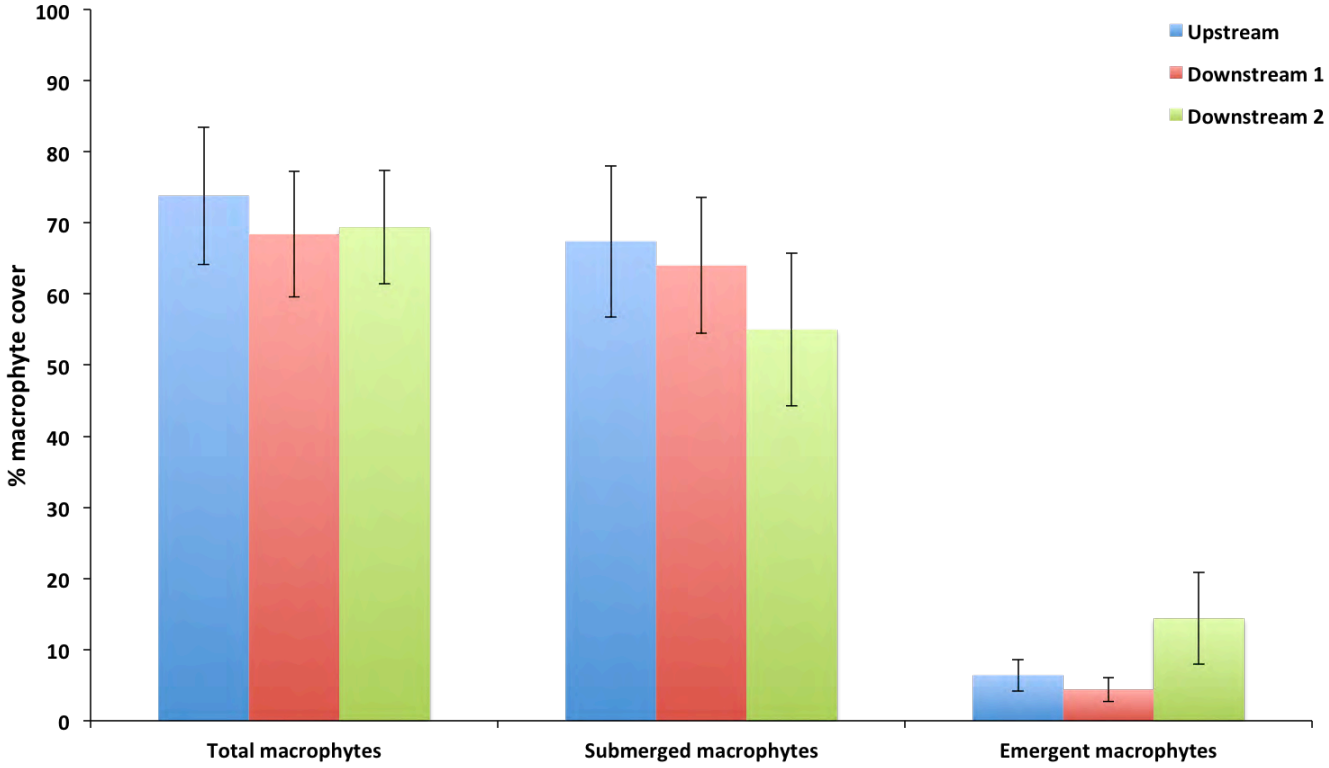

Figure 4 *Percentage cover of the bed substrate by macrophytes at the three survey sites in the Tokanui River, April 2017 (mean +/- one standard error).*

Table 7 *Results of one factor analysis of variance for each of the macrophyte cover categories between sites, Tokanui River, April 2017.*

	$F_{2,12}$	p-value	Interpretation
Total vegetation cover	0.18	0.84	No significant difference
Total submerged plants	0.47	0.64	No significant difference
Total emergent plants	0.92	0.43	No significant difference

4.6 Macroinvertebrates

A total of 41 different invertebrate taxa were identified from the three sites, with a total of 28 taxa identified Upstream, 29 taxa from Downstream 1, and 38 taxa from Downstream 2 (Table 8). Overall taxonomic diversity at each site was therefore considerably higher than the national median of 18 taxa per site, as determined by Scarsbrook *et al.* (2000) from samples collected from 66 sites throughout New Zealand. There were no statistically significant differences between sites in the number of taxa (*p>0.05*, Table 9, Figure 5).

A total of 13 different EPT taxa (insect larvae typically indicative of higher water quality; mayflies, stoneflies and caddisflies) were identified from the three sites (Table 8). A total of nine EPT taxa were identified Upstream, ten EPT taxa from Downstream 1, and eleven EPT taxa from Downstream 2. The total number of EPT taxa per site was therefore higher than the median of eight taxa per site determined by Scarsbrook *et al.* (2000) from their national assessment. There were no statistically significant differences between sites in the number of EPT taxa or the percentage of EPT taxa (*p>0.05*, Table 9, Figure 5). EPT taxa found at each site included the high scoring *Deleatidium* mayflies, *Megaleptoperla* stoneflies, and *Helicopsyche* caddisflies (Table 8).

Macroinvertebrate communities at each site were dominated by *Potamopyrgus* snails and *Paracalliope* amphipods (Table 8). *Austrosimulium* (sandfly) larvae, chironomid midge larvae (e.g., *Chironomus*, Orthocladiinae), and oligochaete worms were also abundant at each site.

Freshwater crayfish (*Paranephrops zealandicus*) (koura) were found Upstream and at Downstream 1. Freshwater crayfish are classified as 'At Risk – Declining' under the New Zealand Threat Classification System (NZTCS) criteria (Townsend *et al.* 2008), with criteria C (1/1) (very large population and low to high ongoing or predicted decline, >100,000 mature individuals, predicted decline 10 70 %) and the qualifier 'Partial Decline' (Grainger *et al.* 2014). Large crayfish were caught at both sites, including female crayfish supporting fertilised eggs under the tail (berried females). Most crayfish supported large numbers of *Temnohaswellia* flatworms covering the crayfish exoskeleton (Figure 6). These flatworms live primarily on the exoskeleton of freshwater crayfish, and feed on small invertebrates stirred up by the host crayfish.

Macroinvertebrate community health index (MCI) and semi-quantitative MCI (SQMCI) scores were all similarly low, with average MCI scores at each site indicative of 'fair' quality conditions, and average SQMCI scores at each site indicative of 'poor-fair' quality conditions, using the narrative terminology of Stark and Maxted (2007) (Tables 3 and 8, Figure 5). Soft bottomed MCI variants were also similarly low at each site, with average MCI-sb scores at each site indicative of 'fair' quality conditions, and average SQMCI-sb scores at each site indicative of 'poor' quality conditions. There were no statistically significant differences between sites in any of the community health index scores ($p>0.05$, Table 9, Figure 5).

Environment Southland, in the 2014 Water Plan and the Proposed Southland Water and Land Plan (3 June 2016), specify that in 'lowland soft bed' water bodies, MCI scores shall exceed 80 and SQMCI scores shall exceed 3.5 (Table 1). At each site surveyed in the Tokanui River, average MCI site scores were above 80 and average SQMCI site scores were above 3.5, thereby meeting Environment Southland's standards.

Table 8 *Macroinvertebrate taxa found in the Tokanui River, April 2017.*

			Upstream			Downstream 1			Downstream 2		
TAXON	**MCI score**	**MCI-sb score**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
CNIDARIA											
Hydra species	3	1.6	R	C	C	A	R	R	C	C	C
COLLEMBOLA	6	5.3							R		
CRUSTACEA											
Austridotea annectens	5	4.5	VA	C	A	C	A	A		VA	
Cladocera	5	0.7							R		
Copepoda	5	2.4							R		
Ostracoda	3	1.9		R	C	A	R	C	C	A	R
Paracalliope fluviatilis	5	5.5	VVA	VVA	VA	VVA	VA	VVA	VVA	VVA	VVA
Paraleptamphopus species	5	5.5		R	R		R	R	R		R
Paranephrops zealandicus	5	8.4	R	R		R	R				
Talitridae	5	5.5	R								R
DIPTERA											
Aphrophila species	5	5.6	C	R						R	
Austrosimulium species	3	3.9	VA	VVA	A	VA	A	VA	C	VA	VVA
Chironomus species	1	3.4		R	R	R	R	C	C	R	
Corynoneura scutellata	2	1.7		R		R		C	A		C
Empididae	3	5.4			R			R		R	
Ephydridae	4	1.4							R		
Lobodiamesa species	5	7.7									R
Orthocladiinae	2	3.2	A	A	A	VA	A	A	A	C	A
Polypedilum species	3	8.0	R	R	C	C	R	C	R	R	R
EPHEMEROPTERA											
Austroclima species	9	6.5	R				R	R	R		R
Deleatidium species	8	5.6	A	C	A	C	A	A	R	A	C
HEMIPTERA											
Diaprepocoris zealandiae	5	4.7							R		
Sigara species	5	2.4							R		
MOLLUSCA											
Physa / *Physella* species	3	0.1				R		R	R		
Potamopyrgus antipodarum	4	2.1	VVA	VVA	VVA	VVA	VVA	VVA	VVA	VVA	VVA
Sphaeriidae	3	2.9		R	C	C	R	R	C	R	
NEMATODA	3	3.1				C	R	R		R	R
OLIGOCHAETA	1	3.8	A	C	VA	VA	A	A	A	VA	C
PLATYHELMINTHES	3	0.9	C	R		R	R	R		R	
Temnohaswellia novaezealandiae	3	0.9	R	R				R	C		R
PLECOPTERA											
Megaleptoperla species	9	7.3	A	A	C	C	C	C	R	C	
Zelandobius species	5	7.4	R	C		C	C	C	C	R	C
TRICHOPTERA											
Aoteapsyche species	4	6.0					R			C	R
Helicopsyche species	10	8.6	A	C	A		A	C		A	
Hudsonema alienum	6	6.5				R		R			
Hudsonema amabile	6	6.5									R
Hydrobiosis umbripennis group	5	6.7	C	C	R	R	R	C		R	C
Oxyethira albiceps	2	1.2	A	VA	A	A	C	A	C	A	VA
Polyplectropus species	8	8.1							R		
Psilochorema species	8	7.8	R								
Triplectides species	5	5.7	R		R	R			C		
Number of taxa			22	23	19	23	23	26	27	22	21
Number of EPT taxa			9	6	6	7	8	8	7	7	7
% EPT taxa			41	26	32	30	35	31	26	32	33
MCI score			98	83	84	77	88	84	87	82	82
SQMCI score			4.5	3.9	3.9	3.9	4.3	4.3	4.3	4.2	3.9
MCI-sb score			100.6	87.5	91.4	83.0	93.9	83.2	76.4	89.6	89.8
SQMCI-sb score			4.0	3.7	3.1	3.7	3.1	3.9	3.7	3.9	3.7
Average MCI score				88			83			83	
Average SQMCI score				4.1			4.2			4.1	
Average MCI-sb score				93.2			86.7			85.3	
Average SQMCI-sb score				3.6			3.6			3.8	

Table 9 *Results of one-way analysis of variance (ANOVA) testing for differences between sites for each of the main invertebrate metrics measured.*

Variable	$F_{2,6}$	p-value	Interpretation
Number of taxa	0.98	0.43	No significant difference
Number of EPT taxa	0.4	0.69	No significant difference
% EPT taxa	0.19	0.83	No significant difference
MCI score	0.72	0.53	No significant difference
SQMCI score	0.03	0.97	No significant difference
MCI-sb score	1.10	0.39	No significant difference
SQMCI-sb score	0.31	0.75	No significant difference

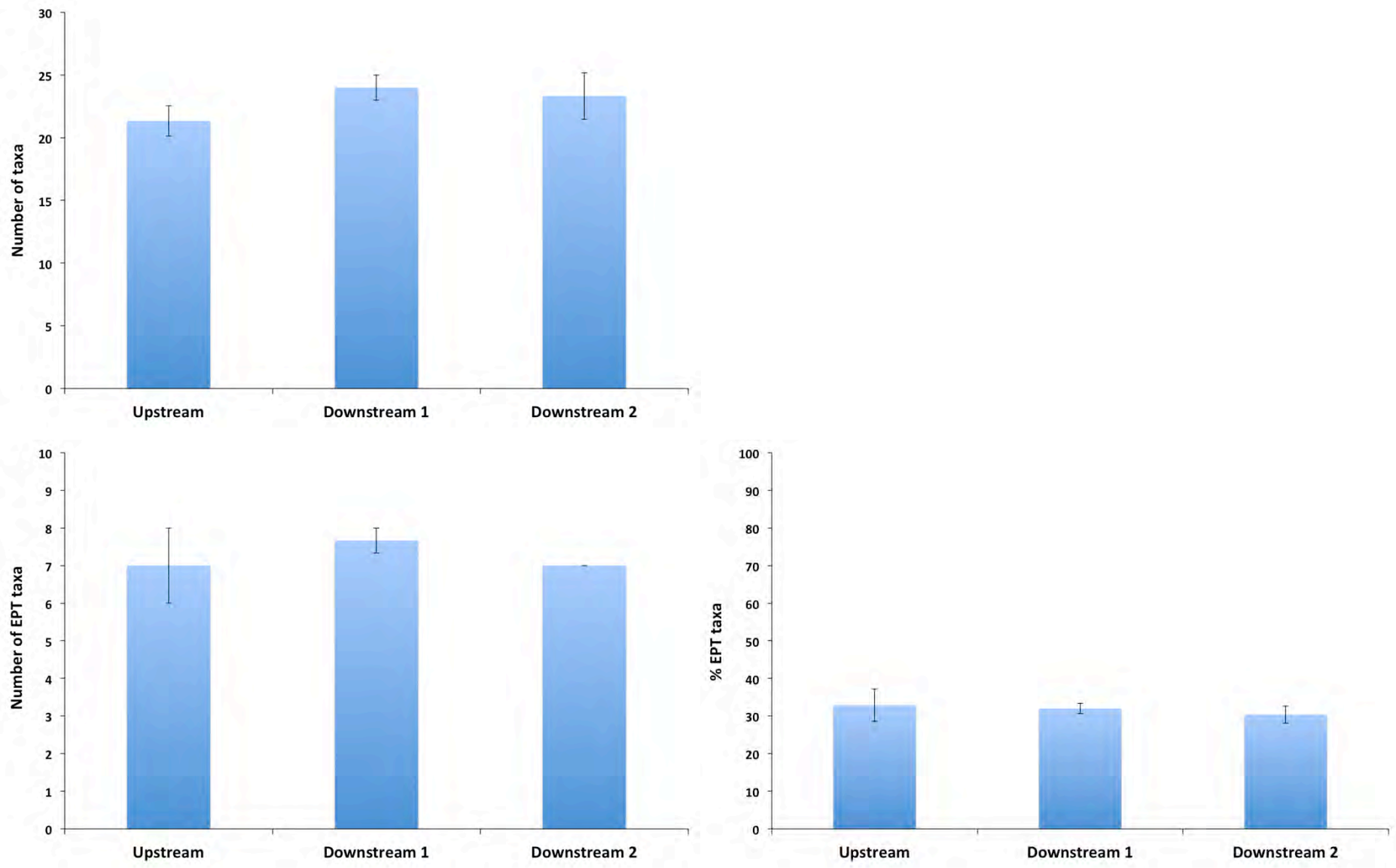

Figure 5 *Values for invertebrate metrics for samples collected from the Tokanui River, April 2017 (mean +/- one standard error).*

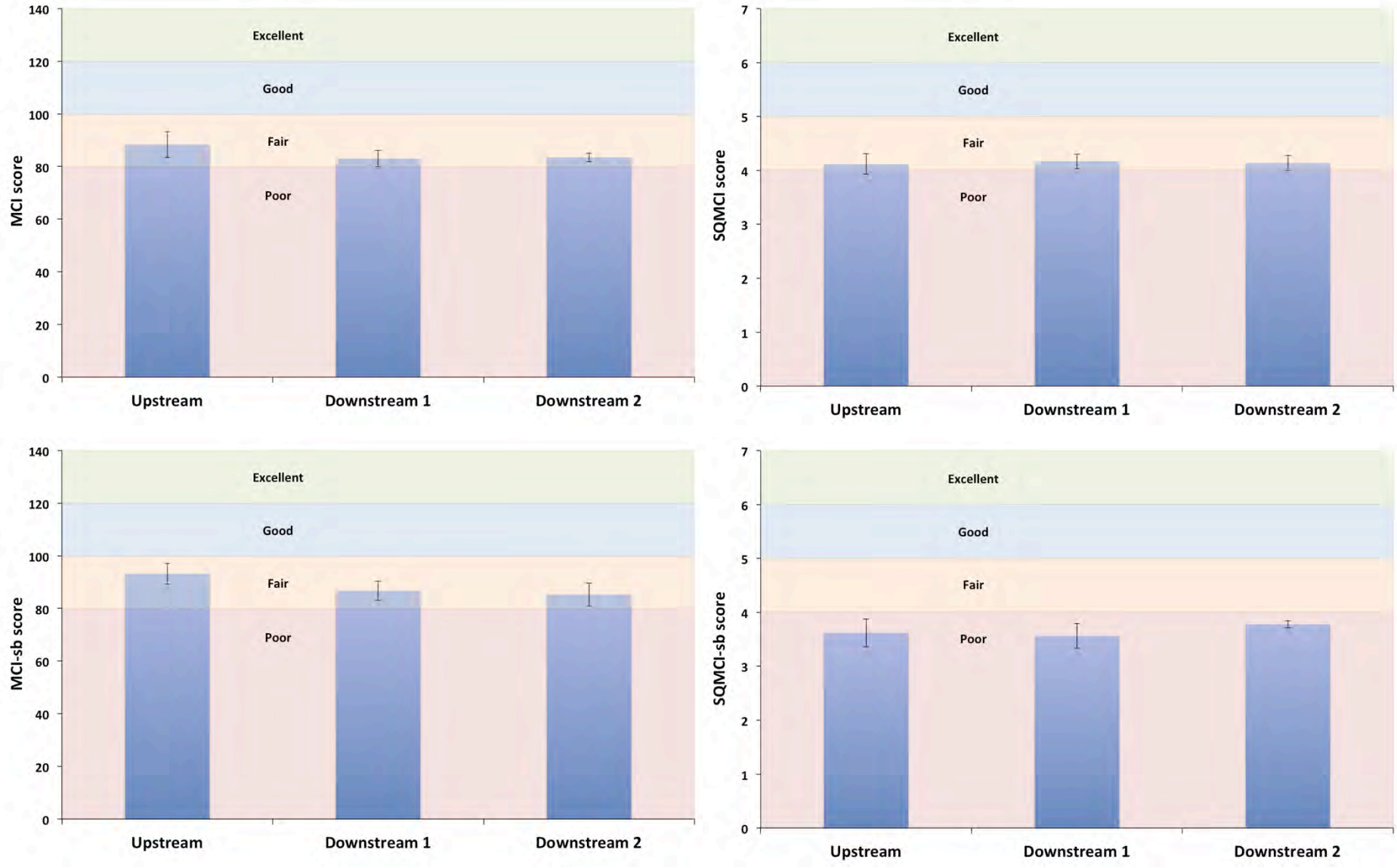

Figure 5 (cont.) *Values for invertebrate metrics for samples collected from the Tokanui River, April 2017 (mean +/- one standard error).*

Figure 6 *Freshwater crayfish covered with* Temnohaswellia *flatworms, Tokanui River, April 2017. Berried female in right photo. Photos blurred due to rain on the camera lens.*

5. Summary and Conclusion

The April 2017 biological survey of the Tokanui River in the vicinity of the Tokanui wastewater treatment system revealed benthic communities dominated by macrophyte beds supporting macroinvertebrate communities typical of soft bottomed lowland rivers.

Water quality throughout the Tokanui River was similar at each site and generally complied with 'lowland soft bed' standards specified by Environment Southland in the 2014 Water Plan and the Proposed Southland Water and Land Plan (3 June 2016). The only water quality standard not met was water clarity, with water clarity at all three sites slightly less than the 1.3 m standard. Water clarity was, however, similar upstream and downstream of the discharge point, indicating the lower clarity was not influenced by the discharge. Overall, conditions throughout the river were similar, indicating that the wastewater treatment system discharge was not adversely affecting the water quality of the

river.

Periphyton mats and short filamentous algae were found on macrophytes beds and solid substrates throughout the river, with communities dominated by *Melosira*, a filamentous diatom found throughout the country in open lowland streams. Overall, periphyton communities upstream and downstream of the discharge were similar and typical of those found in similar slow flowing habitat throughout New Zealand. There were no bacterial or fungal slime growths visible to the naked eye at any of the sites.

Macrophytes were dominant throughout the river, with communities comprising one native species and five exotic species. Macrophyte cover levels were high upstream and downstream of the discharge point, with total cover and channel clogginess highest upstream of the discharge. Communities were dominated by submerged macrophytes (i.e., beneath the water surface or extending to the surface), with similar cover of submerged and emergent macrophytes at each site. Overall, macrophyte community composition and cover was similar at each site, indicating that the wastewater treatment system discharge was not adversely affecting aquatic plant communities in the Tokanui River.

Benthic macroinvertebrate communities were similar throughout the river and characterised by high diversity and composition typical of soft bottomed lowland rivers. Communities included several EPT taxa typically indicative of good water quality (EPT: mayflies, stoneflies and caddisflies), such as *Deleatidium* mayflies. The 'At Risk – Declining' freshwater crayfish was found upstream and downstream of the discharge point, including some very large individuals and large berried females (i.e., supporting fertilised eggs). Macroinvertebrate community health indices were similarly low at each site, with scores upstream and downstream of the discharge point indicative of 'poor' to 'fair' quality conditions. These scores are typical of the type of habitat and Environment Southland's 'lowland soft bed' macroinvertebrate community standards were therefore met at each site. Overall, the similarities in macroinvertebrate communities upstream and downstream of the discharge indicate that the discharge was not adversely affecting benthic invertebrate communities of the Tokanui River.

In conclusion, results from our survey indicate that the discharge from the Tokanui wastewater treatment system was not affecting biological communities of the Tokanui River.

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Appendix One

Macrophyte cover data

Site: Upstream

Transect	Wetted width (m)	Channel width (m)	Vegetation cover (% wetted area)							
			Total cover	Submerged plants					Emergent plants	
				Total submerged	Surface-reaching		Below surface		Total emergent	Taxa
					Sub-total	Taxa	Sub-total	Taxa		
1	3	3	**65**	**60**	**20**	*Potamogeton ochreatus* 20%	**40**	*Elodea canadensis* 10% *Potamogeton ochreatus* 10% *Ranunculus tricophyllus* 20%	**5**	*Erythranthe guttata* 5%
2	4	4	**47**	**42**	**10**	*Potamogeton ochreatus* 10%	**32**	*Elodea canadensis* 2% *Potamogeton ochreatus* 20% *Ranunculus tricophyllus* 10%	**5**	*Erythranthe guttata* 5%
3	3	3	**65**	**50**	**15**	*Potamogeton ochreatus* 15%	**35**	*Elodea canadensis* 25% *Potamogeton ochreatus* 10%	**15**	*Agrostis stolonifera* 5% *Erythranthe guttata* 10%
4	4	4	**97**	**95**	**15**	*Potamogeton ochreatus* 15%	**80**	*Potamogeton ochreatus* 80%	**2**	*Erythranthe guttata* 2%
5	5	5	**95**	**90**	**0**		**90**	*Elodea canadensis* 40% *Potamogeton ochreatus* 50%	**5**	*Erythranthe guttata* 5%

Site: Downstream 1

Transect	Wetted width (m)	Channel width (m)	Vegetation cover (% wetted area)							
			Total cover	Submerged plants					Emergent plants	
				Total submerged	Surface-reaching		Below surface		Total emergent	Taxa
					Sub-total	Taxa	Sub-total	Taxa		
1	5	5	**50**	**45**	**40**	*Potamogeton ochreatus* 40%	**5**	*Potamogeton ochreatus* 5%	**5**	*Erythranthe guttata* 5%
2	6	6	**75**	**65**	**20**	*Potamogeton ochreatus* 20%	**45**	*Elodea canadensis* 15% *Potamogeton ochreatus* 30%	**10**	*Erythranthe guttata* 5% *Nasturtium officinale* 5%
3	4	4	**87**	**85**	**0**		**85**	*Elodea canadensis* 15% *Potamogeton ochreatus* 70%	**2**	*Erythranthe guttata* 2%
4	5	5	**85**	**85**	**0**		**85**	*Elodea canadensis* 5% *Potamogeton ochreatus* 80%	**0**	
5	3.5	3.5	**45**	**40**	**0**		**40**	*Elodea canadensis* 20% *Potamogeton ochreatus* 20%	**5**	*Erythranthe guttata* 5%

Site: Downstream 2

Transect	Wetted width (m)	Channel width (m)	Vegetation cover (% wetted area)							
			Total cover	Submerged plants					Emergent plants	
				Total submerged	Surface-reaching		Below surface		Total emergent	Taxa
					Sub-total	Taxa	Sub-total	Taxa		
1	7	7	**82**	**75**	**10**	*Potamogeton ochreatus* 10%	**65**	*Elodea canadensis* 5% *Potamogeton ochreatus* 60%	**7**	*Erythranthe guttata* 5% *Nasturtium officinale* 2%
2	5	5	**85**	**80**	**0**		**80**	*Potamogeton ochreatus* 80%	**5**	*Erythranthe guttata* 5%
3	4	4	**50**	**50**	**10**	*Potamogeton ochreatus* 10%	**40**	*Elodea canadensis* 20% *Potamogeton ochreatus* 20%	**0**	
4	5	5	**80**	**50**	**0**		**50**	*Elodea canadensis* 10% *Potamogeton ochreatus* 40%	**30**	*Erythranthe guttata* 30%
5	5	5	**50**	**20**	**0**		**20**	*Elodea canadensis* 10% *Potamogeton ochreatus* 10%	**30**	*Erythranthe guttata* 30%

Appendix K Planning Maps

Refer Map 42▲

RURAL

Building Restriction 150m radius

D49
Wastewater Treatment

D144
School

D221
Exchange

ER65

TOKANUI RIVER

URBAN

D182
Substation

NEILL RD

BUCKINGHAM ST

DUNCAN ST

McKENZIE ST

NIAGARA TOKANUI HWY

TOKANUI GORGE ROAD HWY

SHIRLEY RD

OTARA ST

EAST ST

SOUTH ST

WILKS RD

TURNER RD

GRAHAM RD

TOKANUI HALDANE RD

BAUCHOP RD

Refer Map 42▲

Refer Map 42▲

▼Refer Map 42

Southland DISTRICT PLAN Maps

Location Map

Adjoining Maps

NORTH

SCALE 1:9,000
@ A3

0 100 200 300
Metres

If discrepancies exist between this map and the online Plan maps, the online Plan is the authoritative version.

Please refer overleaf for Documentation Page.

TOKANUI URBAN ZONE

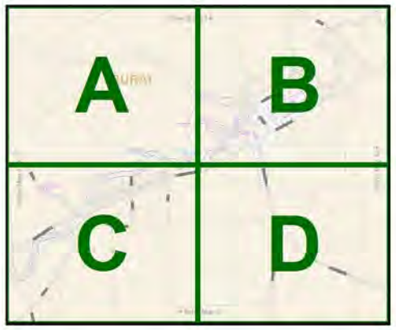
Map 73

People First
Southland District Council
Te Rohe Pōtae O Murihiku

DOCUMENTATION FOR SOUTHLAND DISTRICT PLAN MAP 73

Legend Index

Map Quadrants



This Planning Map is divided into four quadrants, as shown left.

The quadrant system is used throughout this page, as part of the planning features index.

