

Trustpower Ltd
Motukawa HEP Scheme
Monitoring Programme
Monitoring Report 2010-2014

Technical Report 2014-79

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Executive summary

Trustpower Limited (Trustpower) operates the Motukawa hydroelectric power (HEP) scheme in the Manganui River and Waitara River catchment. 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 2010-June 2014 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 176 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. Most of these consents were granted during the 2005-2006 year, with the abstraction consents to take and use exercised in the reported period.

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

The Council's monitoring for the period under review included 50 inspections of fish passage and residual flow facilities, continuous river monitoring at three sites between November and April each year, two biomonitoring surveys and three fish surveys of receiving waters, and review of abstraction, discharge, and lake and race water level data forwarded by the Company, as well as elver transfer data.

The monitoring showed that during the period under review, the management of abstraction rates, race and lake water levels were 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 few significant losses of data, and no breaches of maximum water levels within the race during the reported period. The submitted race water level data indicated that there had been no flooding of adjacent farmland.

Water temperature differences appear to have reduced between natural flows and those in the residual flow reach since the establishment of the 400 litre per second residual flow. Over the reported period, there was a reduction in the number of days that water temperatures in the residual flow reach exceeded 25°C, and the temperature differences between upstream and downstream of the weir were generally lower than the 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 sampled were representative of more 'natural' conditions, as the surveys were

preceded by flushing flows. The results indicate that the MCI scores don't differ markedly from previous surveys, although the SQMCI_s scores from the residual flow sites all significantly exceeded (were better than) their respective long term medians. However, a similar result was recorded at the control site indicating that this result was most likely related to the cooler temperatures over this time. Overall, the results indicate that the invertebrate community supported by a residual flow of 400 litres per second, 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 current results also illustrate the impact on the invertebrate community of regular flushing flows.

A significant result of fish monitoring undertaken to date, was the presence of the key indicator species redfin bully, shortjaw kokopu and inanga upstream of the weir. Redfin bully were again recorded upstream of the weir during the reported period, and in improved densities. Inanga were also observed in the residual flow reach, and torrentfish were recorded at the base of the fish pass.

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.

Eel and elver passage requirements were generally fulfilled with the elver transfer system at the power station working well. 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, although due to low numbers no eels were transferred in 2011. Over the following three seasons, 40 eels were transferred.

During the reported period, Trustpower's performance was generally maintained at a high level. With the exception of one incident that warranted enforcement action, there were no incidents of concern. 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 one incident that did result in enforcement action related to insufficient flow in the Manganui River. Human error resulted in insufficient flow being released to the Manganui River, and as a result an infringement notice was issued. Although the performance rating for the relevant consent is 'improvement required' this improvement has already occurred with improved communications and understanding of the staff and contractor involved.

This is a reflection of the consent holder's improved systems, and thorough monitoring of a highly complex scheme. Trustpower has maintained a good level of communication with the Council, including notifying Council of any breach of consent, no matter how minor. Overall, it is considered that Trustpower was able to demonstrate a good level of environmental performance and compliance with the resource consents, and compliance with the

administrative requirements of the consents was high. Although there was one infringement notice issued in this time, the cause was remedied immediately, and had Trustpower not notified Council, it is unlikely it would have been discovered. Tempering this single incident was a high level of compliance with all other consents over this time.

This report includes recommendations for the 2014-2015 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 2010-June 2014 by the Taranaki Regional Council (The Council) describing the monitoring programme associated with resource consents held by Trustpower Ltd 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 19th 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 compliance monitoring under the *Resource Management Act (RMA)* and the Council's obligations and general approach to monitoring sites through annual programmes, the resource consents held by Trustpower, the nature of the monitoring programme in place for the period under review, and a description of the activities and operations conducted in the Manganui and Waitara River catchments in relation to the Motukawa HEP scheme.

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

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

Section 4 presents recommendations to be implemented in the 2014-15 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 *Resource Management Act* 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 a discharger, and may include cultural and socio-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 (e.g., recreational, cultural, or aesthetic);
- (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 discharge source. Monitoring programmes are not only based on existing permit conditions, but also on the obligations of the Resource Management Act to assess the effects of the exercise of consents. In accordance with section 35 of the Resource Management Act 1991, the Council undertakes compliance monitoring for consents and rules in regional plans; and maintains an overview of performance of resource users against regional plans and consents. Compliance monitoring, including impact monitoring, also enables the Council to continuously assess its own performance in resource management as well as that of resource users particularly consent holders. It further enables the Council to continually re-evaluate its approach and that of consent holders to resource management, and, ultimately, through the refinement of methods, to move closer to achieving sustainable development of the region's resources.

1.1.4 Evaluation of environmental performance

Besides discussing the various details of the performance and extent of compliance by the consent holder/s during the period under review, this report also assigns a rating as to each Company's environmental and administrative performance.

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 (i.e. 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 compliance

- **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 2013-2014 year, 60% of consent holders in Taranaki monitored through tailored compliance monitoring programmes achieved a high level of environmental performance and compliance with their consents, while another 29% demonstrated a good level of environmental performance and compliance with their consents.

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 (Aylings 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.

Except when the Tariki weir is overtopping, the bed of the Manganui River carries a residual flow of at least 400 L/s for five kilometres between the weir and the confluence with the Mangaotea Stream. The confluence with the next major tributary, the Mangamawhete Stream, is a further eight kilometres 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. 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.

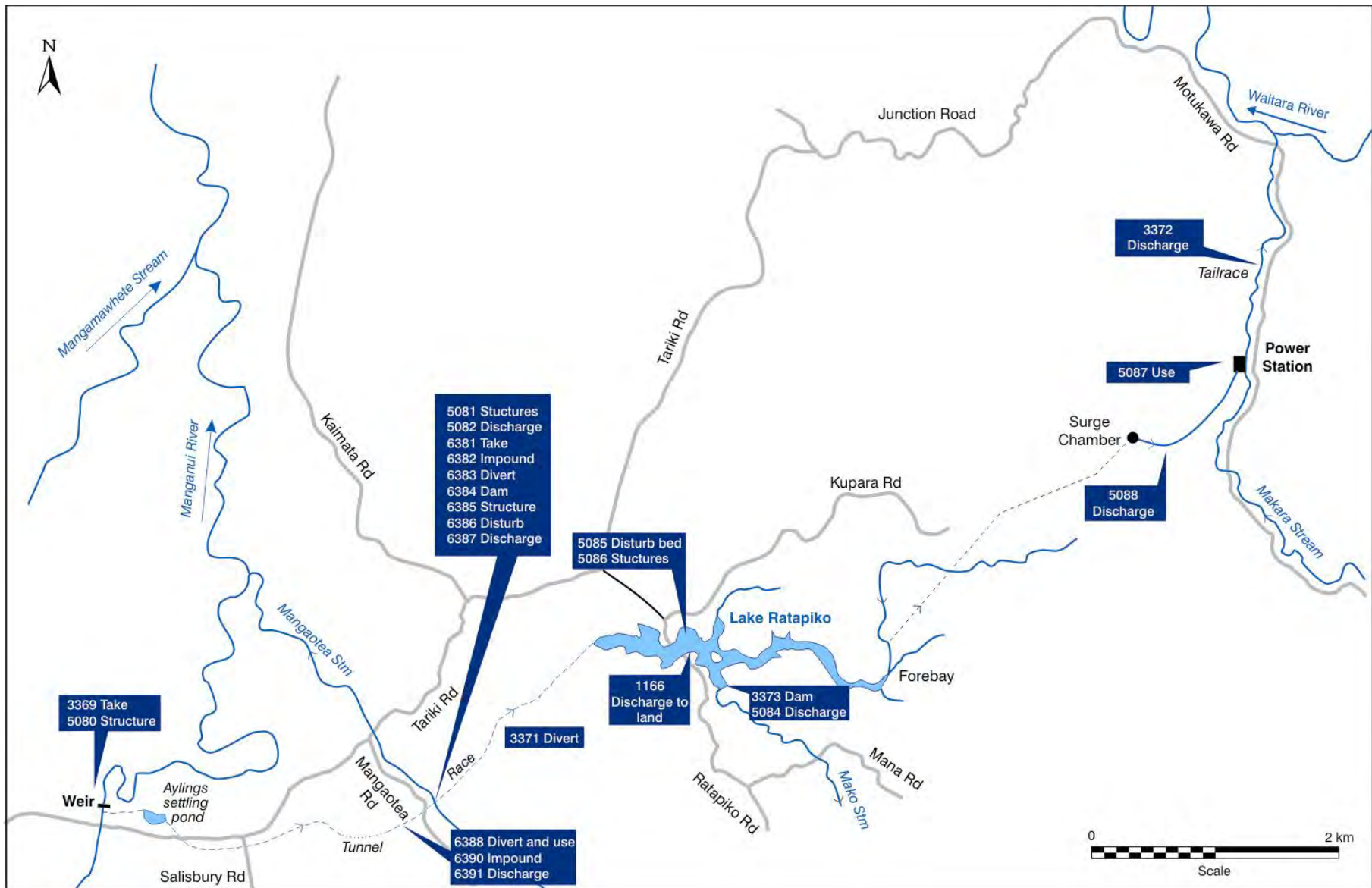


Figure 1 Main features of the Trustpower Motukawa HEP Scheme including relevant consents

1.3 Resource consents

1.3.1 Water abstraction permits

Section 14 of the *Resource Management Act* 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 5200 litres per second of water from the Manganui River in the Waitara Catchment for hydroelectric power generation. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the Resource Management Act. 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 5000 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 8000 litres per second of stormwater runoff and the entire flow of various unnamed watercourses draining into the race and into Lake Ratapiko for hydroelectric power supply purposes. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the Resource Management Act. 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.

Trustpower holds water permit **3373-2** to cover the damming of the Mako Stream to form Lake Ratapiko for hydroelectric power generation purposes, including the spillway structure. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the Resource Management Act. 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 7787 litres per second of water from Lake Ratapiko for hydroelectric power generation purposes. This permit was issued by the Council on 19 September 2001 under Section 87(d) of the Resource Management Act. 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 hydroelectric power generation purposes. This permit was issued by the Council on 27 July 2004 under Section 87(d) of the Resource Management Act. 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 hydroelectric power generation purposes. This permit was issued by the Council on 27 July 2004 under Section 87(d) of the Resource Management Act. 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.

Trustpower holds water permit **6381-1** to take and use water from the Mangaotea Stream, a tributary of the Manganui River, for hydroelectric power 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 hydroelectric power generation purposes. This permit was issued by the Council on 7 December 2005 under Section 87(d) of the Resource Management Act. 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 hydroelectric power generation purposes. This permit was issued by the Council on 7 December 2005 under Section 87(d) of the Resource Management Act. 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.

The permits are attached to this report in Appendix I.

1.3.2 Water discharge permits

Section 15(1)(a) of the RMA stipulates that no person may discharge any contaminant into water, unless the activity is expressly allowed for by a resource consent or a rule in a regional plan, or by national regulations.

Trustpower holds water discharge permit **3372-2** to cover the discharge of up to 7787 litres per second of water from the Motukawa hydroelectric power station in to the Makara Stream. This permit was issued by the Council on 19 September 2001 under Section 87(e) of the Resource Management Act. 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 2000 litres per second 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 Resource Management Act. 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 55000 litres per second 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 Resource Management Act. 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.

The last two special conditions are review provisions.

Trustpower holds water discharge permit **5088-1** to cover the discharge of up to 2000 litres per second of water, from the surge chamber of the Motukawa hydroelectric power 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.

The last two special conditions are 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 Resource Management Act. 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.

The permits are attached to this report in Appendix I.

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 4000 cubic metres/day of dredgings from maintenance of Lake Rataipiko 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.

The permit is attached to this report in Appendix I.

1.3.4 Land use permits

Sections 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 rule in a regional plan and any relevant proposed regional plan, or a resource consent.

Trustpower holds land use permit **5080-1** to cover the erection, placement, use and maintenance of the weir and various structures associated with hydroelectric power

generation activities in the Manganui River. This permit was issued by the Council on 19 September 2001 under Section 87(a) of the Resource Management Act. 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 hydroelectric power generation activities in the Mangaotea Stream. This permit was issued by the Council on 19 August 1999 under Section 87(a) of the Resource Management Act. 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 2000 litres per second 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 Ratapiko for maintenance and repairs associated with hydroelectric power 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 Ratapiko for hydroelectric power generation purposes. This permit was issued by the Council on 19 September 2001 under Section 87(a) of the Resource Management Act. 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 Ratapiko Road causeway, so as not to restrict the flow of water between the two parts of Lake Ratapiko. 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 hydroelectric power 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 are 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 hydroelectric power 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.

The permits are attached to this report in Appendix I.

1.4 Monitoring programme

1.4.1 Introduction

Section 35 of the RMA sets out an obligation for the Council to gather information, monitor, and conduct research on the exercise of resource consents, and the effects arising, within the Taranaki region.

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 seven 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 reviews;
- renewals;
- new consents;
- 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 50 times during the reported period, including twenty two hydrological inspections and twenty eight 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 (Photo 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.

Sources of data being collected by the consent holder 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) for each year in the reported period. Up to three temperature recorders were used, one being located immediately upstream of the Tariki weir (T1), a second recorder 2.3 kilometres downstream of the Tariki weir (T2), and the third recorder downstream of the confluence of the Mangaotea Stream and Manganui River (T3). This third logger was installed in the 2007-2008 period, to monitor the impact of the abstraction from the Mangaotea Stream. Monitoring at site T3 was discontinued following after the 12-13 monitoring period. The locations of the recorders are illustrated in Figure 2.

Photo 1 The new fish pass (8 September 2010)

1.4.5 Data audit

The consent holder 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.

In addition, the consent holder submitted a report in accordance with consent conditions for the abstraction of water from the Mangaotea Stream. This report is also reviewed herein.

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, biological surveys were performed on two occasions in the Manganui River to determine whether or not residual flows below the Tariki weir have had a detrimental effect upon the water quality and communities of the river. Four sites were sampled and 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.

Three fishing surveys were performed in the Manganui catchment in the discussed period. Electric fishing was undertaken at a total of nine sites in the Manganui River, five downstream of the weir and four upstream. Three sites were surveyed by electric fishing 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

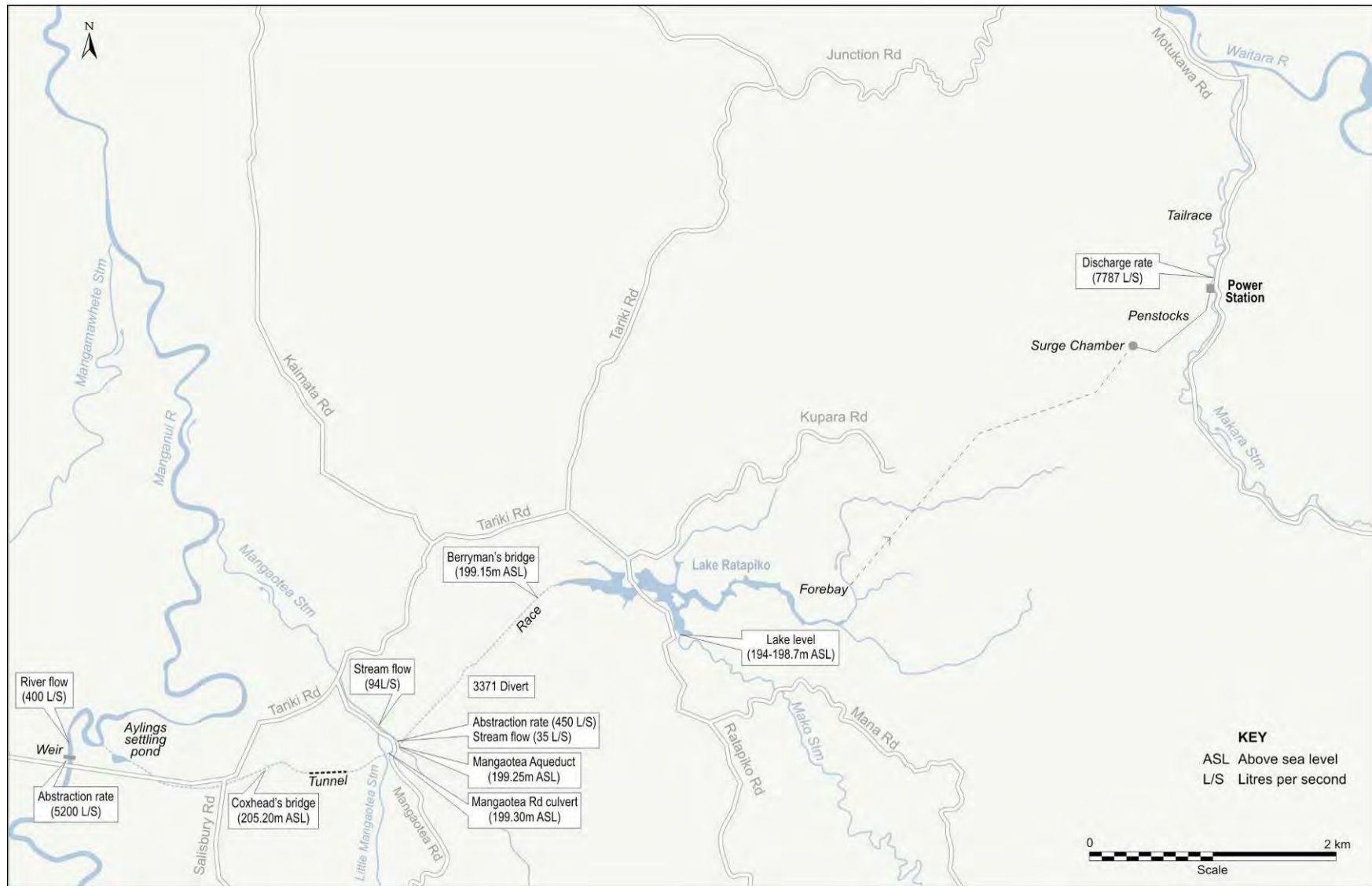


Figure 3 Location of water abstraction, discharge and water level monitoring sites for the Motukawa HEP scheme (limits in brackets)

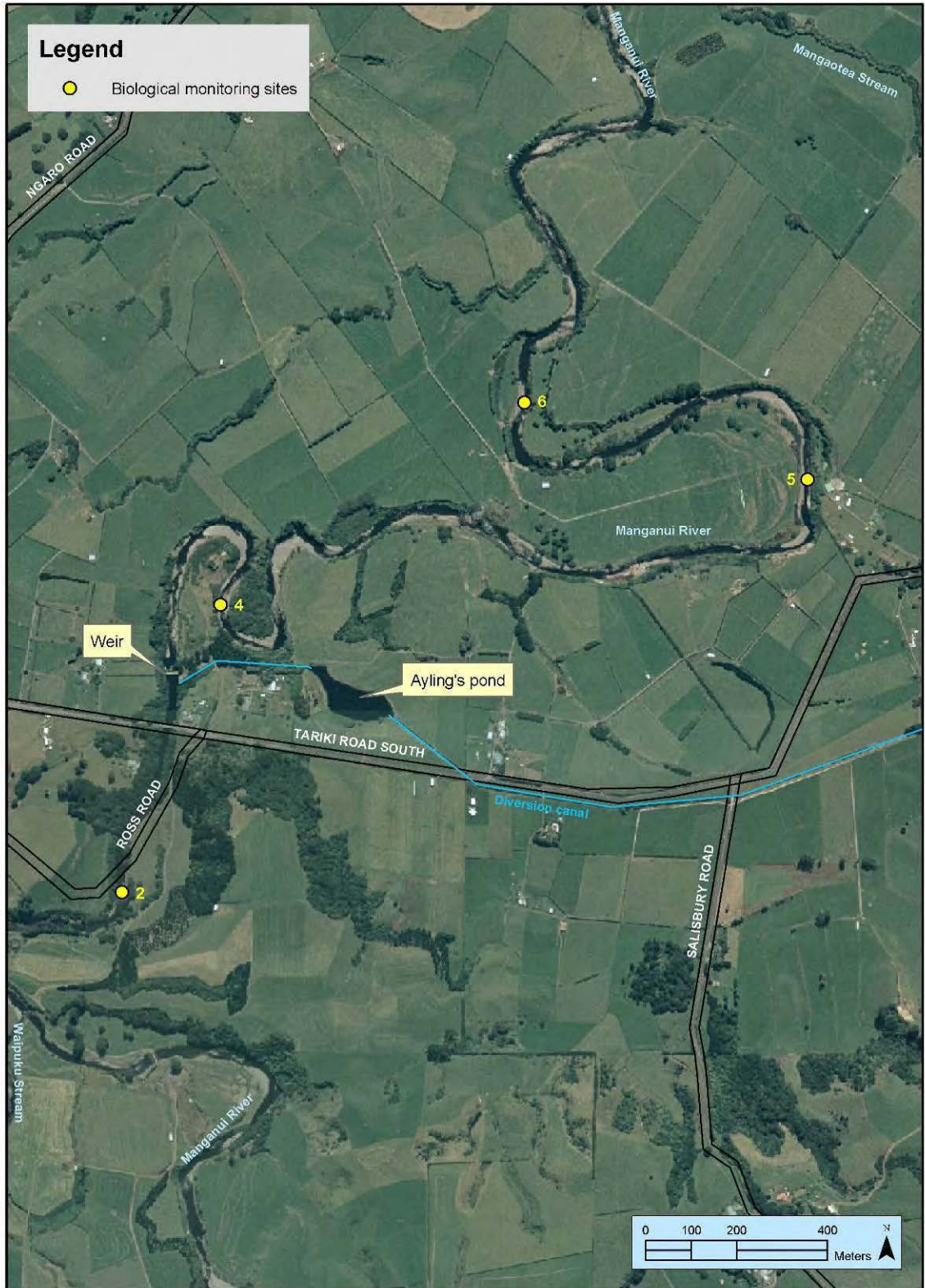


Figure 4 Macroinvertebrate monitoring sites in the Manganui River in relation to the Motukawa HEP scheme

2. Results

2.1 Water

2.1.1 Site inspections

Each inspection undertaken of the Motukawa 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 fully inspection record is available on request. Some notable observations made during the reported period are included below.



Photo 2 The top weir of the fish pass, following modifications in 2010 also evident

During all compliance monitoring inspections, the lake level was within the consented operating range (194 - 198.7 MASL), and adequate residual flow were also evident. No flooding of land adjacent to the water race was observed at any time, and the fish passage structures appeared well maintained, with no blockages noted. Trustpower did notify TRC that the fish pass was blocked with sand on one occasion (16 August 2010), and that they were

augmenting the residual flow with spill flow, until the fish pass could be cleared. Follow up maintenance was then undertaken of the fish pass, in order to reduce the potential for it to block with sand. This involved modifying the top weir of the fish pass, which has had little to no impact on the provision of fish passage (Photo 2).



Photo 3 Lake Ratapiko during the inspection of 14 March 2011, showing the low lake level

In March 2011, an inspection of the Mangaotea Stream pump station found that the pumps were operating, and that the damaged intake screen, which was first noted in the previous monitoring period, had been repaired. No issues were noted with the intake screen during this inspection.

In late summer of 2011, Trustpower had lowered the level of Lake Ratapiko in an effort to reduce the macrophyte biomass (Photo 3).



Photo 4 A heron feeding in an isolated area of standing water

At times these macrophytes can become so prolific as to hinder recreational use of the lake, which is popular for boating and water skiing. An inspection undertaken at this time noted the low lake level, and that the flow of water through the lake was scouring out lake sediment, resulting in discoloured water. There were also large areas of still water, in which white faced herons and various cormorants were observed feeding (Photo 4).

The Mako Dam was inspected on 8 December 2011, and it was noted that some vegetation had been cleared from this area. This appeared to have reduced the amount of shading for the spillway, where elvers are expected to migrate up to the elver trap (Photo 5). Concern was raised at the potential for water temperatures becoming too hot to encourage elver migration up to the elver pass. The elver pass



Photo 5 The Mako Dam spillway at Lake Ratapiko. The elver pass is the pvc pip on the left of the dam

was operating, but only providing a small trickle of flow. At the time of inspection, it was recommended to Trustpower that they investigate a means of improving passage up the spillway, for example by increasing the flow.

During this inspection, a dead elver was observed on the hard clay spillway.

Prior to the inspection of 2 May 2012, some bank maintenance of the race had been undertaken

downstream of the Mangaotea Aqueduct. At this time works were still to be completed at the race inlet, near the Manganui River, where large geotextile bags were being placed for bank stabilisation.



Photo 6 The Tariki Weir, 29 June 2012

These works at the race inlet had been completed by 29 June 2012, and some vegetation clearance had also been undertaken alongside the race. A large log had become lodged on the weir, which gave a good indication of the flood magnitude that this river can experience (Photo 6). At the Mangaotea Pumps, some valuable observations were made, in relation to the potential for fish impingement. Although the pumps were operating at a high rate, leaves that were floating downstream were

becoming impinged for only one or two seconds, after which they were freed and continued floating downstream. This would indicate that an actively swimming fish could avoid impingement.

Following notification that the race water level had exceeded the maximum consented level at the Berrymans recorder, an inspection was undertaken on 23 August 2012. It is important to note that the water level remained within the 5% allowable error, and as such was not deemed non-compliant. This inspection did not find any evidence of flooding in association with the high race level. The in-race generator was inspected on 27 June 2013, and it was found not to be operating. It was later established that this was due to mechanical failure, and this caused the generator to be out of operation for quite some time.



Photo 7 Race maintenance undertaken downstream of Mangaotea Road

During the elver migration season the elver trap is inspected from time to time. Such an inspection was undertaken on 24 February 2014, when elvers and galaxiids were observed swimming in the power station outlet. Unfortunately the valve to the elver trap had not been turned on after the trap was last emptied. This was resolved at the time of inspection. Of note was the presence of a large eel that appeared to be feeding around the trap inlet.

Further bank maintenance had occurred prior to the inspection of 8 May 2014, with large concrete blocks placed upstream and downstream of the Mangaotea Aqueduct (Photo 7), with some stabilisation works also undertaken on the banks of the Mangaotea Stream, in relation to the intake structure. A very high abstraction rate was noted at the Mangaotea Pumps (Photo 8).



The final inspection of the reported period, completed on 24 June 2014, found the Manganui River in moderate flow, and although there was no spill flow, the residual flow provided by the two fish passes appeared compliant. There was a moderate rate of take into the race, and the in-race generator was not operating. The Mangaotea Pumps were operating, with a moderate rate of take. The intake screen was clear, indicating that the screen cleaning brush is effective (Photo 9). The level of Lake Ratapiko was normal, and some vegetation clearance having been undertaken between the dam and spillway.

Photo 8 A high pumping rate at the Mangaotea Pumps, observed on 29 June 2012



Photo 9 The Mangaotea Pumps intake and screen cleaning brush

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 litres/second 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 to the required amount of 400 l/sec.

Table 1 shows that seventeen 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. At no stage was the gauged flow less than 400 litres per second, with the average gauged residual flow being just over 474 litres per second.

