

Trustpower Ltd
Motukawa HEP Scheme
Monitoring Programme
Annual Report
2016-2017

Technical Report 2017-98

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Executive summary

Trustpower Limited (Trustpower) operates the Motukawa hydroelectric power (HEP) scheme in the Manganui River and Waitara River catchments. Trustpower draws water from behind a weir on the Manganui River near Tariki and diverts this water through a race to Lake Ratapiko and then through penstocks to the Motukawa Power Station. The power station discharges into the Makara Stream, a tributary of the Waitara River. Consents for the Motukawa HEP scheme allow Taranaki Generation Ltd to maintain structures, to take, divert and discharge water, and to disturb the bed of Lake Ratapiko. This report for the period July 2016-June 2017 describes the monitoring programme implemented by the Taranaki Regional Council (the Council) to assess Trustpower's environmental performance during the period under review, and the results and environmental effects of their activities.

Trustpower holds a total of 23 resource consents, which include a total of 186 conditions setting out the requirements that the Company must satisfy. The Company holds five consents to allow it to take and use water, five consents to discharge water or sediment into the Makara, Mangaotea, and Mako streams, one consent to discharge wastes to land around Lake Ratapiko and four land use permits for bed disturbance and structures in the Manganui River, Mangaotea Stream and Lake Ratapiko. Seven additional consents allow Trustpower to abstract water, and construct and maintain structures in the Mangaotea Stream.

During the period under review, Trustpower demonstrated a high level of environmental performance at the Motukawa power scheme.

The Council's monitoring for the period under review included 12 inspections of fish passage and residual flow facilities, continuous water temperature at two sites between November and April each year, a biomonitoring survey, fish monitoring and review of abstraction, discharge, and lake and race water level data forwarded by the Company, as well as elver and adult eel transfer data.

The monitoring showed that during the period under review, the management of abstraction rates, race and lake water levels was generally good. With regard to the management and recording of flows within the diversion race, performance has improved significantly compared to previous monitoring years, with no significant loss of data. This is the second consecutive monitoring period to record no such occasions of lost data since monitoring has focused on the continuity of the data record. There were only three occasions where required flow rates were not complied with. The first related to a severe weather event, while the other two related to insufficient residual flow at a time when maintenance required the control gates to be manually controlled. These incidents were all of short duration (no more than 4 hours).

Compliance with flushing flow requirements was good with regards to the Manganui River requirements, but some improvement is necessary regarding the Mangaotea Stream requirements, where only one of the four flushing flows was provided as required. This is an area that the Company has struggled to meet full compliance, and it remains a work in progress. It is unlikely that the lack of flushing follows in this instance was detrimental to the stream, considering the size of the natural flood at the times.

Water temperature differences appear to have reduced between natural flows and those in the residual flow reach since the establishment of the 400 L/s residual flow limit. Due to Taranaki experiencing a wet summer over the reported period, at no times did the water temperatures in the residual flow reach exceed 25°C, occurring from December 2015 to February 2016. However, the temperature differences between upstream and downstream of the weir were similar to the average, with the exception of December when temperature differences were higher than average.

Macroinvertebrate monitoring indicates improvement at some sites since the increased residual flow was implemented, however elevated water temperatures and denser periphyton substrate cover have affected macroinvertebrate communities of the residual flow reach in more recent surveys. In terms of the current report, it is considered that the communities of the residual flow reach represent what would be considered better than typical of a low flow community. The results indicate that the MCI scores at these sites were

higher than most previous surveys, as were the SQMCI_s scores, which were all significantly higher than their respective medians. However, a similar result was recorded at the control site indicating that there is a catchment wide improvement also.

Overall, the results indicate that the invertebrate community supported by a residual flow of 400 L/s, with regards to presence/absence of taxa, and their respective abundances, is not significantly different to that supported by natural flows. The principal difference between the two flows is that there is a greater amount of invertebrate habitat available under natural flow conditions due to the increased amount of wetted riverbed width.

A significant result of fish monitoring undertaken to date, is the presence of the key indicator species redfin bully, shortjaw kokopu and inanga upstream of the weir. Migrating trout were netted and tagged during the previous monitoring period, but no angler catch returns have been received to date. This information would provide some information about the movement of these fish in the Manganui River catchment and Motukawa scheme. Interim results indicate that trout are able to negotiate the fish pass and flow control valve. Overall, fish results to date indicate that with respect to the management objectives for which the residual flow was developed:

- reasonable water quality is being maintained;
- passage for trout is probably being achieved through the residual flow reach and past the weir;
- passage for some (but not all) native fish is being achieved in the residual flow reach and it would appear through the fish pass;
- habitat of native fish has improved but fish diversity is similar to that recorded prior to the 400 L/s residual flow and may suggest that the objective of 'some native fish habitat' is not being achieved for torrentfish, although redfin bullies and inanga have been recorded in the residual flow reach.

The results from a fish survey undertaken in the Mangaotea Stream in the reported period did not indicate any issue with fish passage at the intake, or with the reduced flows downstream of the intake.

Eel and elver passage requirements were generally fulfilled with the elver transfer system at the power station working well. The total weight of elvers transferred in the reporting period was the third highest of the last eight years. Electric fields have been installed at the intake and forebay and testing indicates that these are successful in deterring fish from these areas. Transfer of adult eels was attempted during each migration season, with 20 longfin eel and 4 shortfin eel transferred in the most recent migration season.

During the reported period, Trustpower's performance was generally maintained at a high level. There were no incidents that warranted enforcement action. There were a number of minor incidents, but due to the swift response of the consent holder, they remained minor, and it is likely no environmental impact resulted.

The improved environmental performance of the consent holder is a result of efforts to improve their internal systems and monitoring of this highly complex scheme. Trustpower has maintained a good level of communication with the Council, including notifying the Council of any breach of consent they become aware of. Overall, it is considered that Trustpower was able to demonstrate a high level of environmental performance and compliance with the resource consents, and compliance with the administrative requirements of the consents.

For reference, in the 2016-2017 year, consent holders were found to achieve a high level of environmental performance and compliance for 74% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 21% 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 is being maintained at a high level.

This report includes recommendations for the 2017-2018 year.

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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 the Monitoring Report for the period July 2016-June 2017 by the Taranaki Regional Council (The Council) describing the monitoring programme associated with resource consents held by Trustpower Limited (Trustpower) for the Motukawa hydroelectric power (HEP) scheme. This scheme diverts water from the Manganui River and Mangaotea Stream to Lake Ratapiko and then onto the Motukawa Power Station on Motukawa Road.

This report covers the results and findings of the monitoring programme implemented by the Council in respect of the consents held by Trustpower that relate to abstractions and discharges of water in the Waitara catchment. This is the 22nd report to be prepared by the Council to cover the Motukawa HEP scheme activities and their effects.

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 Manganui and Waitara River catchments;
- 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 2017-2018 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' inasmuch 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 significant 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 in response to unauthorised incident reports, 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 in response to unauthorised incident reports. 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 in response to unauthorised incident reports. 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 2016-2017 year, consent holders were found to achieve a high level of environmental performance and compliance for 74% of the consents monitored through the Taranaki tailored monitoring programmes, while for another 21% of the consents, a good level of environmental performance and compliance was achieved.

1.2 Process description

The Motukawa HEP scheme first generated electricity in January 1927 and has been modified over the years to improve efficiency. Previous monitoring reports provide additional detail on the scheme's history. Trustpower currently owns and operates the scheme, which was formerly operated by Powerco Ltd and also by Taranaki Energy. The main elements of the scheme are shown in Figure 1.

Trustpower draws water from behind a weir on the Manganui River near Tariki and diverts this water through a settling pond (Ayling's Pond) and then via a water race into Lake Ratapiko, an artificial storage lake resulting from the damming of the Mako Stream. About half way along, the race crosses the Mangaotea Stream. At this location, water is pumped from the Mangaotea Stream, and discharged to the water race to supplement the Manganui River take. From Lake Ratapiko the water is piped through penstocks to the Motukawa Power Station, used to generate electricity, and discharged into the Makara Stream, a tributary of the Waitara River.

Trustpower have also installed an in-race generator. By constructing a small dam in the Motukawa Race and diverting water through a generator, it allowed Trustpower to utilise the natural head in the race at this point. A 200 KW generator now produces about 0.9 gigawatt/hours of electricity per year.

The Manganui River downstream of the weir carries a residual flow of at least 400 litres per second (L/s) for five km between the weir and the confluence with the Mangaotea Stream, more if the Tariki weir is overtopping. The confluence with the next major tributary, the Mangamawhete Stream, is a further eight km downstream. This residual flow has been implemented following the renewal of consent 3369, and the

construction of a new fish pass on the true right bank, which carries approximately 300 L/s of the residual flow past the weir (constructed in 2002). The remaining residual flow passes through an old (and mostly ineffective) fish pass on the true left bank of the weir.

Much of the scheme is monitored and operated remotely by the Company. Through a computerised water level sensor system, Trustpower can monitor the residual flows in the Manganui River and Mangaotea Stream, water levels in the race and lake and how much rain is falling locally. This has allowed Trustpower to manage race flows to minimise flooding, and has greatly improved Trustpower's compliance with residual flow requirements.

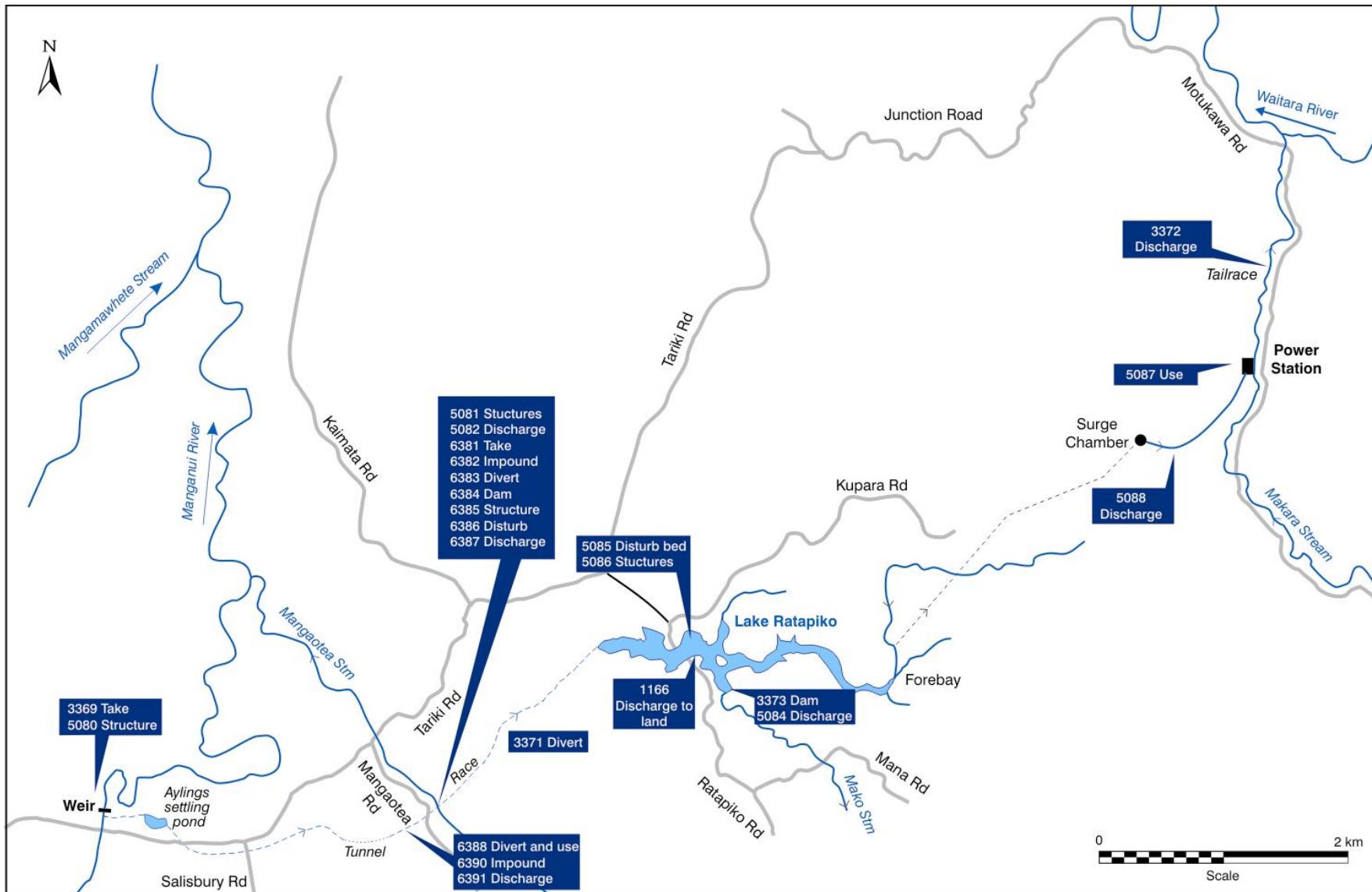


Figure 1 Main features of the Trustpower Motukawa HEP Scheme including relevant consents

1.3 Resource consents

1.3.1 Water abstraction permit

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.

Trustpower holds water permit **3369-2** to cover the abstraction of up to 5,200 L/s of water from the Manganui River in the Waitara Catchment for HEP generation. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Five special conditions relate to residual flow requirements ensuring:

- a residual flow of no less than 400 L/s is maintained in the Manganui River below the weir at all times. This is to provide for the passage of fish and reasonable water quality in the Manganui River downstream of the weir. This residual flow is to be passed through the fish pass (special conditions 1 and 2).
- residual flows required when the weir had not naturally overtopped for 30 days or the flow of the Waitara River is less than or equal to 5,000 L/s. This provides flushing flows to mitigate effects during periods of extended low flow (special conditions 4 and 5).
- a residual flow of 150 L/s is required in the race during maintenance periods. This ensures fish will not be stranded in the race during maintenance periods. If this residual flow is unpractical, a fish salvage operation to relocate stranded fish should be arranged by the consent holder (special condition 7).

Two conditions relate to monitoring and measurement of abstraction rates and race water levels within a water level control system, data from which should be forwarded to the Council every three months. This ensures that compliance with the conditions of this and other consents can be assessed, and that flooding of farmland adjacent to the race as a result of the activities of the consent holder is avoided (special conditions 3 and 6).

Special condition eight allows for the mitigation of the effects of the abstraction by donating to the Taranaki Tree Trust for the purpose of providing riparian management in the Manganui River catchment.

Special condition nine requires the consent holder to meet with interested submitters to the consent to discuss any matter relating to the exercise of the consent with particular reference to the monitoring programme design, implementation and interpretation. This condition is present throughout all consents for the Motukawa HEP scheme.

The last two conditions are review provisions.

Trustpower holds water permit **3371-2** to cover the diversion and use of up to 8,000 L/s of stormwater runoff and the entire flow of various unnamed watercourses draining into the race and into Lake Ratapiko for HEP supply purposes. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Seven special conditions relate to the prevention of flooding of the adjacent farmland as a result of the activities of the consent holder and include:

- monitoring and measurement via a race water level control system and stage boards (special conditions 1, 3 & 5);
- maximum race water levels at four sites along the race (special condition 2);
- five yearly surveys of the race to ensure race capacity is maintained (special condition 4);

- a bond to be entered into until such time as specified improvement works have been completed if flooding occurs within a specified period (special condition 7 & 8).

Special condition six requires the consent holder to meet with interested submitters to the consent to discuss any matter relating to the exercise of the consent with particular reference to the monitoring programme design, implementation and interpretation. This condition is present throughout all consents for the Motukawa HEP scheme.

The last two conditions are review provisions.

The conditions of this consent were amended in 2016, so that certain site names used in the conditions reflected their geographical location, rather than the landowner.

Trustpower holds water permit **3373-2** to cover the damming of the Mako Stream to form Lake Ratapiko for HEP generation purposes, including the spillway structure. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

The first two special conditions relate to the safety of the dam structure.

Special conditions three to seven relate to the spillway and lake levels. This is to ensure that lake levels do not cause flooding of land adjacent to the lake and race. Water levels shall be monitored as per special condition nine.

Special condition eight requires the consent holder to install and monitor a facility to enable the passage of elvers and adult eels over the spillway. Monitoring information is to be forwarded to the Council every 12 months.

Special condition nine requires the consent holder to meet with interested submitters to the consent to discuss any matter relating to the exercise of the consent with particular reference to the monitoring programme design, implementation and interpretation. This condition is present throughout all consents for the Motukawa HEP scheme.

The last two conditions are review provisions.

Trustpower holds water permit **5087-1** to cover the taking and use of up to 7,787 L/s of water from Lake Ratapiko for HEP generation purposes.

This permit was issued by the Council on 19 September 2001 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Special conditions one to four relate to the management of lake water levels during normal operation and maintenance periods so as to avoid or minimise fish stranding and the potential for flooding of land adjoining the lake and race.

Special condition nine requires the consent holder to meet with interested submitters to the consent to discuss any matter relating to the exercise of the consent with particular reference to the monitoring programme design, implementation and interpretation. This condition is present throughout all consents for the Motukawa HEP scheme.

The last two conditions are review provisions.

Trustpower holds water permit **6388-1** to cover the diversion and use of water in the Motukawa Race for HEP generation purposes. This permit was issued by the Council on 27 July 2004 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent should be carried out generally in accordance with the information submitted with the application.

Special condition three requires that the Council be notified prior to the exercise of the consent.

Special condition four relates to the lapse period if the consent is not exercised and the last condition is a review provision.

Trustpower holds water permit **6390-1** to cover the impoundment of water behind a dam in the Motukawa Race for HEP generation purposes. This permit was issued by the Council on 27 July 2004 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent should be carried out generally in accordance with the information submitted with the application.

Special condition three requires that the Council and Fish and Game New Zealand be notified prior to the construction of the dam and turbine.

Special conditions four to seven provide for the protection and monitoring of freshwater fauna, including trout, in the race.

Special condition eight provides maximum race water levels to avoid flooding of adjacent farmland as a result of the consent holder's activities and is consistent with other existing consents for the scheme.

The last two conditions relate to the lapse period if the consent is not exercised and a review provision.

As mentioned, resource consent 3371-2 was changed in July 2016, with the names of some specific locations changed. Unfortunately consent 6390-1 was not changed, and as this consent refers to the same locations, there is now some contradiction between consents. It is therefore recommended that Trustpower also change consent 6390-1, so that it is consistent with consent 3371-2.

Trustpower holds water permit **6381-1** to take and use water from the Mangaotea Stream, a tributary of the Manganui River, for HEP generation purposes. This permit was issued by the Council on 7 December 2005 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Special condition one requires that the consent is carried out generally in accordance with the information submitted with the application.

Special condition two requires that the Council is notified prior to the exercising of this consent.

Special condition three limits the amount and the rate of abstraction.

Special condition four sets a residual flow for two points in the Mangaotea Stream.

Special condition six provides for flushing flows in the Mangaotea Stream.

Special condition seven requires the consent holder to install and operate measuring devices to measure a range of flows, and provide the data to the Council.

Special condition eight requires the consent holder to commission and implement a monitoring programme to determine the hydrological and ecological effects of the abstraction.

Special condition ten requires the consent holder to meet with interested submitters to the consent to discuss any matter relating to the exercise of the consent with particular reference to the monitoring programme design, implementation and interpretation. This condition is present throughout all consents for the Motukawa HEP scheme.

Special condition eleven relate to the lapse period if the consent is not exercised.

Special conditions five, nine and twelve all relate to the review of the consent, should the residual flow be found to not be appropriate, or other issues arise.

Trustpower holds water permit **6382-1** to impound water behind a temporary dam within the Mangaotea Stream, for the purposes of constructing a water intake structure for HEP generation purposes. This permit

was issued by the Council on 7 December 2005 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Special condition one requires that the consent is carried out generally in accordance with the information submitted with the application.

Special condition two requires that the Council is notified prior to the exercising of this consent.

Special condition three places a restriction as to what time of the year the consent can be exercised.

Special condition four requires the consent holder to minimise the area and volume of riverbed disturbed.

Special condition five states that the impoundment shall not cause an obstruction to fish passage.

The last two conditions relate to the lapse period if the consent is not exercised and a review provision.

Trustpower holds water permit **6383-1** to divert water around a temporary dam within the Mangaotea Stream for the purposes of constructing a water intake structure for HEP generation purposes. This permit was issued by the Council on 7 December 2005 under Section 87(d) of the RMA. It is due to expire on 1 June 2022.

Special condition one requires that the consent is carried out generally in accordance with the information submitted with the application.

Special conditions two and three requires that the Council is notified prior to the exercising of this consent or prior to and subsequent maintenance works.

Special condition four places a restriction as to what time of the year the consent can be exercised.

Special condition five requires the consent holder to minimise the area and volume of riverbed disturbed.

Special condition six states that the impoundment shall not cause an obstruction to fish passage.

The last two conditions relate to the lapse period if the consent is not exercised and a review provision.

1.3.2 Water discharge permit

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.

Trustpower holds water discharge permit **3372-2** to cover the discharge of up to 7,787 L/s of water from the Motukawa HEP station into the Makara Stream. This permit was issued by the Council on 19 September 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

The first special condition relates to flushing flow requirements during extended periods of low flow in the Waitara River in order to mitigate the effects of low flows in the Waitara River.

Special condition two relates to the measurement and monitoring of discharge rates into the Makara Stream, records of which are to be forwarded to the Council every three months.

The third special condition relates to the provision for the passage of elvers over the dam, including maintenance and monitoring of an elver pass.

The fourth condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

The last two conditions are review provisions.

Trustpower holds water discharge permit **5082-1** to cover the discharge, under emergency conditions, of up to 2,000 L/s of water from the Mangaotea Aqueduct into the Mangaotea Stream. This permit was issued by the Council on 19 August 1999 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

The first condition states that the discharge shall occur after compliance with condition two of consent 5081 (land use permit) is achieved. This condition (5081) requires the lowering of the northern side of the aqueduct and installing a gate.

Special conditions two to four relate to the avoidance of flooding of farmland adjacent to the race and downstream of the aqueduct and defines emergency conditions, as well as setting aside money for maintenance if there are adverse effects from the discharge.

The sixth condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

Two conditions are review provisions (conditions 5 & 7).

Trustpower holds water discharge permit **5084-1** to cover the discharge of up to 55,000 L/s of hydroelectric generation water, during adverse weather conditions, via spillways and lake drainage valves from Lake Ratapiko into the Mako Stream. This permit was issued by the Council on 19 September 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the preparation of a contingency plan for the purpose of managing the discharge so as to avoid or minimise damage to property downstream, within six months of the granting of the consent.

The third condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme and the last two special conditions are review provisions.

Trustpower holds water discharge permit **5088-1** to cover the discharge of up to 2,000 L/s of water, from the surge chamber of the Motukawa HEP station during maintenance periods into an unnamed tributary of the Makara Stream. This permit was issued by the Council on 19 September 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

The first two special conditions require the consent holder to provide and act in accordance with a contingency plan for the purpose of managing the discharge so as to avoid or minimise the potential for damage to property downstream.

Special condition three requires the Council to be notified at least 48 hours prior to the discharge and also the adoption of the best practicable option to prevent or minimise any actual or likely effect on the environment arising from the discharge.

Special condition four requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme, with the last two special conditions being review provisions.

Trustpower holds water discharge permit **6391-1** to cover the discharge of sediment during earthworks associated with the construction of a generator structure into the Motukawa Race. This permit was issued by the Council on 27 July 2004 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent be exercised generally in accordance with the information submitted with the application.

Special conditions three, four and six require the Council to be notified prior to and on completion of any works associated with this consent, as well as approval of a site erosion and sediment control management plan, including rehabilitation of the site after construction. This ensures adverse effects will be minimised during construction periods and that works can be monitored by the Council.

The fifth condition defines mixing zones downstream of the works, and effects that should not result from the works.

The last two special conditions are define lapse periods and review provisions.

Trustpower holds water discharge permit **6387-1** to cover the discharge of sediment during earthworks associated with the construction of an intake structure into the Mangaotea Stream. This is a new permit and was issued by the Council on 7 December 2005 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent be exercised generally in accordance with the information submitted with the application.

Special conditions three, four and five require the Council to be notified prior to and on completion of any works associated with this consent, specifies the timing of the works, and requires approval of a site erosion and sediment control management plan, including rehabilitation of the site after construction. This ensures adverse effects will be minimised during construction periods and that works can be monitored by the Council.

The sixth condition defines mixing zones downstream of the works, and effects that should not result from the works.

Special condition seven requires all earthwork areas to be stabilised vegetatively or otherwise as soon as practicable after soil disturbance and reinstatement, to reduce the potential for sediment entrainment during rain.

The last two special conditions are define lapse periods and review provisions.

1.3.3 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.

Trustpower holds discharge permit **1166-3** to cover the discharge of up to 4,000 cubic metres/day of dredgings from maintenance of Lake Ratapiko onto land above the one-metre mark around the lake margin. This permit was issued by the Council on 19 September 2001 under Section 87(e) of the RMA. It is due to expire on 1 June 2022.

The first two special conditions require the consent holder to notify the Council at least 48 hours prior to the commencement of the discharge and to adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants onto land arising from the discharge.

The third condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

The last two special conditions provide review provisions.

1.3.4 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.

Trustpower holds land use permit **5080-1** to cover the erection, placement, use and maintenance of the weir and various structures associated with HEP generation activities in the Manganui River. This permit was issued by the Council on 19 September 2001 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

Special conditions one to three relate to the passage of fish including the installation, maintenance and monitoring of a structure to allow for the passage of eels, native fish, juvenile and adult trout.

The fourth special condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

Special conditions five and six are review provisions.

Trustpower holds land use permit **5081-1** to cover the erection, placement, use and maintenance of the Mangaotea Aqueduct associated with HEP generation activities in the Mangaotea Stream. This permit was issued by the Council on 19 August 1999 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

The first special condition requires the consent holder to install and survey a stage board in the race at the Mangaotea Aqueduct, for the purpose of providing a visual check on race water levels.

Special condition two requires the consent holder to lower the northern side of the aqueduct by 300 mm to provide for a flow of 2,000 L/s and shall install a gate in the lowered section which shall be controlled by the race water level control system.

The third special condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

Special conditions four and five are review provisions.

