



TONGARIRO POWER SCHEME



5 1

DISCLAIMER //

This report provides a summary of key environmental outcomes at the Tongariro Power Scheme for the operating period 1 July 2014 to 30 June 2015 (hereafter referred to as 'the reporting period').

There are a number of technical reports, research programmes, environmental initiatives and agreements that have fed into this report. It is not the intention of this report to reproduce or replicate this information, rather to provide a summary of it. Genesis Energy is happy to provide further details or technical reports or discuss matters directly with interested parties.

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1 July 2014 to 30 June 2015

Whio Numbers The 2014/15 whio breeding season saw a record year with 114 breeding pairs and 218 ducklings living in the approximately 48 kilometres of survey area downstream of the Western Diversion structures. With multiple single adults also detected during monitoring surveys, more than 450 whio were recorded this reporting period thriving within the predator trapped area (see Section 5.2).

Lake Rotoaira Relationship Agreement In 2014 Genesis Energy entered into a relationship agreement and easement arrangement with the Lake Rotoaira Trust and Lake Rotoaira Forest Trust (who own much of the land surrounding Lake Rotoaira), which recognises Genesis Energy's use of the lake and surrounding land for hydro generation. The easement also provides Genesis Energy with greater long term certainty for their current activities (see Section 6.1).

Rotoaira Weed Harvest Prolific weed growth on Lake Rotoaira resulted in vast rafts of Hornwort and Lagarosiphon during the summer growing season this reporting period. Genesis Energy and the Lake Rotoaira Trust undertook a weed harvesting trial that saw 2,610 m³ of green weed (783 tons) proactively removed from the lake via a weed harvesting operation, leased from the Bay of Plenty Regional Council, during May and June (see Section 6.1.2).

Elvers at Lake Otamangakau Over 5,000 juvenile eels (elvers) were collected and transferred upstream to the Upper Whanganui and into Lake Otamangakau during the reporting period. This represents the first significant tuna recruitment since the Western Diversion structures were first established over 40 years ago (see Section 6.1.3).

Tokiahuru Agreement During the reporting period Genesis Energy and Ngati Rangī negotiated an "Agreed Flow" to be released from the Tokiahuru Intake of the Wahianoa Aqueduct as part of the Mitigation Agreement. This flow is aimed at developing an ecology that will enhance tuna (eels) and freshwater crayfish (koura) populations. A monitoring programme is being developed to determine the success of the new flow at achieving this outcome (see Section 3.1.3)

Kiwi Forever – 10 year anniversary 2015 marked the 10 year anniversary of the Kiwi Forever programme at Tongariro, and is the third year that Genesis Energy has been involved. The programme is a collaboration between Untouched World, DoC, Ngati Rangī and Genesis Energy. Participants on the programme learn about whio conservation, healthy rivers and striking the balance, alongside the Ngati Rangī world view (see Section 8.3).

ABBREVIATIONS

AER	Annual Environmental Report
AFDM	Ash-free dry mass
BoPRC	Bay of Plenty Regional Council
CDMP	Construction Debris Management Plan
CSR	Comprehensive Safety Review
DOC	Department of Conservation
ECNZ	Electricity Corporation of New Zealand
EMS	Environmental Management System
EPT	Ephemeroptera, Plecoptera, and Trichoptera (the three insect orders commonly used to test water quality)
ERLAWs	Eastern Ruapehu Lahar Alarm and Warning System
EWP	Environment Working Party
FNU	Formazin Nephelometric Units
GETAC	Genesis Energy Turangi Aquatic Centre
GIS	Geographic Information System
GWh	Gigawatt hour
IBI	Index of Biological Integrity
KEF	Kayak Education Fund
LRFT	Lake Rotoaira Forest Trust
masl	meters above sea level – Moturiki Datum
MPI	Ministry for Primary Industries
MCI	Macro-invertebrate Community Index
MfE	Ministry for the Environment
MVA	Megavolt Ampere
MW	Megawatt
MWRC	Manawatu Wanganui Regional Council
NIWA	National Institute of Water and Atmospheric Research
NZDF	New Zealand Defence Force
NZSOLD	New Zealand Society on Large Dams
NZTA	New Zealand Transport Agency
PIT	Passive Integrated Transponder
QMCI	Quantitative Macro-invertebrate Community Index
RCMS	Resource Consent Management System
RECC	Renewable Energy Control Centre
RDC	Ruapehu District Council
RMA	Resource Management Act (1991)
SHMAK	Stream Health Monitoring Assessment Kit
TDC	Taupo District Council
TFEF	Tongariro Fishery Enhancement Fund
TNTC	Tongariro National Trout Centre
TPS	Tongariro Power Scheme
TRMP	Tongariro River Monitoring Plan
TSMG	Tokaanu Stream Management Group
VAMP	Volcanic Activity Management Plan
WDC	Wanganui District Council
WRC	Waikato Regional Council
WHIONE	Whio Operation Nest Egg
WRET	Whanganui River Enhancement Trust

Cover photo: Genesis Energy staff enjoy a recreational release on the Whakapapa River, while a whio keeps watch.

Back photo: Rafters prepare for a trip down the Tongariro River, with Poutu Intake in the background.

01 INTRODUCTION

Nau mai haere mai ki tenei Ripoata Taiao e pa ana ki te mahi hihiko mo tenei rohe o Tongariro.

Welcome to the 2014/15 Annual Environmental Report (AER) for the Tongariro Power Scheme (TPS). The purpose of this report is to update communities and stakeholders on the wide range of activities which occurred at the TPS between 1 July 2014 and 30 June 2015 (the 'reporting period'). This is the tenth AER for the TPS and follows the previous year's (2013/14) report. This report will:

- › provide an overview of resource consent compliance at the TPS;
- › provide an update on monitoring and research programmes;
- › report back on key projects;
- › report on community and environmental initiatives; and
- › define environmental objectives at the TPS for the next 12 months.

Genesis Energy aims to be accessible to the public, to address issues as they arise and to develop closer working relationships within the communities in which it operates.

1.1 DOCUMENT OVERVIEW

Genesis Energy produces a suite of reports and other documentation on its activities each year (Figure 1). These include detailed technical reports, audit reports and various reporting requirements to stakeholders. They address specific issues at a site/local level.

The Company's Annual Report provides an overview of Genesis Energy's performance as a company.

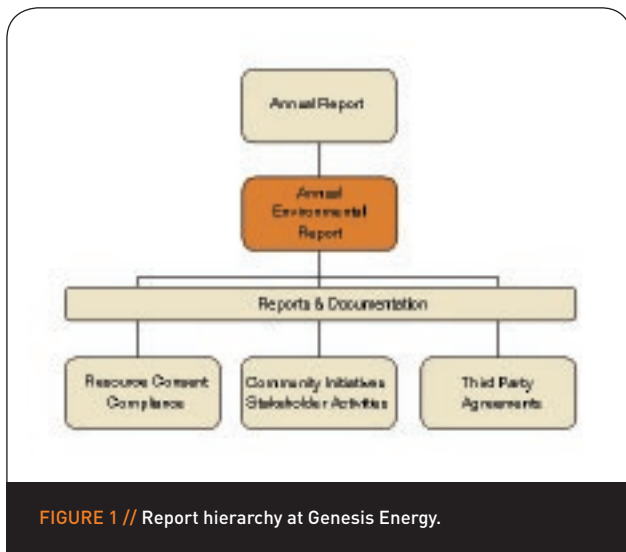


FIGURE 1 // Report hierarchy at Genesis Energy.