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

Date	New fish pass flow (l/s)	Old fish pass flow (l/s)	Total residual flow (l/s)	Compliant?
12/08/2010	386	154	540	Yes
15/10/2010	322	133	455	Yes
19/11/2010	325	154	479	Yes
10/01/2011	318	128	446	Yes
16/06/2011	351	175	526	Yes
22/07/2011	367	140	507	Yes
28/09/2011	340	147	487	Yes
16/11/2011	366	136	502	Yes
17/01/2012	311	128	439	Yes
10/04/2012	312	142	454	Yes
02/08/2012	310	132	442	Yes
06/11/2012	316	123	439	Yes
27/03/2013	318	159	477	Yes
19/09/2013	292	140	432	Yes
05/11/2013	328	129	457	Yes
29/01/2014	332	140	472	Yes
27/05/2014	360	145	505	Yes

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 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.

This report has been provided and is discussed in more detail in section 0 below. No review was undertaken, and therefore the residual flows in the Mangaotea Stream are as follows:

- 35 l/sec immediately downstream of the abstraction point
- 94 l/sec immediately downstream of the confluence with the Little Mangaotea Stream.

Table 2 Gauging results for gaugings undertaken in relation to the Manganui River residual flow

Abstraction Occurring?	Downstream of intake	Downstream of confluence	Compliant?
N	167	203	Yes
Y	112	176	Yes
Y	73	137	Yes
Y	244	218*	Yes
Y	158	-	Yes
Y	138	206	Yes
N	36	52	Yes
Y	168	240	Yes
Y	150	278	Yes
Y	152	257	Yes

*The flow upstream is higher than that recorded downstream as there was an increase in abstraction rate during the inspection, and the downstream gauging was undertaken second.

Eight inspections were undertaken while the pumps were operating, and on each occasion, all gaugings indicated compliance with the residual flow requirements (Table 2). Gaugings were undertaken when no abstraction was occurring on two occasions, to provide detail on natural flows within the catchment.

An extra hydrological gauging was undertaken on 12 April 2011, in the race at the Mangaotea Aqueduct. At this time the flow in the race was measured to be 1718 l/sec, well within the maximum abstraction rate of 5200 l/sec, as set by consent 3369-2.

2.1.3 Data audit

Trustpower holds several consents which, through various special conditions, require the Company 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.

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

	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 5200 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 5000 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 Rataipiko	2	Maximum race water levels	Race water level: Coxhead's bridge: 205.20 m a.s.l Mangaotea Rd culvert: 199.30 m a.s.l Mangaotea Aqueduct: 199.25 m a.s.l Berryman's bridge: 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 7787 l/sec)
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.

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. In the 2010-14 monitoring period, there were six separate occasions on which notable loss of data occurred. These occasions were explained by Trustpower when the data was provided, and were related primarily to equipment failure. The consent holder immediately took steps to identify and remedy this equipment failure when they became aware of it. These occasions of lost data were not deemed to be incidents of non-compliance. Over the last eight years, the Company has made significant efforts

to improve this scheme's equipment and systems used for measuring and recording the required data.

This improvement in management is also evident in the management of flows and levels within consent limits. Table 4 provides a summary of the number of recorded instances where flows were outside of their respective limits set by special conditions of the relevant resource consent(s). Only those incidents of one hour or longer are included, as such incidents of a shorter timeframe are unlikely to cause any notable effects. It should also be noted that Table 4 does not include any instance where flows or levels were outside of but within 5% of a limit. This is because the data recorded is allowed a 5% margin of error, to provide for the error associated with the recording equipment. However, this is not to say that all such incidents will be treated as such. Should flows frequently exceed the limits, but stay within the 5% margin of error, Trustpower may still need to determine the cause and undertake remedial action.

On two occasions, the race water level dropped below the low flow limit of 150 l/sec. The first instance lasted for a total of 3.75 hours, and flows dropped as low as 134 l/sec. This was not considered a significant breach, as it was for a short time period, and flows did not recede significantly. In addition, the Company's explanation, that it was a transducer error (i.e. equipment failure), also indicated that this was not a serious incident. The second instance involved a number of breaches over a number of days. In late February 2014, Taranaki was experiencing a long period of dry weather. As a result, consent conditions required the release of flushing flows down the Manganui River. However, there was insufficient flow in the Manganui River to provide both the flushing flow and the minimum race flow. The consent holder contacted Council, and was advised that the river took precedence, and as such they could breach the race minimum flow if necessary. Over this time period of thirteen days, flows were below 150 l/sec for a total of 1.5 hours, and dropped as low as 38 l/sec. When flushing flows stopped on each day, the race flow quickly recovered (Figure 5).

There was one instance where the level of Lake Ratapiko exceeded the maximum level of 198.7 metres above sea level. This was due to a significant weather event, and Trustpower undertook all practical steps to minimise this breach, including generating at maximum capacity, and closing the intake gates at the Manganui River to reduce inflows (Figure 6). However, due to runoff into the race and lake, the lake level continued to rise, resulting in a breach of the maximum lake level. This was not dealt with as a non-compliance incident, as it was principally due to the severe weather event.

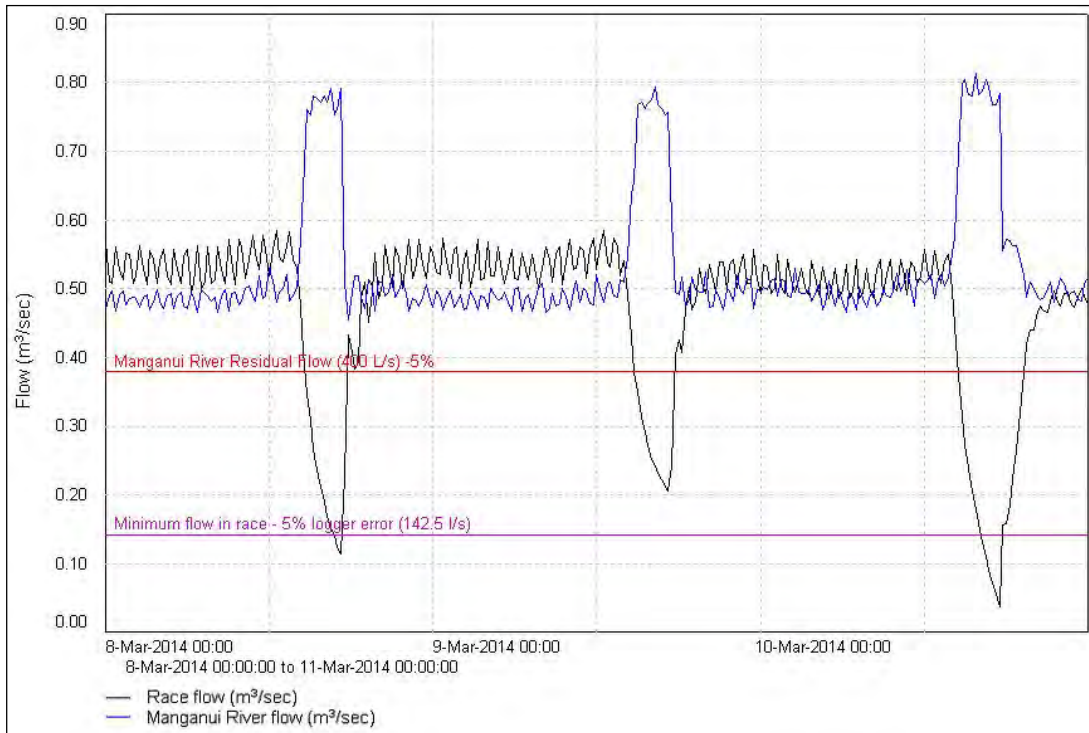


Figure 5 Flow in the Motukawa race and Manganui River from 8 March 2014 to 11 March 2014.

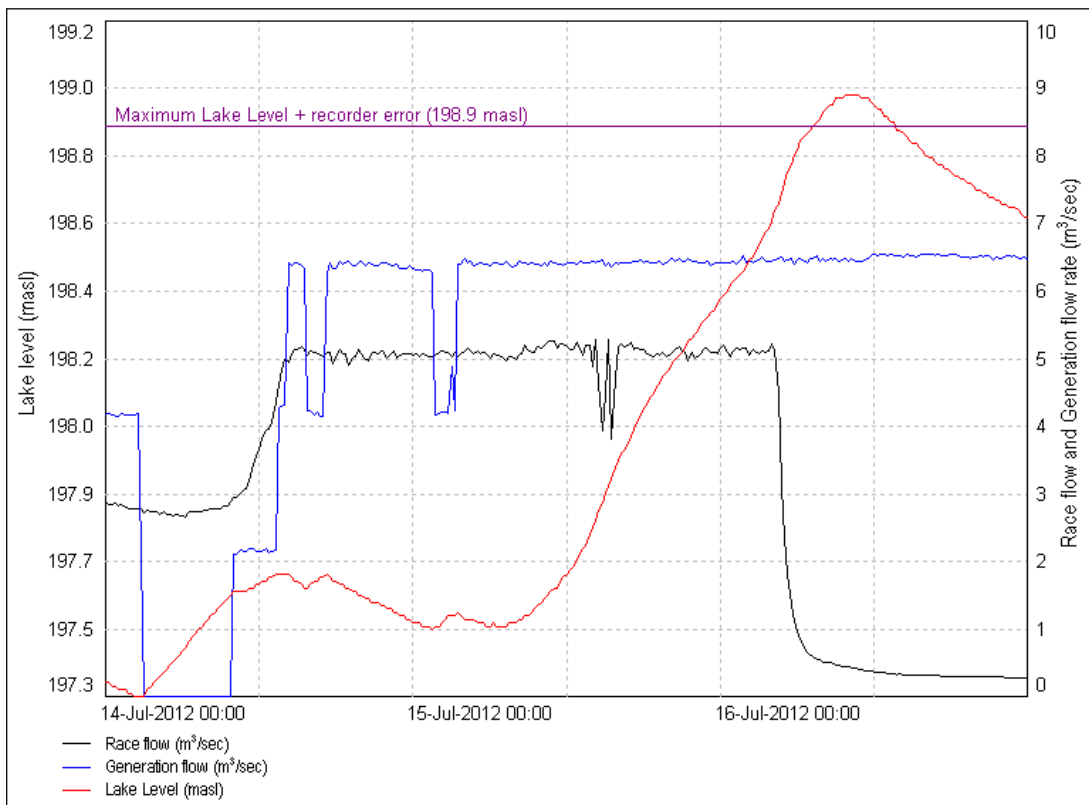


Figure 6 Lake levels, race flow and generation flow from 14 July 2012 to 18 July 2012.

The data provided by Trustpower shows that with regards to the residual flow in the Manganui River, that there were three instances where flow dropped below the limit by more than 5%, for over one hour. The most significant of these in terms of duration was from 10 to 13 January 2014, over which the flow was below 380 l/sec

for a total of 1.39 days. This incident was as a result of human error, and resulted in Trustpower receiving an infringement notice.

The second instance resulted in flows being recorded as being below 380 l/sec for a total of 24 hours between 26 and 30 April and 2 May 2014. During this period flows apparently dropped as low as 256 l/sec. This was related to water level monitoring equipment coming loose and recording incorrect data. Although the record indicates that flow dropped below 400 l/sec, it is unlikely that this was the case, as confirmed by site inspections made by Trustpower at the time. The last occurrence was of only 4.75 hours in duration, on 2 May 2014. Flows as recorded dropped as low as 333 l/sec over this time.

During the reported period, water levels in the race did not exceed any of the levels set by the consents, and the abstraction rate from the Mangaotea pumps never exceeded the maximum allowable rate of take. In addition, records indicate no breach of the Mangaotea Stream residual flows.

Records of the discharge to the Makara Stream show that there were no occasions during the 2010-2014 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 a strong improvement in this area of compliance.

There are certain operational requirements also set by consents, which require flushing flows of 400 litres/second 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 5000 litres/sec that either the abstracted water is passed continuously through the lake, or that abstraction cease (with regard to the 150 l/sec residual flow in the race).

At no stage in the discussed 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 5000 l/sec. In February and March 2013, the recorded flow in the Waitara River dropped below 5000 l/sec, but a gauging found that the rating curve at such low flows was inaccurate, and there was more water than recorded. However, in March and April 2014 flows did drop below 5000 l/sec, but in this instance Trustpower were not informed. The consent indicates that Council needed to inform Trustpower of the low flow, and only then are they required to comply with the special condition. Therefore no consent non-compliance occurred in relation to these low flow events in the Waitara River. It should be noted that at this time Trustpower ceased discharging into the Makara Stream (i.e. they were not generating electricity), and only diverted enough water into the Motukawa Race to supply the required minimum flow. This means that they effectively complied with this requirement.

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 (duration in hours)													Detail	Deemed Compliant?
	Manganui Abstraction		Coxheads	Mangaotea Rd Culvert	Mangaotea Aqueduct	Berrymans	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/sec	5200 l/sec	205.2 masl	199.3 masl	199.25 masl	199.15 masl	7787 l/sec	194.0 masl	198.7 masl	400 litres/sec	35 l/sec	94 l/sec	450 l/sec		
24/01/2012	134l/s (3.75hrs)	100% Compliant	100% Compliant	100% Compliant	100% Compliant	100% Compliant	100% Compliant	100% Compliant			100% Compliant	100% Compliant	100% Compliant	Transducer error	Compliant
16/07/2012									198.990m (6hrs)					Due to a significant weather event	Compliant
10/01/14 to 13/01/14									362l/s (total of 1.39 days)					Human error	Non- compliant
27/02/14 – 11/03/14	38l/s (1.5hrs)								Flow reduced in order to provide daily flushing flows in Manganui River	Compliant					
26/04/14 to 30/04/14									256l/s (total of 24hrs)					Recorder error	Complaint
02/05/2014									333l/s (total of 4.75hrs)					Recorder error	Complaint

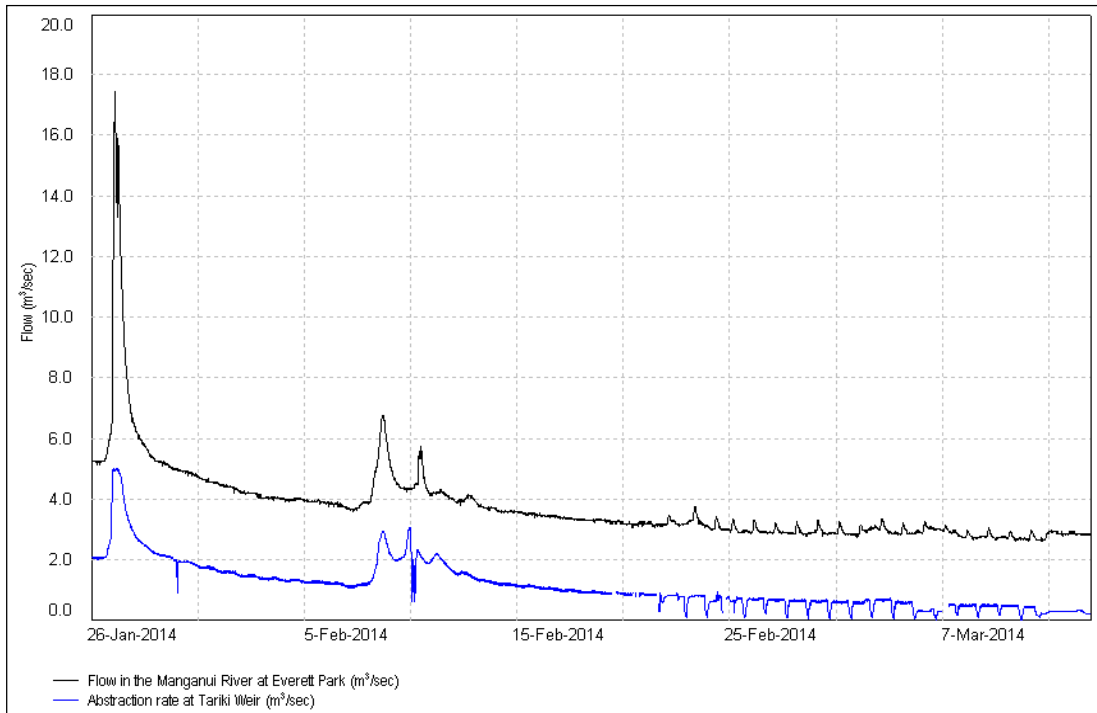


Figure 7 Flow in the Manganui River at Everett Park and abstraction rate at the Tariki Weir, late summer 2014

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 four periods when flushing flows were required, and on each occasion, these flushing flows were provided. One of these occasions is displayed in Figure 7, showing the impact of these flushing flows on the flow in the Manganui River at Everett Park.

The abstraction from the Mangaotea Stream is also required to provide flushing flows, although the criteria that defines when differs slightly 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 section 2.1.3.1), determined that a flushing flow as per this definition was 366 l/sec. In analysing the data, there have been numerous occasions where these flushing flows were required but not provided, although they were provided on the odd occasion. An example of when a flushing flow should have been provided but wasn't, is shown in Figure 8. This shows that after a flushing flow on 17 November 2012, the abstraction partially absorbed flood flows on 6, 24 and 30 December, preventing the stream from 'flushing', with lesser freshes almost completely absorbed on 3, 11 and 14 January. Had the abstraction stopped for eight hours during the flood on 15 January, it would have resulted in a flood peak of approximately 822 l/sec, which would have provided a better 'flush'. Instead, abstraction increased, reducing the flood peak, and breaching consent 6381-1.

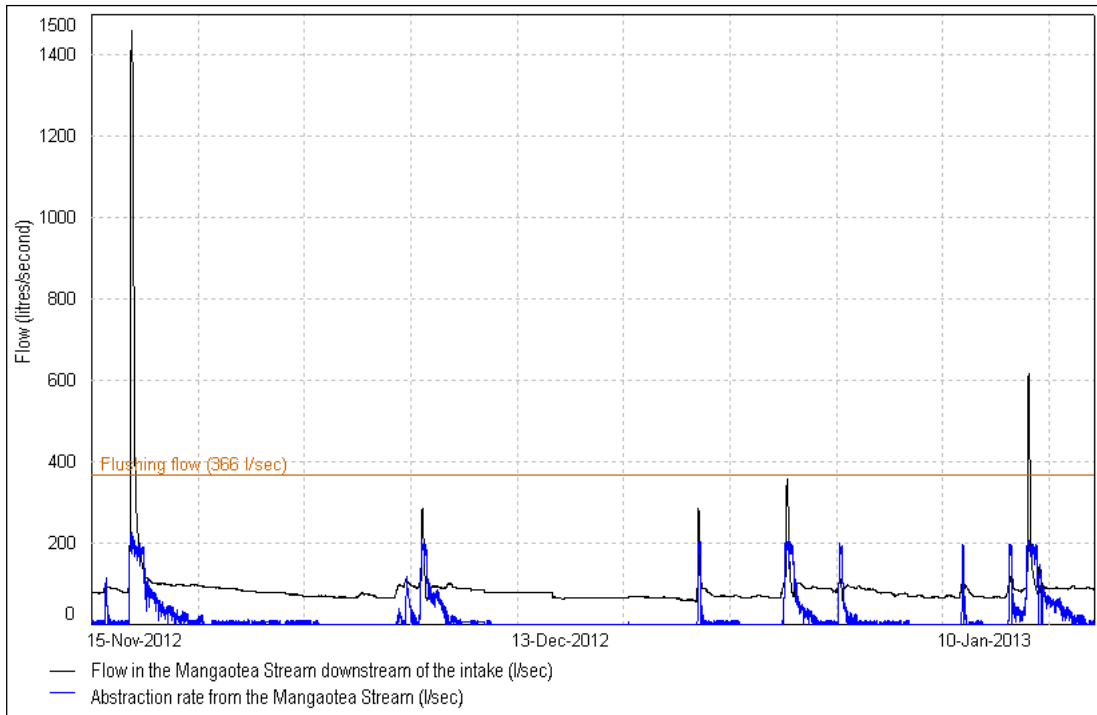


Figure 8 Flow in the Mangaotea Stream and abstraction rate between 15 November 2012 and 20 January 2013

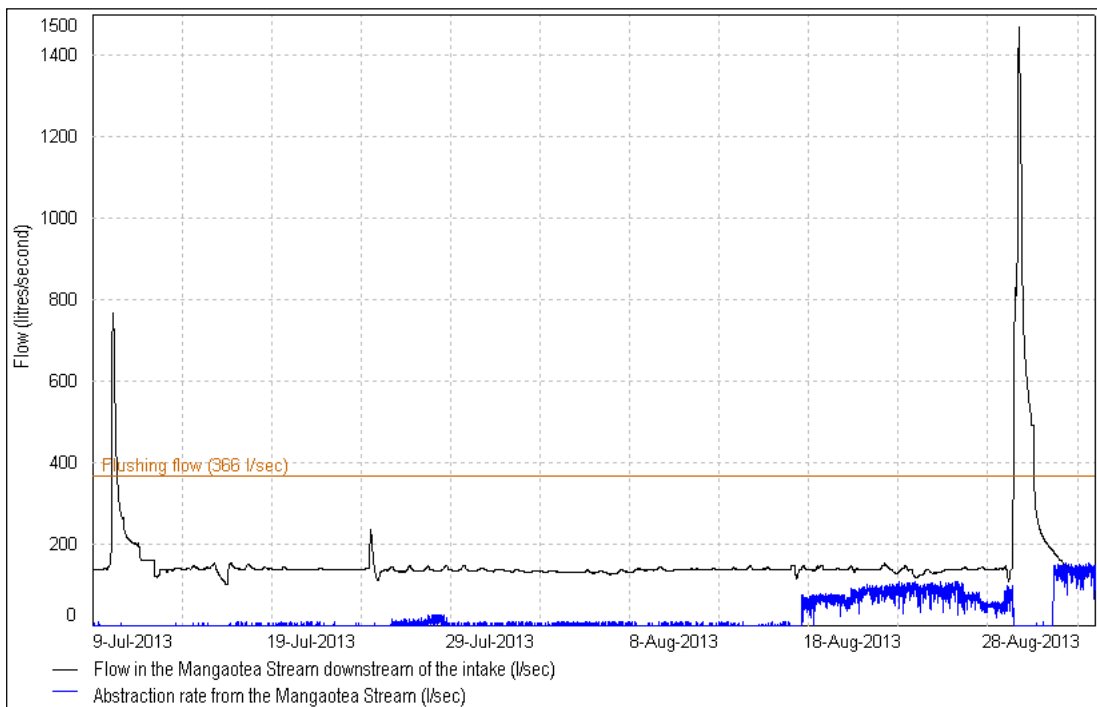


Figure 9 Flow in the Mangaotea Stream and abstraction rate between 15 November 2012 and 20 January 2013

Figure 9 presents flow data for an occasion where the flushing flow was provided as required. It is clear that abstraction ceased as required when a flushing flow occurred on 29 August 2013.

It appears that the cause of the non-compliance is some confusion over the consent condition, and as a result flushing flows were only provided on some of

the occasions that met the criteria. However, following discussions between Council and Trustpower regarding this condition, the intent of the consent condition was clarified. As a result, Trustpower have changed the automated system which controls the abstraction, to ensure that in future, the flushing flows are provided as intended. This was not registered as an unauthorised incident, and did not any warrant enforcement action. This was primarily because the condition does not stipulate what location is to experience the flushing flow in order to 'reset the clock'. It was conceivable that the condition could be interpreted as meaning the Mangaotea Stream upstream of the abstraction, in which case they would most likely have been compliant. However, Council considers that the intent of the condition is to provide flushing flows downstream of the abstraction point. Considering the ambiguity of the consent condition, it was decided to work with Trustpower, to establish what this condition meant, rather than carry out formal enforcement action.

Figure 10 shows how the fish pass flow responds to floods. Flows are reduced to protect the fish pass from damage, and remains so for most of the duration of the flood. Previously the pass has been completely closed, which created some issues, where elevated flows can remain for a number of days, as it meant the fish pass would stay closed for that time. More recently, the pass has been kept slightly open during floods, to continue providing attractant flow and potentially passage.

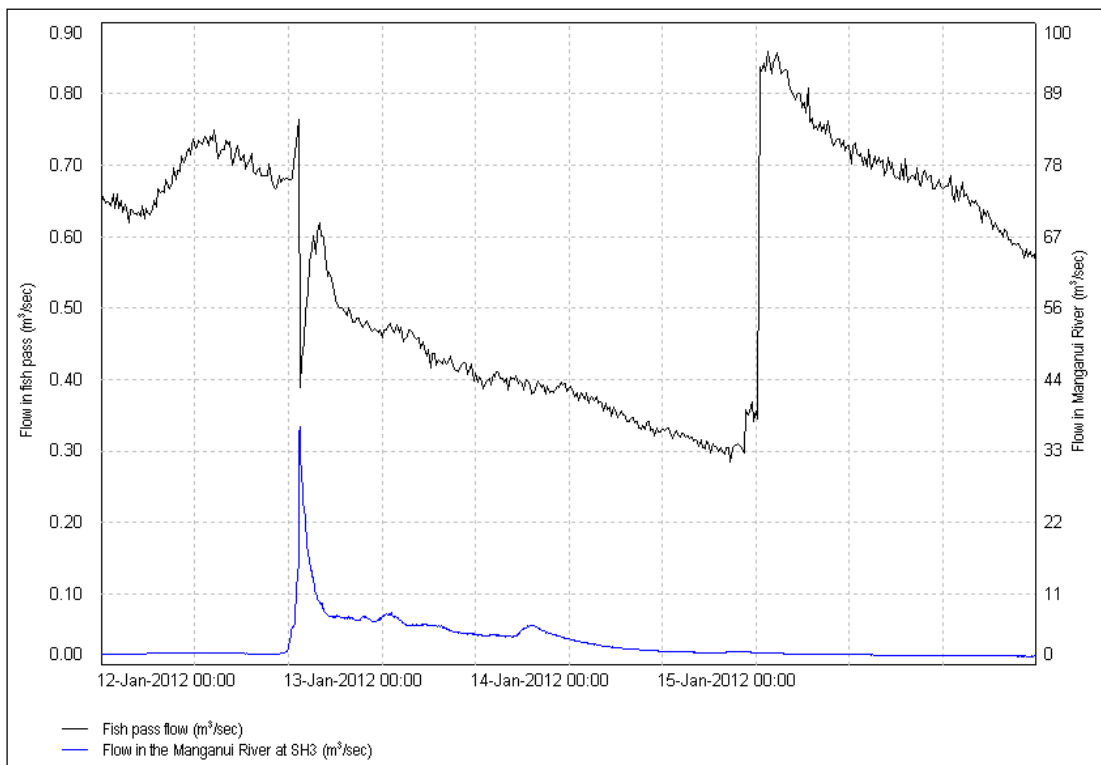


Figure 10 Combined fish pass flows and flow records for the Manganui River at SH3

2.1.3.1 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 8000 litres/second, 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 was completed on 28 October 2011, and identified two areas that required remedial work. Inspections confirmed that these remedial works have been completed.

Special condition 8 of consent 6381-1 requires that:

“In the first two years following the exercise of this consent, a monitoring programme designed in consultation with submitters and the 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 Council and submitters within 6 weeks.”