Trustpower holds land use permit **5085-1** to cover the disturbance of the bed of Lake Rataipiko for maintenance and repairs associated with HEP generation. This permit was issued by the Council on 19 September 2001 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

The first special condition requires the consent holder to notify the Council at least 48 hours prior to the commencement of any disturbance activities.

The second condition requires the consent holder to adopt the best practicable option to prevent or minimise any actual or potential effect on the environment arising from any disturbance activities.

The third special condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

Special conditions four and five are review provisions.

Trustpower holds land use permit **5086-1** to cover the erection, placement, use and maintenance of various structures in, on and over the bed of Lake Rataipiko for HEP generation purposes. This permit was issued by the Council on 19 September 2001 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

The first two conditions relate to the passage of fish including preventing entrapment in the penstock intake structure.

Special condition three requires the installation of a stage board in the lake to provide a visual check on lake water levels.

Under special condition four, the consent holder shall upgrade the Rataipiko Road causeway, so as not to restrict the flow of water between the two parts of Lake Rataipiko. This is to avoid flooding of the land adjoining the race.

The sixth special condition requires the consent holder to meet with interested submitters once per year as in other consents related to this power generation scheme.

Special conditions five and seven are review provisions.

Trustpower holds land use permit **6384-1** to cover the erection, placement, use and maintenance of a temporary dam within the Mangaotea Stream, for the purposes of constructing a water intake structure for

HEP generation purposes. This permit was issued by the Council on 7 December 2005 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent be exercised generally in accordance with the information submitted with the application.

Special conditions three and four require the Council to be notified prior to and on completion of any works associated with this consent including subsequent maintenance works, and specifies the timing of the works. This ensures adverse effects will be minimised during construction periods and that works can be monitored by the Council.

Special condition five requires the consent holder to minimise the area and volume of streambed disturbance, and to reinstate any disturbed areas where practicable.

The sixth condition requires that the diversion and impoundment does not obstruct fish passage.

The last two special conditions define lapse periods and review provisions.

Trustpower holds land use permit **6385-1** to erect, place and maintain an intake structure including pumps in the bed of the Mangaotea Stream for the purposes of abstracting water for HEP generation purposes. A variation to this permit was issued by the Council on 9 February 2007 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent be exercised generally in accordance with the information submitted with the application.

Special conditions three and four require the Council to be notified prior to and on completion of any works associated with this consent including subsequent maintenance works, and specifies the timing of the works. This ensures adverse effects will be minimised during construction periods and that works can be monitored by the Council.

Special condition five requires the consent holder to minimise the area and volume of streambed disturbance, and to reinstate any disturbed areas where practicable.

The sixth condition requires that the diversion and impoundment does not obstruct fish passage and the seventh condition requires that the intake is appropriately screened to avoid the entrapment of freshwater fauna.

Condition eight requires that the structure be removed if and when it is no longer required.

The last two special conditions define lapse periods and review provisions.

Trustpower holds land use permit **6386-1** to disturb and modify the bed and banks of the Mangaotea Stream in association with the construction of an intake structure for HEP generation purposes. This permit was issued by the Council on 7 December 2005 under Section 87(a) of the RMA. It is due to expire on 1 June 2022.

Special conditions one and two relate to the adoption of the best practical option, and that the consent be exercised generally in accordance with the information submitted with the application.

Special conditions three and four require the Council to be notified prior to and on completion of any works associated with this consent including subsequent maintenance works, and specifies the timing of the works. This ensures adverse effects will be minimised during construction periods and that works can be monitored by the Council.

Special condition five requires the consent holder to minimise the area and volume of streambed disturbance, and to reinstate any disturbed areas where practicable.

The sixth condition requires that the streambed works do not obstruct fish passage.

The last two special conditions are define lapse periods and review provisions.

Special condition five requires the consent holder to minimise the area and volume of streambed disturbance, and to reinstate any disturbed areas where practicable.

This summary of consent conditions may not reflect the full requirements of each condition. The consent conditions in full can be found in the resource consents which are appended to this report.

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 Motukawa HEP scheme consisted of six 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;
- in 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 scheme was visited 12 times during the reported period, including six hydrological inspections and six site inspections. With regard to consents for the abstraction of water, the main points of interest were:

- whether or not the old fish pass was free of blockages and to assess the flow over the old pass;
- to assess the flow and condition of the new fish pass (Photograph 1);
- to assess residual flow compliance;
- to document whether the weir was overtopping;
- to assess water levels in the race and lake; and
- to monitor maintenance work where appropriate.



Photograph 1 The new fish pass (8 September 2010)

Sources of data being collected by Trustpower were identified and accessed, so that performance in respect of operation, internal monitoring, and supervision could be reviewed by the Council.

1.4.4 Water temperature monitoring

Water temperature was identified in past monitoring years as the water quality parameter of most concern in the residual flow reach (consent 3369), other than the obvious lack of submerged habitat below the weir.

The impact of the diversion of water at the weir upon water temperatures in the Manganui River was assessed using continuous monitoring over the summer period (November to May) of the monitoring year. Two temperature recorders were used, one being located immediately upstream of the Tariki weir (T1) and the second recorder located 2.3 km downstream of the Tariki weir (T2). A third location (T3), located downstream of the confluence with the Mangaotea Stream, was monitored for summer water temperatures from 2007 and 2013. The locations of the recorders are illustrated in Figure 2.

1.4.5 Data audit

Trustpower provided the Council with data on water abstraction from numerous locations, including the Manganui River and Mangaotea Stream. Data for race and lake water levels, river flows (including residual flows) and discharge rates to the Makara Stream were also provided. The Council assessed the abstraction and discharge data to determine whether or not the abstraction/discharge rates exceeded the consented rates. The lake level data were assessed to determine whether or not the range in water levels in Lake Ratapiko was within the range expressed in the consent conditions. The fish pass flows and Mangaotea Stream flows were compared with required residual flows, for consent compliance assessment, while race water levels were also assessed to determine whether water levels exceeded maximum levels specified in consents. The locations of these water level monitoring sites are shown in Figure 3.

1.4.6 Biomonitoring surveys

Riverbed macroinvertebrate communities provide useful information relating to habitat quality because they are relatively sessile (attached to the bed), they can be easily sampled, and they form distinctive community structures that reflect certain physical and chemical conditions. There is also considerable past data for the Manganui River catchment for comparison with new results.

During the discussed period, one biological survey was performed in the Manganui River to determine whether or not residual flows below the Tariki weir were sufficient to maintain healthy water quality and macroinvertebrate communities in the river. Four sites were sampled and their locations are shown in Figure 4.

1.4.7 Fish monitoring

The Council has been monitoring fish species distribution in the Manganui River catchment since 1990. Electric fishing techniques and spotlighting at night have been used for this purpose. Following on from recommendations in previous monitoring reports, trout were captured at the head of the true right bank fish pass during the autumn and early winter of 2016. The trapping was reported in the 2015-2016 monitoring report (TRC, 2016), while any tag returns, where fisherman report catching tagged fish, will be reported in subsequent reports.

One fish survey was completed in the 2016-2017 monitoring period, with a four site spotlighting survey undertaken in the Mangaotea Stream.

The elver trap and transfer system continued to operate over the reported period. Inspections of the system were conducted during the transfer season and results of the transfers are reviewed in the current report (consents 3372, 3373).



Figure 2 Continuous water temperature monitoring sites in the Manganui River in relation to the Motukawa HEP scheme

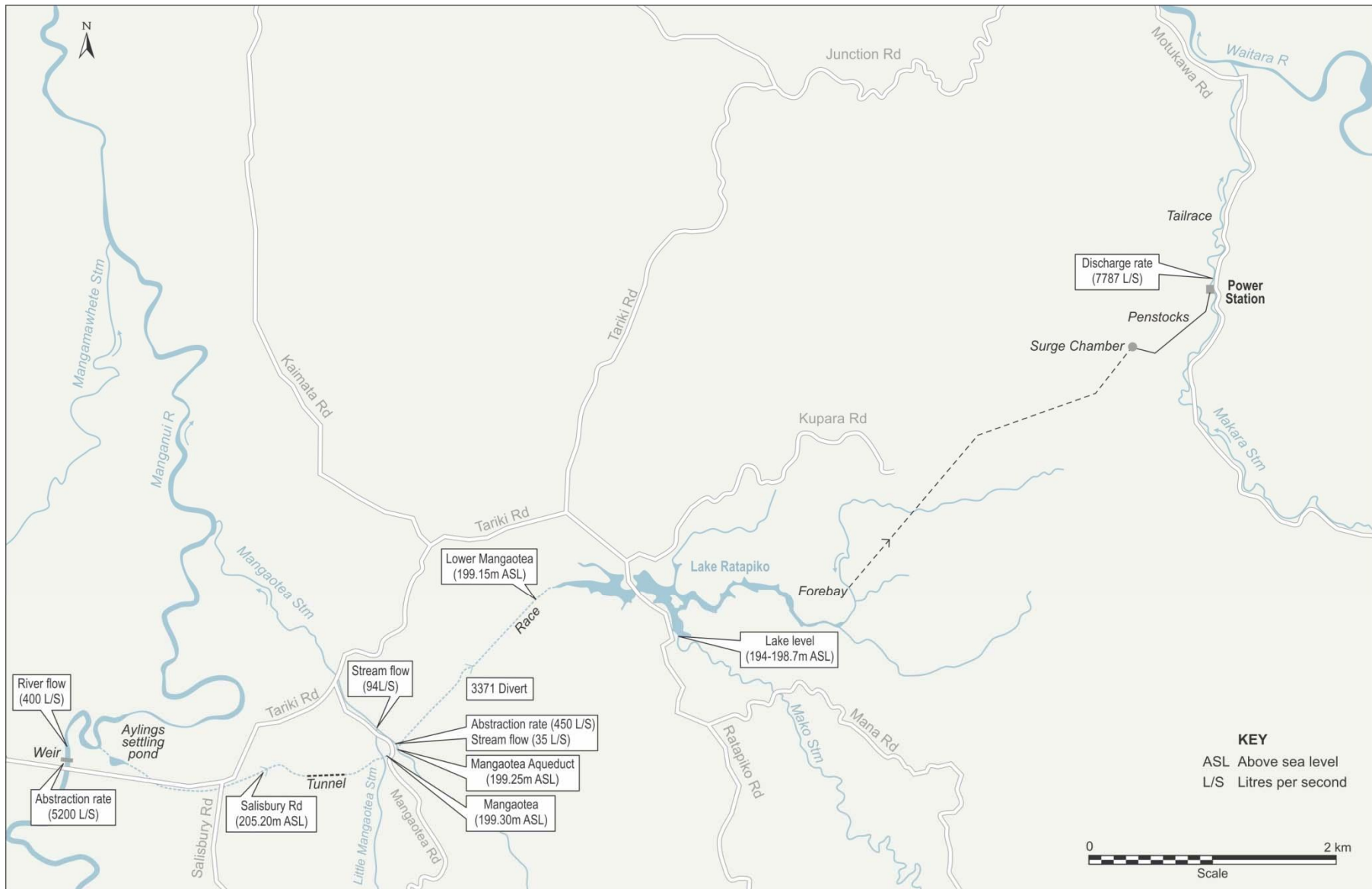


Figure 3 Location of water abstraction, discharge and water level monitoring sites for the Motukawa HEP scheme (limits in brackets)



Figure 4 Macroinvertebrate monitoring sites in the Manganui River in relation to the Motukawa HEP scheme

2 Results

2.1 Water

2.1.1 Inspections

Each inspection undertaken of the Motukawa HEP Scheme essentially followed the same format, including checking water levels, fish passage and making notes of general observations. As a result, the vast majority of inspection comments are very similar and as such, there is little value in repeating them in detail here. However, a full inspection record is available on request. Some notable observations made during the reported period are included below.

The first two compliance monitoring inspections, completed on 10 October and 1 December 2016 found that there was a relatively high rate of take from the river and that there was also quite a high rate of take from the Mangaotea Stream. The intake structure on the Mangaotea Stream appeared in good order, being intact and clear of debris.

The third compliance monitoring inspection was performed on 10 January 2017, and found the Manganui River has a low and clear flow. The fish pass was in good condition, although macrophyte growth was beginning to constrict the flow down the pass. A visit to the station on Motukawa Rd found that generation was occurring and that the elver trap was in operation. At Lake Ratapiko, it was found that the elver pass over the Mako Dam had insufficient flow, and this needed some attention. The following inspection, completed on 23 February 2017, found that flows had improved down the Mako Dam elver pass.

The fifth inspection, completed on 5 May 2017, observed no abstraction from the Mangaotea Stream, and quite a high lake level. In contrast, the final inspection which was undertaken on 30 June 2017, found a high rate of take from the Mangaotea Stream, and a relatively low lake level.

It was noted during most inspections undertaken in the 2016-2017 period that the staff gauge in Lake Ratapiko was too dirty to read accurately. Trustpower responded to this by installing a new staff gauge at the Ratapiko Dam. This was completed early in the 2017-2018 monitoring period.

2.1.2 Hydrological inspections

Special condition 1 of consent 3368-1 sets the residual flow that the operator needs to comply with in the Manganui River. The consent holder needed to comply with the following:

“That the abstraction shall be managed to ensure that a residual flow of not less than 400 L/s is maintained at all times in the Manganui River below the weir”.

The consent holder provides this residual flow by passing flow through the new fish pass, located on the true right bank of the weir, and supplementing the flow through the old fish pass, located on the true left of the weir. When this residual flow is assessed for compliance purposes, a gauging is undertaken at each fish pass, with the total flow compared against the required amount of 400 L/s. Gaugings are only undertaken when there is no more than an insignificant amount of water spilling over the Tariki Weir.

Due to the relatively wet weather experienced during the 2016-2017 monitoring period, the Manganui River was found to be spilling over the weir during three of the five visits to this location.

Table 1 shows that five hydrological inspections were undertaken in relation to the Manganui River residual flow. These inspections found that the residual flow was being provided as required during each inspection. On 9 June 2016, the flow was recorded at 399 L/s. Although this is less than the required residual flow, when the standard error of 8% is applied to the gauging, it is likely that the actual flow at

this time was between 367 and 430 L/s. Therefore the flow was deemed compliant. However the consent holder was reminded of the importance of providing a residual flow of at least 400 L/s.

Table 1 Gauging results for gaugings undertaken in relation to the Manganui River residual flow

Date	Weir spilling?	New fish pass flow (L/s)	Old fish pass flow (L/s)	Total residual flow (L/s)	Compliant?
21/10/16	No	296	128	424	Yes
12/01/17	No	324	156	480	Yes
23/05/17	Yes	-	-	>400	Yes*
21/06/17	Yes	-	-	>400	Yes*
29/06/17	Yes	-	-	571	Yes**

* On this occasion the weir was spilling, with a visual assessment finding sufficient residual flow.

** On this occasion a gauging was completed downstream of the weir

Special condition 4 and 5 of consent 6381-1 set out the residual flow requirements of the Mangaotea Pumps intake, in the Mangaotea Stream. These conditions state the following:

4. For the first two years following the exercise of this consent the abstraction authorised by this consent shall cease when the flow in the Mangaotea Stream immediately downstream of the confluence with the Little Mangaotea Stream located at Q19: 227-201 (GPS E2622779 N6220149) is equal to or less than 94 L/s. If at this site flows are greater than 94 L/s, the abstraction shall cease when the flow in the Mangaotea Stream immediately downstream of the abstraction point (GPS E2622836 N6220071) is equal to or less than 35 L/s.
5. Two years after the exercise of this consent, and following assessment of monitoring conducted as per special conditions 8, if a review of the residual flows detailed in special condition 4 is required (as per condition 9), residual flows shall be based on 55% of the median flow immediately downstream of the confluence with the Little Mangaotea Stream, and at the point of abstraction shall be 35 L/s or mean annual low flow whichever is higher.

This assessment of monitoring was completed in 2012 and it was concluded that no review was warranted, and therefore the residual flows in the Mangaotea Stream are as follows:

- 35 L/s immediately downstream of the abstraction point; and
- 94 L/s immediately downstream of the confluence with the Little Mangaotea Stream.

The Mangaotea Stream pumps were visited on four occasions. On one of these four occasions, no water was being abstracted from the Mangaotea Stream, and therefore no gaugings were completed. Gaugings were completed on the other three occasions, with the results shown in Table 2.

No gaugings were undertaken in the race during the 2016-2017 monitoring period.

Table 2 Gauging results for gaugings undertaken in relation to the Mangaotea Stream residual flow, 2016-2017 monitoring period.

Date	Abstraction Occurring?	Flow downstream of intake	Flow downstream of confluence	Compliant?
11/10/16	Yes	237	375	Yes
12/01/17	Yes	65	95	Yes
21/06/17	Yes	100	152	Yes

2.1.3 Results of abstraction and discharge data audit

Trustpower holds several consents which, through various special conditions, require them to record abstraction rates, discharge rates and water levels, and provide these records to the Council on a three-monthly basis. The details of these consent requirements are shown in Table 3. Locations of the water level monitoring stations are shown in Figure 3. Once these records are submitted, they are audited so as to assess compliance with the relevant consent conditions.

There are two aspects of compliance at play here, being the actual recording of data, and also staying within particular limits set by consents. These will be dealt with separately.

Previous reports for this scheme have reported the number of occasions where data was either lost or not recorded. Only notable periods were included, being greater than 24 hours for one site, or greater than 12 hours for two or more sites. Over the last nine years, the Company has made significant efforts to improve this scheme's equipment and systems used for measuring and recording the required data. As a result, there have been no notable gaps in the data since the 2014-2015 monitoring period.

When assessing the data to determine whether the consent holder stayed within consent limits, it is important to apply an acceptable error to the data. This acknowledges that the recording equipment has an accepted accuracy (degree of closeness of a measurement to the actual value). If a flow is calculated using water level, then it is also important to consider the accuracy of the rating curve. In addition, when recorded data is compared with that measured in the field, and checked for accuracy, it is important to also consider the error associated with the field measuring technique. In this case the measured data (when taking into account error in technique) must still comply with the limit specified in the consent. It is the responsibility of the consent holder to ensure the limit is complied with, and as such they must have adequate regard for the error in their monitoring methods.

Table 3 Details of consents and special conditions in relation to abstraction rates, discharge rates and water levels, and the recording thereof

Resource Consent	Special Condition	Detail	Limit/Requirement
3369 – Abstraction from Manganui River	3	Measuring rate of abstraction	Measuring abstraction rate from the Manganui River (not to exceed 5,200 L/s ± 5% (logger error))
	5	Flushing flows if weir has not overtopped for 30 days	Release 400 L/s for 3 hours daily
	4	If Waitara River drops below 5,000 L/s	Cease abstraction or pass water continuously through power station
	7	Residual flow in race	Retain a flow of at least 150 L/s, or a fish salvage is to be undertaken
3371 - Diversion of water into race and Lake Ratapiko	2	Maximum race water levels	Race water level: Salisbury Rd: 205.20 m a.s.l Mangaotea: 199.30 m a.s.l Mangaotea Aqueduct: 199.25 m a.s.l Lower Mangaotea: 199.15 m a.s.l
	5	Recording of water levels and rainfall	Water levels at the above sites to be recorded, with the inclusion of rainfall at the Mangaotea Aqueduct
3372 – Discharge to Makara Stream	2	Recording of discharge rate	Record the rate of water discharged to the Makara Stream (not to exceed 7,787 L/s)
3373 – To dam the Mako Stream	5	Minimum lake level	Minimum level: 194 m a.s.l (except during maintenance)
	6	Maximum lake level	Maximum level: 198.7 m a.s.l
	8	Recording data	Record the lake level at the spillway
6381 - Take water from Mangaotea Stream	3	Abstraction rate	Abstraction rate not to exceed 450 L/s
	4	Residual flows	94 L/s downstream of Little Mangaotea confluence If this is exceeded, then 35 L/s at point of take
	6	If a flushing flow (three-times median flow) has not occurred for 20 days	Cease abstraction for 8 hours
	7	Recording of flows	Abstraction rate, residual flow at point of take and flow downstream of Little Mangaotea Confluence all to be recorded.

Prior to the 2015-2016 monitoring period, a standard 5% was applied to the data value provided, regardless of whether it was flow or water level data. This was not necessarily consistent with the National Environmental Standards for water level recording (2013b). It was therefore considered necessary to define what the acceptable error is for each relevant consent condition.

This discussion between the Council and Trustpower is ongoing, and it maybe determined that it is better to define this error through the consent renewal process, which is anticipated to begin in 2021.

In the 2016-2017 period there were only three occasions where such limits were breached. The first, which occurred on 24 July 2016, related to a severe weather event. Significant rainfall occurred in the Mangaotea area, causing an increase in flow in the race. As a result, water levels in the race exceeded the limit at three locations, for up to 1.75 hours. This was not treated as a non-compliance event, due to it being of a minor nature and related to a natural event

The other two events, which occurred on 9 February and 31 May 2017, both related to inadequate residual flow in the Manganui River below the Tariki weir. On both occasions the intake gate controls had been switched to manual, to allow maintenance works to occur. The river receded further than anticipated, resulting in the residual flow receding below the minimum flow of 440 L/s. Both incidents were of a minor nature, in that they did not occur for an extended period of time. However, it is suggested that Trustpower improve supervision of the residual flow at times when the gate controls are switched to manual, in an effort to avoid a recurrence.

During the reported period, the abstraction rate from the Mangaotea pumps remained within the maximum allowable rate of take and the records indicate compliance with the Mangaotea Stream residual flows. On no occasion during the reported period did the flow in the Mangaotea Stream drop below the residual flows (including when abstraction wasn't occurring), reflecting the particularly wet summer experienced over this time.

Records of the discharge to the Makara Stream show that there were no occasions during the 2016-2017 monitoring period where the discharge rate exceeded the consent limit. Past compliance has been high with only one exceedance recorded since the beginning of the 2002-2003 monitoring year (May 2002).

The lower lake water level has not been breached since records began, on 1 July 2002. The fact that so few limits were breached, including those related to the Mangaotea Stream abstraction, indicates very good management of the scheme.

There are certain operational requirements also set by consents, which require flushing flows of 400 L/s to be released down the residual flow reach once the Tariki Weir has not naturally overtopped for 30 days, and that once flows in the Waitara River at the Bertrand Road bridge drop below 5,000 L/s that either the abstracted water is passed continuously through the lake, or that abstraction cease (with regard to the 150 L/s residual flow in the race).

At no stage in the reporting period were Trustpower required to pass all abstracted water continuously through the lake, or to cease abstraction, due to the flow in the Waitara River dropping below 5,000 L/s. It should be noted that the consent states that Council needed to inform Trustpower of the low Waitara River flow, and only then are Trustpower required to comply with the special condition.

Table 4 Incidents where recorded flows/water levels did not meet consent requirements. Includes only those incidents of one hour or longer that exceeded the 5% margin of error. Table includes the extent of non-compliance, and total duration in brackets.

Date	Consent requirement													Detail	Deemed Non-compliant?
	Manganui Abstraction		Salisbury Rd	Mangaotea	Mangaotea Aqueduct	Lower Mangaotea	Makara Station d/c	Lake Level		Residual flow Manganui river	Mangaotea Abstraction				
	Min	Max	Max	Max	Max	Max	Max	Min	Max	Min	Min Residual flow		Max rate		
	150 L/s	5,200 L/s	205.2 masl	199.3 masl	199.25 masl	199.15 masl	7,787 L/s	194.0 masl	198.7 masl	400 L/s	35 L/s	94 L/s	450 L/s		
24/07/16				199.55m (1.75 hrs)	199.37m (1 hr)	199.22 (1.5hrs)			198.77 (3.5hrs)	Compliant				Due to a significant weather event	No
09/02/17	100% Compliant	100% Compliant	100% Compliant				100% Compliant	100% Compliant		365 (3 hrs)	100% Compliant	100% Compliant	100% Compliant	Maintenance works being undertaken	No – minor event with swift response
31/05/17				Compliant	Compliant	Compliant			Compliant	313 (3.75 hrs)				Gates on manual control to facilitate civil inspection – river receded more than expected	No – minor event with swift response

The data has also been assessed to determine when the Tariki Weir was not naturally overtopped for a period of 30 days in this time, requiring the release of flushing flows. This assessment identified no periods when flushing flows were required, as the weir overtopped frequently. Even during the driest period, the longest time the weir went without overtopping was 21 days, from 18 February to 11 March 2017.

The abstraction from the Mangaotea Stream is also required to provide flushing flows, although the criteria that defines when is different to that for the Manganui River. Condition 6 of consent 6381-1 states that:

“if a flushing flow (defined as three times the median flow) has not occurred within a continuous period of 20 days, the consent holder shall cease abstraction for 8 hours during the next naturally occurring flushing flow, so as to enhance water quality downstream of the abstraction point.”

The hydrological analysis undertaken in relation to condition 8 of this consent (discussed in the 2010-2014 report, Taranaki Regional Council, 2015a), determined that a flushing flow as per this definition was 366 L/s. The location at which this flushing flow applies is downstream of the abstraction, but upstream of the Little Mangaotea confluence. In analysing the data, there were four occasions where these flushing flows were required. On the first of these occasions, where the natural flushing flow occurred on 23 December 2017, the abstraction ceased as required. On the second occasion (12 March 2017), abstraction ceased later than required, missing the peak of the flushing flow. On the second and third occasions, abstraction continued throughout the natural flushing flow. Three of the four occasions are illustrated in Figure 5.

The Company investigated the lack of flushing flows and has been unable to determine a cause for the control system not providing these flushing flows as required. This investigation is ongoing.

2.1.4 Other submitted data

Special condition 4 of consent 3371-2, which relates to the diversion of water into the race, requires that a five-yearly monitoring survey of the race be completed by the consent holder to identify any maintenance requirements in order to maintain a race capacity of 8,000 L/s, for the purpose of avoiding flooding adjacent farmland. It also requires that any required maintenance shall occur within 12 months of the completion of the survey. This survey is now conducted once a year by site staff, and a brief report discussing the most recent survey was provided to the Council in 2018.

Recent surveys identified three slips along the race banks, with remedial work undertaken. Ongoing monitoring and repairs of these slip sites is now a part of the maintenance programme.