This AER bridges the gap between site specific reporting and the company's Annual Report. It provides an overview of all environmental and stakeholder activities relating to the TPS. It does not detail company strategy or performance (refer to the Annual Report for this information) or provide extensive detailed information on monitoring programmes and other initiatives undertaken (refer to specific technical reports listed in the references).

More information about Genesis Energy, including an electronic copy of this document, can be found on the website: www.genesisenergy.co.nz

1.2 RESOURCE CONSENTS OVERVIEW

The TPS environment is arguably one of the most extensively researched in New Zealand. A significant amount of baseline technical information was collected prior to the scheme's construction. Since 1991, with multi-stakeholder collaboration, an extensive amount of research and information on the ongoing effects of the scheme has been gathered.

Many individuals and organisations were directly involved, over a long period of time, in the process to renew resource consents for the TPS. These parties assisted the Electricity Corporation of New Zealand Limited (ECNZ) and then Genesis Energy to develop comprehensive consultation processes, to define issues, to identify how these issues should be investigated and, in most cases, to agree on outcomes to address these issues.

The extensive programme of consultation and research has led to a comprehensive suite of resource consents that authorise the continued operation of the TPS.

Ongoing monitoring programmes, some required by consent conditions and some undertaken by Genesis Energy for operational reasons, have added to information gathered during the consents process.

This document refers to a range of outcomes from the consultative process; both resource consent conditions as well as mitigation outcomes that operate outside of the resource consents. Where possible, outcomes resulted in resource consent conditions that require specific actions to occur at specific locations and points in time. However, some issues cannot be addressed via resource consent conditions because they cannot be easily tied to a specific location. In such cases, Genesis Energy works directly with parties to implement mitigation outcomes that are outside the resource consent conditions. These outcomes are referred to as 'agreements'.

1.3 HOW TO USE THIS DOCUMENT

This report documents environmental outcomes based on the following key geographical regions:

- › Eastern Diversion (Wahianoa, Lake Moawhango and the Moawhango River);
- › Tongariro River;
- › Western Diversion (Whanganui River Catchment); and
- › Lake Rotoaira and Lake Taupo.

The report also provides non-geographical information for:

- › Scheme-wide Outcomes; and
- › Community and Environmental Initiatives.

'**Bold text like this**' will help you to find your way around the report.

Consent Description Consent # (condition) identifies the parts of the report that relate to specific resource consent conditions.

'**Orange text like this**' throughout the report provides useful background information on specific issues.

1.4 GENESIS ENERGY'S APPROACH TO ENVIRONMENTAL MANAGEMENT

1.4.1 ENVIRONMENTAL MANAGEMENT SYSTEM

Genesis Energy operates an Environmental Management System (EMS) which incorporates a suite of management processes and tools that are well integrated with other core business systems. The EMS applies to all activities involving the use of natural and physical resources and the environment, from the conceptual stage of any project through to Genesis Energy's normal day-to-day operational activities.

The EMS aligns with the core Company behaviours of:

- › Make it happen – Be brave, smart, real and deliver together.
- › Keep it simple – Make it easy for our customers and ourselves
- › Do what's right – For each other, our customers and communities

During the reporting period, the Environmental Management and Community Engagement Policy Statement was approved by the Genesis Energy Board (see below), and is now one of the overarching documents in the Business Management System (BMS). This policy can also be found on the Genesis Energy website: www.genesisenergy.co.nz/environmental-management.

ENVIRONMENTAL MANAGEMENT AND COMMUNITY ENGAGEMENT POLICY STATEMENT

Whilst meeting its commitments to its shareholders, Genesis Energy is committed to ensuring that environmental, social and cultural awareness and responsibility are cornerstones of the Company's business activities and that a duty of care towards people, communities and the environment is exercised at and around our assets.

The Company achieves this by implementing an Environmental Management System that aligns with core Company values to ensure that:

- › The Company operates with integrity and a duty of care towards the environment, stakeholders and communities in which we operate.
- › The Company promotes environmental and social awareness as a responsibility of all people working at, or for, Genesis Energy.
- › The role of tangata whenua (the people of the land) as kaitiaki (guardians) of the natural resources and taonga (treasures) within their rohe (land) and the Treaty of Waitangi principles is respected.
- › The Company investigates and understands the effects of its operations on the environment and seeks collaborative solutions to avoid, remedy, or mitigate these while achieving its business commitments.
- › The Company ensures that environmental risks from its operations are identified, documented, audited and effectively managed in a manner that is consistent with the Company's risk appetite through the Company's risk management procedures and in accordance with the Enterprise-Wide Risk Management Policy.
- › The Company seeks full regulatory compliance as a minimum standard and publicly reports on its environmental performance.
- › The Company accounts for its use of natural resources and seeks to minimise use while meeting business requirements.
- › The Company aligns with internationally accepted environmental management standards.
- › The Company takes a continuous improvement approach in respect to environmental and stakeholder management through implementation, monitoring, audit and review.
- › The Company seeks to foster robust, long-term relationships with Tangata Whenua, communities and key stakeholders where it operates.

Genesis Energy is currently reviewing its Environmental Standards, Processes, Instructions and Guidelines which will sit below this Policy Statement in the BMS hierarchy. Genesis Energy's EMS is aligned, where appropriate, with international standards for environmental management systems, namely ISO 14001.

1.4.2 RESOURCE CONSENT MANAGEMENT SYSTEM

To help manage compliance across all generation sites, Genesis Energy has developed a Resource Consent Management System (RCMS). This system holds all information relating to resource consents, third party agreements, and permitted activities, and defines prompts and monitors actions required by their conditions, and reports on the status of these. The purpose of the RCMS is to ensure that Genesis Energy manages its statutory and stakeholder obligations effectively and that essential requirements are not overlooked.

All Genesis Energy staff can access the RCMS through the company's intranet but only designated administrators within the Environmental Team can make changes and update/sign off tasks, or view potentially confidential information contained within third party agreements.

An internal RCMS and environmental compliance audit is undertaken on a biennial basis at generation sites. The purpose of the audit is to ensure correct procedures are being followed and to identify any improvements that could be made to RCMS systems or processes to best achieve 100% compliance.

An internal audit was completed during the reporting period of the TPS resource consents and third party agreements. Minor improvements were identified and implemented as a result of the audit.

During the 2012/13 reporting period, improvements to the RCMS were identified including enhanced reporting functionality and ensuring that the system is more user-friendly. A project was planned to incorporate these changes in the RCMS in the reporting period, however IT infrastructure upgrades and the possible re-development of the RCMS mean this project has been deferred.