Council received a number of reports in 2012, and determined that together, they met the requirements of this condition. These reports concluded that:

- The effect the abstraction has on the Mangaotea Stream flow regime is minor.
 - The abstraction has its greatest effect towards the middle of the flow range (around mean flow).
 - The effect at low and high flows is negligible.
- There is no evidence to support submitter concerns that Mangaotea water is contributing to heating of the Manganui River. Rather the Mangaotea stream water is generally cooler than that recorded by TRC in the Manganui.
- There is no evidence that the current abstraction regime governed by Special Condition 4 of the Resource Consent conditions is having a more than minor effect on dissolved oxygen and temperature, and hence on fish that inhabit Mangaotea stream. 6.
- The current flow regime/residual flow condition appears adequate to protect the fishery values of the Mangaotea stream.
- Based on analysis of data for the 2011/12 summer, changes to the abstraction regime on the Mangaotea Stream will have a small effect (less than 0.5oC) on the temperature of water in the Manganui River. This reflects that the average flow in the Mangaotea Stream is only about 7% of the flow in the Manganui River.

2.1.4 Results of receiving environment monitoring

2.1.4.1 Water temperature monitoring

Data loggers were used for continuous monitoring of river water temperatures at three sites (Figure 2). One logger was located immediately upstream of the weir at Tariki Road. The second logger was located 2.3 kilometres downstream of the weir while the third logger was located downstream of the confluence of the Mangaotea Stream and Manganui River. The third site has only been in use since the 2007-2008 monitoring period, and was discontinued after the 2012-13 period, while the remaining two have been in use since 1992. 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 twelve years (July 2002 to June 2014) since the residual flow increase. Data for the present reporting period (10-14) will be discussed together, rather than discussing each monitoring year separately.

During the 2010-14 period, the highest monthly mean water temperature upstream of the weir was recorded in February, and this was also the case for the two downstream sites (Table 5). The lowest monthly means were recorded in April at all sites. When comparing the sites, the downstream sites both had a higher mean monthly water temperature in all months monitored than that recorded upstream (0.5 to 1.4 °C higher). Interestingly, the most downstream site had a consistently cooler mean monthly temperature than site T2, except for in March, when temperatures were cooling.

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/sec)		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
	2002-2010 (post 400 l/sec)		8.4-22.3	14.6	9.7-23.0	16.1	10.7-25.4	18.0	12.1-25.6	18.2	9.6-22.3	15.9	6.7-18.2	12.7
	Reported period	10-14	10.0-23.5	15.6	11.7-23.1	16.8	12.8-23.6	17.1	11.3-23.7	18.1	11.4-20.8	15.6	8.3-17.8	13.3
2.3 Km Downstream (T2)	1992-2002 (pre 400 l/sec)		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
	2002-2010 (post 400 l/sec)		8.6-24.1	15.5	10.6-25.4	17.4	10.5-28.2	19.5	12.6-27.8	19.1	10.3-24.1	16.9	7.8-19.0	13.5
	Reported period	10-14	11.4-25.9	16.8	11.7-25.4	17.9	13.0-25.8	18.5	11.8-26.1	19.1	11.4-22.6	16.3	8.5-19.0	13.8
D/S Mangaotea Str (T3)	Previous data	07-10	11.9-21.2	16.1	11.8-21.8	17.2	13.9-25.6	19.3	15.0-24.4	19.5	12.2-20.2	16.7	9.7-16.6	13.2
	Reported period	10-12	12.0-23.2	16.4	11.9-23.4	17.9	13.2-23.6	18.5	12.1-24.2	19.0	11.6-21.0	16.5	8.8-18.3	13.8

* These periods are missing data, preventing a complete assessment for these periods.

Maximum temperatures both upstream and downstream of the abstraction occurred in February 2013 for all sites. The maximum upstream temperature for the entire reporting period was 23.7 °C, within the range for this site. This temperature was recorded on 3 February 2013, and was 1.9°C cooler than the maximum recorded on 7 February 2005. On the same day, site T2 recorded a maximum temperature of 26.1 °C, while site T3 recorded 24.2 °C. These were also

the highest temperatures recorded at these sites in the reported period. Of note, is that for the reported period, the upstream site recorded annual maximum temperatures less than the high temperatures recorded in 2008 and 2009 (Figure 11).

However, they were higher than 23 °C, which has been the trend over the last ten years. Whether this is a reflection of climate change, or a change in upstream land use is unclear, although it does indicate that water temperature monitoring is a worthwhile component of the monitoring.

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 11). However, in February 2005 and January 2008, the maximum daily temperature at the upstream site exceeded 25°C, on a total of three days. Because conditions were generally cooler during the currently reported period, the upstream site never exceeded 25 °C (Table 6), and the first downstream site (site T2) only exceeded 25°C on twelve days in the reported period (10-14), although this was restricted to the 2010-11 and 2012-13 periods, with the 2011-12 and 2013-14 periods not recording temperatures in excess of 25 degrees at this site. Water temperatures at site T3, below the confluence with the Mangaotea Stream, did not exceed 25°C in the reported period (Table 6).

The 2010-11 and 2012-13 periods experienced an unusually warm spring. November 2010 and December 2012 recorded new daily maximum temperatures at all three sites, and resulted in the daily maximum water temperature at site T2 exceeding 25°C twice in November 2010 and December 2012. The 2010-11 data is presented in Figure 12. The November and December mean water temperatures for all sites over the reported period were higher than any annual mean temperature recorded for those months previously (Table 5). This may indicate that spring water temperatures may be warming.

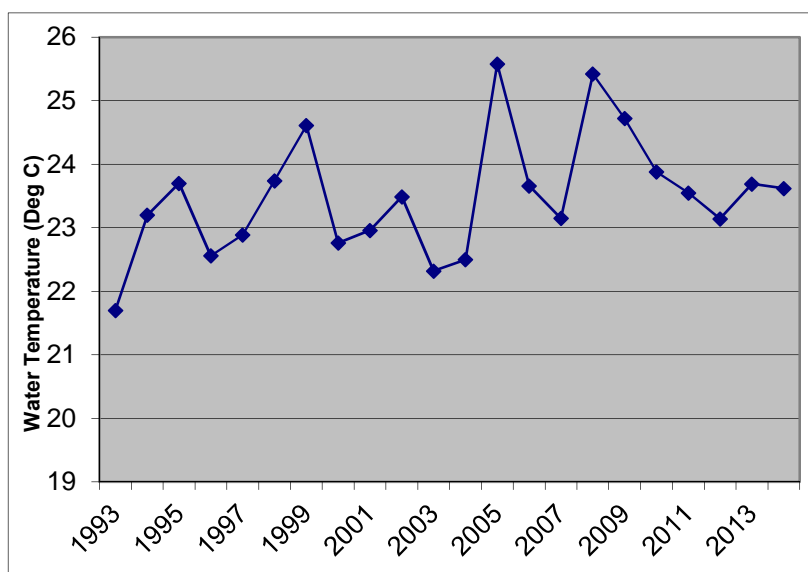


Figure 11 Annual maximum water temperatures recorded upstream of the abstraction (Site T1)

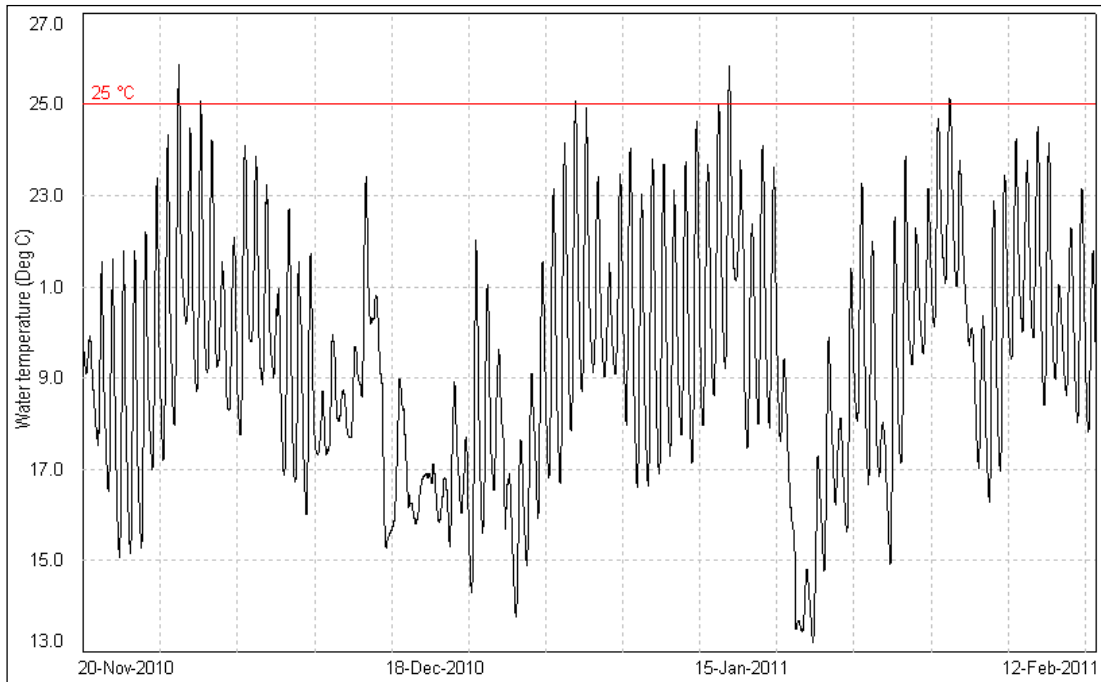


Figure 12 Water temperatures in the Manganui River, 2.3 km downstream of the Tariki Weir. 20 November 2010 – 12 February 2011

The most extreme time period for water temperatures in the residual flow reach during the reported period came during the 2012-2013 period, during the months of January to February 2013. The average daily water temperature in January was 19.6°C at site T2, similar to the long term average (Table 5). Five days recorded a maximum water temperature in excess of 25°C, while this temperature was not exceeded upstream of the weir. This occurred during the period of 28 January to 3 February; when over half of the days experienced a maximum temperature in excess of 25°C (Figure 12). Temperature extremes of this nature have the potential to cause fish kills, although none were reported to Council during this period. Although this period was not as warm as the worst period, reported in the 2006-2008 period (TRC, 2009), it is still 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, and reflects that there were two warm periods (2010-11 & 2012-13) and two cool periods (2011-12 & 2013-14), with the primary difference being the proportion of days that experienced a maximum daily temperature between 20 and 25°C.

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 2010-2014 reporting period, the percentage of time water temperatures exceeded 20°C downstream of the weir (site T2) was more than double that recorded in the natural flow regime upstream of the weir (Table 7). This is similar to the percentage exceedances recorded since the 400 L/s residual flow was implemented. Comparing the percentage exceedance times for all data pre 400 L/s residual flow, with all data post 400 L/s residual flow, indicates that temperatures greater than 20 °C have still occurred more downstream, but are marginally less frequent than occurred prior to the 400 L/s being released down

the river (16% 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 6 Summary of maximum daily water temperatures in the Manganui River, upstream and downstream of the weir, between 1 January and 31 March, 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/sec residual flow)	855	5.3	63.4	31.3	0.0
	2002-2010 (post 400 l/sec residual flow)	716	4.5	62.4	32.7	0.4
	2010-2011	90	2.2 (2)	52.2 (47)	45.6 (41)	0.0 (0)
	2011-2012	91	8.8 (8)	82.4 (75)	8.8 (8)	0.0 (0)
	2012-2013	90	0.0 (0)	57.8 (52)	42.2 (38)	0.0 (0)
	2013-2014	90	1.1 (1)	80.0 (72)	18.9 (17)	0.0 (0)
Downstream	1992- 2002 (pre 400 l/sec residual flow)	895	1.8	43.1	52.1	3.0
	2002-2010 (post 400 l/sec residual flow)	720	2.2	40.6	51.3	6.0
	2010-2011	90	1.1 (1)	36.7 (33)	58.9 (53)	3.3 (3)
	2011-2012	91	3.3 (3)	76.9 (70)	19.8 (18)	0.0 (0)
	2012-2013	90	0.0 (0)	24.4 (22)	70.0 (63)	5.6 (5)
	2013-2014	90	1.1 (1)	56.7 (51)	42.2 (38)	0.0 (0)

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 (eight 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 litre/sec residual flow.

Table 7 Exceedance time (%) for Manganui River water temperatures recorded in the period prior to (1992-2002) and post residual flow increase (2002-2008) 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
Upstream	1992-2002	100	100	99	99	93	73	47	21	6	<1	<1	0
	2002-2010	100	100	99	98	90	71	46	23	8	2	<1	0
	2010-2014	100	100	100	99	92	73	46	21	7	1	0	0
2.3Km Downstream	1992-2002	100	100	100	99	97	84	64	40	18	5	<1	<1
	2002-2010	100	100	100	99	93	79	57	35	16	6	1	<1
	2010-2014	100	100	100	99	94	80	58	33	15	5	1	<1
Downstream Mangaotea Stream	2007-2010	100	100	100	99	91	79	60	37	13	3	<1	0
	2010-2014	100	100	100	99	96	83	60	36	13	2	<1	0

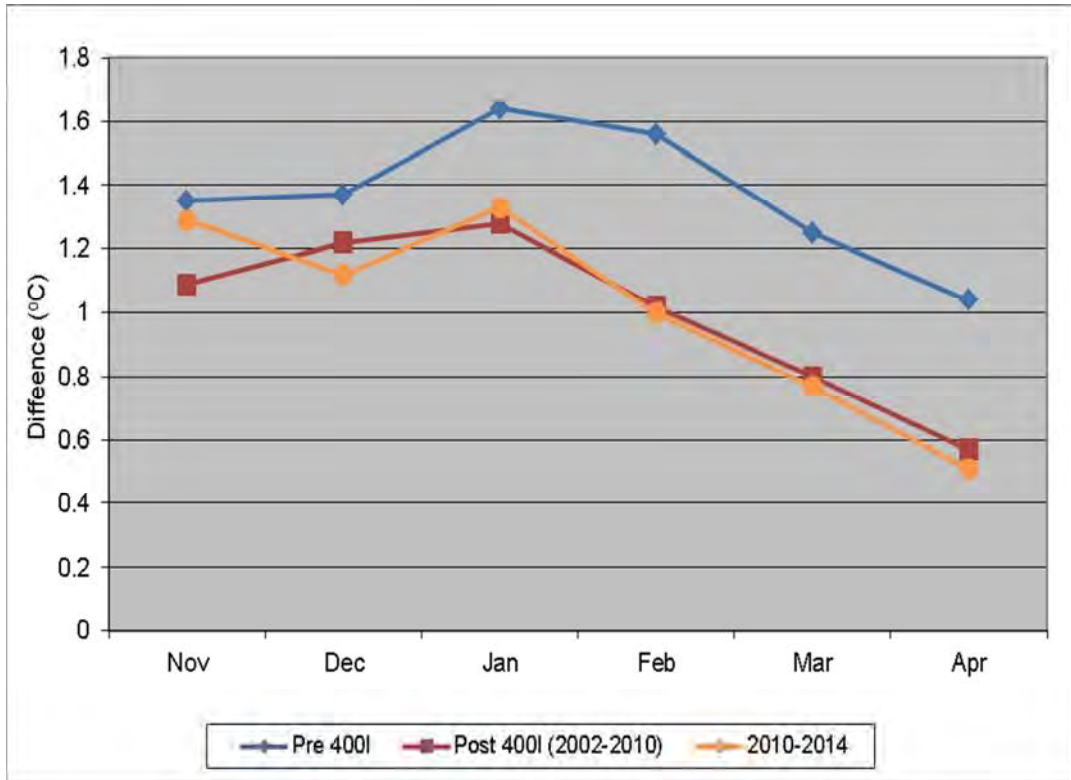


Figure 13 The average difference in mean monthly water temperatures between upstream and downstream, pre and post 400 litre per second residual flow implementation, and during the reported period

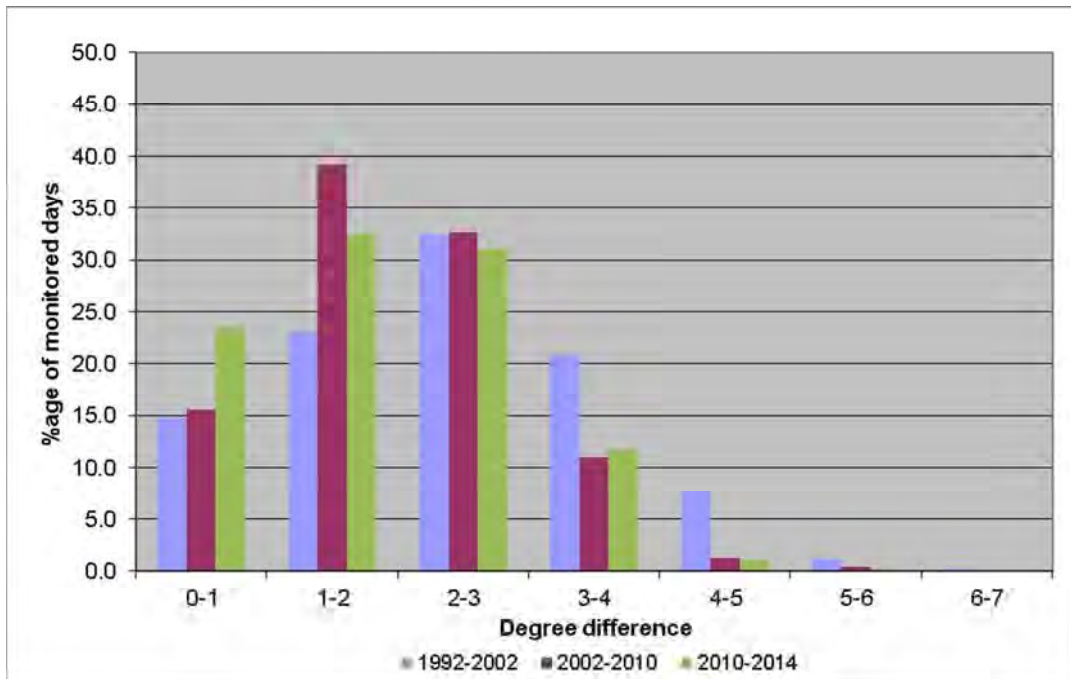


Figure 14 The distribution of maximum daily temperature differences (downstream minus upstream), displayed as a percentage of total days monitored. Data has been split into pre-400L/sec residual flow (1992-2002) and post 400 L/sec residual flow (2002-2010)

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 13, Figure 14). Figure 13 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 13 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 13 is data for the reported period. This shows that the average daily difference in November for the reported period was higher than typical, and this is related to the 2010-2011 and 2012-2013 periods experiencing a very dry spring. The remaining months had average daily differences similar to that previously recorded since the residual flow was increased to 400 l/s.

Prior to the 400 L/s, the most frequent maximum temperature difference was between two and three degrees, with almost 30% of the days experiencing a maximum difference of more than three degrees. In the eight years following the increased residual flow, the most frequent maximum daily temperature difference has reduced to 1-2 degrees, with the number of days experiencing a maximum daily difference of more than three degrees dropping to 17.1%, less than half that recorded prior to the 400 L/sec. When data from the reported period is compared with this historical summary (Figure 14), it can be seen that temperature differences reduced further. The proportion of time that maximum daily temperature differences were between 0-1 degrees increased from 15.5% in the 2002-2010 period to 23.5% over the reported period. However, the proportion of time that the maximum daily temperature difference exceeded two degrees was relatively similar to the post 400l/s data.

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 15, for a flood event that occurred in March 2013. As in previous years, this figure illustrates that the greatest differences in water temperature occur between the two sites during recession flows. During freshes, the differences in water temperature between the two sites are close to zero. Immediately preceding the flood illustrated in Figure 15, Trustpower were releasing daily flushing flows of approximately 400l/sec (12 - 16 March 2013). Figure 15 indicates that this had little impact on the difference in river water temperatures between the two monitoring sites, although this may be related to the fact that these flushing flows were released overnight, when there is reduced warming downstream of the weir.

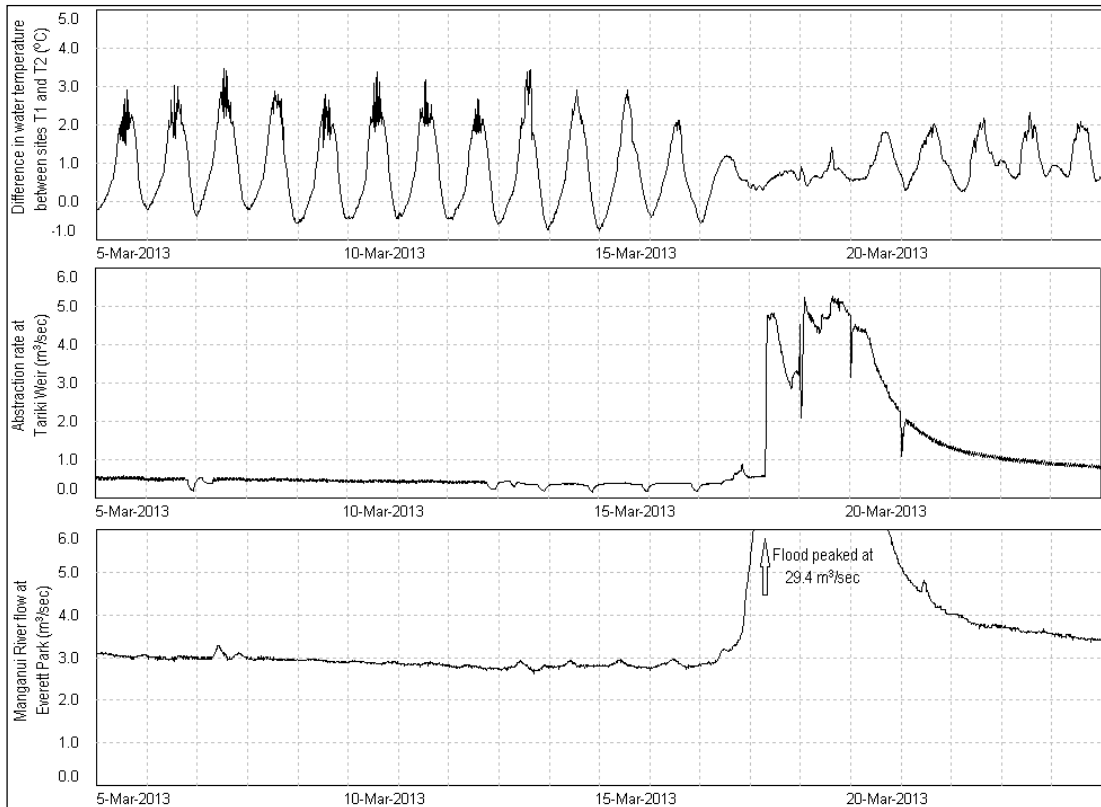


Figure 15 Manganui River water temperature differences between sites upstream and downstream of the Motukawa HEP weir (top) compared with abstraction rate (middle) and flow in the Manganui River at Everett Park (bottom) from 5 to 25 March 2013.

Schedule 3 of the RMA (1991) 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 three, 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.

2.1.4.2 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 two occasions during the monitoring period under review, to determine if the residual flow below the weir has 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 SQMCI_s scores for each site.

The MCI is a measure of the overall sensitivity of the macroinvertebrate community to the effects of organic pollution in stony streams. It is based on the presence/absence of taxa with varying degrees of sensitivity to environmental conditions. The SQMCI_s 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.

May 2012

The macroinvertebrate survey conducted on 25 May 2012 found taxonomic richness (number of taxa) similar to the median numbers of taxa previously recorded at these sites, although site 5 recorded a lower richness than that recorded at the other three sites (by between 7 and fourteen taxa). MCI values were relatively similar in a downstream direction, which was likely to have been related to the cooler water temperatures that preceded this autumn survey, and also the relatively frequent floods that occurred in the months prior. 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 current survey recorded cool temperatures (around 10 °C), and little periphyton, with no filamentous algae, and only two sites supporting patchy algal mats. 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, a reflection of the moderate flow conditions which occurred over summer 2012.

There were a small number of changes in the macroinvertebrate communities noted between sites 2 and 4, with five taxa increasing significantly in abundance, most likely due to the reduced flushing site 4 would experience, being downstream of the weir and abstraction. Site 5 was notable, in that there were only two taxa recorded in abundance, and ten taxa reduced significantly in abundance from that recorded at site 4. Recovery was noted at site 6, with six

taxa increasing significantly in abundance. Although little change is indicated by the MCI and SQMCI_s scores, the abundance of invertebrates at this site reduced markedly, suggesting habitat limitation at this site. It is likely that the residual flow was not providing sufficient habitat to maintain an abundant invertebrate community at this site. This conclusion is also supported by the lower taxa richness recorded at this site, which was fourteen taxa less than that recorded at site 4 upstream.

In general, and with the exception of site 5, all sites were dominated by similar taxa. This was most probably associated with the fact that there had been relatively frequent freshes, with seven occurring in the two months previous. As this survey was undertaken in autumn, it was unlikely to show clear impacts from the diversion of water, as these impacts usually are most evident in summer, and directly related to differences in densities of periphyton cover and water temperatures. This was reflected by the fact that all sites contained moderately high 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.

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 indicated they were in particularly good health, when compared to their respective medians. This is not unexpected however, as the higher temperatures usually experienced in the residual flow reach, which are likely to reduce these scores, were not experienced prior to this survey, due in part to the time of year this survey was undertaken. It was noted however, that characteristic seasonal changes (i.e., higher MCI values in spring) have been demonstrated more consistently at the control site 2, upstream of the weir, compared to all three sites downstream in the residual flow reach, a trend which may be a result of the flow regulation in this reach. This trend is unlikely to be illustrated in future, with the change in monitoring programme to exclude spring monitoring, instigated in the 2006-2007 monitoring 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 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. The degree of improvement at this site in the current survey is even more marked, with the MCI score being 20 units above the median, and the SQMCI_s score being 3.2 units higher than the median, both statistically significant improvements. 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 this May 2012 survey, it is considered that the communities of the residual flow reach were representative of more 'natural' conditions, as the survey was undertaken in autumn, and was preceded by frequent freshes. The results indicate that the MCI scores at these sites improved markedly from previous surveys, as did 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 this result was due to the river experiencing regular floods that provided flushing flows, and this has been the dominant influence on the community. Overall, the results indicate that the invertebrate community supported by a residual flow of 400 litres per second, 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 current results also illustrate the impact on the invertebrate community of regular flushing flows.

February 2014

With regards to the survey conducted on 25 February 2014, the scheme was operating normally, although due to the river not having naturally overtopped the weir for 30 days, a flushing flow was being released down the river for a number of hours each day, as required by consent. There had been little variation in flow after a large (121 m³/sec) flood that occurred on 5 January 2014, with only three small freshes after that time. The flow downstream of the weir had been between 450 and 450 l/s for fifteen days preceding this survey, although the flushing flows, which had occurred each day for the five days immediately prior to this survey, increased the flow to around 930 l/s for a few hours each day.

This survey recorded taxonomic richness (number of taxa) similar to the median numbers of taxa previously recorded at these sites, which included a recovery in invertebrate richness at site 5, when compared with that recorded in the previous survey. MCI values were relatively similar in a downstream direction, with the exception of site 6, which recorded a lower MCI score. 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 did not record such deterioration is a positive indication that the impacts of the diversion were not as severe as expected during this summer low flow period, and may be an indication that the flushing flows were having the desired effect. The current

survey recorded warm temperatures (around 19 °C), and patchy growths of periphyton mats and filaments at all downstream sites. The upstream sites supported only a thin film of algae. 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, a reflection of the moderate flow conditions which occurred over summer 2010.