Legend

Designations
Refer District Plan Schedule 5.3

ID NUMBER	MAP QUADRANT	SUBJECT	NOTATION
D49	B	Tokanui Wastewater Treatment Facility	Public Utility
D144	B	Tokanui Primary School	Education Purposes
D182	C	Tokonui Substation	Electricity Zone Substation, Depot and Ancillary Purposes
D221	B	Tokanui Exchange	Telecommunication and Radio Communication and Ancillary Purposes

Esplanade Requirements
Refer District Plan Schedule 5.4

ID NUMBER	MAP QUADRANT	WATERWAY	LOCATION
ER65	A-D	Tokanui River	Tokanui to the sea

Zones

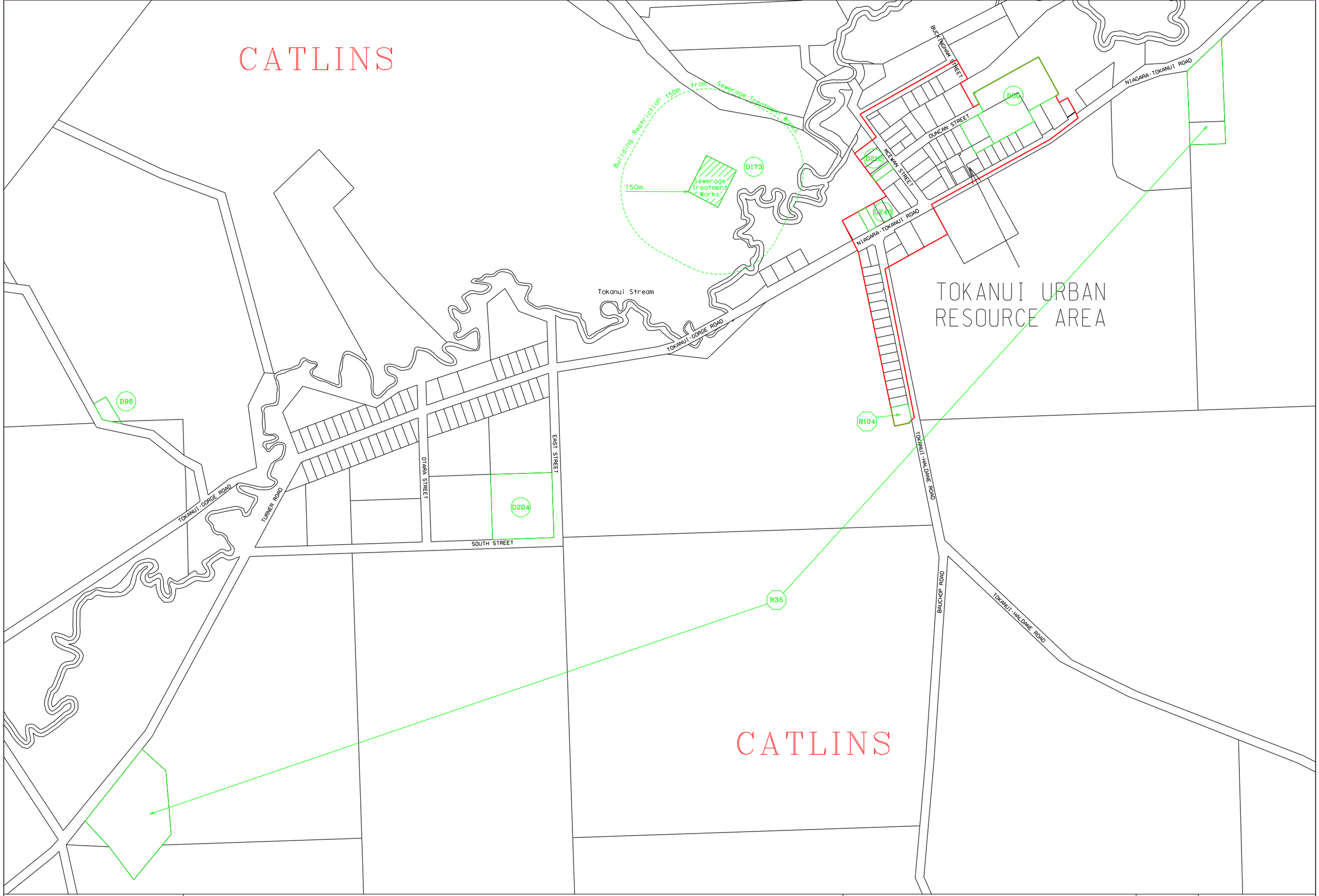
Rural

Urban

Map Metadata

Status:	Proposed
Map Version:	2
Map Created Date:	18 January 2016
Author Organisation:	Southland District Council

People First
Southland District Council
Te Rohe Pōtae O Murihiku



Southland District Council

TOKANUI URBAN RESOURCE AREA

SOUTHLAND DISTRICT PLAN

Produced by Southland District Council G.I.S.
Design File Reference - TOKANUI.DGN

0 100 200 300 400 500 m

SCALE 1 : 7500

AS AT 1 AUGUST 1995

37 37 37
37 52 37
37 37 37

Appendix L Assessment Tables

The impact of the discharge on the degree to which the receiving water complies with a number of requirements has been assessed in the following tables:

- Compliance with the conditions of consent 201599 has been summarised in Table 1.
- Compliance with water quality standards outlined in Appendix G of the RWP and Appendix E of the pSWLP have also been assessed in Table 2.
- Compliance with the relevant NPS-FM standards has been assessed in Table 3.

The tables identify the relevant standard, assesses the degree of compliance and provide an explanatory comment on the information on which the assessment has been performed.

Table 1: Compliance with Conditions of Consent 201599

Condition Number	Condition	Compliance[1]	Comment
2	Discharge quantity 55 m^3/day.		The assessment of compliance with this condition has been undertaken using inflow data derived from the pump station as there is no available data for outflows. It is noted that the Environment Southland compliance reports use inflows to assess compliance against this condition and hence the WWTP has been assessed as non-compliant with this condition. It would not be possible to determine compliance based on the current wording of the condition as the rate of discharge from the base of the ponds cannot be determined. The Council therefore requests that the new discharge permit adopts an annual average daily volume of 55 m^3/day based on inflows.
4	Rates of discharge monitored daily for at least four weeks per year.		Daily inflows have been derived from pump station data. Records from July 2013 to June 2017 have been assessed for this application.
5(a)	Discharge parameters: conductivity, total suspended solids, cBOD, ammoniacal nitrogen, total nitrogen, total phosphorus, E.*Coli.*		Data assessed from October 2005 to March 2017.

[1] Assessment uses following code:
- Green shading indicates that the discharge can meet the standard in the receiving environment.
- Orange shading indicates that there is insufficient data to determine compliance.
- Yellow shading indicates non-compliance with the standard that is not as a result of the WWTP.
- Red shading indicates non-compliance which the WWTP discharge will have contributed to.

Condition Number	Condition	Compliance[1]	Comment
5(b)	Receiving environment parameters: temperature, pH, conductivity, turbidity, dissolved oxygen, ammoniacal nitrogen, nitrate nitrogen, dissolved reactive phosphorus, E.*Coli*.		Data assessed from October 2005 to March 2017.
6(a)(i)	All monitoring shall be undertaken twice between 1 September and 30 April each year.		Monitoring has generally been undertaken in March and October of each year.
6(a)(ii)	When the Mokoreta River flow is less than 1.2 m^3/s, monitoring shall be undertaken at least monthly.		The daily flow record for the Mokoreta River at McKays Road was obtained from Environment Southland. The mean daily flow in m^3/s was used to determine compliance. There were three occasions when the flow in the river fell below 1.2 m^3/s, during March and April 2013 and for two days in January 2015. Monitoring as required under Condition 5 of the consent was undertaken in March 2013, however this monitoring was not undertaken in April 2013. Condition 6(a)(ii) states that this additional monitoring is to occur at least once a month while low flow conditions persist. The low flow conditions only persisted for two days and it is considered that this is not long enough to warrant additional monitoring. During the period reviewed (2013-present) there was only one occasion where this condition was not met.
8	The consent holder shall undertake an investigation into options for land treatment and disposal and provide an annual report up until 30 June 2008.		A report summarising the land disposal options assessed has been provided as part of this consent application.
Receiving Environment Standards (Appendix 1 201599 – Class D Waters)			
a)	The natural water temperature shall not be changed by more than 3 ^oC.		Monitoring results to date indicate that this standard is met.
b)	pH shall be within the range 6.0 to 9.0.		Monitoring results to date indicate that this standard is met.

Condition Number	Condition	Compliance[1]	Comment
c)	The water shall not be made unpalatable or toxic for stock consumption.		The stock drinking water guidelines from ANZECC 2000 are exceeded both upstream and downstream, but is not significantly affected by the WWTP discharge.
c)	The water shall not emit objectionable odour.		No complaints regarding odour from the Tokanui WWTP or the discharge have been recorded to date.
d)	There shall be no destruction of natural aquatic life.		Ryders undertook a biological survey of the Tokanui River on 12th April 2017. The results of this survey indicated that the discharge from the Tokanui WWTP was not adversely affecting the ecosystems of the Tokanui River. It is expected therefore that there would be no destruction of natural aquatic life as a result of the discharge.
e)	The natural colour or clarity shall not be changed to a conspicuous extent.		The Ryders 2017 biological survey assessed clarity at all three monitoring sites (15 m upstream, 60 m downstream, and 150 m downstream). Water clarity was similar at all three sites, indicating that the discharge was not affecting the water clarity at the time of sampling. During the site visit in Sept 2017, the discharge was clear, such that it would not change the colour or clarity of the River. The additional data collected in 2017 for turbidity indicates minimal difference between the up and downstream turbidity indicating minimal clarity impact. It is considered likely that this standard is met.
f)	The oxygen content in solution shall not be reduced below 5 mg/L.		Monitoring data indicates that this standard is complied with.

Table 2: Compliance with Environment Southland Plan Standards (Lowland Soft Bed)

Plan Standard	Compliance[2]	Comment
The temperature of water shall not exceed 23 °C.		The temperature both upstream and downstream of the discharge has not exceeded 23 °C. The maximum temperature recorded since October 2005 is 16 °C.
The daily maximum ambient water temperature shall not be increased by more than 3 °C when the natural or existing water temperature is 16 °C or less as a result of the discharge. If the natural or existing water temperature is above 16 °C, the natural or existing water temperature shall not be exceeded by more than 1 °C as a result of any discharge.		Temperature data for both the upstream and downstream sample locations is available from October 2011. The temperature of the Tokanui River has not increased between up and downstream sites by more than 1 °C downstream during any of the monitoring rounds.
The pH of the water shall be within the range 6.5 to 9, and there shall be no pH change in water due to a discharge that results in a loss of biological diversity or a change in community abundance and composition.		The pH of the Tokanui River has remained within the range of 6.5 to 9 during all monitoring rounds, with the exception of March 2015. During the March 2015 monitoring round the pH at both the upstream and downstream location were slightly less than 6.5 however the results were within the expected margin of error of the plan standard. In general the pH of the upstream and downstream sample locations were comparable, suggesting that there will be no loss of biological diversity from a pH change as a result of the discharge.

[2] [2] Assessment uses following code:

- Green shading indicates that the discharge can meet the standard in the receiving environment.
- Orange shading indicates that there is insufficient data to determine compliance.
- Yellow shading indicates non-compliance with the standard that is not as a result of the WWTP.
- Red shading indicates non-compliance which the WWTP discharge will have contributed to.

Plan Standard	Compliance[2]	Comment
The concentration of dissolved oxygen in water shall exceed 80% of saturation concentration.		The current monitoring programme records concentration of dissolved oxygen (mg/L). These results were converted to percentage saturation as identified in the data record (Appendix F). In the long term record, there have been four river monitoring samples since 2005 that recorded a percentage oxygen saturation below 80%. One of these was at the upstream site and has therefore not been considered further. The three downstream samples recorded dissolved oxygen percentage saturations of 70%, 76% and 77% respectively. The last sample to not meet this standard was collected in 2013. It should be highlighted that these percentages are based on converted dissolved oxygen concentrations and therefore there is likely to be some margin of error. In addition in all three cases the concentration of dissolved oxygen was greater than 5 mg/L. However, in the intensive sampling programme that started in August 2017, from mid December, the dissolved oxygen as %sat has been less than 80% sat at all sites and at all locations, with minimal difference between sites. This is probably a result of the higher temperatures in the waterbody. The median BOD5 of the discharge (between 2005 and 2017) is 12 g/m^3, which after dilution would be non-detectable (less than 0.03 g/m^3). Therefore, it is considered unlikely that the decrease in dissolved oxygen downstream is as a result of the WWTP discharge. It is considered unlikely that the decrease in dissolved oxygen downstream is as a result of the WWTP discharge. Dissolved oxygen can be impacted by a range of factors including differences in macrophyte growth and flow regime. The Ryder survey noted such differences in the stream between the locations, and this is considered to be the primary cause of the difference in dissolved oxygen concentrations.
There shall be no bacterial or fungal slime growths visible to the naked eye as obvious plumose growths or mats. Note this standard also applies to within the zone of reasonable mixing for a discharge.		Ryders undertook a biological assessment of the Tokanui River upstream and downstream of the discharge in April 2017. They concluded that there were no bacterial or fungal slime growths visible to the naked eye at any of the sites.

Plan Standard	Compliance[2]	Comment
When the flow is below the median flow, the visual clarity of the water shall not be less than 1.3 metres.		Visual clarity is not currently assessed as part of the consent-driven monitoring. Ryders assessed the visual clarity of the Tokanui River during the April 2017 biological survey and stated that the median flow in the Tokanui River was not calculated, but that water clarity at all three sites was slightly less than 1.3 m. Ryders went on to note that as the clarity of the river was similar at all three sites, including upstream of the discharge point, the discharge was not affecting water clarity at the time of sampling.
The concentration of total ammonia shall not exceed the values specified in Table 1 *'Ammonia standards for Lowlands and Hill surface water bodies'*.		The concentration of ammoniacal nitrogen in the receiving water did not exceed the applicable standards in Table 1. The maximum concentration of ammoniacal nitrogen recorded since 2013 was 0.4 g/m^3.
The concentration of faecal coliforms shall not exceed 1,000 coliforms per 100 millimetres, except for popular bathing sites, defined in Appendix K 'popular bathing sites' and within 1 km immediately upstream of these sites, where the concentration of *Escherichia colil* shall not exceed 130 *E.coli* per 100 millimetres.		This standard is regularly exceeded both upstream and downstream, however this is not as a result of the WWTP discharge.
The Macroinvertebrate Community Index shall exceed 80 and the Semi-Quantitative Macroinvertebrate Community Index shall exceed 3.5.		The MCI and SQMCI survey results undertaken in April 2017 indicate that this standard can be met both upstream and downstream of the discharge.
Fish shall not be rendered unsuitable for human consumption by the presence of contaminants.		The discharge from the WWTP is domestic in nature and therefore it is not expected that there would be significant metal or organic contamination. It is considered therefore the fish will not be rendered unsuitable for human consumption as a result of the discharge.

Table 3: Compliance with NPS-FM Standards

NPSFW Standard	Compliance[3]	Comment
Nitrate toxicity A - ≤1.0/≤1.5 B - ≤2.4/≤3.5 C - ≤6.9/≤9.8 D - >6.9/>9.8		**Upstream** Median – 1.0g/m^3 95th percentile – 1.3g/m^3 **Downstream** Median – 1.0g/m^3 95th percentile – 1.3g/m^3 The concentration of nitrate upstream and downstream are reasonably consistent. It appears that the river can meet the A grade under the NPSFW, although as this assessment is based on limited samples, the assessment has been undertaken using four years of data rather than an annual value as required under the NPS.
Ammonia Toxicity A - ≤0.03/≤0.05 B - ≤0.24/≤0.40 C - ≤1.3/≤2.2 D - >1.3/>2.2		**Upstream** Median – 0.02g/m^3 95th percentile – 0.28g/m^3 **Downstream** Median – 0.03g/m^3 95th percentile – 0.06g/m^3 The median concentration is generally consistent, however the 95th percentile concentration is considerably higher in the upstream location. The results indicate that the river can meet the B grade within the vicinity of the discharge.

[3] Assessment uses following code:

- Green shading indicates that NPS-FM Grade A can be met in the receiving environment.
- Orange shading indicates that NPS-FM Grade B can be met in the receiving environment
- Yellow shading indicates that NPS-FM Grade C can be met in the receiving environment
- Red shading indicates that water quality is below the National Bottom Line and does not meet NPS-FM Grade C

NPSFW Standard	Compliance[3]	Comment
Dissolved Oxygen[4] A - ≥8.0/≥7.5 B - ≥7.0/≥5.0 C - ≥5.0/≥4.0 D - <5.0/<4.0		The long term data record to mid 2017 records: **Upstream** Median – 9.65g/m^3 95th percentile – 8.92g/m^3 **Downstream** Median – 9.65g/m^3 95th percentile – 8.46g/m^3 Results indicate that the upstream and downstream concentrations of dissolved oxygen are consistent and it appears that the river can meet the A grade. This assessment is based on grab samples however, not on a full day's worth of data and therefore the available data is not directly comparable to the NPS standards. However, in the intensive data record from mid 2017, from mid December the dissolved oxygen concentration is typically less than 7.5, but was only occasionally less than 7. This would indicate that the waterbody may be able to meet the B grade, but the caveat around the lack of continuous sampling to include the worst case conditions remains.
E.coli A - ≤130/≤540 B - ≤130/≤1000 C - ≤130/≤1200 D - >130/>1200 E - >260/>1200		The long term data record to mid 2017 records: **Upstream** Median – 1,075cfu/100mL 95th percentile – 2,538cfu/100mL **Downstream** Median – 974cfu/100mL 95th percentile – 1,449cfu/100Ml Results indicate that the water quality at the downstream site is better than the water quality at the upstream site. Despite this both sites indicate that the national bottom line cannot be met within the Tokanui River at this location. Whilst the data in the intensive sampling programme indicates generally lower *E.coli* concentrations. It still indicates that the national bottom line would not be complied with.

[4] The dissolved oxygen standards have developed to apply to a continuous record, the monitoring data for the Tokanui River provides grab sample concentrations for dissolved oxygen and are therefore not directly comparable. The assessment therefore provides an indication only.

Appendix M Groundwater Model Report

Groundwater Contaminant Transport - Tokanui

Rev. No.	Date	Description	Prepared By
1	16/11/17	Contaminant transport modelling	J Dommisse

1 Introduction

This report provides a description of modelling undertaken to assess the concentrations of Total nitrogen and bacterial contaminants in groundwater.

2 Total Nitrogen

The Total nitrogen concentration in groundwater from the down-gradient edge of the infiltration trench was predicted using the steady-state advection-dispersion model of Domenico (1987). An initial concentration in groundwater of 17mg/L was used based on historical median concentrations measured in the treated wastewater discharge. The model is conservative in that it assumes no removal of nitrogen through the unsaturated zone prior to reaching the water table. It also assumes that little or no dilution will occur in groundwater beneath the base of the trench which is likely given how narrow the trench is.

In the model, the source width was set to 40m which is equal to the distance (in a straight line) from where the trench exits the ponds to where the trench connects to the Tokanui River. Longitudinal dispersivity was calculated using a scale dependent value derived from the equation of Gelhar (1986). Transverse dispersivity was calculated using a scale dependent value based on the general rule outlined by Barnett et al. (2012) as shown in Table 1. As the model is steady-state, predictions are insensitive to changes in hydraulic conductivity, effective porosity and hydraulic gradient of the aquifer. A summary of the model inputs and values are provided in Table 1.

Table 1: Parameters used in the Domenico advection / dispersion modelling

Parameters	Abbreviation	Value	Unit
Hydraulic conductivity	K	Insensitive parameter	m/d
Effective porosity	ne	Insensitive parameter	dec.frac
Hydraulic gradient	i	Insensitive parameter	m/m
Longitudinal dispersivity	ax	10 percent of travel distance	m
Transverse dispersivity	ay	10 percent of ax	m
Vertical dispersivity	az	10 percent of ay	m
Source width	W	40	m
Source depth	Z	1	m
Source concentration	Co	17	mg/L
Background concentration	C	0	mg/L

Concentrations down-gradient of the trench in the direction of groundwater flow (which is considered most likely to occur towards or parallel to the stream) are shown in Attachment A for depths of 0m, 1m and 5m below the top of the water table. Overall the results show the highest concentrations at the top of the water table and lowest concentrations at deeper depths. At the top of the water table, the concentration in the center of the plume is half the initial concentration within 50m and less than 1mg/L within 200m. Overall, the modelling suggests that elevated levels of total nitrogen will be limited to a relatively small area near the trench. This is considered reasonable given the likely amount of dilution that will occur from discharging wastewater to the trench at an average daily rate of 43m^3 (equal to 0.5 L/s) into a sandy gravel aquifer that is likely to have a much higher flow.

3 Microbial Removal

3.1 Pang 2009

Removal rates for bacterial contaminants given by Pang (2009) were used to predict the levels of *E.coli* at varying distances down-gradient of the trench for a range of different scenarios. The results are shown in Attachment B.

The modeling used a best case *E.coli* concentration of 3,300 cfu/100ml based on the 95th percentile of the available data record and worst case concentration of 7,000 cfu/100ml based on the maximum concentration from the available data record. It is expected that during winter, soils would be close to field capacity for the majority of time and there would be little to no unsaturated zone due to high groundwater levels. This time of year also coincides with lower concentrations of *E.coli* within the discharge due to increase dilution from stormwater and rainwater falling on the ponds.

During summer there will be some unsaturated zone through which contaminants are filtered, however the concentration of *E.coli* within the discharge is greater, therefore an unsaturated zone of 1 m and 2 m have been modelled.

Under worst case conditions, it was assumed that the soil would be saturated, thus increasing bacterial survival times, and that the water table would be high and there would no microbial removal in the unsaturated zone. Under the best case scenario, an unsaturated zone thickness of 2 m was assumed. For all scenarios, a soil thickness of 0.3 m was assumed. This is based on the soils being greater than 1 m deep and the trench dug to 0.7 m deep.

For conditions where there is a 1 m to 2 m thick unsaturated zone, the effects on groundwater will be relatively small with the levels of *E.coli* reducing by 80 % to 100 % prior to the wastewater entering groundwater. Under the best and middle case (most likely) scenarios, the *E.coli* levels range from 0 cfu/100ml to 35 cfu/100ml.

The largest effect is likely to occur when elevated levels of *E.coli* are discharged to the trench during periods when the soils are saturated and the water table is high and there is little or no un-saturated zone. Under saturated soil conditions, the survival rate of *E.coli* and other bacteria is generally higher. To help account for this, the removal rate was reduced by approximately half that used for the scenarios. For this worst case scenario, concentrations in groundwater 200 m from the trench may occur in the range of 250 cfu/100ml to 2,200 cfu/100ml.

3.2 Decay Rates

For comparison, *E.coli* levels were also predicted using a decay constant of 0.41 (from Environmental Scientific Research cited in PDP, 2006) for sandy gravel aquifers and average groundwater travel times using a range of aquifer parameters and moderate hydraulic gradient of 0.005 m/m (see Attachment B). The model shows that at 200m down-gradient assuming worst case conditions with no removal of bacteria through the soil or vadose zone, the *E.coli* concentration would be very low (2 cfu/100ml). In reality, the maximum extent is likely to be as a result of advection and dispersion processes as shown in the Domenico model which is not accounted for using this approach.

Considering the results of both approaches, it is considered that within 200m of the infiltration trench, bacterial levels in groundwater are most likely to be well below 1,000 cfu/100ml.

4 References

Barnett, B., Townley, L., Post, V., Evans, R., Hunt, R., Peters, L., Richardson, S., Werner, A., Knapton, A. & Boronkay, A. (2012). Australian groundwater modelling guidelines. Canberra, Australia. National Water Commission, Canberra.

Domenico, P.A. (1987). An analytical model for multidimensional transport of a decaying contaminant species. Journal of Hydrology, 91, pp 49-59.

Gelhar, W. (1986). Stochastic subsurface hydrology from theory to application. Water Resources Research, 22(9), pp 135-145.

Pang, L.P. (2009). Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. Journal of Environmental Quality, 38, pp 1531–1559.

PDP (2006). Masterton wastewater upgrade – groundwater report. Report prepared for Beca Carter Hollings and Ferner Limited. Pattle Delamore Partners Ltd, Wellington, December 2006.

Attachment A – Modelled Concentrations of Total Nitrogen in Groundwater

Concentration at the top of the water table

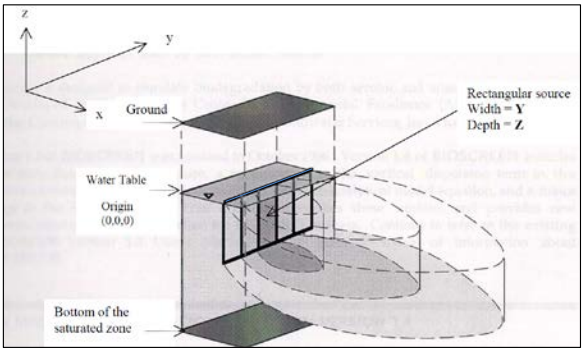
Steady-state Continious Planar Source Groundwater Contaminant Transport Model

Model uses scale dependent values of dispersivity where α_x = 0.1x, α_y = 0.01x, α_z = 0.001x (rule based on Ghelar 1986 and Barnett et al, 2013)

Background concentration	**C**	0	mg/L
Initial concentration	**C_o**	17	mg/L
Vertical distance to measurement point	**z**	0	m
Source width (S_w)	**Y**	40	m
Source depth (S_d)	**Z**	1	m
Longitudinal dispersivity	**α_x**	0.1x	m
Transverse dispersivity	**α_y**	0.1ax	m
Vertical dispersivity	**α_z**	0.1ay	m

First order decay	**λ**	0	-
Hydraulic conductivity	**K_h**	10	m/d
Effective porosity	**η_e**	0.1	-
Hydraulic gradient	**i**	0.0001	m/m
Advective velocity	**v_c**	0.010	m/d
Retardation factor	**R**	1.00	m

$$C=\left(\frac{C_o}{4}\right)\left\{\operatorname{erf}\left[\frac{(y+S_w/2)}{2(\alpha_y x)^{1/2}}\right]-\operatorname{erf}\left[\frac{(y-S_w/2)}{2(\alpha_y x)^{1/2}}\right]\right\}\left\{\operatorname{erf}\left[\frac{(z+S_d)}{2(\alpha_z x)^{1/2}}\right]-\operatorname{erf}\left[\frac{(z-S_d)}{2(\alpha_z x)^{1/2}}\right]\right\}\exp\left[\frac{x}{2\alpha_x}\left[1-\left(1+\frac{4\lambda\alpha_x}{v_c}\right)^{1/2}\right]\right]$$



Distance from source in y direction	Distance down-gradient from source in the x direction																			
	1	5	10	25	50	75	100	150	200	250	300	350	400	450	500	550	600	650	700	750
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
30	0.0	0.0	0.0	0.0	0.5	0.7	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20	8.5	8.5	8.3	5.3	2.9	2.0	1.5	0.9	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10	17.0	17.0	16.6	10.7	5.4	3.3	2.2	1.2	0.7	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
0	17.0	17.0	16.6	10.7	5.8	3.7	2.5	1.3	0.8	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10	17.0	17.0	16.6	10.7	5.4	3.3	2.2	1.2	0.7	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
20	8.5	8.5	8.3	5.3	2.9	2.0	1.5	0.9	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
30	0.0	0.0	0.0	0.0	0.5	0.7	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0

References

Barnett, B., Townley, L., Post, V., Evans, R., Hunt, R., Peters, L., Richardson, S., Werner, A., Knapton, A. & Boronkay, A. (2012). Australian groundwater modelling guidelines. Canberra, Australia. National Water Commission, Canberra.

Domenico, P.A. (1987). An analytical model for multidimensional transport of a decaying contaminant species. *Journal of Hydrology,* 91, pp 49-59.

Gelhar, W. (1986). Stochastic subsurface hydrology from theory to application. *Water Resources Research*, 22(9), pp 135-145.

Concentration 1 m below the water table

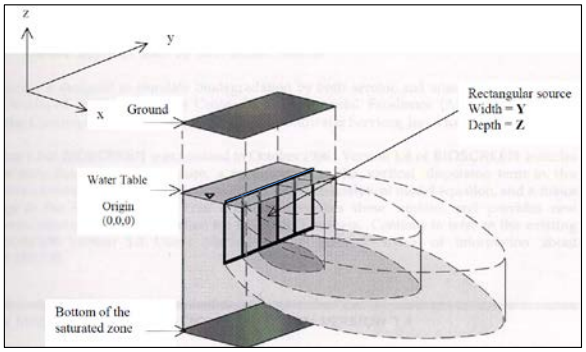
Steady-state Continious Planar Source Groundwater Contaminant Transport Model

Model uses scale dependent values of dispersivity where α_x = 0.1x, α_y = 0.01x, α_z = 0.001x (rule based on Ghelar 1986 and Barnett et al, 2013)

Background concentration	**C**	0	mg/L
Initial concentration	**C_o**	17	mg/L
Vertical distance to measurement point	**z**	1	m
Source width (S_w)	**Y**	40	m
Source depth (S_d)	**Z**	1	m
Longitudinal dispersivity	**α_x**	0.1x	m
Transverse dispersivity	**α_y**	0.1ax	m
Vertical dispersivity	**α_z**	0.1ay	m

First order decay	**λ**	0	-
Hydraulic conductivity	**K_h**	10	m/d
Effective porosity	**η_e**	0.1	-
Hydraulic gradient	**i**	0.0001	m/m
Advective velocity	**v_c**	0.010	m/d
Retardation factor	**R**	1.00	m

$$C=\left(\frac{C_o}{4}\right)\left\{\operatorname{erf}\left[\frac{(y+S_w/2)}{2(\alpha_y x)^{1/2}}\right]-\operatorname{erf}\left[\frac{(y-S_w/2)}{2(\alpha_y x)^{1/2}}\right]\right\}\left\{\operatorname{erf}\left[\frac{(z+S_d)}{2(\alpha_z x)^{1/2}}\right]-\operatorname{erf}\left[\frac{(z-S_d)}{2(\alpha_z x)^{1/2}}\right]\right\}\exp\left[\frac{x}{2\alpha_x}\left\{1-\left(1+\frac{4\lambda\alpha_x}{v_c}\right)^{1/2}\right\}\right]$$



Distance from source in y direction	Distance down-gradient from source in the x direction																			
	1	5	10	25	50	75	100	150	200	250	300	350	400	450	500	550	600	650	700	750
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
30	0.0	0.0	0.0	0.0	0.4	0.7	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20	4.3	4.3	4.2	3.9	2.7	1.9	1.5	0.9	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10	8.5	8.5	8.5	7.9	4.9	3.1	2.2	1.2	0.7	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
0	8.5	8.5	8.5	7.9	5.3	3.6	2.5	1.3	0.8	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10	8.5	8.5	8.5	7.9	4.9	3.1	2.2	1.2	0.7	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
20	4.3	4.3	4.2	3.9	2.7	1.9	1.5	0.9	0.6	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
30	0.0	0.0	0.0	0.0	0.4	0.7	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0

References

Barnett, B., Townley, L., Post, V., Evans, R., Hunt, R., Peters, L., Richardson, S., Werner, A., Knapton, A. & Boronkay, A. (2012). Australian groundwater modelling guidelines. Canberra, Australia. National Water Commission, Canberra.