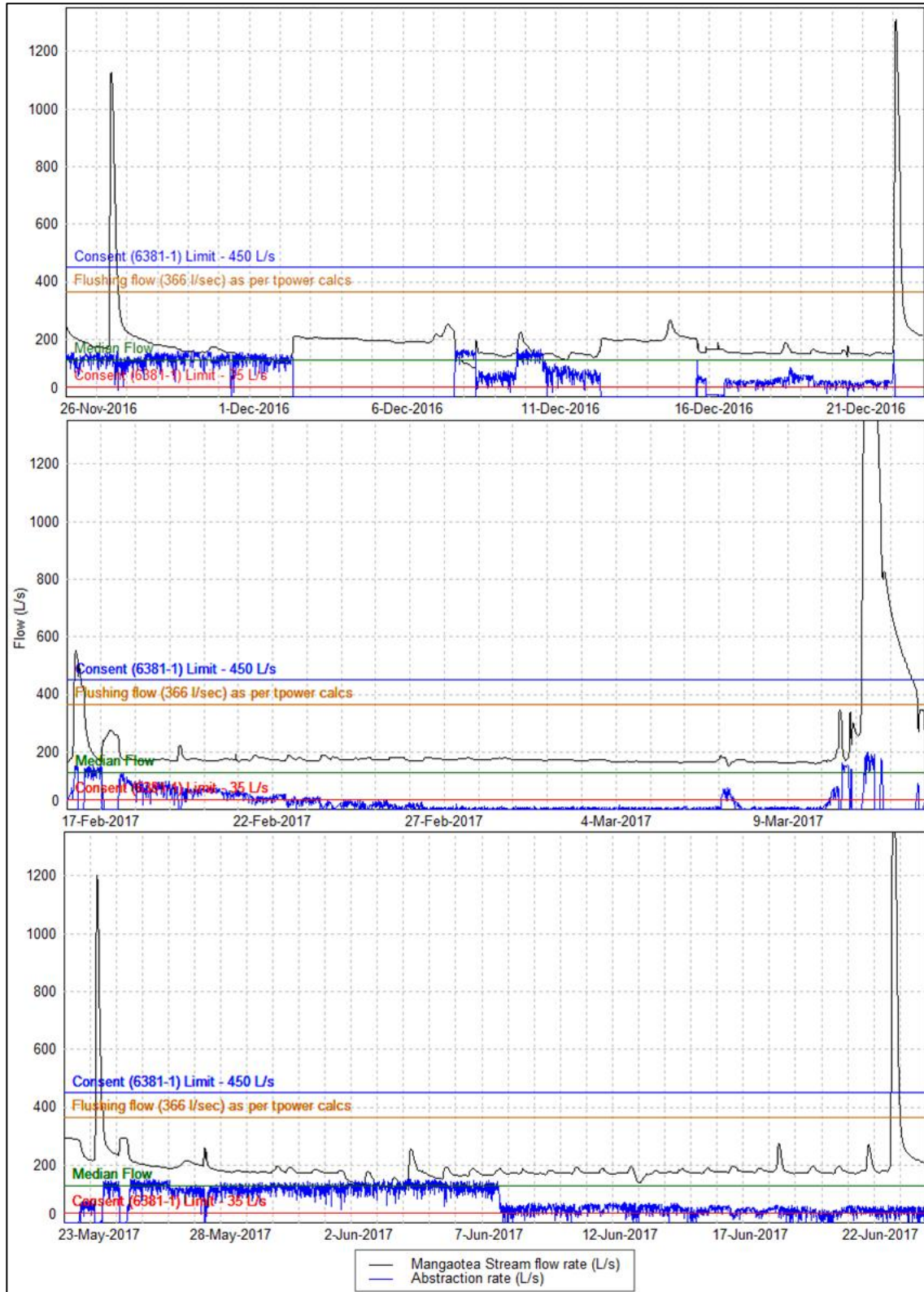


Figure 5 Flow rate in the Mangaotea Stream immediately downstream of the intake, and the abstraction rate from the Mangaotea Stream at a time when abstraction ceased as required (top), when abstraction ceased later than required (middle), and when abstraction continued unabated during the natural flushing flow (bottom).

2.1.5 Results of receiving environment monitoring

2.1.5.1 Water temperature monitoring

Data loggers were used for continuous monitoring of river water temperatures at two sites (Figure 2). One logger was located immediately upstream of the weir at Tariki Road while the second logger was located 2.3 km downstream of the weir. These data have been collated and a monthly statistical summary presented in Table 5 together with data from the ten years (1992-2002) prior to the residual flow increase to 400 L/s, and the 13 years (July 2002 to June 2016) since the residual flow increase. It should be noted that the logger located upstream of the weir was determined to be out of the water from 14 March to 3 April 2017, and the loggers were deployed late and retrieved early. This resulted in both sites missing data for approximately 17 days in March 2017, while the upstream site was also missing 15 days in November 2016 and 12 days in April 2017. The downstream site is missing data for approximately 15 days in November 2016 and 9 days in April 2017. Any analysis using this data should be treated with caution.

During the 2016-2017 period, the highest monthly mean water temperature upstream of the weir was recorded in February, and this was also the case for the downstream site (Table 5). The lowest monthly mean was recorded in April for both the upstream and downstream sites. When comparing the sites, the downstream site had a higher mean monthly water temperature in all months monitored, when compared with that recorded upstream (0.3 to 1.5 °C higher).

Table 5 Summary of summer Manganui River daily water temperatures (°C) prior to the increase in residual flow to 400 L/s (1992-2002) and for the years since, upstream and downstream of the Motukawa HEP weir

	Period	Month											
		November		December		January		February		March		April	
		Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Upstream (T1)	1992-2002 (pre 400 L/s)	7.9-20.2	13.9	10.4-22.8	16.2	11.1-24.6	17.1	11.3-23.7*	17.7*	9.4-21.7	16.2	8.3-17.0	12.9
	2002-2016 (post 400 L/s)	7.7-23.5	14.7	9.7-23.1	16.4	10.7-25.4	18.0	11.3-25.6*	18.4*	9.6-22.3	15.9	6.7-18.2	13.0
	Reported period 2016-2017	10.9-18.9*	14.4	12.0-21.1	15.7	12.1-21.9	16.4	13.1-20.4	16.8	13.3-19.1*	16.5*	10.7-16.6	13.9*
2.3 Km Downstream (T2)	1992-2002 (pre 400 L/s)	8.4-22.7	15.2	11.0-24.6	17.6	12.0-28.3	19.2	12.0-25.8*	19.0*	11.0-22.4	17.5	9.3-20.4	13.9
	2002-2016 (post 400 L/s)	8.4-25.9	16.0	10.6-25.4	17.6	10.5-28.2	19.2	11.8-27.8	19.3	10.3-24.1	16.7	7.8-19.0	13.5
	Reported period 2016-2017	11.6-21.3*	15.3	13.2-23.2	17.2	12.3-23.9	17.7	14.7-22.2	17.9	13.3-20.3	16.9	11.1-17.7	14.2*

* These periods include periods of missing data that exceeded 240 hours, preventing a complete assessment for these periods.

Maximum temperatures recorded upstream and downstream of the abstraction both occurred in January 2017. The maximum upstream temperature for the reporting period was 21.9 °C, within the range for this site. This temperature was recorded on 10 January 2017, and was 3.5 °C cooler than the maximum recorded on 7 February 2005. On the same day, site T2 recorded a maximum temperature of 23.9 °C, which was the highest temperature recorded at this site during for the monitored period. Of note, is that for the reported

period, the upstream site recorded a relatively low annual maximum temperature, being the fourth lowest since records began in 1992. This reflects the wet summer experienced in Taranaki over this time, but overall, there appears to be a subtle warming trend in this data (Figure 6). Whether this is a reflection of climate change, or a change in upstream land use is unclear, but it does reflect the value of continuing the water temperature monitoring component of the programme.

Temperatures over 25 °C can significantly adversely affect trout and other freshwater fish communities, as well as being outside the tolerance range of some sensitive macroinvertebrate taxa. Prior to the 2005-2006 monitoring period, 25 °C had only ever been exceeded in the residual flow reach (Figure 6). However, in February 2005 and January 2008, the maximum daily temperature at the upstream site exceeded 25 °C, on a total of three days. During the 2016-2017 period, the upstream site never exceeded 25 °C, and only exceeded 20 °C on 6 days (Table 6). The downstream site (site T2) also did not exceed 25 °C, and exceeded 20°C on 42 days, primarily in late December to mid January (Figure 7).

The 2016-2017 period experienced a warmer March and April period than normal, with the downstream site during these months recording a mean temperature between 0.3 and 0.4 °C higher than the respective monthly means recorded between 2002 and 2015 (Table 5). Upstream this difference was even more marked, with the mean April temperature being 0.9 °C higher than the long term mean, although it should be noted that some April 2017 data was missing for this month. The earlier months (November to February) were notably cooler than normal, with mean temperatures being between 0.3 and 1.6 °C lower than normal at the upstream site and 0.4 and 1.4 °C lower than normal at the downstream site. Furthermore, new minimum temperatures were recorded at the downstream site in December, January and February. This indicates that the 2016-2017 period was cooler overall, with none of the extreme daily maximums recorded in some previous years.

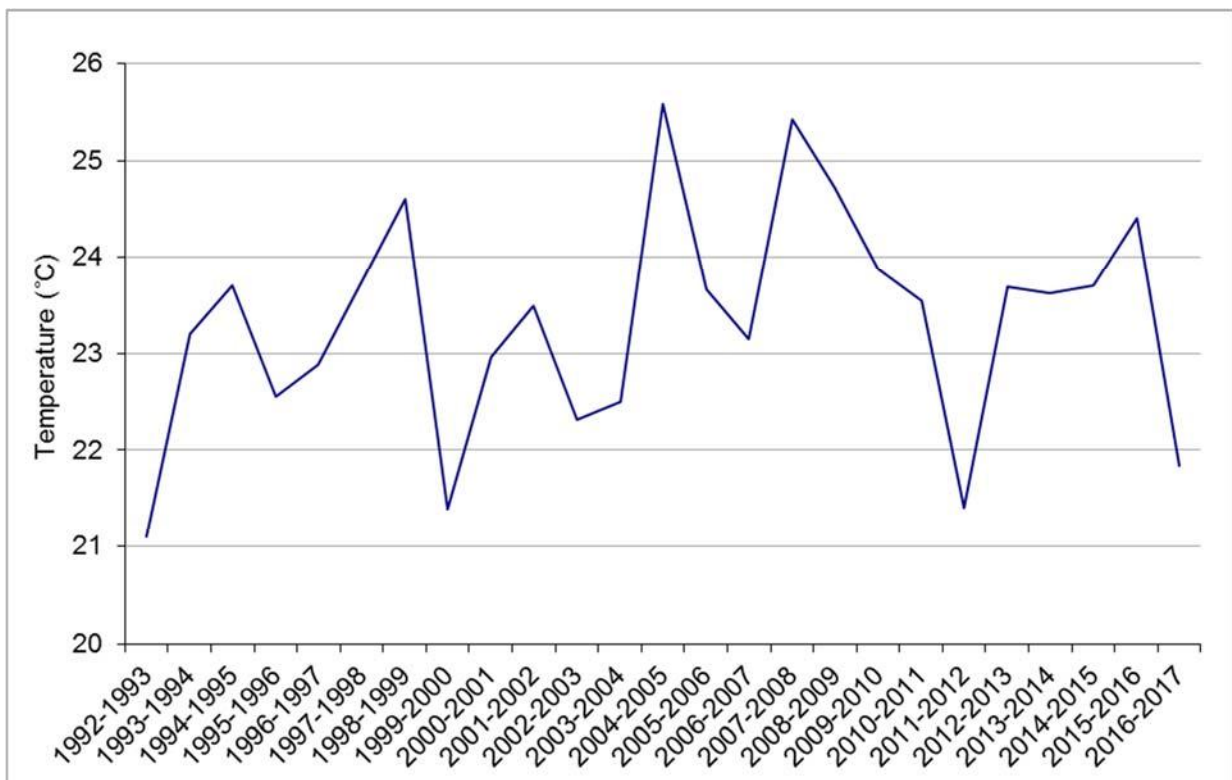


Figure 6 Maximum water temperatures in each monitoring year (November to April inclusive) recorded upstream of the abstraction (Site T1)

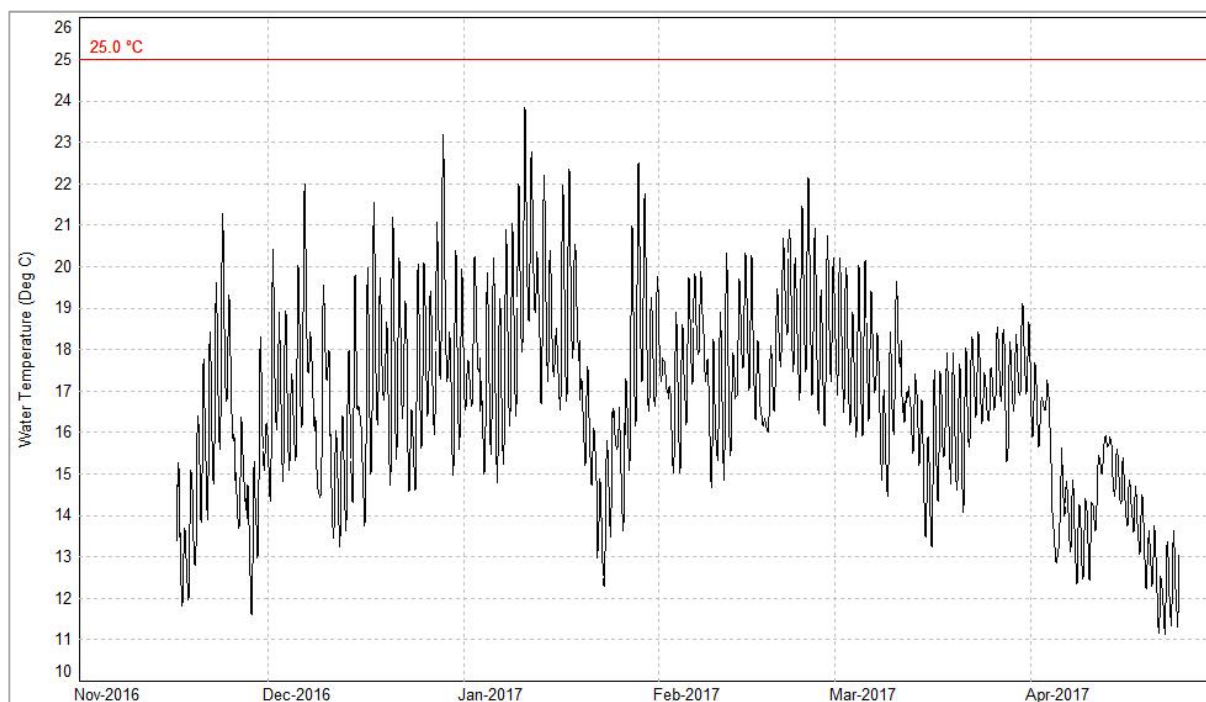


Figure 7 Water temperatures in the Manganui River, 2.3 km downstream of the Tariki Weir.
1 November 2016–1 April 2017

Table 6 Summary of maximum daily water temperatures in the Manganui River, upstream and downstream of the weir, between 1 November and 30 April inclusive.

		No. days monitored	% of maximum temperatures in this range (no. of days)			
			10-15 °C	15-20 °C	20-25 °C	25+ °C
Upstream	1992- 2002 (pre 400 L/s residual flow)	1624	20.4	60.8	18.8	0.0
	2002-2016 (post 400 L/s residual flow)	2462	19.1	59.4	21.2	0.1
	2016-2017*	135	10.4 (14)	85.2 (115)	4.4 (6)	0.0 (0)
Downstream	1992- 2002 (pre 400 L/s residual flow)	1677	11.7	49.0	37.6	1.6
	2002-2016 (post 400 L/s residual flow)	2486	12.1	46.5	38.4	3.0
	2016-2017**	159	8.2 (13)	65.4 (104)	26.4 (42)	0.0 (0)

* Data record is missing approximately 15 days in November 2016, 17 days in March 2017 and 12 days in April 2017.

** Data record is missing approximately 15 days in November 2016 and 9 days in April 2017.

Unlike in most previous monitoring periods, at no time during the reported period were particularly extreme water temperatures recorded. Although the maximum water temperature at the downstream site was recorded in January 2017, the highest average water temperature (17.9 °C) was recorded in February 2017. The most extreme time period for water temperatures in the residual flow reach during the previous (2015-2016) period reported period came during February. The average daily water temperature at that time was 21.2 °C at site T2, 1.9 °C higher than the long term (post 2002) average (Table 5). Furthermore, six days recorded a maximum water temperature in excess of 25 °C, over the period 3 to 13 February 2017. Temperature extremes of this nature have the potential to cause fish kills, although none were reported to Council during this period. There were also no fish kills reported in the current monitoring period. This is an indication that water temperatures have the potential to rise to lethal levels in the residual flow reach. Table 6 presents a summary of maximum daily water temperatures for the reported period from November to April. This table shows that the number of days that recorded a maximum temperature in excess of 20 °C reduced significantly at both site T1 and T2 when compared to the average, although site T2 had a much higher number of days that experienced a maximum daily temperature in excess of 20 °C (42 compared with 6 days).

When water temperatures above 20 °C occur for long periods of time, conditions can become stressful for fish, therefore the duration of time that water temperatures exceed this temperature is also important. In the 2016-2017 reporting period, the percentage of time water temperatures exceeded 20 °C downstream of the weir (site T2) was six times that recorded in the natural flow regime upstream of the weir (Table 7). Although a significant jump from that typically recorded since the 400 L/s residual flow was implemented, this statistic is a result of how little time the upstream site exceeded 20 °C, rather than due to the downstream reach experiencing greater warming. This is reflected by the fact that the downstream site only exceeded 20 °C for 6% of the time, well down on the average of 17%. Comparing the percentage exceedance times for all data pre 400 L/s residual flow with all data post 400 L/s residual flow, it is clear that that temperatures greater than 20 °C have still occurred more downstream (compared with upstream), but are marginally less frequent than occurred prior to the 400 L/s being released down the river (17% of time following the residual flow compared to 18% of the time prior). This compares well with the upstream temperatures, which have actually seen an increase in the percentage exceedance of 20 °C, from 6% prior to, to 8% following the residual flow increase.

Table 7 Exceedance time (%) for Manganui River water temperatures recorded in the period prior to (1992-2002) and post residual flow increase (2002-2014) for comparison at both sites (1 November – 30 April)

Site	Period	Temperature (°C)											
		4	6	8	10	12	14	16	18	20	22	24	26
T1 - Upstream	1992-2002	100	100	99	99	93	73	47	21	6	<1	<1	0
	2002-2016	100	100	99	99	93	75	49	24	8	1	<1	0
	2016-2017	100	100	100	100	98	81	46	12	1	0	0	0
T2 - 2.3Km Downstream	1992-2002	100	100	100	99	97	84	64	40	18	5	<1	<1
	2002-2016	100	100	99	99	95	82	61	37	17	6	1	<1
	2016-2017	100	100	100	100	98	88	66	28	6	<1	0	0

* For the upstream site, data is missing for approximately 17 days in March 2017, 15 days in November 2016 and 12 days in April 2017. The downstream site is missing data for approximately 15 days in November 2016 and 9 days in April 2017.

The key purpose of the water temperature monitoring is to assess whether the 400 L/s residual flow has reduced the mean and peak temperatures, and differences in water temperature, between the natural flow and residual flow reaches. Table 7 compares all data prior to the residual flow of 400 L/s (10 years of data) with all data following the residual flow implementation (14 years of data). Upstream of the weir under natural flows, pre and post residual flow water temperature data are comparable; although it appears that there may be a very subtle warming trend. Because of this slight warming trend it can be difficult to compare the raw temperature data, with that from prior the 400 L/s residual flow.

A comparison of temperature differences can prove more useful. The temperature differences between the natural and residual flow reaches have changed markedly, since the 400 L/s has been implemented (Figure 8, Figure 9). Figure 8 presents the average difference in mean monthly temperatures between site T1 (upstream) and site T2 (downstream), separated into pre 400 L/s and post 400 L/s. It is clear from this data that the increased residual flow has led to a reduced average monthly temperature difference, with this effect being particularly noticeable during the months most critical for temperature (January to March). Figure 8 also shows that the temperature difference is greatest from November to January, which is most likely related to the upstream reach only beginning to warm in the latter half of the summer. Included in Figure 8 is data for the reported period. This shows that the average daily difference was highest in December, coincident with the headwaters receiving about half the normal rainfall for this time¹. The remaining months had average daily differences similar to or slightly less than that previously recorded since the residual flow was increased to 400 L/s.

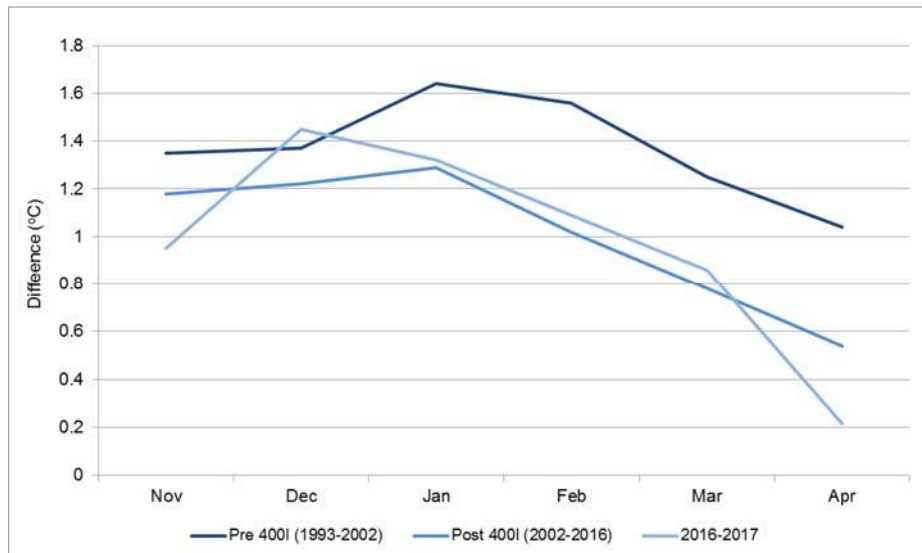


Figure 8 The average difference in mean monthly water temperatures between upstream and downstream, pre and post 400 L/s residual flow implementation, and during the reported period. Note that for the upstream site, data is missing for approximately 17 days in March 2017, 15 days in November 2016 and 12 days in April 2017. The downstream site is missing data for approximately 15 days in November 2016 and 9 days in April 2017.

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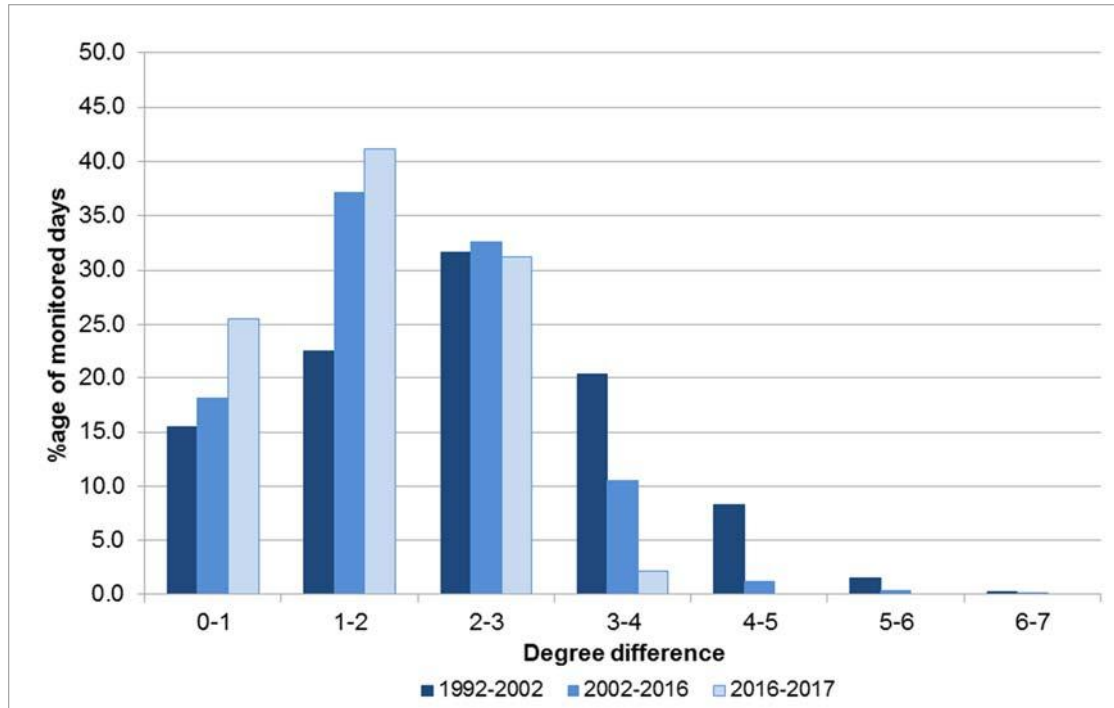


Figure 9 The distribution of maximum daily temperature differences (downstream minus upstream), displayed as a percentage of total days monitored. Data has been split into pre-400 L/s residual flow (1993-2002) and post 400 L/s residual flow (2002-2014), and are for the months November to April only.

Prior to the 400 L/s, the most frequent maximum temperature difference was between 2-3 degrees, with almost 30% of the days experiencing a maximum difference of more than three degrees. In the fourteen years following the increased residual flow, the most frequent maximum daily temperature difference has reduced to 1-2 °C, with the number of days experiencing a maximum daily difference of more than 3 °C dropping to 12.2%, less than half that recorded prior to the 400 L/s. When data from the reported period is compared with this historical summary (Figure 9), it can be seen that temperature differences reduced further. The proportion of time that maximum daily temperature differences were between 0-1 °C increased from 18.1% in the 2002-2016 period to 25.5% over the reported period. In addition, the proportion of time that the maximum daily temperature difference exceeded 3 °C dropped to 2.1%.

