

**Trustpower Ltd**  
**Mangorei Hydroelectric Power Scheme**  
Monitoring Programme  
Annual Report  
2020-2021

Technical Report 2021-55



Working with people | caring for Taranaki



Taranaki Regional Council  
Private Bag 713  
Stratford

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## Executive summary

Trustpower Ltd (the Company) operates the Mangorei hydroelectric power (HEP) scheme in the Waiwhakaiho River catchment to the south of New Plymouth. The Company diverts water from the Waiwhakaiho River into Lake Mangamahoe, from where it is directed through penstocks to the Mangorei Power Station, located on Hydro Road. The water is returned to the Waiwhakaiho River at the Meeting of the Waters, six kilometres downstream of the original diversion. This report for the period July 2020 to June 2021 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess the Company's environmental and consent compliance performance during the period under review. The report also details the results of the monitoring undertaken and assesses the environmental effects of the Company's activities.

### **During the monitoring period, the Company demonstrated an overall high level of environmental performance.**

The Company holds seven resource consents, which include a total of 35 conditions setting out the requirements that the Company must satisfy. The Company holds three consents to allow it to divert, use and discharge water and four consents for various structures, including to dam the Mangamahoe Stream, the Waiwhakaiho River intake weir, and an access culvert related to this site.

The Council's monitoring programme for the year under review included 12 hydrological inspections, which included a gauging of the residual flow on each occasion, two macroinvertebrate surveys, the auditing of data provided by the Company, and water temperature monitoring of the Waiwhakaiho River.

Gauging of the residual flow recorded a compliant flow on all occasions. Inspections found all aspects of the scheme in good order. Data provided by the Company showed good compliance with lake level restrictions and residual flow requirements, and the requirement to generate at least 950 L/s during the day to provide adequate flow downstream of the scheme.

The number of elvers transferred from the Mangorei Power Station to the Waiwhakaiho River during the period under review was the fourth highest recorded. Downstream migratory adult eel passage was also provided by the Company by manual trapping and transfer. A total of 37 adult eels were transferred in the reported period.

Macroinvertebrate sampling reflected the high water quality and habitat conditions found in the river, but also reflected issues with algal proliferation and other potential effects, such as elevated water temperatures, within the residual flow reach and below the meeting of the waters. Sampling showed an impact on the presence of 'sensitive' taxa and their relative abundance, causing the community to be more compositionally and numerically dominated by 'tolerant' taxa in a downstream direction within the river. A decrease in the macroinvertebrate community health was seen at the Hydro Road site within the residual reach and the site below the Meeting of Waters. The results suggest an impact from the increased rate of take allowed by the variation of consent 2053 since 2016.

The Company has struggled to provide regular and timely updates on progress made towards monitoring sedimentation within the lake in this monitoring period. Due to the late submission of a lake sedimentation report during the writing of this report, a compliance assessment on the work undertaken by the Company to date has not yet been made in this monitoring period. Any enforcement action, if deemed necessary, will be pursued in the 2022 period.

Due to a relatively mild spring and summer, water temperatures, in particular maximum temperatures, were generally below average at all sites during this monitoring period. Overall, during this monitoring period, water temperatures in the lower river and residual reach did not present excessive levels for any extended period, although there is clear relationship between the activity and increased water temperatures. In the lower river, the spreading of power generation releases during daylight hours, as required by consent

conditions, would have aided in mitigating extreme temperatures. The minor warming seen over the 20 year period since an increased summer residual flow was implemented appears to be due to climatic changes, given a similar trend is apparent upstream of the scheme. Water temperature results indicated the effect of a colder than average summer, coupled with a typical change in water temperature in a downstream direction attributable to the HEPS. This monitoring has again demonstrated how the variability in climatic conditions can greatly influence temperatures within the river at any given period.

During the year, the Company demonstrated a high level of environmental and a good level of administrative performance with the resource consents related to the Mangorei HEP scheme.

For reference, in the 2020-2021 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved.

In terms of overall environmental and compliance performance by the consent holder over the last several years, this report shows that the consent holder's performance remains at a high level.

This report includes recommendations for the 2021-2022 year.



## Table of contents

		Page
1	Introduction	1
1.1	Compliance monitoring programme reports and the Resource Management Act 1991	1
1.1.1	Introduction	1
1.1.2	Structure of this report	1
1.1.3	The Resource Management Act 1991 and monitoring	1
1.1.4	Evaluation of environmental and administrative performance	2
1.2	Process description	3
1.3	Resource consents	5
1.4	Monitoring programme	6
1.4.1	Introduction	6
1.4.2	Programme liaison and management	6
1.4.3	Site inspections	6
1.4.4	Data audit	6
1.4.5	Water temperature monitoring	6
1.4.6	Biological inspection and surveys	7
2	Results	8
2.1	Water	8
2.1.1	Hydrological inspections	8
2.1.2	Fish passage inspection	8
2.1.3	Provision of consent holder data	9
2.1.4	Results of receiving environment monitoring	15
2.1.4.1	River water temperatures	15
2.1.4.2	Macroinvertebrate monitoring	23
2.1.4.3	Fish monitoring	27
2.1.4.4	Adult eel and elver transfers	27
2.2	Incidents, investigations, and interventions	29
2.3	Riparian planting	30
2.4	Stakeholders' meeting	30
3	Discussion	31
3.1	Discussion of site performance	31
3.2	Environmental effects of exercise of consents	31
3.3	Evaluation of performance	33
3.4	Recommendations from the 2019-2020 Annual Report	39

3.5	Alterations to monitoring programmes for 2021-2022	39
4	Recommendations	40
	Glossary of common terms and abbreviations	41
	Bibliography and references	42
	Appendix I Resource consents held by Trustpower Ltd	

## List of tables

Table 1	Resource consents held by the Company in relation to the Mangorei HEP scheme	5
Table 2	Water temperature monitoring sites in the Waiwhakaiho River	6
Table 3	Results of gaugings undertaken in relation to the Mangorei HEP scheme, 2020-2021	8
Table 4	The results of spot calibration checks made of the Company's flow recorder located downstream of the intake weir	10
Table 5	Summary of maximum daily water temperatures in the Waiwhakaiho River at three monitored locations, between 1 December and 31 March	17
Table 6	Waiwhakaiho River water temperature data at three sites prior to, and after, the requirement for the 700 L/s summer (January- March) residual flow	18
Table 7	Hourly mean water temperature (°C) data for January 2021 at Hydro Road. Red represents higher water temperature and blue represent lower temperature with white being mid-range temperature relative to data set.	21
Table 8	Difference in mean hourly water temperature (°C) data for January 2021 between Rimu Street and Hydro Road. Positive values represent hotter temperatures at Rimu Street. Red represents hotter temperatures at Hydro Road. Green represents occasions where the mean temperature difference for a selected hour is higher throughout the month at the Hydro Road Site	22
Table 9	Numbers of adult eels transferred at the Mangorei HEP scheme since 2009	28
Table 10	Estimated numbers of elvers trapped and transferred at the Mangorei HEP scheme powerhouse in the monitoring years to date	28
Table 11	Numbers of elvers transferred during the 2020-2021 period	29
Table 12	Summary of performance for consent 2053-3.2	33
Table 13	Summary of performance for consent 2054-3	33
Table 14	Summary of performance for consent 2056-3	34
Table 15	Summary of performance for consent 4886-1	34
Table 16	Summary of performance for consent 4887-1	35
Table 17	Summary of performance for consent 4888-1	35
Table 18	Summary of performance for consent 6810-1	35
Table 19	Evaluation of environmental performance over time	36

## List of figures

Figure 1	Lake Mangamahoe environs showing the Waiwhakaiho diversion, community water supply, and the Company's hydroelectric power generating system	4
Figure 2	Water level data recorded by the Company, downstream of the intake weir	10
Figure 3	Water level downstream of the intake weir, compared with indicative water level required to ensure residual flow compliance and the indicative water level to ensure flow compliance with a margin of error allowance	11
Figure 4	Lake Mangamahoe water level as recorded by the Company (2020-2021)	12
Figure 5	Generation at the Mangorei Power house, displayed as the proportion of time a value was exceeded, 1 July 2020 – 1 July 2021, 9 am to 6 pm only	13
Figure 6	Flow variation in the Waiwhakaiho River at Rimu Street as a result of generation at the Mangorei Power Station in the 2018 – 2019 compliance period	14
Figure 7	Water temperature monitoring sites (W1, W5, and W7) in the lower Waiwhakaiho River catchment	15
Figure 8	Average daily water temperature at three sites in the Waiwhakaiho River for the monitoring period, compared with historical data	16
Figure 9	The distribution of maximum daily temperature differences (Hydro Road minus Egmont Village), displayed as a percentage of total days monitored	18
Figure 10	Difference in water temperature compared with flow in the Waiwhakaiho River in November 2018	19
Figure 11	Biological monitoring sites in the Waiwhakaiho River in relation to the Mangorei Power Scheme with survey results, January 2021	25
Figure 12	Biological monitoring sites in the Waiwhakaiho River in relation to the Mangorei Power Scheme with survey results, March 2021	26

## List of photos

Photo 1	The access culvert licensed by resource consent 6810-1 (top left), the Waiwhakaiho River at Kaipii Rd (top right), the Waiwhakaiho River upstream of Mangamahoe Stream outlet (bottom left), and the intake weir (bottom right)	9
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# 1 Introduction

## 1.1 Compliance monitoring programme reports and the Resource Management Act 1991

### 1.1.1 Introduction

This report is for the period July 2020 to June 2021 by the Taranaki Regional Council (the Council) on the monitoring programme associated with resource consents held by Trustpower Limited (the Company) in relation to the Mangorei hydroelectric power (HEP) scheme. The scheme diverts water from the Waiwhakaiho River to Lake Mangamahoe, and then on to the Mangorei Power Station, located on Hydro Road.

The report includes the results and findings of the monitoring programme implemented by the Council in respect of the consents held by the Company that relate to diversions of water and related in-stream structures within the Waiwhakaiho catchment.

One of the intents of the *Resource Management Act 1991* (RMA) is that environmental management should be integrated across all media, so that a consent holder's use of water, air, and land should be considered from a single comprehensive environmental perspective. Accordingly, the Council generally implements integrated environmental monitoring programmes and reports the results of the programmes jointly. This report discusses the environmental effects of the Company's use of water and land, and is the 24th combined annual report by the Council for the Company.

### 1.1.2 Structure of this report

**Section 1** of this report is a background section. It sets out general information about:

- consent compliance monitoring under the RMA and the Council's obligations;
- the Council's approach to monitoring sites through annual programmes;
- the resource consents held by the Company in the Waiwhakaiho catchment;
- the nature of the monitoring programme in place for the period under review; and
- a description of the activities and operations conducted in the Company's site/catchment.

**Section 2** presents the results of monitoring during the period under review, including scientific and technical data.

**Section 3** discusses the results, their interpretations, and their significance for the environment.

**Section 4** presents recommendations to be implemented in the 2021-2022 monitoring year.

A glossary of common abbreviations and scientific terms, and a bibliography, are presented at the end of the report.

### 1.1.3 The Resource Management Act 1991 and monitoring

The RMA primarily addresses environmental 'effects' which are defined as positive or adverse, temporary or permanent, past, present or future, or cumulative. Effects may arise in relation to:

- a. the neighbourhood or the wider community around an activity, and may include cultural and social-economic effects;
- b. physical effects on the locality, including landscape, amenity and visual effects;
- c. ecosystems, including effects on plants, animals, or habitats, whether aquatic or terrestrial;

- d. natural and physical resources having special significance (for example recreational, cultural, or aesthetic); and
- e. risks to the neighbourhood or environment.

In drafting and reviewing conditions on discharge permits, and in implementing monitoring programmes, the Council is recognising the comprehensive meaning of 'effects' in as much as is appropriate for each activity. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the RMA to assess the effects of the exercise of consents. In accordance with Section 35 of the RMA, the Council undertakes compliance monitoring for consents and rules in regional plans, and maintains an overview of the performance of resource users and consent holders. Compliance monitoring, including both activity and impact monitoring, enables the Council to continually re-evaluate its approach and that of consent holders to resource management and, ultimately, through the refinement of methods and considered responsible resource utilisation, to move closer to achieving sustainable development of the region's resources.

#### 1.1.4 Evaluation of environmental and administrative performance

Besides discussing the various details of the performance and extent of compliance by the Company, this report also assigns them a rating for their environmental and administrative performance during the period under review.

Environmental performance is concerned with actual or likely effects on the receiving environment from the activities during the monitoring year. Administrative performance is concerned with the Company's approach to demonstrating consent compliance in site operations and management including the timely provision of information to Council (such as contingency plans and water take data) in accordance with consent conditions.

Events that were beyond the control of the consent holder and unforeseeable (that is a defence under the provisions of the RMA can be established) may be excluded with regard to the performance rating applied. For example loss of data due to a flood destroying deployed field equipment.

The categories used by the Council for this monitoring period, and their interpretation, are as follows:

##### Environmental Performance

**High:** No or inconsequential (short-term duration, less than minor in severity) breaches of consent or regional plan parameters resulting from the activity; no adverse effects of significance noted or likely in the receiving environment. The Council did not record any verified unauthorised incidents involving environmental impacts and was not obliged to issue any abatement notices or infringement notices in relation to such impacts.

**Good:** Likely or actual adverse effects of activities on the receiving environment were negligible or minor at most. There were some such issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party but these items were not critical, and follow-up inspections showed they have been dealt with. These minor issues were resolved positively, co-operatively, and quickly. The Council was not obliged to issue any abatement notices or infringement notices in relation to the minor non-compliant effects; however abatement notices may have been issued to mitigate an identified potential for an environmental effect to occur.

For example:

- High suspended solid values recorded in discharge samples, however the discharge was to land or to receiving waters that were in high flow at the time;
- Strong odour beyond boundary but no residential properties or other recipient nearby.

**Improvement required:** Likely or actual adverse effects of activities on the receiving environment were more than minor, but not substantial. There were some issues noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent minor non-compliant activity could elevate a minor issue to this level. Abatement notices and infringement notices may have been issued in respect of effects.

**Poor:** Likely or actual adverse effects of activities on the receiving environment were significant. There were some items noted during monitoring, from self-reports, or during investigations of incidents reported to the Council by a third party. Cumulative adverse effects of a persistent moderate non-compliant activity could elevate an 'improvement required' issue to this level. Typically there were grounds for either a prosecution or an infringement notice in respect of effects.

### Administrative performance

**High:** The administrative requirements of the resource consents were met, or any failure to do this had trivial consequences and were addressed promptly and co-operatively.

**Good:** Perhaps some administrative requirements of the resource consents were not met at a particular time, however this was addressed without repeated interventions from the Council staff. Alternatively adequate reason was provided for matters such as the no or late provision of information, interpretation of 'best practical option' for avoiding potential effects, etc.

**Improvement required:** Repeated interventions to meet the administrative requirements of the resource consents were made by Council staff. These matters took some time to resolve, or remained unresolved at the end of the period under review. The Council may have issued an abatement notice to attain compliance.

**Poor:** Material failings to meet the administrative requirements of the resource consents. Significant intervention by the Council was required. Typically there were grounds for an infringement notice.

For reference, in the 2020-2021 year, consent holders were found to achieve a high level of environmental performance and compliance for 86% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 11% of the consents, a good level of environmental performance and compliance was achieved. <sup>1</sup>

## 1.2 Process description

The Mangorei HEP scheme diverts water from the Waiwhakaiho River to Lake Mangamahoe via an intake weir and tunnel (Figure 1). Water is taken from the lake for the Mangorei Power Station, and returned to the Waiwhakaiho River approximately 6 km downstream of the intake weir. The New Plymouth Water Treatment Plant also takes water from Lake Mangamahoe for the New Plymouth and Waitara water supplies.

When the Mangorei HEP scheme consents were renewed in 1996, the main areas of concern related to the flow in the reach between the intake weir and the Meeting of the Waters, known as the residual flow reach, and fish passage at the intake weir. These concerns were addressed by specifying a residual flow regime, with flows ranging from 400 L/s to 700 L/s depending on the time of year, and by requiring modifications to the fish pass, to ensure trout and native fish species were able to migrate upstream past the weir.

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<sup>1</sup> The Council has used these compliance grading criteria for more than 17 years. They align closely with the 4 compliance grades in the MfE Best Practice Guidelines for Compliance, Monitoring and Enforcement, 2018

Historical points of note are discussed in previous reports, listed in the bibliography and references section.