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Gelhar, W. (1986). Stochastic subsurface hydrology from theory to application. *Water Resources Research*, 22(9), pp 135-145.

Concentration 5 m below the water table

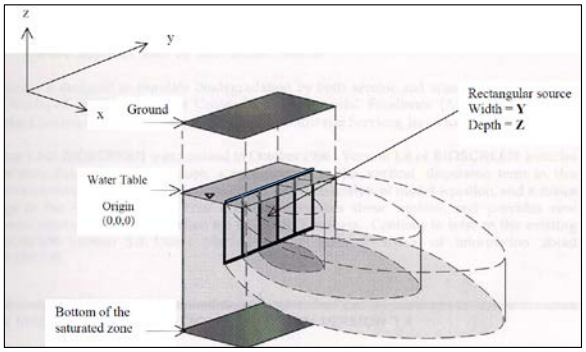
Steady-state Continious Planar Source Groundwater Contaminant Transport Model

Model uses scale dependent values of dispersivity where α_x = 0.1x, α_y = 0.01x, α_z = 0.001x (rule based on Ghelar 1986 and Barnett et al, 2013)

Background concentration	**C**	0	mg/L
Initial concentration	**C_o**	17	mg/L
Vertical distance to measurement point	**z**	5	m
Source width (S_w)	**Y**	40	m
Source depth (S_d)	**Z**	1	m
Longitudinal dispersivity	**α_x**	0.1x	m
Transverse dispersivity	**α_y**	0.1ax	m
Vertical dispersivity	**α_z**	0.1ay	m

First order decay	**λ**	0	-
Hydraulic conductivity	**K_h**	10	m/d
Effective porosity	**η_e**	0.1	-
Hydraulic gradient	**i**	0.0001	m/m
Advective velocity	**v_c**	0.010	m/d
Retardation factor	**R**	1.00	m

$$C=\left(\frac{C_o}{4}\right)\left\{\operatorname{erf}\left[\frac{(y+S_w/2)}{2(\alpha_y x)^{1/2}}\right]-\operatorname{erf}\left[\frac{(y-S_w/2)}{2(\alpha_y x)^{1/2}}\right]\right\}\left\{\operatorname{erf}\left[\frac{(z+S_d)}{2(\alpha_z x)^{1/2}}\right]-\operatorname{erf}\left[\frac{(z-S_d)}{2(\alpha_z x)^{1/2}}\right]\right\}\exp\left[\frac{x}{2\alpha_x}\left\{1-\left(1+\frac{4\lambda\alpha_x}{v_c}\right)^{1/2}\right\}\right]$$



Distance from source in y direction	Distance down-gradient from source in the x direction																			
	1	5	10	25	50	75	100	150	200	250	300	350	400	450	500	550	600	650	700	750
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
30	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.5	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
20	0.0	0.0	0.0	0.0	0.3	0.7	0.8	0.7	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10	0.0	0.0	0.0	0.0	0.5	1.1	1.2	0.9	0.6	0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
0	0.0	0.0	0.0	0.0	0.6	1.3	1.4	1.0	0.7	0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
10	0.0	0.0	0.0	0.0	0.5	1.1	1.2	0.9	0.6	0.5	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
20	0.0	0.0	0.0	0.0	0.3	0.7	0.8	0.7	0.5	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
30	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.5	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
40	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
70	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0
80	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

References

Barnett, B., Townley, L., Post, V., Evans, R., Hunt, R., Peters, L., Richardson, S., Werner, A., Knapton, A. & Boronkay, A. (2012). Australian groundwater modelling guidelines. Canberra, Australia. National Water Commission, Canberra.

Domenico, P.A. (1987). An analytical model for multidimensional transport of a decaying contaminant species. *Journal of Hydrology,* 91, pp 49-59.

Gelhar, W. (1986). Stochastic subsurface hydrology from theory to application. *Water Resources Research*, 22(9), pp 135-145.

Attachment B – Predicted Concentrations of Bacteria in Groundwater

Removal of Escherichia coli through vadose and groundwater zones

$$R(\%) = 100[1 - (10^{(z.-RR)})] \qquad C_p = C_0(10^{(z.-RR)})$$

			2 m Un-Saturated Zone						1 m Un-Saturated Zone						No Un-Saturated Zone				
Soil	**Initial concentration**	C_0	3,300	3,300	3,300	7,000	7,000	7,000	3,300	3,300	3,300	7,000	7,000	7,000	3,300	3,300	7,000	7,000	cfu/100mL
	Soil name	-	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	Woodlands / Waikiwi	-
	Soil type	-	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	Silt loam	-
	Clay content	-	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	25 - 35	%
	Depth classification	-	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	> 1	-
	Thickness	z	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	m
	Removal rate	RR	6	4	2	6	4	2	6	4	2	6	4	2	3	1	3	1	log_{10}/m
	Removed	R	98	94	75	98	94	75	98	94	75	98	94	75	87	50	87	50	%
	Final concentration	C_p	52	208	829	111	442	1,758	52	208	829	111	442	1,758	415	1,654	881	3,508	cfu/100mL
Vadose Zone	**Material**	-	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	Gravel, silt, clay	-
	Thickness	z	2	2	2	2	2	2	1	1	1	1	1	1	0	0	0	0	m
	Removal rate	RR	0.88	0.5	0.12	0.88	0.5	0.12	0.88	0.5	0.12	0.88	0.5	0.12	None	None	None	None	log_{10}/m
	Removed	R	98	90	42	98	90	42	87	68	24	87	68	24	0	0	0	0	%
	Final concentration	C_p	1	21	477	2	44	1,012	7	66	629	15	140	1,334	415	1,654	881	3,508	cfu/100mL
Ground water Zone	**Material**	-	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	Sand Gravel	-
	Best removal rate	RR_B	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	log_{10}/m
	Middle removal rate	RR_M	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-
	Worst removal rate	RR_W	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	-
	Distance down-gradient	z	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	m
	Best concentration	C_{pB}	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	cfu/100mL
	Middle concentration	C_{pM}	**0**	**0**	**5**	**0**	**0**	**10**	**0**	**1**	**6**	**0**	**1**	**13**	**4**	**17**	**9**	**35**	cfu/100mL
	Worst concentration	C_{pW}	**1**	**13**	**301**	**1**	**28**	**638**	**4**	**42**	**397**	**9**	**88**	**842**	**262**	**1,044**	**556**	**2,214**	cfu/100mL

Notes:

Modelling assumes that groundwater flows directly from the RIBs to the Un-Named bore.

Soil

Removal rates based on range of values for all soil types listed in Table 10 of Pang (2009).

Vadose Zone

Minimum and maximum removal rates in the vadose zone of 0.12 and 0.9 log_{10}/m from Gerba et al (1991) cited in Table 11 of Pang (2009) for MS2 phages in sandy gravels with clay lenses.

In comparison, the minimum and maximum removal rates in the vadose zone range from 0.27 to 0.5 log_{10}/m from Sinton (1986) cited in Table 11 of Pang (2009) for E.coli removal in coarse gravels in Canterbury, New Zealand.

Groundwater Zone

Removal rates in the groundwater zone from Pang (2009) cited in Table 16 for low and high permeability sand and gravel aquifers range from 0.1 to 0.001 log_{10}/m.

Reference

Pang, L.P. (2009). Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. *Journal of Environmental Quality,* Vol. 38, 1531–1559.

Relationship between die-off rate, first order decay and half life

After Kuo (1998)

$$T_{90} = \frac{-IN(0.1)}{k} \qquad T_{50} = \frac{LN(2)}{k} \qquad v_x = \frac{K}{\eta_e} i \qquad C_t = C_o.0.5^{(t/t_{50})}$$

Distance from source	z	200	200	200	200	m
Concentration at Distance from Site	C_t	0	0	0	2	cfu/100ml
Initial concentration	C_o	7,000	7,000	7,000	7,000	cfu/100ml
Advective groundwater flow velocity	v_x	0.05	0.50	4	10	m/d
Hydraulic conductivity of aquifer	K	1	10	75	200	m/d
Effective porosity of aquifer	n_e	0.1	0.1	0.1	0.1	-
Hydraulic gradient of aquifer	i	0.005	0.005	0.005	0.005	m/m
Average particle travel time to bore	t	4,000	400	53	20	days
First order decay	k	0.41	0.41	0.41	0.41	days
Time for 90% of coliforms to die-off	T_{90}	5.6	5.6	5.6	5.6	days
Half life	T_{50}	1.691	1.691	1.7	1.7	days

Reference

Kuo, J. (1998). Practical design calculations for groundwater and soil remediation. Ist Edition. CRC Press.

Appendix N Preliminary Site Investigation

Tokanui Wastewater Treatment Plant
Preliminary Site Investigation

This report has been prepared for the benefit of Southland District Council. No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other person.

This disclaimer shall apply notwithstanding that the report may be made available to Environment Southland and other persons for an application for permission or approval or to fulfil a legal requirement.

Rev. No.	Date	Description	Prepared By	Reviewed By	Approved By
01	12/12/2017	Final	Isobel Oldfield	Sue Bennett	Rima Krause

Reviewed by the following suitably qualified and experienced person in accordance with the *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* (NES, 2011):

.....
Sue Bennett
Principal Environmental Scientist

1 Introduction

Stantec New Zealand (Stantec) were commissioned by Southland District Council (SDC) to undertake a preliminary site investigation (PSI) within the location of a proposed infiltration trench associated with the Tokanui wastewater treatment plant (WWTP). This report summarises the results of a desktop investigation of available information sources and provides an assessment of the risk to human health posed by the proposed works.

The PSI was undertaken to determine the impact of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (the NES) on the project.

1.1 Site Location

The subject site is located within an area of land adjacent to the Tokanui WWTP. The Tokanui WWTP is located at 11B McEwan Street, Tokanui, approximately 250 metres north of the Niagara-Tokanui Highway, and 350 metres west of the Tokanui Township (Figure 1-1). Access to the site is provided via a farm track off McEwan Street and a bridge spanning the Tokanui River. The infiltration trench will be located between the secondary pond and the outfall.

Figure 1-1: Tokanui WWTP Location

1.2 Proposed Works

The applicant proposes to construct an infiltration trench between the WWTP and the Tokanui River to facilitate the land contact and discharge of some of the WWTP's treated wastewater to land. Construction of the infiltration trench will involve approximately 150 m^3 of earthworks between the oxidation ponds and the Tokanui River. The concept design of the trench is shown in the drawings attached in Attachment A. The actual quantities involved will be confirmed following detailed design and site investigation.

The infiltration trench design shows a meandering channel leading from the second oxidation pond to the Tokanui River via a shallow trench up to 700 mm deep. The floor of the trench would be approximately 500 mm wide, containing granular or rock material approximately 200 mm deep in the base, for the length of the trench.

The trench will cross two legal parcels, Lot DP 1 8315 BLK X ToeToe Survey District, owned by the Southland District Council (and on which the Tokanui WWTP oxidation ponds are situated) and Section 10, Section 22-23, Section 41-42, Part Section 5 and Part Section 7 BLK X ToeToe Survey District (or 32 McEwan Street), owned by Pjnui Farms Limited.

The applicant has reached a purchase agreement with the land owners of the affected area of land as shown in Attachment A and is also applying to extend the designation to cover the area of the proposed infiltration trench. The infiltration trench will therefore be wholly contained within the legal parcel in which the WWTP is located, on land that is owned by SDC, however this process will not be formalised until the consents applied for have been granted.

Figure 1-2 shows the current property boundary of the WWTP and the area owned by the surrounding land owner. For the purpose of this assessment the property parcel the WWTP ponds are currently situated within will be referred to as the WWTP property and the surrounding area of land owned by Pjnui Farms (which

includes a section of the area proposed for the new infiltration trench) will be referred to as the farm property.

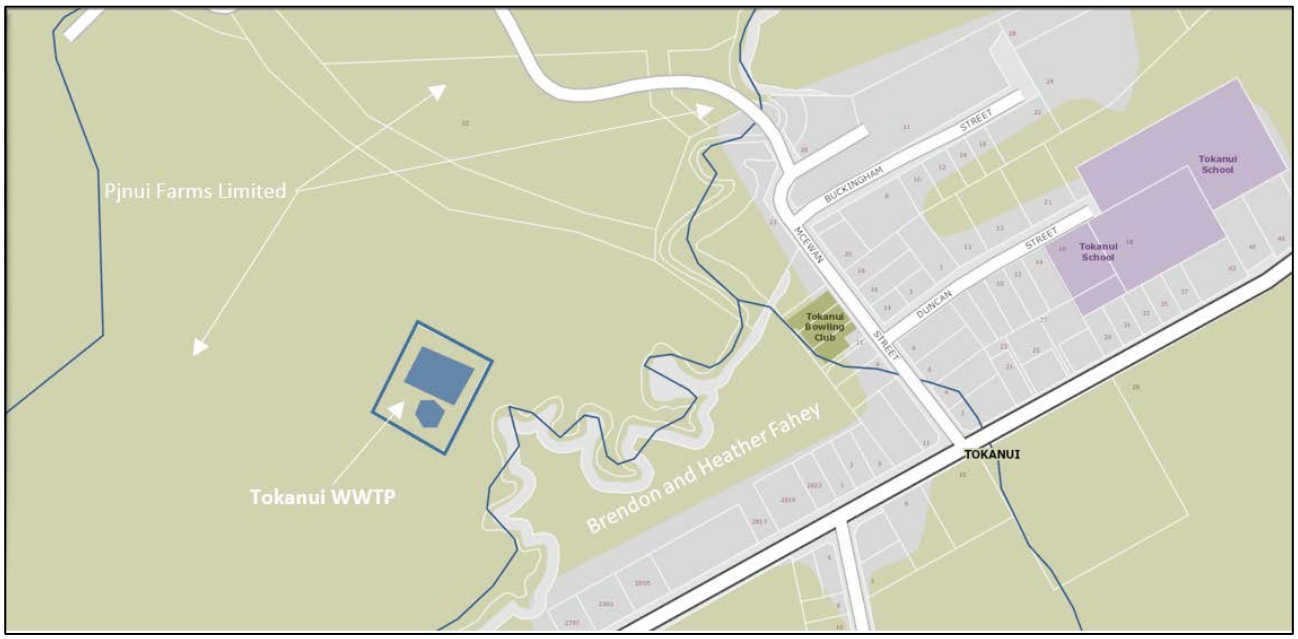


Figure 1-2: Tokanui WWTP Land Ownership

2 Summary of Previous Activities

2.1 Current Site Uses

The WWTP property is currently used for the treatment of domestic sewage. The WWTP serves 67 houses and all inflows are domestic in nature. Given this there is not expected to be significant heavy metal concentrations within the sewage or treated wastewater discharge. The current treatment process involves two ponds, a facultative pond and a maturation pond connected in series. The treated wastewater is then discharged via a buried pipe to the Tokanui River.

This PSI relates to the disturbance of soil to install an infiltration trench which will provide limited further treatment to the wastewater, with some discharge to land under optimal conditions. The remaining discharge will continue to be to the Tokanui River.

The property file for 11B McEwan Street (the WWTP property) was requested for SDC, however it was advised that there is no information available for this property parcel.

The surrounding land is grazed by Pjnui Farms, which is a dairy farm. The property file for 32 McEwan Street (the farm property) was provided by SDC. An application to install covered yards submitted in 1984 including a hand drawn map which identified an existing wool shed. This suggests that at some point the farm was run as a sheep farm which indicates that there was likely to be a sheep dip.

The property file also included a compliance schedule statement which related to the construction of a dairy shed. This indicates that the farm was converted from a sheep farm to a dairy farm at some point in its history.

2.2 Aerial Photographs

Historic aerial photographs were accessed from Google Earth. All aerial photographs are attached in Attachment B. The earliest readily available historic aerial photograph was taken in March 2005 (accessed from Google Earth). In this aerial photograph the WWTP oxidation ponds are already present. In addition it appears that the wool shed is still in existence.

The 2011 aerial photograph shows that the wool shed has been removed and that three long structures and an effluent pond have been constructed to the north east of the old wool shed. It is likely that these new structures are associated with the conversion to dairy.

The remaining aerial photographs show little change from 2011 through to 2016.

2.3 Environment Southland Records

A search of the Environment Southland Selected Land Use Sites (SLUS) register was requested. Environment Southland advised that there were no records on the SLUS within the vicinity of the Tokanui WWTP, however given that WWTPs are a HAIL activity Environment Southland noted that their records were incomplete and that the WWTP site would be registered in the near future. The adjoining farmland was not considered to be associated with a HAIL activity and Environment Southland do not hold a record of hazardous activity on the property.

3 Assessment of Risk

A number of potentially contaminating activities have been identified on the two subject properties. The WWTP property is the site of wastewater treatment, which is Item G.6 on the October 2011 Hazardous Activities and Industries List (HAIL) list. Appendix C of the Users Guide to the NES (2012) states that hazardous substances from wastewater treatment activities depends on the type of waste treated but can include biological hazards (bacteria, viruses), metals, polyaromatic hydrocarbons, semi-volatile organic compounds and solvents. The Tokanui WWTP treats domestic sewage only and therefore there is not expected to be high levels of metals or hydrocarbons. The greatest risk is therefore likely to be from biological hazards.

The treatment process is currently limited to two ponds which are lined. The risk from exposure to biological hazards during the construction of the trench and in particular the connection with the discharge point from the pond can be appropriately managed through a health and safety plan.

Property records and aerial photographs indicate that the farm property was used to farm sheep from at least 1984 until approximately 2011. Some sheep farms included sheep dip sites, which are Item A.8 on the October 2011 HAIL list because of the risk of arsenic and other contaminants.

The map on the property file indicates that the wool shed was located approximately 450 metres north east of the proposed area of the infiltration trench. A sheep dip site would have been located close to farm buildings, such as the wool shed and therefore it is considered likely that the if there was a sheep dip on the site that this would have been located a significant distance from the proposed area of land disturbance.

Other potentially contaminating activities, which are considered less likely to have occurred than sheep dips, which are on the October 2011 HAIL list include A.1: Storage and filling or washing tanks of agrichemicals as part of application and A.17: Storage of drums of fuel or chemicals. All of these would have occurred in or around the buildings which are noted to the north east of the WWTP and hence are not considered to have occurred in the area in which the infiltration trench will be constructed.

The proposed area of disturbance, outside of the current WWTP property boundary is therefore not considered to be occurring within an area of land on which a HAIL activity is more likely than not to have occurred. Therefore, the NES does not apply to the area outside of the current WWTP property boundary.

The proposed area of disturbance within the WWTP property boundary is considered to be occurring within an area of land on which a HAIL activity has taken place. The NES therefore applies only to the proposed area of disturbance occurring with the WWTP property.

The risk to human health from the HAIL activity is considered to be negligible and therefore a detailed site investigation is not considered necessary. The land will continue to be used for wastewater treatment with no access to the public.

It is expected that approximately 25 m of the 50 m long trench will be constructed within an area of land that the NES applies to. This equates to approximately 75 m^3 of soil disturbance. The actual volumes will be confirmed once detailed design and site investigations have been undertaken.

Clause 8 of the NES outlines permitted activities, including Clause 8(3) disturbing soil. This section sets out the following conditions to allow the disturbance of soil to be considered a permitted activity.

(a) controls to minimise the exposure of humans to mobilised contaminants must-
  i) be in place when the activity begins
  ii) be effective while the activity is done
  iii) be effective until the soil is reinstated to an erosion-resistant state
(b) the soil must be reinstated to an erosion-resistant state within 1 month after the serving of the purpose for which the activity was done
(c) the volume of the disturbance of the soil of the piece of land must be no more than 25m^3 per 500m^2
(d) soil must not be taken away in the course of the activity, except that,-
  i) for the purpose of laboratory analysis, any amount of soil may be taken away as samples
  ii) for all other purposes combined, a maximum of 5m^3 per 500m^2 of soil may be taken away per year
(e) soil taken away in the course of the activity must be disposed of at a facility authorised to receive soil of that kind
(f) the duration of the activity must be no longer than 2 months
(g) the integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.

It is expected that all of the conditions above can be complied with except potentially part (c) which states that the volume of disturbance shall not exceed 25 m^3 per 500 m^2 and part (f) as the construction may take longer than 2 months. The property parcel is 7,000 m^2 and almost entirely consists of the WWTP. The 'piece of land' is therefore considered to be the WWTP. A total of 350 m^3 of soil can therefore be disturbed before the permitted activity rule is breached and a total of 70 m^3 can be removed from site.

As discussed above, it is estimated that only 75 m^3 of soil disturbance will be required and it is expected that all soil disturbed will remain on site. On this basis and if all other conditions of Section 8 can be met the activity would be considered a permitted activity. However, to ensure flexibility during construction, a consent will be applied for.

It should be noted that once the infiltration trench is constructed and the additional area of land between the WWTP property and the river is divided off from the farm property, this additional property parcel will become a SLUS site because wastewater treatment will be occurring in that parcel of land.

4 Conclusion

The risk to human health from the HAIL activity identified within the WWTP property is considered negligible due to the domestic nature of the wastewater. The risk to human health from biological hazards will be minimal if basic health and safety protocols are observed.

It is considered that the NES does not apply to the area to be disturbed which falls outside of the WWTP property boundary. Environment Southland's SLUS does not record any HAIL activities associated with this piece of land.

It is considered that the activity can probably meet the permitted activity section of the NES. However this will be confirmed once detailed designs have been finalised, and to ensure flexibility during construction a consent will be applied for.

STATEMENT OF LIMITATIONS

Stantec New Zealand (Stantec) has prepared this report for the use of the Southland District Council in accordance with the usual care and thoroughness of the consulting profession. It has been prepared in accordance with the scope of work and for the purpose outlined in this report. It is based on accepted practices and standards at the time it was prepared. No other warranty, express or implied, is made as to the professional advice included in this report. Stantec makes no determination or recommendation regarding a decision to provide or not to provide financing with respect to the site.

There is no investigation that is thorough enough to preclude the presence of materials at the site which presently, or in the future, may be considered hazardous. As regulatory evaluation criteria are subject to change, concentrations of contaminants present and considered acceptable may, in the future, become subject to different regulatory standards which cause them to become unacceptable and require remediation for the site to be suitable for the existing or proposed land use activities.

The methodology adopted and sources of information used by Stantec are outlined in this report. Stantec has made no independent verification of the information beyond the agreed scope of works and Stantec assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to Stantec was false.

This report was prepared in December 2017 and is based on the conditions encountered and information reviewed at the time of preparation. Stantec disclaims any responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Attachment A – Concept design of trench


TOKANUI POND SITE
2:1
2:1
EXISTING GROUND
Varies up to 700mm
200mm GRANULAR / ROCK MATERIAL
500mm
TYPICAL DRAINAGE CHANNEL CROSS-SECTION
NEW FENCE (40m)
EXISTING DRAIN
NEW FENCED AREA TO BE PLANTED
NEW MANHOLE / SUMP OVER EXISTING DISCHARGE PIPE
TOTAL NEW AREA : 1380m²
EXISTING DISCHARGE PIPE
NEW FOUL DRAINAGE CHANNEL (SHALLOW SWALE) (50m)
NEW FENCE (45m)

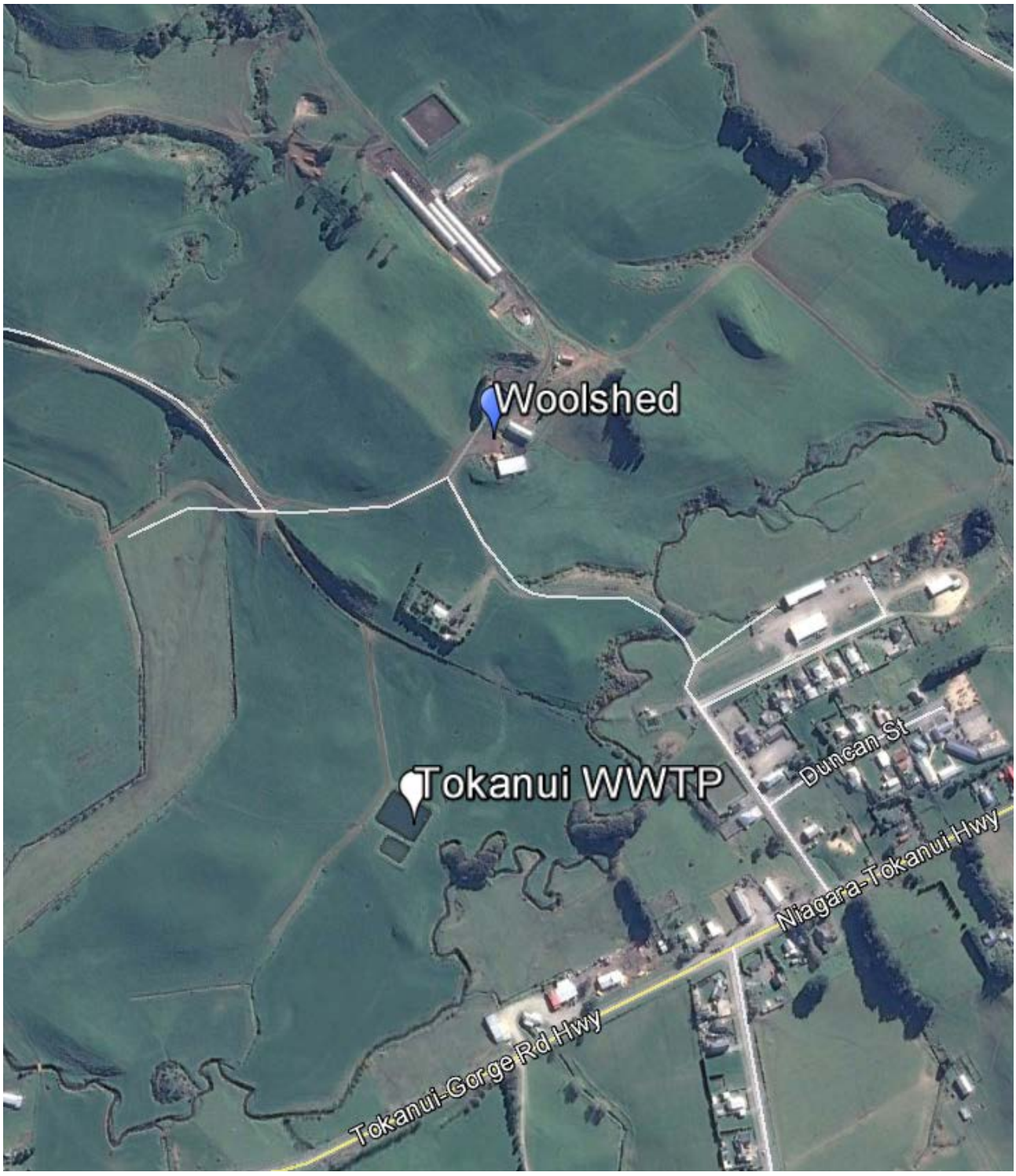
Attachment B - Historic Aerial Photographs


Woolshed
Tokanui WWTP
Duncan St
Niagara-Tokanui Hwy
Tokanui-Gorge Rd Hwy

March 2007


Woolshed
Tokanui WWTP
Duncan St
Niagara-Tokanui Hwy
Tokanui-Gorge Rd Hwy


Woolshed
Tokanui WWTP
Duncan St
Niagara-Tokanui Hwy
Tokanui-Gorge Rd Hwy


Woolshed
Tokanui WWTP
Duncan St
Niagara-Tokanui Hwy
Tokanui-Gorge Rd Hwy


Woolshed
Tokanui WWTP
Duncan St
Niagara-Tokanui Hwy
Tokanui-Gorge Rd Hwy

Appendix O Cultural Impact Assessment

TE AO MARAMA INC.