There were a few changes in invertebrate abundance noted between the sites, which is an improvement on the previous survey, particularly at site 5. In the previous survey, site 5 recorded far fewer invertebrates in abundance than the sites upstream and downstream. This was not the case in the current survey, indicating that the habitat limitation suspected in the previous survey was no longer present. This conclusion is also supported by the improved taxa richness recorded at this site, which was eight taxa more than that recorded in the previous survey.

In general, all sites were dominated by similar taxa. This is despite the summer low flow conditions, and may reflect a positive impact from the flushing flows. Only subtle changes in abundance indicate a change in periphyton biomass, with the most notable change being an increase in the abundance of 'tolerant' *Aoteapsyche* caddisflies at site 6 to extremely abundant, resulting in a reduction in SQMCI_s score. This was reflected by the fact that 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.

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 fair to good 'health', while the SQMCI_s scores indicated they were in particularly good health, 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. Water temperatures were as high as 24.4 °C in the week 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 is repeated in the current survey, with the MCI score at site 5 being eleven units above the median, and the SQMCI_s score being 2.5 units higher than the median, both statistically significant improvements. 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 this February 2014 survey, it is considered that the communities of the residual flow reach represent what would be typical of a low flow community, but one that has been exposed to frequent, small scale flushing flows. 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 litres per second, 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 current results also suggest that the small scale flushing flows required at times by consent may be reducing the degree of impacts caused by the diversion of water during summer low flow conditions.

Copies of the reports detailing these surveys are attached in Appendix II.

2.1.4.3 Fish monitoring

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).
- 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 the 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.

During the monitoring period under review, a total of twelve site surveys were undertaken, all using the electric fishing method. All surveys were undertaken when the river was running clear, though not always during low flows, and special emphasis was given to targeting the habitat of key migrant species, especially inanga and redfin bully. The results for these surveys are presented in Table 8 and Table 9.



Photo 10 The Te Popo Stream tributary, at the end of Denbigh Road

Species diversity upstream of the weir was moderate, with five species recorded. Two of these species were not migratory (crans bully and brown trout), and the longfin eel, which is migratory, has been frequently recorded upstream in the past. The Te Popo Stream and Waipuku Stream sites were sampled in an unsuccessful effort to target koaro. However, the site approximately 400m upstream of the weir recorded redfin bully,

and this is the third consecutive reported period to record redfin bully upstream of the weir. This species was recorded upstream of the weir for the first time in 2009, and it appears they have continued to increase in abundance, with six individuals recorded at this site in 2011, and 8 in 2014.

In 2010 shortjaw kokopu and inanga were recorded upstream of the weir for the first time. Although these species were not recorded upstream of the weir in the current reporting period, it is likely these species were still present. Electric fishing is unlikely to detect shortjaw kokopu or inanga when they are present in low densities.

Table 8 Results of fishing surveys performed during the 2010-2014 monitoring period, upstream of the Tariki Weir

	Site code	TPP000105	TPP000130	WPK000095	MGN000300	
Species (Highest altitude where this species has been recorded on Taranaki Ringplain (m)*)	Stream	Te Popo Stream	Te Popo Stream tributary	Waipuku Stream	Manganui River	Previously recorded upstream of weir?
	Location	End of Radnor Rd	End of Denbigh Rd	Inside National Park	400m u/s of Tariki Road	
	Distance from weir (km)	23.4	24.1	15.4	0.4	
	Altitude (m)	490	520	540	210	
	Date	28/01/14	28/01/14	28/01/14	23/05/11 & 28/01/14	
Strong climbing ability	Longfin Eel (550)	✓			✓	✓
	Shortfin Eel (380)				✓	✓
	Koaro (800)					✓
	Shortjaw Kokopu (670)					✓
	Banded Kokopu (510)					
Moderate climbing ability	Giant Kokopu(370)					
	Redfin Bully (410)				✓	✓
	Torrentfish (440)					
	Inanga (210)					✓
	Common Bully (360)					✓
Non Migratory	Brown Trout		✓	✓	✓	✓
	Crans Bully				✓	✓
	Upland bully					✓
	Unidentified/juvenile bully				✓	✓
	Unidentified Galaxiid					✓
	Unidentified eel			✓	✓	✓
	Elver					✓
Diversity (no. of species)		1	1	2	5	10

*Altitude provided for migratory fish only. Data gathered from New Zealand Freshwater Fish Database on 11 September 2008. For reference the weir and fish pass are at 210masl

Table 9 Results of fishing surveys performed during the 2010-2014 monitoring period, downstream of the Tariki Weir

	Site code	Fish Pass	Downstream of weir					Previously recorded in residual flow reach or above weir?
		MGN000305	MGN000315	MGN000320	MGN000375	MGN000360		
Species (Highest altitude where this species has been recorded on Taranaki Ringplain (m*))	Stream	Manganui River	Manganui River	Manganui River	Manganui River	Manganui River	Manganui River	
	Location	Tariki Rd Fish Pass	100m d/s of weir	300m d/s of weir	2.3 km d/s of weir	1.7km d/s of weir		
	Distance from weir (km)	0	0.1	0.3	2.3	1.7		
	Altitude (m)	210	210	200	190	200		
	Date	23/05/11 & 28/01/14	23/05/11	23/05/11 & 28/014	23/05/11	23/05/11		
Strong climbing ability	Longfin Eel (550)	✓	✓	✓	✓	✓	✓	
	Shortfin Eel (380)	✓		✓	✓	✓	✓	
	Koaro (800)						✓	
	Shortjaw Kokopu (670)						✓	
	Banded Kokopu (510)							
Moderate climbing ability	Giant Kokopu(370)							
	Redfin Bully (410)	✓	✓	✓	✓	✓	✓	
	Torrentfish (440)	✓					✓	
	Inanga (210)						✓	
	Common Bully (360)						✓	
Non Migratory	Brown Trout	✓	✓	✓			✓	
	Crans Bully	✓	✓		✓	✓	✓	
	Upland bully						✓	
	Unidentified/juvenile bully	✓	✓	✓	✓	✓	✓	
	Unidentified Galaxiid						✓	
	Unidentified eel	✓	✓	✓	✓	✓	✓	
	Elver	✓		✓	✓	✓	✓	
	Paratya shrimp (migratory)						✓	
	Diversity (no. of species)	6	4	4	4	4	11	

* Altitude provided for migratory fish only. Data gathered from New Zealand Freshwater Fish Database on 11 September 2008. For reference the weir and fish pass are at 210masl



Photo 11 The outlet of the Tariki Weir fish pass

The presence of these three species upstream of the weir suggests that fish are beginning to move through the residual flow reach and fish pass. However all surveys, including those undertaken in the reporting period, have failed to record torrentfish upstream of the weir. This historical absence of torrentfish upstream of the weir continues to be of concern, especially as suitable habitat just upstream of the weir was targeted by electric fishing (the best method for detecting torrentfish) in the currently reported period.

The presence of redfin bully, shortjaw kokopu, and most significantly inanga, upstream of the weir indicates that the fish pass provides adequate passage for fish who can climb or jump, and it is hypothesised that

inanga, who are not good at swimming, climbing or jumping, have wriggled through the damp vegetation on the edges of the fish pass weirs. Torrentfish have been recorded in the fish pass, but only below the bottom weir of the pass (Photo 11). This may suggest that the weirs in the fish pass are not negotiable for torrentfish.

Downstream of the Tariki Weir, five sites were sampled, also by electric fishing. Redfin bullies are rarely recorded in abundance within the residual flow reach. However, during this survey they were recorded at all sites, including in the fish pass. Redfin bullies were recorded in the Tariki weir fish pass for the first time in 2005. The increased presence of redfin bullies in the Manganui River following the implementation of the 400 L/s residual flow, suggests that the residual flow is allowing the passage of redfin bullies up to the weir, and possibly providing some habitat within the residual flow reach, at least in the winter months when the weir is frequently overtopped. This is supported by the increased incidence of redfin bully upstream of the weir.



Photo 12 Inanga, observed approximately 1.7 km downstream of the weir, 25 February 2014

Inanga were recorded in the residual flow reach for the first time in 2009. Although not recorded by electric fishing in the reported period, a school of inanga was observed about 1.7km downstream of the weir during the macroinvertebrate survey undertaken on 25 February 2014 (Photo 12).

The fish pass contained six species of fish (Table 9), one of which was torrentfish, a key migrant species. Inanga have also been recorded in the pass from time to time. Overall, this provides promising evidence that flows in general are adequate to attract these fish up to the weir.

Overall, when all fish surveys undertaken in the fish pass are considered, there is generally a high abundance of fish in the fish pass, with inanga, bullies, eels and trout, extending right up to the top pool of the pass. This greater abundance of native fish in the fish pass is likely related to the fish pass providing different habitat compared to the main stem of the Manganui River, which may be preferred by bullies (and the eels which feed on bullies), and the fish pass providing a narrow stream channel which better enables the capturing of fish using electric fishing (in comparison to the Manganui River channel).

The presence of inanga, redfin bully and shortjaw kokopu upstream of the weir suggests that the flow control valve at the head of the fish pass does not constitute a barrier to fish passage. It is likely that this is related to the installation of blocks on the bed of the valve, which provide some flow variation and rest areas for fish, which will further assist fish passage through this valve.



Photo 13 A large dead brown trout, observed approximately 2.3km downstream of the weir, 25 February 2014.

Brown trout were recorded in the fish pass and at downstream of the weir in the currently reported period, and they have been regularly observed in this reach in previous surveys and while undertaking other monitoring, suggesting that trout are possibly resident in the residual flow reach throughout the year. During the macroinvertebrate survey undertaken in February 2014, a large brown trout was observed 'holding' in the current at

2.3km d/s of the weir. However, at this same location a large dead brown trout was also observed (Photo 13). This trout was in poor condition, and its death may be related to inadequate food supply in the residual flow reach, and also elevated water temperatures. Electric fishing is not considered to be an accurate way of monitoring the presence/absence of mature trout. This is illustrated by the fact that many of the trout caught in previous surveys were small in size (maximum 20 cm).

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, to be able to get a more accurate gauge of the adult fish moving through the fish pass, it is hoped to in conjunction with Fish and Game (Taranaki), undertake some further monitoring specific to trout, being the capturing, tagging and releasing of adult trout within the residual flow reach and possibly further downstream.

Anglers who then recapture these trout will return catch details to either the Council or the Fish and Game Council (Taranaki). This also has the potential to record the

movement of trout down the race, with implications for management at the in-race generator. While it was hoped that this could be completed in the reported period, difficulties in sourcing tagging equipment has delayed this work. It is now proposed for completion in the 2014-2015 period, instead of the programmed six site fish survey.

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. The results from the previously reported period 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.

Mangaotea Stream

Fish monitoring was also undertaken in the Mangaotea Stream. One survey has been undertaken previously, to establish what fish were present prior to the Mangaotea Pumps becoming operative. This survey 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.

Three sites were sampled, one upstream, and two downstream of the abstraction point. All three sites were sampled using the electric fishing technique on 28 January 2014. The results are provided in Table 10.

The fish habitat in the Mangaotea Stream varies along its length. Upstream of the abstraction point, the stream has been extensively modified, 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, although some farmers are undertaking to plant the stream margins. This habitat continues for some distance downstream.

Table 10 Results of fishing surveys performed in the Mangaotea Stream during the 2010-2014 monitoring period

Species	Site Code	MOT000025	MOT000040	MOT000090	Previously recorded in the Mangaotea Stream
	Location	1770m upstream of abstraction point	20m downstream of abstraction point	2340m downstream of abstraction point	
Longfin eel		3	1	3	✓
Shortfin eel			12	8	✓
Giant kokopu					✓
Inanga					✓
Redfin bully				1	
Crans bully			1	1	✓
Brown trout					✓
Unidentified eel			9	10	
Unidentified galaxiid					
Unidentified bully					
Total no. of species		1	3	4	6

However, approximately 860m downstream of Tariki Road (1710m downstream of 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 10). This included redfin bully, the first time this species has been recorded in this stream. The other two sites recorded lower species diversity.

The Mangaotea Stream is a difficult stream to survey by electric fishing, due to the sediment that is disturbed in the process. In addition, the amount of cover means that fish not come out from cover when stunned. This explains the reduced species richness from that recorded in the previous survey, which used the spotlighting technique. Previous surveys recorded giant kokopu, brown trout and inanga, and one fish tentatively identified as a banded kokopu. This indicates that there is reasonable water quality in the Mangaotea Stream, and that the cascade below Tariki Road is not a complete barrier to fish passage.

In general, these results are quite similar to that recorded during the only other electric fishing survey, undertaken prior to the pumps being operative, reported in TRC, 2009. This does not indicate any issue with fish passage at the intake, or with reduced flows downstream of the intake.

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.

Photo 14 shows the elver trap. 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 2010-2014 elver migration seasons (December to February) in Figure 16 and along with previous years' data in Table 11. Normally, elvers begin to appear at the tail race at the start of December and this was the case during all periods (Figure 16).



Photo 14 Elver trap at the base of the tail race at the power station

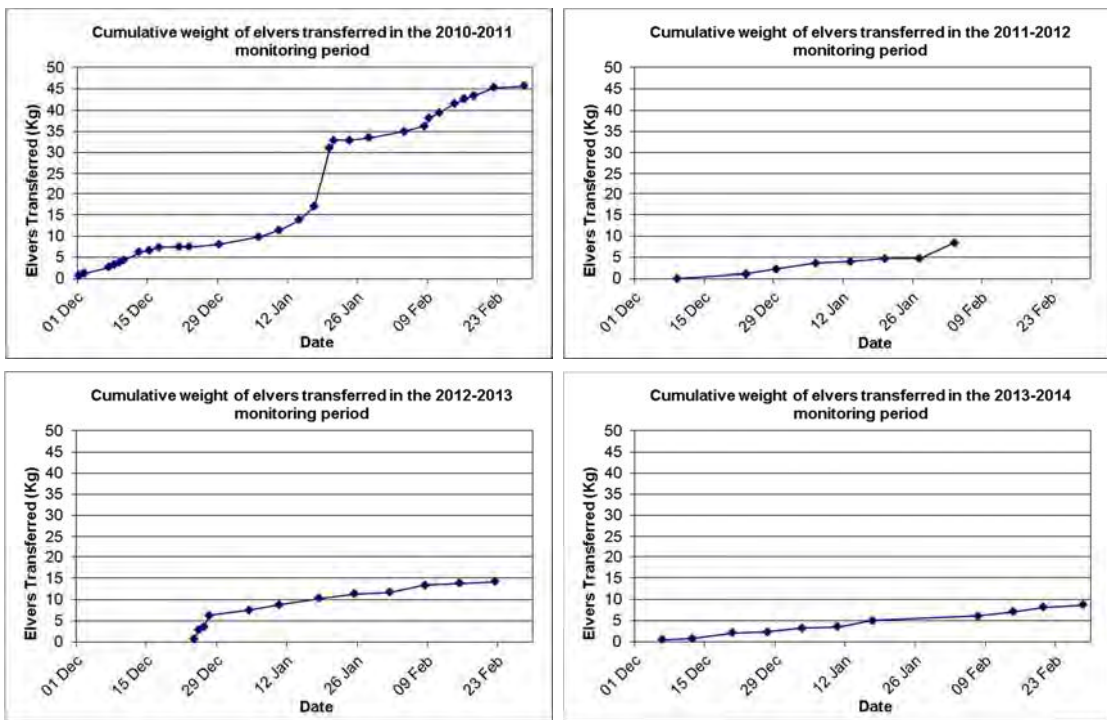


Figure 16 Cumulative weight of elvers transferred from the Motukawa Power Station during the 2010-2011, 2011-2012, 2012-2013 and 2013-2014 periods

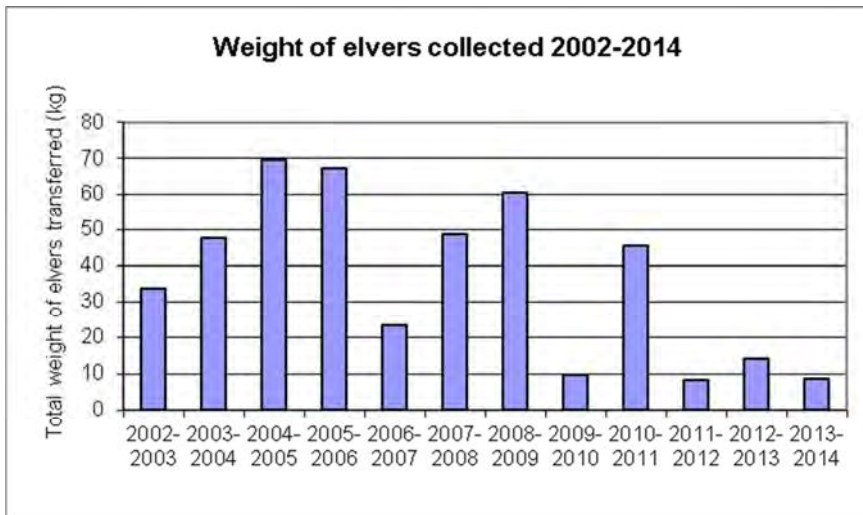


Figure 17 Elver transfer data for the monitoring years to date

The elver run in the 2010-2011 period began as normal, with the first transfer occurring on 1 December 2010. The run of elvers was relatively steady, up until mid January, when a large run occurred (Figure 16). The run slowed again after this time, with the total weight of elvers transferred during this period totalling 45.57 kg (Figure 17).

The following three seasons returned relatively low numbers of elvers. There was no spike in numbers during these years, with the total weight of elvers collecting in each season not exceeding 15 kg. It appears that the number of elvers arriving at the trap is highly variable, but it is clear that, with the exception of the 2010-2011 season, the last five years have been poor in terms of weights transferred. The elver run usually finishes in March, and this pattern continued in the reported period. It is noted that there was no generation for most of February 2012, and as a result there was no flow to the elver trap. This may explain the low numbers transferred during this season, with the total weight of elvers transferred being the lowest on record (Figure 17).

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 1350 elvers per kilo, and the other finding 950 elvers per kilo. Table 11 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 four occasions during the reported period. During the first three inspections, the trap was operating and contained a small number of elver. The inspection undertaken on 24 February 2014 observed elver and galaxiids swimming in the discharge from the power station. This may indicate a need to consider modifying the trap to try and collect galaxiids also.

Table 11 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 = 1350 elvers (2003 count))	Estimated number of elvers transferred (1 kg = 950 elvers (2006 count))
2002-2003	33.7	45495	-
2003-2004	47.7	64395	-
2004-2005	69.5	93825	-
2005-2006	67.5	91125	64125
2006-2007	23.18	31293	22021
2007-2008	48.55	65542	46122
2008-2009	60.65	81878	57618
2009-2010	9.71	13109	9225
2010-2011	45.57	61520	43291.5
2011-2012	8.35	11273	7932.5
2012-2013	14.15	19103	13442.5
2013-2014	8.61	11624	8179.5

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

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. Trustpower – Taranaki Generation Ltd 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).

Table 12 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%

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 transferred adult eels from the lake. There was very little movement of adult eels in autumn 2011, and as such no eels were transferred from Lake Ratapiko in that year. Nine eels were transferred in 2012, twenty-seven eels were transferred in 2013, and four eels were transferred in 2014.

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 208-2010 reporting period did observe an eel that appeared to have passed through the turbines, so it is recommended that the required screen spaces be revisited 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 this consent, 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, Trustpower – Taranaki Generation Ltd 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 however 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 (\$6000) 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, twenty-seven landholders in the Manganui catchment had been subsidised 50% of the cost of plants planted within the catchment for riparian protection, in the 2010-2014 period. To date, Trustpower have provided \$84,000 towards subsidising riparian planting in this catchment, of which every dollar has been allocated.

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.

One meeting was held in the reporting period, at the Quality Hotel Plymouth International on 22 November 2011. Representatives from Trustpower, Taranaki Regional Council, New Plymouth District Council, Fish and Game NZ and Jet Boating NZ attended, and discussed the compliance and operations of the scheme, with some discussion around trout and native fish movements in relation to the weir and intake race. There were few issues raised at this meeting, and it was determined that prior to holding such a meeting again in future, the stakeholders should be canvassed, to determine whether there was a need to hold further meetings. Through this stakeholder consultation, it was determined that no other meetings needed to be held in the reporting period. Trustpower is seeking to expand the invite list and are embarking on a process to invite Motukawa iwi, landowners and council (NPDC and TRC) to a North Taranaki Hui to subsequent meetings. A meeting will be scheduled for early 2015.

2.4 Register of incidents

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 'Unauthorised Incident Register' (UIR) includes events where the Company concerned has itself notified the Council. The register contains details of any investigation and corrective action taken.

Incidents may be alleged to be associated with a particular site. If there is 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 2010-2014 period, there were three incidents recorded by the Council that were associated with the Trustpower Motukawa HEP scheme. All incidents were notified to Council by Trustpower, as soon as they became aware of the situation themselves.

The first incident, reported to Council on 25 August 2010, related to a programming error in the gate controls, which control the abstraction rate from the Manganui River. At this time, the gates did not close quick enough following a fresh, and as a result the residual flow dropped below the minimum flow for 30 minutes. No enforcement action was warranted as the incident was of a minor nature, and that cause was rectified by Trustpower immediately.

The second incident, notified to Council on 16 July 2012, related to an exceedance of the maximum lake level. This was also related to a fresh, and is discussed in greater detail in section 2.1.3. No enforcement action was necessary, as Trustpower did all

they could to prevent the high lake level, and the primary cause was a significant weather event.

The third incident occurred over 10-13 January 2014. Gaugings were undertaken to maintain the rating curves for the left hand and right hand fish passes. These gaugings determined that there was a need to calibrate the rating curve, but this calibration was not relayed to Trustpower's operations team. As a result, insufficient flow was released down the Manganui River over this time. The Company received an infringement notice for this breach.

3. Discussion

3.1 National perspective

In July 2006, the Parliamentary Commissioner for the Environment (PCE) released a report entitled *Electricity, energy, and the environment: environmental performance assessment 1 July 2004-30 June 2005* (PCE, May 2006). The report examines the present and future environmental performance and effects of the electricity generation and transmission sector in New Zealand. It includes a focus upon the environmental performance and resource consent compliance of generators.

One of the recommendations in the PCE report is as follows:

‘13. Improve the transparency in reporting of resource consent compliance and monitoring

At present there is a lack of transparency in the monitoring and reporting of resource consent compliance by electricity generators...

Based on the information provided by the large electricity generators in their environmental and sustainability reports, most companies breach their resource consent conditions several times a year. These breaches are often reported as minor, or as having no detrimental environmental effects. It is impossible to verify the actual effects of these breaches from the available reporting methods.

The PCE recommends that MFE work with electricity generators to develop a robust, transparent, and verifiable system of reporting on resource consent compliance and the environmental effects of electricity generation.’

The report comments on possible roles for the Ministry for the Environment. It states:

‘MFE has limited involvement in the electricity sector, but the PCE believes it should have a broader role in the development of energy policy. Key areas where MFE could play an important role are:

- establishing a nationally consistent method for electricity generators to report on compliance with resource consent conditions and the environmental impacts of electricity generation;
- working with electricity generators to reduce the number of breaches of resource consent conditions;...

In many cases these national-level environmental issues are not effectively dealt with by regional councils or territorial authorities.’

The report also examines the consent compliance reporting record of each company. It concludes:

‘General comments on sustainability reporting

With the exception of Trustpower, none of the electricity generators detail the number of times they breach their agreed resource consent conditions. Some

generators argue that compliance may not be a reasonable measure of their environmental performance. In general, it seems that it is not uncommon for electricity generators to breach their agreed resource consent conditions several times a year.

The PCE is seeking to quantify the number of non-compliance events in order to compare numbers for different generation plant and generators. The purpose is to identify any trends, which may be relevant.

Resource consent conditions for some plants are significantly more onerous than others, and sometimes this difference is based on the timing of the last resource consent rather than the local environmental effects.

National consistency in categorizing the breaches would be useful for this assessment report and for other purposes. We intend to look at this area in more detail in the next assessment period. This will include the extent to which these companies are reporting what they are doing to promote a robust demand-side sector in the electricity market, at both the wholesale and retail levels. (See Recommendation 13.)

The Council notes that it is the long-standing practice of the Council to report publicly on environmental performance and consent compliance (including non-compliance events) in each annual compliance report. It has done so since compliance reports were first prepared. In the case of Trustpower's power generation facility at Motukawa, the record of reporting covers 25 years (12 years while in Trustpower ownership). The reader is referred particularly to sections 2.4, 3.2, 3.3 and 3.4 in this report for more information.

3.2 Discussion of plant performance

Several consents contain special conditions requiring Trustpower – Taranaki Generation Ltd to monitor and forward abstraction, discharge and water level data at three monthly intervals. This data was forwarded as required during the monitoring year under review. Compliance of this data is summarised below. Following improvements made in the 2006-2007 monitoring period, compliance with these requirements has improved significantly. During the monitoring period under review, there were six occasions on which notable loss of data occurred. These were related primarily to equipment failure and remedied immediately. These occasions of lost data were not deemed to be incidents of non-compliance. 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.

Trustpower have undertaken significant changes both to the equipment and operationally to improve the way the abstraction from the Manganui River is managed. Water permit 3369 is the consent to take water from the Manganui River for the purpose of hydroelectric power generation. The consent allows for the abstraction of 5200 L/s (5460 L/s allowing for five percent error). The abstraction

rate of 5460 L/s (the allowable abstraction plus five percent error) was not exceeded during the 2010-2014 monitoring period.

This consent also requires that the consent holder maintains a flow of at least 150 L/sec in the race, except during maintenance, when a fish salvage is to be undertaken. During the reported period, there were two incidents where race flow dropped below 150 L/sec. One incident was minor in nature and associated with equipment failure, while the other was done in consultation with Council.

Water permit 3373 is the consent to dam the Mako Stream (thereby creating Lake Ratapiko) for hydro-electric power generation purposes. Conditions 5, 6, 7 and 9 of the consent requires that under normal operating conditions the water level in Lake Ratapiko should be maintained within the range of 194 and 198.7 metres above sea level. One exceedance of the upper lake level occurred during the reported period, which was related to an extreme weather event.

Trustpower - Taranaki Generation holds consent 3372 to discharge 7787 litres per second of water from the Motukawa hydroelectric power station into the Makara Stream in the Waitara catchment. The discharge rate did not exceed the consent limit during the 2010-2014 monitoring period.

Consent 3371 requires the Company to maintain the water level of the race, which receives water from the Manganui River as well as various unnamed tributaries and stormwater runoff, within a maximum level at various points along the race under special condition 2. Over all four sites specified in the consent, none exceeded their maximum level at any time during the 2010-2014 period.

Special condition 1 of this consent requires that the consent holder shall regulate the Manganui River intake to ensure that the race does not over-top causing flooding of surrounding farmland. The water race was enlarged in March 1999 to ensure that flooding would not occur. The race water level monitoring data indicates that no flooding occurred during the 2010-2014 monitoring period. In addition, condition 4 of this consent requires the consent holder to identify and undertake any maintenance to prevent flooding. Two areas were identified and remedied in compliance with this condition.