1.4.3 HYDROLOGY

Genesis Energy has an extensive hydrology monitoring network around the TPS. A variety of flow, water level, water quality and rainfall data is collected in real-time and telemetered near real-time. This information is sent to Genesis Energy's Renewable Energy Control Centre (RECC) together with a range of plant and market information.

During the reporting period the Hydrology staff continued improvements to the monitoring network. This has led to a high level of compliance along with more efficient operation of plant for Genesis Energy. Examples of instrumentation upgrades include the Lake Moawhango water level site, the Te Whaiau Canal flow station, the Lake Otamangakau water level site, the Lake Te Whaiau water level site, the Waikato Falls flow station, the Moawhango Tunnel valve flow and the Whakapapanui and Lake Moawhango rainfall sites.

A new station was installed at the Otamangakau Valve which now records the valve discharge more accurately than the downstream flow station that this site has replaced. Similarly, at the Lake Moawhango main drawdown valve, the flow is now recorded using acoustic pipe flow sensors. This site will now provide a more accurate flow record during times when the valve is being operated, including for lake level management and flushing flows. These upgrades provide a more reliable, accurate and complete record and are part of a holistic approach towards improving the hydrological network.

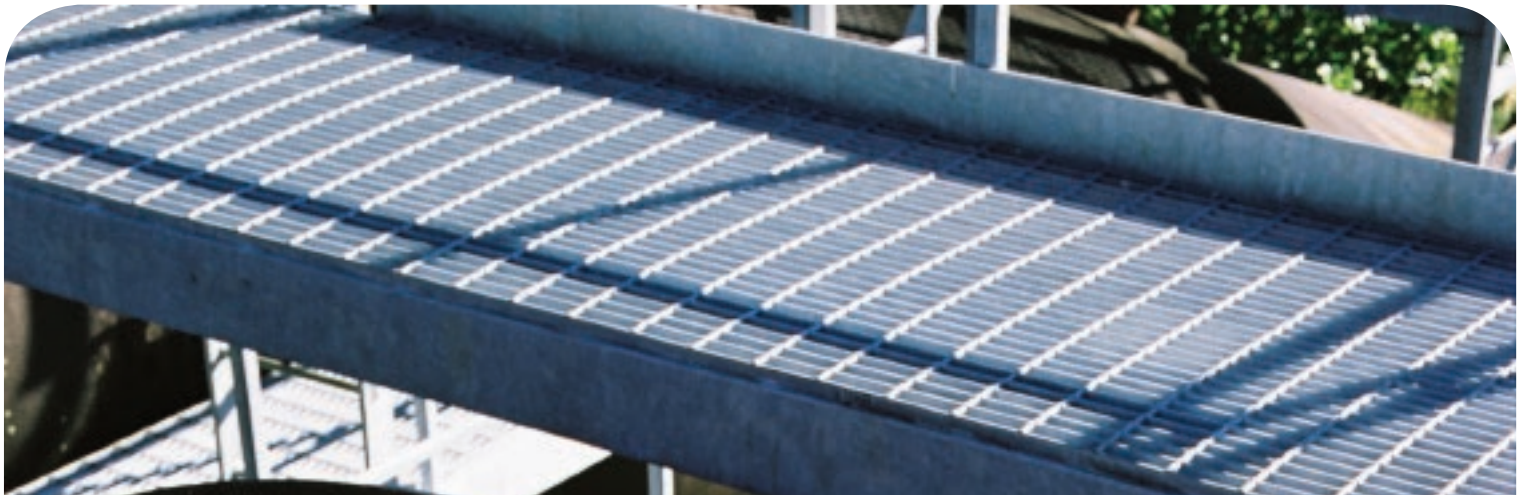
Hydrology staff supported the implementation of key environmental projects with their technical expertise and ability to share this with stakeholders. An example of this is the new flow stations installed on the Wahianoa Aqueduct which will be primarily used for feeding into habitat and flow assessment models in conjunction with Ngati Rangi (see Section 3.1.3).

During the reporting period the Hydrology data has been externally audited. It was found that the data was collected to a very high standard and all correct procedures were followed.

1.5 FEEDBACK

Genesis Energy has worked to make this report informative and easy to understand. Your feedback is welcome on both content and layout. Contact details are as follows:

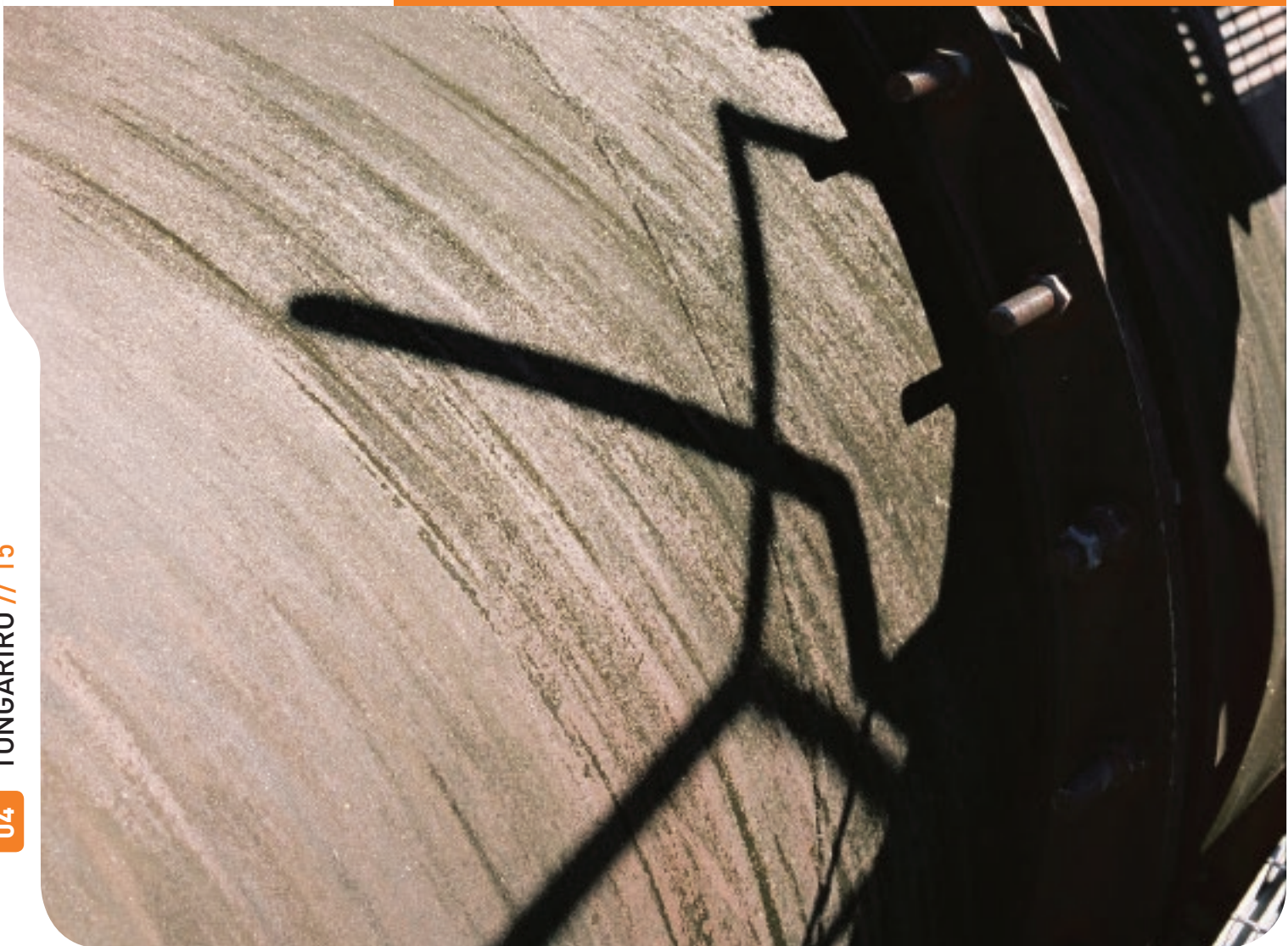
Renewable Energy – Tokaanu Power Station
State Highway 47
Private Bag 36
TURANGI 3353
Attn: Environmental Lead – North Island