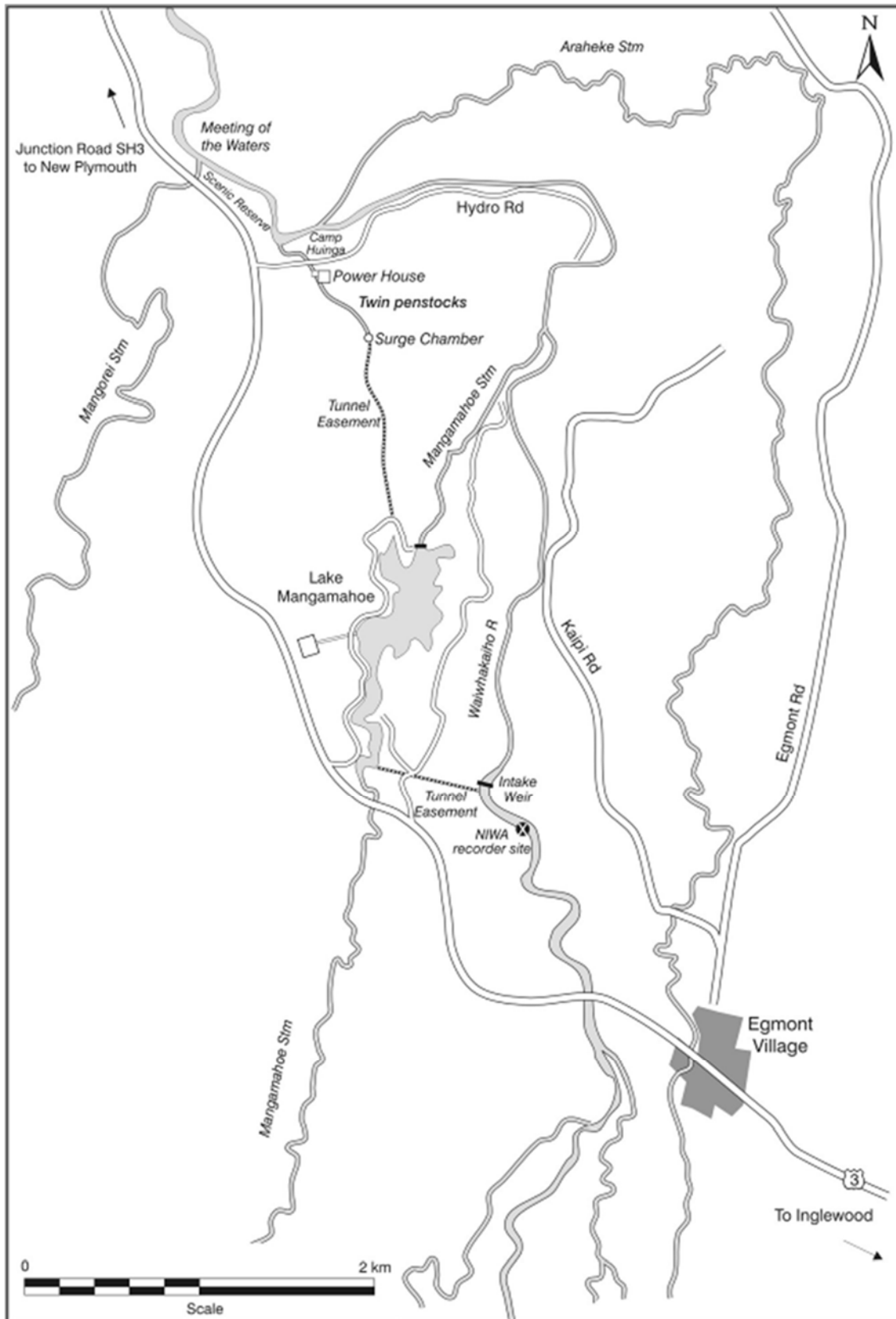


Figure 1 Lake Mangamahoe environs showing the Waiwhakaiho diversion, community water supply, and the Company's hydroelectric power generating system



### 1.3 Resource consents

The Company holds seven resource consents, the details of which are summarised in the table below. Summaries of the conditions attached to each permit are set out in Section 3 of this report. All of the relevant consents are now under Section 124 protection under the RMA as they go through the renewal phase.

A summary of the various consent types issued by the Council is included in Appendix I, as are copies of all permits held by the Company during the period under review.

**Table 1 Resource consents held by the Company in relation to the Mangorei HEP scheme**

Consent number	Purpose	Granted	Review	Expires
<i>Water abstraction permits</i>				
<b>2053-3.2</b>	To divert up to 10 m <sup>3</sup> /s of water from the Waiwhakaiho River via a diversion weir and associated intake structures into Lake Mangamahoe through the Mangorei HEP Scheme and back into the river approximately six kilometres downstream of the diversion point	4 September 1996 Varied 1 August 2017	-	1 June 2021
<b>2056-3.1</b>	To use up to 864,000 m <sup>3</sup> /day of water from Lake Mangamahoe in the Waiwhakaiho catchment for hydroelectric power generation purposes	4 September 1996 Varied 16 June 2016	-	1 June 2021
<i>Water discharge permits</i>				
<b>4888-1</b>	To discharge up to 150,000 L/s of water from Lake Mangamahoe via a spillway into the Mangamahoe Stream in the Waiwhakaiho Catchment under emergency conditions associated with hydroelectric generation purposes	4 September 1996	-	1 June 2021
<i>Land use permits</i>				
<b>2054-3</b>	To dam the Mangamahoe Stream in the Waiwhakaiho Catchment to form Lake Mangamahoe to act as a reservoir of water for hydroelectric power generation purposes	4 September 1996	-	1 June 2021
<b>4886-1</b>	To erect and maintain structures in the Mangamahoe Stream in the Waiwhakaiho Catchment to dam the stream to form Lake Mangamahoe for hydroelectric power generation purposes	4 September 1996	-	1 June 2021
<b>4887-1</b>	To erect and maintain structures associated with the diversion of water from the Waiwhakaiho River into Lake Mangamahoe for hydroelectric power generation purposes	4 September 1996	-	1 June 2021
<b>6810-1</b>	To erect, place and maintain a culvert in an unnamed tributary of the Waiwhakaiho River for access purposes	6 March 2006	-	1 June 2020

## 1.4 Monitoring programme

### 1.4.1 Introduction

Section 35 of the RMA sets obligations upon the Council to gather information, monitor and conduct research on the exercise of resource consents within the Taranaki region. The Council is also required to assess the effects arising from the exercising of these consents and report upon them.

The Council may therefore make and record measurements of physical and chemical parameters, take samples for analysis, carry out surveys and inspections, conduct investigations and seek information from consent holders.

The monitoring programme for the Mangorei HEP scheme site consisted of five primary components.

### 1.4.2 Programme liaison and management

There is generally a significant investment of time and resources by the Council in:

- ongoing liaison with resource consent holders over consent conditions and their interpretation and application;
- discussion over monitoring requirements;
- preparation for any consent reviews, renewals or new consent applications;
- advice on the Council's environmental management strategies and content of regional plans; and
- consultation on associated matters.

### 1.4.3 Site inspections

The Mangorei HEP scheme was visited 12 times during the monitoring period. These were all hydrological inspections, which focused largely on hydrological aspects of the scheme, with a gauging of the residual flow reach undertaken on each occasion and some water level readings also taken. The fish pass was inspected, as was the access culvert.

### 1.4.4 Data audit

The Company provided the Council with data on generation, flow from the power station, residual flow below the weir and the water level of Lake Mangamahoe. This data was assessed by the Council to determine whether consented generation and lake level requirements were complied with.

### 1.4.5 Water temperature monitoring

Water temperature was monitored at three locations, to assess the impacts of the reduced flow through the residual flow reach, and the release of water through generation on water temperatures of the middle and lower reaches of the river. The details of these sites are provided in Table 2.

Table 2 Water temperature monitoring sites in the Waiwhakaiho River

Site	Location	GPS Location	Site code
W1	State Highway 3 (approximately 2 km upstream of weir)	E1698297 N5666893	WKH000500
W5	Hydro Road (within residual flow reach, approximately 5 km downstream of weir)	E1697474 N5671435	WKH000650
W7	Rimu Street track extension (approximately 13 km downstream of weir)	E1696149 N5675261	WKH000820

### 1.4.6 Biological inspection and surveys

The programme now includes an annual (previously biennial) biological inspection. This inspection includes an inspection of the river channel and various structures to assess continuing suitability for fish passage. Provisional monitoring of the elver trap at the station was undertaken for the first time this year.

Macroinvertebrate monitoring was reintroduced to the monitoring programme in the 2016-2017 monitoring period. Two further monitoring sites were added to the programme during the 2019-2020 monitoring period to better assess any potential effects from the various activities undertaken by the Company on aquatic habitat within the residual flow reach and below the meeting of the waters. This monitoring now involves the collection of three macroinvertebrate samples. These samples are in generally collected on the same day the Council's State of the Environment macroinvertebrate monitoring is carried in the Waiwhakaiho catchment. This monitoring is undertaken in spring and summer.

Fish monitoring has been undertaken previously, with the results presented in an earlier report (TRC, 2009). Fish monitoring was provisionally included in the current programme for this year, however, as the Company was already undertaking its own fish surveys for re-consenting purposes, it was decided to postpone any monitoring until the results of those surveys could be reviewed.

## 2 Results

### 2.1 Water

#### 2.1.1 Hydrological inspections

The primary purpose of the hydrological inspections was to gauge the flow downstream of the intake weir, to determine whether the residual flow provided by the Company met the requirements of the consent. A full historical context of residual flow compliance can be found in previous monitoring reports.

The gaugings undertaken in the 2020-2021 period are summarised in Table 3. This table shows that the residual flow was compliant on all occasions.

During these inspections, some notes were also made regarding the condition of the fish pass. On occasion, the pass can contain varying amounts of river gravel, deposited there by floods. This material is removed by the Company when possible (having regard to safety for personnel), and overall, the fish pass has been well maintained.

Table 3 Results of gaugings undertaken in relation to the Mangorei HEP scheme, 2020-2021

Date	Time	Gauged flow downstream of weir (L/s)	Residual flow required at this time	Compliant?
03/07/2020	12:36:00	806	400	Yes
10/08/2020	14:20:00	685	400	Yes
04/09/2020	11:30:00	659	400	Yes
23/10/2020	11:05:00	663	400	Yes
23/11/2020	11:41:00	729	600	Yes
21/12/2020	10:00:00	658	600	Yes
11/01/2021	12:11:00	794	700	Yes
12/02/2021	10:27:00	747	700	Yes
04/03/2021	13:24:00	752	700	Yes
19/04/2021	11:01:00	741	600	Yes
04/05/2021	12:51:00	524	400	Yes
08/06/2021	15:02:00	654	400	Yes

#### 2.1.2 Fish passage inspection

The biological inspection was completed on 26 March 2021, during stable and just below mean annual low flows (MALF) as recorded at the Egmont Village gauging station. This included an inspection of the residual flow reach, to ensure that the river channel was suitable to provide adequate fish passage, an assessment of the access culvert just upstream of the intake, and an assessment of the fish pass at the intake weir.

A number of potential issues were identified at the access culvert and the weir fish pass which may result in fish passage not being comprehensively provided for, however, it is expected that fish passage is largely being achieved at both structures. An outline of the potential issues and recommendations were provided to the Company in an inspection notice, which covered ongoing maintenance, attractant flows, velocity issues at sections within the structures, and predation resulting from delayed passage.

The river channel inspection showed no areas where fish passage was obviously inhibited. Under lower flow conditions some sections may pose a challenge for weaker swimming species due to steeper rocky slopes and for large trout due to shallow water and rocky slopes. This was largely at the lower reach of the survey area where the river becomes 'braided' for a few hundred meters. It is not expected that these sections would cause a barrier when the majority of trout or weaker swimming species are migrating upstream under higher flow conditions, although outside of flood conditions they may struggle. This section of the river could use further investigation.

With regard to Condition 5 of consent 2053-3.2, which requires the Company to maintain the river channel in the residual flow reach to enhance fish habitat and passage, there were no obvious maintenance works required beyond that at the braided section of the residual flow reach which may require further exploration. A selection of photos taken during this inspection are shown below.



Photo 1 The access culvert licensed by resource consent 6810-1 (top left), the Waiwhakaiho River at Kaipi Rd (top right), the Waiwhakaiho River upstream of Mangamahoe Stream outlet (bottom left), and the intake weir (bottom right)

### 2.1.3 Provision of consent holder data

Resource consent 2053-3.2 requires the Company to maintain a measuring device capable of measuring the residual flow downstream of the intake weir, and to provide these records to the Council upon request. This condition outlines that the device be installed and operated to the satisfaction of the Council. The data provided by the Company in fulfilment of this condition is shown in Figure 2. This data shows that water level was recorded throughout the monitoring period, with only minor exceptions.

Table 4 compares the results of spot readings made during site visits with the recorded data provided by the Company. This shows that the accuracy of the meter has varied over the reported period, ranging from

38 mm too high to 11 mm too low. However, 10 of the 12 readings were within 10% of each other, with the other two being less than 12.9%. Although this data shows variation in recorder accuracy, this data was largely used by the Company to guide management of the residual flow. This has been successful, as demonstrated by the results of the gaugings undertaken (Table 3). The data was also compared against indicative water levels, above which adequate residual flow is provided for the majority of the monitoring period (Figure 3).

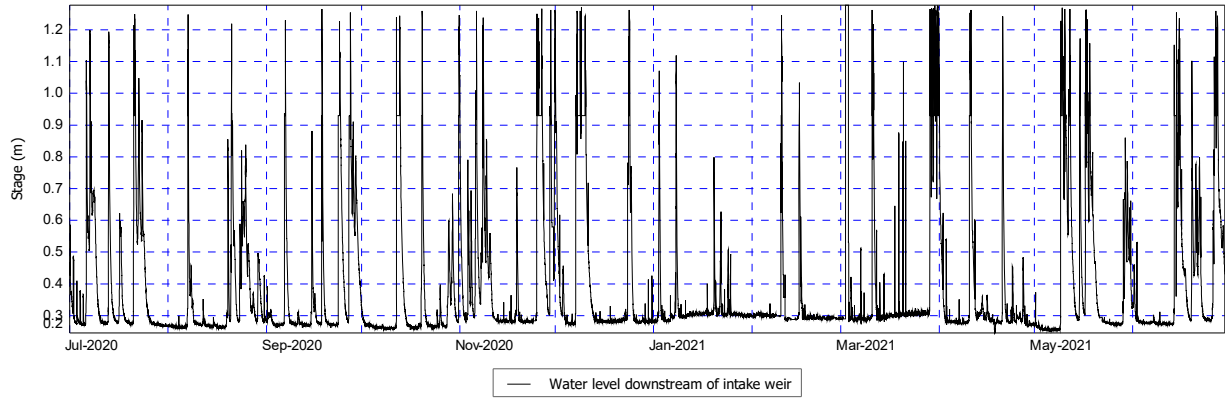


Figure 2 Water level data recorded by the Company, downstream of the intake weir

Although the relevant consent condition requires the provision of residual flow data, the Company only provides water level data. This is done with the agreement of the Council, as the maintenance of a rating curve in the Waiwhakaiho River at this location is problematic, because the river bed cross section can change with every flood. This makes maintaining a rating curve at this location impractical. The Council undertakes monthly gaugings at this location to not only assess compliance with the residual flow requirements, but also to provide flow versus water level data to the Company, which they use to manage their residual flow.

Table 4 The results of spot calibration checks made of the Company's flow recorder located downstream of the intake weir

Date	Time	Manual Reading (mm)	Recorded Reading (mm)	Difference (mm)	Difference as % of Manual reading
03/07/2020	12:36:00	318	294	24	7.55%
10/08/2020	14:20:00	301	274	27	8.97%
04/09/2020	11:30:00	298	275	23	7.73%
23/10/2020	11:05:00	295	257	38	12.88%
23/11/2020	11:41:00	315	278	37	11.75%
21/12/2020	10:00:00	313	284	29	9.27%
11/01/2021	12:11:00	329	301	28	8.51%
12/02/2021	10:27:00	321	294	27	8.41%
04/03/2021	13:24:00	319	308	11	3.45%
19/04/2021	11:01:00	308	282	26	8.44%
04/05/2021	12:51:00	279	259	20	7.17%
08/06/2021	15:02:00	297	277	20	6.73%

The indicative water levels outlined in Figure 3 are as follows:

- Indicative Line - 400 L/s (Jul-Oct), 600 L/s (Nov-Dec), 700 L/s (Jan-Mar), 600 L/s (April), 400 L/s (May-Jun)
- Indicative Line with allowed 10% margin of error - 360 L/s (Jul-Oct), 540 L/s (Nov-Dec), 630 L/s (Jan-Mar), 540 L/s (April), 360 L/s (May-Jun).

An allowance for a 10% margin of error recognises the potential error (uncertainty) associated with the measuring equipment in place and methods used to collect flow data.

As can be seen in Figure 3 there are no notable periods where water levels are below both indicative lines. There was one short term dip below both indicative water levels, seen on 18/04/2021 11:00 (Figure 3). This may be indicative of erroneous data or a result of the physical process of managing water levels, as explained in the previous year’s monitoring report. It is not expected that this dip would result in adverse effects when compared to those that may already be occurring within the authorised flow range. Therefore, this has not been seen as a compliance issue. This is an improvement from the previous monitoring period where two notable periods where water levels were below both indicative lines were recorded, as well as several short term dips.

Overall, the Company is showing a continued good level of compliance with residual flow conditions.