Instantaneous differences in river water temperatures between the two temperature monitoring sites are illustrated together with the flow record for the Manganui River at Everett Park in Figure 10, for a series of high flow events that occurred in late 2016. As in previous years, this figure illustrates that the greatest differences in water temperature occur between the two sites during recession flows. During large freshes, the differences in water temperature between the two sites are close to zero. Smaller freshes have less of an influence, as the scheme is able to absorb these flows, resulting in little change to the flow downstream of the weir.

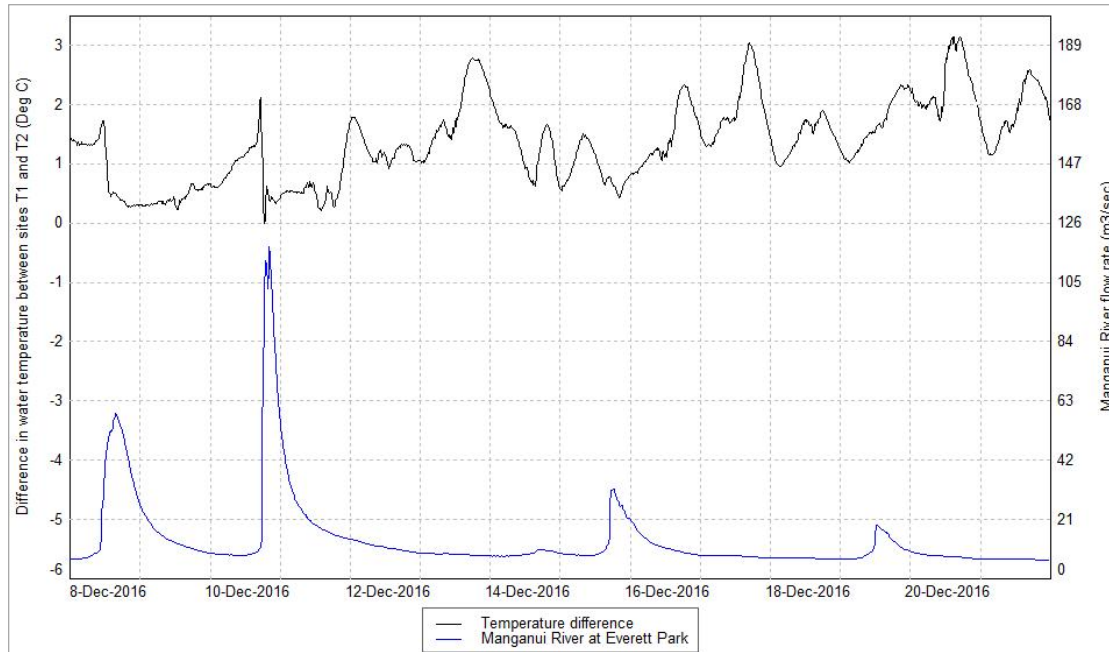


Figure 10 Manganui River water temperature differences between sites upstream and downstream of the Motukawa HEP weir compared with the flow in the Manganui River at Everett Park from 8 December to 22 December 2016.

Schedule 3 of the RMA sets standards for water temperatures, for a range of waterways with specific values. It is acknowledged that the residual flow downstream of the weir is designed to primarily provide passage for trout, with some native fish habitat also provided. However, it follows that in order to provide passage; some aspects of habitat also need to be provided, such as a hospitable water temperature. Clauses 1 and 2 of schedule 3, which respectively relate to water being managed for ecosystem and fishery purposes, state that the natural temperature should not be changed by more than 3 °C, while clause 2 also states that the natural temperature of the water should not exceed 25 °C. It is clear from the results given above, that the increased residual flow has significantly improved water temperatures, with regard to the number of days that have a maximum temperature difference greater than 3 °C. However, there is still a large increase in the number of days where water temperatures downstream of the weir exceed 25 °C (Table 6). It should be noted that it is rare to record little to no temperature increase in a downstream direction, as there will usually be warming attributable to the natural increase in water temperature with a drop in altitude.

2.1.5.2 Biological monitoring

When the consents for the Motukawa HEP scheme were renewed in 2001, part of the basis for determining the residual flow was to ensure the management objective for the reach to maintain reasonable water quality was achieved. The biological monitoring for this scheme is conducted to help assess whether this is being attained.

Biological monitoring was conducted in relation to the Motukawa HEP scheme on one occasion during the monitoring period under review, to determine if the residual flow below the weir had had any adverse effects on the water quality and macroinvertebrate habitat. The Council's standard 'kick-sampling' technique was used at four established sites (Figure 4) to collect streambed macroinvertebrates from the Manganui River. Samples were processed to provide number of taxa (richness), MCI and SQMCI₅ 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 SQMCI₅ takes into account taxa abundance as well as sensitivity to pollution, and may reveal more subtle changes in communities. It may be the more appropriate index if non-organic

impacts are occurring. Significant differences in either the MCI or the SQMCI_s between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

This survey was conducted on 24 February 2017. Flows had been variable in the two months prior, with a small spate occurring seven days prior to this survey. The river had naturally overtopped the weir on a number of occasions in the two-month period preceding this survey.

This survey recorded taxonomic richness (number of taxa) similar to the median numbers of taxa previously recorded at these sites, with the exception of site 5, which recorded a new maximum taxa richness, eight taxa more than this sites median richness. MCI values were relatively similar in a downstream direction, with the highest MCI score recorded at site 2. Previous surveys generally found MCI values to steadily decrease in a downstream direction, and this was attributed to changes in habitat downstream (including increased water temperatures and algal growth), associated with the reduction in flow downstream of the weir. The fact that the current survey recorded some deterioration, although it was not statistically significant, being a positive indication that the impacts of the diversion were not as severe as expected during this summer low flow period. This may reflect the effects of the relatively frequent flushing flows that occurred over the two months prior. The current survey recorded warm temperatures (around 18 °C), and patchy or widespread growths of periphyton mats and filaments at all downstream sites. The upstream sites also supported patchy growths, but they were not as extensive. Under a residual flow regime, such prolific growths may not be flushed away by floods on a regular basis, as might happen under a more natural flow regime and they can become particularly prolific under lengthy periods of stable low flow conditions. Such proliferations were not as apparent during the current survey, reflecting the frequent flushing flows that occurred during the start of 2017.

There were no significant changes in invertebrate abundance noted between sites 2 and 4 or sites 4 and 6, although there were a number noted between sites 4 and 5 and sites 5 and 6. These changes are primarily related to the difference in habitat noted at site 5, and not considered reflective of a change in water quality at this site. Previous surveys have noted some significant changes in abundance related to the slight increase in algal biomass observed downstream of the weir. This was not as apparent in the current survey. Overall, the current survey indicated that the habitat limitation that appeared to be present in some previous surveys (especially at site 5) was no longer present. This conclusion is also supported by the moderate to high taxa richnesses recorded downstream of the weir.

In general, all sites were dominated by similar taxa, despite the summer low flow conditions. Only subtle changes in abundance were noted, reflecting a change in periphyton biomass and site specific habitat conditions, although there was little impact on the SQMCI_s scores, with a trend of increasing SQMCI_s in a downstream direction, and all downstream sites recording an SQMCI_s score significantly higher than that recorded upstream of the weir. This is in contrast to most previous surveys, which tended to record the SQMCI_s scores reducing gradually in a downstream direction. All sites contained moderate proportions of 'sensitive' taxa, and the communities downstream of the abstraction weir were more generally dominated by these 'sensitive' taxa, which was in contrast to most previous survey results, which usually found 'tolerant' taxa to be generally dominant. Overall, the SQMCI_s scores at these downstream sites were all close to the maximum scores recorded for these sites.

The presence of a number of 'highly sensitive' taxa at all sites indicated generally good preceding physicochemical water quality, although individual abundances within these taxa tended to vary across sites. *Deleatidium* mayflies, considered 'highly sensitive', were well represented at all sites. MCI scores indicated that the stream communities were of good 'health', while the SQMCI_s scores were representative of excellent water quality (Stark & Maxted, 2007), especially when compared to their respective medians. This is an encouraging result, as the higher temperatures usually experienced in the residual flow reach, would be expected to reduce these scores. However, the spring-like weather conditions that preceded this survey suppressed water temperatures, with then not exceeding 24°C in the month prior to this survey.

Since the new residual flow has been operating, some improvement in communities have been observed particularly at site 5, 1.7 km downstream of the weir, where MCI values have generally been above the historical median. The habitat at this site prior to the establishment of the new residual flow was generally poor due to smothering by iron oxide deposits, which has been significantly reduced since the new residual flow has been implemented. This result was repeated in the current survey, with the MCI score at site 5 being ten units higher than the median, and the SQMCI₅ score a statistically significant 3.0 units higher than the median. The overall improvement in macroinvertebrate communities at this site is likely to have been a direct result of the increased residual flow, although there also appears to be a general overall improvement in the catchment, as demonstrated at site 2, upstream of the affected reach. However, elevated water temperatures and more dense periphyton cover have affected macroinvertebrate communities of the residual flow reach in more recent summer surveys.

When the results for each site are compared over time, it is clear that the control site (site 2) is more stable in both taxa number and MCI score than recorded at the three downstream sites. This reflects the 'buffering' effect of the higher flow upstream, which protects the community from extremes such as elevated temperatures. The reduced flow downstream of the weir does not provide as great a buffer and therefore there is more variation in the macroinvertebrate communities recorded at sites in the residual flow reach.

In terms of the current survey, it is considered that the communities of the residual flow reach represent what would be considered better than typical of a low flow community. They are similar to that recorded in the previous survey, despite the previous survey being preceded by stable low flows, with only two large floods in the previous two months. The results indicate that the MCI scores at these sites were higher than most previous surveys, as were the SQMCI₅ scores, which were all significantly higher than their respective medians. However, a similar result was recorded at the control site indicating that there is a catchment wide improvement also. Overall, the results indicate that the invertebrate community supported by a residual flow of 400 L/s, with regards to presence/absence of taxa, and their respective abundances, is not significantly different to that supported by natural flows. The principal difference between the two flows is that there is a greater amount of invertebrate habitat available under natural flow conditions due to the increased amount of wetted riverbed width.

2.1.5.3 Fish monitoring

2.1.5.3.1 Residual flow and fish pass

One of the most significant issues in relation to the water abstraction and associated weir on the Manganui River is the provision for fish habitat and fish passage through the residual flow reach and past the weir at Tariki Road. The new fish pass and residual flow of 400 L/s have been designed to provide:

- Passage for trout through the critical reach between the weir and the Mangamawhete Stream (8 km downstream); and
- Some native fish habitat and passage.

Improved fish diversity and abundance are key aspects for determining the success of the fish pass and residual flow with respect to the objectives above, however key native indicator species, including redfin bully and torrentfish, also provide important information on the successful passage through the residual flow reach and past the weir. Previous annual reports detail the results of numerous fish surveys undertaken in relation to the Motukawa HEP, and these are useful reference documents, providing a valuable historical perspective.

Recent surveys have recorded longfin eel, shortjaw kokopu, redfin bully and inanga upstream of the weir. However, torrentfish, which have been recorded at the bottom of the fish pass, have never been recorded upstream of the weir. This indicates that most fish species expected to be present at this altitude and distance inland are able to use the fish pass to continue upstream.

The aim of the 400 L/s residual flow (with regard to trout), is to provide adequate passage for adult trout to move up and spawn in the headwaters. Anecdotal evidence suggests trout populations upstream of the weir have improved (A. Stancliff, Fish and Game pers com), suggesting that passage through the residual flow reach and fish pass is being achieved. However, this has not been proven, and therefore previous reports suggested including monitoring specific to trout, being the capturing, tagging and releasing of adult trout within the residual flow reach and possibly further downstream. This was attempted in the 2015-2016 monitoring period, with two fyke nets set at the head of the fish pass but downstream of the flow control valve, at times when trout were anticipated to be moving upstream to spawn. The methodology and details of the tagged trout are included in the report for the 2015-2016 monitoring period (TRC, 2016).

This tagging work indicates that brown trout can easily move up the fish pass, and the fact that tagged fish were not repeatedly recaptured indicates that these fish are also able to negotiate the flow control valve at the top of the fish pass. However, no anglers have to date made contact with either Fish and Game or the Council to report having captured a tagged trout.

There is still potential for these fish to be captured in the future, and it is hoped that any anglers who capture a tagged fish will return the catch details to either the Council or the Fish and Game Council (Taranaki). This will enable a better understanding of trout movement in the Manganui River catchment, and also has the potential to record the movement of trout down the race, with implications for management at the in-race generator. This tagging may be repeated in the future, in an effort to increase the number of trout tagged.

Based on monitoring of fish populations to date, the new residual flow appears to have improved the passage through the residual flow reach for trout and most native fish, and occasionally torrentfish. Habitat has improved since the implementation of the 400 L/s residual flow, and it appears that inanga and redfin bully populations in the residual flow reach have improved. However, the sporadic occurrence of torrentfish suggests that the residual flow may not provide sufficient native fish habitat, which is one of the management objectives.

Another possible factor which influences native fish migration is that of pheromones. A number of scientific papers have been published that report certain native fish displaying a preference for streams that have adult fish pheromones in them (e.g. Baker & Hicks 2003). This would mean that fish are not migrating up the residual flow reach due to a lack of adults in the headwaters, a catch twenty-two situation. In the previous biennial report, it was suggested that if future monitoring continue to show a lack of upstream migration, consideration should be given to manually transferring juvenile fish into the headwaters, in an effort to re-establish an adult population, and thereby an attractant pheromone in the water. Previous monitoring results suggest that galaxiids may be slowly re-colonising the upstream catchment, and therefore the proposal to transfer juvenile fish is not warranted at this stage.

2.1.5.3.2 Mangaotea Stream

Fish monitoring was undertaken in the Mangaotea Stream during the 2016-2017 monitoring period. Two surveys have been undertaken previously, the first to establish what fish were present prior to the Mangaotea Pumps becoming operative, the second was to assess the communities following commissioning of the Mangaotea Pumps. These surveys also provided some information on fish migration within the residual flow reach, as the Mangaotea Stream enters the Manganui River approximately three kilometres upstream of the residual flow reach end.

During the current survey three sites were sampled, one upstream, and two downstream of the abstraction point (Figure 11). All three sites were sampled using the spotlighting technique on the evening of 31 May 2017. The results are provided in Table 8. Although it was intended to monitor four sites, the site immediately upstream of the Motukawa race had become so overgrown, it was no longer possible to survey it.

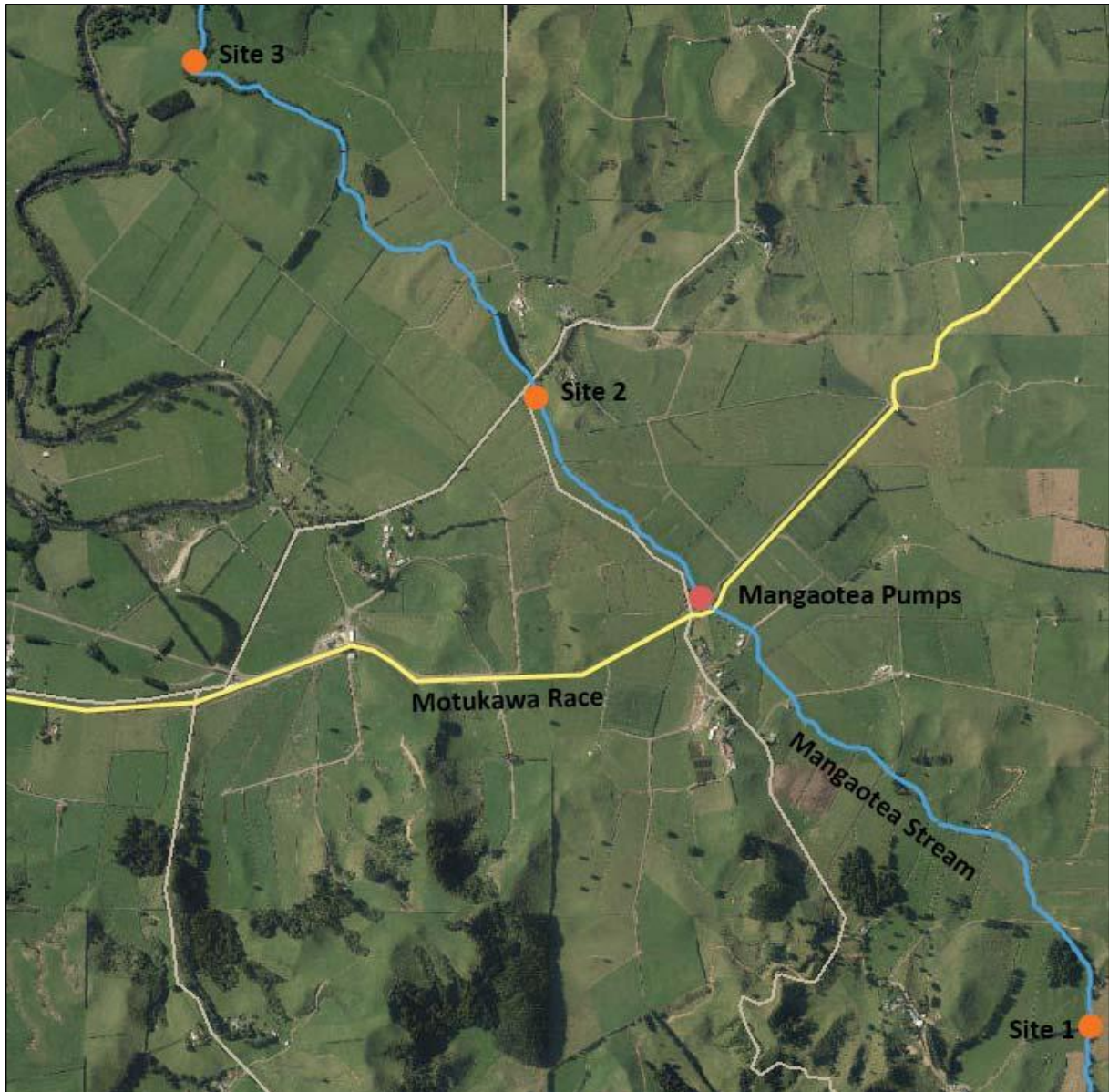


Figure 11 Sites surveyed for fish in the Mangaotea Stream, 31 May 2017.

The fish habitat in the Mangaotea Stream varies along its length. At the upstream site (site 1), the stream has been extensively modified, but with maturation of the riparian planting, habitat is beginning to develop, with some pools and riffles observed. Downstream of the abstraction point (site 2) the stream is channelized, with little variation in habitat, other than that provided by change in water speed. The banks are typically high and steep, with limited pool habitat. The majority of flow is provided through groundwater seepage, and there is some aquatic vegetation, which provides cover. There is little riparian vegetation (other than rank grass), although some farmers are undertaking to plant the stream margins. This habitat continues for some distance downstream.

Table 8 Results of fishing surveys performed in the Mangaotea Stream during the 2016-2017 monitoring period

Species	Site No:	1		2		3		Previously recorded in the Mangaotea Stream
	Site Code:	MOT000025		MOT000065		MOT000090		
	Location	1770 m upstream of abstraction point		20 m upstream of Tariki Rd		2340 m downstream of abstraction point		
		Number	Length Range (mm)	Number	Length Range (mm)	Number	Length Range (mm)	
Longfin eel	3	550-1,100	1	800			✓	
Shortfin eel			1	750	2	250-500	✓	
Giant kokopu	1	330					✓	
Inanga					1	70	✓	
Redfin bully					1	100	✓	
Crans bully							✓	
Brown trout					1	150	✓	
Unidentified eel								
Unidentified galaxiid								
Unidentified bully								
Total no. of species		2		2		4	7	

However, approximately 860m downstream of Tariki Road (1,710m downstream of the abstraction point), the stream descends into a gorge, and cascades a number of metres into what appears to be the old Manganui River flood plain. In this area, the stream changes character, with a number of deep pools, and some riffle habitat. Further downstream, the stream flows through some remnant native forest. Only one site was sampled downstream of this gorge, and not surprisingly, this site had the highest species diversity, with four species recorded (Table 8). This included redfin bully, the second time this species has been recorded in this stream. The other two sites recorded lower species diversity. The most notable observation of this survey was that of a large giant kokopu at site 1 (Photograph 2).



Photograph 2 A large giant kokopu, recorded at site 1.

In general, these results are quite similar to that recorded during the previous fish surveys, including those undertaken prior to the pumps being operative, reported in TRC, 2009. Previous surveys have recorded giant kokopu, brown trout and inanga, and one fish tentatively identified as a banded kokopu. This indicates that there is adequate water quality in the Mangaotea Stream, and that the cascade below Tariki Road is not a complete barrier to fish passage.

Overall, these results do not indicate any issue with fish passage at the intake, or with reduced flows downstream of the intake. The majority of fish recorded prefer slower flowing, deep water habitat. This habitat is less likely to be affected by the abstraction of water from the Mangaotea Stream.

The Mangaotea Stream is a difficult stream to survey, due to the streambed comprising mainly soft sediment, and there being a large amount of cover. In addition, the maturation of the riparian planting is making access more difficult with each survey. As a result it is recommended that Mangaotea Stream fish monitoring component of the compliance monitoring programme is made provisional, only to implemented should circumstances arise that warrant it.

2.1.5.3.3 Adult eel and elver transfers

Special conditions in consents 3372 (condition 3) and 3373 (condition 8) require the consent holder to provide for the passage of elvers (both consents) and adult eels (consent 3373). An elver pass using a trap and transfer system similar to that implemented successfully at the Patea Dam was installed at the power station (consent 3372) late in the 2001-2002 summer. Following modifications, this trap has operated successfully since the 2002-2003 elver migration period, with elvers transferred to either the Manganui River upstream of the weir or into Lake Ratapiko.

Photograph 3 shows the elver trap prior to the upgrade that occurred in the current period. Elvers enter a pipe carrying the attractant flow, which leads to the trap. These elvers are then transferred to an area above the Manganui River head works.

The consent holder provided records in terms of weight of elvers and dates of transferral. These are presented for the 2016-2017 elver migration season (December to February) in Figure 12 and along with previous years' data in Table 9. Normally, elvers begin to appear at the tail race at the start of December and this was the case during the reported period (Figure 12).



Photograph 3 Elver trap at the base of the tail race at the power station

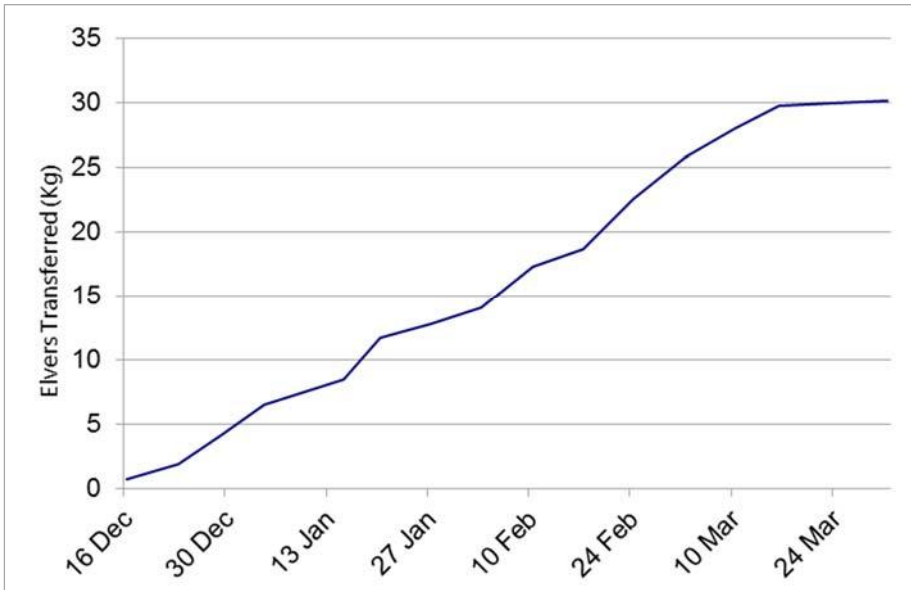


Figure 12 Cumulative weight of elvers transferred from the Motukawa Power Station during the 2016-2017 period

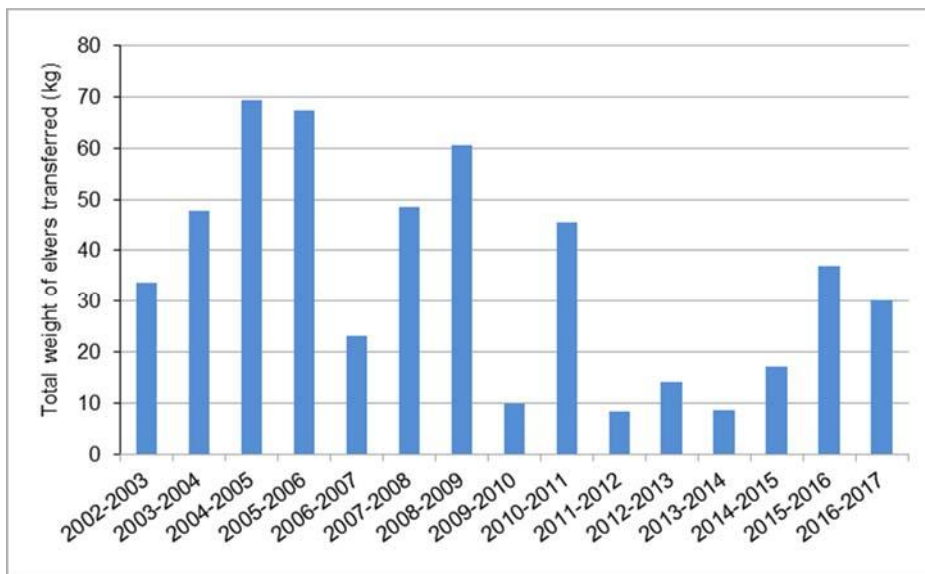


Figure 13 Elver transfer data for the monitoring years to date

The elver run in the 2015-2016 period started as normal, with the first transfer occurring on 16 December 2016. There were two peaks in the run during this period, with 3.24 kg transferred on 20 January 2017, and 3.94 kg transferred on 24 February 2017 (Figure 12). The last transfer was undertaken on 31 March 2017, by which time the elver has typically finished, and the total weight of elvers transferred during this period totalled 30.21 kg (Figure 13).