02



TONGARIRO POWER SCHEME



02 TONGARIRO POWER SCHEME

Genesis Energy owns and operates the Tongariro Power Scheme (TPS), which is situated in the central North Island, south of Lake Taupo. The location and features of the scheme are shown on the map inside the back cover.

The TPS was conceived in the 1950's to generate electricity using the energy of the rivers and streams that flow from the mountains of the central volcanic plateau. It was constructed between 1960 and 1983. The Tokaanu Power Station first generated electricity in 1973 and the last major development, the Rangipo Power Station, was commissioned in late 1982. Infrastructure such as roads, bridges and housing, including the township of Turangi, was constructed in the area during scheme development. Ownership of the TPS transferred from the New Zealand Electricity Department to the Electricity Corporation of New Zealand Limited (ECNZ) in 1987, and then to Genesis Energy in April 1999.

The TPS is located in the headwaters of four major catchments: Whangaehu, Whanganui, Moawhango and Tongariro. Most of the water comes from the Kaimanawa Ranges and the central North Island volcanoes, Mount Ruapehu, Tongariro and Ngauruhoe. The scheme uses a series of lakes, canals and tunnels to bring water to the Rangipo and Tokaanu power stations before discharging that water in to Lake Taupo.

The dominant weather patterns that affect river flows in the TPS area come from the north-west and the south-west, with most of the rainfall derived from north-west frontal systems. Mean annual rainfall varies extensively across the area, mainly in relation to elevation: it ranges from 1400 mm at Turangi to over 3400 mm at the central North Island volcanoes. There is also very high rainfall variability from year to year. The catchments of the scheme are subject to tropical cyclones that can result in significant amounts of rainfall in short periods of time.

The water diverted by the TPS produces approximately 5% of New Zealand's annual electricity demand, 3.5% of this from the Tokaanu, Rangipo and Mangaio power stations and the remainder via additional generation at power stations along the Waikato River. On an instantaneous basis, when operating at full capacity, the TPS provides a significantly greater proportion of the nation's electricity supply.

The generating equipment at Tokaanu, Rangipo and Mangaio power stations is relatively modern compared to hydro generating facilities elsewhere in New Zealand. Individual components have been modified over recent years to take advantage of new design concepts and to improve efficiency. An example of this is the upgrade of Tokaanu Power Station's turbine runners during the mid-1990s, which increased the station's output from 220 to 240 megawatts (MW), utilising the same flow of water.

The TPS plays an important role in New Zealand's electricity grid. A substantial amount of generation within the New Zealand supply system is located in the South Island. The Tokaanu Power Station, ideally located along the main south-north electricity transfer route, provides essential support to the transmission grid by boosting the voltage (pressure) on the grid as electricity travels north during the day. At night-time, it reduces the high voltages as the load alters.

An additional benefit that is critical to the operation of the New Zealand power system is the ability of Tokaanu Power Station to increase load from low levels to full load in a matter of minutes, thus providing security for the electricity system. This ability arises as a result of using water stored within Lake Rotoaira and being able to discharge large amounts of water into the Tokaanu Tailrace with negligible downstream effects.

2.1 OPERATING THE TONGARIRO POWER SCHEME

Genesis Energy has an extensive hydrology monitoring network around the TPS. A variety of flow, water level, rainfall and water quality data is collected in real time and telemetered near real time. This information is brought into the Renewable Energy Control Centre (RECC) at Tokaanu Power Station, together with a range of plant and market information.

A 24/7 Generation Control team runs the TPS as effectively and efficiently as possible, to maximise electricity generation revenue requirements while maintaining compliance with resource consent conditions and operating within the electricity market rules.

A complex operational control system that underwent a significant upgrade in 2009 assists the operations team, providing details on all aspects of the scheme, enabling remote control and alerting the Generation Controllers when various parameters approach their standard operating limits (including resource consent limits).

2.2 CLIMATE AND POWER GENERATION

Results of rainfall monitoring during the reporting period are shown in Table 1. During the reporting period the volume of rainfall measured at Genesis Energy's high altitude monitoring sites (Karikaringa and Ruatahuna) was above average. The rainfall totals were equal to the annual average up until the month of April when 150% of the rainfall occurred in the last three months of the reporting period. This rainfall coincided with southerly winds, from which the low altitude rain gauges were more sheltered.

The lower altitude rain gauges on the Eastern Diversion (Waipakahi and Tukino) show a lower than average annual volume, which is also mirrored in the river flow data. A similar trend occurred on the Western Diversion where a large amount of rain fell from April to June and prior to this rainfall was below the annual average.

TABLE 1 // Genesis Energy rainfall monitoring during the reporting period.

Monitoring Site	Rainfall Total (mm)	Percentage of average (%)
Karikaringa	1,849	110
Ruatahuna	2,264	121
Waipakahi	2,011	88
Tukino	834	93
Turangi Met	1,239	89
Ruapehu Met	2,979	109
Whakapapanui	1,861	112

River flows within the TPS were slightly below average for the reporting period, with natural inflows at 93% of the long-term mean on the Eastern Diversion and 103% of the long term mean on the Western Diversion. The rainfall patterns were similar to the previous two years where only average rainfall fell in winter and spring with an extended period of low flow from October to April. This year distinguishes itself from these previous two years by the period from April to June which showed a marked increase in inflows. The largest flood for the year at the Tongariro at Waipakahi flow station had an annual exceedance probability of 37%; this occurred on 20 June. Whilst the largest flood on the Western Diversion occurred on 27 April, statistically this flood was no larger than a mean annual flood.

The upper Tongariro and the Moawhango catchments (on the Eastern Diversion) had 90% of mean annual inflows, which is reflective of the long period between August and April where inflows were at 75% of the long term mean. This was also reflected on the Western Diversion where the intakes were not diverting full flow for 109 days to meet the minimum flow requirements at the Whanganui at Te Maire flow station.