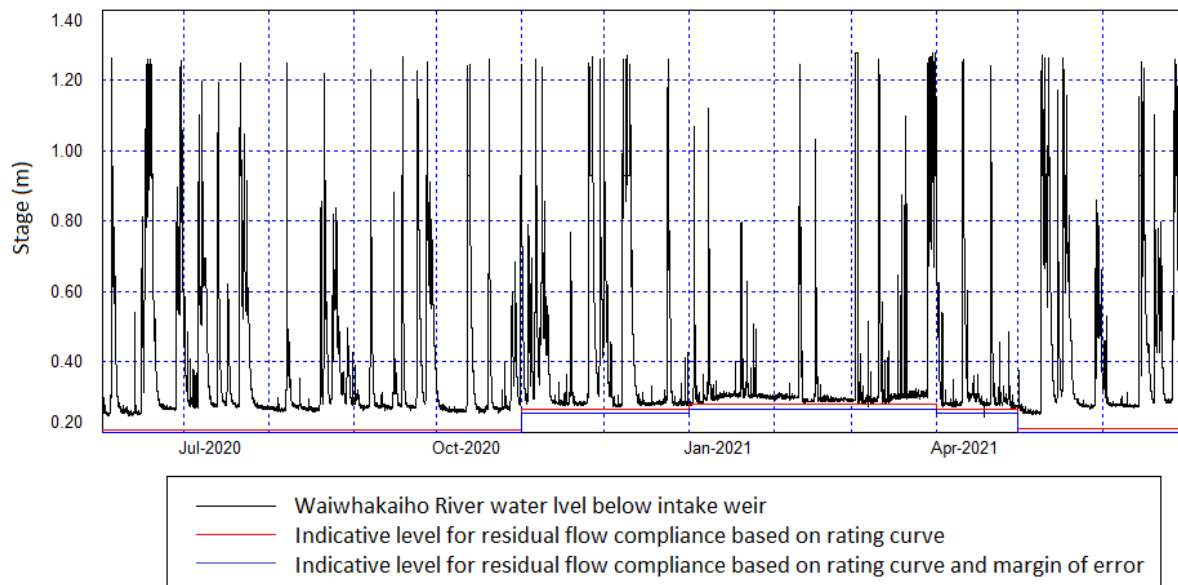


Figure 3 Water level downstream of the intake weir, compared with indicative water level required to ensure residual flow compliance and the indicative water level to ensure flow compliance with a margin of error allowance

The Company has also provided lake level data to the Council. This data is presented in Figure 4, and shows that management with the minimum lake level was good, with no breaches recorded. The two instances where the lake level exceeded the spillway level were all associated with floods in the contributing catchments.

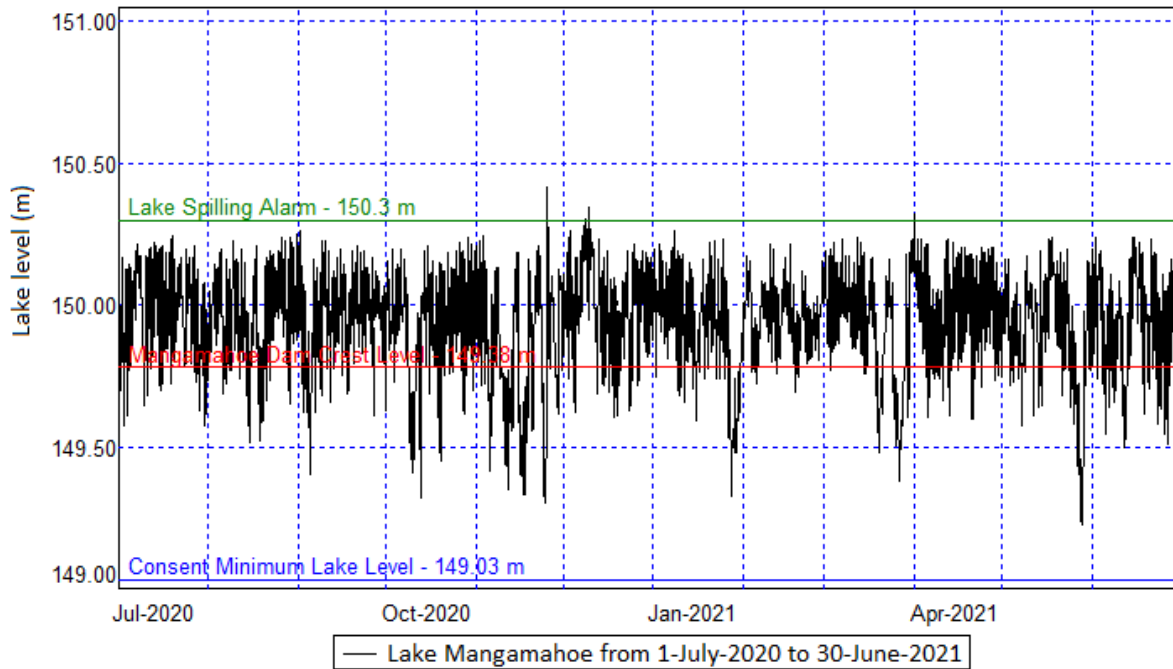


Figure 4 Lake Mangamahoe water level as recorded by the Company (2020-2021)

The Company also provides the Council with generation data, and this allows an assessment of compliance with condition 1 of consent 2053-3.2, which requires that a continuous generation flow release of at least 950 L/s be maintained between 8 am and 6 pm each day. This requirement is intended to mitigate for the low flows and high water temperatures that can occur in mid to late summer, while also providing recreational opportunities, and maintaining water and habitat quality in general.

Figure 5 shows the exceedance time for the generation data, in essence showing what percent of the time that generation exceeded a certain rate. A generation rate of 0.575 MW approximately equates to a flow of 950 L/s, and this generation rate was exceeded 95% of the time between 9 am and 6pm during the 2020-2021 period. For those times when a generation flow is not provided as required, the Company has historically notified the Council beforehand (for planned generation changes only) or afterwards (in relation to an unforeseeable event etc.) that a compensation flow would be provided. Compensation flows are provided by reducing the abstraction of water from the Waiwhakaiho River at the intake weir or by using the bypass valve at the station; when the bypass valve is in operation the intake weir is closed.

On six occasions during this monitoring period the Council was not notified in a timely manner when generation flows were not provided. However, based on the observed data, and as has been historically seen in previous years, it is expected that these are related to network outages as opposed to not providing appropriate flows. At the time of writing this report, confirmation of this is being sought from the Company. In past years the Company was able to show that the appropriate flows were provided for throughout the monitored period. The timeliness of the provision of notifications has been an ongoing issue. However, it should be reiterated that the Company has had a very good record with the actual provision of flows.



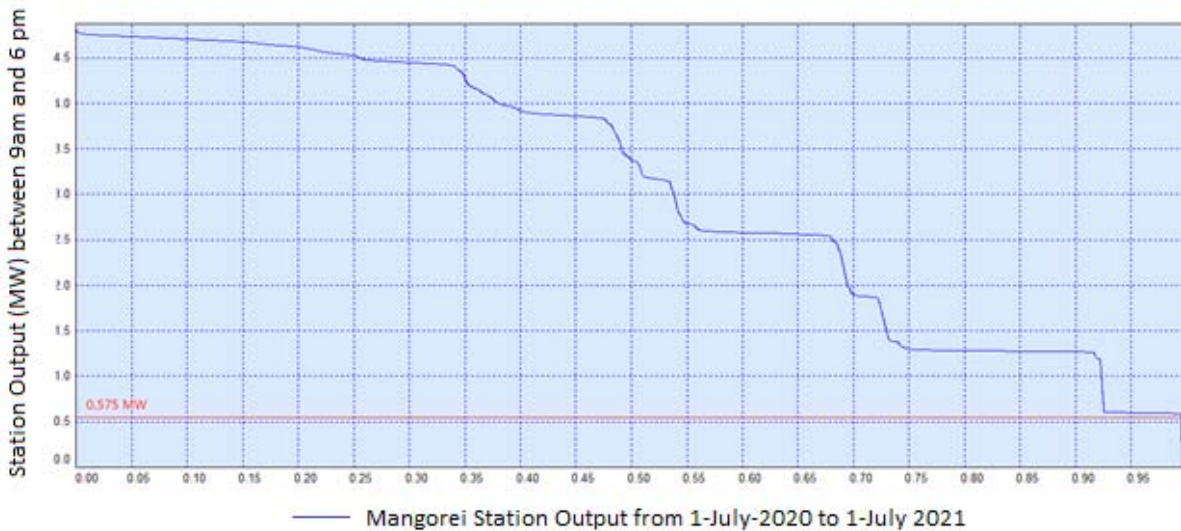


Figure 5 Generation at the Mangorei Power house, displayed as the proportion of time a value was exceeded, 1 July 2020 – 1 July 2021, 9 am to 6 pm only

The impact on the flow regime of the lower Waiwhakaiho River is illustrated by data collected by the Council’s flow recorder, located on Rimu Street. Figure 6 shows how flow responds to changes in generation, and with changes in the residual flow requirements.

Although a lower residual flow is provided in the winter months, the lowest flow recorded at Rimu Street is still higher than in summer, when a higher residual flow is provided. This is due to the higher winter flow in the tributaries that join the Waiwhakaiho River downstream of the Meeting of the Waters. It is also apparent that less generation occurs in the summer, a direct reflection of the reduced flows over this time.

Condition 3 of consent 2053-3.2 requires the diversion of water to cease when flows exceed 85 cumecs. This consent does not include a requirement to record the rate that water is diverted from the river, and as such it is not possible to monitor this condition through the assessment of data. Therefore, the Council will continue to liaise with the Company to ensure that this consent condition is adhered to.

A condition of consent 2053-3.2 requires the Company to monitor the sedimentation of the lake. The Company undertook two bathymetric surveys of Lake Mangamahoe in May 2013 and prior to implementation of the diversion of 10 cumecs in March 2017, with both reports submitted to the Council<sup>2</sup>. The next bathymetry survey was scheduled to be completed in December 2020. The Company was to undertake and report on sediment sampling that relates the flow in the Waiwhakaiho River to the rate of sediment entering Lake Mangamahoe via the diversion. On 9 December 2021 a report titled ‘Mangorei HEPS Sediment quantity and survey report’ was submitted to Council, the report was dated December 2020. This report is the only update with regard to sediment in the lake to be received by Council in this monitoring period, and was received after significant delay and numerous requests for further information starting from November 2020. An assessment of the content within the submitted report and the work completed to date by the Company has not yet been completed, and therefore an assessment of compliance has not been made at the time of writing this report. The report will be reviewed in 2022 and an assessment of compliance will be made against the relevant consents.

<sup>2</sup> Document numbers 1219864 & 1894394

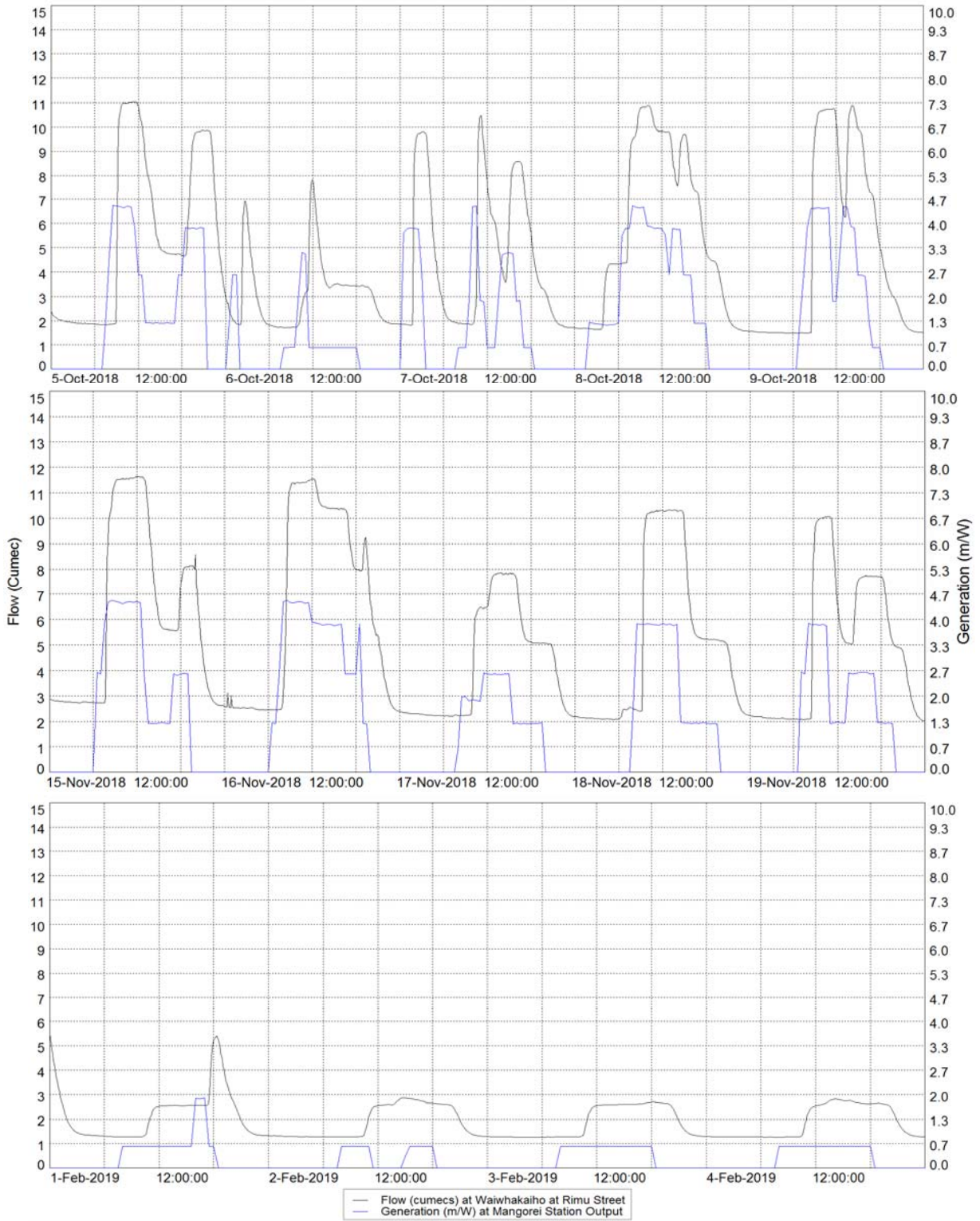


Figure 6 Flow variation in the Waiwhakaiho River at Rimu Street as a result of generation at the Mangorei Power Station in the 2018 – 2019 compliance period

## 2.1.4 Results of receiving environment monitoring

### 2.1.4.1 River water temperatures

Continuous river water temperature measurements have been performed throughout the term of the consents at three sites on the Waiwhakaiho River. Temperatures are monitored at one site upstream of the abstraction point, one site within the residual flow reach of river between the abstraction point and the power station outlet, and one site below the power station outlet. These locations are illustrated in Figure 7. Full and complete records of temperature from each site were provided for the 2020-2021 period.

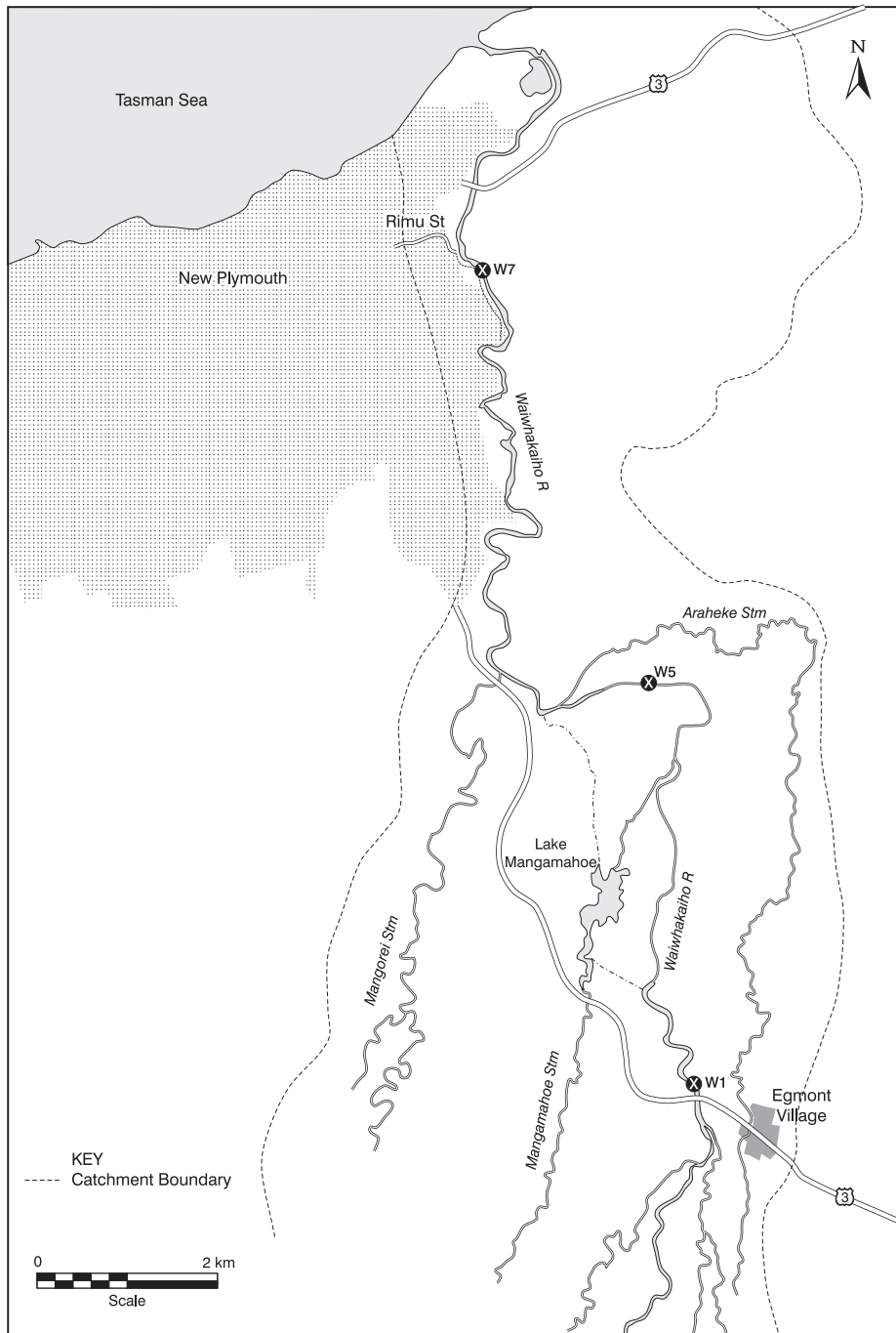


Figure 7 Water temperature monitoring sites (W1, W5, and W7) in the lower Waiwhakaiho River catchment

The Waiwhakaiho River exhibited average daily water temperatures throughout 2020-2021 typical of the long term daily average (Figure 8), with a few select cooler periods of less than a week or so in January and February. Conversely, warmer than average periods of less than a week were recorded in May and June.