Cultural Impact Assessment

Tokanui Wastewater Treatment Plant- Discharge to Land and Water

Prepared for the Southland District Council

February 2018

ACKNOWLEDGEMENTS

The compilation of the report was greatly assisted and contribution given by Dawn Wybrow, Stephanie Blair, Gail Thompson, Moana Grey and Dean Whaanga.

This report has been peer reviewed by Stephanie Blair.

FIGURE 1: LOOKING UPSTREAM OF THE DISCHARGE AND UPSTREAM MONITORING SITE. PHOTO BY STEVIE-RAE BLAIR.

EXECUTIVE SUMMARY

The Southland District Council (SDC) is currently carrying out consultation to renew their existing resource consent for the Tokanui Wastewater Treatment Plant (WWTP). This Cultural Impact Assessment (CIA)was requested by the SDC to document tangata whenua values associated with the discharge and the impact the proposed activity has on those values.

The SDC owns and operates the Tokanui WWTP which provides the town of Tokanui with wastewater treatment and disposal services. The current discharge permit authorizes up to 55 m^3/day of treated wastewater to land and to water, this expires on 8th September 2018. To allow the SDC to continue to lawfully discharge wastewater to land and to water, an application needs to be lodged with Environment Southland (ES) and the SDC six months prior to expiry; calculated being 8 March 2018.

The permits that are being applied for are:

- A discharge permit to discharge a maximum annual average of 55 m^3/day of treated wastewater from the Tokanui Wastewater Treatment Plant to land and to water (groundwater and the Tokanui River). A term of 25 years is sought.
- The use of land for the construction of an effluent storage facility (infiltration trench) within 50m of a surface water body.
- To disturb more than 25 m^3 per 500 m^2 of soil on land where an activity described by the Ministry for the Environment's hazardous Activities and Industries List is occurring and for longer than a two month period.

The SDC are proposing to construct a new infiltration trench between the WWTP and the Tokanui River to facilitate some degree of discharge to land. Under certain conditions will this reduce the volume of the discharge to the Tokanui River.

The information within this document is based on literature and conversations held with Awarua whānau, Te Ao Marama staff, local experts and sit visits.

Mana whenua have had a long association with the Tokanui River and it is visible through mahinga kai, purakau (stories) and archaeological sites that are within the area. The southern coast was used extensively by Ngāi Tahu whānui and it is still used today for similar reasons and for education purposes for our young people.

This cultural impact statement has identified the following values that are of importance that need to be considered as part of the SDC reconsenting project for the Tokanui WWTP:

- Ki uta ki tai: The need to consider the effects of the project from ki uta ki tai and that activities in the higher end of the catchment has an effect on the lower end of the catchment and vice versa.
- Mahinga kai is central to Ngāi Tahu wellbeing and identity.
- The cultural landscape of the Tokanui River, in particular the coastal area where the river flows to the sea.
- The area has a considerable amount of wāhi tapu and archaeological sites and the adverse effects of human waste discharge on wāhi tapu/ archaeological sites downstream of this area.
- The discharge of human waste to water and its effect on cultural values.

The following particular points have been recommended from tangata whenua:

- The proposed activity to include an infiltration trench is an improvement against the current WWTP, although some of the discharge will go straight to groundwater/ surface water during the wetter months of the year. The expectation outlined in the Iwi Management Plan that waste

water disposal practice will improve over time and with improved technology. Recommended that potentially a consent duration that is less than the current 25 years applied for to correlate with any improved technology as per the policy in Te Tangi a Tauira.

- That the infiltration trench is made as long as possible to accommodate as much discharge to land as possible.
- For Te Ao Marama Inc. to be included in any monitoring results.
- Potential for the SDC to include a planting regime around the infiltration trench and by the river as mitigation.
- The area is showing signs of erosion/ bank slumping which could be mitigated through planting etc.. Mitigations should be in place for sediment and erosion control during any earthworks.
- The Accidental Discovery Protocol is used during earthworks.

TABLE OF CONTENTS

INTRODUCTION

The Southland District Council (SDC) is currently carrying out consultation to renew their existing resource consent for the Tokanui Wastewater Treatment Plant (WWTP). This Cultural Impact Assessment (CIA)was requested by the SDC to document tangata whenua values associated with the discharge and the impact the proposed activity has on those values.

Ngāi Tahu ki Murihiku have a long and enduring relationship with the area of the wastewater discharge that touches on all aspects of their traditional and spiritual beliefs. Ngāi Tahu are interlinked to the landscape and the resources that lie within it. This relationship is imbued with spiritual and cultural values that impose duties of kaitiakitanga on Ngāi Tahu to nurture and care for the environment.

SOUTHLAND DISTRICT COUNCIL 2018 RE-CONSENTING PROJECT

The SDC owns and operates the Tokanui WWTP which provides the town of Tokanui with wastewater treatment and disposal services. The Tokanui WWTP is located at 11B McEwan Street and includes 67 residential and commercial properties. The scheme was originally built in 1972 and services Tokanui via a gravity fed wastewater reticulation system, there is one single pump station acts as the termination point for all of the towns gravity reticulation. The pump transfer the wastewater to the oxidation ponds and those consist of two pumps in an underground wet well.

FIGURE 2: AERIAL PHOTO OF THE WWTP AT TOKANUI. RETRIEVED FROM: TOKANUI CONSENT APPLICATION AND AEE.

The current discharge permit authorizes up to 55 m^3/day of treated wastewater to land and to water, this expires on 8th September 2018. To allow the SDC to continue to lawfully discharge wastewater to land and to water, an application needs to be lodged with Environment Southland (ES) and the SDC six months prior to expiry; calculated being 8 March 2018.

The permits that are being applied for are:

- A discharge permit to discharge a maximum annual average of 55 m^3/day of treated wastewater from the Tokanui Wastewater Treatment Plant to land and to water (groundwater and the Tokanui River). A term of 25 years is sought.
- The use of land for the construction of an effluent storage facility (infiltration trench) within 50m of a surface water body.
- To disturb more than 25 m^3 per 500 m^2 of soil on land where an activity described by the Ministry for the Environment's hazardous Activities and Industries List is occurring and for longer than a two month period.

The current WWTP consists of two connected oxidation ponds, the first and larger of the two being a facultative pond and the second smaller pond is a maturation pond. The ponds are lined with a clay-like material and there is significant evaporation from the surface of these ponds and also a slow rate of discharge through the liner to the underlying ground or direct to groundwater. The residual treated wastewater from the maturation pond is then discharged via a buried pipe to the Tokanui River.

Since 2013 the inflow volumes to the WWTP have been recorded and generally they show that the volume of water is below the currently consented volume particularly that the mean daily inflow volume is well below the maximum daily discharge. The limit was exceeded on 59 days over the period from 2013-2017.

The SDC are proposing to construct a new infiltration trench between the WWTP and the Tokanui River to facilitate some degree of discharge to land. Under certain conditions will this reduce the volume of the discharge to the Tokanui River. Construction will include up to 1,380m^3 of vegetation clearance and earthworks and approximately 150m^3 of earthworks between the oxidation ponds and the Tokanui River. The trench will provide some storage capacity consisting of approximately 17.5m^3. The trench will meander toward the river being about 700mm deep, 500mm wide and will contain granular rock or rock material approximately 200mm deep in the base, for the length of the trench.

The proposed trench will connect to the river via the existing outfall to minimize disturbing the river bank.

FIGURE 3: TRENCH SITE LOOKING BACK TOWARD THE WASTEWATER PONDS. PHOTO BY STEVIE-RAE BLAIR.

TOKANUI RIVER CATCHMENT

The Tokanui River is a relatively small coastal catchment at the southern end of the Catlin's. Its steep topography and regular rainfall means it is subject to higher risk of erosion.[1] The lower reaches are affected by sedimentation. Agriculture is the primary land use in this catchment. The inland town of Tokanui is located near the top of the catchment. The river is classified as a lowland, soft bed, macrophyte-dominated stream with a gravel bed.[2]

FIGURE 4: TOKANUI CATCHMENT. RETRIEVED FROM GOOGLE EARTH.

[1] https://www.lawa.org.nz/explore-data/southland-region/river-quality/tokanui-river/, 2018.
[2] Ryder, 2018

MANAWHENUA

Te Rūnanga o Ngāi Tahu is the tribal representative body of Ngāi Tahu whānui, established under the Te Rūnanga o Ngāi Tahu Act 1996. There are 18 Rūnanga Papatipu that constitute the membership of Te Rūnanga o Ngāi Tahu. The Te Rūnanga o Ngāi Tahu Act and the Ngāi Tahu Claims Settlement Act 1998 give recognition of the status of Rūnanga Papatipu as the repositories of the kaitiaki and manawhenua status of Ngāi Tahu Whānui over the natural resources within their takiwā boundaries.

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

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

The takiwā of one rūnanga- Awarua extend across the area encompassed by the Tokanui River catchment.

TE AO MARAMA INC.

Ngāi Tahu ki Murihiku formed an entity known as Te Ao Marama Incorporated, which is made up of representatives from Te Rūnaka o Waihopai, Te Rūnanga o Awarua, Oraka Aparima Rūnaka and Te Rūnanga o Hokonui. Te Ao Marama Incorporated is authorized to represent the four Southland Rūnanga Papatipu in resource management and local government matters.

It is essentially a business unit providing a direct link to local Rūnanga Papatipu, consent applicants, the local authorities and Te Rūnanga o Ngāi Tahu. Resource consent applicants who want to liaise with iwi can contact Te Ao Marama Incorporated, who can then arrange for consultation with the appropriate Rūnanga Papatipu.

FIGURE 5: MURIHIKU (LIGHT GREY) AND LOCATION OF RŪNANGA PAPATIPU (RETRIEVED FROM: NGĀI TAHU KI MURIHIKU, 2008)

REPORT SCOPE AND OBJECTIVES

This report documents Ngāi Tahu ki Murihiku cultural values associated with the Tokanui catchment from its source to the sea. In doing so it will provide background information to help the SDC to better understand the Ngāi Tahu ki Murihiku values of the river and catchment. It will inform the SDC on the impacts for the WWTP against those cultural values.

This report provides some context and information and aids the Kaitiaki Rūnanga Papatipu (via Te Ao Marama Inc) on these issues and may assist further discussions on the SDC reconsenting application. However, this report simply provides background information and cannot be considered to represent any decisions by the Kaitiaki Rūnanga Papatipu (via Te Ao Marama Inc).

LEGAL AND POLICY CONTEXT

It is helpful to understand the broad legal and policy context for Ngāi Tahu ki Murihiku natural resource management.

Various legislation, policies and agreements helps guide TAMI's policy development for resource management in Murihiku. These include responsibilities under the Local Government Act 2002, Resource Management Act 1991, Ngāi Tahu Claims Settlement Act 1998, NZ Pouhere Taonga , and RMA national directives such as the National Policy Statement for Freshwater Management, The Regional plans (including Water and Coastal) Please see Figure 6.

TE RŪNANGA O NGĀI TAHU ACT, 1996

Te Rūnanga o Ngāi Tahu Act 1996 (the TRONT Act) was passed in 1996, to give a legal identity to the Ngāi Tahu iwi. The TRONT Act establishes the body corporate of Te Rūnanga o Ngāi Tahu as the tribal representative body of Ngāi Tahu Whānui, with relevant provisions including the following:

- Section 3: "this Act binds the Crown and every person (including any body politic or corporate) whose rights are affected by any provisions of this Act";
- Section 5: describes the takiwā or tribal area of Ngāi Tahu Whānui, as including all the lands, islands and coasts of the South Island/Te Waipounamu south of White Bluffs/Te Parinui o Whiti on the east coast and Kahurangi Point/Te Rae o Kahurangi on the west coast;
- Sections 7 and 13: defines the members of Ngāi Tahu Whānui and the members of the Rūnanga Papatipu of Ngāi Tahu Whānui;
- Section 15 (status of Te Ngāi o Ngāi Tahu):

1. Te Rūnanga o Ngāi Tahu shall be recognised for all purposes as the representative of Ngāi Tahu Whānui.

2. Where any enactment requires consultation with any iwi or with any iwi authority, that consultation shall, with respect to matters affecting Ngāi Tahu Whānui, be held with Te Rūnanga o Ngāi Tahu.

3. Te Rūnanga o Ngāi Tahu, in carrying out consultation under subsection (2) of this section:

a. shall seek the views of such Rūnanga Papatipu of Ngāi Tahu Whānui and such hapū as in the opinion of Te Rūnanga o Ngāi Tahu may have views that they wish to express in relation to the matter about which Te Rūnanga o Ngāi Tahu is being consulted;

b. shall have regard, among other things, to any views obtained by Te Rūnanga o Ngāi Tahu under paragraph (a) of this subsection; and

c. shall not act or agree to act in a manner that prejudices or discriminates against, any Rūnanga Papatipu of Ngāi Tahu or any hapu unless Te Rūnanga o Ngāi Tahu believes on reasonable grounds that the best interests of Ngāi Tahu Whānui as a whole require Te Rūnanga o Ngāi Tahu to act in that manner.

- First Schedule: Identifies the Rūnanga Papatipu of Ngāi Tahu Whānui and their respective takiwā.

NGĀI TAHU CLAIMS SETTLEMENT ACT, 1998

The Ngāi Tahu Claims Settlement Act 1998 gives effect to the provisions of the Deed of Settlement, entered into between Ngāi Tahu and the Crown in 1997. The key elements of the Ngāi Tahu settlement can be summarised as follows:

- Apology: Crown apologises unreservedly to Ngāi Tahu Whānui for the suffering and hardship caused to Ngāi Tahu;
- Aoraki/Mount Cook: gifting of Aoraki, co-management and renaming;
- Cultural Redress: restores effective Kaitiakitanga;
- Non-Tribal Redress: provides certainty and results;
- Economic Redress: income generated by tribal assets provides funds for social and cultural development.

A significant component of the Ngāi Tahu Settlement is the cultural redress elements, which seek to restore the ability of Ngāi Tahu to give practical effect to its kaitiaki responsibilities. Relevant "cultural redress" elements of the Ngāi Tahu Settlement include:

- ownership and control: pounamu/greenstone, high country stations, four specific sites (including Rarotoka/Centre Island, Whenua Hou/ Codfish Island, former Crown Titi Islands) and Wahi Taonga;
- Mana Recognition: Statutory Acknowledgements, Deeds of Recognition, Topuni, Dual Place Names;
- Mahinga kai: Nohoanga, Customary Fisheries Management, Taonga Species Management, Coastal Space;
- Management Input: Statutory Advisor, Dedicated Memberships, Department of Conservation Protocols, Resource Management Act Implementation, Heritage Protection Review.

Resource Management Act, 1991

The Resource Management Act 1991 (RMA) is New Zealand's primary piece of legislation for sustainably managing natural and physical resources. The RMA contains various provisions that incorporate Maori values into the management of natural resources.
Key provisions include the requirement in the RMA for all persons exercising functions and powers (including policy/plan making and resource consent processes) to:

- recognise and provide for, as a matter of National Importance:
    - the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other Taonga;
    - the protection of historic heritage from inappropriate subdivision, use, and development;
    - the protection of recognised customary activities;
- have particular regard to Kaitiakitanga;
- take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

The RMA makes specific provisions for iwi management plans. In relation to iwi management plans, regional councils and territorial authorities are required to "…take into account any relevant planning document recognised by an iwi authority and lodged with a local authority…", under the provisions of Sections 61(2A)(a), 66(2A)(a), 74(2A)(a) of the RMA. This is relevant to local authorities preparing a Regional Policy Statement, Regional Plans and District Plans.

Te Tangi a tauira

In 2008 Te Tangi a Tauira: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan was published. This Iwi Management Plan consolidates Ngāi Tahu ki Murihiku values, knowledge and perspectives on natural resource and environmental management issues. Its prime purpose is to assist Ngāi Tahu ki Murihiku in carrying out kaitiaki roles and responsibilities. It is also designed to assist local authorities and government agencies in understanding tangata whenua values and policy. It lets applicants and consultants understand issues that need to be addressed in applications to achieve whānau ora. It provides a framework for Nga Tahu ki Murihiku to effectively participate in environmental policy and planning, in order to achieve good environmental outcomes and healthy environments for iwi and the wider community.

Other Matters

The above list is not exhaustive. There are various other statutes, regulations, policies, and associated legal mechanisms of potential or actual relevance to iwi resource management within Murihiku, such as:

NZ Pouhere Taonga Act, Te Runanga o Ngai Tahu Freshwater Policy, Maori Commercial Aquaculture Claims Settlement Act 2004 and the Reserves Act 1977).

Regulatory and Iwi Context for Te Ao Marama Inc.

This diagram outlines the hierarchy of agreements, acts, policies, plans and values that help inform Te Ao Marama Inc's policy development, views and expectations for resource management in Murihiku.

Treaty of Waitangi / Te Tiriti o Waitangi

Treaty Principles

Te Rūnanga o Ngāi Tahu Deed of Settlement 1997

Crown Apology | Historical Account | Ancillary Claims | Cultural Redress | Economic Redress

Local Government Act 2002	Resource Management Act 1991	Ngāi Tahu Claims Settlement Act 1998	Heritage New Zealand Pouhere Taonga Act 2014

Councils' responsibilities

Operate under a defined purpose and framework, and are accountable to their communities.

- Strategic Plans
- Decision making with Māori (s81)
- Committees and Delegations.

RMA National Directives

Policy Statements (Coastal, freshwater, electricity transmission and generation)

National Environmental Standards

(air, drinking water, telecommunications, electricity, contaminants in soil)

Statutory Provisions

Areas, species, activities and their importance and association to Ngāi Tahu are listed in the Ngāi Tahu Claims Settlement Act

(eg. Statutory Acknowledgements, Taonga Species, Mātaitai, Mahinga Kai, etc.)

TRoNT Policies

- Mō tātou, ā, mō kā uri ā muri ake nei
- Ki Uta Ki Tai
- Freshwater Policy
- Ngā Matapono ki te Wai

Wāhi Tapu and Archaeological Sites

Identification, recording, management and protection of recorded and unrecorded sites and areas.

Murihiku Policies and Agreements

Includes 1997 Charter of Understanding

Regional Policy Statements

Gives effect to the National Policy Statements (RMA) and must take into account the Iwi

Te Tangi a Tauira: The Cry of the People

Iwi Management Plan of the four Murihiku Papatipu Rūnanga

Regional Plans

Assist councils in carrying out their functions under the RMA and give effect to the Regional Policy

Environment Southland
Otago Regional Council*

District Plans

Assist councils in carrying out their functions under the RMA and give effect to the national and regional

Invercargill City Council
Southland District Council
Gore District Council
Clutha District Council*

Murihiku Rūnanga Values

Whakapapa, Te Ao Māori, Mauri, Wairua, Kaitiakitanga, Tino Rangatiratanga, Mahinga kai, Manaakitanga, Mātauranga Māori, Te Reo, Whanaungatanga

Murihiku takiwā covers part of the Council's territorial area = *

FIGURE 6: THE REGULATORY FRAMEWORK THAT HELPS INFORM TE AO MARAMA INCORPORATED POLICY DEVELOPMENT (INCL FRESHWATER) IN MURIHIKU. NOTE THAT THERE IS OTHER LEGISLATION OUTSIDE OF TE AO MARAMA INCORPORATED'S MANDATE, OF RMA AND LGA MATTERS, THAT RELATES TO FRESHWATER MANAGEMENT FOR RŪNANGA/NGĀI TAHU WHĀNUI, INCLUDING THE RELATIONSHIP WITH THE DEPARTMENT OF CONSERVATION AND MINISTRY OF PRIMARY INDUSTRIES.

CULTURAL LANDSCAPE

Our tūpuna had considerable knowledge of whakapapa, traditional trails and tauranga waka, places for gathering kai and other taonga, and ways in which to use the resources of the rivers, estuaries, coastal wetlands, lakes, coasts and lands of Murihiku. While the last 170 years have resulted in significant changes to our waterways and wider natural and cultural landscapes their importance to us has not diminished.

Michael Skerrett, Evidence for the Proposed Plan Change 13 (New dairy farming) for the Regional Water Plan for Southland 2010

Cultural landscapes represent the "combined works of nature and man" and the term embraces a diversity of manifestations of the interaction between humankind and the natural environment. Cultural landscapes often reflect specific techniques of sustainable land-use, considering the characteristics and limits of the natural environment they are established in, and a specific spiritual relation to nature.[3]

The following section illustrates some of the Ngāi Tahu ki Murihiku cultural landscape of the Tokanui catchment.

KAITIAKITANGA

Te Tangi a Tauira, 2008 describes kaitiakitanga as '*the exercise of guardianship/stewardship by the tangata whenua of an area and resources in accordance with tikanga Maori.'*

Kaitiakitanga has been explained in the Introduction of the proposed Southland Water and Land Plan. On page 8, the Plan states:

> *Kaitiakitanga is central to Ngāi Tahu and is key to their mana whenua. By exercising kaitiakitanga, Ngāi Tahu ki Murihiku actively work to ensure that spiritual, cultural and Mahinga kai values are upheld and sustained for future generations. Kaitiakitanga in this context includes ensuring the protection, restoration and enhancement of the productivity and life-supporting capacity of mahinga kai, indigenous biodiversity, air, water, land, natural habitats and ecosystems, and all other natural resources valued by Ngāi Tahu ki Murihiku.*[4]

MAURI

Mauri is the essential life-force, the power and distinctiveness which enables each thing to exist itself. Everything in the natural world- people, fish, birds, forests, rivers, water, land, and even created things such as a house or wharenui- has their own mauri. In essence mauri is a force or power which is used to express the relative health and vitality of any place or being.[5]

It is important for mana whenua while practicing kaitiakitanga that the mauri of the estuary and our water bodies be maintained for us and our future generations.

KI UTA KI TAI

Ki uta ki tai reflects the mātauranga that all environmental elements are connected and must be managed as such.[6] Ngāi Tahu understands Ki Uta Ki Tai as:

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[3] World Heritage Centre, 2013
[4] Proposed Southland Water and Land Plan, p. 8
[5] Te Marino Lenihan, 2013
[6] Cain, A & Whaanga D, 2017.

a paradigm and an ethic. It's a way of understanding the natural environment, including how it functions, how people related to it and how it can be looked after appropriately…

Ki Uta Ki Tai gives reference to the Ngāi Tahu understanding of the natural world and the belief that all things are connected – a belief shared by many other iwi and indigenous people. It also highlights the central importance of mahinga kai, the traditional seasonal food gathering rituals of Ngāi Tahu and the role this played in the traditional understanding and management of natural resources.

While being founded on traditional values and understanding, Ki Uta Ki Tai is also a modern management framework that involves the creation of a number of tools, such as natural resource management plans, monitoring and reporting processes and resource inventories and their associated strategies to address the continuing challenges and threats faced by all aspects of the natural environment from the mountains to the sea – ki uta, ki tai.

…Ki Uta Ki Tai, as a concept, comes from the traditions, customs and values of Ngāi Tahu Whānui in relation to the natural environment, and in particular the custom of mahinga kai and transferred between generations through purakau, whakatauki, waiata, korero and on-going practices is the foundation upon which this modern Ngāi Tahu natural resource management framework is built.[7]

Ki Uta ki Tai, with its foundations based on traditional values and understandings, has also evolved into a modern management framework that involves a number of tools, such as State of the Takiwā and cultural monitoring, natural resource plans, resource inventories, management and restoration of sites and mahinga kai practice and wananga (research and education).[8]

WAI

To ask perhaps the most fundamental question "Who am I?" Māori say "*Ko wai ahau?"* When these same words are stated, not asked, they mean "I am water". The physical value of good water and land to Ngāi Tahu can be seen within the patterns of settlement and occupation throughout. [9] Water is fundamental to the health and wellbeing of who we are as Māori. The health, wellbeing and Mauri of the water is directly linked to the health and wellbeing of the people.

The characteristics of the water body (smell, shape, bed, flow, etc.) have a direct impact on its health and surrounding lands, what is harvested from it and when. Preferential sites for mahinga kai tend to be hāpua (estuaries, lagoons), repo (wetlands) and the riparian zones of rivers, streams and lakes.[10]

[7] Kaupapa Taiao (2003) *Ki Uta Ki Tai: Mountains to the Sea Natural Resources Management,* pp. 9-10
[8] Pauling, 2003
[9] Te Marino Lenihan, 2013
[10] Cain, A & Whaanga D, 2017.

MAHINGA KAI

The Ngāi Tahu Claims Settlement Act 1998 defined mahinga kai as 'the customary gathering of food and natural materials, and the places where those resources are gathered.' Mahinga kai is more broadly explained in Te Tangi a Tauira (2008) as being about

> *places, ways of doings things, and resources that sustain the people. It includes the work that is done (and the fuel that is used) in the gathering of all natural resources (plants, animals, water, sea life, pounamu) to sustain well-being. This includes the ability to clothe, feed and provide shelter.*[11]

Mahinga kai is central to the Ngāi Tahu way of life and cultural wellbeing. It represents the ninth component of the 'Nine Tall Trees' that comprised the Ngāi Tahu Claim; an intrinsic part of the tribe's identity, or the "DNA of Ngāi Tahu".[12]
Mahinga kai is central to our relationships with places, waterways, species and resources, and to the cultural, spiritual, social and economic well-being of Ngāi Tahu. It is a vehicle for the intergenerational transfer of Mātauranga (knowledge).[13]

The River, its surrounding waterways and the land were extremely important for Murihiku Māori for mahinga kai. Through years of development the opportunities for gathering kai have substantially decreased, it is important for us to halt the decline. Steph Blair (pers comms, 2018) speaks of the river and how it was used frequently for gathering Tuna and the areas around it were used for gathering various birds.

[11] Te Tangi a Tauira, 2008.
[12] Kitson, J. 2017.
[13] Kitson, J. 2017.

WĀHI INGOA: PLACE NAMES

Because Kai Tahu moved throughout Te Waipounamu, their knowledge of the land was intimate and detailed. This knowledge was preserved in the naming of places. Indeed, the stories of ancestors' journeys of exploration and the creation and shaping of the land also acted as "oral maps", with place names and meanings woven carefully into them. So the places and their names were part of a memory system in which religious belief, history, and geography were combined.

[Dacker, 1990]

As Ngāi Tahu moved throughout Te Wai Pounamu their presence was preserved in the naming of places. Names within the Tokanui Catchment reinforce our connections to Ngāi Tahu creation traditions, tūpuna, incidents, and mahinga kai resources.

Taikunui: Is the name Tūhawaiki used on his maps representing Tokanui.

O-tara: O-Tara is the original name, meaning the place of Tara, a rangatira who resided by the lake a O-tara along with his hapū.

Waipapapa: Waipapapa is the original name, meaning

Toetoe/ Toitoi?: Now called Fortrose, Toetoe/toitoi was the name of a chief.

Puera: Is the name for a lookout point on a prominent hill at Fortrose. A name Tuhawaiki used on his maps.

Pukewaio: Hill and area to the west of Tokanui, this area used to drain into the Tokanui River and the river then received nutrients it needed to keep it fresh and clean (Steph Blair, Pers comms, 2018).

ARCHAEOLOGICAL AND WĀHI TAPU

"Field surveys in these areas [Lakes Te Anau and Manapouri] reveal the presence of sites over a wide area, including some on islands in the lakes indicating that canoes or rafts were used locally. The remains of large eel channels have been located, which give some insight into Maori economy and the supportive social organization. The presence of debarked trees around the lakes points to the manufacture of bark bags for preserving birds and eels. Large ovens are located in the grassland areas and many others have been observed by locals, suggesting the Maoris caught birds, probably moa, or dug up cabbage tree roots which they cooked locally. Duff's work in the Takahe Valley indicates that Maori penetrated the mountains from this area to hunt takahe and the small bush moa"

[Coutts 1982, Doc.31 in WAI 27, cited in Corry & Puentener, 1993]

There are a number of archaeological sites in the Tokanui catchment and the wider area, particularly in the areas towards the coast.

The wāhi tapu sites that are recorded at the mouth are indicative of occupation in the area, they consist of middens, ovens and burial sites. The middens are dominated by blue mussels, pipi, limpet and trumpet shell. There were also several pieces of fish (whale included) and bird bone (Kakapo and moa) found. Adzes and chert flakes have been found within the wāhi tapu. One site extends for almost 70m along the beach. There are three layers of occupation found within the stratosphere. [14]

A whaling station was worked in the 1800's that caught many whales and was one of the main areas used at the time for whaling.

The Tokanui mouth sets a picture of coastal settlements in Murihiku and possibly was used as part of a travelling route to many places, including to Otara and further around the Catlin's Coast, to Ruapuke or the Titi islands and to Toetoe, which then joins up with other trails heading further round the coast to Waiparera or inland along the Mataura River.