The Tongariro River at the Poutu Intake site recorded mean annual flow (101%) during the reporting period. Despite a long dry period, the increase in high flow events during the latter part of the year increased the average flow at this site.

Tokaanu Power Station generated 718 gigawatt hours (GWh), Rangipo Power Station generated 563 GWh and Mangaio Power Station generated 8 GWh, giving a total of 1,289 GWh for the reporting period. Generation for the TPS as a whole during this period was slightly below average.

Based on an average figure of electricity consumption per household of 8,000 kWh/yr (Electricity Authority, 2013; p1), the 1,289 GWh produced in the reporting period was enough electricity to power the annual demand of approximately 161,125 households, Note: this does not include additional generation from water diverted into the Waikato catchment by the TPS and then subsequently used by the hydro-power stations located on the Waikato River.



03



EASTERN DIVERSION



03 EASTERN DIVERSION

The Eastern Diversion extends from the Wahianoa Aqueduct on the southern flanks of Mount Ruapehu, eastward to the Moawhango Dam and north to the discharge point of Moawhango Tunnel at the Rangipo Dam on the Tongariro River (see scheme map inside the back cover).

A significant amount of research and consultation has been undertaken on the rivers, streams and lakes of the Eastern Diversion to determine the effects of the ongoing operation of the Tongariro Power Scheme (TPS). Where appropriate, changes have been made to power scheme operations, monitoring programmes have been established or enhanced, or mitigation has been undertaken. Generally, additional monitoring is undertaken where there has been a change to the operations resulting from the consultative process, or where further monitoring is required to fully understand effects over the long term. Details of the consultation process and monitoring undertaken are described in the Tongariro Power Development Assessment of Environmental Effects (Genesis Power Ltd, 2000). Further details can be found in subsequent monitoring reports.

A description of the major structures in the Eastern Diversion and an update on the monitoring work undertaken during the reporting period is provided below.

3.1 WAHIANOA AQUEDUCT

The Wahianoa Aqueduct diverts water from at least 26 tributaries of the Whangaehu River via 22 intake structures. During floods, water passes over the intakes when the flow upstream of each intake exceeds the intake capacity. The capacity of each intake is generally twice the mean flow of the inflowing stream. No water is diverted from the main stem of the Whangaehu River as this river is periodically acidic, due to its source being Mount Ruapehu's Volcanic Crater Lake.

The Wahianoa Aqueduct is within the rohe of Ngati Rangī. Public access is limited to the Wahianoa Aqueduct as part of it lies within the area that the New Zealand Defence Force (NZDF) actively uses for military training exercises and the remainder is within a Crown forest leased to Ernslaw One Ltd (parent company of Winstone Pulp International). Research and consultation was undertaken during the process to renew consents for the Tongariro Power Scheme (TPS) and consent conditions were agreed around flow monitoring and the public warning of spill events. Further details of the consultation process and monitoring undertaken at this time are described in the Tongariro Power Development Assessment of Environmental Effects (Genesis Power Ltd, 2000).

Ngati Rangī and Genesis Energy were unable to engage constructively until 2010, when the parties entered into lengthy but very constructive discussions. The relationship agreement signed in December 2010 between Ngati Rangī and Genesis Energy paved the way for joint initiatives including research on (but not limited to) the tributaries affected by the diversion of water through the Wahianoa Aqueduct and the investigation of connective and agreed flows (see Section 3.1.3).

Key outcomes of the consultative process for the Wahianoa Aqueduct are:

- › the establishment of a relationship agreement with Ngati Rangī;
- › flow monitoring to confirm how much water is being diverted and when;
- › connective flows and research into agreed flows for four of the tributaries to the Wahianoa Aqueduct;
- › public warning when intakes are closed and water is allowed to flow down its natural course, which can result in a sudden rise immediately downstream of some structures and;
- › no diversion of contaminated water bodies, with particular emphasis on:
 - › the Volcanic Activity Management Plan (VAMP) and;
 - › real-time monitoring of water quality.

3.1.1 HYDROLOGY

Genesis Energy monitors the combined flow of all water being diverted by the Wahianoa Aqueduct at the Mangaio Power Station. The mean flow of the diverted water during this reporting period was 3.3 m³/s which is near the long term mean. Flows in these catchments contain a large component of ground water, however with the extended dry period during the reporting period these flows were observed to decrease, similar to flow recorded at the nearby Tongariro at Waipakihi flow station.

Discharge to Mangaio Stream MWRC 101277 (6)

Maximum Flows Resource consents for the Wahianoa Aqueduct specify that the maximum amount of water able to be diverted is 9 m³/s based on design criteria. There have been no modifications to this structure that have increased this flow capacity and therefore compliance with this resource consent requirement was achieved.

Discharge to Mangaio Stream MWRC 101277 (1)

Public Warning The Wahianoa Aqueduct has automatic gates at both the Wahianoa Intake and Intake 2 for maintenance and hazard management purposes. When these gates operate, water is released, which may create hazards in these streams immediately downstream of the intakes.

To mitigate potential hazards, a public warning system has been established in consultation with the two key neighbours: NZDF and Ernslaw One Ltd. The system consists of an audible alarm that warns of any pending discharge, planned or unplanned, together with signage identifying hazard areas and explaining what to do should the alarm sound. Relevant organisations are notified prior to planned discharge events.

The Wahianoa Aqueduct can be turned out (not diverting water) for several reasons including: high levels in Lake Moawhango, volcanic activity or maintenance work. During the reporting period, the Wahianoa Aqueduct was turned out several times for planned maintenance activities, but not for volcanic activity or high lake levels. Notification was carried out as required for each planned maintenance activity. The maximum lake level during the reporting period was 849.1 m above sea level (masl). The consent requires the Wahianoa Aqueduct to be fully closed when Lake Moawhango reaches 851.6 masl and is continuing to rise.

Throughout the year, routine testing of the automated tripping system was carried out to ensure that the system was robust. A routine test takes up to 10 minutes.

Wahianoa Aqueduct Take MWRC 101278 (3)

3.1.2 AQUATIC ECOSYSTEMS AND WATER QUALITY

Aquatic Ecosystems The agreement reached with Ngati Rangī in 2010 over the impacts of the TPS on their rohe (see Section 3.1.3) includes joint research on the Wahianoa waterways.

During the reporting period, a range of fisheries investigations have been undertaken including eel (tuna) and freshwater crayfish (koura) distribution. Tuna and koura locations have been mapped on a new Ngati Rangī Geographic Information System (GIS) and compared to historical records.

Water Quality Water quality monitoring is undertaken on the Wahianoa Aqueduct to alert Genesis Energy of volcanic events to ensure that contaminated water is not diverted by the TPS.

There were no significant events during the reporting period.

Discharge to Mangaio Stream MWRC 101277 (2)

3.1.3 NGATI RANGI

Ngati Rangī has consistently objected to the development of the TPS and continued diversion of their ancestral waterways out of the catchment and away from their rohe. They assert that the Eastern Diversion of the TPS inhibits Ngati Rangī's ability and responsibility to protect, nurture and uphold the kawa ora. In December 2010, Genesis Energy and the Ngati Rangī Trust, representing the peoples of Ngati Rangī iwi, entered into a long-term Relationship Agreement to work towards the restoration of kawa ora. The agreement fosters the building of a positive, interactive and enduring relationship and sets out steps to mitigate some of the environmental, cultural and spiritual effects on the kawa ora caused by the Eastern Diversion of the TPS.