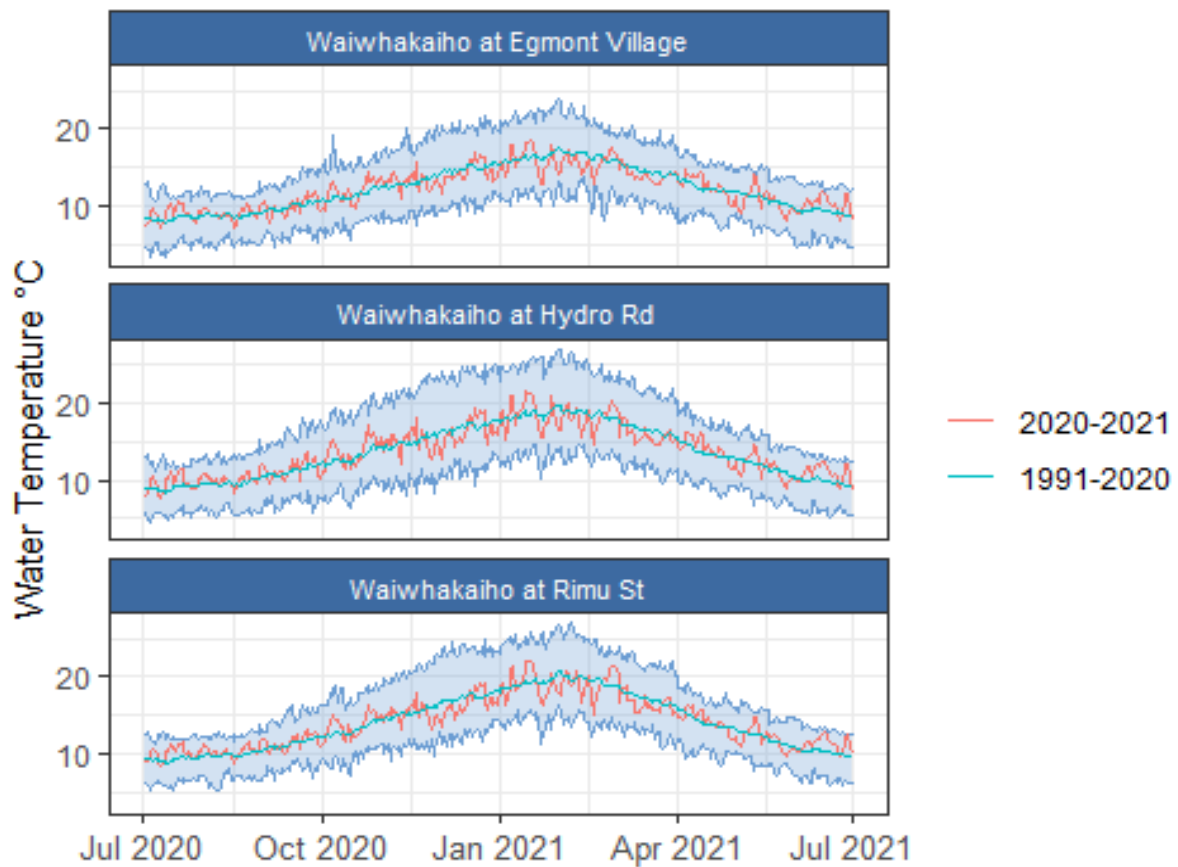


Figure 8 Average daily water temperature at three sites in the Waiwhakaiho River for the monitoring period, compared with historical data

When considering the impact of abstraction on aquatic life, it is biologically relevant to consider the difference in temperature between sites above the abstraction point and sites below the abstraction point. To determine potential impact on aquatic life, both the maximum temperature reached as well as the proportion of time water temperature exceeds the thermal preference and tolerance of aquatic life is considered. Table 5 shows the proportion of days when maximum temperature fell within the denoted temperature range. These proportions are compared with historical data and the previous monitoring years data. The river upstream of the intake at Egmont Village has never exceeded 25°C; however, downstream at Hydro Road, 25°C is exceeded on a varying number of times per year, with 1.4% of the total temperature record being above 25°C. At Rimu Street, 25°C is also exceeded a varying number of times per year, with 0.9% of the total record being above 25°C, despite being much further downstream than Hydro Road. During the 2020-2021 monitoring period, water temperature did not exceed 25°C at any of the three sites, compared to three days where temperatures above 25°C were recorded at the Hydro Road site in the previous monitoring period. Although the 2020-2021 year recorded a reduction in the over 25°C and over 20°C temperatures at all three sites compared to the previous year, the historic data and overall trend indicates that there is a higher incidence of warming, temperature fluctuations, and extreme temperatures in the residual reach compared to the Egmont Village site and the Rimu Street site.

Table 5 Summary of maximum daily water temperatures in the Waiwhakaiho River at three monitored locations, between 1 December and 31 March

Monitoring site	Years	No. of days monitored	% of days in this temperature range (no. of days)			
			10-15°C	15-20°C	20-25°C	>25°C
Egmont Village	1991-2020	3,303	13.5 (446)	77.9 (2,572)	8.6 (285)	0.0
	2019-2020	120	14.2 (17)	73.3 (88)	12.5 (15)	0.0
	2020-2021	119	16 (19)	79 (94)	5 (6)	0.0
Hydro Road	1991-2020	3,087	2 (61)	47.7 (1,473)	48.9 (1,511)	1.4 (42)
	2019-2020	120	0.8 (1)	38.3 (46)	58.3 (70)	2.5 (3)
	2020-2021	119	0.8 (1)	50.4 (60)	48.7 (58)	0.0
Rimu St	1991-2020	3,442	1 (35)	51.6 (1,776)	46.5 (1,599)	0.9 (32)
	2019-2020	120	0.0	44.2 (53)	55.8 (67)	0.0
	2020-2021	119	0.0	56.3 (67)	43.7 (52)	0.0

\*Historical values may differ slightly from those published previously due to new calculation methods and rounding levels

A brief comparison of the previous residual flow regime and the new residual flow regime is provided in Table 6 and Figure 9. Table 6 presents a summary of water temperatures over the time periods, and shows that the Egmont Village site has experienced a gradual increase in water temperature, with the mean temperature increasing by 0.6°C. A similar increase has been recorded downstream at both Hydro Road and Rimu Street at 0.8°C. Although it is likely that the increased residual flow has resulted in cooler temperatures downstream, especially at Hydro Road, it is apparent that this cooling influence is of a smaller influence than the natural increase in temperature that has occurred over time.

In terms of temperature differences between Egmont Village and Hydro Road, there has been a slight increase in the frequency of maximum daily differences between 3°C and 5°C in a downstream direction since the higher residual flow has been implemented. During the 2020-2021 period the majority of recorded differences were in the range of 3-4°C, followed by the 4-5°C range, with all other ranges recording below average.

Figure 10 from the 2018-2019 compliance monitoring period shows how the difference in water temperature between Egmont Village and Hydro Road changes with a change in flow. During a low flow there is a clear diurnal variation, but when flows increase, the water temperature does not change significantly as it flows downstream. This is likely to be because of the volume of water, but also the speed of flow, meaning that the water has less time to warm as it flows downstream.

Table 6 Waiwhakaiho River water temperature data at three sites prior to, and after, the requirement for the 700 L/s summer (January- March) residual flow

River	SH3@Egmont Village		Hydro Rd		Rimu St	
	1992-1997	1998-2021	1992-1997	1998-2021	1992-1997	1998-2021
Maximum (°C)	21.1	23.9	25.5	27	24.8	27
Minimum (°C)	9.2	8.2	9.4	10.2	10.8	10.7
Mean (°C)	15.3	15.9	17.1	17.9	18	18.8
Std Devn (°C)	2	2.1	2.6	2.5	2.3	2.4
% Exceedance						
>25 (°C)	0	0	0.1	0.3	0	0.4
>23 (°C)	0	0.0	1.4	2.8	1.5	4.3
>20 (°C)	0.6	3.0	13.3	20.8	20.9	30.7
>18 (°C)	10.1	16.0	36.5	46.4	49.5	61.4
>16 (°C)	38.9	46.9	67.3	77.1	80.6	88.8
>14 (°C)	74.2	82.4	88.8	95.4	96.5	98.8
>12 (°C)	94.9	97.8	98.4	99.6	99.8	99.9
>10 (°C)	100.0	100.0	100.0	100.0	100.0	100.0
Data record	80.2	99.1	59.7	95.3	99.3	98.9

\*Historical values may differ slightly from those published previously due to new calculation methods and rounding levels

**Note:** 600 L/s residual flow at Hydro Road: 1992-97 and 700 L/s residual flow at Hydro Road: 1998-2020

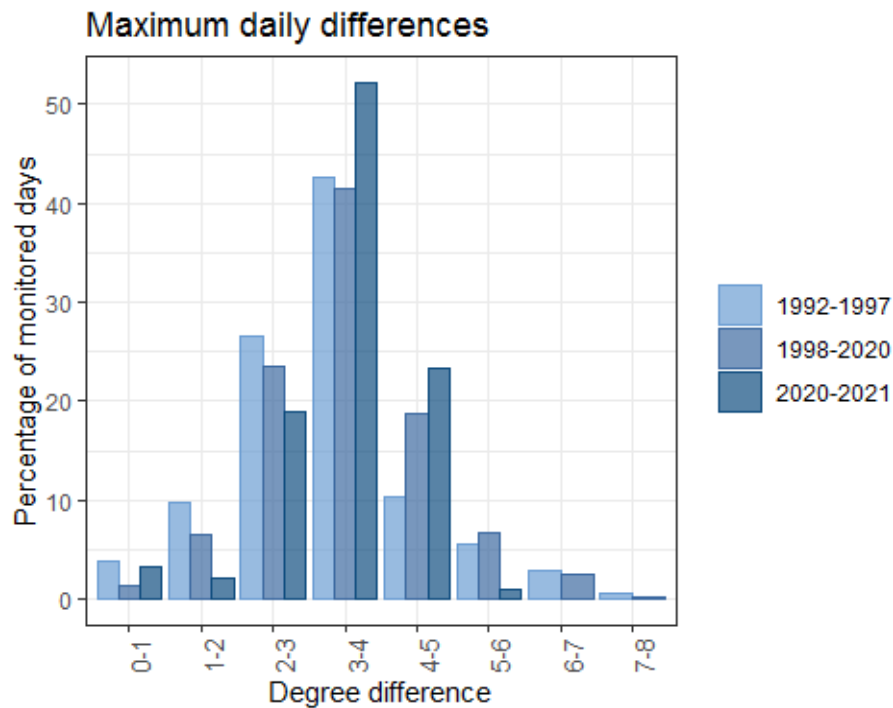


Figure 9 The distribution of maximum daily temperature differences (Hydro Road minus Egmont Village), displayed as a percentage of total days monitored

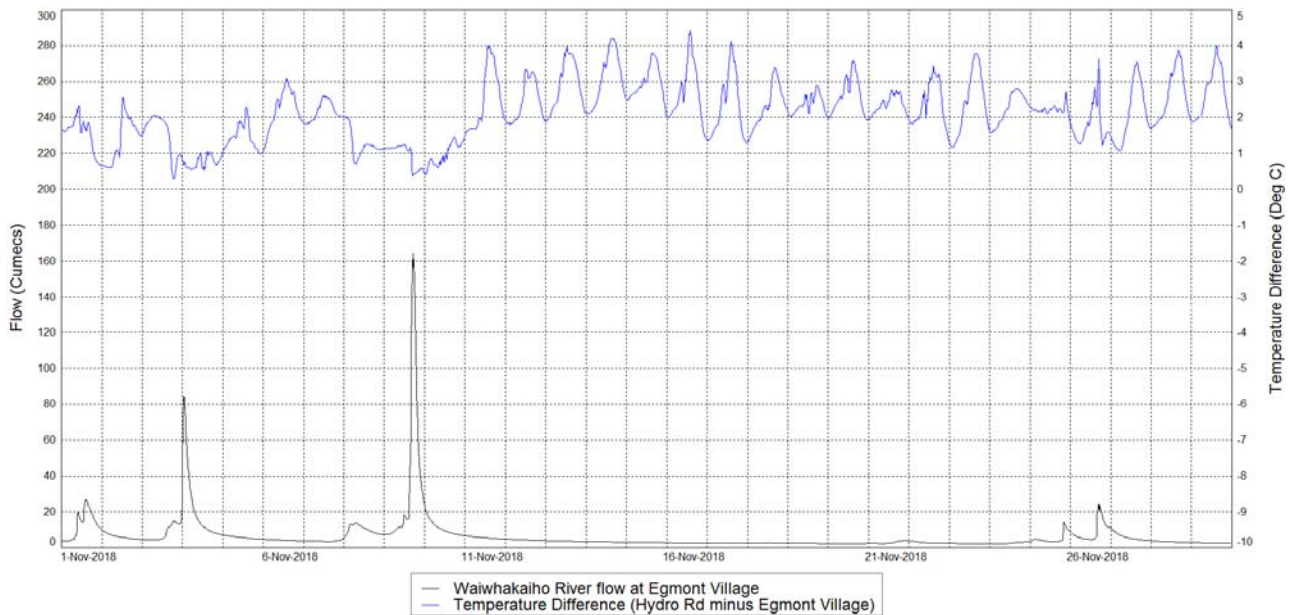


Figure 10 Difference in water temperature compared with flow in the Waiwhakaiho River in November 2018

In previous annual compliance monitoring reports for this scheme it was discussed how the conditions preceding summer can influence the rivers temperatures considerably, showing that basing residual flow requirements on historical data alone can have its drawbacks when attempting to regulate river water temperatures. This topic does not need be discussed again here, however, it is worth outlining what the variation in temperatures on a short term daily and monthly basis look like, both for typical diurnal fluctuations and climatic conditions. This is particularly prudent considering the apparent upward trending temperatures within the catchment as seen at the upstream site.

Table 7 shows the difference in hourly mean temperature ( $^{\circ}\text{C}$ ) throughout the month of January at Hydro Road, illustrating the heating and cooling variation throughout a range of climatic conditions over one day and a month. Note that the colour scheme is based on an unspecified gradient and is used as a visualisation tool only.

Table 8 shows the difference in hourly mean temperature ( $^{\circ}\text{C}$ ) for the month of January between Rimu Street and Hydro Road sites, with positive values representing a hotter water temperature at Rimu Street. This illustrates that whilst the average daily temperature is higher at Rimu Street on all days for the month of January 2021, it is not the case for hourly differences, where it can be clearly seen that on average for the month between the hours of 4 pm and 7 pm Hydro Road is hotter. This shows that the while a daily average temperature is a useful tool for comparison and assessing effects, it can hinder the detection of potential effects on a waterway in the absence of finer scale temperature data, particularly for residual flow reaches.

As can be seen there is considerable variation in water temperatures within the residual reach when diurnal and concurrent climatic conditions are explored. This highlights the potential need for the consideration of a more dynamic approach to abstraction to help protect against potential chronic or acute effects on aquatic life. A dynamic approach on abstraction could take into account for concurrent climatic conditions, rainfall, the flow rate in the river itself, and the time of day to inform instantaneous abstraction rate. This could effectively result in either increased or decreased water extraction dependent on the immediate conditions being experienced within the catchment.

In summary the water temperature results for the 2020-2021 monitoring period indicated the effect of a colder than average summer, coupled with a typical change in water temperature in a downstream direction attributable to the HEPS.

After the Meeting of the Waters, water from the reservoir was thought to provide cooler water into the Waiwhakaiho River, and therefore impacts of higher water temperature are considered to be reduced compared with those at the residual flow reach. However, no current or historical temperature monitoring has been undertaken at the reservoir or immediately below the confluence. Shallow lakes are in many instances known to have higher temperatures than upstream rivers and, therefore, the potential for elevated water temperature caused by the combination of the residual flow reach and the lake reservoir is of concern to the Council. Therefore, water temperature monitoring below the confluence or in the lake would be useful in determining if elevated water temperatures, relative to that at SH3, are occurring. Discussions with the Company began 2020 surrounding post Meeting of the Waters monitoring. It was expected that a monitoring site would be established by the Council in the summer of 2020-2021, if, following trials, the use of a new temperature monitoring device was approved for use in compliance monitoring. Unfortunately, as a result of working through the trialling process the new device could not be established in this monitoring period, however, at the time of writing this report the device had been deployed. The success of the deployment and any data from that monitoring device will be discussed in the following monitoring period.



Table 7 Hourly mean water temperature (°C) data for January 2021 at Hydro Road. Red represents higher water temperature and blue represent lower temperature with white being mid-range temperature relative to data set.