Special conditions 1 and 2 of water permit 3369 require that the consent holder shall ensure that a residual flow of at least 400 L/s is maintained downstream of the Tariki Road weir at all times. Inspections of the fish pass and the residual flow found it was operated well throughout the monitoring period under review. In addition, none of the gaugings of the flow in the fish pass during the 2010-2014 monitoring period recorded results below the required residual flow. However, there were a number of incidents where the residual flow dropped below 400 L/s, most which were minor and did not require enforcement action. However, one incident, related primarily to human error, resulted in the issuance of an infringement notice.

Special condition 4 of water permit 6381 requires that the abstraction from the Mangaotea Stream shall cease when flow in the Mangaotea Stream immediately downstream of the confluence with the Little Mangaotea Stream is equal to or less than 94 L/s, or if this flow is higher than 94 L/s, shall cease when flow in the Mangaotea Stream immediately downstream of the abstraction is equal to or less

than 35 L/s. These residual flows were complied with at all times in the reported period.

Special conditions in all of the consents held by Trustpower – Taranaki Generation Ltd in relation to the Motukawa HEP scheme state that Trustpower shall meet as appropriate and at least once per year, with interested submitters to the consents. One such meeting was held in the reported period, this was with the agreement of the Council.

The elver trap and transfer system, required under special condition 3 of consent 3372, was managed successfully during the 2010-2014 monitoring period, transferring a moderate number of elvers, although the 2011-2012 season saw the lowest weight of elvers transferred to date. This was attributed to a slow run early in the elver season, followed by an earlier closing of the trap, due to the station being shut down.

Several of the resource consents had special conditions attached which required maintenance and upgrades to be completed by certain times. Many of these upgrades were required to be completed within the 2001-2002 monitoring year. Several were unable to be completed in this timeframe and extensions were granted. Details of these are provided in Table 13 to Table 30 (Section 3.4).

Of these conditions, only the installation of light barriers (or alternative) had not been completed prior to the monitoring year under review. NIWA trialled the light barriers but these proved unsuccessful at deterring fish, while electrical fields have shown some success in deterring eels. An electric field barrier was installed at the Manganui River intake gate in August 2005 and at the forebay (Lake Ratapiko) in March 2006. These were removed for further testing and have since been reinstated.

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 8000 litres/second, 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 was completed in 2011, and the remedial works were completed in the reported period.

Special condition 8 of consent 6381-1 required that the consent holder was to monitor the hydrological and ecological effects on the Mangaotea Stream and Manganui River downstream of the Mangaotea Stream confluence, and whether the residual flow is appropriate, in relation to the Mangaotea Pumps. This was completed in 2012.

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 Trust Power – Taranaki Generation Ltd

once work on the spillway and Ratapiko Road culvert has been completed in the 2002-2003 monitoring year. A reviewed plan was received on 27 May 2010.

Management of most aspects of the Motukawa HEP scheme has generally been excellent with significant improvements demonstrated for race and lake water levels, and abstraction rates from the Manganui River, and all improvement works required by resource consents now completed. 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. Unfortunately, one incident in relation to the Manganui Rive residual flow resulted in Council taking enforcement action against the Company. Throughout the reported period, Trustpower and Council have continued to work closely with one another.

3.3 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 relatively typical, being similar to that recorded previously. The upstream site still indicated some natural warming. Average monthly water temperatures were similar to the long term average, but the number of days that experienced a maximum temperature in excess of 25°C were less than average, with the 2011-12 and 2013-14 years not recording temperatures in excess of 25°C. 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, although a large dead trout was observed in February 2014.

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/sec 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 2010-14 period were generally lower than the average.

Because of an extended period of natural to near natural flows in the residual flow reach in early 2010 (previous reporting period), 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 two macroinvertebrate surveys conducted 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. Of the surveys undertaken in the reported period, one was done during autumn, and recorded less deterioration in a downstream direction due principally to the cooler water temperatures, while only subtle deterioration was noted in the other survey, completed in summer.

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 pattern has continued in the current period, with above average MCI scores at most sites, and significantly improved SQMCI₅ scores at all sites. Overall, the results indicate that the invertebrate community supported by a residual flow of 400 litres per second, 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 current results also illustrate the impact on the invertebrate community of regular flushing flows.

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 metres 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).

Fish surveys were conducted during the 2010-2014 period, coupled with that undertaken in previous monitoring years, found that fish were beginning to move through the residual flow reach and fish pass. This is indicated by the presence of

redfin bully, inanga and shortjaw kokopu upstream of the weir, and the improved abundance of redfin bully upstream and downstream of the weir. Torrentfish were recorded in the fish pass in the reported period. This species occurs sporadically in the residual flow reach, and has never been recorded upstream of the lower weir in the pass. 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.

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.

Fish monitoring was also undertaken in the Mangaotea Stream, 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.

3.4 Evaluation of performance

A tabular summary of the Company’s compliance record for the year under review is set out in Table 13 to Table 32.

Table 13 Summary of performance for Consent 3369-2 to take and use up to 5200 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	No
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	Yes
5. Pulse flows released if weir has not overtopped for 30 days	One such period of low flows occurred	Yes

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		Improvement Required
Overall assessment of administrative performance in respect of this consent		High

N/A = not applicable

Table 14 Summary of performance for Consent 3371-2 to divert and use up to 8000 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
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	Report completed and supplied	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	One 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

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 15 Summary of performance for Consent 3372-2 to discharge up to 7787 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	Yes
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	One 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 16 Summary of performance for Consent 3373-2 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. Alter low level spillway crest by 1m within 12 months		Yes
4. Place & maintain structure on top of lowered spillway crest to increase lake storage	Upgrade in 2003-2004 with spring tip flashboard	Yes
5. 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
6. Minimum lake water level of 194 m a.s.l. except during maintenance	Receipt and review of Company data every three months	Yes

Condition requirement	Means of monitoring during period under review	Compliance achieved?
7. Maximum lake water level of 198.7 m a.s.l.	Receipt and review of Company data every three months	Yes
8. 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
9. Install and operate measuring device to measure lake water level and forward to Council	Receipt and review of Company data every three months	Yes
10. Meeting with stakeholders annually	One meeting conducted, with agreement of Council	Yes
11. 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

Table 17 Summary of performance for Consent 1166-3 to discharge up to 4000 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	One 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 18 Summary of performance for Consent 5080-1 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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	One 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 19 Summary of performance for Consent 5081-1 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 2000 L/s & install gate controlled by race water level control system	Conducted in 2000	Yes
3. Meeting with stakeholders annually	One 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 5082-1 to discharge, under emergency conditions, up to 2000 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 2008-2010 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
3. Manage discharge to avoid or minimise flooding of farmland and roads below discharge		Yes
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	One meeting conducted, with agreement of Council	Yes
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 21 Summary of performance for Consent 5084-1 to discharge up to 55000 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	One 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 22 Summary of performance for Consent 5085-1 to disturb the bed of Lake Ratapiko for maintenance and repairs associated with hydroelectric power 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
2. Best practicable option		N/A
3. Meeting with stakeholders annually	One 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 23 Summary of performance for Consent 5086-1 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		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	One meeting conducted, with agreement of Council	Yes
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 24 Summary of performance for Consent 5087-1 to take and use up to 7787 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	Yes
4. Manage lake levels to avoid or minimise flooding of land		Yes
5. Meeting with stakeholders annually	One meeting conducted, with agreement of Council	Yes
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 25 Summary of performance for Consent 5088-1 to discharge up to 2000 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	One 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 26 Summary of performance for Consent 6388-1 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
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 27 Summary of performance for Consent 6390-1 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 has been removed, and is permanently running.	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 has been removed, and is permanently running.	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
9. Consent lapse period of 10 years	Consent has been exercised	N/A

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 28 Summary of performance for Consent 6391-1 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
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 29 Summary of performance for Consent 6381-1 to take and use water from the Mangaotea Stream, for hydroelectric power 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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
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	Review not considered necessary	N/A
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		High

Table 30 Summary of performance for Consent 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 hydroelectric power 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

Condition requirement	Means of monitoring during period under review	Compliance achieved?
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
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	No
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 31 Summary of performance for Consent 6386-1 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

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 32 Summary of performance for Consent 6387-1 to discharge sediments from earthworks into the Mangaotea Stream, associated with the construction of an intake structure, for hydroelectric power 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
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 reported period, the Company's performance was maintained at a high level. With the exception of one incident that warranted enforcement action, there were no incidents of concern. 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 one incident that did result in enforcement action related to insufficient flow in the Manganui River. Although the performance rating for the relevant consent is 'improvement required' this improvement has already occurred with improved communications and understanding of the staff and contractor involved.

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. Using the environmental performance classifications as defined in section 1.1.4, Trustpower's performance for the entire 2010-2014 period is 'good'. Although there was one infringement notice issued in this time, the cause was remedied immediately, and had Trustpower not notified Council, it is unlikely it would have been discovered. Tempering this single incident was a high level of compliance with all other consents over this time.

3.5 Recommendations from the 2008-2010 Biennial Report

In the 2008-2010 Biennial Report, it was recommended:

THAT monitoring of consents relating to the Motukawa HEP scheme in the 2010-2011 year continues at the same level as in 2009-2010. A recommendation to this effect is attached to this report.

This recommendation was implemented in the 2010-11 period with the following exceptions:

- Inspections were reduced to six inspections per year in the 2013-14 period
- Water temperature monitoring downstream of the Mangaotea Stream confluence ceased in the 2013-14 period
- Dissolved oxygen monitoring of the Mangaotea Stream is not being undertaken during inspections

3.6 Alterations to monitoring programmes for 2014-2015

In designing and implementing the monitoring programmes for air/water discharges in the region, the Council has taken into account the extent of information made available by previous authorities, its relevance under the Resource Management Act, the obligations of the Act in terms of monitoring emissions/discharges and effects, and subsequently reporting to the regional community, 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 emitting to the atmosphere/discharging to the environment.

It is proposed that monitoring of consents relating to the Motukawa HEP scheme in the 2014-2015 year continue at the same level as in 2013-2014.

3.7 Exercise of optional review of consents

Resource consents 1166-3, 3369-2, 3371-2, 3372-2, 3373-2, 5080-1, 5081-1, 5082-1, 5084-1, 5085-1, 5086-1, 5087-1, 5088-1, 6381-1, 6382-1, 6383-1, 6384-1, 6385-1, 6386-1, 6387-1, 6388-1, 6390-1 and 6391-1 provide for an optional review of the consent in June 2015. Conditions of these consents allow the Council to review the consent, if there are grounds that, principally for the purpose of ensuring that the conditions are adequate to deal with any adverse effects which were not foreseen or considered at the time the consent was granted.

Based on the results of monitoring in the period under review, and in previous years as set out in earlier annual compliance monitoring reports, it is considered that there are no grounds that require a review to be pursued.

3.8 Review of consent 3369

When consent 3369 was renewed in 2001, an agreement was made between submitters and the applicant, that the residual flow downstream of the weir be maintained at at least 400 L/sec, and that in mitigation, the existing consents that authorised an abstraction of water from the Mangaotea Stream would be surrendered. This was done.

However, in 2005, Trustpower applied for resource consent to re-instate the Mangaotea Pumps abstraction, and this consent was subsequently granted. This withdrew the mitigation that was committed to previously. Therefore, it follows that the residual flow in the Manganui River be re-visited, to assess what mitigation has been lost, and whether this mitigation needs to be provided for in another way. Furthermore, Fish and Game Taranaki had it noted in the officer's report for consent 3369 that the effects on the Manganui River were best addressed through the review of consent 3369.

It was therefore recommended in the 2006-2008 biennial report that the conditions of consent 3369 be reviewed in June 2009. This recommendation was implemented by serving a notice of review in accordance with the conditions of the consent and section 129 of the RMA. This review process is currently on hold with the agreement of the consent holder.

The Council is currently working through a review of the Regional Freshwater Plan for Taranaki and intends to notify a new Plan in early 2015. The recent National Policy Statement for Fresh Water 2014 requires the Plan to include an allocation limit and a minimum flow for every river in order to meet national objectives for water quality and quantity. It now appears that the most effective and efficient way to establish the appropriate residual flows downstream of the operation is through the public process of the Regional Plan rather than by a review of consent conditions. This has been proposed to the consent holder, and further discussions will decide whether this is indeed the appropriate process.

A recommendation to this effect (re that the Council notes the recommendation in the 2007-2008 report adopted by the Council might now not proceed) is presented in section 4.

4. Recommendations

1. THAT monitoring of consents relating to the Motukawa HEP scheme in the 2014-2015 year continues at the same level as in 2013-2014.
2. THAT review of those consents that contain a review provision for June 2015 is not undertaken.
3. That the Council notes the review of consent 1795-4 may lapse.

Glossary of common terms and abbreviations

The following abbreviations and terms are 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
DO	dissolved oxygen
fresh	elevated flow in a stream, such as after heavy rainfall
g/m ³	grammes per cubic metre, and equivalent to milligrammes per litre (mg/L). In water, this is also equivalent to parts per million (ppm), but the same does not apply to gaseous mixtures
l/s	litres per second
MCI	macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the sensitivity of the taxa present to organic pollution in stony habitats
mixing zone	the zone below a discharge point where the discharge is not fully mixed with the receiving environment. For a stream, conventionally taken as a length equivalent to 7 times the width of the stream at the discharge point.
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	Resource Management Act 1991 and subsequent amendments
SQMCI _s	Semi-quantitative Macroinvertebrate community index; a numerical indication of the state of biological life in a stream that takes into account the numerical abundances and sensitivities of the taxa present to organic pollution in stony habitats
SS	suspended solids
Temp	temperature, measured in °C (degrees Celsius)
Turb	turbidity, expressed in NTU
UIR	Unauthorised Incident Register entry- an event recorded by the Council on the basis that it had potential or actual environmental consequences that may represent a breach of a consent or provision in a Regional Plan

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

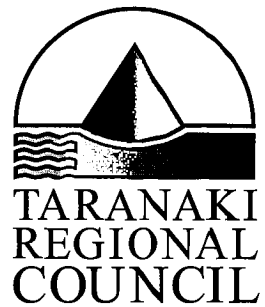
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- Taranaki Regional Council, 2005: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2003-2004. Technical Report 2004-81.
- Taranaki Regional Council, 2006: TrustPower - Taranaki Generation Ltd Motukawa HEP Scheme Monitoring Programme Annual Report 2004-2005. Technical Report 2005-43.
- Taranaki Regional Council, 2006: 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.

Appendix I

Resource consents held by
Trustpower Limited – Taranaki Generation



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number
on all correspondence

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

*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

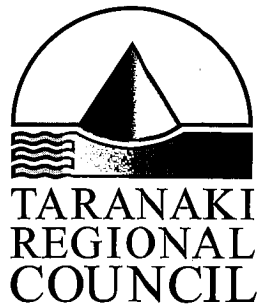
1. The consent holder shall at all times adopt the best practicable option, as defined in section 2 of the Resource Management Act 1991, to prevent or minimise any adverse effects on the environment from the exercise of this resource consent.
2. The exercise of this consent shall be undertaken generally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



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

CHIEF EXECUTIVE
PRIVATE BAG 713
47 CLOTEN ROAD
STRATFORD
NEW ZEALAND
PHONE 06-765 7127
FAX 06-765 5097

Please quote our file number
on all correspondence

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

Consent 6391-1

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

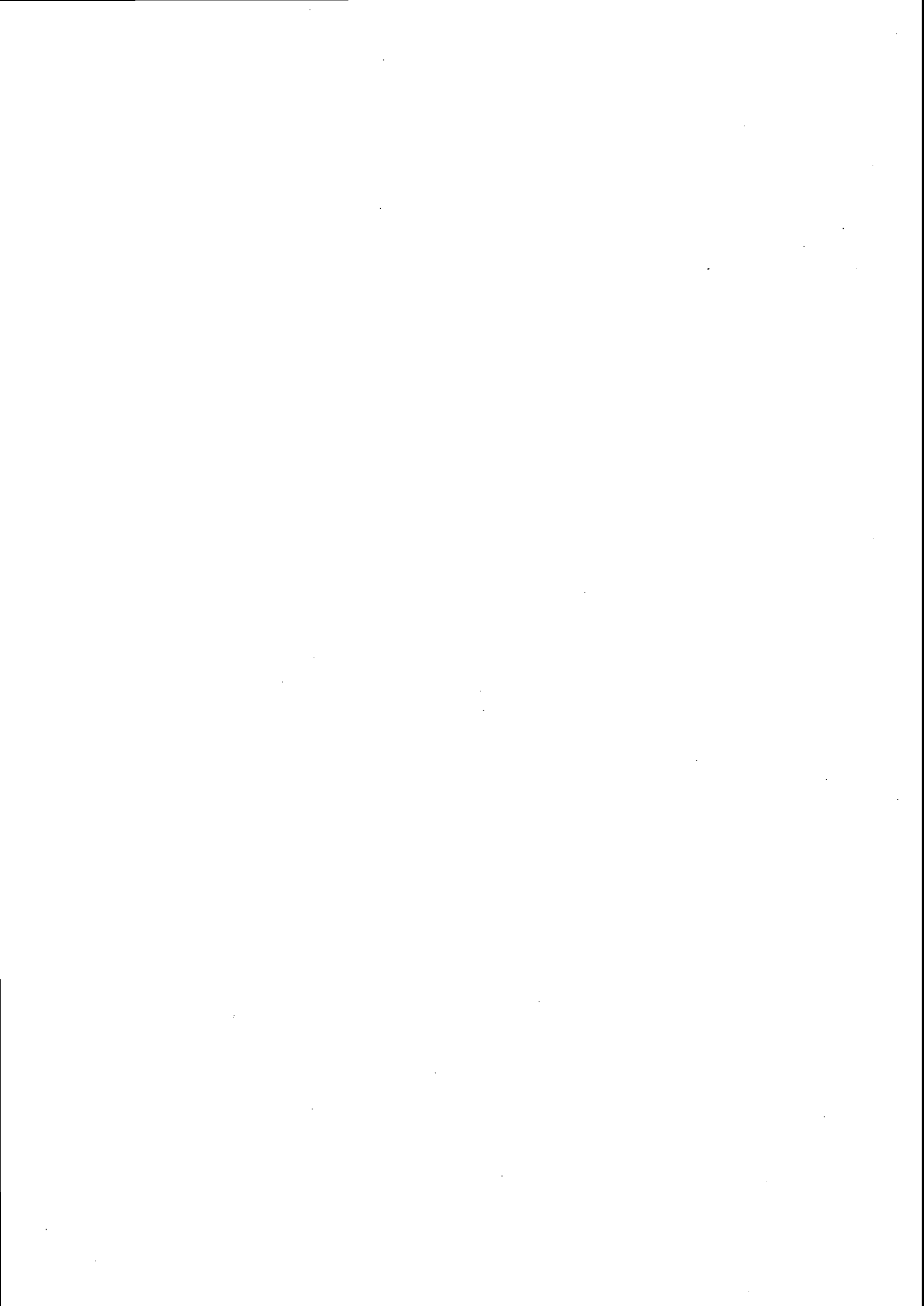
7. This consent shall lapse on the expiry of ten years after the date of issue of this consent, unless the consent is given effect to before the end of that period or the Taranaki Regional Council fixes a longer period pursuant to section 125(1)(b) of the Resource Management Act 1991.
8. In accordance 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



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: 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 at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2007, June 2009, June 2015

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

Legal Description: Pt Secs 32-34 Blk VI Huiroa SD, Lots 2-3 Lot 5 DP 7088
Lot 2 DP 16055

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;

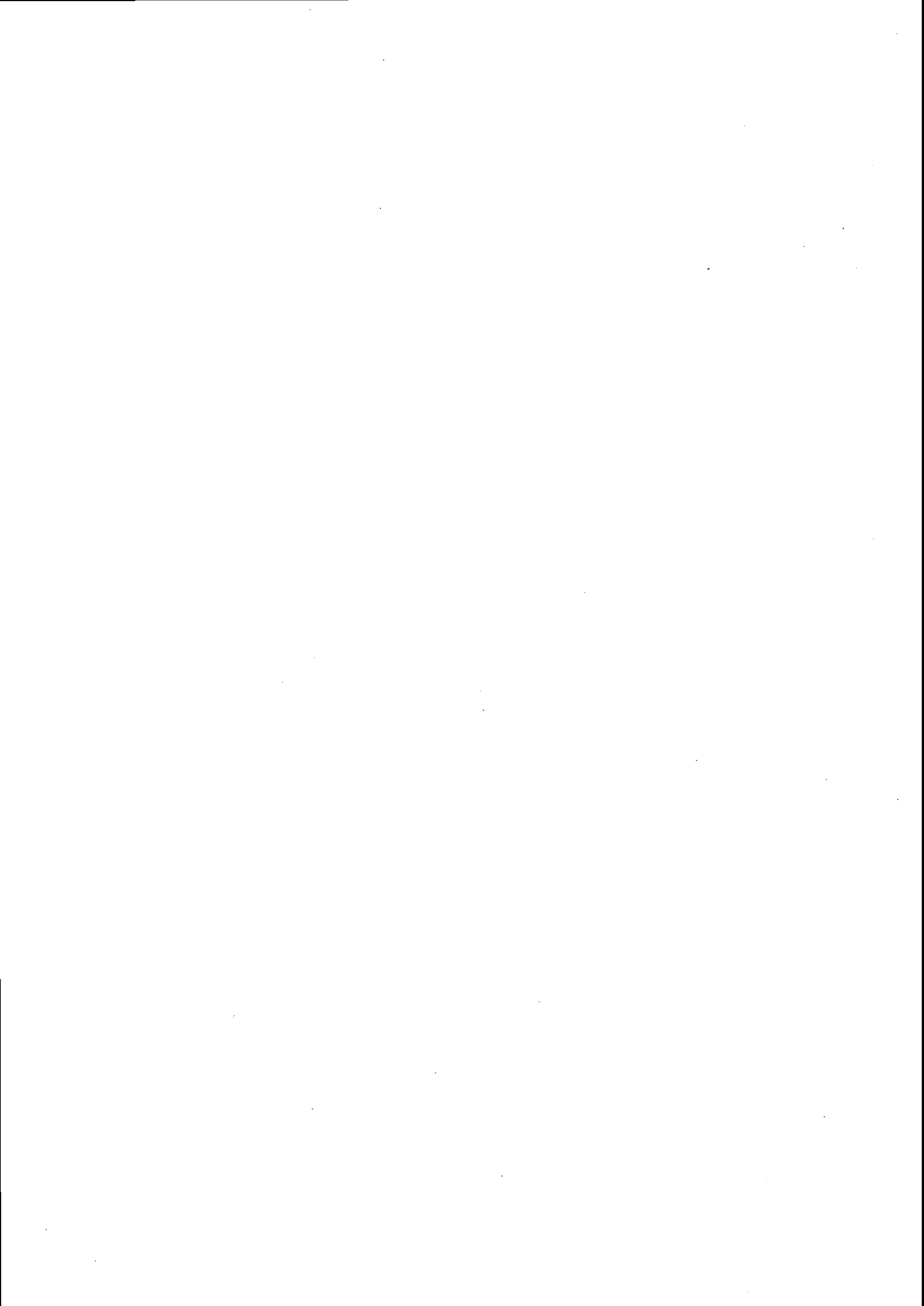
Consent 6387-1

- e) any significant adverse effects on aquatic life.
- 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.

Signed at Stratford on 7 December 2005

For and on behalf of
Taranaki Regional Council

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

Consent Granted
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 at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2007, June 2009, June 2015

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

Legal Description: Pt Secs 32-34 Blk VI Huiroa SD, Lots 2-3 Lot 5 DP 7088
Lot 2 DP 16055

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.

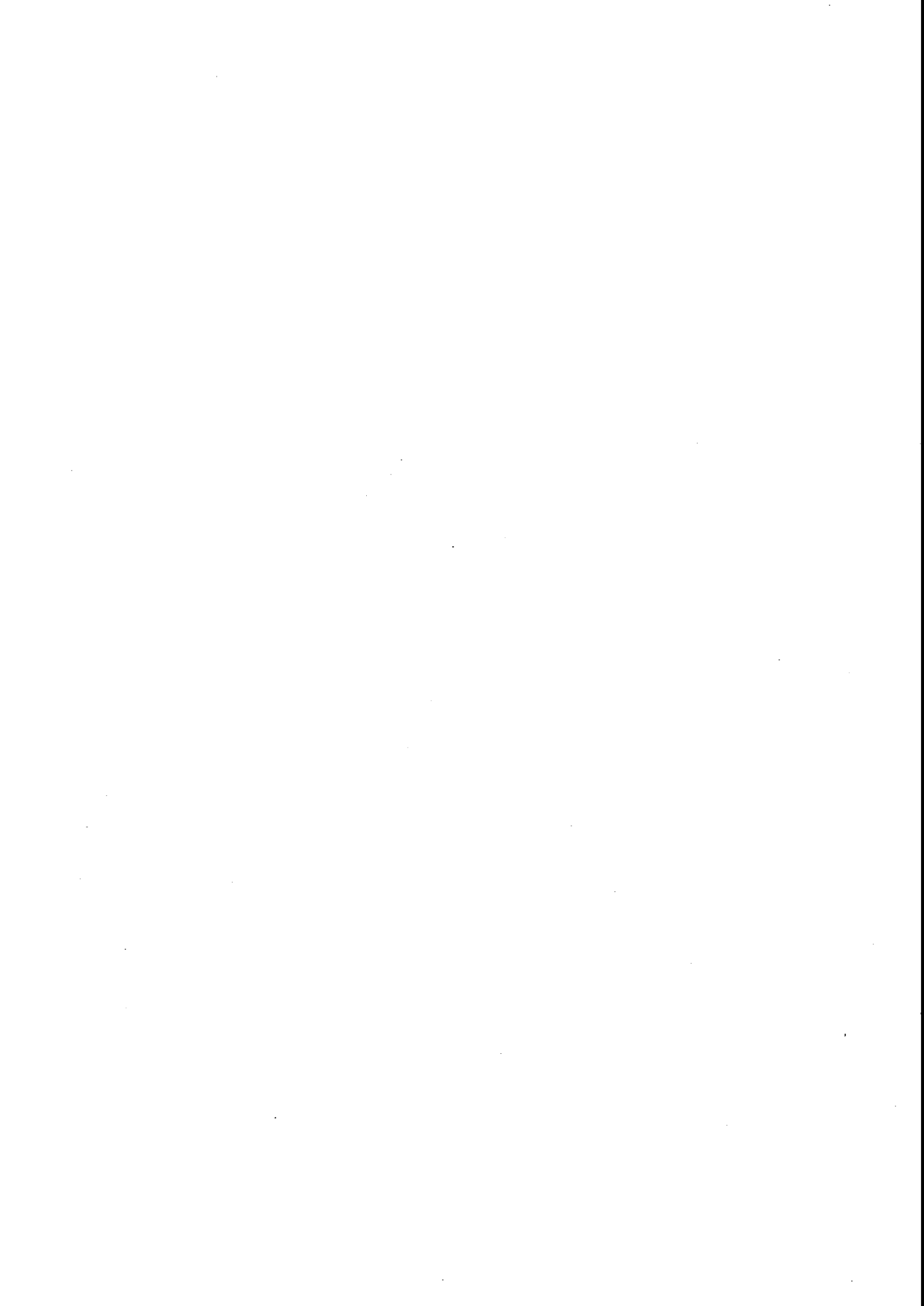
Consent 6386-1

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.