The agreement sets out the framework and goals to mitigate adverse effects on Ngati Rangī through the establishment of a Relationship Group. This group oversees the development and monitoring of key objectives including connective flows research, agreed flows research, a mitigation programme, the sharing of knowledge and information, and above all, promotes a strong relationship.

Ngati Rangī has established an Environmental Unit responsible for the implementation of the agreement and to provide the iwi with capacity to focus on environmental outcomes within their rohe. The Ngati Rangī Trust, including the Environmental Unit, is based in the old Department of Conservation (DOC) Ranger Station at the bottom of the Ohakune Mountain Road.

The Relationship Group, comprising Ngati Rangī and Genesis Energy representatives, met regularly through the reporting period to discuss issues and progress the requirements of the Relationship Agreement. The Relationship Group have identified the importance of blending western science with Ngati Rangī Mātauranga to align with a more holistic approach to environmental and cultural management in the restoration of the Ngati Rangī tupuna (ancestral) waterways. This includes continuing research on taonga species re-inhabitation such as tuna.

Connective Flows Project The implementation of 'connective flows' on four tributaries of the Whangaehu River (the Wahianoa, Makahikatoa, Tokiahuru and Tomowai) is an important component of the Relationship Agreement. The purpose of a 'connective flow' is to reconnect the mauri of these four waterways, or awa, on the Wahianoa Aqueduct by ensuring that there is a continuous and visible flow 'from the mountains to the sea'. Connective flows were established on the Makahikatoa (5 l/s), Wahianoa (15 l/s) and Tomowai Stream (6 l/s) between 2011 and 2013. These flows are maintained through regular valve checks by Genesis Energy maintenance staff, reported to Ngati Rangī monthly. Annually in the autumn (low flow period), flow monitoring is undertaken by Genesis Energy to ensure connective flows meet negotiated levels.

Agreed Flows Project Another key part of the Relationship Agreement is the investigation and implementation of 'agreed flows' to achieve some or all of the following outcomes:

- › Increase in-stream habitat;
- › Re-establish key kai species identified by Ngati Rangī; and
- › Cultural connections.

During connective flow testing in 2012/13, the Tokiahuru Stream was identified as having a complex hydrogeology. Both parties agreed to move directly to 'agreed flow' research to assess an appropriate flow regime for the stream. Investigations of a potential agreed flow were undertaken in February 2014 by a group of independent experts. Their findings were reported in a report (Cawthorn and Tipa & Associates, 2014) which formed the basis of a Relationship Group recommendation in August 2014 to the governance group. As a result, an agreed flow of 100 l/s has been negotiated. A flow delivery mechanism to provide this flow is currently being designed ready for installation later in 2015 (Figure 2). As part of the agreed flow, a monitoring programme is also under development to assess if the flow achieves the outcomes sought.



FIGURE 2 // Keith Wood of Ngati Rangī and Cam Speedy of Genesis Energy meet with Dean Hassall (Aecom engineer) to progress the agreed flow delivery mechanism.

Further agreed flow investigations are being planned for the remaining three awa, with flow measuring devices now in place to provide guidance of seasonal flow rates and variability. Cultural assessments are likely to be undertaken over a full range of seasonal flows for the remaining awa, which are planned for the 2015/16 reporting period.

Lila Pakinga Memorial Scholarships During the reporting period, the Lila Pakinga Memorial Scholarships of \$1,000 per recipient were awarded to Ruapehu College student's Courtenay McDonnell and Rawinia Thomas. These scholarships commemorate the significant contribution Lila Pakinga made, in her capacity as a Ngati Rangī Trustee, to the Ngati Rangī/Genesis Energy relationship prior to her death in 2011. Lila had a passion for education and these scholarships are awarded annually to promising students who show strong leadership potential.

3.1.4 MANGAIO POWER STATION

The Mangaio Power Station is located at the Lake Moawhango end of the Wahianoa Aqueduct. The station utilises the existing flow and head to generate 1.8 MW of electricity. Mangaio Power Station was commissioned on 21 December 2008.

There are no specific resource consents or conditions for the Mangaio Power Station.

3.2 LAKE MOAWHANGO

Lake Moawhango is an artificial hydro lake and is the only large water storage reservoir within the TPS. There is no public access to Lake Moawhango as it is part of the area that the NZDF actively uses for military training and exercises. The NZDF strictly controls access into Lake Moawhango.

Key outcomes of the consultative process for Lake Moawhango are:

- › lake level monitoring;
- › provision of river flow information via free phone and/or Genesis Energy's website;
- › lake shoreline erosion monitoring; and
- › an agreement with the NZDF.

3.2.1 HYDROLOGY

Lake Moawhango has a normal operating range of 15.1 m from 837 masl to 852.1 masl. The consent allows the lake to be lowered to a minimum operating level of 835.75 masl if required. The lake level was 100% compliant during the reporting period (see Table 2). **Moawhango Dam MWRC 101279 (2)**

TABLE 2 // Lake Moawhango lake level compliance during the reporting period.

Parameter	Value	Compliance	Consent Number
	(masl)	(%)	(condition)
Minimum Level	837	100	MWRC 101279 (2)

Dam Specifications Dam specifications are defined in the resource consent based on design criteria. There have not been any modifications to the dam during the reporting period.

Moawhango Dam MWRC 101279 (1)

3.2.2 SEDIMENT (EROSION, TRANSPORT AND DEPOSITION)

In 2002 the crest of the Moawhango Dam was raised by 1.2 m, increasing the normal operating range to 15.1 m. Wave action associated with high winds, soft (volcanic) shoreline geology and a lack of protective vegetation can result in shoreline erosion throughout this operating range. Genesis Energy has been working in conjunction with the NZDF to ensure that lake erosion does not unduly affect their land, and in particular their road access to and around the lake. Through a 2002 agreement, regular lakeshore monitoring is carried out so that any significant erosion can be identified and, where appropriate, remedial works undertaken.

Genesis Energy put in place a monitoring programme involving repeat shore profile surveys (five yearly from 2002) with annual photo-point monitoring to identify any shoreline changes occurring at Lake Moawhango. This monitoring became part of resource consent requirements following re-consenting in 2004.

The annual photo-point survey was repeated on Lake Moawhango on 2 April 2015 (see Figure 3) and the results of this survey reported by Cheal Consultants Ltd (2015).

Moawhango Dam MWRC 101279 (6)

Moawhango Dam Discharge MWRC 101280 (12)



FIGURE 3 // Annual Photo-Point Survey.