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean	Min	Max	Range
Day																												
1	17.57	17.15	16.77	16.5	16.27	16.07	16.04	16.16	16.64	17.29	18.23	19.01	19.74	20.74	21.46	21.82	21.85	21.55	21.3	20.77	20.2	19.68	19.18	18.72	18.78	16.04	21.85	5.81
2	18.35	18.07	17.84	17.65	17.49	17.34	17.22	17.13	17.06	17.01	17.19	17.25	17.3	17.46	17.56	17.68	16.8	15.73	15.44	14.9	14.57	14.31	14.23	14.21	16.66	14.21	18.35	4.14
3	14.21	14.16	14.11	14.05	14.04	14.04	14.11	14.25	14.57	14.93	15.24	15.68	16.39	16.9	17.42	18.1	18.28	18.27	18.19	18.05	17.78	17.48	17.2	16.99	16.02	14.04	18.28	4.24
4	16.76	16.48	16.2	15.99	15.83	15.6	15.53	15.79	16.21	16.71	17.54	18.6	19.56	20.67	21.6	22.34	22.72	22.67	22.21	21.7	21.2	20.62	20.06	19.58	18.84	15.53	22.72	7.19
5	19.19	18.81	18.5	18.24	17.98	17.72	17.55	17.74	18.27	18.93	19.61	20.44	21.41	22.44	23.35	23.94	24.14	24.04	23.63	22.92	22.35	21.81	21.21	20.61	20.62	17.55	24.14	6.59
6	20.08	19.68	19.32	19.01	18.7	18.41	18.26	18.35	18.64	19.17	19.83	20.31	20.96	22.13	23.01	23.54	23.93	23.9	23.44	22.88	22.23	21.59	20.98	20.45	20.78	18.26	23.93	5.67
7	20.03	19.68	19.49	19.29	19.14	19	18.88	18.86	18.87	18.95	18.95	19	19.12	19.12	19.18	19.04	18.86	18.64	18.42	18.19	17.88	17.63	17.38	17.1	18.78	17.1	20.03	2.93
8	16.96	16.36	15.69	15.38	15.09	14.93	14.86	14.91	15.16	16.33	16.95	17.49	18.27	19.03	19.76	20.15	20.01	19.7	19.37	19.08	18.8	18.48	18.16	17.35	14.86	20.15	5.29	
9	17.89	17.62	17.41	17.27	17.06	16.93	16.94	17.17	17.61	18.24	18.81	18.82	19.4	20.43	20.44	20.66	21.47	21.35	21.02	20.6	20.15	19.7	19.19	18.66	18.95	16.93	21.47	4.54
10	18.21	17.83	17.54	17.28	17.08	16.79	16.59	16.76	16.98	17.31	17.98	19	19.97	20.95	21.8	22.31	22.42	22.2	21.69	21	20.3	19.66	19.04	18.54	19.13	16.59	22.42	5.83
11	18.15	17.87	17.56	17.32	17.12	17.01	16.89	16.97	17.46	17.71	17.9	18.81	19.32	20.25	21.07	21.6	21.89	21.87	21.6	21.12	20.6	20.02	19.4	18.9	19.1	16.89	21.89	5
12	18.49	18.23	18.02	17.79	17.55	17.32	17.21	17.36	17.81	18.3	18.94	19.77	20.73	21.71	22.62	23.24	23.54	23.45	23.04	22.48	21.9	21.29	20.73	20.24	20.07	17.21	23.54	6.33
13	19.88	19.53	19.25	18.99	18.75	18.51	18.37	18.48	18.96	19.46	19.9	20.94	21.99	22.99	23.75	24.4	24.82	24.55	24.02	23.44	22.78	22.11	21.52	21.03	21.18	18.37	24.82	6.45
14	20.63	20.22	19.94	19.66	19.39	19.03	18.81	18.93	19.39	19.97	20.54	21.04	21.87	22.81	23.68	24.29	24.41	24.29	23.91	23.4	22.81	22.2	21.57	20.93	21.41	18.81	24.41	5.6
15	20.45	19.95	19.59	19.21	18.89	18.58	18.32	18.42	18.87	19.34	19.95	20.84	21.67	22.72	23.59	24.32	24.47	24.18	23.61	22.88	22.26	21.63	21.12	20.67	21.06	18.32	24.47	6.15
16	20.27	20.04	19.84	19.7	19.53	19.38	19.29	19.33	19.58	19.89	20.51	21.01	21.76	22.52	23.04	23.9	23.93	23.72	23.35	22.74	22.17	21.57	20.97	20.49	21.19	19.29	23.93	4.64
17	20.03	19.69	19.48	19.32	19.14	18.97	18.85	18.85	18.86	18.99	19.06	19.15	19.06	19.21	19.61	20.2	20.76	20.79	20.55	20.28	19.9	19.53	19.12	18.79	19.51	18.79	20.79	2
18	18.51	18.21	17.92	17.69	17.44	17.16	17	17.05	17.28	17.53	17.67	18.35	19.13	19.59	20.4	20.68	20.57	20.41	20.2	19.8	19.34	18.98	18.62	18.31	18.66	17	20.68	3.68
19	18	17.81	17.58	17.39	17.21	17.08	17.05	17.15	17.45	17.97	18.4	18.97	19.5	20.29	20.98	21.26	20.87	20.42	20.14	19.72	19.24	18.78	18.39	18.02	18.74	17.05	21.26	4.21
20	17.27	15.97	15.18	14.61	14.29	14.06	13.86	13.88	14.11	14.53	15.15	15.72	16.6	17.14	17.41	17.67	17.49	17.26	17.06	16.58	16.16	15.78	15.45	15.13	15.76	13.86	17.67	3.81
21	14.83	14.59	14.39	14.25	14.09	13.91	13.8	13.83	14.08	14.44	14.91	15.79	16.31	16.94	17.8	18.54	18.68	18.43	18.08	17.51	16.97	16.43	16.01	15.57	15.84	13.8	18.68	4.88
22	15.22	14.8	14.28	13.79	13.43	13.04	12.47	12.47	12.96	13.22	13.58	14.37	15.17	15.94	16.92	17.93	18.42	18.58	18.48	18.06	17.57	17.12	16.71	16.38	15.45	12.47	18.58	6.11
23	16.1	16	15.87	15.71	15.61	15.47	15.3	15.39	15.64	16.02	16.2	16.72	17.49	17.99	18.42	18.78	18.93	18.93	18.77	18.31	17.92	17.66	17.4	17.14	16.99	15.3	18.93	3.63
24	16.93	16.78	16.7	16.62	16.58	16.53	16.52	16.61	16.89	17.54	18.13	18.47	18.99	19.06	19.46	19.96	20.05	20.06	19.66	19.07	18.48	17.98	17.58	17.2	17.99	16.52	20.06	3.54
25	16.79	16.48	16.22	16.02	15.82	15.62	15.46	15.24	15.08	15.58	16.53	17.52	18.7	19.86	20.99	21.71	21.99	21.88	21.31	20.66	20.16	19.67	19.14	18.65	18.21	15.08	21.99	6.91
26	18.33	18.09	17.89	17.7	17.5	17.28	17.16	17.28	17.68	18.18	19.05	19.89	20.86	21.97	22.92	23.66	23.92	23.84	23.49	22.88	22.28	21.62	21.02	20.45	20.21	17.16	23.92	6.76
27	20	19.63	19.4	19.22	19.05	18.88	18.79	18.76	18.85	19.03	19.32	19.71	20.06	20.31	20.62	20.81	20.8	20.91	20.75	20.33	20.03	19.76	19.47	19.17	19.74	18.76	20.91	2.15
28	18.88	18.69	18.51	18.34	18.21	18.07	17.94	17.92	18.01	18.45	19.1	19.71	19.66	19.48	19.48	19.61	19.82	19.91	19.91	19.31	18.61	18.14	17.77	17.38	16.94	18.66	16.94	1.91
29	16.65	16.38	16.11	15.84	15.57	15.31	15.16	15.17	15.38	16.03	17.04	17.96	18.67	19.53	20.13	20.5	20.38	19.85	19.11	18.33	17.53	16.79	16.18	17.28	15.16	20.5	5.34	
30	15.64	15.12	14.68	14.32	13.98	13.71	13.49	13.53	13.91	14.46	15.11	15.82	16.7	17.81	18.82	19.57	19.89	19.79	19.34	18.62	17.91	17.26	16.62	16.1	16.34	13.49	19.89	6.4
31	15.63	15.28	15.01	14.74	14.49	14.27	14.12	14.23	14.71	15.36	16.1	16.95	17.92	19.09	20.14	20.86	21.19	21.17	20.81	20.21	19.59	18.93	18.31	17.7	17.37	14.12	21.19	7.07
Mean	17.93	17.59	17.30	17.06	16.85	16.65	16.51	16.58	16.86	17.27	17.80	18.44	19.12	19.85	20.52	21.04	21.21	21.07	20.72	20.20	19.69	19.19	18.72	18.29				
Min	14.21	14.16	14.11	13.79	13.43	13.04	12.47	12.47	12.96	13.22	13.58	14.37	15.17	15.94	16.92	17.67	16.8	15.73	15.44	14.9	14.57	14.31	14.23	14.21				
Max	20.63	20.22	19.94	19.7	19.53	19.38	19.29	19.33	19.58	19.97	20.54	21.04	21.99	22.99	23.75	24.4	24.82	24.55	24.02	23.44	22.81	22.2	21.57	21.03				
Range	6.42	6.06	5.83	5.91	6.1	6.34	6.82	6.86	6.62	6.75	6.96	6.67	6.82	7.05	6.83	6.73	8.02	8.82	8.58	8.54	8.24	7.89	7.34	6.82				

Table 8 Difference in mean hourly water temperature (°C) data for January 2021 between Rimu Street and Hydro Road. Positive values represent hotter temperatures at Rimu Street. Red represents hotter temperatures at Hydro Road. Green represents occasions where the mean temperature difference for a selected hour is higher throughout the month at the Hydro Road Site

Hour	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Mean
Day 1	0.76	0.81	0.84	0.81	0.81	0.92	0.96	0.97	0.86	0.84	0.59	0.4	0.18	-0.45	-0.87	-0.8	-0.58	-0.24	-0.01	0.22	0.23	0.18	0.14	0.19	0.32
2	0.23	0.33	0.43	0.51	0.52	0.68	0.75	0.76	0.74	0.89	0.92	0.95	0.94	0.71	0.61	0.58	1.58	2.52	2.25	2.24	1.83	1.56	1.37	1.34	1.05
3	1.31	1.33	1.32	1.32	1.26	1.17	1.06	1.02	0.97	1.01	0.87	0.71	0.41	0.25	0.01	-0.49	-0.6	-0.59	-0.6	-0.57	-0.46	-0.38	-0.38	-0.36	0.4
4	-0.3	-0.17	-0.04	0.05	0.13	0.26	0.37	0.32	0.28	0.31	0.13	-0.32	-0.64	-1.18	-1.53	-1.85	-1.96	-1.88	-1.59	-1.35	-1.27	-1.18	-1.09	-0.82	-0.64
5	-0.46	-0.15	0.05	0.18	0.33	0.46	0.53	0.62	0.47	0.13	0.02	-0.17	-0.47	-0.74	-1.06	-1.3	-1.34	-1.26	-1.09	-0.86	-0.74	-0.75	-0.71	-0.58	-0.37
6	-0.35	-0.18	0.01	0.22	0.43	0.62	0.81	0.96	0.93	1.08	0.96	0.86	0.57	-0.07	-0.49	-0.54	-0.57	-0.38	-0.04	0.22	0.51	0.82	1.08	1.23	0.36
7	1.22	1.22	1.14	1.09	1.04	1.04	1.08	1.08	1.11	1.05	1.05	0.95	0.64	0.52	0.53	0.78	0.93	1.01	1.18	1.11	1.26	1.3	1.46	1.64	1.06
8	1.73	2.2	2.71	1.85	1.33	1.23	1.15	1.17	1.15	1.08	0.9	0.89	0.77	0.52	0.22	-0.2	-0.49	-0.55	-0.48	-0.52	-0.49	-0.39	-0.24	-0.01	0.65
9	0.17	0.37	0.53	0.67	0.82	0.86	0.86	0.75	0.61	0.15	-0.3	0	-0.45	-1.29	-1.25	-1.33	-2.06	-2.12	-1.96	-1.72	-1.43	-1.07	-0.62	-0.23	-0.42
10	-0.02	0.16	0.25	0.39	0.53	0.7	0.8	0.85	0.87	0.86	0.56	-0.12	-0.57	-0.76	-1.1	-1.44	-1.69	-1.59	-1.29	-0.92	-0.57	-0.26	0.04	0.34	-0.17
11	0.54	0.65	0.77	0.87	0.93	0.95	1.06	1.08	0.87	0.91	0.88	0.33	0.46	0.36	0.04	-0.42	-0.88	-1.06	-1.04	-0.82	-0.53	-0.21	0.2	0.47	0.27
12	0.69	0.76	0.79	0.82	0.85	0.88	0.87	0.94	1.03	0.79	0.41	-0.05	-0.14	-0.3	-0.63	-0.93	-1.08	-0.95	-0.65	-0.27	0.13	0.59	0.88	1.11	0.27
13	1.19	1.28	1.29	1.26	1.25	1.24	1.22	1.22	1.23	1.28	1.34	0.95	0.46	-0.22	-0.71	-1.02	-1.1	-0.57	-0.17	-0.05	0.1	0.23	0.42	0.58	0.53
14	0.68	0.87	1.03	1.17	1.27	1.42	1.53	1.56	1.61	1.49	1.32	1.35	1.1	0.44	-0.16	-0.3	-0.13	-0.03	0.15	0.33	0.44	0.54	0.68	0.87	0.8
15	1.02	1.23	1.33	1.48	1.55	1.65	1.72	1.72	1.75	1.74	1.47	0.96	0.47	-0.21	-0.4	-0.58	-0.57	-0.35	-0.07	0.24	0.39	0.63	0.88	1.02	0.79
16	1.22	1.27	1.3	1.26	1.24	1.2	1.21	1.25	1.58	1.46	1.22	0.9	0.26	-0.11	-0.74	-0.82	-0.72	-0.47	0.14	0.58	0.98	1.29	1.51	1.76	
17	1.66	1.75	1.76	1.68	1.63	1.62	1.64	1.59	1.53	1.55	1.48	1.36	1.27	1.3	0.9	0.58	0.11	0.02	0.26	0.45	0.85	1.15	1.23	1.13	1.19
18	1.08	1.17	1.21	1.24	1.3	1.42	1.5	1.51	1.6	1.41	1.15	0.81	0.57	0.81	0.54	0.45	0.57	0.67	0.68	0.88	1.08	1.15	1.28	1.32	1.06
19	1.41	1.53	1.61	1.69	1.71	1.72	1.7	1.68	1.63	1.51	1.2	0.89	0.73	0.55	0.12	0.15	0.5	0.8	0.72	0.52	0.41	0.37	0.42	0.54	1.01
20	1.05	2.18	2.79	3.11	2.91	2.57	2.31	1.91	1.57	1.68	1.56	1.63	1.23	0.95	0.7	0.64	0.62	0.61	0.82	1.04	1.12	1.17	1.24	1.37	1.53
21	1.48	1.55	1.6	1.58	1.55	1.55	1.66	1.67	1.28	0.77	1	0.78	0.56	0.3	-0.11	-0.48	-0.46	-0.19	0.12	0.43	0.58	0.75	0.9	1.11	0.83
22	1.27	1.49	1.79	2.04	2.17	2.36	2.72	2.54	2.08	1.75	1.32	0.91	0.65	0.28	-0.43	-1.14	-1.28	-1.39	-1.35	-1.01	-0.62	-0.33	-0.11	0.01	0.66
23	0.13	0.13	0.11	0.2	0.22	0.27	0.42	0.44	0.47	0.6	0.51	0.15	-0.43	-0.57	-0.32	-0.38	-0.33	-0.27	-0.19	0.06	0.24	0.28	0.33	0.38	0.1
24	0.46	0.49	0.51	0.55	0.57	0.57	0.6	0.6	0.59	0.45	0.29	0.26	-0.06	0.28	0.03	-0.35	-0.37	-0.45	-0.41	-0.32	-0.15	0.07	0.23	0.4	0.2
25	0.58	0.7	0.75	0.76	0.77	0.83	0.9	1.18	1.56	1.24	0.78	0.69	0.36	-0.15	-0.67	-1.04	-1.09	-0.79	-0.27	-0.06	-0.36	-0.46	-0.21	0.08	0.25
26	0.29	0.4	0.45	0.5	0.6	0.74	0.75	0.72	0.91	1.08	0.44	0.07	-0.11	-0.58	-1.06	-1.41	-1.32	-1	-0.72	-0.46	-0.66	-0.96	-0.92	-0.64	-0.12
27	-0.34	-0.06	0.12	0.27	0.39	0.55	0.64	0.72	0.71	0.67	0.69	0.5	0.42	0.53	0.31	0.13	0.18	-0.03	-0.37	-0.32	-0.21	-0.12	0.03	0.12	0.23
28	0.28	0.32	0.38	0.49	0.55	0.66	0.75	0.83	0.89	0.96	0.85	0.47	0.53	0.7	0.63	0.56	0.48	0.34	0.73	1.02	1.11	1.13	1.22	1.43	0.72
29	1.43	1.43	1.45	1.42	1.43	1.52	1.59	1.59	1.58	1.7	1.27	0.66	0.2	0.12	-0.09	-0.21	-0.37	-0.22	0.11	0.51	0.86	1.22	1.55	1.7	0.94
30	1.8	1.94	2.01	1.98	2.03	2.04	2.01	1.88	1.9	1.8	1.62	1.4	1.09	0.48	-0.2	-0.84	-1.03	-0.84	-0.43	0.13	0.62	1.06	1.41	1.68	1.06
31	1.93	2.03	2.05	2.09	2.11	2.1	2.05	1.87	1.88	1.85	1.72	1.49	1.2	0.58	-0.14	-0.74	-1.07	-1.13	-0.99	-0.56	0.04	0.85	1.23	1.51	1
Mean	0.78	0.94	1.04	1.08	1.1	1.15	1.2	1.19	1.16	1.1	0.92	0.68	0.41	0.11	-0.22	-0.47	-0.52	-0.41	-0.23	-0.01	0.16	0.32	0.49	0.66	

### 2.1.4.2 Macroinvertebrate monitoring

Two biomonitoring surveys were conducted during the period under review, on 18 January 2021 and 26 March 2021. The results and conclusions of these surveys are summarised in this report. Full copies of the biomonitoring reports are available from the Council upon request.