Signed at Stratford on 7 December 2005

For and on behalf of
Taranaki Regional Council

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

Consent Granted
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 at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2007, June 2009, June 2015

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

Legal Description: Pt Secs 32-34 Blk VI Huiroa SD, Lots 2-3 Lot 5 DP 7088
Lot 2 DP 16055

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.

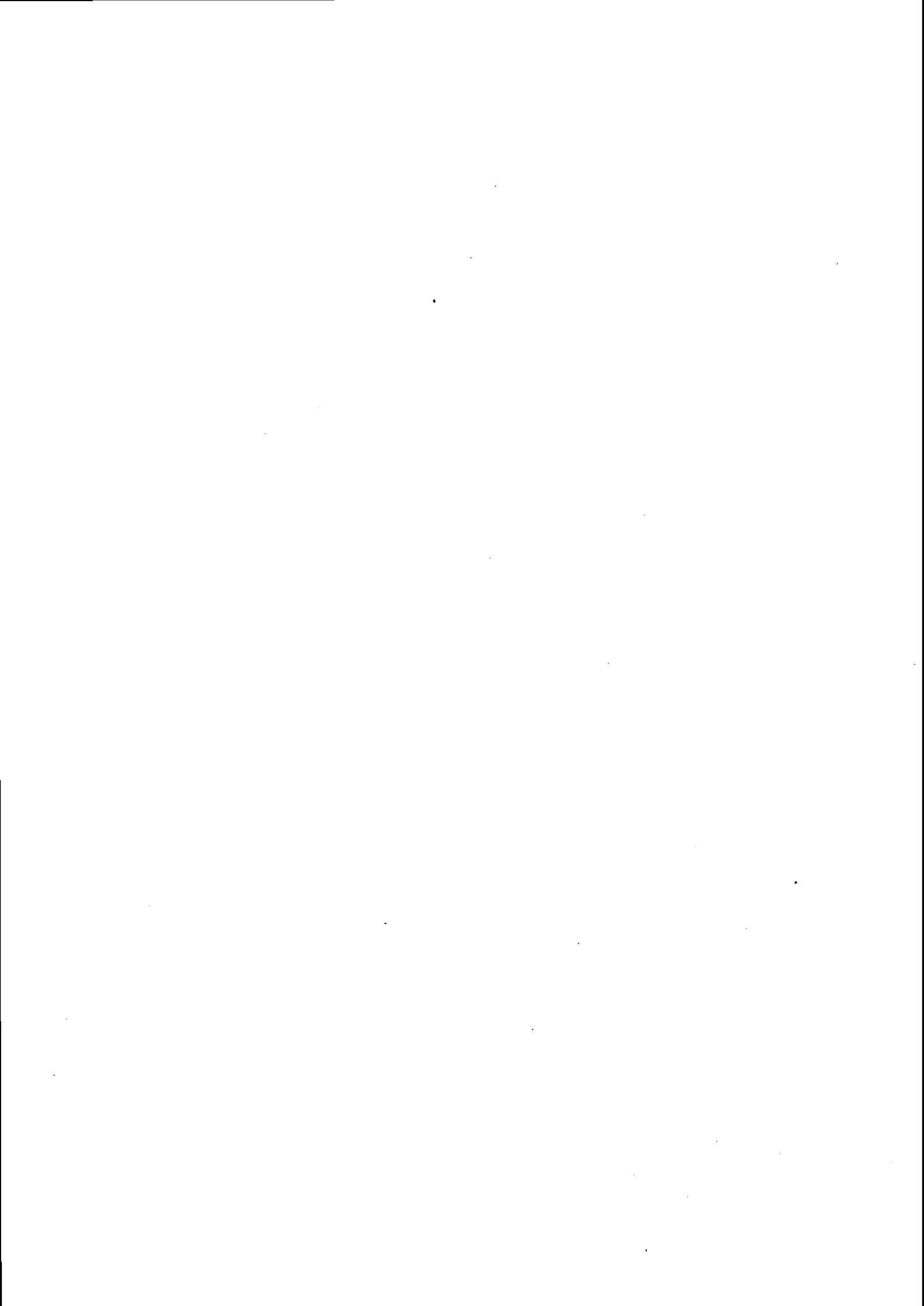
Consent 6384-1

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.

Signed at Stratford on 7 December 2005

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

Consent Granted
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 at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2007, June 2009, June 2015

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

Legal Description: Pt Secs 32-34 Blk VI Huiroa SD, Lots 2-3 Lot 5 DP 7088
Lot 2 DP 16055

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.

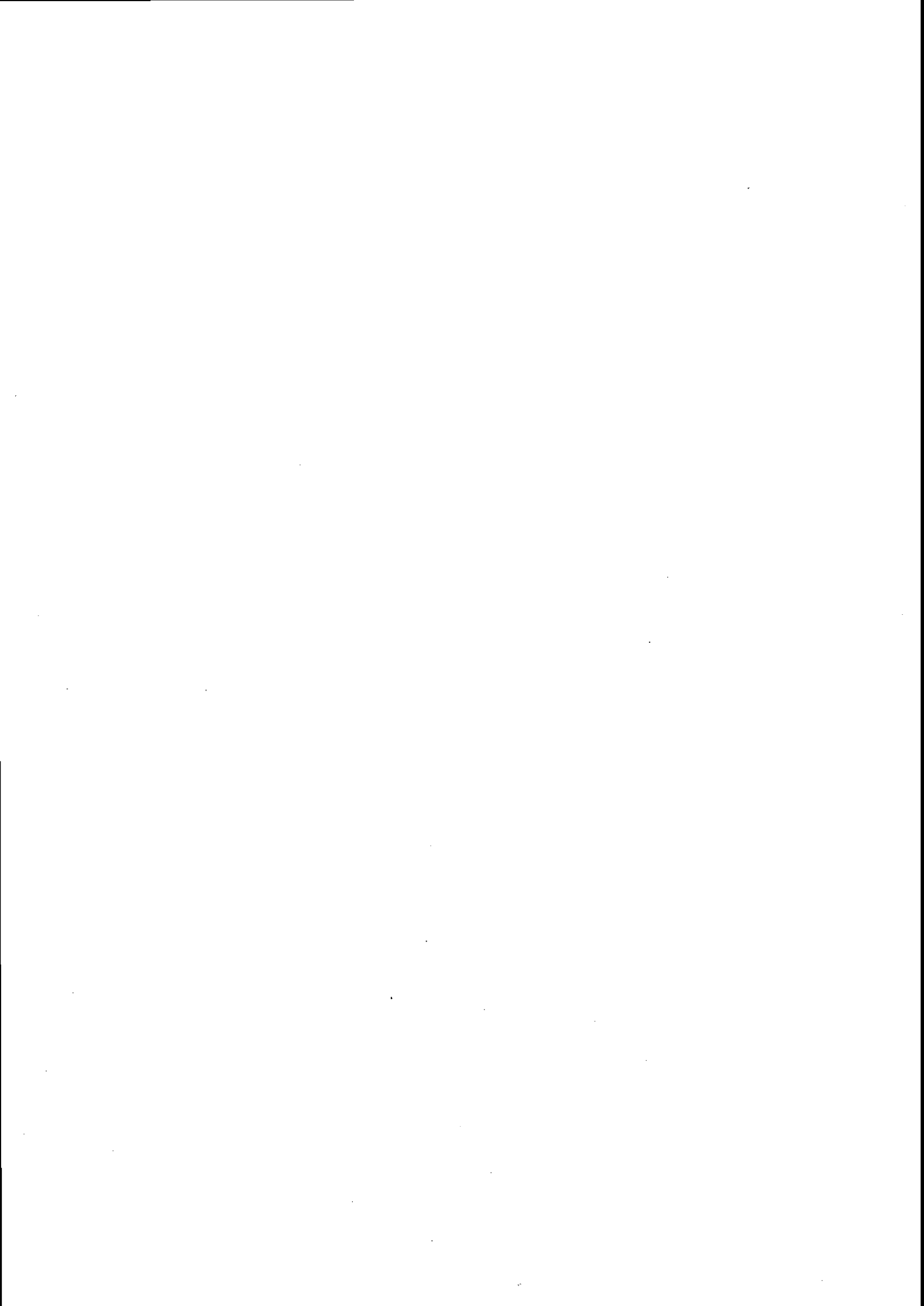
Consent 6383-1

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.

Signed at Stratford on 7 December 2005

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

Consent Granted
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 at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2007, June 2009, June 2015

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

Legal Description: Pt Secs 32-34 Blk VI Huiroa SD, Lots 2-3 Lot 5 DP 7088
Lot 2 DP 16055

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.

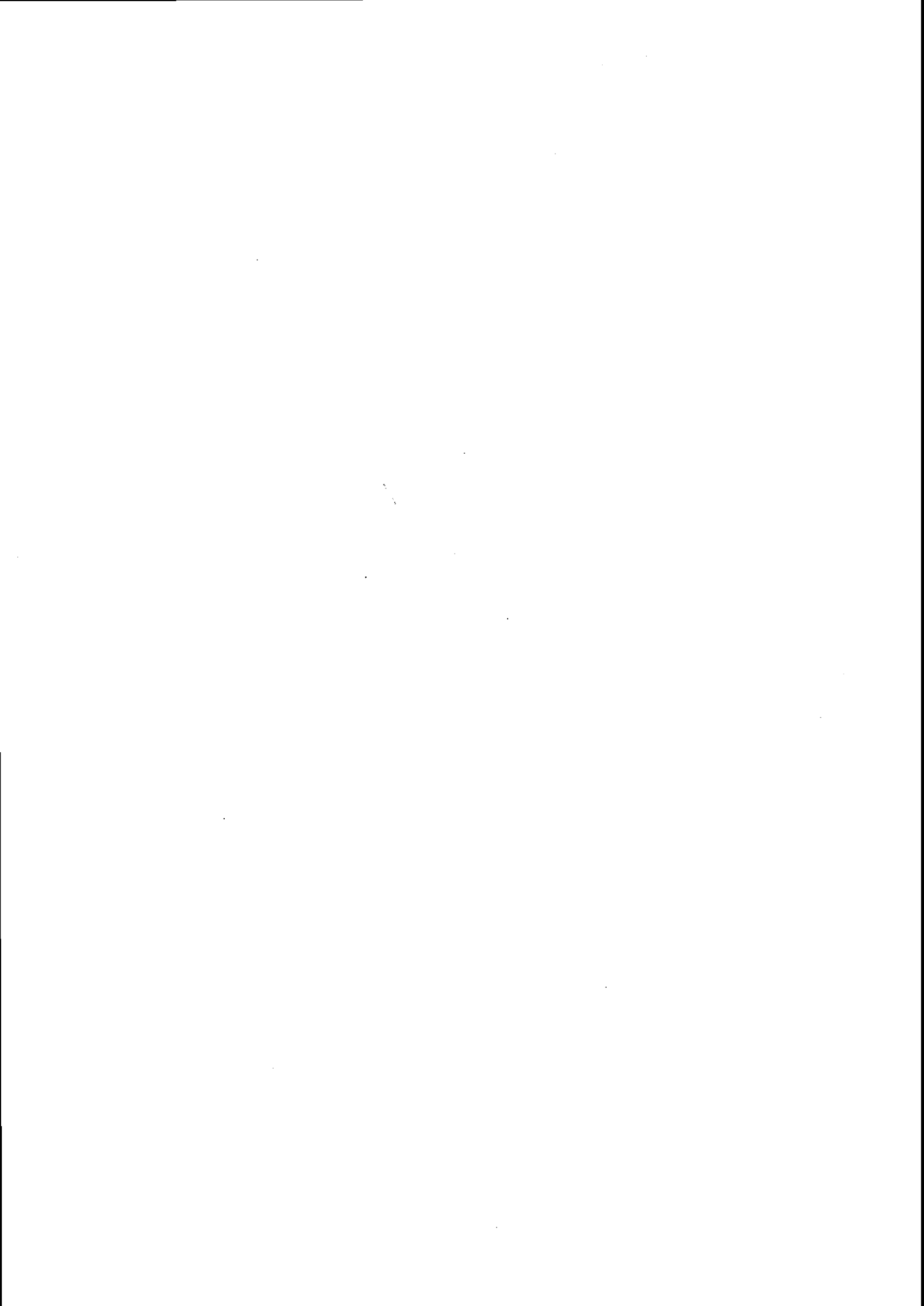
Consent 6382-1

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.

Signed at Stratford on 7 December 2005

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

Consent Granted
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 at or about GR: Q19:228-200

Expiry Date: 1 June 2022

Review Date(s): June 2007, June 2009, June 2015

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

Legal Description: Pt Secs 32-34 Blk VI Huiroa SD, Lots 2-3 Lot 5 DP 7088
Lot 2 DP 16055

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.
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.

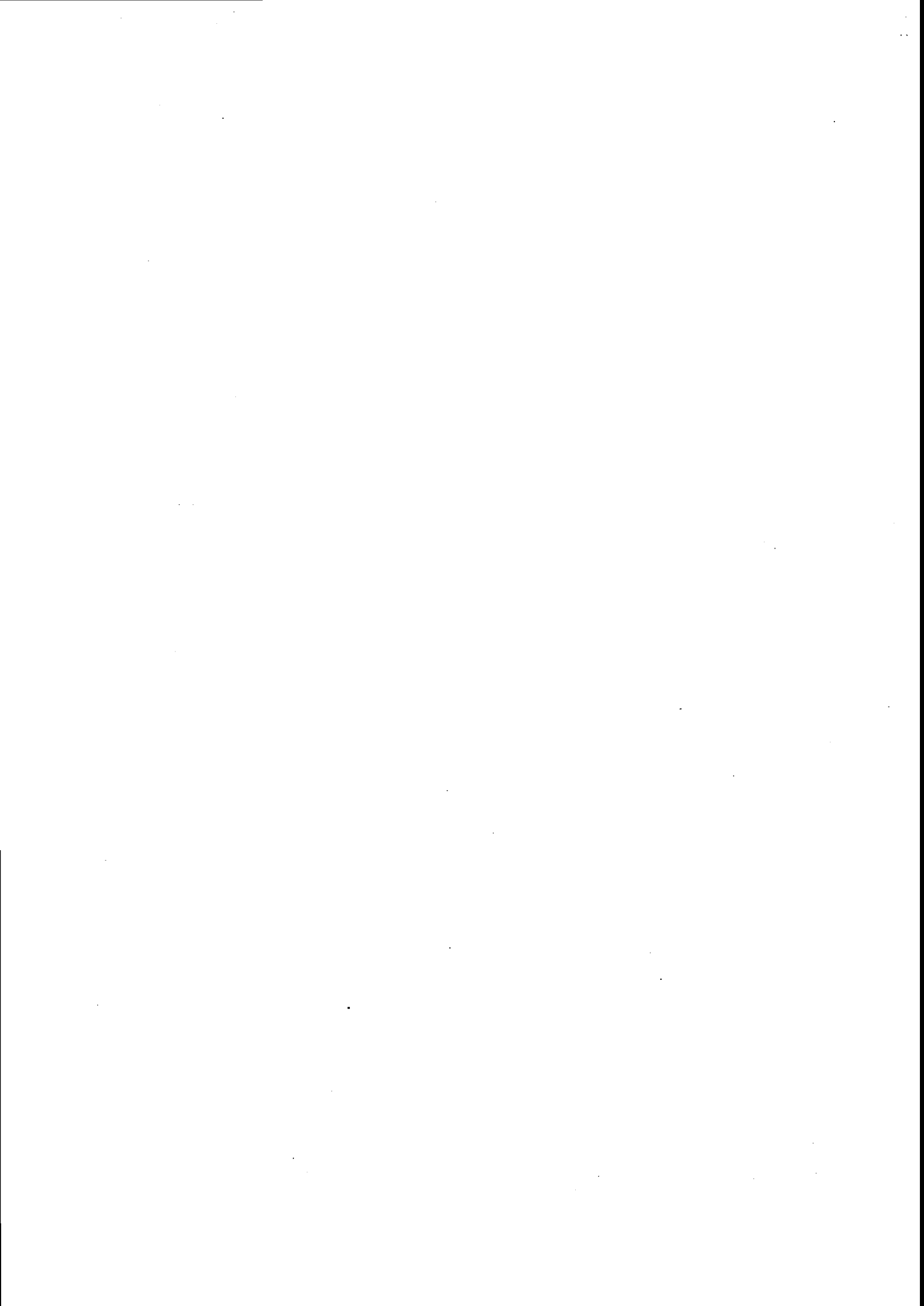
Consent 6381-1

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.
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.

Signed at Stratford on 7 December 2005

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

Change To
Conditions Date: 23 June 2006 [Granted: 27 July 2004]

Conditions of Consent

Consent Granted: To impound water behind a dam on 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, Inglewood

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

*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.

Signed at Stratford on 23 June 2006

For and on behalf of
Taranaki Regional Council

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

Consent Granted
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 at or about 2624800E-6221300N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Ratapiko Road, Ratapiko, Inglewood

Legal Description: Pt 51-52, 54-55 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Lake Ratapiko

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.
- 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 July 2007

For and on behalf of
Taranaki Regional Council

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: 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 at or about 2625100E-6220900N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Ratapiko Road, Ratapiko, Inglewood

Legal Description: Sub 4 Pt Sec 54 Blk VI Huiroa SD

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.

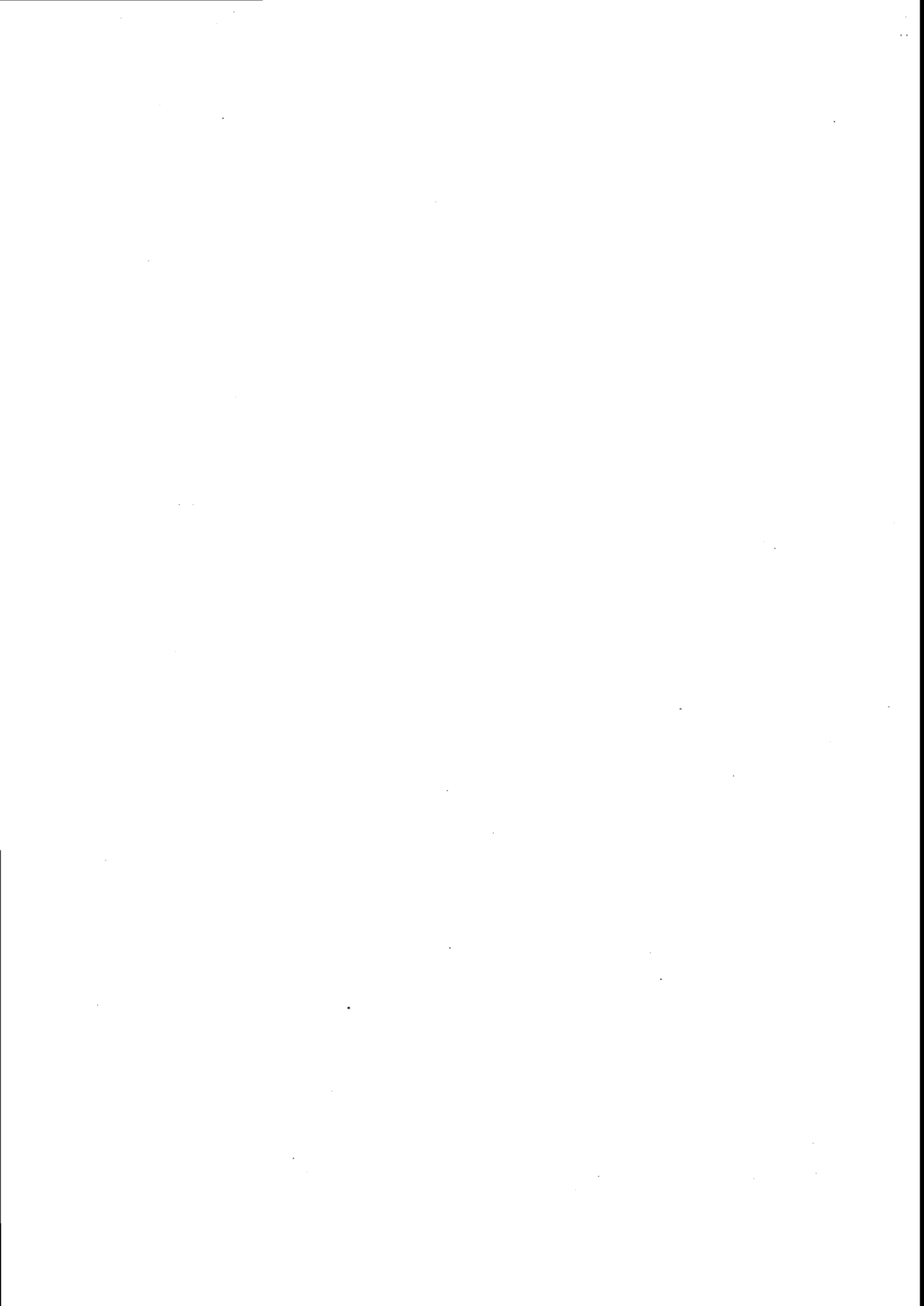
Consent 5084-1

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 July 2007

For and on behalf of
Taranaki Regional Council

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: 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 at or about 2622800E-6220100N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Mangaotea Aqueduct Mangaotea Road, Ratapiko, Inglewood

Legal Description: Lot 3 D P 11327 Pt Sec 33 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Manganui
Mangaotea

Consent 5082-1

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.

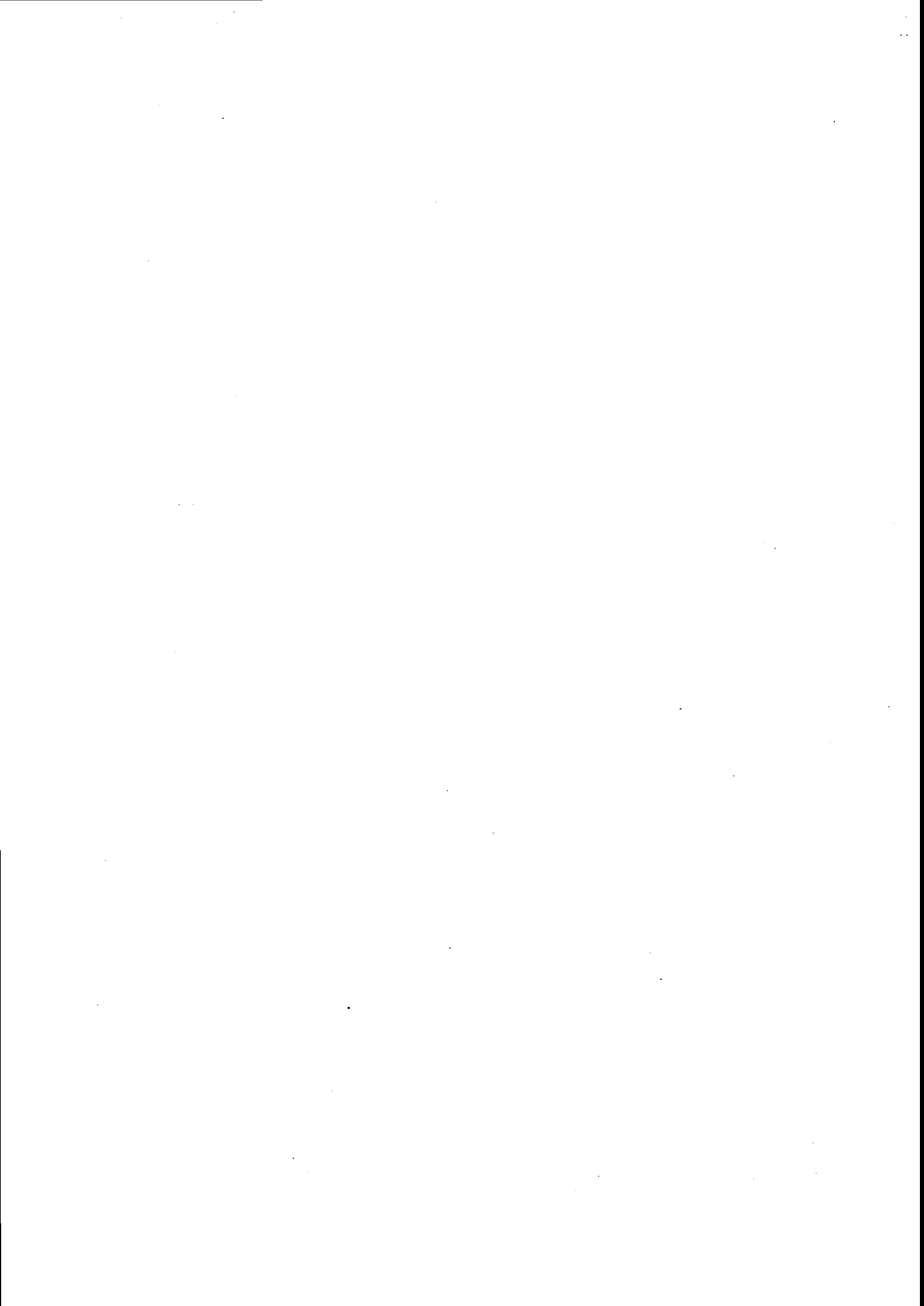
Consent 5082-1

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 July 2007

For and on behalf of
Taranaki Regional Council

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

Consent Granted
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 at or about 2622800E-6220100N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

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

Legal Description: Pt sec 25, 27, 31,32, 33, 51, 52, 54, 55 Blk IV Huiroa SD

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.