This follows on from the promising result recorded in the previous (2015-2016) period, and is more than twice that transferred in five of the last seven seasons. It appears that the number of elvers arriving at the trap is highly variable, but it is clear that this is the second best result since the 2010-2011 season.

With regard to the numbers of elvers transferred, it can be difficult to accurately calculate the total number, from the recorded weight, as the average weight of the individual elvers appears to vary between years. Subsamples of elvers from the Motukawa elver trap have been weighed and counted during two separate

years, with one count finding 1,350 elvers per kg, and the other finding 950 elvers per kg. Table 9 shows how many elvers were transferred during the reported period, using both weights, compared with previous years.

The elver trap was visited by Council staff on two occasions during the reported period. These inspections, the first completed on 10 January 2017 and the second on 23 February 2017, found the elver trap to be in operation, with elvers in the trap.

Table 9 Elver transfer data for the four monitoring years to date

Monitoring year	Total weight of elvers transferred (kg)	Estimated number of elvers transferred (1 kg = 1,350 elvers (2003 count))	Estimated number of elvers transferred (1 kg = 950 elvers (2006 count))
2002-2003	33.7	45,495	-
2003-2004	47.7	64,395	-
2004-2005	69.5	93,825	-
2005-2006	67.5	91,125	64,125
2006-2007	23.18	31,293	22,021
2007-2008	48.55	65,542	46,122
2008-2009	60.65	81,878	57,618
2009-2010	9.71	13,109	9,225
2010-2011	45.57	61,520	43,291
2011-2012	8.35	11,273	7,932
2012-2013	14.15	19,103	13,442
2013-2014	8.61	11,624	8,179
2014-2015	17.23	23,261	16,368
2015-2016	37.01	49,957	35,154
2016-2017	30.21	40,784	28,699

During the 2005-2006 monitoring period, a number of sub samples of elvers were collected and identified, to assess what proportion of the elvers were longfin, and what proportion were shortfin eels. The results are summarised in Table 10.

A relatively consistent ratio of longfin eels to shortfin eels was found on each occasion with the majority being shortfin eels.

Table 10 Proportion of elvers as longfin and shortfin eels for elvers trapped at Motukawa Power Station

Date	Number of longfin eels	Proportion of longfin eels	Number of shortfin eels	Proportion of shortfin eels
27-Jan-06	11	24%	35	76%
8-Feb-06	19	26%	55	74%
17-Feb-06	24	22%	85	78%

As per special condition 8 of consent 3373 an elver pass also needs to be installed at the spillway and dam on the Mako Stream (which forms Lake Ratapiko), within 6 months of the granting of this consent. The Company requested that this be delayed until March 2003, to allow works on the spillway to be completed during suitable weather in the summer of 2002-2003. This work was subsequently delayed, but was completed during the 2003-2004 monitoring period. Night spotting of the Mako Stream spillway has been conducted at times, although the most recent such visit was conducted in January 2006 and no elvers were observed accumulating at the dam, although there was no water flowing down the pass at the time of the monitoring. It is considered worthwhile to either try and trap at the head of this pass, or to conduct some monitoring later in the elver migration season (possibly late February or March) as this site is some distance inland from the coast (88.5 km).

Adult eels migrate down rivers to the sea in autumn and have been known to congregate at the Ratapiko Dam which dams the Mako Stream and at the penstocks leading to the power station. The facilitation of passage for adult eels over the Mako dam is required under special condition eight of consent 3373. During the period under review, Trustpower staff attempted to transfer adult eels from the lake. The results are an improvement from the previous period, with 20 longfin eel and 4 shortfin eel transferred.

It is hoped that Trustpower will eventually have a net in place each year at the start of the migrating season (autumn) and removed at the end of it. While the net is in place it will be checked and emptied regularly and the eels transferred downstream. Currently, the nets are shared between this scheme and the Mangorei HEP, which includes Lake Mangamahoe.

Consent 5086 also has a special condition (1) relating to the penstock intake screens, maintaining the screens with spaces of no larger than 30 mm. Screens of this size were installed at the power station, complying with this condition. However, a monitoring inspection undertaken during the 2008-2010 reporting period did observe an eel that appeared to have passed through the turbines, so it is recommended that the required screen spaces be reconsidered at some stage.

Special conditions in consents 5080 (3) and 5086 (2) require the consent holder to install, maintain and operate a light barrier, within six months of the granting of these consents, for the purpose of diverting fish from the intake gate at the abstraction point from the Manganui River and the intake gate from the power station. During the 2001-2002 monitoring year, the Company purchased light sticks to comply with these consent conditions and requested that installation of the light sticks be delayed pending trials by Mr Jacques Boubee of NIWA. The Council agreed that this would be appropriate and acknowledged that installation would not be conducted within the six months specified in consent conditions. Research to date has found these lights to be ineffective, however eels appeared to have a strong avoidance to 12 volt electrical fields. This option has been investigated, and electrical field devices had been installed at the intake gates at the Tariki weir and at the penstocks in the forebay. These were removed for further testing, but have since been reinstalled and are operational.

2.2 Riparian planting

As per special condition 8 of consent 3369, the consent holder donates annually to the Taranaki Tree Trust (\$6,000) to mitigate the effects of the abstraction from the Manganui River. Funding on the Manganui Catchment was initially targeted at Lake Ratapiko and the Rumkeg Creek. It was then expanded to include plantings on the wider Manganui Catchment.

At the time of compiling this report, 13 landholders in the Manganui catchment had applied for the subsidy in the 2016-2017 period, which covers 50% of the cost of plants planted within the catchment for riparian protection. To date, five of these landowners have received the subsidy.

2.3 Stakeholders' meeting

As a requirement under a special condition in all the Motukawa 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 warranted i.e. when particular issues warranted a round table discussion. In the 2014-2015 report it was suggested that Trustpower canvas the submitters, to determine whether such a meeting was required. This recommendation was made following the flooding that occurred in June. Due to insufficient interest, no subsequent meeting was held.

2.4 Investigations, interventions, and incidents

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.

The Council operates and maintains a register of all complaints or reported and discovered excursions from acceptable limits and practices, including non-compliance with consents, which may damage the environment. The incident register includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

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 company is indeed the source of the incident (or that the allegation cannot be proven).

In the 2016-2017 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. Although there were a number of instances where consent conditions were not strictly adhered to, they were determined to be of a very minor nature and did not warrant further action. See section 2.1.3 for more detail.

3 Discussion

3.1 Discussion of site performance

Several consents contain special conditions requiring Trustpower to monitor and forward abstraction, discharge and water level data to the Council at three monthly intervals. This data was forwarded as required during the monitoring year under review and checked for continuity of the data record, and compliance with their respective limits. During the monitoring period under review, there were no occasions when a notable loss of data occurred. This is the second consecutive monitoring period to record no such occasions of lost data since monitoring has focused on the continuity of the data record.

There was also good compliance with set flows and levels, with no incidents occurring that warranted enforcement action. It should be noted that only those incidents of one hour or longer are discussed, provided the limit was breached by at least 5%, to allow for errors associated with recording equipment. In the 2016-2017 period there were only three occasions where such limits were breached. The first related to a severe weather event, while the other two related to insufficient residual flow at a time when maintenance required the control gates to be manually controlled. These incidents were all of short duration (no more than 4 hours).

This compliance with flows and levels was also confirmed through inspections, including hydrological gaugings where appropriate. These inspections also confirmed compliance with other requirements such as the operation of an elver trap at the station and elver pass at the Mako Dam spillway.

During periods of stable flow, the station is required to either release flushing flows (Manganui River), or cease abstracting during the next naturally occurring flushing flow (Mangaotea Stream). During the reported period, no such flushing flows were required for the Manganui River. There were four occasions when flushing flows were required for the Mangaotea Stream however, only one of these was provided. This is an area that the Company has struggled to meet full compliance, and it remains a work in progress. It is unlikely that the lack of flushing follows in this instance was detrimental to the stream, considering the size of the natural flood at the times.

Special condition 4 of consent 3371-2, which relates to the diversion of water into the race, requires that a five-yearly monitoring survey of the race be completed by the consent holder to identify any maintenance requirements in order to maintain a race capacity of 8,000 L/s, for the purpose of avoiding flooding adjacent farmland. This work is now a part of an annual survey and maintenance programme, achieving the intent of this condition.

Consent 5082 allows the discharge of water into the Mangaotea Stream in emergency conditions. Special condition 4 of this consent requires the consent holder to put aside \$600 per year for flood management, and to make this available to landowners downstream of the race in the Mangaotea Stream catchment. This money continues to be made available each year (but is not accumulated from year to year).

A draft contingency plan had been received in 2002 to cover conditions in consents 5084 and 5088. This was to be reviewed by the Company once work on the spillway and Ratapiko Road culvert has been completed in the 2002-2003 monitoring year. An Emergency Management Plan and Emergency Action Plan contact list has been provided to Council, up to date to December 2013.

Management of most aspects of the Motukawa HEP scheme over the period being reported has generally been excellent with the significant improvements undertaken in previous years contributing to this. It is clear that Trustpower takes compliance with consent conditions seriously, and this is reflected in their self notification of any breaches they become aware of, and their swift response in each case. No incidents were recorded in relation to this scheme in the 2016-2017. Throughout the reported period, Trustpower and Council have continued to work closely with one another.

3.2 Environmental effects of exercise of consents

Continuous water temperature monitoring was performed in the Manganui River upstream and downstream of the Tariki Road weir from November to May in each monitoring year. This monitoring indicated that over the reported period, water temperatures were cooler throughout this period, without significant extremes. This is a direct result of the wet summer that Taranaki experienced over this time, although the upstream site still indicated some natural warming. Average monthly water temperatures were cooler than the long term average. Furthermore, the number of days that experienced a maximum temperature in excess of 25 °C was well below average, with neither site experiencing a water temperature in excess of 25 °C, and the downstream site only exceeded 20 °C for 6% of the time, well down on the average of 17%. Temperatures over 25 °C can significantly adversely affect trout and other freshwater fish communities as well as being outside the tolerance range of some sensitive macroinvertebrate taxa. Furthermore, temperatures over 20 °C, for extended periods, can put stress on fish. No fish kills were reported in the residual flow reach of the Manganui River and no dead trout were observed.

A comparison of the water temperatures prior to the new residual flow of 400 L/s against those once the new residual flow was implemented indicated that water temperature differences had generally decreased between the two water temperature monitoring sites some 2.3 km apart. The proportion of days that had a maximum temperature difference of 1 – 2 °C since the 400 L/s was almost double that recorded prior, with the difference coming from a reduction in the proportion of days that experienced a maximum temperature difference of more than 3 °C. The temperature differences recorded in the 2016-2017 period were very similar to the average, with the exception of December 2017, when the downstream reach warmed similar to that recorded prior the increased residual flow. This is related to December receiving below average rainfall, indicating finer weather and more heating.

Because of an extended period of natural to near natural flows in the residual flow reach in early 2010, it was possible to assess what impact the main abstraction has on the water temperatures in this reach. This showed that even though the Manganui River was running slightly warmer at that time than was typical, the temperatures in the residual flow reach were reduced by this natural flow. It was also clear that temperatures which can negatively affect stream biota (>20 °C) are less likely to occur under the more natural flow, and that their increased occurrence in the residual flow reach is directly related to the reduced flow.

The macroinvertebrate survey conducted in the reported period indicated that the residual flow from the Motukawa HEP scheme was maintaining reasonable water quality and some habitat for macroinvertebrate communities downstream of the diversion weir.

Previous surveys have found a general trend of decreasing MCI scores in a downstream direction which was more likely related to the natural changes in habitat downstream, than due to the reduced flow downstream of the weir. The current survey recorded only subtle (and not statistically significant) deterioration, and this is a positive indication that the impacts of the diversion were not as severe as expected during this summer low flow period.

Since the new residual flow has been operating, some improvement in communities have been observed particularly at site 5, 1.7 km downstream of the weir, where MCI values have been above the historical median, since the new residual flow was implemented. This result was again repeated in the current survey, with both the MCI SQMCI₅ scores being higher than their respective median.

Overall, the results indicate that the invertebrate community supported by a residual flow of 400 L/s, with regards to presence/absence of taxa, and their respective abundances, is not significantly different to that supported by natural flows. The principal difference between the two flows is that there is a greater amount of invertebrate habitat available under natural flow conditions due to the increased amount of wetted riverbed width.

The macroinvertebrate monitoring continues to show that water quality in the residual flow reach is maintained, indicating that the objective of maintaining water quality (which was used to determine an appropriate residual flow of 400 L/s), is being achieved, and has improved physical macroinvertebrate habitat and physicochemical water quality conditions when compared to previous residual flows of less than 100 L/s.

Improved fish diversity and abundance are key aspects for determining the success of the fish pass and residual flow with respect to fish passage in the residual flow reach as well as providing some native fish habitat. Key native indicator species, including the redfin bully and torrentfish, also provide important information on the successful passage through the residual flow reach and past the weir.

Electric fishing surveys in the Manganui catchment prior to the installation of the new fish pass in 2002, and increased residual flow, indicated that redfinned bullies and torrentfish did not swim to the base of the Motukawa diversion weir, at an altitude of 210 metres (Taranaki Regional Council, 1999a and 2000). The minimal residual flow downstream of the weir was insufficient to attract these fish up the river as far as the weir. Redfinned bullies swim well above an altitude of 200 m in the Ngatoro-iti, Ngatoro-nui, Waitepuke and Mangamawhete streams, all tributaries of the Manganui River (which enter the Manganui River downstream of the Tariki weir).

Numerous fish surveys have been conducted in relation to the Motukawa scheme. More recent surveys have recorded improving populations of redfin bully and shortjaw kokopu upstream of the weir, and also recorded inanga upstream of the weir. This shows that fish are beginning to move through the residual flow reach and fish pass. Torrentfish however have only been recorded in the fish pass and sporadically in the residual flow reach, not upstream of the weir. This is likely to be related to the residual flow being insufficient to attract significant numbers of torrentfish, and those that do make it to the fish pass may not be able to negotiate the weirs in the fish pass.

In the previous (2015-2016) monitoring period, brown trout were caught in the fish pass and tagged, in an effort to confirm the anecdotal observations that they can negotiate the fish pass. Although only five trout were captured and tagged, the interim results indicate that this species can negotiate the pass, including the flow control valve. No anglers have yet reported catching these fish.

Overall, results indicate that with respect to the management objectives for which the residual flow was developed:

- reasonable water quality is being maintained;
- passage for trout is probably being achieved through the residual flow reach and past the weir;
- passage for some (but not all) native fish is being achieved in the residual flow reach and it would appear through the fish pass; and
- habitat of native fish has improved but fish diversity is similar to that recorded prior to the 400 L/s residual flow and may suggest that the objective of 'some native fish habitat' is not being achieved for torrentfish, although redfin bullies and inanga have been recorded in the residual flow reach.

Fish monitoring was in the Mangaotea Stream in the current period, to assess how the fish communities in this stream compared to communities present prior to the abstraction at the Mangaotea Pumps. In general, the results did not indicate any issue with fish passage at the intake, or with the reduced flows downstream of the intake.

3.3 Evaluation of performance

A tabular summary of the Company's compliance record for the year under review is set out in Table 11 to Table 30. Three consents are not included in this tabular summary (6382-1, 6383-1 & 6384-1), as these were for temporary activities associated with the installation of an intake structure, and these activities are no longer being undertaken.

Table 11 Summary of performance for Consent 3369-2

Purpose: To take and use up to 5,200 L/s of water from the Manganui River		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintenance of residual flow of 400 L/s	Inspections fish pass, including water levels in pass; gaugings. Where non-compliance was found, Company rectified it immediately	Yes Very minor non-compliance only
2. Residual flow passes through fish pass within 12 months of the granting of this consent	Inspection; Implemented in 2002	Yes
3. Install and operate measuring device for monitoring abstraction rate and forward to Council	Receipt and review of Company data every three months	Yes
4. Cease abstraction if flow in Waitara is \leq 5000 L/s	Council to notify if Waitara flow is less than threshold	Not required
5. Pulse flows released if weir has not overtopped for 30 days	One such period of low flows occurred	Not required
6. (a) Install race water level control system to manage inflow from Manganui River (b) Avoid flooding of farmland (c) Emergency power source	Receipt and review of Company data every three months	Yes
7. Maintain 150 L/s in race during maintenance	Notification by Company	Yes
8. Donation to Taranaki Tree Trust	Confirmation with Council finance dept that donation received	Yes
9. Meeting with stakeholders annually	One meeting conducted, with agreement of Council	Yes
10. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
12. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 12 Summary of performance for Consent 3371-2

Purpose: To divert and use up to 8,000 L/s of stormwater runoff and tributaries draining in to race and Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. (a) Install race water level control system (b) Emergency power source	Installed in 1998	Yes
2. Management of maximum race water levels at 4 sites to avoid flooding of farmland	Receipt and review of Company data every three months	Yes – one breach related to severe weather
3. Install and survey stage boards for visual check on race levels	Installed in 1995; Inspections of race	Yes
4. Five yearly survey of race to identify maintenance requirements	Next report due prior to 2017	Yes
5. Install and operate measuring device to measure water levels and forward to Council	Receipt and review of Company data every three months	Yes
6. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
7. Bond required if flooding occurs between May 1999 and April 2000		N/A
8. Review of conditions if there is flooding of adjacent farmland	Not exercised	N/A
9. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
10. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 13 Summary of performance for Consent 3372-2

Purpose: To discharge up to 7,787 L/s of water from the Motukawa HEP into the Makara Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Cease abstraction if flow in Waitara is \leq 5000 L/s	Council to notify if Waitara flow is less than threshold	Not required
2. Install and operate measuring device to measure discharge of water to Makara St and forward to Council	Receipt and review of Company data every three months	Yes
3. Install, maintain & monitor elver passage facility within 6 months of granting of consent	Installed in 2001-2002 monitoring year; Inspections; receipt and review of Company data	Yes
4. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
9. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
10. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 14 Summary of performance for Consent 3373-2

Purpose: To dam the Mako Stream to form Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Within 6 months of granting consent, provide a SEED review	Received in 2002	Yes
2. Maintain & operate a safe dam		Yes
3. Place & maintain structure on top of lowered spillway crest to increase lake storage	Upgrade in 2003-2004 with spring tip flashboard	Yes
4. Manage structure in condition 4 and lake level so as to avoid flooding of farmland	Receipt and review of Company data every three months	Yes
5. Minimum lake water level of 194 m a.s.l. except during maintenance	Receipt and review of Company data every three months	Yes

Purpose: To dam the Mako Stream to form Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
6. Maximum lake water level of 198.7 m a.s.l.	Receipt and review of Company data every three months	Yes
7. Install, maintain & monitor elver /eel passage facility over spillway within 6 months of granting of consent	Inspections Installed in 2003-2004; Delays approved by Council	Yes
8. Install and operate measuring device to measure lake water level and forward to Council	Receipt and review of Company data every three months	Yes
9. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
10. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
11. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 15 Summary of performance for Consent 1166-3

Purpose: To discharge up to 4,000 m³/day of dredgings from maintenance of Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notify Council at least 48 hours prior to commencement of discharge	No notification received. No maintenance undertaken	N/A
2. Adopt best practicable option		N/A
3. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
4. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
5. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		High

Table 16 Summary of performance for Consent 5080-1

Purpose: To erect, place, use and maintain the weir and various structures in Manganui River		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Design, install, maintain & monitor structure at weir for fish passage	Inspections; biological monitoring	Yes
2. Fish pass to be constructed within 12 months	Completed in 2002	Yes
3. Install & operate a light barrier within 6 months to divert fish from intake	Research found light barrier to be ineffective. Electric fields have been reinstalled at intake and forebay in 2010-2014 period. Extension of time limit approved.	Yes
4. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
5. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
6. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 17 Summary of performance for Consent 5081-1

Purpose: To erect, place, use and maintain the Mangaotea Aqueduct in and above the Mangaotea Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Install and survey a stage board for visual check on race levels	Installed in 1995; Inspections of race	Yes
2. Lower northern side of aqueduct by 300 mm to provide a flow of 2,000 L/s & install gate controlled by race water level control system	Conducted in 2000	Yes
3. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes

Purpose: To erect, place, use and maintain the Mangaotea Aqueduct in and above the Mangaotea Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
4. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
5. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 18 Summary of performance for Consent 5082-1

Purpose: To discharge, under emergency conditions, up to 2,000 L/s of overflow water from the Mangaotea Aqueduct into the Mangaotea Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. That the discharge shall occur after compliance with condition 2 of 5081 is achieved	No discharges in the monitoring period	N/A
2. Definition of emergency conditions	When local stormwater runoff to the race is required to be discharged to Mangaotea Stream in order to avoid the race flooding adjoining land	N/A
3. Manage discharge to avoid or minimise flooding of farmland and roads below discharge	No discharges in the monitoring period	N/A
4. Set aside \$600 annually for maintenance of the flood capacity of the Mangaotea Stream below the discharge, and make funds available to landowners for works.	Money continues to be made available each year	Yes
5. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
6. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
7. Optional review provision re environmental effects	No review undertaken	N/A

Purpose: To discharge, under emergency conditions, up to 2,000 L/s of overflow water from the Mangaotea Aqueduct into the Mangaotea Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of environmental performance and compliance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		High

Table 19 Summary of performance for Consent 5084-1

Purpose: To discharge up to 55,000 L/s of HEP generation water, during adverse weather conditions, from Lake Ratapiko into the Mako Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Prepare a contingency plan for managing discharge so as to avoid or minimise damage to property downstream	Reviewed contingency plan received in 2004-2005 monitoring year	Yes
2. Exercise consent in accordance with contingency plan		Yes
3. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
4. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
5. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 20 Summary of performance for Consent 5085-1

Purpose: To disturb the bed of Lake Ratapiko for maintenance and repairs associated with HEP generation		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Notify the Council 48 hours prior to commencement of disturbance activities	No notifications received. No disturbance undertaken	Yes

Purpose: To disturb the bed of Lake Ratapiko for maintenance and repairs associated with HEP generation		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
2. Best practicable option		N/A
3. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
4. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
5. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		High

Table 21 Summary of performance for Consent 5086-1

Purpose: To erect, place, use and maintain various structures in, on and over the bed of Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Maintain penstock intake screens with spaces no larger than 30 mm in order to minimise eel & fish entrapment	Inspections	Yes
2. Install & operate a light barrier within 6 months to divert fish from intake	Research found light barrier to be ineffective. Electric fields have been reinstalled at intake and forebay in 2010-2014 period. Extension of time limit approved.	Yes
3. Install and survey a stage board for visual check on lake water levels	Installed in 1995; Inspections	Yes
4. Upgrade Ratapiko Road causeway	Completed in 2003	Yes
5. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
6. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes

Purpose: To erect, place, use and maintain various structures in, on and over the bed of Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 22 Summary of performance for Consent 5087-1

Purpose: To take and use up to 7,787 L/s of water from Lake Ratapiko		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Minimum lake water level of 194 m a.s.l.	Receipt and review of Company data every three months	Yes
2. For lake maintenance, the draw down of the level will occur gradually over 7 days & notify the Council and Fish and Game	No such works undertaken	N/A
3. Maximum lake water level under normal operating conditions does not exceed 198.7 m a.s.l.	Receipt and review of Company data every three months	Inspections
4. Manage lake levels to avoid or minimise flooding of land		Yes
5. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Inspections
6. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
7. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 23 Summary of performance for Consent 5088-1

Purpose: To discharge up to 2,000 L/s of water from the surge chamber of the Motukawa power station during maintenance periods into an unnamed tributary of the Makara Stream		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Prepare contingency plan within 6 months	Reviewed contingency plan received in 2004-2005 monitoring year	Yes
2. Exercise consent in accordance with contingency plan		Yes
3. Notify the Council 48 hours prior to the discharge and adopt best practicable option	No notifications received	Yes
4. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
5. Optional change/cancellation of conditions by consent holder	Not exercised	N/A
6. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 24 Summary of performance for Consent 6388-1

Purpose: To divert and use water in the Motukawa Race		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	Inspections	Yes
2. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	Inspections	Yes
3. Notify the Council 7 days prior to the exercise of consent	Notification received 21 February 2006	Yes
4. Consent lapse period of 10 years	Consent has been exercised	N/A
5. Optional review provision re environmental effects	No review undertaken	N/A

Purpose: To divert and use water in the Motukawa Race		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 25 Summary of performance for Consent 6390-1

Purpose: To impound water behind a dam on the Motukawa Race		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	Inspections	Yes
2. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	Inspections	Yes
3. Notify the Council 14 days prior to the construction of dam and turbine unit in the race	Notification received 13 October 2005	Yes
4. The intake is appropriately screened to avoid entrapment of freshwater fauna	Screens used found to be too narrow for operation. Change of consent conditions granted and new screens installed in July 2006	Yes
5. On 3 occasions between Nov and Feb, cease generation and open bypass valve for 12 hours to allow trout passage	It has been agreed by Council and Fish and Game that this is no longer required, as the bypass valve will be permanently running from November to February.	N/A
6. Company must monitor effectiveness of bypass valve for first 6 bypass events and forward information to Council and Fish and Game.	It has been agreed by Council and Fish and Game that this is no longer required, as the bypass valve will be permanently running from November to February.	Yes
7. Review conditions of consent if monitoring of bypass events show a significant trout accumulation	Not exercised	N/A
8. Management of race water level to avoid or minimise flooding of adjacent farmland	Receipt and review of Company data every three months	Yes – one breach related to severe weather
9. Consent lapse period of 10 years	Consent has been exercised	N/A

Purpose: To impound water behind a dam on the Motukawa Race		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
10. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 26 Summary of performance for Consent 6391-1

Purpose: To discharge sediment during earthworks associated with the construction of a generator structure into the Motukawa Race		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	Works completed	N/A
2. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	Works completed	N/A
3. Notify the Council 48 hours prior to the commencement and upon completion of the initial installation and again on any subsequent maintenance works	Notification to commence received 28 February 2005 and subsequently for each stage of works. No subsequent maintenance works undertaken as yet	N/A
4. Site erosion and sediment control management plan	Received 28 February 2005	N/A
5. Discharge shall not give rise to adverse effects on surface water body after reasonable mixing	Works completed	N/A
6. All earthworks shall be stabilised vegetatively or otherwise as soon as practicable following completion of activities	Works completed	N/A
7. Consent lapse period of 10 years	Consent has been exercised	N/A
8. Optional review provision re environmental effects	No review undertaken	N/A