The Council's standard 'kick-sampling' technique was used at four established sites (Hydro Road, SH3, DD1, and RR1) to collect streambed macroinvertebrates from the Waiwhakaiho River on each sampling occasion (Figure 11 and Figure 12). Samples were processed to provide number of taxa (richness), MCI and SQMCI scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI takes into account taxa abundances as well as sensitivity to pollution. It may indicate subtle changes in communities, and therefore be the more relevant index if non-organic impacts are occurring. Significant differences in either the MCI or the SQMCI between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

Results from the January survey show a decrease in macroinvertebrate health at all sites compared to the previous survey aside from site RR1 (Figure 11). The MCI score obtained at the upstream site SH3 was uncharacteristically low for the conditions and is the lowest score recorded since July of 1983. Despite the high rainfall throughout the summer season and elevated flows in the 60 day period leading up to the survey, the control site shows a 22 unit decrease in MCI score compared to the previous survey, which was undertaken in much drier conditions. The lack of any obvious natural cause of the decline indicates that there may have been upstream influences that potentially had a negative effect, or a potential sampling error caused by difficult sampling conditions at the control site (SH3). There was an overall negative trend in MCI and SQMCI in a downstream direction starting at site RR1. The SQMCI recorded at site SH3 is the lowest recorded score since November of 2002. Site DD1 recorded MCI and SQMCI scores significantly lower than site RR1, indicating potential negative effects from discharges upstream or other negative effects associated with the reduced flow throughout the residual reach. A comparison of historical data had shown that there is a definitive negative effect associated with the abstraction of water on the residual reach and potentially below the meeting of the waters, which is exacerbated at low flow levels.

The March survey results showed a decrease in macroinvertebrate health at the downstream Hydro Road and DD1 sites when compared to the previous January survey, while the upstream sites, SH3 and RR1, showed an improvement (Figure 12). When compared with the results of the samples collected at SH3 and RR1, it is clear that there is deterioration of macroinvertebrate community health at the Hydro Road and DD1, with the MCI scores being significantly (Stark, 1998) lower. There was a decrease in MCI at RR1 from SH3, however, this was not significant. The decrease in macroinvertebrate community health is particularly evident between the SH3 and Hydro Road site, with the MCI score for the upstream site having 'good' health and the site near Hydro Road having 'very poor' health. SH3 and RR1 saw an increase in MCI from the previous January results, which was significant and largely expected for SH3 given the previous assumed sampling issue. Hydro Road and DD1 both saw a significant decline in MCI, with both sites setting historic low scores. There was an overall negative trend in MCI in a downstream direction.

The decrease in taxa richness between sites is also of note, with the Hydro Road and DD1 site having less than half the taxa found at the SH3 and RR1 sites. At Hydro Road, no highly sensitive taxa, and only one moderately sensitive taxa was found, with the remaining being tolerant taxa. This is in contrast to the species assemblages found at the SH3 site, as well as the RR1 site, where a number of highly and moderately sensitive species were found. Each of the taxa results across the sites were within historical range, with the exception for Hydro Road which was now just below its record low.

Any decrease downstream is less evident in the SQMCI scores, which categorises the SH3 site as having 'poor' health and all other sites being categorised as having 'very poor' health. The SQMCI result saw a minor increase for SH3 and DD1, with SH3 remaining well below the median value for the site. There were some larger but non-significant declines in SQMCI at the site RR1 and Hydro Road, with Hydro Road sitting well below the median for the site as well.

A closer examination of the taxa recorded at the hydro road site shows that the primary reason for the deterioration in MCI and SQMCI scores is the increased abundance of taxa commonly associated with higher algal biomass. There is also a consequent reduction in the abundance of 'sensitive' taxa, most of which require a streambed which is relatively clear of algae. Observations made at the time of sampling indicated that algal biomass at the Hydro Road site was significantly higher than that at the other sites. Several factors can contribute to an increase in algal biomass in the residual reach including: reduced flood peaks which decrease the amount of periphyton scour; reduced water depth which increases light reaching the riverbed; and lower flows which increase water temperatures. All these factors increase periphyton growth rates and ultimately periphyton biomass.

Increased water temperatures can in addition to promoting algal growth, directly impact the macroinvertebrate community, reducing the number and abundance of 'sensitive' taxa, which generally prefer cooler water temperatures. The water temperature at Hydro Road site for both the spring and summer surveys are elevated respectively when compared to that of the upstream surveys at SH3 as clearly shown in the temperature section of this report. It is likely that the differences in temperature would have directly impacted the macroinvertebrate community, reducing the number and abundance of 'sensitive' taxa.

Observing historic data has shown that there is a definitive negative effect associated with the abstraction of water on the residual reach and potentially below the meeting of the waters, which is exacerbated at low flow levels. The increased rate of take allowed by the variation of consent 2053 has now been exercised in the five prior years. Subsequent monitoring since the variation shows a continual increase in the proportion of the community comprising 'tolerant' taxa when compared to the prior surveys on a seasonal and in most cases an overall basis. There has also been a decrease in the abundance and richness of sensitive taxa. The spring survey also noted some effects of the water abstraction, however, the macroinvertebrate community was overall in a slightly healthier state due to expected natural seasonal variation. These observed macroinvertebrate community changes most likely reflect the effects of the water abstraction combined with natural seasonal variation. Similar changes have not been observed at the upstream monitoring site.

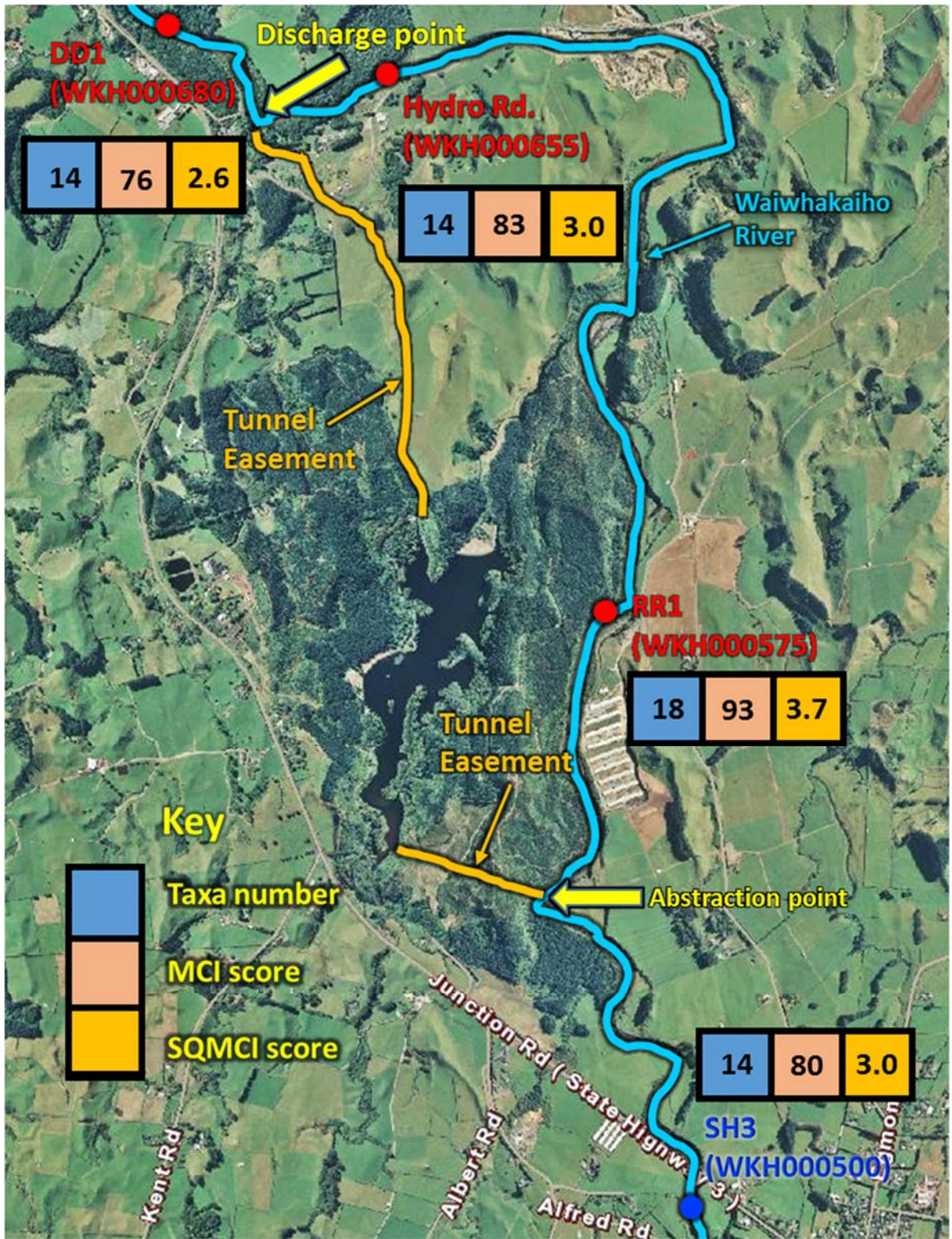


Figure 11 Biological monitoring sites in the Waiwhakaiho River in relation to the Mangorei Power Scheme with survey results, January 2021

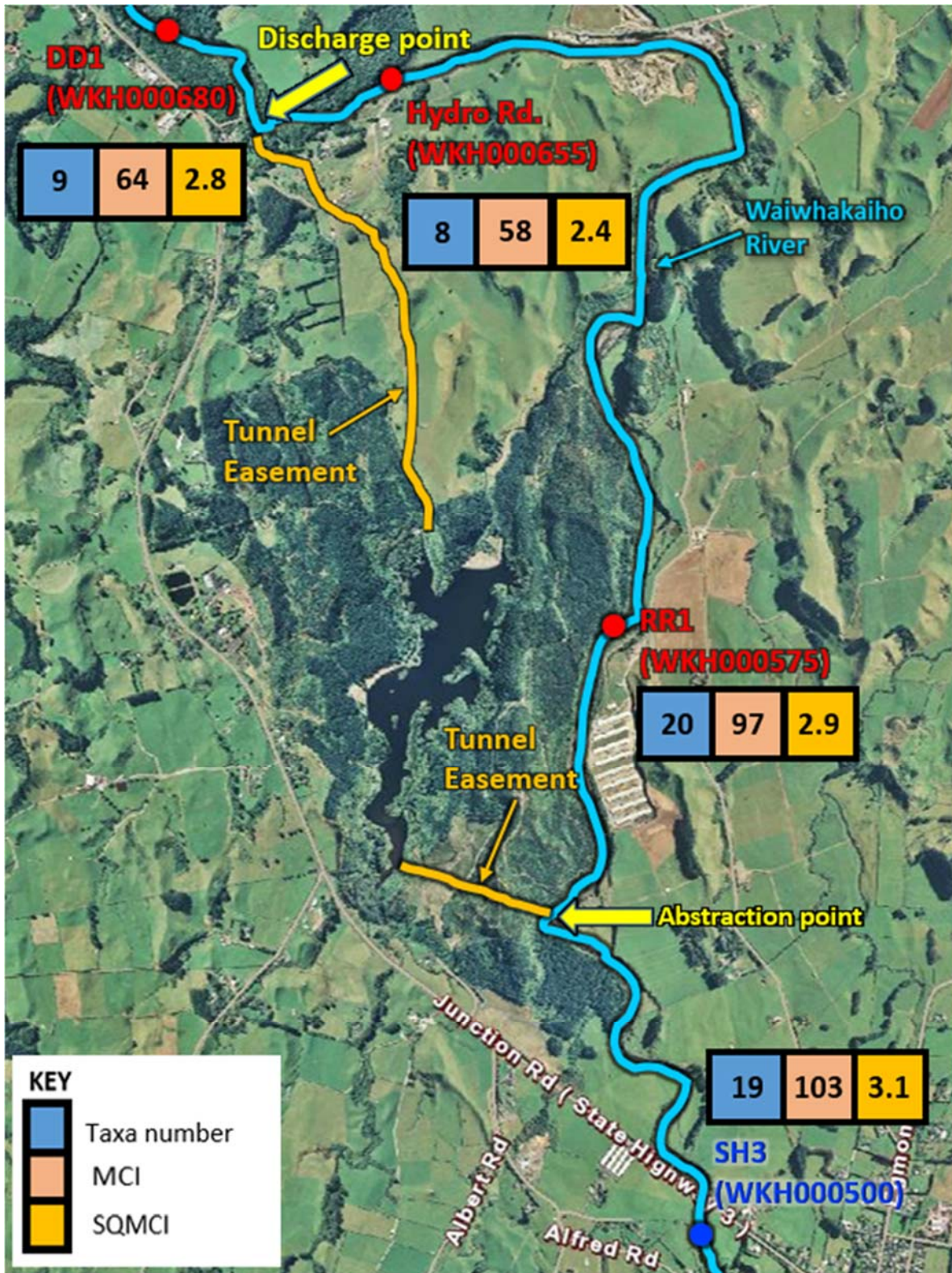


Figure 12 Biological monitoring sites in the Waiwhakaiho River in relation to the Mangorei Power Scheme with survey results, March 2021

### 2.1.4.3 Fish monitoring

Provisional fish monitoring was added into the compliance programme for the Mangorei HEP scheme in this monitoring period. As the Company had undertaken its own fish monitoring as part of their re-consenting process in the previous monitoring period, it was decided that the Council would not undertake its own compliance monitoring. Further fish monitoring is still being considered for the 2021-2022 period, however at this time, it is not expected that monitoring will be undertaken until the consenting process is underway. It is possible that more specific monitoring information may be sought through the consenting process. Liaison with the Company regarding future and ongoing fish monitoring at the scheme is expected to form a significant part of the re-consenting process.

### 2.1.4.4 Adult eel and elver transfers

Every year, the Company transfers adult eels that are attempting to migrate downstream through Lake Mangamahoe, so that they can continue their migration downstream of the HEP scheme. These eels tend to accumulate where water is taken from the lake for generation purposes, and can be captured using nets set in this location. This system has been employed each autumn since 2009, with the number of eels transferred varying significantly each year. The numbers transferred are presented in Table 9. A total of 37 adult eels were transferred in the reported period. This included 15 longfin eel and 22 shortfin eel. Overall, the number of eels transferred in the 2020-2021 period was a mid-range result for this transfer programme. It is understood that commercial eeling does occur within the lake which likely influences the number of migrating adult eels caught within the lake from year to year. Any specific details of this eeling is unknown at the time writing this report, however, this information, if available, would be useful for the Company in terms of managing downstream migrations at the scheme.

In early summer, juvenile eels, known as elvers, migrate up the Waiwhakaiho River. Some of these elvers are attracted by the generation flow from the station, and move up the powerhouse outlet canal and into the power station. In 2002, a trap was installed within the power station, this trap being a smaller version of the one used at the Patea hydro dam. Elvers are collected from this trap, weighed and then transferred to the Waiwhakaiho River residual flow reach upstream of the Meeting of the Waters. The elver trap was visited on one occasion during this period, with a number of elver seen within the trap. A few elver were seen dead outside of the trap, which had occurred as a result of trap 'leakage' or during the transfer process; this is a fairly typical observation given the climbing abilities of the fish which can be hard to cater for. Due to trap inlet being located under the station it was not possible to assess the effectiveness of the setup in drawing elver to the trap. Like many other elver traps throughout the country, competing attractant flows and barriers can influence trap effectiveness as well as exposure of migrating fish to predation. It is understood that a number of large resident eels live under the station, which is perhaps due to a large migrating fish food source. Unfortunately, there are few opportunities to make a more thorough inspection of the trap under normal operations due to H&S concerns.

This trapping and transfer programme commenced in the 2002-2003 period with the numbers of elver trapped and transferred summarised in Table 10. This data was collected and supplied by the Company. Numbers of elvers were calculated from a calibration exercise performed at the trap (in late January 2003) when it was determined that 1 kg equated to 1,200 elvers, although subsequent calibration exercises in mid-December 2005 and late January 2009 found that 1 kg equated to 760 and 1,030 elvers at these times, respectively.

The total number of elver trapped and transferred in this monitoring period was slightly lower than that transferred in the previous year but was still the fourth highest number transferred on record (Table 10).