A map of the archaeological sites are included as Appendix 1.

[14] Jacomb, 2013.

FIGURE 7: ADZE CACHE FOUND IN F47/53 (AREA A, LAYER 3). RETRIEVED FROM JACOMB, 2013.

ASSESSMENT OF EFFECTS ON CULTURAL VALUES

The SDC currently discharges waste water to the Tokanui River, and has asked for tangata whenua impacts on such discharges for the reconsenting process. This section compiles information from relevant Ngāi Tahu whānui, reports and documents.

The disposal of waste and the treatment and disposal of human effluent and wastewater to water is of major concern for Ngāi Tahu.[15] Particular issues relate to the resultant physical and spiritual contamination of the water way, including the need to protect mahinga kai and wāhi tapu and other cultural and physical contamination.[16]

> *Our bottom line is to avoid discharge of wastewater (e.g. sewage and stormwater) to water, as such activities have adverse effects on cultural values such as mauri, wairua, mahinga kai and wāhi tapu. Our preference is for wastewater to be treated to remove contaminants, and then discharged to land via wetlands and riparian areas, to allow Papatūānuku to provide a natural filter for waste. Where this is not practical or feasible, and discharge to water is proposed, then adverse effects must be mitigated through treatment to a very high standard and robust monitoring programs. Ngāi Tahu ki Murihiku will always look for the most culturally, environmentally, socially and economically appropriate option for a particular site. (Ngāi Tahu ki Murihiku, 2008)*

There is a strong need for Ngāi Tahu whānui to maintain a separation between the human food chain and human waste streams. There is a strong preference for effluent to be treated by a land-based solution, to filter and cleanse contaminants. A discharge, even when treated is still considered to be culturally unacceptable.

The list of policies in Te Tangi a Tauira: Ngāi Tahu ki Murihiku Natural Resource and Environmental Iwi Management Plan, 2008 relating to wastewater can be found in Appendix 2. It is important to note that these policies are pragmatic in their approach and that proposed wastewater discharges are to be assessed on a case by case basis by kaitiaki rūnanga. The policies also identify the expectation that practice will be improved if the technology exists.

The application provides for improvement by installing an infiltration trench to allow wastewater to filter through this before entering the Tokanui River. It is stated in the application that in winter at the wettest part of the year this can significantly limit infiltration rates, due to the high groundwater levels. It has been assumed that there will be no infiltration of wastewater through the base of the trench in winter.

[15] Ngāi Tahu Freshwater Policy, 2002.
[16] Ngāi Tahu ki Murihiku, 2008.

PROPOSED CONSENT CONDITIONS

Below is a table that include comment from whānau on the proposed consent conditions. Please note there has been no comment on the Land use Consent to disturb soil on a HAIL site as this land is already designated to be a wastewater facility and our values have been covered within the discharge permit.

Consent Condition	Support/Oppose	Comment
1. This consent authorises the discharge of treated wastewater from the Tokanui Wastewater Treatment Plant: (a) To land; and (b) To groundwater from the base of the oxidation ponds and the infiltration trench; and (c) To the Tokanui River; in general accordance with the application "Tokanui Wastewater Treatment Plant Discharge to Land and Water" dated [DATE]:	Support in part	Support the discharge to land.
2. The discharge of treated wastewater from the Tokanui wastewater treatment plant to land and to water shall not exceed an annual average of 55 m3/day. The consent holder shall record the daily volume of wastewater being discharged **to** the wastewater treatment plant, to determine compliance with this Condition.	Support in part	Support the recording of daily inflow volumes.
3. The consent holder shall install two groundwater monitoring bores, one located up gradient of the discharge from the infiltration trench and the oxidation ponds at or about map reference [XXXXX], and one located downstream of the infiltration trench at or about map reference [XXXXX], and shown on the map attached as Attachment A.	Support	Support the monitoring of groundwater.
4. Every six months, the consent holder shall monitor and record: a. the instantaneous rate of the discharge of treated wastewater discharged to the Tokanui River at the time of the survey. b. the quality of the treated wastewater discharged from the oxidation pond by collecting representative samples of the discharge and having those samples analysed for: i. Electrical conductivity ii. Total suspended solids concentration iii. Carbonaceous oxygen demand concentration (BOD5) iv. Ammoniacal nitrogen concentration v. Total nitrogen concentration vi. Total phosphorus concentration vii. *Escherichia coli* concentration c. The quality of water in the Tokanui River by	Support	

collecting representative samples from the stream, upstream and approximately 150 metres downstream of the point of discharge. The samples shall be analysed for: i. Temperature ii. pH iii. Electrical conductivity iv. Turbidity v. Visual clarity as measured using either a black disc or clarity tube vi. Dissolved oxygen concentration (%sat and mg/L) vii. Total ammoniacal-nitrogen concentration viii. Total oxidised nitrogen concentration ix. Dissolved reactive phosphorus concentration x. *Escherichia coli* concentration d. The quality of groundwater in the vicinity of the Tokanui wastewater treatment plant infiltration trench by collecting representative samples from the upstream and downstream bores required by condition (3) of this consent, and having those samples analysed for: i. Temperature ii. pH iii. Electrical conductivity iv. Total ammoniacal-nitrogen v. Total oxidised nitrogen concentration vi. Dissolved reactive phosphorus concentration vii. *Escherichia coli* concentration		
5. Visual observations of bacterial or fungal slime growths shall be undertaken in the Tokanui River throughout the length of the mixing zone downstream of the discharge. These observations shall be undertaken at each sampling event completed in accordance with Condition 4 of this consent. Photographs of the stream bed taken 5 m downstream of the point of discharge and then every 10 m up to 45 m from the point of discharge shall be recorded and provided to the Consent Authority when reporting the results of the visual observations required by this condition.	Support	
6. The consent holder shall undertake aquatic ecology monitoring in 2022 and every five years thereafter, to characterise the impact of the discharge on the aquatic environment of the Tokanui River. This aquatic ecology monitoring shall consist of Macroinvertebrate sampling, following Protocol C2 (soft-bottomed, semi-quantitative) as outlined in the document "Protocols for sampling macroinvertebrates in wadeable streams" (authors Stark, Boothroyd, Harding, Maxted, & Scarsbrook, 2001), with analysis for a full range of metrics, including %EPT, MCI and SQMCI;	Support	

7. Aquatic ecology monitoring outlined in Condition 6 shall be undertaken at two downstream sample locations and one upstream sample locations (as identified on the plan attached to these conditions as Attachment A), with at least five replicate samples (or the number considered appropriate as outlined in Section 3 of the document "Stream Periphyton Monitoring Manual" (authors Biggs & Kilroy, 2000)) being collected from each location measured from the point of discharge as follows: (a) Upstream Point 1 (15 metres upstream); (b) Downstream Point 2 (60 metres downstream); (c) Downstream Point 3 (150 metres downstream). Sampling should occur when flows are lower than the median flow condition. No sampling shall be carried out within ten days of the Tokanui River exceeding seven times its median flow or within seven days of flows that are greater than three times the median flow. Median flow conditions in the Tokanui River shall be indicated by the monitoring conducted on the Waikawa River at Biggar Road by the Consent Authority which is to be used as a surrogate. Median flow for the Waikawa River is 2.706 cumecs1.	Support	
8. The consent holder shall submit a report to the Consent Authority within two months of the receipt of results for monitoring undertaken in accordance with Conditions 6 and 7 of this consent. The report shall summarise the results of all monitoring, analyse trends and comment on compliance with the relevant Lowland Soft Bed standard (attached as Attachment B to these conditions).	Support	Te Ao Marama Inc. would like to receive copies of this on behalf of Te Rūnanga o Awarua.
9. All sampling procedures, including collection and transportation of samples, and laboratory analysis undertaken in accordance with the conditions of this permit must be performed to IANZ registered standards or otherwise as agreed upon in writing by the Consent Authority.	Support	
10. The consent holder shall establish and maintain permanent signage in a prominent position at or near the point of discharge to the Tokanui River to advise the public of the potential risk associated with the presence of treated wastewater in the Tokanui River resulting from the discharge of treated wastewater from the Tokanui Wastewater Treatment Plant.	Support	
11. The discharge of treated wastewater to the Tokanui River shall not result in any of the following effects at or beyond the zone of reasonable mixing, being 150 linear metres from the point of discharge: (a) The production of conspicuous oil or grease	Support	

films, scums or foams, or floatable or suspended materials; (b) Any conspicuous plumes, change in colour or reduction of visual clarity (c) Any emission of objectionable odour; (d) The rendering of fresh water as unsuitable for consumption by farm animals; (e) Any significant adverse effects on aquatic life; and (f) The minimum standards set for Lowland Soft Bed waters, as described in the Southland Regional Water Plan (attached as Appendix 1 to this consent), being exceeded. **Note:** By 150 m downstream, it is expected that some of the treated wastewater discharged from the Tokanui wastewater treatment plant to land and or groundwater will have entered the surface water of the Tokanui River.		
Earthworks:		
12. All vegetation clearance and soil disturbance shall be preceded by erosion and sediment control measures necessary to ensure that disturbed soil and sediment-laden stormwater migration from construction of the infiltration trench is minimised to the extent practicable. All erosion and sediment control measures shall be maintained as effective until such time as all disturbed areas are stabilised.	Support	
13. No cut or cleared vegetation shall be placed in a manner where it could obstruct or enter the Tokanui River;	Support	
14. No stockpiling of excavated soils and / or materials will occur within 20 m of the Tokanui River;	Support	
15. No refuelling, repairs or maintenance of plant or machinery shall take place within 20 m of the Tokanui River.	Support	
16. The site shall be cleared of all construction debris and stockpiles upon the completion of construction works, with any contaminated material being disposed of at a suitably approved facility.	Support	
Administration 17. The Consent Authority may in accordance with section 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 or of receiving any monitoring results, for the purpose of: (a) Determining whether the conditions of this consent are adequate to deal with any adverse effects on the environment which may arise from the exercise of the consent and which it is	Support	

appropriate to deal with at a later stage, or which became evident after the date of commencement of the consent; or (b) Amending any monitoring, if the results indicate that the monitoring programme is inadequate; (c) Adding or adjusting compliance limits; (d) Requiring the adoption of the best practicable option to remove, reduce or mitigate any adverse effect on the environment arising as a result of the exercise of this consent; or (e) Without limiting the statutory powers of review, to achieve consistency with any future changes to the to the Southland Regional Council's plans or policies and to address nutrient allocation following limit setting.		

TABLE 1: PROPOSED CONSENT CONDITIONS AND COMMENT

CONCLUSION

Awarua Rūnanga have attended a site visit, had conversations and been able to comment on the Cultural Impact Statement. This cultural impact statement has identified the following values that are of importance that need to be considered as part of the SDC reconsenting project for the Tokanui WWTP:

- Ki uta ki tai: The need to consider the effects of the project from ki uta ki tai and that activities in the higher end of the catchment has an effect on the lower end of the catchment and vice versa.
- Mahinga kai is central to Ngāi Tahu wellbeing and identity.
- The cultural landscape of the Tokanui River, in particular the coastal area where the river flows to the sea.
- The area has a considerable amount of wāhi tapu and archaeological sites and the adverse effects of human waste discharge on wāhi tapu/ archaeological sites downstream of this area.
- The discharge of human waste to water and its effect on cultural values.

The SDC proposal to discharge wastewater to land, groundwater and water to the Tokanui river is impacting on Ngāi Tahu values and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga. It also has the ablity to impact on kaitiakitanga (RMA s7). The SDC are applying to improve the current status quo and provide a discharge to land in the first instance when conditions suit.

Whānau ki Awarua have identified recommendations that SDC may take in to help mitigate the effect on cultural values.

RECOMMENDATIONS

The following particular points have been recommended from tangata whenua:

- The proposed activity to include an infiltration trench is an improvement against the current WWTP, although some of the discharge will go straight to groundwater/ surface water during the wetter months of the year. The expectation outlined in the Iwi Management Plan that waste water disposal practice will improve over time and with improved technology. Recommended that potentially a consent duration that is less than the current 25 years applied for to correlate with any improved technology as per the policy in Te Tangi a Tauira.
- That the infiltration trench is made as long as possible to accommodate as much discharge to land as possible.
- For Te Ao Marama Inc. to be included in any monitoring results.
- Potential for the SDC to include a planting regime around the infiltration trench and by the river as mitigation.
- The area is showing signs of erosion/ bank slumping which could be mitigated through planting etc.. Mitigations should be in place for sediment and erosion control during any earthworks.
- The Accidental Discovery Protocol is used during earthworks.

FIGURE 8: DOWNSTREAM MONITORING ZONE (150M). PHOTO BY STEVIE-RAE BLAIR

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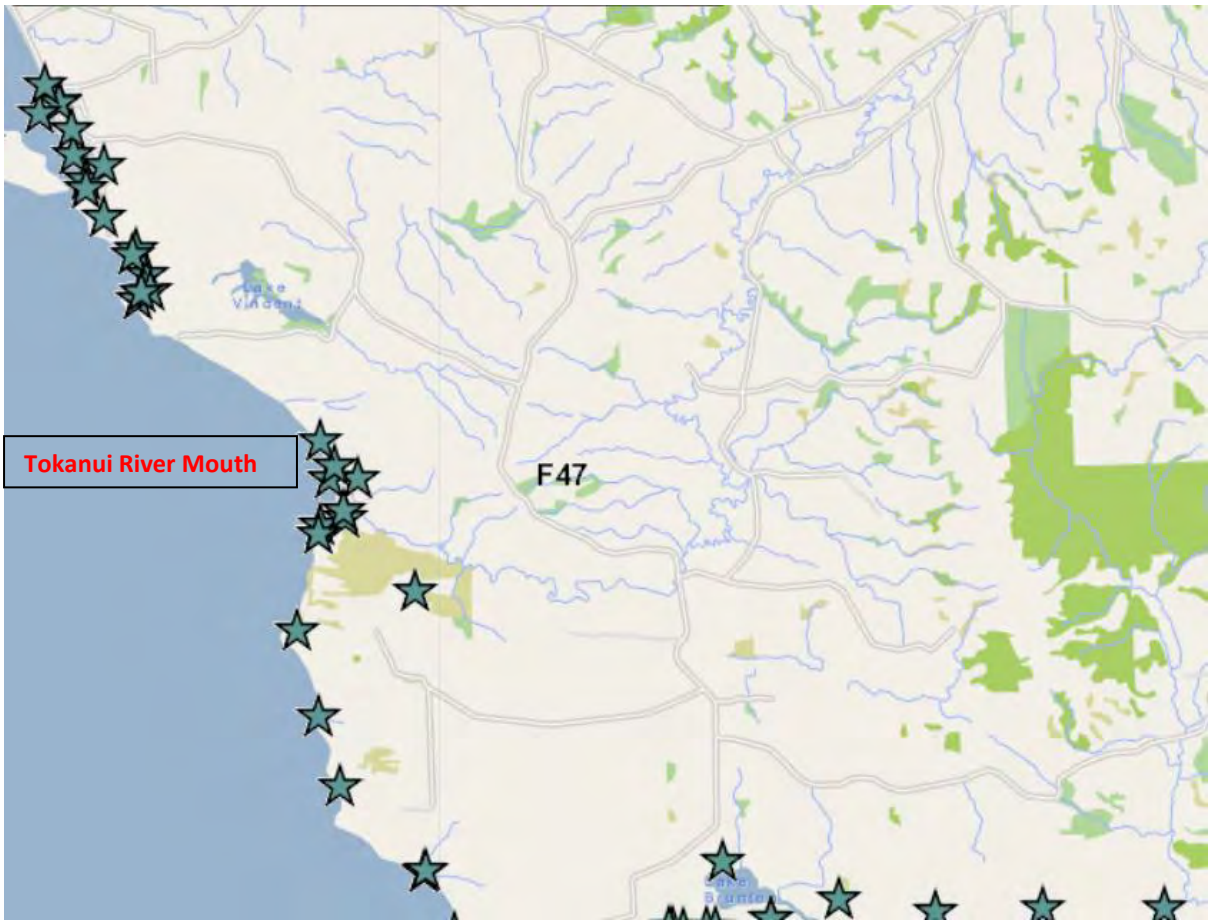
APPENDIX 1



APPENDIX 2

3.5.2 Wastewater Disposal

Wastewater disposal is a resource management issue arising from community sewage schemes, new subdivision and residential development proposals, and industrial operations such as freezing works and fish processing plants.

For Ngāi Tahu ki Murihiku, discharge to land is considered a better option than discharge to water, as discharging to land allows Papatūānuku to filter and cleanse contaminants from the discharge in a natural way, before the discharge enters the hydraulic system.

Ngā Take - Issues

- Physical and spiritual contamination of water as a result of wastewater disposal to water.
- Discharge to land activities that contaminate or over saturate soils.
- Need to ensure that economics alone do not determine whether disposal is to land or water.
- Sewage and stormwater disposal provisions for new subdivision applications.
- Stormwater run-off from roads or industrial sites, and potential for contaminants to enter water or contaminate soils.
- Poorly designed or operated effluent and sludge disposal schemes, and potential for contaminants to enter water.
- Impacts of wastewater disposal on culturally significant sites and places.
- Long term consent durations that prevent the consideration and adoption of improvements in technology over time.

> "…it is extremely important to us that sewage is not discharged on the bones of our ancestors."

Ngā Kaupapa - Policy

1. Promote the inclusion of Ngāi Tahu ki Murihiku issues and policies in statutory plan provisions and best practice guidelines for managing wastewater disposal.
2. Ensure that Ngāi Tahu ki Murihiku are provided with the opportunity to participate through pre hearing meetings or other processes in the development of appropriate consent conditions for discharge consents, including monitoring conditions.
3. Require that sufficient and appropriate information is provided with applications to allow tangata whenua to assess cultural effects (e.g. nature of the discharge, treatment provisions, assessment of alternatives, actual and potential effects).
4. Promote education and awareness of Ngāi Tahu ki Murihiku values associated with water, and how those values can be adversely affected by activities involving the discharge of contaminants to water.

5. Assess proposed wastewater discharge activities in terms of:
    a. type/nature of the discharge;
    b. location and sensitivity of the receiving environment;
    c. cultural associations with location of operations;
    d. actual and potential effects on cultural values;
    e. available best practice technology;
    f. mitigation that can occur (e.g. using plants to filter waste, discharging at specific times to minimise impact, treatment options)
    g. community acceptability;
    h. cost.

6. Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Even if the discharge is treated and therefore considered "clean", it may still be culturally unacceptable. Generally, all discharge must first be to land.

7. Assess waste disposal proposals on a case by case basis, with a focus on local circumstances and finding local solutions.

8. Wastewater disposal options that propose the direct discharge of treated or untreated effluent to water need to be assessed by the kaitiaki rūnanga on a case by case, individual waterway, basis. The appropriateness of any proposal will depend on the nature of the proposal, and what waterway is involved. Individual waterways possess their individual mauri and values, and kaitiaki rūnanga are in the best position to assess the potential impacts of a proposal on such values.

9. Encourage creative, innovative and sustainable approaches to wastewater disposal that make use of the best technology available, and that adopt principles of waste reduction and cleaner production (e.g. recycling grey water for use on gardens, collecting stormwater for a pond that can then be used for recreation in a new subdivision).

10. Require that the highest environmental standards are applied to consent applications involving the discharge of contaminants to land or water (e.g. standards of treatment of sewage).

11. Require soil risk assessments (type and percolation of the soils) prior to consent for discharge to land, to assess the suitability and capability of the receiving environment. Wastewater loading rates (mm/day) must reflect effluent quality and soil properties.

12. Encourage the establishment of wetland areas, where practical, to improve discharge to land activities, through allowing Papatūānuku the opportunity to filter and clean any impurities.

13. Require the use of buffer zones, bunds and other mechanisms to prevent wastewater from entering waterways.

14. Promote the use of high uptake vegetation (e.g. commercial/production forest plantations) for wastewater disposal, and to ensure that Ngāi Tahu ki Murihiku are involved in decisions relating to such disposal.

15. Any discharge activity must include a robust monitoring programme that includes regular monitoring of the discharge and the potential effects on the receiving environment. Monitoring can confirm system performance, and identify and remedy any system failures.

16. Require that large scale wastewater disposal operations (e.g. town sewage schemes, industry) develop environmental management plans, including contingency plans to cope with any faults, breakdowns, natural disasters, or extreme weather events (e.g. cash bonds for liability).

17. Duration of consent for wastewater disposal must recognise and provide for the future growth and development of the industry or community, and the ability of the existing operations to accommodate such growth or development.

18. Recommend a duration not exceeding 25 years, for discharge consents relating to wastewater disposal, with an assumption that upon expiry (if not before), the quality of the system will be improved as technological improvements become available. In some instances, a lesser term may be appropriate, with a condition requiring the system is upgraded within a specified time period.
19. Require conditions of consent that allow for a 5-year review of wastewater disposal activities. During review, consent holders should be required to consider technological improvements. If improvements are available, but not adopted, the consent holder should provide reasons why.
20. Encourage developers and consent applicants to provide site visits for tangata whenua representatives to observe proposed wastewater treatment systems. Site visits enable ngā rūnanga representatives to see what is proposed "on the ground".

Consent durations:

Ngāi Tahu ki Murihiku do not believe we should be granting consents for activities where we do not know what the effects may be over the long term. Anything over 25 years is essentially making decisions for the next generation.

We also need to ensure that consent duration recognises and provides for changes in technology, thus allowing us to continually improve the way we do things.

> Our bottom line is to avoid discharge of wastewater (e.g. sewage and stormwater) to water, as such activities have adverse effects on cultural values such as mauri, wairua, mahinga kai and wāhi tapu. Our preference is for wastewater to be treated to remove contaminants, and then discharged to land via wetlands and riparian areas, to allow Papatūānuku to provide a natural filter for waste. Where this is not practical or feasible, and discharge to water is proposed, then adverse effects must be mitigated through treatment to a very high standard and robust monitoring programs. Ngāi Tahu ki Murihiku will always look for the most culturally, environmentally, socially and economically appropriate option for a particular site.

Note: Part 2 of this Plan explains the cultural values and principles that guide the policies on wastewater disposal.

Appendix P Proposed Consent Conditions

Proposed Consent Conditions

Discharge Permit:

1. This consent authorises the discharge of treated wastewater from the Tokanui Wastewater Treatment Plant:

   (a) To land; and

   (b) To groundwater from the base of the oxidation ponds and the infiltration trench; and

   (c) To the Tokanui River;

   in general accordance with the application *"Tokanui Wastewater Treatment Plant Discharge to Land and Water"* dated [DATE]:

2. The discharge of treated wastewater from the Tokanui wastewater treatment plant to land and to water shall not exceed an annual average of 55 m^3/day. The consent holder shall record the daily volume of wastewater being discharged **to** the wastewater treatment plant, to determine compliance with this Condition.

3. The consent holder shall install two groundwater monitoring bores, one located up gradient of the discharge from the infiltration trench and the oxidation ponds at or about map reference [XXXXX], and one located downstream of the infiltration trench at or about map reference [XXXXX], and shown on the map attached as Attachment A.

4. Every six months, the consent holder shall monitor and record:

   a. the instantaneous rate of the discharge of treated wastewater discharged to the Tokanui River at the time of the survey.

   b. the quality of the treated wastewater discharged from the oxidation pond by collecting representative samples of the discharge and having those samples analysed for:

      i. Electrical conductivity

      ii. Total suspended solids concentration

      iii. Carbonaceous oxygen demand concentration (BOD_5)

      iv. Ammoniacal nitrogen concentration

      v. Total nitrogen concentration

      vi. Total phosphorus concentration

      vii. *Escherichia coli* concentration

   c. The quality of water in the Tokanui River by collecting representative samples from the stream, upstream and approximately 150 metres downstream of the point of discharge. The samples shall be analysed for:

      i. Temperature

      ii. pH

      iii. Electrical conductivity

      iv. Turbidity

      v. Visual clarity as measured using either a black disc or clarity tube

      vi. Dissolved oxygen concentration (%sat and mg/L)

      vii. Total ammoniacal-nitrogen concentration

      viii. Total oxidised nitrogen concentration

      ix. Dissolved reactive phosphorus concentration

      x. *Escherichia coli* concentration

d. The quality of groundwater in the vicinity of the Tokanui wastewater treatment plant infiltration trench by collecting representative samples from the upstream and downstream bores required by condition (3) of this consent, and having those samples analysed for:

   i. Temperature

   ii. pH

   iii. Electrical conductivity

   iv. Total ammoniacal-nitrogen

   v. Total oxidised nitrogen concentration

   vi. Dissolved reactive phosphorus concentration

   vii. *Escherichia coli* concentration

5. Visual observations of bacterial or fungal slime growths shall be undertaken in the Tokanui River throughout the length of the mixing zone downstream of the discharge. These observations shall be undertaken at each sampling event completed in accordance with Condition 4 of this consent. Photographs of the stream bed taken 5 m downstream of the point of discharge and then every 10 m up to 45 m from the point of discharge shall be recorded and provided to the Consent Authority when reporting the results of the visual observations required by this condition.

6. The consent holder shall undertake aquatic ecology monitoring in 2022 and every five years thereafter, to characterise the impact of the discharge on the aquatic environment of the Tokanui River. This aquatic ecology monitoring shall consist of Macroinvertebrate sampling, following Protocol C2 (soft-bottomed, semi-quantitative) as outlined in the document "Protocols for sampling macroinvertebrates in wadeable streams" (authors Stark, Boothroyd, Harding, Maxted, & Scarsbrook, 2001), with analysis for a full range of metrics, including %EPT, MCI and SQMCI;

7. Aquatic ecology monitoring outlined in Condition 6 shall be undertaken at two downstream sample locations and one upstream sample locations (as identified on the plan attached to these conditions as Attachment A), with at least five replicate samples (or the number considered appropriate as outlined in Section 3 of the document "Stream Periphyton Monitoring Manual" (authors Biggs & Kilroy, 2000)) being collected from each location measured from the point of discharge as follows:

   (a) Upstream Point 1 (15 metres upstream);
   (b) Downstream Point 2 (60 metres downstream);
   (c) Downstream Point 3 (150 metres downstream).

   Sampling should occur when flows are lower than the median flow condition. No sampling shall be carried out within ten days of the Tokanui River exceeding seven times its median flow or within seven days of flows that are greater than three times the median flow.

   Median flow conditions in the Tokanui River shall be indicated by the monitoring conducted on the Waikawa River at Biggar Road by the Consent Authority which is to be used as a surrogate. Median flow for the Waikawa River is 2.706 cumecs[1].

8. The consent holder shall submit a report to the Consent Authority within two months of the receipt of results for monitoring undertaken in accordance with Conditions 6 and 7 of this consent. The report shall summarise the results of all monitoring, analyse trends and comment on compliance with the relevant Lowland Soft Bed standard (attached as Attachment B to these conditions).

9. All sampling procedures, including collection and transportation of samples, and laboratory analysis undertaken in accordance with the conditions of this permit must be performed to IANZ registered standards or otherwise as agreed upon in writing by the Consent Authority.

10. The consent holder shall establish and maintain permanent signage in a prominent position at or near the point of discharge to the Tokanui River to advise the public of the potential

[1] This was determined from the time series provided by Environment Southland from December 2007 to June 2017.

risk associated with the presence of treated wastewater in the Tokanui River resulting from the discharge of treated wastewater from the Tokanui Wastewater Treatment Plant.

11. The discharge of treated wastewater to the Tokanui River shall not result in any of the following effects at or beyond the zone of reasonable mixing, being 150 linear metres from the point of discharge:

    (a) The production of conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
    (b) Any conspicuous plumes, change in colour or reduction of visual clarity
    (c) Any emission of objectionable odour;
    (d) The rendering of fresh water as unsuitable for consumption by farm animals;
    (e) Any significant adverse effects on aquatic life; and
    (f) The minimum standards set for Lowland Soft Bed waters, as described in the Southland Regional Water Plan (attached as Appendix 1 to this consent), being exceeded.

    Note: By 150 m downstream, it is expected that some of the treated wastewater discharged from the Tokanui wastewater treatment plant to land and or groundwater will have entered the surface water of the Tokanui River.

Earthworks

12. All vegetation clearance and soil disturbance shall be preceded by erosion and sediment control measures necessary to ensure that disturbed soil and sediment-laden stormwater migration from construction of the infiltration trench is minimised to the extent practicable. All erosion and sediment control measures shall be maintained as effective until such time as all disturbed areas are stabilised.
13. No cut or cleared vegetation shall be placed in a manner where it could obstruct or enter the Tokanui River;
14. No stockpiling of excavated soils and / or materials will occur within 20 m of the Tokanui River;
15. No refuelling, repairs or maintenance of plant or machinery shall take place within 20 m of the Tokanui River.
16. The site shall be cleared of all construction debris and stockpiles upon the completion of construction works, with any contaminated material being disposed of at a suitably approved facility.