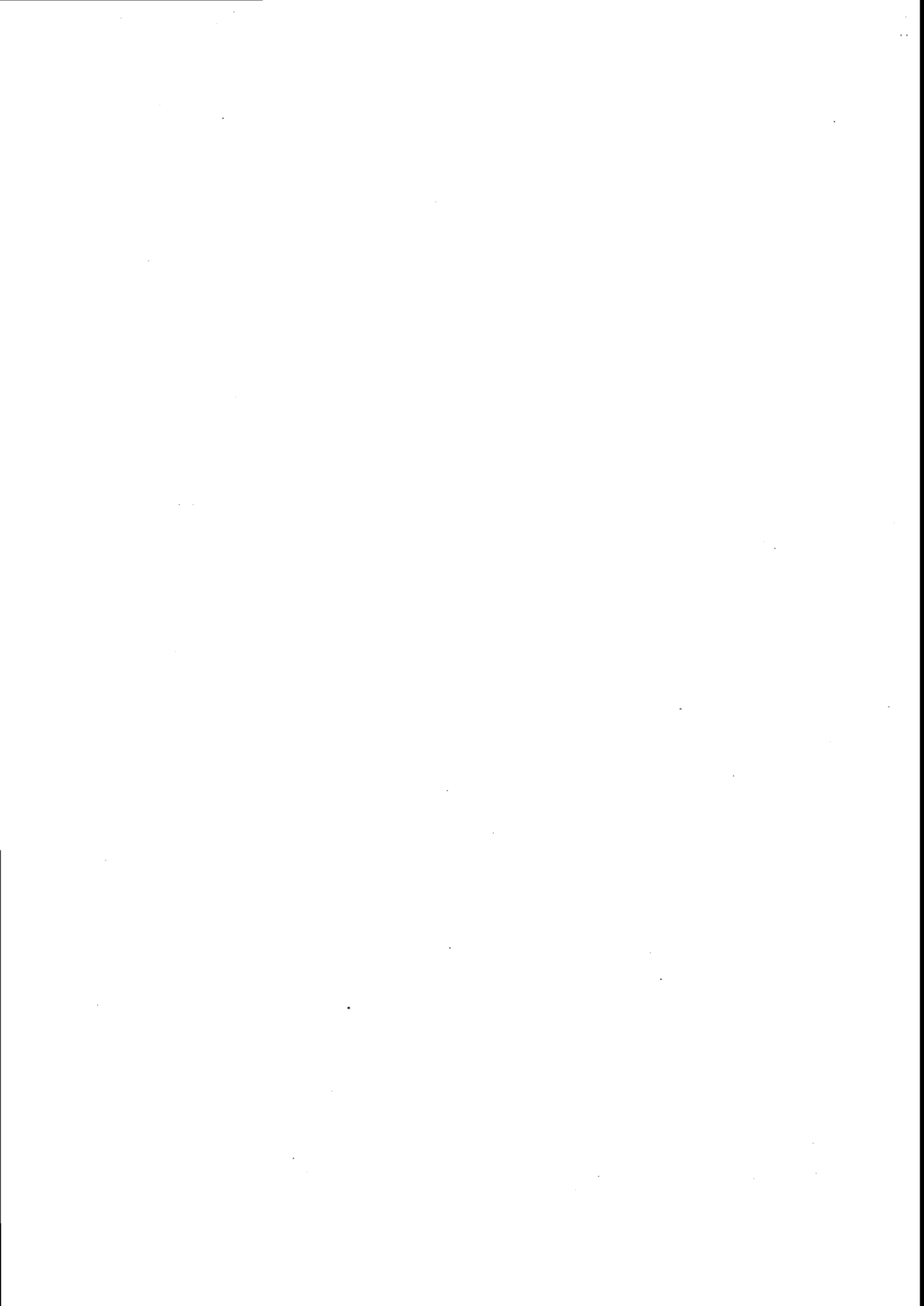
Consent 5081-1

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 July 2007

For and on behalf of
Taranaki Regional Council

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: 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 at or about 2625100E-6221500N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Lake Ratapiko, Ratapiko Road, Ratapiko

Legal Description: Pt 51-52, 54-55 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Lake Ratapiko

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.
- 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 July 2007

For and on behalf of
Taranaki Regional Council

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

Consent Granted
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 at or about 2620200E-6220100N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

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

Legal Description: Pt Sec 25, 27, 31-33, 51-52, 54-55 Huiroa SD

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 July 2007

For and on behalf of
Taranaki Regional Council

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

Consent Granted
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 at or about 2624800E-6221300N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Ratapiko Road, Ratapiko, Inglewood

Legal Description: Pt 51-52, 54-55 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Lake Ratapiko

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 July 2007

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

Consent Granted
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 at or about
2626600E-6221300N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Ratapiko Road, Ratapiko, Inglewood

Legal Description: Pt 51-52, 54-55 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Lake Ratapiko

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

Consent 5087-1

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 July 2007

For and on behalf of
Taranaki Regional Council

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: 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 at or about 2628500E-6222900N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Motukawa Road, Ratapiko, Inglewood

Legal Description: Sub 5 Pt Sec 14 Blk VII Huiroa SD

Catchment: Waitara

Tributary: Makara

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 July 2007

For and on behalf of
Taranaki Regional Council

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

Change To
Conditions Date: 4 November 2002 [Granted: 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 at or about 2625100E-6220900N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

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

Legal Description: Sub 4 Pt Sec 54 Blk VI Huiroa SD

Catchment: Waitara

Tributary: Makino
Mako
Lake Ratapiko

Consent 3373-2

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 July 2007

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

Consent Granted
Date: 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 between 2620200E-6220100N and 2626512E-6221308N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

Site Location: Motukawa Hydro Race and Lake Ratapiko, Ratapiko Road, Ratapiko, Inglewood

Legal Description: Pt Sec 25, 27, 31-33, 51-52, 54-55 Huiroa SD

Catchment: Waitara

Tributary: Lake Ratapiko

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

Consent 3371-2

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 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 Q19:239 213].
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

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

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 July 2007

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

Consent Granted
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 at or about 2620200E-6220100N

Expiry Date: 1 June 2022

Review Date(s): June 2001, June 2003, June 2009, June 2015

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

Legal Description: Pt Sec 25, 27, 31-33, 51-52, 54-55 Huiroa SD

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 2620200E-6220100N.
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 July 2007

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 BJ243
Doc No 1429882
Date 10 November 2014

Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, May 2012

Introduction

This was the only scheduled biomonitoring survey relating to the Motukawa HEP scheme for the 2011-2012 monitoring year. Reports presenting the results from surveys performed since the 2001-2002 monitoring year are presented in the references in this report. With regards to the current survey, the scheme was operating normally, although there had been a sizeable fresh 10 days prior, with the Manganui River at the SH3 recorder exceeding a flow of 23 times the median flow (more than 20,000 l/s), ten days previously. The flow downstream of the weir had been below 800 litres per second for seven days preceding this survey.

Methods

The standard '400 ml kick-sampling' technique was used to collect streambed macroinvertebrates from four sites in the Manganui River (Table 1, Figure 1) on 25 May 2012, 8 and 10 days after flows in excess of three and seven times the median flow respectively. 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).

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

Site No.	Site code	Map reference	Location
2	MGN 000300	Q20: 201 196	400 m upstream of weir (upstream of Tariki Road)
4	MGN 000320	Q19: 203 203	300 m downstream of weir
5	MGN 000360	Q19: 216 206	1700 m downstream of weir
6	MGN 000375	Q19: 209 206	2300 m downstream of Tariki weir

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.

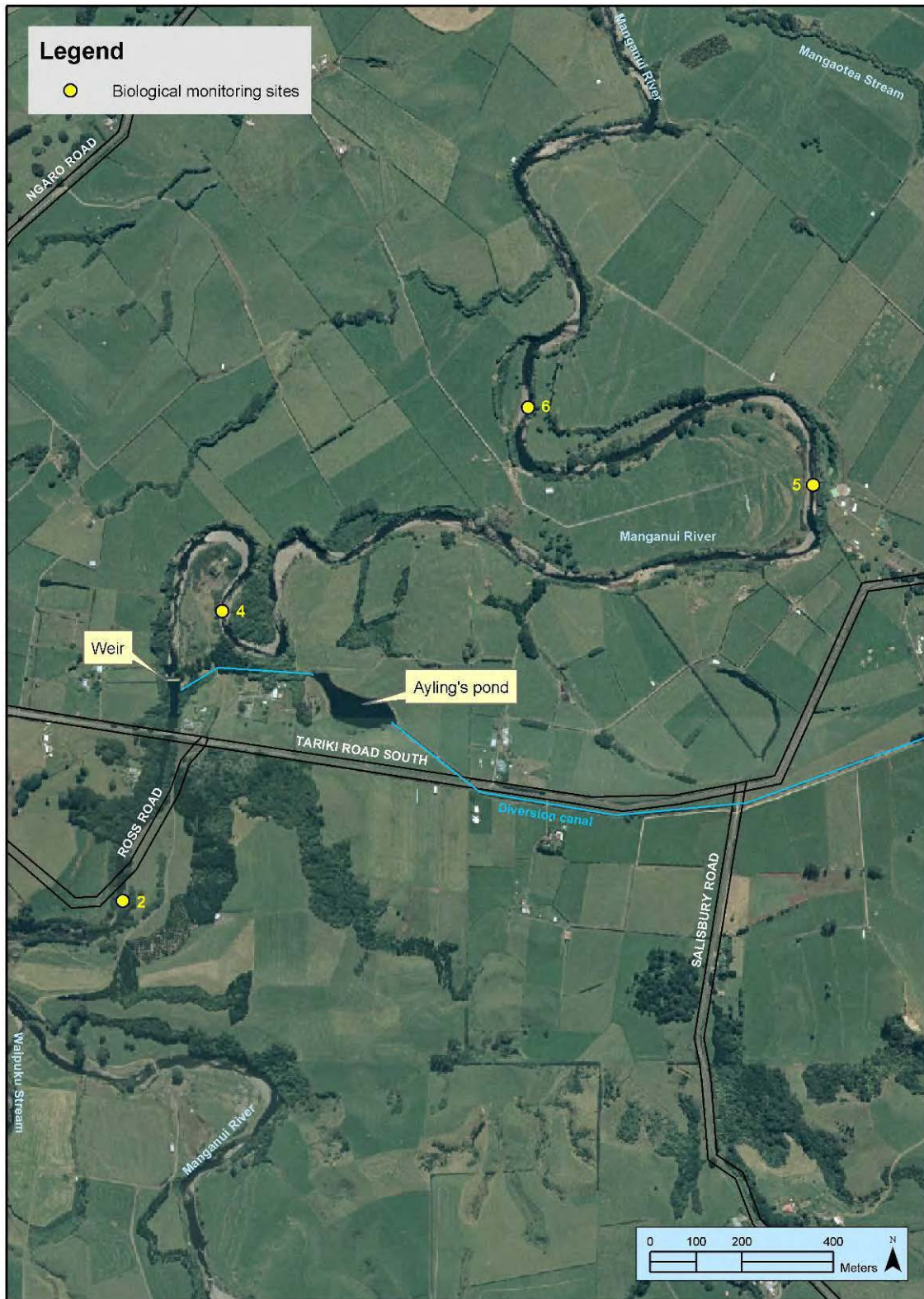


Figure 1 Biological monitoring sites in the Manganui River in relation to the Motukawa Power Scheme

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. More 'sensitive' communities inhabit less polluted waterways.

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.

Results and discussion

At the time of this afternoon survey the water temperature in the Manganui River was 10.2°C upstream of the weir, and ranged from 9.6°C to 10.2°C downstream of the weir (Table 2). At all sites, the flow was moderate, clear and uncoloured. The flow was swift at sites 2, 4 and 5, and steady at site 6. The similarity in water temperature was reflective of the time of year this survey was undertaken, with the heat of the summer no longer present.

The substrate at all sites comprised predominantly gravel, cobbles and boulders, with some sand also being present. Periphyton mats were present in patches on the streambed at sites 4 and 6, while only a slippery film was present at site 2 and 5. No filamentous algae was noted at any site, and an observation was made during the survey, specifically noting a lack of periphyton at site 6.

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.

Table 2 Selected environmental parameters monitored on 25 May 2012 in relation to the Motukawa HEP scheme

Site no.	Site code	Time of sampling (NZST)	Water temperature (°C)
2	MGN000300	1445	10.2
4	MGN000320	1420	9.6
5	MGN000360	1355	10.2
6	MGN000375	1315	9.9

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	Numbers of taxa			MCI values			SQMCI _s values				
	N	Median	Range	Current survey	Median	Range	Current survey	N	Median	Range	Current survey
2	36	25	12-35	24	100	86-116	112	20	3.2	2.3-6.8	7.0
4	35	26	14-34	31	101	85-123	107	20	4.5	2.7-7.4	6.9
5	32	24	16-31	17	96	79-119	116	20	4.3	2.2-7.2	7.5
6	18	24	19-30	27	101	81-123	115	18	3.5	2.0-7.4	7.3

Site 2 - upstream of weir (MGN000300)

Twenty-four taxa were recorded at this site, upstream of the Tariki weir. This was very similar to the median of numbers recorded by all previous surveys (Table 3). The presence of five 'highly sensitive' taxa was indicative of good preceding physicochemical water quality. The community was characterised by one 'highly sensitive' taxon (mayfly (*Deleatidium*)); six 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmids beetles, dobsonfly (*Archichauliodes*), caddisfly (*Costachorema* and *Hydrobiosis*), and crane fly (*Aphrophila*)); and one 'tolerant' taxon (free-living caddisfly (*Aoteapsyche*)). The numerical dominance of the 'highly sensitive' mayfly *Deleatidium* was also indicative of good preceding physicochemical water quality conditions, and coupled with the reduced number of abundant 'tolerant' taxa, increased the SQMCI_s score to 7.0 units. This was significantly higher than the median SQMCI_s for this site (Stark, 1998) and 0.2 unit higher than the previous maximum SQMCI_s score recorded at this site. This result was most likely related to the cooler autumn conditions, and the relatively frequent floods that flushed the river (about seven in the previous two months).

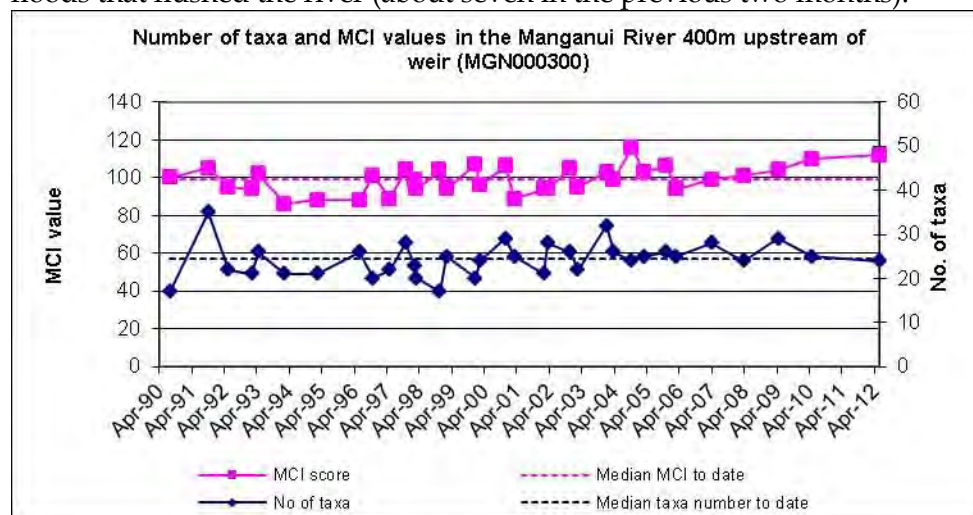


Figure 2 Number of taxa and MCI values since 1990 for the Manganui River upstream of the Tariki weir

The MCI value (112) was also significantly higher (Stark, 1998) than the long term median (Table 3, Figure 2) and was due to the relative balance between 'sensitive' (71% of richness) and 'tolerant' taxa. The score was also significantly [15 units] higher than the predicted score 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.

Table 4 Macroinvertebrate fauna of the Manganui River in relation to Motukawa H.E.P scheme sampled on 25 May 2012

Taxa List	Site Number	MCI score	2	4	5	6
	Site Code		MGN000300	MGN000320	MGN000360	MGN000375
	Sample Number		FWB12293	FWB12294	FWB12295	FWB12296
NEMERTEA	Nemertea	3	-	R	-	-
ANNELIDA	Oligochaeta	1	-	C	C	R
MOLLUSCA	<i>Latia</i>	5	-	R	-	-
	<i>Potamopyrgus</i>	4	R	-	R	-
EPHEMEROPTERA	<i>Austroclima</i>	7	R	C	-	-
	<i>Coloburiscus</i>	7	VA	VA	C	VA
	<i>Deleatidium</i>	8	XA	XA	XA	XA
	<i>Nesameletus</i>	9	C	C	C	A
	<i>Zephlebia group</i>	7	-	R	-	R
PLECOPTERA	<i>Acroperla</i>	5	-	R	-	-
	<i>Megaleptoperla</i>	9	-	R	-	-
	<i>Zelandobius</i>	5	R	R	-	R
	<i>Zelandoperla</i>	8	C	C	R	C
COLEOPTERA	Elmidae	6	VA	VA	VA	VA
	Hydraenidae	8	-	-	-	R
	Ptilodactylidae	8	-	-	-	R
MEGALOPTERA	<i>Archichauliodes</i>	7	A	VA	C	A
TRICHOPTERA	<i>Aoteapsyche</i>	4	VA	VA	R	A
	<i>Costachorema</i>	7	A	C	R	C
	<i>Hydrobiosis</i>	5	A	C	C	A
	<i>Neurochorema</i>	6	-	R	-	-
	<i>Psilochorema</i>	6	R	-	R	R
	<i>Beraeoptera</i>	8	C	A	R	C
	<i>Confluens</i>	5	R	A	R	A
	<i>Olinga</i>	9	R	-	-	R
	<i>Pycnocentria</i>	7	-	C	-	C
DIPTERA	<i>Pycnocentroides</i>	5	R	A	-	C
	<i>Aphrophila</i>	5	A	A	R	A
	Eriopterini	5	C	C	C	R
	<i>Maoridiamesa</i>	3	C	C	-	-
	Orthocladinae	2	R	R	-	R
	<i>Polypeditum</i>	3	-	R	-	-
	Tanytarsini	3	-	C	-	R
	Empididae	3	R	R	-	R
	Muscidae	3	R	R	-	R
	<i>Austrosimulium</i>	3	R	-	-	-
Tanyderidae	4	-	-	R	R	
ACARINA	Acarina	5	-	R	-	-
No of taxa			24	31	17	27
MCI			112	107	116	115
SQMCIs			7.0	6.9	7.5	7.3
EPT (taxa)			14	17	10	15
%EPT (taxa)			58	55	59	56
'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 31 taxa was found at this site, 300 metres downstream of the hydro weir. This richness was higher than the long term median number of taxa previously found at this site and that recorded at site 2 upstream of the weir (Table 3). The proportion of 'sensitive' taxa (71% of richness) at this site was also equal to that recorded at the upstream site, resulting in a similar MCI of 107 units, which was six units above the long term median for this site. Seasonal changes in MCI scores have not been so consistent at this site, compared to the site upstream of the weir, a factor which may be attributable to the flow regulation in this reach (and a consequently reduced frequency of flood flows). Seasonal changes will no longer be detectable, with the cessation of spring sampling after 2006.

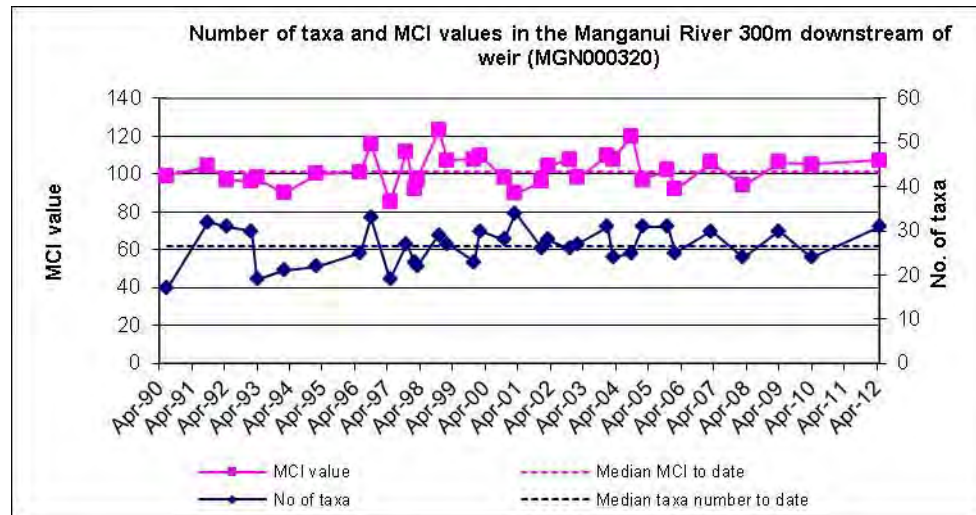


Figure 3 Number of taxa and MCI values since 1990 for the Manganui River 300m downstream of the Tariki weir

The community was characterised by two 'highly sensitive' taxa (mayfly (*Deleatidium*) and caddisfly (*Beraeoptera*)); six 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmids beetles, dobsonfly (*Archichauliodes*), caddisfly (*Confluens* and *Pycnocentroides*), and *Aphrophila* crane fly); and one 'tolerant' taxon (caddisfly (*Aoteapsyche*)). The numerical dominance of 'highly sensitive' *Deleatidium* mayfly larvae was responsible for the relatively high SQMCI_s value of 6.9 units, similar to that recorded at the upstream 'control' site. Nine taxa were abundant compared with the previous survey, in which eight taxa were abundant, and the fact that seven 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 reduced richness of 17 taxa was recorded at this site, 1.7 kilometres downstream of the Tariki weir. This was lower than the median, and a reduction from the previous survey, which recorded 20 taxa (Table 3, Figure 4). This may be a reflection of the different area sampled during this survey, although the higher flows experienced by the residual flow reach in the weeks prior to this survey may also have had an influence. The community consisted of a slightly higher proportion of 'sensitive' taxa (76%) than the two upstream sites. This resulted in a slightly higher MCI score (116), which was the second highest MCI score recorded for this site. In addition, this score was a significant 20 units higher than the long term median for this site, and the highest recorded in the current survey. The current result is a continuation of a trend observed over the last three years, with MCI scores improving with each survey, although the current result is likely a reflection of the cooler autumn temperatures, and recent flushing flows.

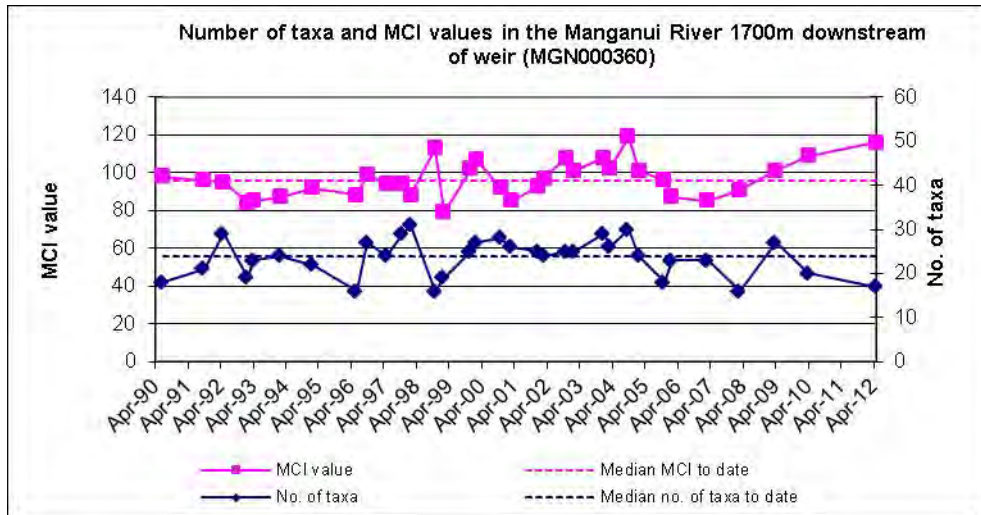


Figure 4 Number of taxa and MCI values since 1990 for the Manganui River 1700m downstream of the Tariki weir

These results may suggest a return to the trend of above median values. Such a trend had generally been maintained since the implementation of the 400 L/s residual flow (Figure 4), 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. Previous surveys had recorded that there was still some smothering occurring at this site, caused by the deposition of sand. However, the current survey did not note any such smothering.

The dominant taxa at this site included only one 'highly sensitive' taxon (mayfly (*Deleatidium*)) and one 'moderately sensitive' taxon (elmid beetles), a reduction from the six taxa recorded in abundance in the previous survey, and the nine taxa recorded in abundance upstream in the current survey. Similar to the two sites upstream, the numerical dominance of the extremely abundant 'highly sensitive' mayfly *Deleatidium* resulted in the good SQMCI_s score of 7.5 units at site 5, which was significantly higher than the median for this site (Stark, 1998) and the highest recorded at any site included in this survey to date. Although this is likely to be a reflection of the reduced water temperatures, it is also a reflection of the lack of other abundant taxa. In addition, ten taxa recorded upstream at site 4 exhibited a significant reduction in abundance at this site. Overall, this suggests habitat limitation at this site, with it likely that the residual flow was not providing sufficient habitat to maintain an abundant invertebrate community at this site. This could also explain the lower taxa richness recorded at this site.

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

A moderate richness of 27 taxa was recorded at this site, 2.3 kilometres downstream of the weir. This was three taxa more than the median richness recorded from the 18 previous surveys at this site (Table 3) but within the range of richnesses recorded at the other three upstream sites in this survey (Table 3).

A moderate proportion (26% of richness) of the community were 'tolerant' taxa (Table 5), while the presence of seven '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*), six 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmid beetles, dobsonfly (*Archichauliodes*), caddisfly (*Hydrobiosis* and *Confluens*) and *Aphrophila* crane fly); and one 'tolerant' taxon (net building caddisfly (*Aoteapsyche*)).

Seven taxa exhibited significant changes in numerical abundance from site 5 to site 6, all of them increases in abundance. The increased abundance of some less 'sensitive' taxa from site 5 upstream resulted in a SQMCI_s score that was slightly lower (Stark, 1998), at 7.3 units. In terms of this site however, this represents a good SQMCI_s score, being a significant 3.8 units higher than the long term median (Stark, 1998), and only 0.1 unit less than the previously recorded maximum.

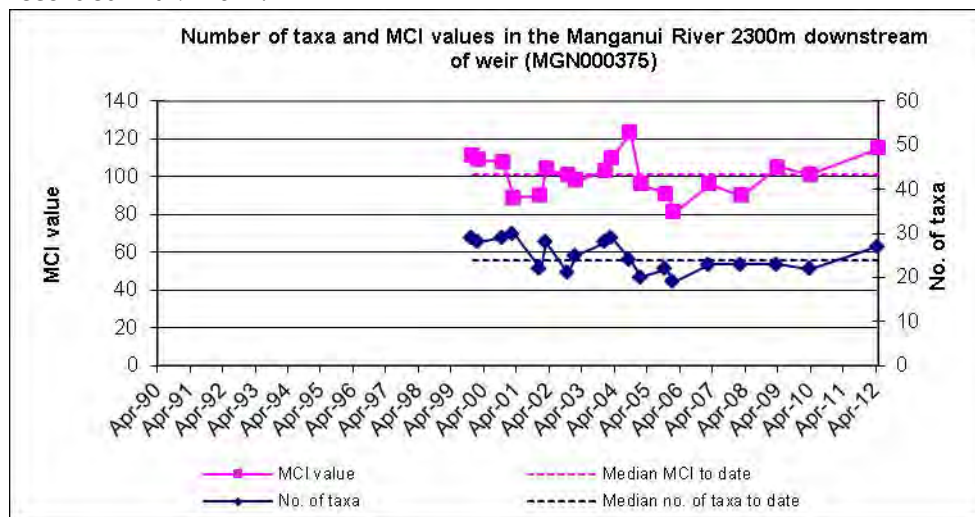


Figure 5 Number of taxa and MCI values since 1999 for the Manganui River 2300m downstream of the Tariki weir

The MCI score for this site (115) was similar to that recorded at all upstream sites, and reflected a similar proportion of 'sensitive' taxa in the community (74%). This MCI score was significantly higher than the median for this site, and that recorded during the previous survey at this site (Figure 5) (Stark, 1998). This improvement indicated a lack of impacts of H.E.P. abstraction and habitat limitation through the residual flow reached, which is most likely related to the reduced temperatures and frequent freshes that preceded this survey.

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 SQMCI_s scores for each site.

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

The macroinvertebrate survey conducted on 25 May 2012 found taxonomic richness (number of taxa) similar to the median numbers of taxa previously recorded at these sites, although site 5 recorded a lower richness than that recorded at the other three sites (by between 7 and fourteen taxa). MCI values were relatively similar in a downstream direction, which was likely to have been related to the cooler water temperatures that preceded this autumn survey, and also the relatively frequent floods that occurred in the months prior. 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 current survey recorded cool temperatures (around 10 °C), and little periphyton, with no filamentous algae, and only two sites supporting patchy algal mats. 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, a reflection of the moderate flow conditions which occurred over summer 2012.