Table 9 Numbers of adult eels transferred at the Mangorei HEP scheme since 2009

Year	Number of longfin eels transferred	Number of shortfin eels transferred	Number of unidentified eels transferred	Number of mortalities observed	Total number of eels transferred
2009	-	-	171	-	171
2010	-	-	4	-	4
2011	-	-	7	-	7
2012	-	-	7	-	7
2013	-	-	21	-	21
2014	13	30	44	-	87
2015	21	8	-	-	29
2016	11	1	-	-	12
2017	40	17	-	-	57
2018	11	10	-	-	21
2019	-	3	-	-	3
2020	16	18	-	0	34
2021	15	22	-	0	37

Table 10 Estimated numbers of elvers trapped and transferred at the Mangorei HEP scheme powerhouse in the monitoring years to date

Monitoring year	Transfer period	Total number of elvers	Peak daily number	Peak month
2002-2003	9 Jan 03-25 Apr 03	18,160	1,020	Jan 2003
2003-2004	4 Dec 03-25 Mar 04	19,445	1,715	Jan 2004
2004-2005	14 Jan 04-21 Mar 05	9,780	600	Jan 2005
2005-2006	30 Nov 05-20 Mar 06	19,965	1,140	Feb 2006
2006-2007	3 Jan 07-26 Apr 07	25,230	1,910	Jan 2007
2007-2009	30 Nov 07-26 Mar 08	29,668	940	Jan 2008
2008-2009	2 Dec 08-16 Mar 09	38,040	1,140	Jan 2009
2009-2010	18 Dec 09-25 Feb 10	8,566	237	Jan 2010
2010-2011	8 Nov 10-28 Feb 11	18,776	525	(late) Dec 2010
2011-2012	21 Jan 12-31 Mar 12	640	96	Feb 2012
2012-2013	14 Dec 12-12 Apr 13	15,972	270	Jan 2013
2013-2014	20 Dec 13-28 Mar 14	19,680	566	Jan 2014
2014-2015	1 Nov 14-30 Apr 15	13,200	471	Jan 2015
2015-2016	11 Dec 15-24 Mar 16	24,588	906	Jan 2016
2016-2017	16 Dec 16-7 Apr 17	18,696	411	Feb 2017
2017-2018	8 Dec 17-5 Apr 18	15,828	1,200	Dec 2017
2018-2019	7 Dec 18-15 Mar 19	37,176	2,256	Jan 2019



Monitoring year	Transfer period	Total number of elvers	Peak daily number	Peak month
2019-2020	6 Dec 19-30 Apr 20	35,532	777	Jan 2020
2020-2021	20 Nov 20-12 Apr 21	34,284	1244	Jan 2021

The traps are typically operative from 1 November each year, with elvers usually arriving mid-December. In the monitoring period the first elvers were trapped on 20 November 2020. The trap was shut down in the middle of April 2021, as the elver run had effectively stopped at that time. During the six month period (late November 2020 to April 2021), a relatively high number of elvers (approximately 34,300 based on 1,200 individuals per kg) was caught and transferred. The majority of numbers were recorded in January 2021 (Table 11).

Although the number of elvers transferred at the Mangorei scheme are low compared to those transferred at the Company's Patea scheme, it is likely that a significant proportion of upstream elver movements would follow the main channel of the Waiwhakaiho River rather than enter the smaller outlet channel of the powerhouse outlet canal.

Table 11 Numbers of elvers transferred during the 2020-2021 period

Date	Elver numbers		Cumulative total
	Interval (days)	Elver per day	
20-Nov-20	1	300	300
11-Dec-20	21	22	768
18-Dec-20	7	110	1,536
23-Dec-20	5	197	2,520
30-Dec-20	7	134	3,456
4-Jan-21	5	768	7,296
8-Jan-21	4	537	9,444
15-Jan-21	7	315	11,652
21-Jan-21	6	736	16,068
26-Jan-21	5	583	18,984
29-Jan-21	3	1,244	22,716
5-Feb-21	7	471	26,016
12-Feb-21	7	336	28,368
19-Feb-21	7	182	29,640
26-Feb-21	7	171	30,840
5-Mar-21	7	99	31,536
12-Mar-21	7	57	31,932
26-Mar-21	14	95	33,264
9-Apr-21	14	40	33,828
15-Apr-21	6	76	34,284

## 2.2 Incidents, investigations, and interventions

The monitoring programme for the year was based on what was considered to be an appropriate level of monitoring, review of data, and liaison with the Company. During the year matters may arise which require additional activity by the Council, for example provision of advice and information, or investigation of

potential or actual causes of non-compliance or failure to maintain good practices. A pro-active approach, that in the first instance avoids issues occurring, is favoured.

For all significant compliance issues, as well as complaints from the public, the Council maintains a database record. The record includes events where the individual/organisation concerned has itself notified the Council. Details of any investigation and corrective action taken are recorded for non-compliant events.

Complaints may be alleged to be associated with a particular site. If there is potentially an issue of legal liability, the Council must be able to prove by investigation that the identified individual/organisation is indeed the source of the incident (or that the allegation cannot be proven).

In the 2020-2021 period, the Council was not required to undertake significant additional investigations and interventions, or record incidents, in association with the Company's conditions in resource consents or provisions in Regional Plans.

### 2.3 Riparian planting

As per special condition 8 of consent 2053-3.2, the Company donates annually to the Council (\$5,000-adjusted to the consumer price index) for the purpose of providing riparian planting and management in the Waiwhakaiho River catchment.

At the time of compiling this report, six landholders in the Waiwhakaiho catchment had applied to be subsidised 50% of the cost of plants planted within the catchment for riparian protection in the 2020-2021 period, with just under \$24,000, available to them at the start of the period. It is expected that there will be approximately \$17,000 available for the 2021-2022 period following the next consent holder input.

### 2.4 Stakeholders' meeting

As a requirement under a special condition in various Mangorei HEP scheme consents, an annual meeting of interested stakeholders is held to discuss any matters relating to the exercise of these consents, but particularly monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.

Previously, stakeholders meetings have only been held when particular issues warranted it. No such issues were raised during the reported period, however, as a result of the upcoming consenting process for many of the consents that expire in 2021, it was agreed that the scheme walkover held in December 2018 was sufficient to meet the requirements of the stakeholder meeting that year. The Company invited various stakeholders from the Department of Conservation, Fish and Game, Ngati Tawhirikura Hapu (Te Atiawa), the New Plymouth District Council, the Council, and various consultants to visit the scheme, where the history and future of the scheme was discussed. The Company has informed the Council that they have continued to engage with stakeholders as part of the upcoming consenting process for the scheme during this period and they have considered that a stakeholder meeting has therefore not been necessary. The Council has not been approached by stakeholders with queries during this period or with requests for a stakeholder meeting. On 8 November 2021, the Company provided the Council with a brief report outlining the stakeholder engagement undertaken over the last few years. The Council is satisfied that the submission shows the Company is actively engaging with stakeholders through a less formal process. Should any stakeholder have any issues or wish to have a meeting they can formally request it. The stakeholder meeting may be a good mechanism for the Company to engage with adjacent landowners and other interested parties in initiating the resource consent renewal process.

## 3 Discussion

### 3.1 Discussion of site performance

Monitoring undertaken over the 2020-2021 period has concentrated on the provision and maintenance of appropriate residual flow releases below the intake weir, maintenance of lake levels and discharge flows, provision of fish passage, and the provision of data from the Company as required.

The station is largely controlled automatically, with the river intake gates opening or closing dependant on flows in the Waiwhakaiho River. The data recorded by the Company's water level recorder located downstream of the intake weir is used in this control system and has resulted in a good standard of compliance with the required residual flows.

Compliance with the residual flow requirements was determined through monthly gaugings, which found residual flow requirements were being complied with on all occasions. Despite the presence of telemetered water level monitoring immediately downstream of the intake weir, these gaugings retain their importance, as maintaining the accuracy of flow rates calculated with level data from this recorder is often difficult, given the frequent changes in the river bed cross section at the monitoring location.

Daily minimum powerhouse generation releases of 950 L/s during daylight hours were successfully maintained by the Company. The automatic compensation valve at the powerhouse, which removed the need for spillages via the intake weir during power station outages was required on several occasions. At times, spillage over the intake weir was necessary when maintenance precluded a discharge from the station. The spreading of daily power generation flows over longer daylight periods has benefits for water quality and ecology in the lower river, as well as providing recreational opportunities in reaches commonly used by the public near and within New Plymouth city boundaries.

Compliance with Lake Mangamahoe minimum lake levels was also achieved throughout the period, with few lake spillages. Furthermore, liaison with the Company indicated good compliance with the new maximum abstraction rate of 10 cumecs.

The fish pass was maintained and operated successfully during the monitoring period. Typically there are occasions where floods deposit a large amount of river gravels and cobbles in the pass, however, the Company appears to have cleared the pass as quickly as practicable following any such events with no inspections showing major concerns, although some minor improvements could be made to ensure fish passage is as comprehensive as possible.

Overall, in terms of compliance with consent conditions, the performance of the Company in relation to the Mangorei HEP scheme was of a high standard throughout the 2020-2021 period.

### 3.2 Environmental effects of exercise of consents

The primary impact of the Mangorei HEP scheme is the reduced flow in the Waiwhakaiho River. This reduced flow is largely limited to the residual flow reach, as the release of at least 950 L/s during the day from the station results in higher flows in the river downstream of the scheme. In addition, the variable residual flow requirements ensures that the scheme can make good use of winter flows, while providing a higher residual flow in the summer.

River water temperature records illustrate the impacts of residual flow releases on the lower river reaches and also indicate a general trend of a rise in water temperatures along the length of the river in more recent years (although the current year recorded below average temperatures in January and February), despite the increase in the summer residual flow release. The increasing trend in temperatures are also evident upstream of the scheme and are therefore due, at least in part, to warmer weather, possibly related to climate change.

Temperatures in excess of 25°C can be lethal to some fish, including sportfish such as rainbow and brown trout. Temperatures in excess of 20°C for extended periods may also negatively impact fish through stress. Over extended periods, this can make fish more susceptible to infection, can cause fish to lose body condition, and can even lead to fish death. This kind of warming can cause fish to change behaviours, including seeking cooler tributary flows. Because the residual reach is the only fish passage to the upper Waiwhakaiho and its tributaries, active management of the temperature in the residual reach is imperative.

In terms of the warming of waters in a downstream direction, the abstraction of water results in less buffering of the temperature, and consequently can result in much warmer waters than would occur naturally. This was acknowledged when the current consents were granted in 1998, with a higher residual flow required in summer than winter.

Macroinvertebrate sampling reflected the high water quality and habitat conditions found in the river, but also reflected issues with algal proliferation and other potential effects, such as elevated water temperatures, within the residual flow reach and below the meeting of the waters. Sampling showed an impact on the presence of 'sensitive' taxa and their relative abundance, causing the community to be more compositionally and numerically dominated by 'tolerant' taxa in a downstream direction within the river. A decrease in the macroinvertebrate community health was seen at the Hydro Road site within the residual reach and the site below the meeting of waters. The results suggest an impact from the increased rate of take allowed by the variation of consent 2053 since 2016.

In terms of fish passage, the fish pass is in general considered adequate to provide for the passage of all fish species expected to migrate up to and beyond the weir. This includes all native migratory species recorded as present in the residual flow reach, and adult trout, which have been shown to be capable of negotiating the pass. Maintenance is usually required to maintain this passage and based on the various inspections it appears to have been done without excessive delay. There are still opportunities available to better ensure fish passage is as comprehensive as possible, such as with minimising attractant flows that do not lead to the pass at the weir, removing some potential velocity barriers within the pass, and decreasing predation opportunities which were possibly observed with large trout positioning themselves at the entrance and exit of the pass.

The Company also transferred elvers that were trapped at the power station for release in the residual flow reach, and transferred migrating adult eels from Lake Mangamahoe into the lower Waiwhakaiho River. A mid-range number of adult eels were transferred in the 2020-2021 period, and the fourth highest number of elvers on record were transferred, a number slightly less than that transferred in the previous season.

The Company is required to provide some mitigation for the effects of the diversion of the river flow by financially contributing to riparian management elsewhere in the Waiwhakaiho catchment. This is done by subsidising the cost of plants sold to landowners in the catchments, an opportunity taken up by six landowners during the reported period.

Finally, the Company is also required to undertake sediment and lake bathymetric monitoring, in relation to a consent variation that provided for an increased rate of take, so that the Company can take advantage of flood flows. The initial bathymetric survey of Lake Mangamahoe was commissioned by the Company and performed in mid-2013, with another survey completed March 2017. The next bathymetry survey was scheduled to be completed in December 2020. On 9 December 2021 a report titled 'Mangorei HEPS Sediment quantity and survey report' was submitted to Council, the report was dated December 2020. This report is the only update with regard to sediment in the lake to be received by Council in this monitoring period, and was received after significant delay and numerous requests for further information starting from November 2020. The report will be reviewed in 2022 and an assessment of compliance will be made against the relevant consents.

### 3.3 Evaluation of performance

A tabular summary of the consent holder's compliance record for the year under review is set out in Tables 12 to 19.

Table 12 Summary of performance for consent 2053-3.2

<b>Purpose: To divert water from the river into Lake Mangamahoe</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Continuous daily generation of 950 L/s between 8am & 6pm	Supply of data by consent holder	Yes
2. Seasonal residual flows released over the weir	Inspections, gaugings (TRC), and automatic flow recording (by consent holder)	Yes
3. Cessation of diversion when Waiwhakaiho River $\geq 85$ cumecs	Liaison with consent holder	Yes
4. Maintenance of residual flow recording device and supply of records	Supply of levels by consent holder	Yes
5. Provision of suitable fish passage in residual flow channel	Inspections	Yes
6. Provision of sediment/lake bathymetry monitoring programme by the Company	Consent holder to undertake and provide data	No (provided late)
7. Provision of public safety notices	Liaison with consent holder and inspections	Yes
8. Mitigation by riparian management	TRC Land Management records	Yes
9. Stakeholders bi-annual meetings	Consent holder liaison	Yes
10. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent Overall assessment of administrative performance in respect of this consent		<b>High Improvement required</b>

[N/A = not applicable]

Table 13 Summary of performance for consent 2054-3

<b>Purpose: To dam the Mangamahoe Stream for HEP scheme generation purposes</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Operation and maintenance of dam to satisfaction of the Council	Liaison with consent holder	Yes
2. Maintenance of minimum level in Lake Mangamahoe	Supply of data by consent holder	Yes

<b>Purpose: To dam the Mangamahoe Stream for HEP scheme generation purposes</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
3. Notification if lake level to be lowered for weed maintenance purposes	Liaison with consent holder	N/A
4. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

[N/A = not applicable]

Table 14 Summary of performance for consent 2056-3

<b>Purpose: To use up to 750,000 cubic metres per day of water from Lake Mangamahoe for HEP scheme generation purposes</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Spread generation during daylight hours as far as reasonably practical	Review of data	Yes
2. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>Good</b>

[N/A = not applicable]

Table 15 Summary of performance for consent 4886-1

<b>Purpose: To erect and maintain structures in, and dam, the Mangamahoe Stream for the formation of Lake Mangamahoe for HEP scheme generation purposes</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Operation and maintenance of structures to satisfaction of the Council	Liaison with consent holder	Yes
2. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

[N/A = not applicable]

Table 16 Summary of performance for consent 4887-1

<b>Purpose: To erect and maintain structures associated with the diversion of Waiwhakaiho River water into Lake Mangamahoe for HEP scheme generation purposes</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Operation and maintenance	Inspections and liaison with consent holder	Yes
2. Installation and maintenance of fish pass	Inspections and liaison with consent holder	Yes
3. Maintain residual flow device	Inspections and liaison with consent holder	Yes
4. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

[N/A = not applicable]

Table 17 Summary of performance for consent 4888-1

<b>Purpose: Emergency discharge of Lake Mangamahoe water to the Mangamahoe Stream</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>High</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

[N/A = not applicable]

Table 18 Summary of performance for consent 6810-1

<b>Purpose: To erect, place and maintain a culvert for access purposes, in an unnamed tributary of the Waiwhakaiho River</b>		
<b>Condition requirement</b>	<b>Means of monitoring during period under review</b>	<b>Compliance achieved?</b>
1. Silt discharge and riverbed disturbance minimisation	Liaison with the Council by consent holder	N/A
2. Exercise in accordance with documentation	Inspections	N/A
3. Notification of installation and maintenance works	Notification by consent holder	N/A
4. Timing of works	Inspections	N/A
5. Riverbed disturbance limits	Inspections	N/A
6. Limits to effects on receiving waters	Inspections	N/A
7. Removal of structure if no longer required	Liaison with consent holder	N/A

Purpose: <i>To erect, place and maintain a culvert for access purposes, in an unnamed tributary of the Waiwhakaiho River</i>		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
8. Flow and fish passage restrictions	Inspections	Yes (some improvements required)
9. Ponding restrictions	Inspections	Yes
10. Erosion and sediment control plan	Provision by consent holder	N/A
11. Lapse of consent	Consent exercised	N/A
12. Optional review provision	No reviews remaining	N/A
Overall assessment of consent compliance and environmental performance in respect of this consent		<b>Good</b>
Overall assessment of administrative performance in respect of this consent		<b>High</b>

[N/A = not applicable]

Table 19 Evaluation of environmental performance over time

Year	Consent no	High	Good	Improvement req	Poor
2010	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2011	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2012	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-



Year	Consent no	High	Good	Improvement req	Poor
2013	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2014	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2015	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2016	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2017	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2018	2053-3	1	-	-	-

Year	Consent no	High	Good	Improvement req	Poor
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
	6810-1	1	-	-	-
2019	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
2020	6810-1	1	-	-	-
	2053-3	-	1	-	-
	2054-3	1	-	-	-
	2056-3	-	1	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
2021	6810-1	1	-	-	-
	2053-3	1	-	-	-
	2054-3	1	-	-	-
	2056-3	1	-	-	-
	4886-1	1	-	-	-
	4887-1	1	-	-	-
	4888-1	1	-	-	-
Totals		83	3	0	0

During the year, the Company demonstrated a high level of environmental and a good level of administrative performance with the resource consents as defined in Section 1.1.4. Most components of the Mangorei HEP scheme were operated well, with the Company being active in maintaining fish passage at the weir, and assisting with the migration of both adult and juvenile eels when these fish congregate at the scheme. Improvement is however needed with some administrative tasks, in particular with regard to lake monitoring for sedimentation.