Purpose: To discharge sediment during earthworks associated with the construction of a generator structure into the Motukawa Race		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
Overall assessment of environmental performance and compliance in respect of this consent		N/A
Overall assessment of administrative performance in respect of this consent		N/A

Table 27 Summary of performance for Consent 6381-1

Purpose: To take and use water from the Mangaotea Stream, for HEP generation purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	Inspections, data review	Yes
2. Notify the Council 48 hours prior to the exercise of this consent	Notification received	Yes
3. Restriction of abstraction rate and daily volume	Data review	Yes
4. Maintenance of residual flows within the Mangaotea Stream	Data review, gaugings	Yes
5. Specifies aspects of the review, should one be required as per special condition 9	Review not considered necessary	N/A
6. Flushing flow requirement	Data review, inspections	No
7. Requires the recording of abstraction rate, residual flow downstream of abstraction and flow downstream of Little Mangaotea Stream confluence	Data review	Yes
8. Consent holder to undertake a two year monitoring programme of hydrological and ecological effects in the Mangaotea Stream and Manganui River	Monitoring completed in 2012	Yes

Purpose: To take and use water from the Mangaotea Stream, for HEP generation purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
9. Review provision should the residual flow and/or flow regime be considered not appropriate	Review not considered necessary	N/A
10. Meeting with stakeholders annually	No meeting conducted, with agreement of Council	Yes
11. Consent lapse period of 10 years	Consent has been exercised	N/A
12. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		Good

Table 28 Summary of performance for Consent 6385-1

Purpose: To erect, place and maintain an intake structure including pumps in the bed of the Mangaotea Stream, for the purposes of abstracting water for HEP generation		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	No maintenance works undertaken	N/A
2. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	No maintenance works undertaken	N/A
3. Notify the Council 48 hours prior to the commencement and upon completion of the initial installation and again on any subsequent maintenance works	No notifications received	N/A
4. Timing of works restricted to 1 November – 30 April , unless waived by Council	No maintenance works undertaken	N/A
5. Must ensure that the area and volume of streambed disturbance is minimised so far as practicable	No maintenance works undertaken	N/A

Purpose: To erect, place and maintain an intake structure including pumps in the bed of the Mangaotea Stream, for the purposes of abstracting water for HEP generation		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
6. The diversion and impoundment shall not obstruct fish passage	No maintenance works undertaken	Yes
7. The intake shall be appropriately screened to prevent entrapment of freshwater fauna	Inspections	Yes
8. The structure shall be removed and area reinstated should it no longer be required	Structure still required	N/A
9. Consent lapse period of 10 years	Consent has been exercised	N/A
10. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 29 Summary of performance for Consent 6386-1

Purpose: To disturb and modify the bed and banks of the Mangaotea Stream, associated with the construction of an intake structure for hydroelectric generation purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	No maintenance works undertaken	N/A
2. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	No maintenance works undertaken	N/A
3. Notify the Council 48 hours prior to the commencement and upon completion of the initial installation and again on any subsequent maintenance works	No notifications received	N/A
4. Timing of works restricted to 1 November – 30 April, unless waived by Council	No maintenance works undertaken	N/A

Purpose: To disturb and modify the bed and banks of the Mangaotea Stream, associated with the construction of an intake structure for hydroelectric generation purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
5. Must ensure that the area and volume of streambed disturbance is minimised so far as practicable	No maintenance works undertaken	N/A
6. The diversion and impoundment shall not obstruct fish passage	Inspections	Yes
7. Consent lapse period of 10 years	Consent has been exercised	N/A
8. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

Table 30 Summary of performance for Consent 6387-1

Purpose: To discharge sediments from earthworks into the Mangaotea Stream, associated with the construction of an intake structure, for HEP generation purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
1. Best practicable option	No maintenance works undertaken	N/A
2. Exercise of consent shall be undertaken generally in accordance with documentation submitted with application	No maintenance works undertaken	N/A
3. Notify the Council 48 hours prior to the commencement and upon completion of the initial installation and again on any subsequent maintenance works	No notifications received	N/A
4. Site erosion and sediment control management plan	Received March 2007	N/A
5. Timing of works restricted to 1 November – 30 April, unless waived by Council	No maintenance works undertaken	N/A

Purpose: To discharge sediments from earthworks into the Mangaotea Stream, associated with the construction of an intake structure, for HEP generation purposes		
Condition requirement	Means of monitoring during period under review	Compliance achieved?
6. Discharge shall not give rise to adverse effects on surface water body after reasonable mixing	No maintenance works undertaken	N/A
7. All earthworks shall be stabilised vegetatively or otherwise as soon as practicable following completion of activities	No maintenance works undertaken	N/A
8. Consent lapse period of 10 years	Consent has been exercised	N/A
9. Optional review provision re environmental effects	No review undertaken	N/A
Overall assessment of environmental performance and compliance in respect of this consent		High
Overall assessment of administrative performance in respect of this consent		High

During the year, the Company demonstrated a high level of environmental and high level of administrative performance with the resource consents as defined in section 1.1.4. There were no incidents that warranted enforcement action, and although there were a number of minor incidents, due to the swift response of the consent holder they remained minor, and it is likely no environmental impact resulted.

This is a reflection of the consent holder's improved systems, and thorough monitoring of a highly complex scheme. The Company has maintained a good level of communication with the Council, including notifying Council of any breach of consent, no matter how minor.

3.4 Recommendations from the 2015-2016 Annual Report

In the 2015-2016 Annual Report, it was recommended:

1. THAT monitoring of the Motukawa HEP Scheme in the 2016-2017 year continue at the same level as in 2015-2016.
2. That Trustpower apply to change the conditions of consent 6390-1, so that the specified locations are consistent with consent 3371-2.

Recommendation 1 was implemented in the 2016-2017 monitoring year, but there was no progress in implementing recommendation 2.

3.5 Alterations to monitoring programmes for 2017-2018

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 2017-2018 monitoring remains at the same level as that undertaken in the 2016-2017 year, with the exception of the Mangaotea Stream survey. It is recommended that this component be made provisional, to be implemented should circumstances arise which warrant it.

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 2017-2018.

3.6 Exercise of optional review of consent

Resource consent 3371-2.1 provides for an optional review of the consent at any time should there be flooding of areas adjoining the Motukawa Power Scheme attributable to the activities of the consent holder. No circumstances arose that warranted the implementation of this provision.

No other consents included a provision for an option for review in June 2017.

4 Recommendations

1. THAT in the first instance, monitoring of the Motukawa HEP Scheme in the 2017-2018 year continue at the same level as in 2016-2017 with the exception of the Mangaotea Stream fish survey which is to be made provisional.
2. THAT should there be issues with environmental or administrative performance in 2017-2018, monitoring may be adjusted to reflect any additional investigation or intervention as found necessary.
3. THAT Trustpower apply to change the conditions of consent 6390-1, so that the specified locations are consistent with consent 3371-2.

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.
Bund	A wall around a tank to contain its contents in the case of a leak.
Cumec	A volumetric measure of flow- 1 cubic metre per second (1 m ³ s ⁻¹).
DO	Dissolved oxygen.
Fresh	Elevated flow in a stream, such as after heavy rainfall.
g/m ² /day	grams/metre ² /day.
g/m ³	Grams per cubic metre, and equivalent to milligrams per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures.
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.
m ²	Square Metres.
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.
NTU	Nephelometric Turbidity Unit, a measure of the turbidity of water.
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.
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.
SS	Suspended solids.
SQMCI _s	Semi quantitative macroinvertebrate community index.
Temp	Temperature, measured in °C (degrees Celsius).
Turb	Turbidity, expressed in NTU.

UI Unauthorised Incident.

For further information on analytical methods, contact the Council's laboratory.

Bibliography and references

- Baker CF, & Hicks BJ, 2003: Attraction of migratory inanga (*Galaxias maculatus*) and koaro (*Galaxias brevipinnis*) juveniles to adult galaxiid odours *New Zealand Journal of Marine and Freshwater Research* 37: 291–299
- Jowett IG, 1982: The incremental approach to studying stream flows. NZ case studies. In McColl, R H S ed., River low flows: conflicts of water use. *Water and Soil* Miscellaneous Publication 47:9-15.
- Jowett IG, 1991: A method of predicting brown trout abundance in rivers. *Freshwater Catch* 45:3-6.
- Joy MK and Death RG, 2000: Development and application of a predictive model of riverine fish community assemblages in the Taranaki region of the North Island, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 34: 241-252.
- McDowall R M, 1978: New Zealand Freshwater Fishes, A natural history and guide. *Heinemann Educational Books (NZ) Ltd, Auckland*.
- Mitchell C, 1993: Fish Passage Problems in Taranaki. Report prepared for the Taranaki Regional Council.
- Moore S, 1992: Fish Kill - Complete Draining of Lake Ratapiko 12-14 February 1992. Report SM326.
- NEMS, 2012: Open Channel Flow Measurement – Measurement, Processing and Archiving of Open Channel Flow Data. National Environmental Monitoring Standards, New Zealand.
- NEMS, 2013a: Water Meter Data – Acquisition of Electronic Data from Water Meters for Water Resource Management. National Environmental Monitoring Standards, New Zealand.
- NEMS, 2013b: Water Level Recording - Measurement, Processing and Archiving of Water Level Data. National Environmental Monitoring Standards, New Zealand.
- NEMS, 2016: Rating Curves – Construction of stage-discharge and velocity-index ratings. National Environmental Monitoring Standards, New Zealand.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil* Miscellaneous Publication No. 87.
- Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research* 32(1): 55-66.
- Stark JD, 1999: An evaluation of Taranaki Regional Council's SQMCI biomonitoring index Cawthron Institute, Nelson. Cawthron Report No. 472.
- Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.
- Taranaki Regional Council, 1990: Taranaki Electricity Manganui Diversion Race Monitoring 1989/90. Technical Report 90-39.
- Taranaki Regional Council, 1991: Taranaki Electricity Manganui River diversion, biological and race water level monitoring 1990/91. Technical Report 91-9.
- Taranaki Regional Council, 1992: Taranaki Electricity Motukawa Power Scheme Monitoring Annual Report 1991/92. Report SM352.
- Taranaki Regional Council, 1993: Taranaki Energy Motukawa Power Scheme Monitoring Annual Report 1992/93. Technical Report 93-9.

- Taranaki Regional Council, 1994: Taranaki Energy Motukawa Power Scheme Monitoring Annual Report 1993/94. Technical Report 94-3.
- Taranaki Regional Council, 1995: Taranaki Energy Motukawa Power Scheme Monitoring Annual Report 1994/95. Technical Report 95-7.
- Taranaki Regional Council, 1996: Taranaki Energy (A Division of Powerco Ltd) Motukawa Power Scheme Monitoring Programme Annual Report 1995-1996. Technical Report 96-31.
- Taranaki Regional Council, 1997: Taranaki Energy (A Division of Powerco Ltd) Motukawa Power Scheme Monitoring Programme Annual Report 1996-97. Technical Report 97-29.
- Taranaki Regional Council, 1998: Powerco Ltd Motukawa Power Scheme Monitoring Programme Annual Report 1997-98. Technical Report 98-22.
- Taranaki Regional Council, 1999a: Taranaki Generation Ltd Motukawa Power Scheme Monitoring Programme Annual Report 1998-99. Technical Report 99-13.
- Taranaki Regional Council, 1999b: Hearing Committee Report on an application by Taranaki Generation Limited (formerly Powerco Limited) for 13 consents relating to the Motukawa Hydroelectric Power Scheme.
- Taranaki Regional Council, 1999c: Taranaki Generation Limited (formally Powerco Limited) Motukawa Hydroelectric Scheme Application for Resource Consents. Officers Report 26 July 1999.
- Taranaki Regional Council, 2000: Taranaki Generation Ltd Motukawa Power Scheme Monitoring Programme Annual Report 1999-2000. Technical Report 2000-14.
- Taranaki Regional Council, 2001: Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2000-2001. Technical Report 2001-09.
- Taranaki Regional Council, 2003: TrustPower - Taranaki Generation Ltd Motukawa Power Scheme Monitoring Programme Annual Report 2001-2002. Technical Report 2002-54.
- Taranaki Regional Council, 2004: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2002-2003. Technical Report 2003-98.
- Taranaki Regional Council, 2005: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2003-2004. Technical Report 2004-81.
- Taranaki Regional Council, 2006a: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2004-2005. Technical Report 2005-43.
- Taranaki Regional Council, 2006b: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2005-2006. Technical Report 2006-58.
- Taranaki Regional Council, 2009: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Biennial Report 2006-2008. Technical Report 2008-06.
- Taranaki Regional Council, 2010: TrustPower – Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Biennial Report 2008-2010. Technical Report 2010-20.
- Taranaki Regional Council, 2015a: Trustpower Ltd Motukawa HEP Scheme Monitoring Programme Monitoring Report 2010-2014. Technical Report 2014-79
- Taranaki Regional Council, 2015b: Trustpower Ltd Motukawa HEP Scheme Monitoring Programme Monitoring Report 2014-2015. Technical Report 2015-38
- Taranaki Regional Council, 2016: Trustpower Ltd Motukawa HEP Scheme Monitoring Programme Monitoring Report 2015-2016. Technical Report 2016-8

Appendix I

Resource consents held by Trustpower Ltd Motukawa HEP Scheme

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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To discharge up to 4000 cubic metres/day [10000 cubic metres/year] of dredgings from maintenance of Lake Ratapiko in the Waitara catchment onto land above the one-metre mark around the lake margin

Expiry Date: 1 June 2022

Site Location: Lake Ratapiko, Ratapiko Road, Ratapiko

Grid Reference (NZTM) 1715022E-5659765N

Catchment: Waitara

Tributary: Lake Ratapiko

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

- 1. That the consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the commencement of the discharge.
- 2. That the consent holder shall at all times 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 onto land arising from the discharge.
- 3. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
- 4. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 1166-3

5. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009, and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To take and use up to 5200 litres/second of water from the Manganui River in the Waitara catchment for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Manganui River, Downstream Of Tariki Road Bridge,
Ratapiko, Inglewood

Grid Reference (NZTM) 1710124E-5658362N

Catchment: Waitara

Tributary: Manganui

*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. That the abstraction shall be managed to ensure that a residual flow of not less than 400 litres/second is maintained, at all times in the Manganui River below the weir situated at grid reference 1710124E-5658362N.
2. That the residual flow shall be passed through the fish pass, within 12 months of the granting of this consent, subject to conditions 1 and 2 of consent 5080.
3. That the consent holder shall install and operate a measuring device capable of measuring, at a minimum of 15 minute intervals, the abstraction rate of water from the Manganui River and shall make records of such measurements available to the Chief Executive, at three monthly intervals.
4. That the abstraction shall be managed so as to ensure that when the flow in the Waitara River, as measured at the Bertrand Road hydrology gauging site, is less than or equal to 5000 litres/second, the flow in the upper Manganui River, above the weir will either:
 - (a) pass directly over the weir into the Manganui River; or
 - (b) pass continuously through Lake Ratapiko [with provision for the residual flow in the Manganui River] and the power station into the Makara Stream, and thence the lower Waitara River;

in order to mitigate the effects of low flows in the Waitara River. The Taranaki Regional Council shall notify the consent holder when flows at the Bertrand Road site are equal to 5000 litres/second.

5. That the consent holder shall pass 400 litres/second for three hours daily over the weir, if the weir licensed by consent 5080 is not naturally overtopped by flows in the Manganui River, of the same or larger volume, for a continuous period of 30 days.

Consent 3369-2

6. That the consent holder shall design, install, maintain and monitor a race water level control system to manage the inflow from the Manganui River, within 2 months of the granting of this consent. The purpose of the control system shall be to avoid flooding of farmland attributable to the activities of the consent holder, as a result of the abstraction and the diversion of stormwater under consent 3371. The control system shall have an emergency power source capable of monitoring the system for up to 48 hours and shutting the race intake gate.
7. That the consent holder shall, as far as is practicable, maintain a residual flow of 150 litres/second in the race during maintenance periods. During periods when it is not practicable, the consent holder shall arrange for a fish salvage operation to relocate stranded fish from the race.
8. That by the agreement of the consent holder, the consent holder shall mitigate the effects of the abstraction by donating annually to the Taranaki Tree Trust \$6000 [goods and services tax exclusive] for the purpose of providing riparian management in the Manganui River catchment.
9. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
10. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of this consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of monitoring, provided that such application may not be made more than once in any twelve month period.
11. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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): 7 July 2016

Commencement Date
(Change): 7 July 2016 (Granted: 19 September 2001)

Conditions of Consent

Consent Granted: To divert and use up to 8000 litres/second of stormwater run-off and the entire flow of various unnamed watercourses draining into the race and into Lake Ratapiko in the Waitara catchment for hydroelectric power supply purposes

Expiry Date: 1 June 2022

Review: In accordance with special condition 8

Site Location: Motukawa Hydro Race & Lake Ratapiko, Tariki Road,
Ratapiko

Grid Reference (NZTM) 1710120E-5658360N

Catchment: Waitara

Tributary: Manganui

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall design, install, maintain and monitor a race water level control system, within 2 months of the granting of this consent, for the purpose of achieving compliance with condition 2. The control system shall have an emergency power source capable of monitoring the system for up to 48 hours and shutting the race intake gate.
2. That the consent holder shall manage the water in the race so as to avoid or minimise the potential for flooding of adjacent farmland attributable to the activities of the consent holder by ensuring a maximum race water level (metres), above mean sea-level, of:
 - 205.20 at Salisbury Road (NZTM: 1711773E-5658233N);
 - 199.30 at Mangaotea (NZTM: 1712685E-5658307N);
 - 199.25 at the Mangaotea Aqueduct (NZTM: 1712760E-5658335N);
 - 199.15 at Lower Mangaotea (NZTM: 1713893E-5659542N).
3. That the consent holder shall, within 1 month of granting of this consent, install and survey stage boards at the sites noted in condition 2 for the purpose of providing a visual check of race water levels, to the satisfaction of the Chief Executive.
4. That a five-yearly monitoring survey of the race be completed by the consent holder to identify any maintenance requirements in order to maintain a race capacity of 8000 litres/second, for the purpose of avoiding flooding adjacent farmland, any required maintenance shall occur within 12 months of the completion of the survey.
5. That the consent holder shall install and operate measuring devices capable of measuring the water level, at a minimum of 15 minute intervals, in the race at the locations specified in condition 2, and shall make records of such measurements available to the Chief Executive at three monthly intervals. The records supplied are also to include the rainfall data at hourly intervals from the station established at the Mangaotea Road culvert.

Consent 3371-2.1

6. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
7. That:
 - a) In order to ensure compliance with conditions 1 to 2 of this consent or to remedy any adverse environmental effects caused by the acts or omissions of the consent holder in carrying out activities pursuant to these conditions, the Taranaki Regional Council requires the consent holder to enter into a bond with a financial institution of good repute to be provided as surety to the reasonable satisfaction of the Chief Executive;
 - b) The bond shall be in the sum of \$150,000;
 - c) The consent holder shall complete such work requested, in respect of which any bond is held, within the time period nominated by the Taranaki Regional Council's written request;
 - d) If the bond is raised and required pursuant to paragraph 7(b) it shall be held or remain in full force and effect throughout the term of the consent and until all requirements of the bond have been performed;
 - e) The form of the bond is to be prepared by the Taranaki Regional Council's solicitors and the consent holder is to pay the Taranaki Regional Council's costs on preparation and execution of the bond;
 - f) If the consent is transferred in part or whole to another party or person, the bond shall continue until any outstanding work at the date of transfer is completed to ensure compliance with the conditions of this consent, unless the Taranaki Regional Council is satisfied adequate provisions have been made to transfer the liability to the new consent holder;
 - g) In the event of any such transfer of the consent, the consent holder shall ensure that the transferee forthwith provides a replacement bond to the Taranaki Regional Council on the terms required by condition 7(a) to 7(f);

provided that this condition shall only take effect if flooding of land adjoining the race attributable to the activities of the consent holder occurs within the period 1 May 1999 to 30 April 2000. For the avoidance of doubt, the consent holder shall not be required to establish such a bond unless such flooding occurs within that period.

8. That the Taranaki Regional Council may review, under section 128 of the Resource Management Act 1991, the conditions of this consent if, at any time after the race water level control system is installed, there is flooding of adjoining of the Motukawa Power Scheme attributable to the activities of the consent holder.

Consent 3371-2.1

9. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of this consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account to operational requirements or the results of monitoring provided that such an application may not be made more than once in any twelve month period.
10. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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
(Change): 4 November 2002

Commencement Date
(Change): 4 November 2002 (Granted Date: 19 September 2001)

Conditions of Consent

Consent Granted: To dam the Mako Stream a tributary of the Makino Stream in the Waitara catchment to form Lake Ratapiko for hydroelectric power generation purposes, including the spillway structure

Expiry Date: 1 June 2022

Site Location: Motukawa Hydroelectric Power Scheme, Lake Ratapiko, Ratapiko Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1715023E-5659165N

Catchment: Waitara

Tributary
Makino
Mako
Lake Ratapiko

*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. That the consent holder shall, within 6 months of the granting of this consent, provide a SEED [Survey Evaluation of Existing Dams] review from a registered engineer, experienced in the design and safety of dams.
2. That it is the responsibility of the consent holder to maintain and operate a safe dam and the Taranaki Regional Council accepts no responsibility in this regard.
3. The consent holder may construct, place and maintain a structure on top of the spillway crest for the purpose of increasing lake storage.
4. That the consent holder shall manage the structure in condition 3 and the lake level so as to avoid flooding of land adjacent to the lake and race as may be attributable to the activities of the consent holder.
5. That the consent holder shall ensure that a minimum lake water level of 194 metres above mean sea level, is retained at all times, except during periods of maintenance, for the purpose of maintaining aquatic habitat.
6. That the consent holder shall ensure the maximum level, under normal operating conditions, of Lake Ratapiko does not exceed 198.7 metres above mean sea level.
7. That the consent holder shall design, install, maintain and monitor a facility to enable the passage of elvers and adult eels over the spillway within six months of the granting of this consent. The monitoring information is to be forwarded to the Chief Executive, Taranaki Regional Council, at twelve monthly intervals.
8. That the consent holder shall install and operate a measuring device capable of measuring the lake water level, at a minimum of 15 minute intervals, at the spillway, and shall make records of such measurements available to the Chief Executive, at three monthly intervals.

Consent 3373-2

9. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
10. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.
11. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To erect, place, use and maintain the weir and various structures associated with hydroelectric power generation activities in the Manganui River in the Waitara catchment

Expiry Date: 1 June 2022

Site Location: Manganui River, Tariki Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1710124E-5658362N

Catchment: Waitara

Tributary: Manganui

*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. That the consent holder shall design, install, maintain and monitor a structure at the weir to enable the passage of eels, native fish, juvenile and adult trout.
2. That the fish pass structure, required by condition 1, shall be constructed within 12 months of the granting of this consent, according to sheets 1, 2 and 3 of drawing 4-1007-2-7804 supplied with the application. The consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the commencement of fish pass construction.
3. That the consent holder shall install, maintain and operate a light barrier, within 6 months of the granting of this consent, for the purpose of diverting fish from the intake gate.
4. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
5. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 5080-1

6. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 August 1999

Commencement Date: 19 August 1999

Conditions of Consent

Consent Granted: To erect, place, use and maintain the Mangaotea Aqueduct associated with hydroelectric power generation activities in and above the Mangaotea Stream a tributary of the Manganui River in the Waitara catchment

Expiry Date: 1 June 2022

Site Location: Mangaotea Stream Aqueduct, Mangaotea Road, Ratapiko Inglewood

Grid Reference (NZTM) 1712724E-5658364N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall, within 1 month of the granting of this consent, install and survey a stage board in the race at the Mangaotea Aqueduct, for the purpose of providing a visual check on race water levels, to the satisfaction of the Chief Executive.
2. That the consent holder shall, within 12 months of the granting of this consent, lower the northern side of the aqueduct by 300 mm to provide for a flow of 2 000 litres/second and shall install a gate in the lowered section which shall be controlled by the race water level control system.
3. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
4. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 5081-1

5. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 August 1999

Commencement Date: 19 August 1999

Conditions of Consent

Consent Granted: To discharge, under emergency conditions, up to 2000 litres/second of overflow water from the Mangaotea Aqueduct into the Mangaotea Stream a tributary of the Manganui River in the Waitara catchment

Expiry Date: 1 June 2022

Site Location: Mangaotea Aqueduct Mangaotea Road, Ratapiko Inglewood

Grid Reference (NZTM) 1712724E-5658364N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the discharge shall occur after compliance with condition 2 of consent TRK995081 is achieved.
2. That emergency conditions constitute a period when local stormwater runoff to the race is required to be discharged to the Mangaotea Stream in order to avoid the race flooding adjoining land.
3. That the consent holder shall manage the discharge so as to avoid or minimise the flooding of farmland and roads below the discharge, as may be attributable to the activities of the consent holder.
4. That by the agreement of the consent holder, the consent holder shall set aside \$600 annually, [adjusted annually to reflect changes in the Cost Construction Index as published by the Department of Statistics or its succeeding organisation], for the maintenance of the flood capacity of the Mangaotea Stream below the discharge to mitigate the effects of the discharge and shall make the funds available to landowners for such works, to the reasonable satisfaction of the General Manager, Taranaki Regional Council, upon request.
5. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.
6. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.