Administration

17. The Consent Authority may in accordance with section 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 or of receiving any monitoring results, for the purpose of:

    (a) Determining whether the conditions of this consent are adequate to deal with any adverse effects 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 became evident after the date of commencement of the consent; or

    (b) Amending any monitoring, if the results indicate that the monitoring programme is inadequate;

    (c) Adding or adjusting compliance limits;

    (d) Requiring the adoption of the best practicable option to remove, reduce or mitigate any adverse effect on the environment arising as a result of the exercise of this consent; or

    (e) Without limiting the statutory powers of review, to achieve consistency with any future changes to the to the Southland Regional Council's plans or policies and to address nutrient allocation following limit setting.

Southland District Council

Land use consent - Soil Disturbance on a HAIL site in excess of 25 m^3 per 500 m^2:

1. This consent authorises the disturbance of soil on land currently containing an activity identified on the Ministry for the Environment's Hazardous Activities and Industries List, being the Tokanui Wastewater Treatment Plant.
2. The disturbance of soil authorised by this consent will be undertaken in general accordance with the description of the activity and associated mitigation measures described in the application *"Tokanui Wastewater Treatment Plant Discharge to Land and Water"* dated [DATE]:
3. The consent holder shall prepare a health and safety plan which appropriately addresses the risk of human exposure to biological hazards prior to works commencing.
4. All workers on site shall read and sign the health and safety plan and a copy of the plan shall be kept on site for the duration of the works.

Administration

5. The Consent Authority may in accordance with section 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 or of receiving any monitoring results, for the purpose of:
   (a) Determining whether the conditions of this consent are adequate to deal with any adverse effects 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 became evident after the date of commencement of the consent; or
   (b) Adding or adjusting compliance limits;
   (c) Requiring the adoption of the best practicable option to remove, reduce or mitigate any adverse effect on the environment arising as a result of the exercise of this consent.

No conditions are proposed in respect of the NoR given that:

(a) The alteration sought does not result in a significant change in either the scale of the designation or designated activity, or the associated effects of the activity;

Attachment B: Water Quality Standards from Regional Water Plan – Appendix G

Surface water bodies classified as "Lowland soft bed"

The temperature of the water:

- shall not exceed 23°C
- the daily maximum ambient water temperature shall not be increased by more than 3°C when the natural or existing water temperature is 16°C or less, as a result of any discharge. If the natural or existing water temperature is above 16°C, the natural or existing water temperature shall not be exceeded by more than 1□C as a result of any discharge.

The pH of the water shall be within the range 6.5 to 9, and there shall be no pH change in water due to a discharge that results in a loss of biological diversity or a change in community abundance and composition.

The concentration of dissolved oxygen in water shall exceed 80% of saturation concentration.

There shall be no bacterial or fungal slime growths visible to the naked eye as obvious plumose growths or mats. Note that this standard also applies to within the zone of reasonable mixing for a discharge.

When the flow is below the median flow, the visual clarity of the water shall not be less than 1.3 metres.[2]

The concentration of total ammonia shall not exceed the values specified in Table 1 "Ammonia standards for Lowland and Hill surface water bodies".

The concentration of faecal coliforms shall not exceed 1,000 coliforms per 100 millilitres, except for popular bathing sites, defined in Appendix K "Popular Bathing Sites" and within 1 km immediately upstream of these sites, where the concentration of Escherichia coli shall not exceed 130 E. coli per 100 millilitres.

The Macroinvertebrate Community Index shall exceed 80 and the Semi-Quantitative Macroinvertebrate Community Index shall exceed 3.5. [3]

Fish shall not be rendered unsuitable for human consumption by the presence of contaminants.

Table 1: Ammonia standards for Lowland and Hill surface water bodies

Total Ammoniacal Nitrogen in mg/m^3 at different pH	
pH	**NH4+-N + NH3-N mg/m3**
6.0	2570
6.1	2555
6.2	2540
6.3	2520

[2] Visual clarity is assessed using the black disc method or other comparable method employed by Environment Southland

[3] MCI and SQMCI indices to be determined using Environment Southland's SOE sampling protocol and MfE's Protocol P2 for sample processing (Stark et al. 2001)

Total Ammoniacal Nitrogen in mg/m^3 at different pH	
pH	**NH4+-N + NH3-N mg/m3**
6.4	2490
6.5	2460
6.6	2430
6.7	2380
6.8	2330
6.9	2260
7.0	2180
7.1	2090
7.2	1990
7.3	1880
7.4	1750
7.5	1610
7.6	1470
7.7	1320
7.8	1180
7.9	1030
8.0	900
8.1	780
8.2	660
8.3	560
8.4	480
8.5	400
8.6	340
8.7	290
8.8	240
8.9	210
9.0	180

Appendix Q Consultation Outcomes

Dunning, Janan

From: Joe Findley <Joe.Findley@southlanddc.govt.nz>
Sent: Sunday, 18 February 2018 2:13 p.m.
To: Dunning, Janan; Paul Reid; Ian Evans
Subject: FW: Southland District Council Land purchase

Hi Janan,

Below is confirmation from Peter O'Brian at Tokanui that he is happy with the proposed plan for Council to purchase the additional land required for the pond upgrades as part of the consent. Bevan said you may require this as evidence for the lodgement of the consent.

Please feel free to contact me if required

Kind Regards

Joe

Joe Findley
Project Engineer
Southland District Council
PO Box 903
Invercargill 9840
P: 0800 732 732 | F: 0800 732 329
www.southlanddc.govt.nz

From: Peter O'Brian [mailto:pjnui@outlook.co.nz] **On Behalf Of** Peter O'Brian
Sent: Saturday, 17 February 2018 12:49 p.m.
To: Joe Findley
Subject: RE: Southland District Council Land purchase

Hi joe
Read through plan. Would be willing to proceed.
Sent from Mail for Windows 10thanks peter

From: Joe Findley <Joe.Findley@southlanddc.govt.nz>
Sent: Wednesday, November 22, 2017 11:12:38 AM
To: 'pjnui@farmside.co.nz'
Subject: Southland District Council Land purchase

Hi Peter,

Apologies for my delay in getting an email to you regarding this.

Attached is a plan which has been done up by our Consultant who is managing the consent application. It includes a land area for purchase of (let's say) 1318.1 square meters.

As discussed on site, if you are happy to proceed with a purchase price of $35,000 per hectare then we would purchase the piece of land from you for $4,613.00. Council would undertake the fencing and planting itself as part of the works.

If you are still happy to proceed with this I can get the ball rolling with our property department to prepare the necessary paper work.

If you wish to discuss this again at all, please email or phone me and I will be happy to answer any questions you might have.

Kind Regards

Joe Findley
021 853548

Joe Findley
Project Engineer
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Meeting Notes

Tokanui WWTP Reconsenting Consultation Meeting

Tokanui WWTP

Date/Time:	November 14, 2017 / 1:00 PM
Place:	Southland District Council Office
Next Meeting:	TBC
Attendees:	Sue Bennett (Stantec), Janan Dunning (Stantec), Isobel Oldfield (Stantec), Bevan McKenzie (SDC), Jacob Smyth (Fish & Game), Stevie-Rae Blair (Te Ao Marama Incorporated), Linda Robertson (Public Health South), Jitender Arora (Public Health South), Amy Evans (Department of Conservation)
Absentees:	n/a

Item: **Action:**

Tokanui Consultation Meeting

Janan
Summarised the proposal which was outlined in the summary document provided with the meeting invitation. The proposal is not just a straight forward replacement but includes improvement in the form of an infiltration trench.

Jacob
Asked whether the ponds are unlined and therefore if there is actually any discharge to the Tokanui River?

Sue stated that the ponds are lined, but that there is some residual discharge through the base of the ponds. She noted that the previous AEE had limited information and assumed a more significant discharge from the base of the ponds than is actually occurring.

Bevan noted that the liner is made up of silty clay.

Sue/Bevan
Discussion around the daily flows into the wastewater treatment plant. Bevan noted that the flow into the wastewater treatment plant is approximately 30m^3/day, dropping to approximately 20m^3/day. It was also noted that flows increase during rainfall events.

The current consent includes a maximum daily discharge of 55m^3/day, it is proposed to change this to an annual average daily maximum.

Item: **Action:**

Sue noted that there is no expected growth in the population at Tokanui, the change is proposed so that SDC can comply with the condition given the 'peaky' nature of the inflows.

Sue and Bevan
Sue noted that a pond drop test had been completed, but that this test does not comply with the relevant appendix in the plan because the pond was not desludged first. Oxidation ponds are normally only desludged every ten years.

Bevan stated that the data indicates that approximately 8m^3/day is being discharged from the base of the pond.

Janan
Discussed the consenting process – SDC will be applying to replace consent to discharge to land and to water (ground and surface). The activity status will be non-complying.

It was noted that dissolved oxygen does not meet the plan standard.

Jacob
Thought the river was compliant with dissolved oxygen as outlined in the report completed by Ryders (April 2017)?

Sue
The main issues are with dissolved oxygen and faecal coliforms.

For faecal coliforms the discharge quality is comparable to the upstream quality and the impact of the discharge is negligible.

For dissolved oxygen, there are two standards, the National Policy Statement for Freshwater (NPS) requires dissolved oxygen concentrations to be maintained above 5mg/L. The plan requires dissolved oxygen percentage saturation to remain above 80%.

The Tokanui River consistently complies with the NPS standard. All results have been collected in mg/L – to compare this to the plan standard the concentration of dissolved oxygen was converted to percentage saturation. This involved some assumptions and therefore is not as reliable. The conversion indicates however that at some times the plan standard cannot be met. It was noted however that the quality upstream and downstream is comparable.

Jacob
Stated that from Fish and Game's perspective they are concerned about impacts from the discharge.

Janan
Description of the infiltration trench which will be based on the trench at Curio Bay. Discharge to the stream is likely only to occur when groundwater is high. In winter the discharge will mainly go to the stream.

Item: **Action:**

The existing discharge pipe will remain and wastewater will trickle through the gravels in the trench.

Sue has completed some calculations to show that the trench will have approximately one day's worth of storage volume.

Stevie-Rae
Asked what the term of the consent would be?

Bevan
25 years

Sue
Noted that the "good" quality of the discharge, is probably due to the wastewater treatment plant being a two pond system, with the second pond essentially polishing the discharge.

Jacob
Also expressed surprise at the quality and noted that two pond systems haven't worked well for dairy farms in Southland.

Asked whether a second pipe will go through the gravels of the infiltration trench?

Bevan
No, wastewater will trickle through the gravels and be picked up in a sump at the end of the trench and discharge via the existing pipe through the bank of the stream.

Janan
SDC will be looking to designate the area the trench will occupy. The wastewater treatment plant is an MfE hazardous activities and industries list (HAIL) activity and therefore a consent will be required from SDC under the National Environmental Standard for Assessing and Managing Contaminants in Soil.

Jitender
Are there any drinking water bores near the discharge?

Sue
No, all the bores are up gradient with a good separation distance

Jitender
In the future if there was a proposal to establish a bore would the bore owners be notified?

Janan
Environment Southland would have the Tokanui WWTP on their database and consent to establish a bore would need to be applied for through Environment Southland, at this point the proposed bore owners would be notified of the proximity to the WWTP.

Sue
What happens in the groundwater was modelled. The natural soil is silty clay which makes it good for treatment but not for infiltration. Modelling shows the groundwater moves slowly and assuming all the wastewater discharges to groundwater (which is conservative), the concentration are back to background levels within 100-200 metres.

Jacob
Is groundwater hydraulically connected with stream?

Sue
Stantec hydrogeologist has looked at this and given the soil type it may not be.

The assessment of effects has looked at what happens if the entire discharge goes to the stream and if the entire discharge goes to groundwater to be conservative.

Linda
Is there any recreational use in the vicinity of the discharge?

Janan
The land use surrounding the wastewater treatment plant is primarily farming and not easily accessible for the public, however the Tokanui River does provide some recreational values.

Jacob
Stated that there is some value, with some angling, although most values are associated with the lower tidal reach. It was noted children may catch eels in the River.

Stevie-Rae
Used to go to school there, and noted that local kids play in the stream, however it is likely the locals know about the WWTP discharge and avoid it.

Sue
There is signage and the oxidation pond is fenced

Jitender
Do you regularly test sludge from the ponds?

Sue
Stated that there is a desludging programme for a number of the Southland District WWTPs and that sludge testing has been undertaken as part of this, however Tokanui is not part of this contract.

Testing is largely of the actual discharge as the sludge stays in the bottom of the pond.

Jacob
Is aeration needed?

Sue
No

Item: **Action:**

Stevie-Rae
Asked about groundwater levels at the site.

Sue
Groundwater levels are highly variable, with ponding due to high groundwater occurring during winter. There is not a lot of data available in the area but we would expect the groundwater levels to be seasonally variable.

Jacob
Expressed some sympathy with SDC, who have a number of small, outlying communities with static or declining populations.

Stevie-Rae
Asked about signs at the WWTP.

Bevan
There are signs at the ponds themselves and on the bank at the location of the discharge.

Stevie-Rae
Commented that she was happy that more of the discharge is going to infiltration trench rather than direct discharge to the river.

Bevan
SDC looked at the cost of land disposal to a forestry block, however this option was cost prohibitive.
It was noted that SDC are currently upgrading a number of other WWTP and therefore given the minor discharge from this one an infiltration trench was considered a reasonable upgrade which was significantly cheaper than other options.

Jitender
Is there any treatment for odour issues?

Janan
There have been no complaints so far and we are not aware of issues with odour. A consent application for discharge of odour is not required because the WWTP meets the permitted activity rule due to its size.

Sue noted that there is a fair degree of separation to nearest residential house, Sue has been to the site and can't remember too much odour, however she did note that she is used to WWTPs.

Linda
Is it possible to go on a site visit?

Bevan
This can be arranged.

Item: **Action:**

It was discussed whether this should occur after the application has been provided so that all parties have more information. The general consensus was that this is a good idea.

Sue
Stated that within the discharge trench some filtration would be expected and therefore some removal of solids. Once the trench becomes established there will be some biological community which will provide limited nutrient removal but the extent would be difficult to quantify. The proposal does not include cut and carry and therefore there will be no removal of nitrogen.

Jacob
Would deep rooted planting help?

Sue
It could help, particularly with trying to keep the groundwater down

Janan
Would there be maintenance challenges with deeper rooted plants?

Bevan
Might have to thin them out occasionally

Sue
Manuka and Kánuka can be good to suck up water and can reduce nitrogen leaching, although it is thought that these plants reduce nitrate leaching because they are biocidal and so the bugs that convert ammonia to nitrate die. This wouldn't work in this case because the nitrogen is already predominantly in the nitrate form. However these plants would be helpful in keeping groundwater levels lower, which increases the unsaturated zone available to treat the wastewater.

Sue
Does DoC have any particular interest in Tokanui?

Amy
Would need to check with the team, but as far as she is aware, no they don't.

Janan
We are aiming to distribute the application after Christmas. Do you want to see a draft before lodgment?

Jacob
Would like to see the application after lodgment in case there are any changes (all agreed)

Jacob
Overland flow [from other land uses] would be a problem in this area?

Sue

Item:	Action:
The WWTP is located within the gleyed physiographic zone and for that zone overland flow is the primary concern. **Stevie-Rae** Does the river ever flood up to the ponds? **Bevan** The ponds site above the bank of the river, over a meter above the River banks.	

The meeting adjourned at 1:45pm

Appendix R Statutory Assessment

Assessment of the policy framework

National Policy Statement for Freshwater Management 2014 (amended 2017)

Table 1. NPS-FM: Policy Framework Assessment

Provision	Assessment
Objective A1: *To safeguard:* *a) the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; and* *b) the health of people and communities, as affected by contact with fresh water;* *in sustainably managing the use and development of land, and of discharges of contaminants.*	The assessment of effects shows that the adverse effects of the current discharge on the life-supporting capacity, ecosystem processes and associated aquatic species in the Tokanui River are very limited (less than minor) after reasonable mixing. The effect of the surface water discharge on the life-supporting capacity, ecosystem processes and indigenous species of the Tokanui River, and on the health of people who come into contact with the water in the river is also very low due to: - the high quality of the effluent; - the typically small volume of the discharge; and - the high degree of available dilution in the river. The surface water discharge therefore represents a sustainable use of the Tokanui River as a natural and physical resource, with the use of the land for the treatment ponds and the trench also appropriate. The proposed activity will therefore achieve this objective.
Objective A2: *The overall quality of fresh water within a freshwater management unit is maintained or improved while:* *a) protecting the significant values of outstanding freshwater bodies;* *b) protecting the significant values of wetlands; and* *c) improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.*	The Tokanui River is not identified as an outstanding water body, and no wetland values will be affected by the discharge. The quality of the treated wastewater discharged from the WWTP to land, groundwater and surface water is high, and therefore the effect of the discharge on fresh water values after reasonable mixing is low (less than minor). Taking into account the limited effect of the discharge on water quality (scale and extent), and the existing quality of the Tokanui River, the overall quality of the water in the FMU will be maintained. Some improvement may also be achieved as a result of the treated effluent passing through the infiltration trench. The Tokanui River has been degraded by human activity (primarily upstream agriculture). The discharge has a very limited effect on water quality, and given the current high quality of the discharge, is expected to remain the same or to improve to a minor degree. The overall effect of the discharge on freshwater quality would be negligible. The proposed activity will therefore help to achieve this objective within the extent of the FMU.

Provision	Assessment
Objective A3 *The quality of fresh water within a freshwater management unit is improved so it is suitable for primary contact more often, unless:* *a) regional targets established under Policy A6(b) have been achieved; or* *b) naturally occurring processes mean further improvement is not possible.*	Given the very limited effect of the existing discharge on water quality in the Tokanui River, measureable improvements in the quality of fresh water over the FMU are likely to be minimal, however the proposal will contribute to achieving this objective given the very limited effect of the discharge on water quality, and the absence of measureable effect on the overall quality of water in the FMU.
Objective A4 *To enable communities to provide for their economic well-being, including productive economic opportunities, in sustainably managing freshwater quality, within limits.*	The discharges will not adversely affect the ability of the Southland community to provide for their economic wellbeing, insofar as it is reliant on the quality of the water in the Tokanui River. Taking into account the minimal adverse effect on water quality resulting from the discharge, approving the consent application will enable the Southland community to sustainably use the District's water resources (groundwater and the Tokanui River) in a manner that does not undermine present or future productive economic opportunities. Authorising the discharge will enable the existing WWTP to continue to be used to manage and treat wastewater in a very cost-effective manner while avoiding significant adverse environmental effects. Given the quality and volume of the discharge, any effect on future allocation limits (quality) will be minimal. The discharge does not prevent downstream users from accessing water for productive purposes. The discharge is also a key part of economically providing for high quality wastewater treatment for the Tokanui community. The proposed activity will achieve this objective.
Policy A4 *Direction to regional councils to amend regional plans to include Policy A4 until any changes under Schedule 1 needed to give effect to Policy A1 and A2 become operative.*	Policy A4(3) notes that the policy applies to: a. new discharges; or b. existing discharges into fresh water or to land where the contaminant may enter freshwater, that are changing or increasing. This application is to replace an existing discharge permit authorising the discharge of treated wastewater to 'ground and to water' (201599). The applicant seeks to: i. authorise the discharge of an annual average volume of 55 m^3 / day; and ii. construct an infiltration trench to facilitate land contact, including some discharge to land. Discharges to water (groundwater and the Tokanui River) will be reduced in scale and frequency.

Provision	Assessment
	The 'change' to the discharge is therefore in the process (i.e. the infiltration trench etc.) rather than the volume or quality of the discharge. Policy A4(1): - the current discharges, being primarily to the Tokanui River, do not result in discernible adverse effects on the life-supporting capacity of the river as evidenced in a report on the river's aquatic ecology prepared by Ryder Consulting Ltd (appended to the application) which found no difference between upstream and downstream communities. Monitoring shows that the current discharge avoids adverse effects on freshwater quality (and associated ecosystems) that are more than minor. It is both feasible and dependable therefore that any adverse effects on water quality resulting from the discharges will not be more than minor (Policy A4(1)(b)). Policy A4(2): - The discharge will largely avoid effects on surface water that could adversely affect the health of people and communities who come into contact with it, given the quality of the discharge, and the dilution and dispersal within both surface and groundwater. Discharges to surface water will generally occur during conditions where there is high available dilution in the Tokanui River, achieving rapid dilution and dispersal within the river (e.g. during high flows). The river is also not easily accessible for some distance downstream of the discharge. It is both feasible and dependable therefore that any adverse effects on community health will not be more than minor (Policy A4(2)(b)).
Policy A7 *By every regional council considering, when giving effect to this national policy statement, how to enable communities to provide for their economic well-being, including productive economic opportunities, while managing within limits.*	As for the discussion for Objective A4, authorising the continuation of the current discharge will best enable the Tokanui community to provide for their economic well-being. Continuing the discharge will enable the ongoing use of the WWTP, while ensuring that the adverse effects of the treatment and discharge of the town's wastewater are suitably avoided or mitigated, and have minimal impact on future FMU limits. The proposed activity is therefore consistent with this policy.

Southland Regional Effluent Land Application Plan

Table 2. RELAP: Policy Framework Assessment

Provision	Assessment
Objective 4.1.1 Soil To ensure the life supporting capacity of the soil ecosystem is safeguarded from the adverse effects of discharges of effluent and sludge onto or into land.	The life supporting capacity of soil ecosystems will not be affected by the discharge to land from the base of the oxidation ponds and the trench. The base of the ponds lie below the topsoil layer, and discharges do not affect the quality of the soils nearby. The trench received treated wastewater, and will facilitate a limited volume of discharge to ground. The effects of the discharge is limited to the soil immediately below the ponds and trench, and do not extend beyond the WWTP site. The proposal will achieve this objective.
Objective 4.1.2 – Water To ensure that water quality and the life supporting capacity of the water ecosystem is safeguarded from the adverse effects of discharges of effluent and sludge onto or into land which may enter water.	The discharges from the base of the pond and trench will enter groundwater, and will be heavily diluted, and dispersed within groundwater within the defined mixing zone. The discharge does not diminish the life-supporting capacity of the water ecosystem, however it will reduce the quality of the receiving water to a minor degree, and in this sense will not 'safeguard' the quality or achieve this objective.
Objective 4.1.3 - Human and animal health To ensure that effluent and sludge discharges onto or into land do not adversely affect human and animal health.	The discharges from the pond and trench are to the underlying soils, with no opportunity for human or animal contact that would adversely affect human or animal health. Similarly, there will not be any discharge visible, and no adverse effects on amenity values. The proposal will achieve these objectives.
Objective 4.1.4 - Amenity values To ensure that amenity values are not adversely affected by discharges of effluent and sludge onto or into land.	
Objective 4.1.5 - Takata whenua To recognise and provide for the relationship of takata whenua with ancestral sites, wahi tapu and other taoka.	The discharge of wastewater to land is preferable to takata whenua over discharges to water. The trench provides for land contact prior to discharging to land or to surface water, consistent with the takata whenua preference expressed in the CIA for land based solutions. The CIA acknowledges this improvement, but notes that in winter the degree of land contact will be limited by high groundwater levels.. The proposal therefore partially achieves this objective, and the discharge to land aligns well with the objective.
Policy 4.2.2 - Discharge to land	The effluent discharged from the ponds and trench will be treated further in the underlying unsaturated soil layer, without resulting in significant adverse effects. The proposal is consistent with this policy.

Provision	Assessment
Utilise land treatment of effluent and sludge where this can be undertaken in a sustainable manner and without significant adverse effects.	
Policy 4.2.3 - Avoid where practicable, remedy or mitigate adverse effects on water Avoid where practicable, remedy or mitigate adverse effects on water quality, water ecosystems and water potability from effluent and sludge discharges onto or into land.	The adverse effect of the discharges on the receiving environment will be minor at most, with most effects either avoided or mitigated to a significant extent. There are no known drinking water bores in the vicinity of the WWTP, and no public water supply is drawn from the Tokanui River. The proposal is consistent with this policy.
Policy 4.2.6 - Human and animal health Avoid where practicable, remedy or mitigate any adverse effects to human and animal health arising from discharges of effluent and sludge onto or into land.	The discharges from the pond and trench are to the underlying soils, with no opportunity for human or animal contact that would adversely affect human or animal health. The proposal is consistent with this policy.
Policy 4.2.8 - Takata whenua Recognise and provide for takata whenua concerns related to the discharge of effluent and sludge onto or into land.	Takata whenua concerns have been taken into account, leading to the proposed installation of the infiltration trench to provide land contact to the extent possible prior to discharging to land or to water. Takata whenua have also provided input by way of a cultural impact assessment (attached to this document), and while recognising the improvement inherent in the proposal, continue to maintain their concern about discharges of treated wastewater to water.
Policy 4.2.9 - Amenity values Avoid where practicable, remedy or mitigate any adverse effects on amenity values from discharges of effluent and sludge systems onto or into land.	There will not be any visible aspect to the discharges, which will essentially be subsurface, and consequently will not result in any effects on amenity. The proposal is consistent with this policy.

Southland Regional Policy Statement 2017

Table 3. SRPS: Policy Framework Assessment

Provision	Assessment
Chapter 3 - Tangata Whenua	
Objective TW.1 – Decision-making and partnerships with tangata whenua *The principles of the Treaty of Waitangi/Te Tiriti o Waitangi are taken into account in a systematic way through effective partnerships between tangata whenua and local authorities, which provide the capacity for tangata whenua to be fully involved in council decision-making processes.*	Although this is more a directive to local authorities to involve tangata whenua in resource management decision-making, the applicant has given effect to Treaty principles by engaging with Te Ao Marama Inc. (TAMI) as representatives or tangata whenua, when preparing the application. This engagement included the preparation of a Cultural Impact Assessment (CIA) by TAMI in regard to the effects of the WWTP discharges on Maori cultural and spiritual values. The process followed by the applicant to date therefore meets this objective.
Objective TW.2 – Provision for iwi management plans *All local authority resource management processes and decisions take into account iwi management plans.*	*Te Tangi a Tauira* as an incorporated iwi management plan was taken into account in preparing this application, to assist the consent authority in their decision-making role. The application process to date therefore meets the intent of this objective.
Objective TW.3 – Tangata whenua spiritual values and customary resources *Mauri and wairua are sustained or improved where degraded, and mahinga kai and customary resources are healthy, abundant and accessible to tangata whenua.*	The discharge will not adversely affect the biophysical health or abundance of the aquatic species which are valued as mahinga kai to a discernible degree, however the cultural offence of discharging wastewater to water is acknowledged. The discharge of much of the treated wastewater from the WWTP to land is a substantial mitigation measure in regard to the adverse effect of the discharge on these values, as is ensuring that the surface water discharge contacts land via the infiltration trench prior to discharge. The discharge however is not fully consistent with this policy, taking into account the effect of treated human sewage on mauri and wairua, and Ngai Tahu cultural and spiritual values.
Policy TW.1 – Treaty of Waitangi *Consult with, and enhance tangata whenua involvement in local authority resource management decision-making processes, in a manner that is consistent with the principles of the Treaty of Waitangi/Te Tiriti o Waitangi.*	As for Objective TW.1, the applicant has involved tangata whenua early in the preparation of the application, and through their role in preparing a CIA for the proposal. This early involvement has enabled Maori cultural and spiritual values to be taken into account in the proposal. The application process for this proposal is consistent with this policy.

Provision	Assessment
Policy TW.3 – Iwi management plans *Take iwi management plans into account within local authority resource management decision making processes.*	*Te Tangi a Tauira* was taken into account in preparing this application, and an assessment of the relevant policy provisions is included in this Appendix. The proposed activity is therefore consistent with this policy.
Chapter 4A – Water Quality	
Objective WQUAL.1 – Water quality goals *Water quality in the region:* *(a) safeguards the life-supporting capacity of water and related ecosystems;* *(b) safeguards the health of people and communities;* *(c) is maintained, or improved in accordance with freshwater objectives formulated under the National Policy Statement for Freshwater Management 2014;* *(d) is managed to meet the reasonably foreseeable social, economic and cultural needs of future generations.*	The discharges from the WWTP are of comparatively low volume and are sufficiently treated to ensure that adverse effects on water quality (ground and surface water) and consequently its life-supporting capacity, and the effects on community health are minimal. The discharge permits are sought to continue the existing discharge, albeit now including the infiltration trench component. Consequently the effect on the quality of the underlying groundwater and of the Tokanui River will be no greater than at present (i.e. will at least be maintained). The discharge will not adversely affect the ability of the community to provide for foreseeable social or economic needs, and in this respect will achieve the intent of this objective. The adverse effect on cultural values however is acknowledged. Overall, the proposed activity is considered to meet this objective.
Objective WQUAL.2 – Lowland water bodies *Halt the decline, and improve water quality in lowland water bodies and coastal lakes, lagoons, tidal estuaries, salt marshes and coastal wetlands in accordance with freshwater objectives formulated in accordance with the National Policy Statement for Freshwater Management 2014.*	Continuing to discharge primarily to land will prevent any further decline in the water quality of the Tokanui River as a lowland water body, associated with discharges from the WWTP. This is particularly given the effective treatment of wastewater and the resulting high quality of the discharge, the dilution and dispersion in groundwater when discharged to land, and the less than minor existing adverse effects on water quality. The proposed activity will therefore help to achieve this objective.
Policy WQUAL.1 – Overall management of water quality *(a) …; and* *(b) Manage discharges and land use activities to maintain or improve water quality to ensure freshwater objectives in freshwater management units are met.*	The discharges to land and water will maintain the existing water quality in the Tokanui River, and which result in very little effect on water quality in the vicinity of the discharges, and which will be negligible across the FMU. The proposed activity is therefore consistent with this policy.