The 2015 survey showed that there had been only minor changes to the vegetation line with the largest movements being regression of 0.5 m at just two of the 12 sites. Vegetation has however encroached onto the upper shoreline of most of the remaining sites. This indicates that the upper shoreline had not been inundated with water for some time, allowing the vegetation to become established below the maximum operating level of the lake. There is evidence that increased erosion has occurred directly below the newly established vegetation at these sites, indicating where the maximum lake level had risen since the 2014 survey. Sediment was visible low on the beaches, however as the water level was approximately 3.5 m higher than during the 2014 survey, much of the shoreline in areas subject to sedimentation was below water level and could not be observed.

The bank east of the Moawhango Dam has been further undermined and the risk of erosion of the NZDF access road directly opposite has increased. Genesis Energy is currently in consultation with the NZDF to determine a new route for this access road, away from the lake shore.

A key area of concern and related recommendations noted during the 2014 survey west of the Moawhango Dam is currently being addressed via engineering works involving additional gabion baskets and riprap rock protection. The project began in April 2015 and will be undertaken in two phases. Phase One was suspended in June due to deteriorating weather conditions and will be completed, in association with Phase Two, in autumn 2016. Further information and photographs about this project can be found in Section 7.5.

Lake Moawhango Erosion Protection Works MWRC 104870 (4)

3.3 MOAWHANGO RIVER

Prior to 2001 there was very little flow in the Moawhango River immediately downstream of the dam to the first significant tributary, the Aorangi Stream. The effects of this reduction in flow were most pronounced during summer and included effects on freshwater ecology, as well as the community's ability to use the river for recreation.

Significant research and consultation on the Moawhango River have been undertaken to determine the effects of the on-going operation of the TPS. Where appropriate, changes have been made to power scheme operations, monitoring programmes have been established or enhanced, or mitigation has been undertaken. Generally, additional monitoring is undertaken where there has been a change to the operations resulting from the consultative process, or where further monitoring was required to fully understand effects. Full details of the consultation process and monitoring undertaken are described in the Tongariro Power Development Assessment of Environmental Effects (Genesis Power Ltd, 2000). Further details can be found in subsequent statements of evidence and monitoring reports.

During the consultation process a common objective was agreed by many stakeholders: to make the Moawhango River downstream of the dam representative of a "healthy high-country lake-fed watercourse". This was to be achieved by releasing a continuous minimum flow of 0.6 m³/s downstream of the dam and by the provision of four periodic flushing flows of 30 m³/s for nine hours duration, during summer months (December to March). The minimum flow and flushing flow regime were developed following extensive research, analysis and recommendations by the National Institute of Water and Atmospheric Research (NIWA) and other external scientific agencies.

The provision of minimum flows was to provide habitat to enable aquatic species representative of a healthy high-country lake fed watercourse to become established, and to enhance natural character through the length of the river. Genesis Energy voluntarily implemented the minimum flow in 2001 following strong support from the local community and interested parties, and this is now a consent condition.

The objective of regular flushing flows during summer is to mimic the effects of natural floods by removing accumulated sediment and detritus from the river, thereby improving water quality and preventing the problems associated with anoxic sediments. The flows are also available for rafters and kayakers although willow growth makes the river dangerous in many parts.

The Moawhango River was, and still is, a focal point for the Moawhango community. However, the amenity value of the river had been reduced over the years as a result of reduced flows and willow encroachment. To address these issues, in 2000, Genesis Energy agreed with the community to develop a willow management plan and an amenity area [see Section 3.3.3] in addition to the new minimum/flushing flow regime,

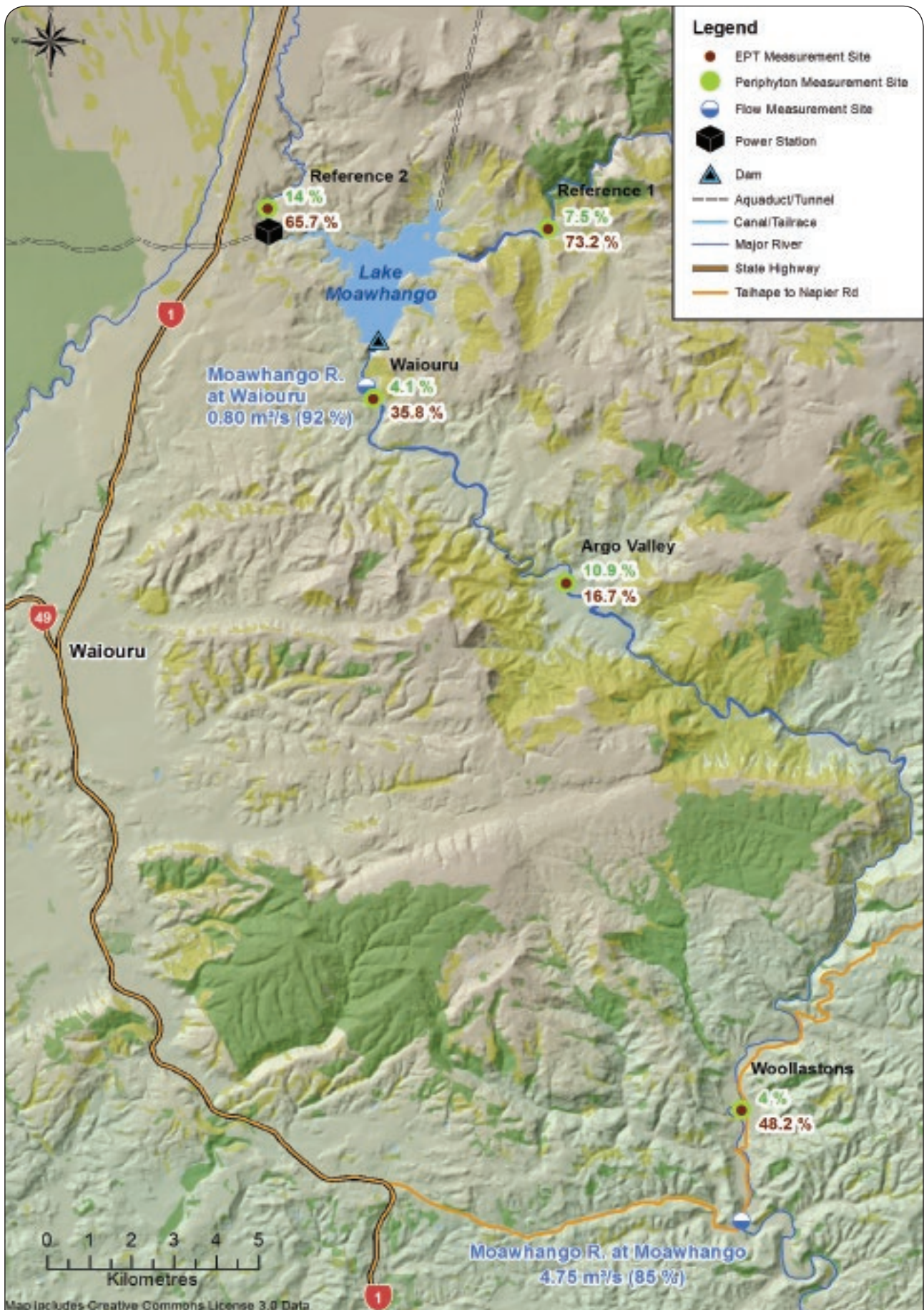


FIGURE 4 // Eastern Diversion monitoring results for the reporting period. Flow measurements are shown as mean flow over the reporting period and % of long term average. EPT measurements are shown as % of invertebrates that are mayfly (E), stonefly (P), and caddisflies (T). Periphyton measurements are shown as average % nuisance Periphyton cover.