Consent 5082-1

7. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To discharge up to 55,000 litres/second of hydroelectric power generation water, during adverse weather conditions, via spillways and lake drainage valves from Lake Ratapiko into the Mako Stream a tributary of the Makino Stream in the Waitara catchment

Expiry Date: 1 June 2022

Site Location: Lake Ratapiko / Mako Stream, Ratapiko Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1715023E-5659165N

Catchment: Waitara

Tributary: Makino
Mako

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall, within 6 months of the granting of this consent, prepare a contingency plan for the purpose of managing the discharge so as to avoid or minimise damage to property downstream. The contingency plan shall include reporting the exercise of the consent.
2. That the consent holder shall exercise the consent in accordance with the contingency plan.
3. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
4. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 5084-1

5. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To disturb the bed of Lake Ratapiko in the Waitara catchment for maintenance and repairs associated with hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Lake Ratapiko, Ratapiko Road Ratapiko, Inglewood

Grid Reference (NZTM) 1714723E-5659565N

Catchment: Waitara

Tributary: Lake Ratapiko

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

- 1. That the consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the commencement of any disturbance activities.
- 2. That the consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or potential effect on the environment arising from any disturbance activities.
- 3. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
- 4. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 5085-1

5. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To erect, place, use and maintain various structures in, on and over the bed of Lake Ratapiko in the Waitara catchment for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Lake Ratapiko, Ratapiko Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1714723E-5659565N

Catchment: Waitara

Tributary: Lake Ratapiko

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall maintain the penstock intake screens with spaces no larger than 30 mm in order to minimise eel and fish entrapment.
2. That the consent holder shall install, maintain and operate a light barrier, within 6 months of the granting of this consent, for the purpose of diverting fish from the penstock intake screens.
3. That the consent holder shall, within 1 month of the granting of this consent, install and survey a stage board in the lake, for the purpose of providing a visual check on lake water levels, to the satisfaction of the Chief Executive.
4. That the consent holder shall, within 13 months of the granting of this consent, upgrade the Ratapiko Road causeway, so as not to restrict the flow of water between the two parts of Lake Ratapiko, for the purpose of avoiding flooding land adjoining the race.
5. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of this consent in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements, or the results of monitoring, or to assess the appropriateness of condition 4, provided that such application may not be made more than once in any twelve month period.
6. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.

Consent 5086-1

7. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To take and use up to 7787 litres/second of water from Lake Ratapiko in the Waitara catchment for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Lake Ratapiko, Ratapiko Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1716522E-5659566N

Catchment: Waitara

Tributary: Lake Ratapiko

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall ensure that a minimum lake water level of 194 metres above mean sea level is retained at all times, except during periods of maintenance, for the purpose of maintaining aquatic habitat.
2. That the consent holder shall, for lake maintenance purposes, draw the level of Lake Ratapiko down gradually, over a 7-day period, in order to avoid or minimise fish stranding, and shall notify the Taranaki Regional Council and Fish and Game New Zealand at the commencement of the draw down period.
3. That the consent holder shall ensure that the maximum level, under normal operating conditions, of Lake Ratapiko does not exceed 198.7 metres above mean sea level.
4. That the consent holder shall manage lake levels so as to avoid or minimise the potential for the flooding of land adjoining the lake and race attributable to the activities of the consent holder.
5. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
6. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 5087-1

7. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 19 September 2001

Commencement Date: 19 September 2001

Conditions of Consent

Consent Granted: To discharge up to 2000 litres/second of water from the surge chamber of the Motukawa hydroelectric power station during maintenance periods into an unnamed tributary of the Makara Stream in the Waitara catchment

Expiry Date: 1 June 2022

Site Location: Motukawa HEP Station, Motukawa Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1718421E-5661167N

Catchment: Waitara

Tributary: Makara

*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 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; and
 - ii) charges authorised by regulations.

Special conditions

1. That the consent holder shall, within 6 months of the granting of this consent, prepare a contingency plan for the purpose of managing the discharge so as to avoid or minimise the potential for damage to property downstream.
2. The consent holder shall exercise the consent in accordance with the contingency plan.
3. That the consent holder shall notify the Taranaki Regional Council at least 48 hours prior to the discharge and shall adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any actual or likely effect on the environment arising from the discharge.
4. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate, and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
5. That the consent holder may apply to the Taranaki Regional Council for a change or cancellation of the conditions of their consent, in accordance with section 127(1)(a) of the Resource Management Act 1991, to take account of operational requirements or the results of the monitoring, provided that such application may not be made more than once in any twelve month period.

Consent 5088-1

6. That the Taranaki Regional Council may review any or all of the conditions of this consent, pursuant to section 128 of the Resource Management Act 1991, by giving notice of review during the month of June 2001, June 2003, June 2009 and/or June 2015, for the purpose of ensuring that the conditions are adequate to deal with any significant adverse effects on the environment arising from the exercise of this 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

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: 7 December 2005

Commencement Date: 7 December 2005

Conditions of Consent

Consent Granted: To take and use water from the Mangaotea Stream, a tributary of the Manganui River in the Waitara catchment, for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aquaduct, Mangaotea Road,
Ratapiko,

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3051. In the case of any contradiction between the documentation submitted in support of application 3051 and the conditions of this consent, the conditions of this consent shall prevail.
2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least seven days prior to the exercise of this consent.
3. The volume of water abstracted shall not exceed 38,880 cubic metres per day at a rate not exceeding 450 litres per second.
4. For the first two years following the exercise of this consent the abstraction authorised by this consent shall cease when the flow in the Mangaotea Stream immediately downstream of the confluence with the Little Mangaotea Stream located at Q19: 227-201 (GPS E2622779 N6220149) is equal to or less than 94 litres per second. If at this site flows are greater than 94 litres per second, the abstraction shall cease when the flow in the Mangaotea Stream immediately downstream of the abstraction point (GPS E2622836 N6220071) is equal to or less than 35 L/s.
5. Two years after the exercise of this consent, and following assessment of monitoring conducted as per special conditions 8, if a review of the residual flows detailed in special condition 4 is required (as per condition 9), residual flows shall be based on 55% of the median flow immediately downstream of the confluence with the Little Mangaotea Stream, and at the point of abstraction shall be 35 L/s or mean annual low flow whichever is higher.

Consent 6381-1

6. That if a flushing flow (defined as three times the median flow) has not occurred within a continuous period of 20 days, the consent holder shall cease abstraction for 8 hours during the next naturally occurring flushing flow, so as to enhance water quality downstream of the abstraction point.
7. Prior to the operation of this consent, the consent holder shall install and operate measuring devices capable of measuring, at a minimum of 15 minute intervals the:
 - abstraction rate of water from the Mangaotea Stream;
 - residual flow in the Mangaotea Stream immediately downstream of the abstraction point; and
 - flow downstream of the confluence with the Little Mangaotea Stream;

and shall make records of such measurements available to the Chief Executive, Taranaki Regional Council, at three monthly intervals.

8. In the first two years following the exercise of this consent, a monitoring programme designed in consultation with submitters and the Taranaki Regional Council, shall be commissioned and implemented by the consent holder to determine hydrological and ecological effects on the Mangaotea Stream and Manganui River downstream of the Mangaotea Stream confluence, and whether the residual flow is appropriate. Following the completion of monitoring, the consent holder shall forward the report(s) of these investigations to the Taranaki Regional Council and submitters within 6 weeks.
9. In accordance with section 128 of the Resource Management Act 1991, the Taranaki Regional Council may review the conditions of this consent if, after the completion of the residual flow monitoring and ecological assessments, two years following the exercise of this consent, and in consultation with submitters, it is found that the residual flow and/or flow regime is not appropriate.
10. That the consent holder and staff of the Taranaki Regional Council shall meet as appropriate and at least once per year, with interested submitters to the consent, to discuss any matter relating to the exercise of this resource consent, particularly the monitoring programme design, implementation and interpretation, in order to facilitate ongoing consultation.
11. This consent shall lapse on the expiry of ten 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.

Consent 6381-1

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 2007 and/or June 2009 and/or June 2015, 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

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: 7 December 2005

Commencement Date: 7 December 2005

Conditions of Consent

Consent Granted: To impound water behind a temporary dam within the Mangaotea Stream a tributary of the Manganui River in the Waitara catchment, for the purposes of constructing a water intake structure for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aquaduct, Mangaotea Road,
Ratapiko

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3052. In the case of any contradiction between the documentation submitted in support of application 3052 and the conditions of this consent, the conditions of this consent shall prevail.
2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 14 days prior to the exercise of this consent and then 48 hours upon completion of the activity.
3. The instream works authorised by this consent 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.
4. The consent holder shall ensure that the area and volume of streambed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.
5. The diversion and impoundment which is the subject of this consent shall not obstruct fish passage.
6. This consent shall lapse on the expiry of ten 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.

Consent 6382-1

7. 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 2007 and/or June 2009 and/or June 2015, 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

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: 7 December 2005

Commencement Date: 7 December 2005

Conditions of Consent

Consent Granted: To divert water around a temporary dam within the Mangaotea Stream, a tributary of the Manganui River in the Waitara catchment, for the purposes of constructing a water intake structure for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aquaduct, Mangaotea Road,
Ratapiko

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3053. In the case of any contradiction between the documentation submitted in support of application 3053 and the conditions of this consent, the conditions of this consent shall prevail.
2. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 14 days prior to the exercise of this consent and then 48 hours upon completion of the activity.
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 activity 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. The instream works authorised by this consent 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 streambed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.
6. The diversion and impoundment which is the subject of this consent shall not obstruct fish passage.
7. This consent shall lapse on the expiry of ten 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.

8. 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 2007 and/or June 2009 and/or June 2015, 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

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: 7 December 2005

Commencement Date: 7 December 2005

Conditions of Consent

Consent Granted: To erect, place and maintain a temporary dam within the Mangaotea Stream, a tributary of the Manganui River in the Waitara catchment, for the purposes of constructing a water intake structure for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aquaduct, Mangaotea Road,
Ratapiko

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3054. In the case of any contradiction between the documentation submitted in support of application 3054 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 14 days prior to the exercise of this consent and then 48 hours upon completion of the initial activity, 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. The instream works authorised by this consent 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 streambed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.
6. The diversion and impoundment which is the subject of this consent shall not obstruct fish passage.
7. This consent shall lapse on the expiry of ten 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.

Consent 6384-1

8. 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 2007 and/or June 2009 and/or June 2015, 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

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
(Change): 9 February 2007

Commencement Date
(Change): 9 February 2007 (Granted Date: 7 December 2005)

Conditions of Consent

Consent Granted: To erect, place and maintain an intake structure including pumps in the bed of the Mangaotea Stream for the purposes of abstracting water for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aqueduct, Mangaotea Road, Ratapiko

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary Manganui
Mangotea

*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

Condition 1 – unchanged

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.

Condition 2 - changed

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of applications 3055 & 4338. In the case of any contradiction between the documentation submitted in support of applications 3055 & 4338 and the conditions of this consent, the conditions of this consent shall prevail.

Conditions 3 – 10 – unchanged

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, in writing at least 14 days prior to the exercise of this consent and then 48 hours upon completion of the initial activity, 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 streambed or discharges to water.
4. The instream works authorised by this consent 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 streambed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated.
6. The structure which is the subject of this consent shall not obstruct fish passage.

Consent 6385-1

7. The consent holder shall ensure that the intake is appropriately screened to avoid the entrapment of freshwater fauna.
8. 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.
9. This consent shall lapse on the expiry of ten 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.
10. 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 2007 and/or June 2009 and/or June 2015, 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

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: 7 December 2005

Commencement Date: 7 December 2005

Conditions of Consent

Consent Granted: To disturb and modify the bed and banks of the Mangaotea Stream, a tributary of the Manganui River in the Waitara catchment, associated with the construction of an intake structure for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aquaduct, Mangaotea Road,
Ratapiko

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3056. In the case of any contradiction between the documentation submitted in support of application 3056 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 14 days prior to the exercise of this consent and then 48 hours upon completion of the initial activity, 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. The instream works authorised by this consent 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. The streambed works which are the subject of this consent shall not obstruct fish passage.
7. This consent shall lapse on the expiry of ten 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.

8. 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 2007 and/or June 2009 and/or June 2015, 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

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: 7 December 2005

Commencement Date: 7 December 2005

Conditions of Consent

Consent Granted: To discharge sediments from earthworks into the Mangaotea Stream, a tributary of the Manganui River in the Waitara catchment, associated with the construction of an intake structure, for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Downstream of Mangaotea Aquaduct, Mangaotea Road, Ratapiko

Grid Reference (NZTM) 1712760E-5658335N

Catchment: Waitara

Tributary: Manganui
Mangaotea

*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 at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3057. In the case of any contradiction between the documentation submitted in support of application 3057 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 14 days 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 streambed or discharges to water.
4. 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.
5. The instream works authorised by this consent 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.
6. After allowing for reasonable mixing, being a mixing zone extending seven times the width of the stream at the point of discharge, the discharge shall not give rise to any of the following effects in the stream:
 - 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 6387-1

7. All earthwork areas shall be stabilised vegetatively or otherwise as soon as is practicable immediately following completion of soil disturbance activities, and all areas disturbed shall be reinstated, to the satisfaction of the Chief Executive, Taranaki Regional Council.
8. This consent shall lapse on the expiry of ten 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.
9. 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 2007 and/or June 2009 and/or June 2015, 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

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

Consent Granted
Date: 27 July 2004

Conditions of Consent

Consent Granted: To divert and use water in the Motukawa Race for hydroelectric power generation purposes at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2009, June 2015

Site Location: Motukawa Race, Mangaotea Road, Ratapiko

Legal Description: Subdivision 2-3 Sec 2 Blk V Huiroa SD, Subdivision 1-2 Section 25 Blk VI Huiroa SD, and Subdivision 2-3 Section 27 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Manganui
Lake Ratapiko
Motukawa Race

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 at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3058. In the case of any contradiction between the documentation submitted in support of application 3058 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 seven days prior to the exercise of this consent.
4. This consent shall lapse on the expiry of ten 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.
5. 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 2009 and/or June 2015, 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.

Signed at Stratford on 27 July 2004

For and on behalf of
Taranaki Regional Council

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: 27 July 2004

Commencement Date: 27 July 2004

Conditions of Consent

Consent Granted: To divert and use water in the Motukawa Race for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Motukawa Race, Mangaotea Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1712726E-5658316N

Catchment: Waitara

Tributary: Manganui
Lake Ratapiko
Motukawa Race

*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 at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3058. In the case of any contradiction between the documentation submitted in support of application 3058 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 seven days prior to the exercise of this consent.
4. This consent shall lapse on the expiry of ten 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.

Consent 6388-1

5. 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 2009 and/or June 2015, 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

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): 23 June 2006

Commencement Date
(Change): 23 June 2006 (Granted Date: 27 July 2004)

Conditions of Consent

Consent Granted: To impound water behind a dam on the Motukawa Race
for hydroelectric power generation purposes

Expiry Date: 1 June 2022

Site Location: Motukawa Race, Mangaotea Road, Ratapiko, Inglewood

Grid Reference (NZTM) 1712726E-5658316N

Catchment: Waitara

Tributary: Manganui
Lake Ratapiko
Motukawa Race

*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

Condition 1 – unchanged

1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.

Condition 2 – changed

2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3060 and 4257. In the case of any contradiction between the documentation submitted in support of application 3060, 4257, and the conditions of this consent, the conditions of this consent shall prevail.

Conditions 3 to 6 – unchanged

3. The consent holder shall notify the Chief Executive, Taranaki Regional Council, and Fish and Game New Zealand [Taranaki Region], in writing at least 14 days prior to the construction of the dam and turbine unit in the Motukawa Race.
4. The consent holder shall ensure that the intake is appropriately screened to avoid the entrapment of freshwater fauna.

Consent 6390-1

5. The consent holder shall, on three occasions during November to February each year, cease generation from the turbine unit and open the bypass valve for 12 hours in order to enable trout to pass through the dam.
6. The consent holder shall monitor the effectiveness of the bypass valve as a fish passage device for the first six [6] bypass events, and shall provide monitoring data to the Chief Executive, Taranaki Regional Council, and Fish and Game New Zealand [Taranaki Region], as soon as practicable after the sixth monitoring event. Monitoring shall include:
 - (a) A visual inspection of the section of the Motukawa Race from the outlet of Coxhead Tunnel to the dam site prior to the first six [6] bypass events in order to determine whether trout are accumulating in the head pond; and
 - (b) A survey of trout in the 100 metre section of the Motukawa Race downstream of the dam, prior to and immediately following the completion of each of the first six [6] bypass events.

Condition 7 – changed

7. In accordance with section 128 of the Resource Management Act 1991, the Taranaki Regional Council may review the conditions of this consent if, after the completion of the first six [6] bypass events, the monitoring shows that a significant number of trout accumulate in the generator head pond and are not being passed by the bypass valve, or there are a significant number of trout mortalities caused by passage through the turbine.

Conditions 8 to 10 – unchanged

8. The consent holder shall manage the water in the race so as to avoid or minimise the potential for flooding of adjacent farmland attributable to the activities of the consent holder by ensuring a maximum race water level [metres], above mean sea-level of:

205.20 at Coxhead’s Bridge [GR Q20:219 198];
199.30 upstream of Mangaotea Road culvert [GR Q19:227 201];
199.25 at the Mangaotea Aqueduct [GR Q19:228 201]; and
199.15 at Berryman’s Bridge [GR Q9:239-213].
9. This consent shall lapse on the expiry of ten 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.

Consent 6390-1

10. 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 2009 and/or June 2015, 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

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

Consent Granted
Date: 27 July 2004

Conditions of Consent

Consent Granted: To discharge sediment during earthworks associated with the construction of a generator structure into the Motukawa Race at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2009, June 2015

Site Location: Motukawa Race, Mangaotea Road, Ratapiko

Legal Description: Subdivision 2-3 Sec 2 Blk V Huiroa SD, Subdivision 1-2 Section 25 Blk VI Huiroa SD, and Subdivision 2-3 Section 27 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Manganui
Lake Ratapiko
Motukawa Race

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 at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally in accordance with the documentation submitted in support of application 3061. In the case of any contradiction between the documentation submitted in support of application 3061 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 river bed or discharges to water.
4. 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.
5. 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.
6. All earthwork areas shall be stabilised vegetatively or otherwise as soon as is practicable immediately following completion of soil disturbance activities to the satisfaction of the Chief Executive, Taranaki Regional Council.

Consent 6391-1

7. This consent shall lapse on the expiry of ten 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.
8. 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 2009 and/or June 2015, 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.

Signed at Stratford on 27 July 2004

For and on behalf of
Taranaki Regional Council

Director-Resource Management

Appendix II

Biomonitoring reports

To Job Manager, Bart Jansma
From Scientific Officer, Bart Jansma
Report No BJ305
Doc No 1928729
Date 7 September 2017

Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, March 2017

Introduction

This was the only scheduled biomonitoring survey relating to the Motukawa HEP scheme for the 2016-2017 monitoring year. Reports presenting the results from surveys performed since the 2001-2002 monitoring year are presented in the references in this report. The purpose of this monitoring is to assess the impact the abstraction from the Manganui River has on the macroinvertebrate communities of the river. With regards to the current survey, the scheme was operating normally, but flows had been variable in the two months prior, with a small spate occurring seven days prior to this survey. The river had naturally overtopped the weir on a number of occasions in the two month period preceding this survey (Figure 1).

The resource consents for this scheme were renewed in September 2001. Work was completed on the new fish pass at the weir prior to the November 2002 survey and the majority of the 400 l/s residual flow required by consent 3369 is provided through this pass. The remainder of the residual flow (approx. 100 l/s) has continued to be released down the old fish pass.

Methods

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from four sites in the Manganui River (Table 1, Figure 2) on 24 February 2017, 21 days after flows in excess of three and seven times the median flow. This 'kick-sampling' technique is very similar to Protocol C1 (hard-bottomed, semi-quantitative) of the New Zealand Macroinvertebrate Working Group (NZMWG) protocols for macroinvertebrate samples in wadeable streams (Stark et al, 2001).

Due to the high, more natural flows during the 2010 survey, the usual riffle area sampled at site 5 was no longer suitable. Consequently, the nearest suitable riffle area was sampled, being approximately 150m further upstream, and this has now become a permanent change.

Samples were preserved with Kahle's Fluid for later sorting and identification under a stereomicroscope according to Taranaki Regional Council methodology using protocol P1 of NZMWG protocols for sampling macroinvertebrates in wadeable streams (Stark et al. 2001). Macroinvertebrate taxa found in each sample were recorded as:

R (rare)	= less than 5 individuals;
C (common)	= 5-19 individuals;
A (abundant)	= estimated 20-99 individuals;
VA (very abundant)	= estimated 100-499 individuals;
XA (extremely abundant)	= estimated 500 individuals or more.

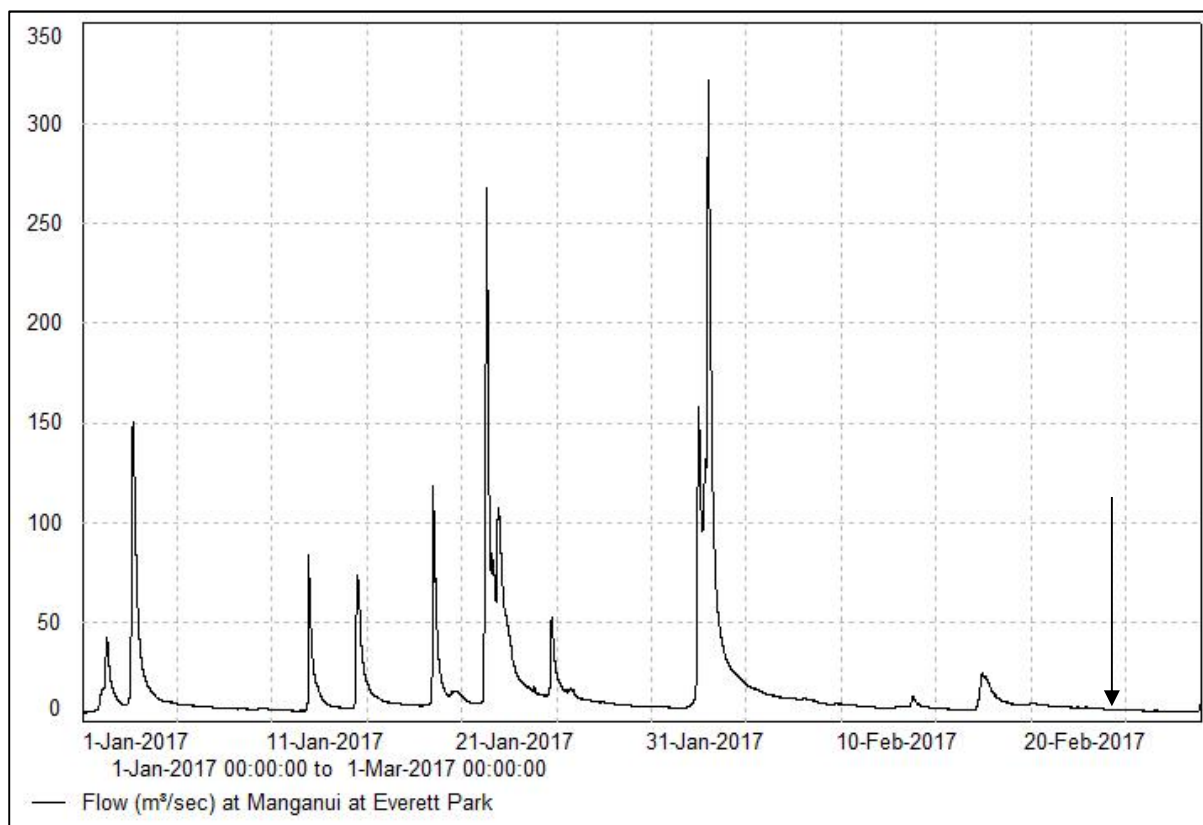


Figure 1 The flow (cubic meters per second) in the Manganui River downstream of the Tariki diversion weir, between 1 Jan 2016 and 10 March 2016. The arrow indicates the time of sampling.

Stark (1985) developed a scoring system for macroinvertebrate taxa according to their sensitivity to organic pollution in stony New Zealand streams. Highly 'sensitive' taxa were assigned the highest scores of 9 or 10, while the most 'tolerant' forms scored 1. Sensitivity scores for certain taxa have been modified in accordance with Taranaki experience. By averaging the scores obtained from a list of taxa taken from one site and multiplying by a scaling factor of 20, a Macroinvertebrate Community Index (MCI) value was obtained. The MCI is a measure of the overall sensitivity of macroinvertebrate communities to the effects of organic pollution. Communities that are more 'sensitive' inhabit less polluted waterways.

Table 1 Biomonitoring sites in the Manganui River in relation to the Motukawa HEP scheme

Site No.	Site code	Map reference	Location
2	MGN000300	Q20: 201 196	400 m upstream of weir (upstream of Tariki Road)
4	MGN000320	Q19: 203 203	300 m downstream of weir
5	MGN000360	Q19: 216 206	1700 m downstream of weir
6	MGN000375	Q19: 209 206	2300 m downstream of Tariki weir

However, the establishment of lengthy historical records of taxa richness, community composition and MCI scores may be useful in assessing trends in the 'health' of macroinvertebrate communities associated with rivers and streams subject to environmental perturbations such as those caused by HEP abstractions.

A semi-quantitative MCI value (SQMCI_s) has also been calculated for the taxa present at each site by multiplying each taxon score by a loading factor (related to its abundance), totalling these products, and dividing by the sum of the loading factors (Stark, 1998 & 1999). The loading factors were 1 for rare (R), 5 for common (C), 20 for abundant (A), 100 for very abundant (VA) and 500 for extremely abundant (XA). Unlike the MCI, the SQMCI_s is not multiplied by a scaling factor of 20, so that its corresponding values range from 0 to 10.



Figure 2 Biological monitoring sites in the Manganui River in relation to the Motukawa Power Scheme

Results and discussion

At the time of this morning survey, the water temperature in the Manganui River was 17.1°C upstream of the weir, and ranged from 17.3°C to 17.8°C downstream of the weir (Table 2). All sites had a moderate clear and uncoloured flow. The flow was swift at all sites with the exception of site 6, where it was steady.

The substrate at all sites comprised predominantly gravel, cobbles and boulders, with some sand present also. Upstream of the weir, algal mats were only present in patches, with algal filaments patchy on the streambed. Both periphyton mats and filaments were present in patches at all downstream sites, with the exception of site 6 where algal mats were observed to be widespread.

Table 2 Selected environmental parameters monitored on 3 March 2015 in relation to the Motukawa HEP scheme

Site no.	Site code	Time of sampling (NZST)	Water temperature (°C)
2	MGN000300	1025	17.1
4	MGN000320	0945	17.4
5	MGN000360	0920	17.8
6	MGN000375	0825	17.3

Macroinvertebrate communities

A summary of the results from previous macroinvertebrate surveys performed in the Manganui River in relation to the Motukawa HEP scheme is presented in Table 3, together with current results (which are presented in full in Table 4).