Provision	Assessment
Policy WQUAL.2 – All waterbodies *Maintain or improve water quality, having particular regard to the following contaminants:* *(a) nitrogen;* *(b) phosphorus;* *(c) sediment;* *(d) microbiological contaminants.*	Water quality will be maintained in respect of all contaminants identified in Policy WQUAL.2. Establishing the infiltration trench is likely to help minimise the frequency and scale of direct discharges to the Tokanui River. The proposed activity is therefore consistent with this policy.
Policy WQUAL.7 – Social, economic and cultural benefits *Recognise the social, economic and cultural benefits that may be derived from the use, development or protection of water resources.*	There are substantial social and economic benefits to be derived by managing public health risks from wastewater, by providing effective community wastewater treatment plants. The use of groundwater and the Tokanui River as receiving environments for treated wastewater is a key part of operating the WWTP in an economic and sustainable way that is affordable for the community. The discharge to the Tokanui River will not prevent downstream water users from accessing and using the river's water resources. The adverse effects of the activity on social and cultural values will be avoided through discharging to land - in this respect the activity is consistent with this policy. The cultural offence caused by discharges to the Tokanui River is acknowledged, however is addressed to some degree by the ensuring that all wastewater contacts land (through the infiltration trench) before discharging to water. In this regard, the proposed activity is not fully consistent with this policy.
Policy WQUAL.8 – Preference for discharge to land *Prefer discharges of contaminants to land over discharges of contaminants to water, where:* *(a) a discharge to land is practicable;* *(b) the adverse effects associated with a discharge to land are less than a discharge to water.*	For most of the year, land disposal for treated wastewater from the WWTP is practical, given groundwater depths, and the depth of unsaturated soil layers. The wastewater will discharge to land for much of the year, with little if any discharge to the Tokanui River. The adverse effects of discharging to land in this case are less than direct discharges to the Tokanui River, minimal as those effects are. The proposed activity is consistent with this policy.
Policy WQUAL.10 – Siting and operation *Manage the siting and operation of activities that result in point source discharges of contaminants to land to ensure that adverse effects on groundwater, surface water and coastal water quality are avoided, remedied or mitigated.*	The WWTP is located at this site for practical and operational reasons. The WWTP is operated in a manner that minimises to the extent practicable, adverse effects on groundwater and the water quality of the Tokanui River. Direct surface water discharges to the river are minimised by the design of the WWTP with a preferential land discharge, largely avoiding the effects of treated wastewater discharges to the Tokanui River. However, even when direct discharges to

Provision	Assessment
	the river do occur, the treatment process and the low volumes discharged ensure that adverse effects are substantially mitigated. The proposed activity is therefore consistent with this policy.
Biodiversity	
Objective BIO.2 – Maintain and protect *Maintain indigenous biodiversity in Southland and protect areas of significant indigenous vegetation and significant habitats of indigenous fauna for present and future generations.*	The WWTP site lies exclusively in exotic pasture, and does not contain any significant indigenous vegetation, or provide significant habitat for indigenous fauna. The Tokanui River does not contain any identified significant habitats of indigenous fauna in the vicinity of the discharge, however several species of indigenous fauna (including some taonga species) have been identified in the vicinity of the WWTP. Given the presence of existing indigenous species near the WWTP, and the absence of significant change between upstream and downstream monitoring sites, the discharge is not considered to result in significant adverse effects on, or result in a decline of indigenous biodiversity. The proposed activity will meet this objective.
Policy BIO.4 – Maintain indigenous biodiversity *Manage a full range of indigenous habitats and ecosystems to achieve a healthy functioning state, and to ensure viable and diverse populations of native species are maintained, while making appropriate provisions for lawful maintenance and operation of existing activities. In giving effect to this policy, regard will be had to the following potential adverse effects:* *(i) fragmentation of, or reduction in the extent of, indigenous vegetation or habitats of indigenous fauna;* *(ii) fragmentation or disruption of connections and linkages between ecosystems or habitats of indigenous fauna;* *(iii) loss of, or damage to, buffering of ecosystems or habitats of indigenous fauna;*	As for the assessment for Objective BIO.2, the discharge from the WWTP results in minimal adverse effects on indigenous vegetation, fauna and habitat. While there are no areas of significant vegetation affected by the activity, and the Tokanui River has not been identified as providing significant indigenous habitat, some indigenous species have been identified in the vicinity of the WWTP, indicating that the discharge itself is not causing the adverse effects identified in Policy BIO.4. Further, the discharge is well established and continuing it is not considered likely to cause further decline in the health, quantity or quality of indigenous species or habitats, or the viability, diversity or range of communities. The proposed activity is consistent with this policy.

Provision	Assessment
(iv) loss or reduction of rare or threatened indigenous species' populations or habitats.	
Contaminated Land	
Objective CONTAM.2 – Avoid, remedy or mitigate adverse effects *Adverse effects on the environment (including human health) from contaminated land are avoided, remedied or mitigated.*	While WWTPs are identified in the Ministry for the Environment's Hazardous Activities and Industries List (HAIL), the disturbance of land during the construction of the infiltration trench is not expected to result in the mobilisation of contaminants that could adversely affect human health or environmental quality, given the nature of the contamination likely to be present at the site as a result of the WWTP activity. Regardless, any such effects can readily be mitigated through appropriate practices and Personal Protective Equipment (PPE). The proposed activity will achieve the intent of Objective CONTAM.2 and is consistent with Policy CONTAM.2.
Policy CONTAM.2 – Management of contaminated land *(a) Protect human health when undertaking activities on land that is potentially, or known to be, contaminated.* *(b) Manage contaminated land to avoid, remedy or mitigate adverse effects on the environment.*	
Infrastructure	
Objective INF.1 – Southland's infrastructure *Southland's regionally significant, nationally significant and critical infrastructure is secure, operates efficiently, and is appropriately integrated with land use activities and the environment.*	The WWTP falls within the definition of 'critical infrastructure' in the RPS. The application for a replacement discharge permit is an essential part of ensuring that the operation of the WWTP is secure by being appropriately provided for by regulations. The WWTP has been shown to operate efficiently, both in respect of managing and treating Tokanui's wastewater in a cost efficient and effective manner, and through the monitoring results demonstrating the minimal environmental effects. The results show that the WWTP is appropriately integrated with the environment. The activity will achieve Objective INF.1.
Policy INF.1 – Regional, national and critical infrastructure *Recognise the benefits to be derived from, and make provision for, the development, maintenance, upgrade and ongoing operation of regionally*	Approving the application for the replacement discharge permit is essential in order to provide for the ongoing operation of the WWTP, and to also provide for the proposed upgrade (by way of the proposed infiltration trench) and future maintenance activities necessary to ensure its ongoing effective operation. By providing for the WWTP in this way, the benefits of the facility in centralising wastewater treatment from Tokanui, and effectively treating and disposing of

Provision	Assessment
significant, nationally significant and critical infrastructure and associated activities.	the wastewater in a sustainable manner can then be achieved. The proposed activity is consistent with this policy.
Policy INF.2 – Infrastructure and the environment *Where practicable, avoid, remedy or mitigate the adverse effects of infrastructure on the environment. In determining the practicability of avoiding, remedying, or mitigating adverse effects on the environment, the following matters should be taken into account:* *(a) any functional, operational or technical constraints that require the physical infrastructure of regional or national significance to be located or designed in the manner proposed;* *(b) whether there are any reasonably practical alternative designs or locations;* *(c) whether good practice approaches in design and construction are being adopted;* *(d) … (e)*	The adverse effects of the existing WWTP and discharges are minor at most, and the replacement consent will not result in any increase in the scale, nature or extent of those effects. Although the Tokanui WWTP is not regionally or nationally significant infrastructure, given that the WWTP relies on discharging treated wastewater to the Tokanui River, there is a functional and operational need for the WWTP to be located in proximity to the river. Similarly, there are no reasonably practicable alternative designs or locations, taking into account the scale and nature of the current adverse effects of the WWTP and discharges, and the cost (as a consideration of practicality) of moving or redesigning the WWTP, or fully discharging to land. Given the effectiveness of the current WWTP in treating wastewater, there would be little benefit in relocating or redesigning the WWTP. The WWTP has been designed and is operating in a manner that achieves effective wastewater treatment, and minimises the adverse environmental effects of wastewater management. The proposed activity is consistent with this policy.
Policy INF.3 – Infrastructure protection *Protect regionally significant, nationally significant and critical infrastructure, particularly from new incompatible land uses and activities under, over or adjacent to the infrastructure.*	Extending the designation will help to protect the WWTP operation from incompatible land uses, and authorising the discharge of treated wastewater will safeguard the ongoing operation of the WWTP as critical infrastructure, and is consistent with this policy.

Southland Regional Water Plan 2010

Table 4. RWP: Policy Framework Assessment

Provision	Assessment
Water Quality Objectives	
Objective 2 – Maintain water quality *To manage water quality so that there is no reduction in the quality of the water in any surface water body, beyond the zone of reasonable mixing for discharges, below that of the date this Plan became operative (January 2010).*	The proposed activity will achieve the intent of this Objective, as the quality of the Tokanui River will not be measurably reduced after reasonable mixing as a result of the discharge from the Tokanui WWTP, particularly during periods when there is no surface water discharge.
Objective 3 – Surface water bodies other than in Natural State Waters *To maintain and enhance the quality of surface water bodies so that the following values are protected where water quality is already suitable for them, and where water quality is currently not suitable, measurable progress is achieved towards making it suitable for them.* *In surface water bodies classified as mountain, hill, lake-fed, spring-fed, lowland (hard bed), lowland (soft bed) and Mataura 1, Mataura 2 and Mataura 3:* *(a) bathing, in those sites where bathing is popular;* *(b) trout where present, otherwise native fish;* *(c) stock drinking water;* *(d) Ngāi Tahu cultural values, including mahinga kai;* *(e) natural character including aesthetics.*	The quality of the Tokanui River as the receiving water body will not be measurably reduced as a result of the discharge, after reasonable mixing. Noting that the adverse effects of the current direct discharges are minimal (less than minor): i. There are no high value bathing sites for the Tokanui River identified in Appendix K of the RWP in the vicinity of the WWTP. ii. Native fish have been identified in the vicinity of the WWTP. The effect of the discharge on the water quality of the Tokanui River (and on the habitat of aquatic species) is minimal (less than minor). iii. The discharge has a negligible additional adverse effect on the suitability of the Tokanui River for stock drinking water when considering the quality of the river upstream of the discharge, and periods where there is no discharge to the river will further reduce any effect. Even if the upstream water quality met the appropriate plan standards, it is unlikely that the WWTP discharge to the river would reduce water quality such that it would fall below the relevant standards, given the low volume of the discharge, the available dilution, and the quality of the treated wastewater. iv. Ngāi Tahu cultural values are adversely affected by the direct discharge of human sewage to the Tokanui River, albeit following contact with land within the infiltration trench. The CIA identifies that the direct discharge adversely affects the cultural suitability of mahinga kai. v. Any adverse effects on natural character values including aesthetic values will be less than minor. The proposed activity will generally achieve this objective, insofar as the portion of wastewater discharged to land will avoid directly discharging to the Tokanui River, and therefore any

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	potential effects on surface water quality. It will not achieve this objective in respect of the effects on Ngāi Tahu cultural values.
Objective 4 – Gradual improvement in surface water quality parameters *To manage the discharge of contaminants and encourage best environmental practice to improve the water quality in surface water bodies classified as hill, lowland (hard bed), lowland (soft bed) and spring fed, and in particular to achieve a minimum of 10 percent improvement in levels of the following water quality parameters over 10 years from the date this Plan became operative (January 2010):* *(a) microbiological contaminants* *(b) nitrate* *(c) phosphorus* *(d) clarity*	The installation of the proposed infiltration trench to receive the treated wastewater as seasonal conditions allow will help reduce the scale and frequency of discharges to the river, and therefore reduce any effects on water quality. Discharging to land (via the base of the ponds, with minor volumes via the trench) is consistent with current best environmental practice, and Ngāi Tahu cultural values. Despite the minimal existing (less than minor) effects on water quality in the Tokanui River from the current WWTP discharge, further reducing the scale and frequency of discharges to surface water will contribute to an overall reduction of cumulative effects on the river as a whole. Reducing surface water discharges therefore will contribute to achieving this objective.
Groundwater Objectives	
Objective 8 – Drinking Water Standard *(a) To maintain groundwater quality in aquifers that already meet the Drinking-Water Standards for New Zealand 2000; and* *(b) To enhance groundwater quality in aquifers degraded by land use and discharge activities (with the exception of those aquifers where ambient water quality is naturally less than the Drinking-Water Standards for New Zealand 2000) to ensure general compliance with the Drinking-Water Standards for New Zealand 2000 by the year 2010.*	The achievement of the NZDWS 2000 in a natural groundwater environment is not generally feasible, as the standards are intended to be applied within the controlled environment of a water treatment plant. Furthermore, as the objective seeks to achieve such improvements by 2010, the proposed activity cannot achieve this objective. However, the treated wastewater discharge is of a quality and volume such that the effects on groundwater quality as a result of discharges to land will be less than minor after reasonable mixing, and therefore the proposal will not measurably reduce the overall quality of underlying aquifers.
Land and Soil Objectives	
Objective 9A – Maintain soil quality	The effects of discharging treated wastewater to land on soil quality and structure will be less than minor given the quality of the discharge, and the relatively small volume. The proposed

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To manage discharges onto or into land so that the quality and structure of soil resources are maintained	activity will not therefore result in a significant adverse effect on soil quality and will therefore achieve this objective.
Objective 9B – Human health *To manage discharges onto or into land so that adverse effects on human health are avoided.*	Adverse effects on human health resulting from discharging treated wastewater to land will be avoided given the quality of the discharge, the location of the discharge (via the bed of the ponds, and to a limited extent the infiltration trench), and restricted public access to the site. The proposed activity will therefore achieve this objective.
Objective 9C – Habitats and ecosystems and other values *To manage discharges onto or into land so that any adverse effects on:* *(a) the diversity and integrity of habitats and ecosystems; and* *(b) amenity and historic heritage values are avoided, remedied or mitigated to ensure that these values are maintained or enhanced.*	The WWTP site is dominated by exotic pasture, and does not contain any significant habitats or ecosystems. Similarly, there are no such habitats in the vicinity of the site. The site does not contain any known heritage values, and the discharge will not result in adverse effects on amenity values, as the site and surrounding area will retain a predominantly rural productive aesthetic. Accordingly, the discharge to land will achieve this objective.
River Bed and Lake Bed Use and Development Objectives	
Objective 10 – Habitats and ecosystems *To maintain or enhance the diversity and integrity of aquatic and riverine habitats and ecosystems.*	The discharge will not adversely affect existing habitats or ecosystems to a significant degree beyond the existing quality (i.e. it is maintained). Reducing the frequency of direct discharges to the Tokanui River may help to reduce adverse effects (which are minimal) on aquatic and riverine habitats and ecosystems. The proposed activity will meet this objective.
Objective 12 – Public access *To maintain and enhance public access to river beds (including beds of streams and modified watercourses) and lake beds except in circumstances where public health and safety are at risk.*	Public access to the Tokanui River will be maintained as at present. Given the location of the infiltration trench adjacent to the river bank, and the public health and safety risks associated with a WWTP, the site is not currently open to the public, and this will not change as a result of this process. The proposed activity will meet this objective.

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Objective 13 – Natural character and outstanding natural features *To protect natural character and outstanding natural features of rivers and lakes from inappropriate use and development.*	The Tokanui River is not noted as having outstanding natural features. The natural character[1] of the river is not currently adversely affected by the discharge to a measurable extent. The proposed activity will achieve this objective.
Policies	
Policy 1A – Take into account Iwi Management Plans *Any assessment of an activity covered by this plan must take into account any relevant Iwi Management Plan.*	The assessment of effects contained in the application, and this policy assessment takes into account the provisions of *Te Tangi A Tauira* as the iwi management plan relevant to this application, and is consistent with this policy.
Policy A4 of the National Policy Statement for Freshwater Management 2014	(Refer to the assessment made for Policy A4 in the NPS-FM in Table B-0-1)
Policy 3 – No reduction in water quality *Notwithstanding any other policy or objective in this plan, allow no discharges to surface water bodies that will result in a reduction of water quality beyond the zone of reasonable mixing, unless it is consistent with the promotion of the sustainable management of natural and physical resources, as set out in Part 2 of the Resource Management Act 1991, to do so.*	The current discharge to surface water does not result in a measurable reduction of water quality after reasonable mixing, hence the proposed activity is consistent with this policy. Furthermore, the frequency and scale of discharges to surface water are expected to reduce to some degree as a result of the proposed infiltration trench. Furthermore, the discharge is consistent with the promotion of sustainable management as set out in the RMA, as (broadly) the WWTP allows the community to provide for their health and safety, as well as their social economic and (partly) cultural wellbeing, while sustaining the life-supporting capacity of the land and water receiving environments, and largely avoiding or mitigating adverse effects. The proposal is consistent with this policy.
Policy 4 – Surface water bodies outside Natural State Waters *For surface water bodies outside Natural State Waters, manage point source and non-point source discharges to meet or exceed the water quality standards referred to in Rule 1 and specified in Appendix G "Water Quality Standards", unless it is consistent with the promotion of the sustainable management of natural and physical resources, as*	The discharge to the Tokanui River (surface water) meets the water quality standards set out in Appendix G after reasonable mixing, in all respects other than for Dissolved Oxygen. Other than for DO therefore, the discharge in isolation does not currently result in contamination sufficient to harm human or animal health, or aquatic life. The failure of the Tokanui River to meet the Appendix G water quality standards therefore cannot be solely attributed to the discharge from the WWTP. Discharging treated wastewater to land will reduce the frequency and volume of direct discharges to the Tokanui River. This is expected to reduce the frequency and scale of

[1] Natural Character consists of: *natural processes, natural elements, natural patterns, and the human experiences of them.*

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set out in Part 2 of the Resource Management Act 1991, to do so and so avoid levels of contaminants in water and sediments that could harm the health of humans, domestic animals including stock and/or aquatic life.	adverse effects on water quality, acknowledging that the effects of the discharges are already less than minor after reasonable mixing. Given the minimal adverse effects of the current discharge on water quality, any improvements are likely to be small, however they will contribute to a cumulative improvement in water quality in the river toward the water quality standards in Appendix G, and in regard to DO. As the discharge does not meet DO standards in Appendix G, the proposed activity is not consistent with this policy, however it is not contrary to it given the limited influence that the discharge has on the overall quality of the Tokanui River, and the anticipated improvement resulting from the land-based discharge. Furthermore, the discharge is consistent with Part 2 of the RMA (as discussed above).
Policy 7 – Prefer discharges to land *Prefer discharges to land over discharges to water where this is practicable and the effects are less adverse.*	The WWTP discharges to land via the base of the ponds, and there will be additional (minimal) discharge to land from the infiltration trench. The effects of the discharge to land are less than would be expected for direct discharges to the Tokanui River (in all flow conditions). Direct discharges to the Tokanui River will still occur, but are expected to be smaller and less frequent given the addition of the infiltration trench. The proposed activity is consistent with this policy.
Policy 8 – Discharges to water *Prefer point source discharges of contaminants to water at times of high flow over discharges at normal or low flows, and ensure that where discharging does take place at low flows, the effects that could not be practically avoided are minimised.*	Direct discharges to the Tokanui River are not expected to occur when the river is in a low flow condition. During some winter / high rainfall conditions, the effluent is expected to mix with groundwater and stormwater in the trench before discharging to the Tokanui River, which will also be in a high flow state. Under such circumstances, discharging to the river cannot be practically avoided, but any adverse effects will be minimal. The proposed activity is therefore consistent with this Policy.
Policy 9 – Zone of reasonable mixing *When determining the size of the zone of reasonable mixing, minimise the size of the area where the relevant water quality standards are breached. Consideration should be given to, but not be limited to, the following matters:* *(a) the aquatic ecosystem values in the affected reach;*	The current direct discharges to the Tokanui River result in adverse effects on receiving water quality that are minimal (less than minor) after reasonable mixing, including in respect of the adverse effects on the aquatic ecosystems. The discharges do not affect fish passage, or the use of the river adjacent to or downstream of the discharge for any known authorised uses. Furthermore, the scale and frequency of any direct discharges will be minimal, with larger discharges typically occurring when the river is in a high flow state. There are no known users of the waterbody within the mixing zone. The proposed mixing zone is consistent with this policy.

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(b) the need for fish passage; *(c) the uses of the water body adjacent to and downstream of the point of discharge*	
Policy 10 - Use of diffusers *Promote where appropriate, the use of diffusers for point source discharges into water.*	The direct discharge to the Tokanui River will be via the existing outfall to minimise the potential effects of the discharge on bank stability, and taking into account the small volume of the discharge. Taking that into account, and considering the minimal effects of the discharge, the use of a diffuser is not necessary. The proposal however is not consistent with this policy.
Policy 25 - Adverse effects arising from point source and non-point source discharges *To avoid, remedy or mitigate the adverse effects arising from point source and non-point source discharges so that there is no deterioration in groundwater quality after reasonable mixing, unless it is consistent with the promotion of the sustainable management of natural and physical resources, as set out in Part 2 of the Resource Management Act 1991, to do so.*	The proposed activity involves discharging treated wastewater to land and water. Given the characteristics of the underlying soil, and the assumed dilution in the groundwater mixing zone, adverse effects on the quality of groundwater will be avoided or mitigated such that they will be minimal (less than minor) after reasonable mixing. There are no other groundwater users in the vicinity who would be adversely affected by the proposed activity. The discharge is consistent with the promotion of sustainable management as set out in Part 2 of the RMA, and is consistent with this policy.
Policy 31A – Matching discharges onto or into land to risk *Match the level of management that is required for discharges of contaminants onto or into land to the level of environmental risk posed by the following risk factors:* *(a) Nature and quantity of contaminants in the discharge* *(b) Sloping land* *(c) Soils with artificial drainage or coarse structures* *(d) Soils with impeded drainage or low infiltration rates* *(e) Well drained soils* *(f) Climate* *(g) Proximity to groundwater* *(h) Proximity to surface water*	The discharge is only of treated wastewater, and is of low volume well suited to the assimilative capacity of the receiving environment. The treated wastewater will be discharged to soils with drainage capacity in relation to the volume of the discharge. The climate is suited to land-based discharges for most of the year, with some periods of winter rainfall likely to result in saturated soils (hence the provision for direct surface water discharges). The site of the WWTP is not exposed to high natural hazard (flood) risk. No issues have been noted as a result of the current discharge to land from the pond base. The level of risk posed by the discharge of treated wastewater to land is low. The quality of the discharge and the effects on the receiving environment will be monitored to ensure that any risk to the receiving environments (land, groundwater and surface water) is appropriately managed to avoid or mitigate adverse effects. There will be no increase in the effects of the existing activity in respect of the effects of the discharges on amenity values or natural character given that the existing effects are already minimal. Any adverse effects on soil quality will be minimal, and will be limited in scale and extent. The adverse effects on

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(i) Soil's current physical, chemical and biological characteristics and its potential to leach nutrients *(j) Natural hazards (for example, flooding and erosion)*	habitats, ecosystems, biological diversity are currently minimal, and the effects on cultural values are likely to be reduced as a result of the construction of the infiltration trench. The proposed activity is consistent with the policies 31A and 31C.
Policy 31C - Manage discharges of contaminants onto or into land *Manage discharges of contaminants onto or into land to avoid, remedy or mitigate adverse effects, including on:* *(a) soil quality;* *(b) amenity values;* *(c) habitats, ecosystems and indigenous biological diversity;* *(d) historic heritage, cultural and traditional values;* *(e) natural character;* *(f) outstanding natural features.*	

Proposed Southland Water and Land Plan

Table 5. pSWLP: Policy Framework Assessment

Provision	Assessment
Region-wide Objectives	
Objective 1: Land and water and associated ecosystems are managed as integrated natural resources, recognising the connectivity between surface water and groundwater, and between freshwater, land and the coast	The discharge of treated wastewater to land will help to realise the benefits of land-based discharges in reducing surface water discharges, while being cognisant of the connectivity between the underlying groundwater and the Tokanui River given its proximity to the proposed infiltration trench. The success of the WWTP as a means of treating Tokanui's wastewater relies on the interaction between the land (unsaturated soil), the underlying groundwater and the Tokanui River, and the discharge has been designed to minimise the potential adverse effects on the receiving environments. The proposed activity will achieve this objective.
Objective 3 The mauri (inherent health) of waterbodies provide for te hauora o te tangata (health of the people), te hauora o te taiao (health of the environment) and te hauora o te wai (health of the waterbody).	Discharging a component of wastewater to land better recognises tangata whenua values and interests, and will help achieve these objectives by minimising discharges to surface water. The CIA recognises that the discharge will adversely affect Maori cultural and spiritual values, and cultural health and suitability of the Tokanui River, while recognising that there will be an improvement from the current discharge.
Objective 4 Tāngata whenua values and interests are identified and reflected in the management of freshwater and associated ecosystems.	
Objective 6 There is no reduction in the quality of freshwater, and water in estuaries and coastal lagoons, by: (a) maintaining the quality of water in waterbodies, estuaries and coastal lagoons, where the water quality is not degraded; and (b) improving the quality of water in waterbodies, estuaries and coastal lagoons, that have been degraded by human activities.	Objective 6(b) applies in this instance. While the activity cannot be considered as part of the existing environment, the effects of that activity are, and form the starting point. Discharging treated wastewater to land will go some way to reducing any existing adverse effects on the water quality of the Tokanui River, while acknowledging that the actual adverse effects are minimal (less than minor). Any reduction in the scale or frequency of the discharge to the Tokanui River will contribute to the improvement of surface water quality, and hence the proposed activity will achieve this objective.

Provision	Assessment
Objective 13 Enable the use and development of land and soils, provided: (a) the quantity, quality and structure of soil resources are not irreversibly degraded through land use activities and discharges to land; (b) the discharge of contaminants to land or water that have significant or cumulative effects on human health are avoided; and (c) adverse effects on ecosystems (including diversity and integrity of habitats), amenity values, cultural values and historic heritage values are avoided, remedied or mitigated to ensure these values are maintained or enhanced.	The discharge of treated wastewater to land will be concentrated through the pond bases and to a minor degree the infiltration trench. The design of the ponds and trench, the quality of the wastewater, and the low volume will avoid irreversible adverse effects on soil quality, significant adverse cumulative effects on human health, and will avoid adverse effects on ecosystems, amenity values and the diversity and integrity of habitats. The discharges to the Tokanui River will result in adverse effects on cultural values, however the scale and frequency of such discharges will be minimised. Overall, this objective is achieved by this proposal.
Objective 14 The range and diversity of indigenous ecosystem types and habitats within dryland environments, rivers, estuaries, wetlands and lakes, including their margins, and their life-supporting capacity are maintained or enhanced.	Although the current discharges have little adverse effect on the range and diversity of ecosystem types and habitats in the Tokanui River given the quality, volume and infrequency of discharges to the river, and the available dilution, much of the wastewater being discharged to land via the pond bases and infiltration trench will help to the enhance ability of the river to support life, and will help to achieve this objective. The discharge will not further reduce the life supporting capacity of the river.
Objective 16 Public access to river and lake beds is maintained, except in circumstances where public health and safety are at risk.	Public access to the Tokanui River will be maintained as at present. The WWTP and infiltration trench will not be open to the public for public health and safety reasons, however this is currently the case and will not change as a result of this proposal. The proposed activity will meet this objective.
Objective 17 The natural character values of wetlands, rivers and lakes including channel form, bed rapids, seasonably variable flows and natural habitats, are protected from inappropriate use and development.	The scale and quality of the discharge, and the disposal of much of it to land helps to avoid potential adverse effects on the Tokanui River's natural character such that any adverse effects on the river's natural character are, and will continue to be minimal (less than minor). The proposed activity will meet this objective.