### 3.4 Recommendations from the 2019-2020 Annual Report

In the 2019-2020 Annual Report, it was recommended:

1. That monitoring changes to the frequency of various inspections at the scheme be implemented during the 2020-2021 year, as detailed in Section 3.5.
2. THAT the monitoring of fish communities to assess various aspects of the scheme be added to the 2020-2021 monitoring programme.
3. THAT the inclusion of water temperature monitoring below the Meeting of the Waters to assess the effects of lake water temperatures on the river be added to the 2020-2021 monitoring programme.
4. THAT all other monitoring of consented activities at Mangorei HEP scheme in the 2020-2021 year continue at the same level as in 2019-2020.
5. THAT should there be issues with environmental or administrative performance in 2020-2021, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

These recommendations were implemented in the 2020-2021 monitoring period, with the exception of recommendation 2 and 3 which will be carried over to the 2021-2022 period.

### 3.5 Alterations to monitoring programmes for 2021-2022

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account:

- the extent of information already made available through monitoring or other means to date;
- its relevance under the RMA;
- the Council's obligations to monitor consented activities and their effects under the RMA;
- the record of administrative and environmental performances of the consent holder; and
- reporting to the regional community.

The Council also takes into account the scope of assessments required at the time of renewal of permits, and the need to maintain a sound understanding of industrial processes within Taranaki exercising resource consents.

It is proposed that for the 2021-2022 monitoring of the Mangorei HEP continues at the same level as in 2020-2021.

It should be noted that the proposed programme represents a reasonable and risk-based level of monitoring for the site(s) in question. The Council reserves the right to subsequently adjust the programme from that initially prepared, should the need arise if potential or actual non-compliance is determined at any time during 2021-2022.

## 4 Recommendations

1. THAT all monitoring of consented activities at Mangorei HEP scheme in the 2021-2022 year continue at the same level as in 2020-2021.
2. THAT should there be issues with environmental or administrative performance in 2021-2022, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.

## Glossary of common terms and abbreviations

The following abbreviations and terms may be used within this report:

Biomonitoring	Assessing the health of the environment using aquatic organisms.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m <sup>3</sup> s <sup>-1</sup> ).
Diadromous	A fish with life-cycles encompassing fresh and salt water stages.
Elver	Juvenile eel(s) that has entered freshwater from the sea.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
Incident	An event that is alleged or is found to have occurred that may have actual or potential environmental consequences or may involve non-compliance with a consent or rule in a regional plan. Registration of an incident by the Council does not automatically mean such an outcome had actually occurred.
Intervention	Action/s taken by Council to instruct or direct actions be taken to avoid or reduce the likelihood of an incident occurring.
Investigation	Action taken by Council to establish what were the circumstances/events surrounding an incident including any allegations of an incident.
Incident Register	The Incident Register contains a list of events recorded by the Council on the basis that they may have the potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan.
L/s	Litres per second.
MCI	Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats.
Mixing zone	The zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
Physicochemical	Measurement of both physical properties (e.g. temperature, clarity, density) and chemical determinants (e.g. metals and nutrients) to characterise the state of an environment.
Residual flow	Flow required to maintain fish passage and/or aquatic habitat.
Resource consent	Refer Section 87 of the RMA. Resource consents include land use consents (refer Sections 9 and 13 of the RMA), coastal permits (Sections 12, 14 and 15), water permits (Section 14) and discharge permits (Section 15).
RMA	<i>Resource Management Act 1991</i> and including all subsequent amendments.
SQMCI	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).

For further information on analytical methods, contact a Science Services Manager.

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# Appendix I

## Resource consents held by Trustpower Ltd

(For a copy of the signed resource consent  
please contact the TRC Consents department)

### Water abstraction permits

Section 14 of the RMA stipulates that no person may take, use, dam or divert any water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or it falls within some particular categories set out in Section 14. Permits authorising the abstraction of water are issued by the Council under Section 87(d) of the RMA.

### Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations. Permits authorising discharges to water are issued by the Council under Section 87(e) of the RMA.

### Air discharge permits

Section 15(1)(c) of the RMA stipulates that no person may discharge any contaminant from any industrial or trade premises into air, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising discharges to air are issued by the Council under Section 87(e) of the RMA.

### Discharges of wastes to land

Sections 15(1)(b) and (d) of the RMA stipulate that no person may discharge any contaminant onto land if it may then enter water, or from any industrial or trade premises onto land under any circumstances, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Permits authorising the discharge of wastes to land are issued by the Council under Section 87(e) of the RMA.

### Land use permits

Section 13(1)(a) of the RMA stipulates that no person may in relation to the bed of any lake or river use, erect, reconstruct, place, alter, extend, remove, or demolish any structure or part of any structure in, on, under, or over the bed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Land use permits are issued by the Council under Section 87(a) of the RMA.

### Coastal permits

Section 12(1)(b) of the RMA stipulates that no person may erect, reconstruct, place, alter, extend, remove, or demolish any structure that is fixed in, on, under, or over any foreshore or seabed, unless the activity is expressly allowed for by a resource consent, a rule in a regional plan, or by national regulations. Coastal permits are issued by the Council under Section 87(c) of the RMA.

**Water Permit**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date  
(Change): 01 August 2017

Commencement Date  
(Change): 01 August 2017 (Granted Date: 01 August 2017)

**Conditions of Consent**

Consent Granted: To divert up to 10 cubic metres per second of water from the Waiwhakaiho River via a diversion weir and associated intake structures into Lake Mangamahoe through the Mangorei Hydroelectric Power Scheme and back into the river approximately six kilometres downstream of the diversion point

Expiry Date: 01 June 2021

Site Location: Lake Mangamahoe, Junction Road, New Plymouth

Grid Reference (NZTM) 1697720E - 5668050N

Catchment: Waiwhakaiho

Tributary: Lake Mangamahoe

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

**General condition**

- a. The consent holder shall pay to the Taranaki Regional Council all the administration, monitoring and supervision costs of this consent, fixed in accordance with section 36 of the Resource Management Act 1991.

**Special conditions**

1. That the consent holder shall maintain a continuous generation flow release of at least 950 litres/second between 8:00 am and 6:00 pm each day.
2. That the consent holder shall maintain, each 12-month period, the following minimum residual flows in the Waiwhakaiho River below the diversion weir:
  - i) at least 700 litres/second between 1 January and 31 March, effective from 1 January 1998;
  - ii) at least 600 litres/second between 1 January and 31 March, until 31 December 1997;
  - iii) at least 600 litres/second between 1 November and 31 December and during April; and
  - iv) at least 400 litres/second between 1 May and 31 October.
3. No water shall be diverted when the flow in the Waiwhakaiho River is greater than or equal to 85 cubic metres per second.
4. That the consent holder shall install and operate, to the satisfaction of the Chief Executive, Taranaki Regional Council, a measuring device capable of measuring the residual flow to be maintained in the Waiwhakaiho River downstream of the diversion weir, and shall provide records of such measurements to the Chief Executive, Taranaki Regional Council, upon request.
5. That the consent holder shall maintain, as far as reasonably practicable, the river channel below the diversion weir to the 'Meeting of Waters' for the purpose of enhancing available fish passage and habitat, to the satisfaction of the Chief Executive, Taranaki Regional Council; and, the Taranaki Regional Council will inspect the fish passage device and river channel for compliance after any significant river fresh.
6. The consent holder shall ensure a monitoring programme is undertaken that includes:
  - a) sediment sampling that relates the flow in the Waiwhakaiho River to the rate of sediment entering Lake Mangamahoe via the diversion;
  - b) bathymetric surveys that record the change in bathymetry of Lake Mangamahoe between winter 2013 and 31 December 2020; and
  - c) a report assessing the effects of this application and any significant change in bathymetry.

## Consent 2053-3.2

7. That the consent holder shall erect and maintain notices and other warnings as may be required, to the satisfaction of the Chief Executive, Taranaki Regional Council, for adequate protection of public safety to warn the public using the river downstream of the scheme of fluctuations in river flow and of the extent of those fluctuations.
8. The consent holder shall mitigate the environmental effects of the diversion by making annual payments of \$5,000 (GST exclusive) to the Taranaki Regional Council as a financial contribution for the purpose of providing riparian planting and management in the Waiwhakaiho River catchment. The amount to be paid shall be adjusted annually according to the consumer price index, or similar index, to account for the effects of inflation, and be made no later than 1 September each year.
9. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once every two years, with submitters to the consent to discuss any matter relating to the exercise of this resource consent.
10. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, June 2006, June 2011 and/or June 2016 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the diversion on the environment.

Signed at Stratford on 01 August 2017

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**



**Land Use Consent**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date: 4 September 1996

Commencement Date: 4 September 1996

**Conditions of Consent**

Consent Granted: To dam the Mangamahoe Stream in the Waiwhakaiho Catchment to form Lake Mangamahoe to act as a reservoir of water for hydroelectric power generation purposes

Expiry Date: 1 June 2021

Site Location: Lake Mangamahoe Junction Road New Plymouth

Grid Reference (NZTM) 1697320E-5669450N

Catchment: Waiwhakaiho

Tributary: Mangamahoe

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

**General conditions**

- (a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- (b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- (c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - (i) the administration, monitoring and supervision of this consent;
  - (ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
  - (iii) charges authorised by regulations.

**Special conditions**

- 1. That the consent holder shall maintain and operate the dam and associated structures, to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 2. That the consent holder shall maintain a minimum lake level of 750 mm below the crest of the Mangamahoe spillway except during lake weed maintenance periods.
- 3. That the consent holder shall notify the Chief Executive, Taranaki Regional Council, of its intention to temporarily lower Lake Mangamahoe for weed management purposes at least seven days prior to commencing lake dewatering.
- 4. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, June 2006, June 2011 and/or June 2016 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the dam on the environment.

Transferred at Stratford on 31 October 2016

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**



**Water Permit**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date  
(Change): 16 June 2016

Commencement Date  
(Change): 16 June 2016

**Conditions of Consent**

Consent Granted: To use up to 864,000 cubic metres/day of water from Lake Mangamahoe in the Waiwhakaiho catchment for hydroelectric power generation purposes

Expiry Date: 1 June 2021

Site Location: Lake Mangamahoe, Junction Road, New Plymouth

Grid Reference (NZTM) 1697220E-5669450N

Catchment: Waiwhakaiho

Tributary: Mangamahoe  
Lake Mangamahoe

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

**General conditions**

- (a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- (b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- (c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - (i) the administration, monitoring and supervision of this consent;
  - (ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
  - (iii) charges authorised by regulations.

**Special conditions**

- 1. That the consent holder shall, as far as reasonably practicable, spread its generation during daylight hours in order to maximise the beneficial effect of artificial flows in the lower Waiwhakaiho River.
- 2. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, June 2006, June 2011 and/or June 2016 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the water use on the environment.

Transferred at Stratford on 31 October 2016

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

**Land Use Consent**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date: 4 September 1996

Commencement Date: 4 September 1996

**Conditions of Consent**

Consent Granted: To erect and maintain structures in the Mangamahoe Stream in the Waiwhakaiho Catchment to dam the stream to form Lake Mangamahoe for hydroelectric power generation purposes

Expiry Date: 1 June 2021

Site Location: Lake Mangamahoe, Junction Road, New Plymouth

Grid Reference (NZTM) 1697318E-5669451N

Catchment: Waiwhakaiho

Tributary: Mangamahoe  
Lake Mangamahoe

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

**General conditions**

- (a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- (b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- (c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - (i) the administration, monitoring and supervision of this consent;
  - (ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
  - (iii) charges authorised by regulations.

**Special conditions**

- 1. That the consent holder shall maintain and operate the structures, to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 2. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, June 2006, June 2011 and/or June 2016 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the structures on the environment.

Transferred at Stratford on 31 October 2016

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

**Land Use Consent**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date: 4 September 1996

Commencement Date: 4 September 1996

**Conditions of Consent**

Consent Granted: To erect and maintain structures associated with the diversion of water from the Waiwhakaiho River into Lake Mangamahoe for hydroelectric power generation purposes

Expiry Date: 1 June 2021

Site Location: Lake Mangamahoe, Junction Road, New Plymouth

Grid Reference (NZTM) 1697719E-5668051N

Catchment: Waiwhakaiho

Tributary: Lake Mangamahoe

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

**General conditions**

- (a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- (b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- (c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - (i) the administration, monitoring and supervision of this consent;
  - (ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
  - (iii) charges authorised by regulations.

**Special conditions**

- 1. That the consent holder shall maintain and operate the structures, to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 2. That the consent holder shall install and maintain, to the satisfaction of the Chief Executive, Taranaki Regional Council, a structure at the diversion weir to enable the passage of native fish, juvenile trout and adult trout.
- 3. That the consent holder shall maintain a device capable of meeting the residual flow requirements of the consent, to the satisfaction of the Chief Executive, Taranaki Regional Council.
- 4. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, June 2006, June 2011 and/or June 2016 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the structures on the environment.

Transferred at Stratford on 31 October 2016

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

**Discharge Permit**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date: 4 September 1996

Commencement Date: 4 September 1996

**Conditions of Consent**

Consent Granted: To discharge up to 150,000 litres/second of water from Lake Mangamahoe via a spillway into the Mangamahoe Stream in the Waiwhakaiho Catchment under emergency conditions associated with hydroelectric generation purposes

Expiry Date: 1 June 2021

Site Location: Lake Mangamahoe, Junction Road, New Plymouth

Grid Reference (NZTM) 1697318E-5669451N

Catchment: Waiwhakaiho

Tributary: Mangamahoe  
Lake Mangamahoe

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

**General conditions**

- (a) That on receipt of a requirement from the Chief Executive, Taranaki Regional Council (hereinafter the Chief Executive), the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- (b) That unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- (c) That the consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - (i) the administration, monitoring and supervision of this consent;
  - (ii) charges for the carrying out of the Council's functions under section 35 in relation to this consent; and
  - (iii) charges authorised by regulations.

**Special condition**

- 1. That the Taranaki Regional Council may review any or all of the conditions of this consent by giving notice of review during June 2001, June 2006, June 2011 and/or June 2016 for the purpose of ensuring that the conditions are adequate to deal with any adverse effects of the discharge on the environment.

Transferred at Stratford on 31 October 2016

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**



**Land Use Consent**  
**Pursuant to the Resource Management Act 1991**  
**a resource consent is hereby granted by the**  
**Taranaki Regional Council**

Name of  
Consent Holder: Trustpower Limited  
Private Bag 12023  
Tauranga 3143

Decision Date: 6 March 2006

Commencement Date: 6 March 2006

**Conditions of Consent**

Consent Granted: To erect, place and maintain a culvert in an unnamed tributary of the Waiwhakaiho River for access purposes

Expiry Date: 1 June 2020

Site Location: Lake Mangamahoe, Junction Road, New Plymouth

Grid Reference (NZTM) 1697023E-5668380N

Catchment: Waiwhakaiho

*For General, Standard and Special conditions  
pertaining to this consent please see reverse side of this document*

### General conditions

- a) On receipt of a requirement from the Chief Executive, Taranaki Regional Council the consent holder shall, within the time specified in the requirement, supply the information required relating to the exercise of this consent.
- b) Unless it is otherwise specified in the conditions of this consent, compliance with any monitoring requirement imposed by this consent must be at the consent holder's own expense.
- c) The consent holder shall pay to the Council all required administrative charges fixed by the Council pursuant to section 36 in relation to:
  - i) the administration, monitoring and supervision of this consent; and
  - ii) charges authorised by regulations.

### Special conditions

1. The consent holder shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 4114. In the case of any contradiction between the documentation submitted in support of application 4114 and the conditions of this consent, the conditions of this consent shall prevail.
3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 48 hours prior to the commencement and upon completion of the initial installation and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water.
4. Any instream works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the Chief Executive, Taranaki Regional Council.
5. The consent holder shall ensure that the area and volume of riverbed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.
6. After allowing for reasonable mixing, being a mixing zone extending seven times the width of the surface water body at the point of discharge, the discharge shall not give rise to any of the following effects in any surface water body:
  - a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
  - b) any conspicuous change in the colour or visual clarity;
  - c) any emission of objectionable odour;
  - d) the rendering of fresh water unsuitable for consumption by farm animals;
  - e) any significant adverse effects on aquatic life.

## Consent 6810-1

7. Except with the written agreement of the Chief Executive, Taranaki Regional Council, the structure[s] authorised by this consent shall be removed and the area reinstated, if and when the structure[s] are no longer required. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to structure[s] removal and reinstatement.
8. The exercise of this consent shall not alter the natural flow of the river or restrict the passage of fish.
9. The exercise of this consent shall not result in the significant ponding of water upstream of the culvert.
10. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the Chief Executive, Taranaki Regional Council, a site erosion and sediment control management plan.
11. This consent shall lapse on the expiry of five years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
12. In accordance with section 128 and section 129 of the Resource Management Act 1991, the Taranaki Regional Council may serve notice of its intention to review, amend, delete or add to the conditions of this resource consent by giving notice of review during the month of June 2008 and/or June 2014, for the purpose of ensuring that the conditions are adequate to deal with any adverse effects on the environment arising from the exercise of this resource consent, which were either not foreseen at the time the application was considered or which it was not appropriate to deal with at the time.

Transferred at Stratford on 31 October 2016

For and on behalf of  
Taranaki Regional Council

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A D McLay  
**Director - Resource Management**