Table 3 Summary of previous numbers of taxa and MCI values recorded in surveys performed in the Manganui River in relation to the Motukawa HEP water abstraction, together with current results

Site	N	Numbers of taxa			MCI values			SQMCI _s values			
		Median	Range	Current survey	Median	Range	Current survey	N	Median	Range	Current survey
2	40	24	12-35	25	101	86-116	111	24	3.6	2.3-7.0	5.4
4	39	26	14-34	25	104	85-123	107	24	5.0	2.7-7.4	6.8
5	36	24	16-31	32	96	79-119	106	24	4.5	7	7.1
6	22	25	19-30	23	102	81-123	106	22	4.3	2.0-7.4	7.3

Site 2 - upstream of weir (MGN000300)

Twenty-five taxa were recorded at this site, upstream of the Tariki weir. This was one taxon more than the median of numbers recorded by all previous surveys (Table 3). The presence of six 'highly sensitive' taxa was indicative of good preceding physicochemical water quality. The community was characterised by two 'highly sensitive' taxa (mayfly (*Deleatidium* and *Nesameletus*)), five 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmids beetles, dobsonfly (*Archichauliodes*), free-living caddisflies (*Costachorema*) and

crane fly (*Aphrophila*), and three 'tolerant' taxa (free-living caddisfly (*Hydropsyche-Aoteapsyche*) and midge larvae (orthoclads and *Maoridiamesa*). The numerical dominance of the 'highly sensitive' mayfly *Deleatidium* was also indicative of good preceding physicochemical water quality conditions, but was balanced somewhat by the very abundant free-living caddisfly *Hydropsyche-Aoteapsyche* and midge *Maoridiamesa*, resulting in a SQMCI_s score of 5.4 units. This was significantly higher than the median SQMCI_s for this site (Stark, 1998), but significantly less than that recorded at this site in the previous survey. Overall, this result reflects the high water quality and habitat conditions at this control site, despite the summer flow conditions at the time.

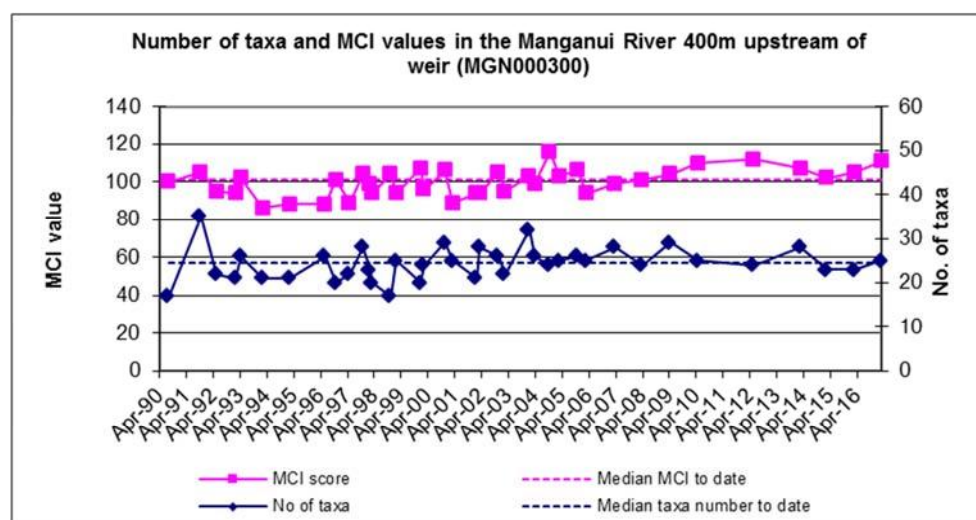


Figure 3 Number of taxa and MCI values since 1990 for the Manganui River upstream of the Tariki weir

The MCI value (111) was significantly higher than the long-term median (Stark, 1998) (Table 3, Figure 3) and was due to the proportion of 'sensitive' taxa in the community (64% of richness). The score, the third highest recorded at this site, was significantly higher than the predicted score (97 units) for this site 22.0 km downstream of the National Park boundary (Stark and Fowles, 2009). Prior to 2006, results indicated that this site exhibited a strong seasonal pattern, with higher MCI scores in spring than in summer. Seasonal changes are no longer apparent, with the cessation of spring sampling after 2006, although due to the high rainfall that occurred during the 2015-16 summer, the current result is more typical of a spring survey.

Table 4 Macroinvertebrate fauna of the Manganui River in relation to Motukawa H.E.P scheme sampled on 24 February 2017

Taxa List	Site Number	MCI score	2	4	5	6	
	Site Code		MGN000300	MGN000320	MGN000360	MGN000375	
	Sample Number		FWB17117	FWB17118	FWB17119	FWB17120	
PLATYHELMINTHES	<i>Cura</i>	3	-	-	R	-	
ANNELIDA	Oligochaeta	1	R	-	C	R	
	Lumbricidae	5	-	-	R	-	
MOLLUSCA	<i>Potamopyrgus</i>	4	R	R	A	R	
EPHEMEROPTERA	<i>Austroclima</i>	7	R	R	C	R	
	<i>Coloburiscus</i>	7	A	C	C	R	
	<i>Deleatidium</i>	8	VA	XA	XA	XA	
	<i>Nesameletus</i>	9	A	VA	VA	VA	
	<i>Zephlebia group</i>	7	R	-	R	-	
PLECOPTERA	<i>Megaleptoperla</i>	9	R	-	R	R	
	<i>Zelandobius</i>	5	-	R	R	-	
	<i>Zelandoperla</i>	8	C	C	R	R	
HEMIPTERA	<i>Saldula</i>	5	-	R	-	-	
COLEOPTERA	Elmidae	6	VA	VA	VA	A	
	Hydraenidae	8	R	R	R	-	
MEGALOPTERA	<i>Archichauliodes</i>	7	A	A	A	C	
TRICHOPTERA	<i>Hydropsyche (Aoteapsyche)</i>	4	VA	VA	A	A	
	<i>Costachorema</i>	7	A	C	C	C	
	<i>Hydrobiosis</i>	5	C	A	A	A	
	<i>Neurochorema</i>	6	R	R	R	R	
	<i>Beraeoptera</i>	8	-	R	-	-	
	<i>Olinga</i>	9	R	-	-	-	
	<i>Oxyethira</i>	2	R	R	R	-	
	<i>Pycnocentria</i>	7	-	-	R	-	
	<i>Pycnocentroides</i>	5	R	R	A	R	
	DIPTERA	<i>Aphrophila</i>	5	VA	VA	C	VA
Eriopterini		5	-	-	C	R	
<i>Limonia</i>		6	-	-	R	-	
<i>Maoridiamesa</i>		3	VA	A	R	C	
Orthoclaadiinae		2	A	A	A	A	
Tanypodinae		5	-	-	R	R	
Tanytarsini		3	C	C	A	C	
Empididae		3	-	-	R	R	
Muscidae		3	-	R	-	-	
<i>Austrosimulium</i>		3	C	R	C	R	
Tanyderidae		4	R	R	C	-	
No of taxa			25	25	32	23	
MCI			111	107	106	106	
SQMCIs			5.4	6.8	7.1	7.3	
EPT (taxa)			13	12	14	11	
%EPT (taxa)			52	48	44	48	
'Tolerant' taxa		'Moderately sensitive' taxa		'Highly sensitive' taxa			

R = Rare C = Common A = Abundant VA = Very Abundant XA = Extremely Abundant

Site 4 - 300m d/s of weir (MGN000320)

A community richness of twenty-five taxa was found at this site, 300 metres downstream of the hydro weir. This richness was similar to the long-term median number of taxa previously found at this site and equal to that recorded at site 2 upstream of the weir (Table 3). The proportion of 'sensitive' taxa (64% of richness) at this site was also equal to that recorded at the upstream site, and resulted in a similar MCI score of 107 units, which was three units above the long-term median for this site. Summer MCI scores appear to be relatively stable at this site, with scores recorded since 2009 ranging from only 105-113 units. This may be attributable to the flow regulation in this reach (and a consequently reduced frequency of flood flows), resulting in more stable communities.

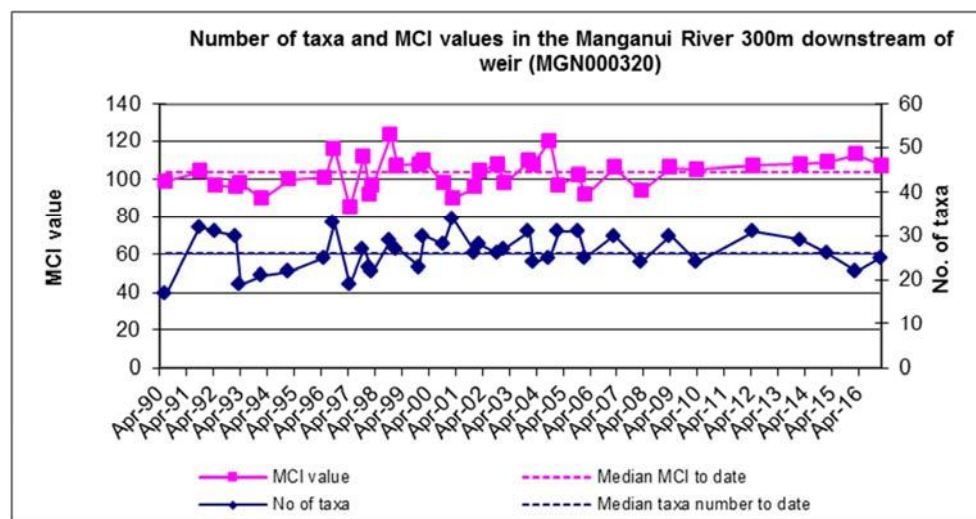


Figure 4 Number of taxa and MCI values since 1990 for the Manganui River 300m downstream of the Tariki weir

The community was characterised by two 'highly sensitive' taxa (mayfly (*Deleatidium* & *Nesameletus*)), four 'moderately sensitive' taxa (elmid beetles, dobsonfly (*Archichauliodes*), free-living caddisfly (*Hydrobiosis*) and *Aphrophila* cranefly); and three 'tolerant' taxa (caddisfly (*Hydropsyche-Aoteapsyche*) and orthoclad and *Maoridiamesa* midge larvae). Due to the increased abundance of 'highly sensitive' *Deleatidium* mayfly, there was a significant (Stark, 1998) increase in SQMCI_s score from site2 upstream. The current value of 6.8 was significantly higher than the long-term median for this site (Stark, 1998). Nine taxa were present in abundance, and the fact that six of these abundant taxa are recognised as 'sensitive' taxa reflects good preceding physicochemical water quality conditions.

Site 5 - 1.7km d/s of weir (MGN000360)

A high community richness of thirty-two taxa was recorded at this site, 1.7 kilometres downstream of the Tariki weir. This was eight taxa more than the median and one taxon higher than the previous maximum taxa richness recorded at this site (Table 3, Figure 4). The community consisted of a similar proportion of 'sensitive' taxa (66%) as that recorded at site 4, producing a similar MCI score of 106 units, ten units higher than the long term median for this site, and within the range previously recorded. The results from the past few surveys at this site shows that there is some variability in MCI scores at this site over time (Figure 4), and that this variation does not appear to have a clear relationship with any environmental variables.

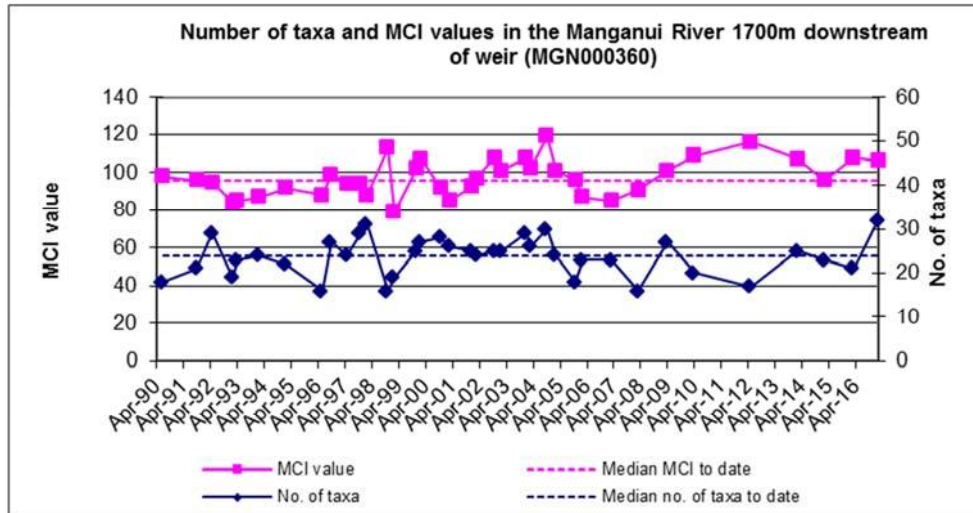


Figure 5 Number of taxa and MCI values since 1990 for the Manganui River 1700m downstream of the Tariki weir

These results continue the trend of above median values, a trend which had generally been maintained since the implementation of the 400 L/s residual flow (Figure 5), probably reflecting the effects of improved habitat provided by the increased residual flow downstream of the weir. This site had previously been affected by iron-oxide smothering of the substrate, which had been a feature of the habitat and survey results prior to the release of the increased residual flow. The current survey did not note any such smothering.

The dominant taxa at this site included two 'highly sensitive' taxa (mayfly (*Deleatidium* and *Nesameletus*)), four 'moderately sensitive' taxa (elmid beetles, dobsonfly (*Archichauliodes*), and caddisfly (*Hydrobiosis* and *Pycnocentrodus*)) and four 'tolerant' taxa (snails (*Potamopyrgus*), net spinning caddisfly (*Hydropsyche-Aoteapsyche*) and midge larvae (orthoclads and tanytarsids), similar to the number of taxa recorded in abundance in the previous survey. Similar to sites 2 upstream, the numerical dominance of 'moderately sensitive' taxa resulted in the moderate SQMCI₅ score of 7.1 units at site 5, which was 2.6 units higher than the median for this site, a very significant improvement (Stark, 1998). This is a good result, reflecting the relatively frequent flushing flows that preceded this survey.

Site 6 - 2.3km d/s of weir (MGN000375)

A moderate richness of twenty-three taxa was recorded at this site, 2.3 kilometres downstream of the weir. This was similar to the median richness recorded from the 22 previous surveys at this site (Table 3) and was the lowest richness recorded in the current survey (Table 3).

A moderate proportion (35% of richness) of the community were 'tolerant' taxa (Table 5), and the presence of four 'highly sensitive' taxa (two in abundance) was indicative of good preceding physicochemical water quality. The community was characterised by two 'highly sensitive taxa (mayfly (*Deleatidium* and *Nesameletus*), three 'moderately sensitive' taxa (elmid beetles, caddisfly (*Hydrobiosis*) and *Aphrophila* crane fly) and two 'tolerant' taxa (net building caddisfly (*Hydropsyche-Aoteapsyche*) and orthoclad midge larvae).

Four taxa exhibited a significant change in numerical abundance from site 5 to site 6, with two 'tolerant' taxa and one 'moderately sensitive' taxon reducing in abundance, and one 'moderately sensitive' taxon increasing in abundance. When the community is considered as a whole, these are relatively subtle changes, and resulted in a SQMCI₅ score that was slightly higher, at 7.3 units. In terms of this site, this represents a very good SQMCI₅ score, being 3.0 units higher than the long-term median, a statistically significant result (Stark, 1998).

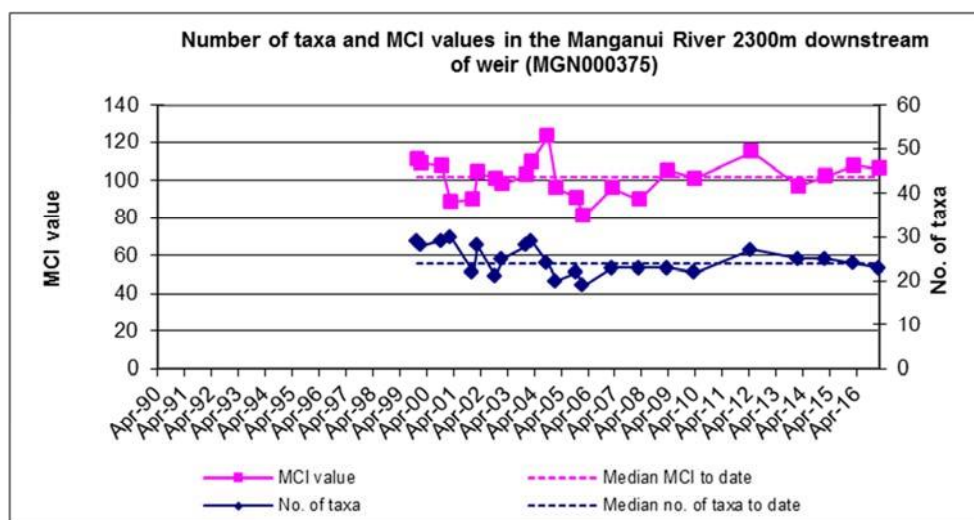


Figure 6 Number of taxa and MCI values since 1999 for the Manganui River 2300m downstream of the Tariki weir

The MCI score for this site (106) was equal to that recorded at site 5, and similar to that recorded at site 2, reflecting the proportion of 'sensitive' taxa in the community (65%). This MCI score was higher than the median for this site, and that recorded in the previous survey (Figure 5). These results suggest no deterioration from that recorded at site 2, which is a promising result, as the water temperature would be expected to increase with distance from the weir. This is probably a reflection of the spring-like conditions that preceded this survey, with the frequent high flows suppressing water temperatures. Unlike in previous surveys, the algal piercing caddisfly *Oxyethira* did not increase in abundance at this site, suggesting that the degree of algal growth at this site was less extensive than previous years, also a likely reflection of the preceding flow conditions.

Summary and Conclusions

The Council's standard 'kick-sampling' technique was used at four established sites to collect streambed macroinvertebrates from the Manganui River. Samples were processed to provide number of taxa (richness), MCI and SQMCI₅ 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 SQMCI₅ 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 SQMCI₅ between sites indicate the degree of adverse effects (if any) of the discharges being monitored.

With regards to the current survey conducted on 24 February 2017, flows had been variable in the two months prior, with a small spate occurring seven days prior to this survey. The river had naturally overtopped the weir on a number of occasions in the two-month period preceding this survey

This survey recorded taxonomic richness (number of taxa) similar to the median numbers of taxa previously recorded at these sites, with the exception of site 5, which recorded a new maximum taxa richness, eight taxa more than this sites median richness. MCI values were relatively similar in a downstream direction, with the highest MCI score recorded at site 2. Previous surveys generally found MCI values to steadily decrease in a downstream direction, and this was attributed to changes in habitat downstream (including increased water temperatures and algal growth), associated with the reduction in flow downstream of the weir. The

fact that the current survey recorded some deterioration, though not statistically significant, is a positive indication that the impacts of the diversion were not as severe as expected during this summer low flow period. This may reflect the effects of the relatively frequent flushing flows that occurred over the two months prior. The current survey recorded warm temperatures (around 18 °C), and patchy or widespread growths of periphyton mats and filaments at all downstream sites. The upstream sites also supported patchy growths, but they were not as extensive. Under a residual flow regime, such prolific growths may not be flushed away by floods on a regular basis, as might happen under a more natural flow regime and they can become particularly prolific under lengthy periods of stable low flow conditions. Such proliferations were not as apparent during the current survey, reflecting the lack of flushing flows during the start of 2016.

There were no significant changes in invertebrate abundance noted between sites 2 and 4 or sites 4 and 6, although there were a number noted between sites 4 and 5 and sites 5 and 6. These changes are primarily related to the difference in habitat noted at site 5, and not considered reflective of a change in water quality at this site. Previous surveys have noted some significant changes in abundance related to the slight increase in algal biomass observed downstream of the weir. This was not as apparent in the current survey. Overall, the current survey indicated that the habitat limitation that appeared to be present in some previous surveys (especially at site 5) was no longer present. This conclusion is also supported by the moderate to high taxa richnesses recorded downstream of the weir.

In general, all sites were dominated by similar taxa, despite the summer low flow conditions. Only subtle changes in abundance were noted, reflecting a change in periphyton biomass and site specific habitat conditions, although there was little impact on the SQMCI₅ scores, with a trend of increasing SQMCI₅ in a downstream direction, and all downstream sites recording an SQMCI₅ score significantly higher than that recorded upstream of the weir. This is in contrast to most previous surveys, which tended to record the SQMCI₅ scores reducing gradually in a downstream direction. All sites contained moderate proportions of 'sensitive' taxa, and the communities downstream of the abstraction weir were more generally dominated by these 'sensitive' taxa, which was in contrast to most previous survey results, which usually found 'tolerant' taxa to be generally dominant. Overall, the SQMCI₅ scores at these downstream sites were all close to the maximum scores recorded for these sites.

The presence of a number of 'highly sensitive' taxa at all sites indicated generally good preceding physicochemical water quality, although individual abundances within these taxa tended to vary across sites. *Deleatidium* mayflies, considered 'highly sensitive', were well represented at all sites. MCI scores indicated that the stream communities were of good 'health', while the SQMCI₅ scores were representative of excellent water quality (Stark & Maxted, 2007), especially when compared to their respective medians. This is an encouraging result, as the higher temperatures usually experienced in the residual flow reach, would be expected to reduce these scores. However, the spring-like weather conditions that preceded this survey suppressed water temperatures, with then not exceeding 24°C in the month prior to this survey.

Since the new residual flow has been operating, some improvement in communities have been observed particularly at site 5, 1.7 km downstream of the weir, where MCI values have generally been above the historical median. The habitat at this site prior to the establishment of the new residual flow was generally poor due to smothering by iron oxide deposits, which has been significantly reduced since the new residual flow has been implemented. This result was repeated in the current survey, with the MCI score at site 5 being ten units higher than the median, and the SQMCI₅ score a statistically significant 3.0 units higher than the median. The overall improvement in macroinvertebrate communities at this site is likely to have been a direct result of the increased residual flow, although there also appears to be a general overall improvement in the catchment, as demonstrated at site 2, upstream of the affected reach. However, elevated water temperatures and more dense periphyton cover have affected macroinvertebrate communities of the residual flow reach in more recent summer surveys.

When the results for each site are compared over time, it is clear that the control site (site 2) is more stable in both taxa number and MCI score than recorded at the three downstream sites. This reflects the 'buffering' effect of the higher flow upstream, which protects the community from extremes such as elevated temperatures. The reduced flow downstream of the weir does not provide as great a buffer and therefore there is more variation in the macroinvertebrate communities recorded at sites in the residual flow reach.

In terms of the current survey, it is considered that the communities of the residual flow reach represent what would be considered better than typical of a low flow community. They are similar to that recorded in the previous survey, despite the previous survey being preceded by stable low flows, with only two large floods in the previous two months. The results indicate that the MCI scores at these sites were higher than most previous surveys, as were the SQMCI_s scores, which were all significantly higher than their respective medians. However, a similar result was recorded at the control site indicating that there is a catchment wide improvement also. Overall, the results indicate that the invertebrate community supported by a residual flow of 400 L/s, with regards to presence/absence of taxa, and their respective abundances, is not significantly different to that supported by natural flows. The principal difference between the two flows is that there is a greater amount of invertebrate habitat available under natural flow conditions due to the increased amount of wetted riverbed width.

References

- Dunning KJ, 2002a: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, January 2002. TRC report KD103.
- Dunning KJ, 2002b: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, March 2002. TRC report KD115.
- Dunning KJ & Fowles CR, 2003: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, November 2002. TRC report CF283.
- Fowles CR & Colgan BG, 2004: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, January 2004. TRC report CF300.
- Fowles CR & Colgan BG, 2004a: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, March 2004. TRC report CF323.
- Fowles CR & Colgan BG, 2004b: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, October 2004. TRC report CF351.
- Fowles CR & Jansma B, 2008a: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, March 2007. TRC report CF452.
- Fowles CR & Jansma B, 2008b: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, March 2008. TRC report CF453.
- Hope KJ, 2005: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, February 2005. TRC report KH23.
- Hope KJ, 2005b: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, November 2005. TRC report KH063.
- Jansma B, 2006: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, February 2006. TRC report BJ006.
- Jansma B, 2009: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa HEP scheme, April 2009. TRC report BJ061.
- Jansma B, 2010: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, April 2010. TRC report BJ092.
- Jansma B, 2014: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, May 2012. TRC report BJ243.
- Jansma B, 2014: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, February 2014. TRC report BJ244.
- Jansma B, 2015: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, February 2015. TRC report BJ265.
- Jansma B, 2016: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, March 2016. TRC report BJ288.
- Moore SC and Fowles CR, 2003: Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, February 2003. TRC report CF283.
- Stark JD, 1985: A macroinvertebrate community index of water quality for stony streams. *Water and Soil* Miscellaneous Publication No. 87.

- Stark JD, 1998: SQMCI: a biotic index for freshwater macroinvertebrate coded abundance data. *New Zealand Journal of Marine and Freshwater Research* 32(1): 55-66.
- Stark JD, 1999: An evaluation of Taranaki Regional Council's SQMCI biomonitoring index Cawthron Institute, Nelson. Cawthron Report No. 472.
- Stark JD, Boothroyd IKG, Harding JS, Maxted JR, Scarsbrook MR, 2001: Protocols for sampling macroinvertebrates in wadeable streams. New Zealand Macroinvertebrate Working Group Report No. 1. Prepared for the Ministry for the Environment. Sustainable Management Fund Project No. 5103. 57p.
- Stark JD and Maxted JR, 2007. A user guide for the macroinvertebrate community index. Cawthron Institute, Nelson. Cawthron Report No. 1166.
- Stark JD and Fowles CR, 2009: Relationships between MCI, site altitude, and distance from source for Taranaki ring plain stream. Prepared for Taranaki Regional Council. Stark Environmental Report No. 2009-01. 47p.
- TRC, 1999: Some statistics from the Taranaki Regional Council database (FWB) of macroinvertebrate surveys performed during the period from January 1980 to 31 December 1998. TRC Technical Report 99-17.