There were a small number of changes in the macroinvertebrate communities noted between sites 2 and 4, with five taxa increasing significantly in abundance, most likely due to the reduced flushing site 4 would experience, being downstream of the weir and abstraction. Site 5 was notable, in that there were only two taxa recorded in abundance, and ten taxa reduced significantly in abundance from that recorded at site 4. Recovery was noted at site 6, with six taxa increasing significantly in abundance. Although little change is indicated by the MCI and SQMCI_s scores, the abundance of invertebrates at this site reduced markedly, suggesting habitat limitation at this site. It is likely that the residual flow was not providing sufficient habitat to maintain an abundant invertebrate community at this site. This conclusion is also supported by the lower taxa richness recorded at this site, which was fourteen taxa less than that recorded at site 4 upstream.

In general, and with the exception of site 5, all sites were dominated by similar taxa. This was most probably associated with the fact that there had been relatively frequent freshes, with seven occurring in the two months previous. As this survey was undertaken in autumn, it was unlikely to show clear impacts from the diversion of water, as these impacts usually are most evident in summer, and directly related to differences in densities of periphyton cover and water temperatures. This was reflected by the fact that all sites contained moderately high 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.

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 indicated they were in particularly good health, when compared to their respective medians. This is not unexpected however, as the higher temperatures usually experienced in the residual flow reach, which are likely to reduce these scores, were not experienced prior to this survey, due in part to the time of year this survey was undertaken. It was noted however, that characteristic seasonal changes (i.e., higher MCI values in spring) have been demonstrated more consistently at the control site 2, upstream of the weir, compared to all three sites downstream in the residual flow reach, a trend which may be a result of the flow regulation in this reach. This trend is unlikely to be illustrated in future, with the change in monitoring programme to exclude spring monitoring, instigated in the 2006-2007 monitoring 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 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. The degree of improvement at this site in the current survey is even more marked, with the MCI score

being 20 units above the median, and the SQMCI_S score being 3.2 units higher than the median, both statistically significant improvements. 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 were representative of more 'natural' conditions, as the survey was undertaken in autumn, and was preceded by frequent freshes. The results indicate that the MCI scores at these sites improved markedly from previous surveys, as did 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 this result was due to the river experiencing regular floods that provided flushing flows, and this has been the dominant influence on the community. Overall, the results indicate that the invertebrate community supported by a residual flow of 400 litres per second, 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 current results also illustrate the impact on the invertebrate community of regular flushing flows.

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To Job Manager, Bart Jansma
From Scientific Officer, Bart Jansma
Report No BJ244
Doc No 1430545
Date 11 November 2014

Biomonitoring of the Manganui River in relation to the Tariki Road diversion weir for the Motukawa H.E.P. scheme, February 2014

Introduction

This was the only scheduled biomonitoring survey relating to the Motukawa HEP scheme for the 2013-2014 monitoring year. Reports presenting the results from surveys performed since the 2001-2002 monitoring year are presented in the references in this report. With regards to the current survey, the scheme was operating normally, although due to the river not having naturally overtopped the weir for 30 days, a flushing flow was being released down the river for a number of hours each day, as required by consent. There had been little variation in flow after a large (121 m³/sec) flood that occurred on 5 January 2014, with only three small freshes after that time. The flow downstream of the weir had been between 450 and 450 l/s for fifteen days preceding this survey, although the flushing flows, which had occurred each day for the five days immediately prior to this survey, increased the flow to around 930 l/s for a few hours each day (**Figure 1**).

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 25 February 2014, 29 and 30 days after flows in excess of three and seven times the median flow respectively. 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.

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

Site No.	Site code	Map reference	Location
2	MGN 000300	Q20: 201 196	400 m upstream of weir (upstream of Tariki Road)
4	MGN 000320	Q19: 203 203	300 m downstream of weir
5	MGN 000360	Q19: 216 206	1700 m downstream of weir
6	MGN 000375	Q19: 209 206	2300 m downstream of Tariki weir

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. More 'sensitive' communities inhabit less polluted waterways. 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.

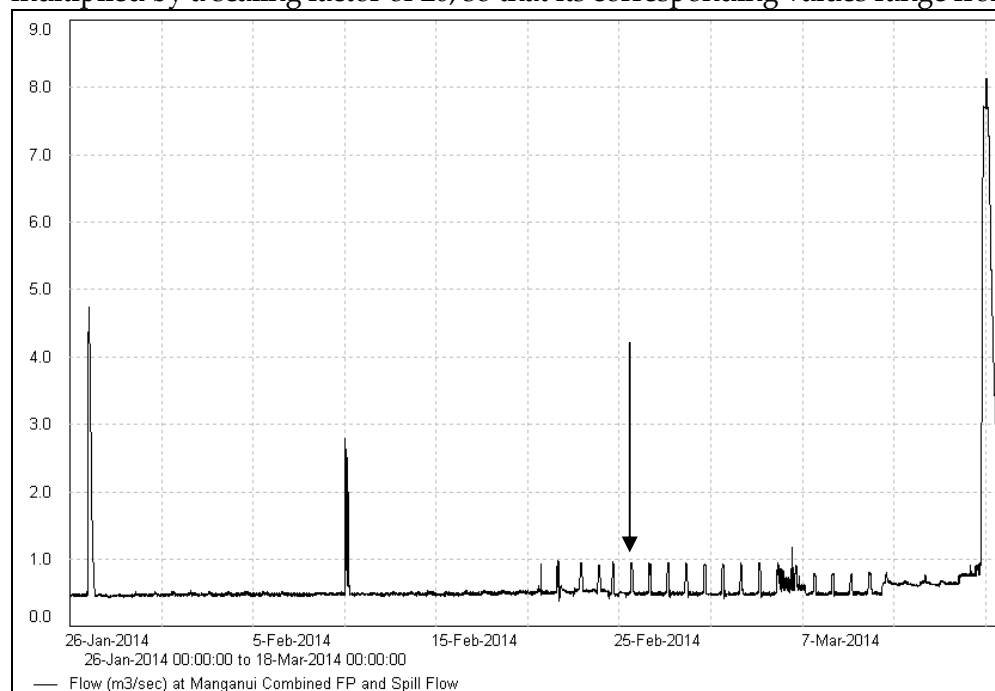


Figure 1 The flow (cubic meters per second) in the Manganui River downstream of the Tariki diversion weir, between 26 Jan 2014 and 18 March 2014. The arrow indicates the time of sampling.



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

Results and discussion

At the time of this afternoon survey the water temperature in the Manganui River was 19.4°C upstream of the weir, and ranged from 17.2°C to 20.1°C downstream of the weir (Table 2). At sites 2 and 4, the flow was moderate, clear and uncoloured, but sites 5 and 6 had a low, clear and uncoloured flow. It was noted that site 4 had much more flow than that observed at sites 5 and 6, and this was due to the flushing flow having started just prior to site 2 being sampled. The flow was swift at all sites. The variation in water temperature was interesting, with the coolest temperature actually recorded at site 4. It is likely that the flushing flows may have moved deeper cooler water from above the weir, resulting in the lower temperature at site 4.

The substrate at all sites comprised predominantly gravel, cobbles and boulders, with some sand also being present. Both periphyton mats and filaments were present in patches at sites 4, 5 and 6, while the control site (site 2) supported only a slippery film of algae.

A number of notable observations were made during this survey, with a school of fish (possibly inanga) in the pool just upstream of site 5, a large dead brown trout at site 6, and also a live trout at site 6. The live trout had a dark colour and was not behaving in a typical way, indicating that it may have been stressed or sick.

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.

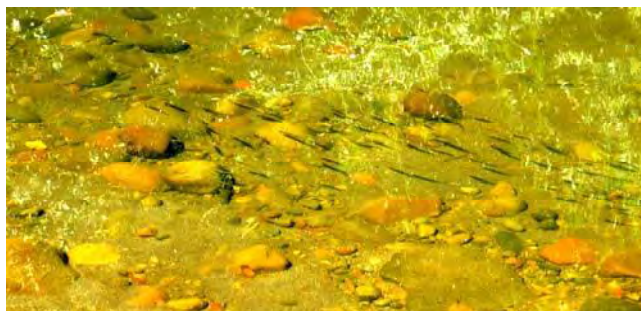
Table 2 Selected environmental parameters monitored on 26 April 2010 in relation to the Motukawa HEP scheme

Site no.	Site code	Time of sampling (NZST)	Water temperature (°C)
2	MGN000300	1445	19.4
4	MGN000320	1410	17.2
5	MGN000360	1335	20.1
6	MGN000375	1305	19.3



Photo 1

A large dead brown trout (left), observed at site 6, and a school of fish (below), observed upstream of site 5. Note the photo below has had its colours augmented to better display the fish.



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	Numbers of taxa			MCI values			SQMCI _s values				
	N	Median	Range	Current survey	Median	Range	Current survey	N	Median	Range	Current survey
2	37	24	12-35	28	100	86-116	107	21	3.2	2.3-7.0	7.0
4	36	27	14-34	29	102	85-123	108	21	4.5	2.7-7.4	6.0
5	33	24	16-31	25	96	79-119	107	21	4.4	2.2-7.5	6.9
6	19	24	19-30	25	101	81-123	97	19	3.8	2.0-7.4	5.9

Site 2 - upstream of weir (MGN000300)

Twenty-eight taxa were recorded at this site, upstream of the Tariki weir. This was four taxa more than the median of numbers recorded by all previous surveys (Table 3). The presence of five 'highly sensitive' taxa was indicative of good preceding physicochemical water quality. The community was characterised by one 'highly sensitive' taxon (mayfly (*Deleatidium*)); six 'moderately sensitive' taxa (mayfly (*Coloburiscus*), elmids beetles, dobsonfly (*Archichauliodes*), caddisfly (*Costachorema* and *Hydrobiosis*), and cranefly (*Aphrophila*)); and one 'tolerant' taxon (free-living caddisfly (*Aoteapsyche*)). The numerical dominance of the 'highly sensitive' mayfly *Deleatidium* was also indicative of good preceding physicochemical water quality conditions, and coupled with the reduced number of abundant 'tolerant' taxa, resulted in a SQMCI_s score of 7.0 units. This was significantly higher than the median SQMCI_s for this site (Stark, 1998) and equal to the previous maximum SQMCI_s score recorded at this site in the previous survey. This result reflects the high water quality and habitat conditions at this control site, despite the summer flow conditions at the time.

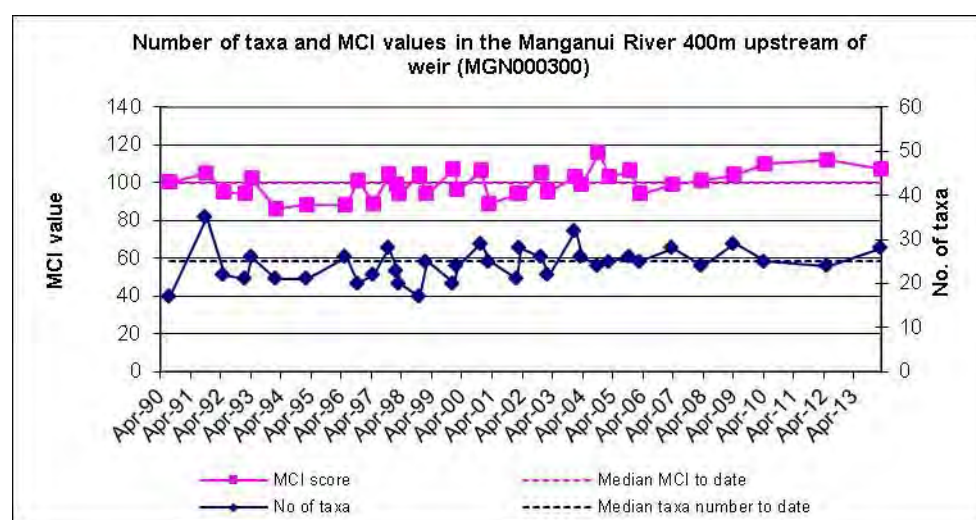


Figure 3 Number of taxa and MCI values since 1990 for the Manganui River upstream of the Tariki weir

The MCI value (107) was also slightly higher (Stark, 1998) than the long term median (Table 3, Figure 3) and was due to the relative balance between 'sensitive' (64% of richness) and 'tolerant' taxa. The score was insignificantly [9 units] higher than the predicted score 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.

Table 4 Macroinvertebrate fauna of the Manganui River in relation to Motukawa H.E.P scheme sampled on 25 February 2014

Taxa List	Site Number	MCI score	2	4	5	6
	Site Code		MGN000300	MGN000320	MGN000360	MGN000375
	Sample Number		FWB14173	FWB14174	FWB14175	FWB14176
ANNELIDA	Oligochaeta	1	R	R	C	C
	Lumbricidae	5	-	-	R	-
MOLLUSCA	<i>Potamopyrgus</i>	4	R	-	R	R
EPHEMEROPTERA	<i>Austroclima</i>	7	C	A	C	A
	<i>Coloburiscus</i>	7	VA	A	VA	A
	<i>Deleatidium</i>	8	XA	XA	XA	XA
	<i>Nesameletus</i>	9	C	A	C	C
	<i>Zephlebia group</i>	7	R	R	-	-
PLECOPTERA	<i>Zelandobius</i>	5	-	R	-	-
	<i>Zelandoperla</i>	8	C	R	-	R
HEMIPTERA	<i>Saldula</i>	5	R	-	-	-
	<i>Sigara</i>	3	-	-	R	R
COLEOPTERA	Elmidae	6	VA	A	VA	A
	Dytiscidae	5	-	R	-	-
	Hydraenidae	8	C	-	R	-
	Ptilodactylidae	8	R	-	-	-
MEGALOPTERA	<i>Archichauliodes</i>	7	A	A	A	A
TRICHOPTERA	<i>Aoteapsyche</i>	4	VA	XA	VA	XA
	<i>Costachorema</i>	7	A	A	C	C
	<i>Hydrobiosis</i>	5	A	A	A	A
	<i>Neurochorema</i>	6	R	R	-	R
	<i>Beraeoptera</i>	8	-	R	R	-
	<i>Confluens</i>	5	R	C	-	R
	<i>Olinga</i>	9	-	-	R	-
	<i>Oxyethira</i>	2	-	R	-	C
	<i>Pycnocentria</i>	7	R	R	R	-
	<i>Pycnocentroides</i>	5	R	R	C	R
DIPTERA	<i>Aphrophila</i>	5	A	A	A	A
	<i>Limonia</i>	6	-	R	-	-
	<i>Harrisius</i>	6	-	R	-	-
	<i>Maoridiamesa</i>	3	C	A	R	R
	Orthoclaadiinae	2	R	R	C	C
	Tanypodinae	5	-	R	R	R
	Tanytarsini	3	C	C	C	A
	Empididae	3	R	R	-	C
	Muscidae	3	R	-	R	R
	<i>Austrosimulium</i>	3	R	-	C	C
	Tanyderidae	4	R	R	-	-
No of taxa			28	29	25	25
MCI			107	108	107	97
SQMCIs			7.0	6.0	6.9	5.9
EPT (taxa)			13	15	11	11
%EPT (taxa)			46	52	44	44
'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 29 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 that recorded at site 2 upstream of the weir (Table 3). The proportion of 'sensitive' taxa (72% of richness) at this site was slightly higher than that recorded at the upstream site, but still resulted in a similar MCI of 108 units, which was six units above the long term median for this site. Seasonal changes in MCI scores have not been so consistent at this site, compared to the site upstream of the weir, a factor which may be attributable to the flow regulation in this reach (and a consequently reduced frequency of flood flows). Seasonal changes will no longer be detectable, with the cessation of spring sampling after 2006.

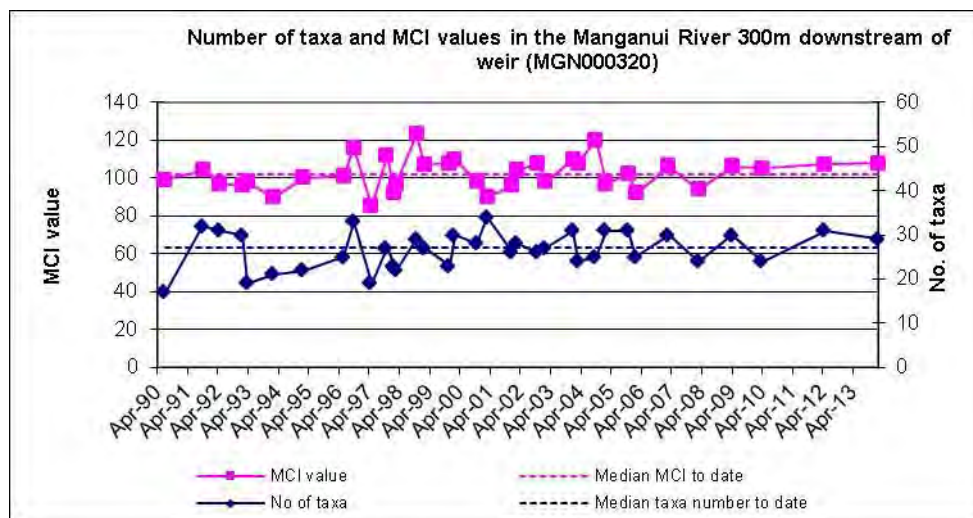


Figure 4 Number of taxa and MCI values since 1990 for the Manganui River 300m downstream of the Tariki weir

The community was characterised by two 'highly sensitive' taxa (mayfly (*Nesameletus* and *Deleatidium*)); seven 'moderately sensitive' taxa (mayfly (*Austroclima* and *Coloburiscus*), elm mid beetles, dobsonfly (*Archichauliodes*), caddisfly (*Costachorema* and *Hydrobiosis*), and *Aphrophila* crane fly); and two 'tolerant' taxa (caddisfly (*Aoteapsyche*) and midge larvae (*Maoridiamesa*)). The numerical dominance of 'highly sensitive' *Deleatidium* mayfly larvae was responsible for the relatively high SQMCI_s value of 6.0 units, significantly less than that recorded at the upstream 'control' site, but significantly higher than the long term median for this site. Eleven taxa were abundant, and the fact that nine 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 community richness of 25 taxa was recorded at this site, 1.7 kilometres downstream of the Tariki weir. This was similar to the median, and a recovery from the previous survey, which recorded 17 taxa (Table 3, Figure 4). This recovery suggests that the habitat limitation thought to be the cause of the lower richness was no longer present, despite the lower flows that preceded the current survey. The community consisted of an equal proportion of 'sensitive' taxa (64%) as that recorded at site 2, producing an equivalent MCI score of 107 units, which nine units higher than the long term trend for this site, but within the range previously recorded. The current result is a continuation of a trend observed over the last four years, with MCI scores improving with each survey, which is promising, considering the flow conditions which preceded this survey.

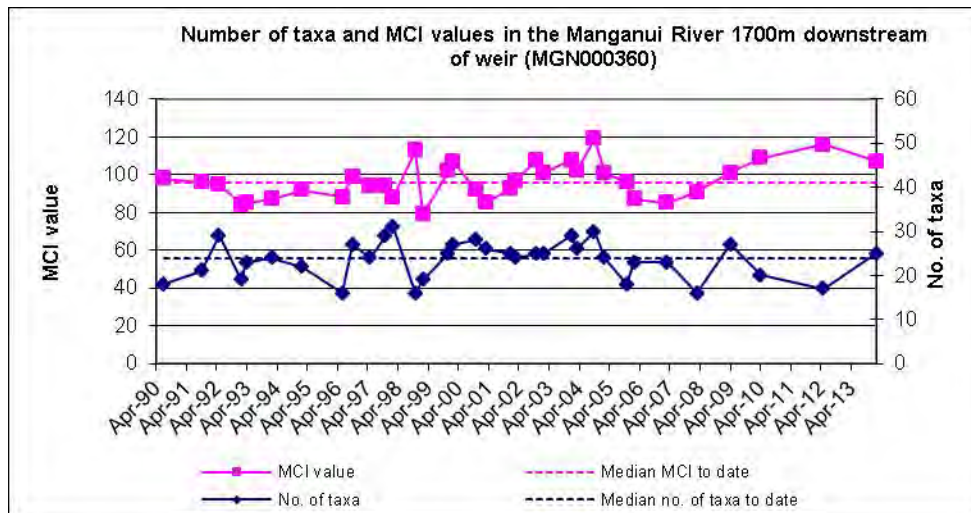


Figure 5 Number of taxa and MCI values since 1990 for the Manganui River 1700m downstream of the Tariki weir

These results may suggest a return to the trend of above median values. Such a trend 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 only one 'highly sensitive' taxon (mayfly (*Deleatidium*)), five 'moderately sensitive' taxa (mayfly (*Coloburiscus*) elmid beetles, dobsonfly (*Archichauliodes*), caddisfly (*Hydrobiosis*) and crane fly (*Aphrophila*)), a recovery from the two taxa recorded in abundance in the previous survey. Similar to the two sites upstream, the numerical dominance of the extremely abundant 'highly sensitive' mayfly *Deleatidium* resulted in the good SQMCI_s score of 6.9 units at site 5, which was significantly higher than the median for this site (Stark, 1998). This is a particularly good result, considering the preceding low flow conditions.

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

A moderate richness of 25 taxa was recorded at this site, 2.3 kilometres downstream of the weir. This was one taxon more than the median richness recorded from the 19 previous surveys at this site (Table 3) and within the range of richnesses recorded at the other three upstream sites in this survey (Table 3).

A moderately high proportion (44% of richness) of the community were 'tolerant' taxa (Table 5), although the presence of three 'highly sensitive' taxa (one in abundance) was indicative of good preceding physicochemical water quality. The community was characterised by one 'highly sensitive taxon (mayfly (*Deleatidium*), six 'moderately sensitive' taxa (mayfly (*Austroclima* and *Coloburiscus*), elmid beetles, dobsonfly (*Archichauliodes*), caddisfly (*Hydrobiosis*) and *Aphrophila* crane fly); and two 'tolerant' taxa (net building caddisfly (*Aoteapsyche*) and tanytarsid midge larvae).

Only two taxa exhibited a significant change in numerical abundance from site 5 to site 6, both of them increases in abundance, and both 'tolerant' taxa. The increased abundance of some less 'sensitive' taxa from site 5 upstream resulted in a SQMCI_s score that was significantly lower (Stark, 1998), at 5.9 units. In terms of this site however, this represents a good SQMCI_s score, being a significant 2.1 units higher than the long term median (Stark, 1998).

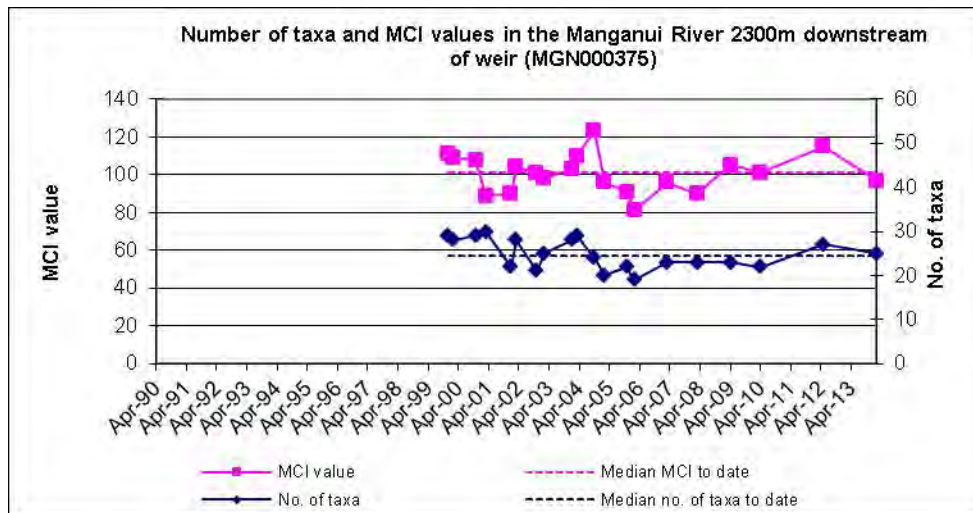


Figure 6 Number of taxa and MCI values since 1999 for the Manganui River 2300m downstream of the Tariki weir

The MCI score for this site (97) was less than that recorded at all upstream sites by at least 10 units, and reflected the decreased proportion of ‘sensitive’ taxa in the community (56%). This MCI score was similar to the median for this site, but significantly less than that recorded in the previous survey (Figure 5) (Stark, 1998). This deterioration is likely a reflection of the low flows that preceded this survey, as the water temperature would increase with distance from the weir. It is also an indication that the algal biomass had increased at this site, with midge larvae increasing in abundance, as did the algal piercing caddisfly *Oxyethira*.

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 SQMCI_s scores for each site.

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

With regards to the current survey conducted on 25 February 2014, the scheme was operating normally, although due to the river not having naturally overtopped the weir for 30 days, a flushing flow was being released down the river for a number of hours each day, as required by consent. There had been little variation in flow after a large (121 m³/sec) flood that occurred on 5 January 2014, with only three small freshes after that time. The flow downstream of the weir had been between 450 and 450 l/s for fifteen days preceding this survey, although the flushing flows, which had occurred each day for the five days immediately prior to this survey, increased the flow to around 930 l/s for a few hours each day.

This survey recorded taxonomic richness (number of taxa) similar to the median numbers of taxa previously recorded at these sites, which included a recovery in invertebrate richness at

site 5, when compared with that recorded in the previous survey. MCI values were relatively similar in a downstream direction, with the exception of site 6, which recorded a lower MCI score. 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 did not record such deterioration is a positive indication that the impacts of the diversion were not as severe as expected during this summer low flow period, and may be an indication that the flushing flows were having the desired effect. The current survey recorded warm temperatures (around 19 °C), and patchy growths of periphyton mats and filaments at all downstream sites. The upstream sites supported only a thin film of algae. 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, a reflection of the moderate flow conditions which occurred over summer 2010.

There were a few changes in invertebrate abundance noted between the sites, which is an improvement on the previous survey, particularly at site 5. In the previous survey, site 5 recorded far fewer invertebrates in abundance than the sites upstream and downstream. This was not the case in the current survey, indicating that the habitat limitation suspected in the previous survey was no longer present. This conclusion is also supported by the improved taxa richness recorded at this site, which was eight taxa more than that recorded in the previous survey.

In general, all sites were dominated by similar taxa. This is despite the summer low flow conditions, and may reflect a positive impact from the flushing flows. Only subtle changes in abundance indicate a change in periphyton biomass, with the most notable change being an increase in the abundance of 'tolerant' *Aoteapsyche* caddisflies at site 6 to extremely abundant, resulting in a reduction in SQMCI_S score. This was reflected by the fact that 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.

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 fair to good 'health', while the SQMCI_S scores indicated they were in particularly good health, 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. Water temperatures were as high as 24.4 °C in the week 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 is repeated in the current survey, with the MCI score at site 5 being eleven units above the median, and the SQMCI_S score being 2.5 units higher than the median, both statistically significant improvements. 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 typical of a low flow community, but one that has been exposed to frequent, small scale flushing flows. 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 litres per second, 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 current results also suggest that the small scale flushing flows required at times by consent may be reducing the degree of impacts caused by the diversion of water during summer low flow conditions.

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