Provision	Assessment
Objective 18 All activities operate at "good (environmental) management practice" or better to optimise efficient resource use and protect the region's land, soils, and water from quality and quantity degradation.	The quality of the treated wastewater effluent demonstrates that the WWTP is being operated in a manner that reflects good environmental practice. The proposal will not undermine the integrity or quality of the soil, and the ground and surface water resources used in managing Tokanui's wastewater will not be compromised as a result of the activity. The land and water resources required for the activity have been, and will continue to be used efficiently. The activity will meet this objective.
Region-wide Policies - **Ngai Tahu Policies**	
Policy 2 – Take into account iwi management plans Any assessment of an activity covered by this plan must: 1. take into account any relevant iwi management plan; and 2. assess water quality and quantity based on Ngāi Tahu indicators of health.	The assessment of effects contained in this application, and this policy assessment takes into account the provisions of *Te Tangi a Tauira* as the iwi management plan relevant to this application. The proposed activity is consistent with Policy 2(1). The CIA has identified the cultural impacts of the proposal, and notes effects on mahinga kai as a particular issue.
Policy 3 – Ngāi Tahu ki Murihiku taonga species To manage activities that adversely affect taonga species, identified in Appendix M.	The attached application document and effects assessment identifies that there are taonga species listed in Appendix M of the pSWLP present in the Tokanui River. The potential for adverse effects on these species, including cultural health will be substantially reduced by managing the treated wastewater to predominantly discharge to land, and reducing any surface water discharges only to times when the Tokanui River is in high flow, although the CIA notes that adverse effects will still occur, particularly when land discharge is reduced due to high groundwater levels. The CIA has provided a series of recommendations, which are the subject of ongoing discussions between the Council and Te Ao Marama Inc.
- **Water Quality Policies**	
Policy A4	(Refer to the assessment made for Policy A4 in the NPS-FM)
Policy 13 – Management of land use activities and discharges *Manage land use activities and discharges (point source and non-point source) to land and water so that water quality and the health of humans, domestic animals and aquatic life, is protected.*	The WWTP is operated in a manner that effectively treats wastewater to a high standard, and the discharges to land and the Tokanui River consequently result in minimal adverse effects on water quality and aquatic life. Similarly, any effects on the health of humans and domestic animals is also minimal, and limited in scale and extent. The proposal is consistent with this policy.

Provision	Assessment
Policy 14 – Preference for discharges to land *Prefer discharges to land, rather than direct discharges to water.*	The treated wastewater will be predominantly discharged to land via the proposed infiltration trench as a preference, with discharges to the Tokanui River only occurring when capacity of the infiltration trench is exceeded (such as during prolonged wet weather) and the river is in a high flow state. The proposed activity is consistent with this policy.
Policy 15 – Maintaining and improving water quality *Maintain and improve water quality by:* *1. despite any other policy or objective in this Plan, avoiding new discharges to surface waterbodies that will reduce water quality beyond the zone of reasonable mixing;* *2. avoiding point source and non-point source discharges to land that will reduce surface or groundwater quality, unless the adverse effects of the discharge can be avoided, remedied or mitigated;* *3 avoiding land use activities that will reduce surface or groundwater quality, unless the adverse effects can be avoided, remedied or mitigated; and* *4. avoiding discharges to artificial watercourses that will reduce water quality in a river, lake or modified watercourse beyond the zone of reasonable mixing; so that:* *1. water quality is maintained where it is better than the water quality standards specified in Appendix E "Water Quality Standards"; or* *2. water quality is improved where it does not meet the water quality standards specified in Appendix E "Water Quality Standards"; and* *3. water quality meets the Drinking-Water Standards for New Zealand 2005 (revised 2008); and* *4. ANZECC sediment guidelines (as shown in Appendix C of this Plan) are met.*	The WWTP is currently authorised under 201599 to discharge treated wastewater to land and to water, and consent is not sought to authorise a new discharge. The proposed activity is expected to result in an improvement to the water quality, albeit a minor improvement given that the current discharge results in minimal (less than minor) adverse effects on water quality. The discharge on its own will not result in a significant adverse effect on whether groundwater beneath the site achieves drinking water standards, or discharges to the river are consistent with the ANZECC sediment guidelines. The proposal is consistent with Policy 15(4)(2) and (4). It is unlikely that groundwater beneath the ponds will meet DWSNZ 2005, even if the discharges were not already occurring, given the requirements of the standard, and the existing background groundwater quality. The proposal is not consistent with all of this policy.

Provision	Assessment
Policy 17 – Effluent management *1. Avoid adverse effects on water quality, and avoid as far as practicable other adverse environmental effects of the operation of, and discharges from effluent management systems.* *2. Manage effluent systems and discharges from them by:* *(a) designing, constructing and locating systems appropriately and in accordance with standards;* *(b) maintaining and operating effluent systems in accordance with best practice guidelines;* *(c) ...;* *(d) avoiding the discharge of raw sewage and untreated agricultural effluent to water.*	The definition of 'effluent' in the pSWLP includes *"A liquid that may include solid components discharged as a waste that originates from: (b) community sewage schemes; ..."*. The proposed activity will not completely avoid adverse effects on water quality (including ground and surface water quality) after reasonable mixing, however any discharge of any quality is likely to result in some degree of adverse effect such that it would fail to be consistent with this policy. However, on the basis of the existing monitoring results, any adverse effects will be minimal (less than minor). Similarly, 'other' adverse environmental effects resulting from the operation of, or discharges from the WWTP will also be minimal (less than minor). The design, construction and location of the WWTP and the quality and volume of the discharges will not change as a result of this proposal, other than in respect of any improvements resulting from the proposed infiltration trench. The WWTP is currently actively maintained and operated, and is treating wastewater to a high standard consistent with such systems. There will be no discharge of raw sewage to water, with only treated wastewater discharged from the WWTP. The proposed activity is consistent with this policy.
Policy 37 – Climate Change *Avoid or mitigate adverse effects on the environment arising from climate change by recognising and providing for the development and protection of the built environment and infrastructure in a manner that takes into account the potential effects of rising sea levels and the potential for more variable and extreme weather patterns in coming decades.*	The WWTP and proposed infiltration trench are not subject to undue risk from natural hazards associated with the anticipated effects of climate change. The operation of the proposed infiltration trench relies on the availability of an unsaturated zone beneath the trench, with direct discharge to the Tokanui River resulting where groundwater levels rise following prolonged rainfall. Wastewater that cannot infiltrate to ground will discharge to the Tokanui River, which is expected to be in a high flow statein such circumstances. While climate change may result in more frequent or intense rainfall events which may result in more frequent occurrences of high groundwater and consequential surface water discharges, the effects of surface water discharges will be less than minor. The proposal is consistent with this policy.
- **Consideration of Resource Consent Applications**	
Policy 40 – Determining the term of resource consents *When determining the term of a resource consent consideration will be given, but not limited, to:* *1. granting a shorter duration when there is uncertainty regarding the nature, scale, duration*	The nature, scale, duration and frequency of the effects of the activity are well understood as the WWTP has been operational for some time, aside from the addition of the proposed infiltration trench. The effects that the discharge to surface water will have on tangata whenua values is acknowledged, and has been addressed to the extent practicable by providing for land contact through the infiltration trench.

Provision	Assessment
and frequency of adverse effects from the activity or the capacity of the resource; *2. relevant tangata whenua values and Ngāi Tahu indicators of health;* *3. the duration sought by the applicant, plus material to support the duration sought;* *4. the permanence and economic life of any capital investment;* *5. the desirability of applying a common expiry date for water permits that allocate water from the same resource or land use and discharges that may affect the quality of the same resource;* *6. the applicant's compliance with the conditions of any previous resource consent; and* *7. the timing of development of FMU sections of this Plan, and whether granting a shorter or longer duration will better enable implementation of the any revised frameworks established in those sections.*	The applicant seeks a 25 year term for this discharge permit taking into account the limited scale and extent of any adverse effects, and the need to focus investment in wastewater network improvements in areas where the effects are greater, and the need more urgent. The WWTP is permanent part of the wastewater infrastructure. The cost of relocating it or providing an alternative would be prohibitively high, and disproportionate to the benefits, given the minimal adverse effects currently resulting from the discharges. Ongoing maintenance and investment from the applicant will ensure that the WWTP continues to be a viable and cost effective asset to the community. There are no known water permits with expiry dates that would be appropriate to apply to this application. The applicant has demonstrated a consistent trustworthy compliance history. Section 128(1)(b) of the RMA allows regional councils to review the conditions of resource consents following rules relating to maximum and minimum water quality standards becoming operative, without any effects triggers being required. A consent term therefore does not need to take into account the development of FMU limits as any necessary changes to consent conditions can be made to ensure any future framework can be appropriately implemented. The proposed activity is consistent with this policy.

Te Tangi a Tauira

Table 6. Te Tangi a Tauira Policy Framework Assessment

Provision	Assessment
Wastewater Disposal	
Policy 3.5.2.6: Avoid the use of water as a receiving environment *for the direct, or point source, discharge of contaminants. Even if the discharge is treated and therefore considered "clean", it may still be culturally unacceptable. Generally, all discharge must first be to land.*	The proposal is not consistent with this policy in respect of the discharge of wastewater to water (ground and surface water). The component of the wastewater to be discharged to land however is consistent. While the discharges to water are at odds with the direction in the policy to avoid direct or point source discharges to water, the policy also notes that 'generally' discharges should be to land first. The policy therefore contemplates circumstances where surface water discharges may be appropriate / acceptable. The proposal is not contrary to this policy.

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Policy 3.5.2.8: *Wastewater disposal options that propose the direct discharge of treated or untreated effluent to water need to be assessed by the kaitiaki rūnanga on a case by case, individual waterway, basis. The appropriateness of any proposal will depend on the nature of the proposal, and what waterway is involved. Individual waterways possess their individual mauri and values, and kaitiaki rūnanga are in the best position to assess the potential impacts of a proposal on such values.*	The applicant has engaged with tangata whenua through Te Ao Marama Inc. (TAMI) and has requested that TAMI completes a Cultural Impact Assessment (CIA) in order to draw on the knowledge of the kaitiaki runanga in determining the acceptability or otherwise of the proposed activity. In this sense, the application has been prepared in a manner consistent with this policy.
Policy 3.5.2.10: *Require that the highest environmental standards are applied to consent applications involving the discharge of contaminants to land or water (e.g. standards of treatment of sewage).*	Monitoring demonstrates that the treatment of wastewater in the WWTP results in good quality effluent for this type of system. Further treatment occurs in the receiving environment, including unsaturated soils, and through dilution and dispersion in water bodies. Given that the adverse effects of the treated wastewater discharge on the biophysical environment are minimal (less than minor), the level of treatment provided by the WWTP is considered to be proportionate to the effects, and therefore meets a high environmental standard. The proposal is inconsistent with this policy only in the sense that the highest possible quality of wastewater treatment is not provided by the WWTP, however the cost of doing so would be significantly disproportionate to the scale and nature of the effects of the current discharges, and would be unlikely to resolve the cultural offence of discharging contaminants to water.
Policy 3.5.2.11: *Require soil risk assessments (type and percolation of the soils) prior to consent for discharge to land, to assess the suitability and capability of the receiving environment. Wastewater loading rates (mm/day) must reflect effluent quality and soil properties.*	The suitability and capability of the receiving soils, and their capacity to assimilate discharges from the WWTP have been assessed as part of this application. Working in the WWTP's favour is the low volume of wastewater inflows, and a correspondingly small discharge volume. The design of the infiltration trench will take into account the ability of the underlying soils to receive part of the discharge. The proposed activity is consistent with this policy.
Policy 3.5.2.15: *Any discharge activity must include a robust monitoring programme that includes regular monitoring of the discharge and the potential effects on the receiving environment. Monitoring can confirm system performance, and identify and remedy any system failures.*	The applicant proposes a robust suite of monitoring conditions to ensure that the effectiveness of the WWTP, the quality of the discharge and any associated effects on the environment are accurately identified and managed. The proposed activity is consistent with this policy.

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Policy 3.5.2.17: *Duration of consent for wastewater disposal must recognise and provide for the future growth and development of the industry or community, and the ability of the existing operations to accommodate such growth or development.*	The WWTP has existing capacity to accommodate the growth projections for the Tokanui township which forms the WWTP catchment, for the 25 year term sought. The proposed activity is consistent with this policy.
Policy 3.5.2.18: *Recommend a duration not exceeding 25 years, for discharge consents relating to wastewater disposal, with an assumption that upon expiry (if not before), the quality of the system will be improved as technological improvements become available. In some instances, a lesser term may be appropriate, with a condition requiring the system is upgraded within a specified time period.*	Given the effectiveness of the existing WWTP in treating wastewater, the expectation that inflows will not significantly increase over the term of the consent, and the minimal adverse effects of the discharges on the biophysical receiving environment, the 25 year term is appropriate. The applicant will, as a matter of course maintain the performance of the WWTP throughout its operational life. The proposed activity is consistent with this policy.
Earthworks	
Policy 3.5.8.9: *Any earthworks or roadworks near rivers must have appropriate measures in place to avoid contaminants (including dust, sediment run-off from stockpiles or any hazardous substance) from entering waterways that may cause contamination, discolouration, or siltation in such waterways.*	The construction of the infiltration trench will require the disturbance of land and vegetation in proximity to the riverbank. All such soil disturbance activities will be preceded by appropriate erosion and sediment control measures as necessary to safeguard the water quality in the river, and such measures will not be removed until disturbed areas are stabilised. The proposed activity is consistent with this policy.
General Water Policies	
Policy 3.5.10.3: *Protect and enhance the mauri, or life supporting capacity, of freshwater resources throughout Murihiku.*	With the treated wastewater being discharged to land under favourable seasonal conditions, the mauri, life supporting capacity and customary relationship of Ngai Tahu with the Tokanui River will be better protected than at present, and will be enhanced to the extent that the current surface water discharge impacts those values. However, as the proposed activity includes some discharges to water which to the CIA notes will result in some degree of adverse effect on mauri and the relationship of Ngai Tahu ki Murihiku with water, the proposal is not entirely consistent with these policies.
Policy 3.5.10.8: *Protect and enhance the customary relationship of Ngāi Tahu ki Murihiku with freshwater resources.*	

Provision	Assessment
Rivers	
Policy 3.5.11.15: *Avoid the use of rivers as a receiving environment for the discharge of contaminants (e.g. industrial, residential, recreational or agricultural sources).*	The proposal is contrary to this policy in respect of the surface water discharge to the Tokanui River, noting that there is a degree of land disposal proposed, and that the surface water will have had land contact prior to discharging to the river.
Discharge to Water	
Policy 3.5.12.1: *Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Even if the discharge is treated and therefore considered "clean", it may still be culturally unacceptable. Generally, all discharge must first be to land. This general policy is a baseline or starting point. From this point, the Rūnanga can assess applications on a case by case basis.*	The preference in this proposal is to discharge treated wastewater to land, with discharges likely to occur intermittently to water only where the capacity of the infiltration trench to receive water is exceeded due to high inflows / high groundwater levels following rainfall. Several alternatives have been considered to the intermittent surface water discharge but have not been deemed practicable. The proposal is not inconsistent with this policy as, despite appearing to be at odds with the direction to avoid surface water discharges, the policy forms a starting point for the consideration by runanga of the appropriateness of such discharges on a case by case basis. The policy therefore contemplates that in some circumstances, such discharges may not be inappropriate.
Policy 3.5.12.4: *When existing rights to discharge to water come up for renewal, they must be considered in terms of alternative discharge options.*	The applicant seeks to replace an existing discharge permit however also proposes to upgrade the discharge of treated wastewater to primarily discharge to land. Alternative methods and locations for receiving treated wastewater have been investigated, with the current option identified as the most practicable, while achieving a high standard of treatment that is cost effective and affordable for the Tokanui community. The proposed activity is consistent with this policy.
Policy 3.5.12.7: *Any discharge activity must include a robust monitoring programme that includes regular monitoring of the discharge and the potential effects on the receiving environment.*	The applicant proposes a suite of monitoring conditions which will confirm the effectiveness of the WWTP treatment process, the quality of the resulting effluent, and the scale and nature of the environmental effects of the discharge. This proposed activity is consistent with this policy.
Water Quality	
Policy 3.5.13.2: *Strive for the highest possible standard of water quality that is characteristic of a particular place/waterway, recognising principles of achievability. This means that we strive for drinking water quality in water we once drank from, contact recreation in water we once used for bathing or swimming, water quality capable of sustaining*	The monitoring undertaken to date prior to land disposal indicates that the discharges have very little adverse effect on the receiving environment. While improving the standard of the discharge further by discharging to land will contribute to reducing the cumulative effect of discharges, the improvement in the overall quality of the Tokanui River will not on its own achieve water quality that supports drinking or recreation. Discharging treated wastewater to land as proposed will achieve the highest quality of treated wastewater that is practicable under the circumstances. Recognising the principles of achievability, the proposed activity is consistent with this policy.

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healthy mahinga kai in waters we use for providing kai.	
Policy 3.5.13.5: *Avoid the use of water as a receiving environment for the direct, or point source, discharge of contaminants. Generally, all discharge must first be to land.*	The proposal is not consistent with this policy in respect of the discharge of wastewater to water (ground and surface water). The component of the wastewater to be discharged to land however is consistent. While the discharges to water are at odds with the direction in the policy to avoid direct or point source discharges to water, the policy also notes that 'generally' discharges should be to land first. The policy therefore contemplates circumstances where surface water discharges may be appropriate / acceptable. The proposal is not contrary to this policy.
Policy 3.5.13.6: *Avoid impacts on water as a result of inappropriate discharge to land activities.*	The discharges to land are not considered to be inappropriate in respect of the scale and nature of resulting adverse effects on water (ground and surface), and the proposed activity is therefore consistent with this policy.
Policy 3.5.13.7: *When assessing the effects of an activity on water quality, where the water source is in a degraded state, the effects should be measured against the condition that the water source should be, and not the existing condition of the water source.*	The monitoring results indicate that the discharge to the Tokanui River results in less than minor adverse effects on water quality after reasonable mixing, taking into account the minimal difference in sample results between up and downstream sites. This indicates that the discharge would have a very limited adverse effect if the water quality of the river was in a state that was not affected by upstream human influences (i.e. was in a condition that it should be), and hence the proposal is consistent with this policy.
Mahinga kai and biodiversity	
Policy 3.5.16.2: *Work towards the restoration of key mahinga kai areas and species, and the tikanga associated with managing those places and species.*	There are mahinga kai species present in the Tokanui River. Disposing some treated wastewater to land will better provide for mahinga kai species, and for tikanga associated with the Tokanui River both in a biophysical and cultural sense by minimising direct discharges of treated wastewater to the river. In this sense, the proposal is contributing to the improvement of the Tokanui River as a habitat for mahinga kai species. The proposed activity is consistent with this policy.
Policy 3.5.16.4: *Consider the actual and potential effects of proposed activities on mahinga kai places, species and activities when assessing applications for resource consent.*	The actual effects on mahinga kai species present in the Tokanui River will be less than minor in a biophysical sense, however the cultural effects are acknowledged. Discharging treated wastewater to land will better provide for mahinga kai species both in a biophysical and cultural sense by minimising discharges to the river. Ensuring surface water discharges contact land within the infiltration trench will also help reduce the degree of cultural offence. This has been a consideration in designing the proposed upgrade and preparing this application, and the proposed activity is therefore consistent with this policy.

Provision	Assessment
Policy 3.5.17.12: *Make full use of the knowledge of tangata whenua with regards to indigenous biodiversity, and the value of such knowledge in understanding how to protect and enhance biodiversity.*	The applicant has engaged in discussions with tangata whenua via Te Ao Marama Inc., and has requested the preparation of a cultural impact assessment (CIA) in order to draw on the body of knowledge held by local runanga. The CIA will inform the consent process, and potentially the development of consent conditions if the application is granted. The proposed activity is therefore consistent with this policy.

Southland District Plan

(Included for completeness)

Table 7.: Southland District Plan Policy Framework Assessment

Provision	Assessment
Manawhenua Issues	
Objective MAO.5 - Wai (Water) *To recognise the significance of water to Kai Tahu traditions and culture and to provide for such traditions and culture.*	The potential for adverse effects from discharging wastewater to water on Kai Tahu traditions and culture have been acknowledged by the applicant, which proposes to upgrade the WWTP to discharge treated wastewater primarily to land primarily to address the potential effects of WWTP discharges on Kai Tahu traditions and culture. The WWTP site will continue to be managed in a way that primarily avoids runoff from the site to the river, including during earthworks associated with the construction of the infiltration trench. The proposed activity will help meet Objective MAO.5, and is consistent with Policy MAO.12.
Policy MAO.12 *To promote and encourage appropriate land management practices adjacent to water bodies in order to reduce and where possible avoid the runoff of contaminants into water.*	
Policy MAO.13 *To liaise with Southland Regional Council on water quality issues, particularly in regard to reducing human sewage discharges into waterways.*	The Southland District Council (as applicant) engaged with Environment Southland prior to the lodgement of the application. The applicant has chosen to pursue land-based discharge to reduce the discharge of treated wastewater to the Tokanui River. The proposed activity is consistent with this policy.
Amenity	
Objective AME.1 *To avoid or mitigate the adverse effects that activities have on the amenities of the District, and the quality of the environment particularly on neighbouring properties.*	The installation of the proposed infiltration trench will not be visible from any public off-site vantage point, and will have a limited effect on the visual amenity of the WWTP in comparison to the existing oxidation ponds. The proposed activity will achieve this objective.

Provision	Assessment
Policy AME.1 *To ensure that activities which give rise to odour, glare, electrical interference, smoke, fumes or dust, particularly on roads, do not adversely effect neighbouring properties.*	The proposal will not result in any increase in the discharge of odour to air, and is consistent with this policy.
Public Works and Network Utilities	
Objective PWN.1 *To provide for the efficient development, operation and maintenance of public works and network utilities throughout the District, while as far as practicable avoiding, remedying and mitigating potentially adverse environmental effects.*	The proposed activity will improve the effectiveness of the existing wastewater treatment process by utilising the additional treatment provided by the soils beneath the base of the infiltration trench, and will minimise the adverse effects of the discharge from the WWTP by discharging to land as a priority, and only discharging to water where capacity is exceeded. Consequently, the adverse effects of the activity are avoided or mitigated to the extent practicable, while providing an essential public service, thus achieving Objective PWN.1, and Policy PWN.1 and PWN.4.
Policy PWN.1 *To minimise or avoid the adverse effects of public works and utilities.*	
Policy PWN.4 *To provide for network utility operations and other essential public services which are necessary for the well-being of people and communities.*	

Proposed Southland District Plan

Table 8. Proposed Southland District Plan Policy Framework Assessment

Provision	Assessment
Tangata Whenua	
Objective TW.1 *To recognise the importance of and provide for, Māori culture and traditions with ancestral lands, sites, water, wāhi tapu and other taonga.*	The adverse effects of discharging wastewater to water on Māori culture and traditions have been acknowledged by the applicant, by proposing to primarily discharge treated wastewater to land. Altering the existing WWTP designation to include the infiltration trench will better provide for all surface water discharges to contact land prior to discharge, in acknowledgement of the importance of Māori culture and traditions. The proposed activity will meet this objective.
Policy TW.1 *To recognise and provide for tangata whenua to exercise kaitiakitanga in the management of and decision-making process regarding natural and physical resources, with particular regard to Iwi Management Plans.*	Particular regard has been given to the provisions of *Te Tangi a Tauira* in preparing this application, and the applicant also engaged with iwi through Te Ao Marama Inc. prior to the application being lodged. TAMI have been commissioned to produce a cultural impact assessment in respect of the proposal, and are actively contributing information to inform both the design of the proposal, and the decision of the consent authority. The proposed activity is consistent with this policy.
Biodiversity	
Objective BIO.1 *Indigenous vegetation and habitats of indigenous fauna are managed so that the overall life supporting capacity of ecosystems are safeguarded.* *(under appeal)*	There is no indigenous vegetation on the site, however the Tokanui River does provide habitat for indigenous species. The adverse effects of the WWTP and discharges of wastewater to land and water on indigenous fauna will be avoided during periods when there is no discharge to water, and otherwise mitigated. This is evidenced by the minimal (less than minor) adverse effects on water quality that the current discharges result in. The proposed activity will meet Objective BIO.1 as currently written, and is consistent with Policy BIO.3.
Policy BIO.3 *Avoid, remedy or mitigate the adverse effects of subdivision, land use and development on indigenous vegetation and habitats of indigenous fauna.*	
Contaminated Land	
Objective CONTAM.1 *Manage contaminated land or potentially contaminated land in order to prevent adverse effects on human health and mitigate other adverse effects on the environment.*	The disturbance of soil on the WWTP site to construct the infiltration trench will be minimised to the extent practicable. While WWTPs are included on the HAIL, the concentrations of contaminants in the soil to be disturbed on the site are likely to be no greater than background levels. Regardless, an accidental discovery protocol will be applied to the discovery or disturbance of any unanticipated contamination, and all persons working on the site will observe all necessary safety measures, including personal equipment, stockpile management

Provision	Assessment
Policy CONTAM.2 *Manage subdivision, land use and development of contaminated land or potentially contaminated land in a manner that prevents adverse effects on human health and mitigates adverse effects on the environment.*	and transportation of potentially contaminated material. The disturbance of soils in constructing the infiltration trench will be managed to minimise the risk to people and the environment. The land is appropriate for the proposed use. The proposed activity is consistent with this policy. The proposed activity will achieve Objective CONTAM.1 and is consistent with Policy CONTAM.2.
Policy CONTAM.3 *Where land is identified as contaminated or potentially contaminated it shall be demonstrated that the land is suitable for the intended subdivision, land use or development activity.*	The site is currently used for wastewater treatment and management purposes. The area of the proposed infiltration trench will be bought by the Council and the designation altered to incorporate it. The land is suitable for the proposed use. The proposed activity is consistent with this policy.
Infrastructure	
Objective INF.1 *To ensure that infrastructure meets the current and foreseeable needs of the District whilst ensuring that the adverse effects on the environment are avoided, remedied or mitigated.*	The WWTP has existing capacity to meet the foreseeable needs of the Tokanui township based on population growth expectations. The adverse environmental effects resulting from the WWTP activity and discharges are minimal (less than minor), being largely avoided or mitigated as discussed previously. Altering the existing designation boundary to provide for the infiltration trench recognises the importance of the WWTP as critical infrastructure. The proposed activity will therefore meet this objective.
Policy INF.1 *Recognise and provide for the development, operation, maintenance upgrading or relocation of infrastructure, particularly regionally significant infrastructure, whilst avoiding, remedying or mitigating the adverse effects of that infrastructure on the environment.*	The proposal involves upgrading the existing WWTP by providing an infiltration trench. The proposal is therefore consistent with this policy as it represents operation maintenance and a minor upgrade of the existing WWTP operation. The proposal will help to maintain an effective WWTP for the Tokanui community, which has been shown to largely avoid or mitigate adverse environmental effects. Designating the area of land needed for the infiltration trench as part of the WWTP will provide for the upgrade and ongoing protection of the WWTP as a community asset. The proposal is consistent with this policy.
Policy INF.2 *Recognise that infrastructure can have a functional, technical or operational requirement to be sited at a particular location.*	The WWTP relies on its location near the Tokanui River to enable wastewater to flow from Tokanui township under gravity for treatment in the oxidation ponds. It also relies on proximity to the Tokanui River for surface water disposal. These are functional, technical and operational constraints best provided for by designating the necessary land area within the District Plan, and the proposal is therefore consistent with this policy.
Rural zone	
Objective RURAL.1 *Subdivision, land use and development in the Rural Zone shall be undertaken in a manner that*	The development of the infiltration trench, and the use of further land for wastewater treatment and disposal will mean that the land is no longer available for productive purposes, however its long term life-supporting capacity and productive value remains, should the WWTP be decommissioned in the future. In that sense, the activity will not render the use of the land

Provision	Assessment
maintains the life supporting capacity and productive value of the land resource.	permanently unavailable for production, and the proposed activity will not prevent this objective from being achieved.
Policy RURAL.1 *Recognise the benefits of subdivision, land use and development in providing for growth and development of the District, whilst avoiding, remedying or mitigating adverse effects on the environment.*	The WWTP provides for the ongoing wellbeing of the Tokanui community, including community health and safety, economic wellbeing and any future economic and / or social growth. The use of land for the WWTP and for the proposed infiltration trench provides for the WWTP as a critical infrastructure asset, and avoids or mitigates many of the adverse effects that can be associated with such infrastructure. The proposed activity is consistent with this policy.
Policy RURAL.8 *Avoid, remedy or mitigate the adverse effects of earthworks.*	The potential for adverse effects resulting from the construction of the infiltration trench will be managed by minimising the area of disturbance, preceding all works with appropriate erosion and sediment control measures, appropriately managing any stockpiling that may occur, and stabilising disturbed areas as soon as practicable. The proposed activity will be consistent with this policy.

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