Key outcomes of the consultative process for the Moawhango River were:

- › to ensure that the river downstream of the Moawhango Dam is representative of “a healthy high-country lake-fed water course”, specifically through:
 - › minimum flows;
 - › flushing flows and;
 - › measuring outcomes through the monitoring of water quality, periphyton growth and macro-invertebrates as defined in the Eastern Diversion Monitoring Plan.
- › flood management and public warning;
- › an agreement with Wellington Region Fish and Game Council to address issues resulting from the loss of fishing opportunity within the Moawhango River;
- › development of a willow management plan;
- › development of an amenity area at Moawhango Village;
- › agreements with Ngati Whitikaupeka, Ngati Tamakopiri and Ngati Hauiti to address tangata whenua issues; and
- › annual consultative meetings with the Moawhango community.

3.3.1 HYDROLOGY

The location of key flow monitoring sites in the Moawhango River are shown in Figure 4. It also shows the mean flow for the reporting period, compared to the long-term mean. The long-term mean is calculated as if theoretically the present resource consent limits had always been in place. Flow at the Moawhango River at Moawhango site was below average (85%) compared to the long-term mean during this reporting period. This is due to below average rainfall during the year with no significant flood events.

Minimum Flow – Moawhango Dam Magflow During the 2010/11 reporting period a magnetic flow meter (Magflow) was installed on the compensation valve that releases the minimum flow from Moawhango Dam. This allows the flow to be monitored in real time as it discharges from the dam. The Magflow has a much higher accuracy than an in-river flow site and provides a greater level of minimum flow compliance. The Magflow was commissioned on 14 June 2011 and has been used to discharge and monitor the 0.6 m³/s minimum flow since that time. The Moawhango River at Waiouru flow monitoring site is maintained to monitor flushing flows and spill flows (see Table 3 for compliance results in the current reporting period).

During the reporting period the flow dropped under 0.6 m³/s for one 5 minute period on 26 July to a flow of 0.599 m³/s. This was due to the controlling valve being set slightly too low which resulted in a momentary non-compliance. The valve was reset immediately and no adverse effects occurred as a result of the minor non-compliance.

Moawhango Dam Discharge MWRC 101280 (6)

TABLE 3 // Moawhango River minimum flow compliance during the reporting period.

Location	Minimum Flows	Compliance	Consent Number
	(m ³ /s)	(%)	(condition)
Moawhango Dam	0.6	99.99%	MWRC 101280 (6,7)

Flushing Flows The four annual flushing flows occur on set dates in each of the months of December, January, February and March. The flushing flow dates are set in consultation with river users, the community and with Manawatu Wanganui Regional Council (MWRC).

In 2014, Genesis Energy undertook a field exercise to verify the stage-to-flow relationship of the Moawhango River at Waiouru flow station (using new technology that enabled the work to be undertaken safely). As discussed in the 2013/14 Annual Environmental Report, this verification work resulted in a revised rating for the flow station. The revised rating showed that flushing flows of 26 m³/s were being released from the dam, rather

than the consented 30 m³/s. This information was presented and discussed with the community, MWRC and iwi during the reporting period. On 7 November 2014, Genesis Energy was granted a consent variation by MWRC aligning the flushing flow requirements with the revised rating.

During the reporting period, the 2013/14 Moawhango River ecological and sediment monitoring results were presented to the Moawhango Community. The results of sediment monitoring showed that the duration of the flushing flows was potentially longer than that required to achieve the desired environmental results. In addition, the monitoring results showed that by reducing the duration of the flushing flows, there is the potential to reduce the impact of sediment deposition on the banks of the Rangitikei River, below the Moawhango River confluence.

Following consultation with the community, an agreement was reached with MWRC to enable the testing of reduced duration flushing flows in February and March. The community and relevant stakeholders were kept informed and notified of the proposed reduced duration trials and the results are shown in Section 3.3.2.

Four flushing flows were released during the reporting period, two regular duration flushing flows in December and January, and two reduced duration flushing flows of 7 and 5 hours respectively in February and March. All flows were compliant with the requirements for flow and duration. Flushing flow compliance is shown in Table 4 below.

Data from annual ecological surveys highlight the fact that the flushing flows, including the reduced duration flushing flows, have resulted in significant improvement to in-stream values in the Moawhango River below Moawhango Dam, and have largely met the target ecological objectives (see Section 3.3.2). The results will be discussed with the community, MWRC and key stakeholders, including the duration of future flushing flows.

Moawhango Dam Discharge MWRC 101280 (3, 4, 5)

TABLE 4 // Moawhango River flushing flows during the reporting period.

OPERATIONAL				
Date	Average Flow (m ³ /s)	Duration	Compliance	
2 December 14	26.59	9h 30 min	Full compliance	
27 January 15	27.19	9h 30 min	Full compliance	
17 February 15	27.52	7 h 40 min	Full compliance	
10 March 15	27.60	5 h 40 min	Full compliance	

Flow Measurement Accuracy Genesis Energy monitors the accuracy of flow data collected for operational and compliance purposes. At flow monitoring sites the water level is measured and converted to flow using a relationship between the two called a ‘rating’. A rating is not permanent and will change over time as the shape of a riverbed changes mainly due to river bed movement during floods or vegetation growth in and around the water way.

Moawhango Dam Discharge MWRC 101280 (8)

Genesis Energy operates the TPS using real-time flow data collected at many sites from around the scheme. This real-time data set (called the operational data set), is Genesis Energy’s compliance data set. Ratings are updated to this data set as soon as rating changes are identified.

Real-time data is quality assured and rating changes are backdated to the time when the rating change occurred (i.e. usually associated with a flood). This data set represents the ‘true flow’ of the river.

Resource consents require that flow rating curves (that is, water level to flow relationships) are maintained so that the flow that the power station generation controllers observe is within plus or minus 8% of the true flow for at least 95% of the time. Non-compliance occurs when the data is not within the ±8% range for 95% of the year.

As the minimum flow is now monitored by the Magflow meter at the Moawhango Dam, the Moawhango River at Waiouru flow monitoring site is utilised primarily for the monitoring of high-flow events. As such, the rating curve is only maintained at the middle to high end of the curve to cover the range of flows present under flushing or spill conditions, which the Magflow cannot measure. Health and safety issues around working at night, which is when flushing flows occur, limit the opportunities to gauge this station.

Public Warning The large operating volume and prudent management of Lake Moawhango means that all but the largest floods can be contained within the reservoir. On average, the lake spills approximately once per year. However, when the lake does spill, a significant amount of water can be released into the Moawhango River, which can create safety issues for downstream river users. Flushing flows can also create significant short-term changes in flow downstream. Public safety surrounding flushing flow and spill events is a priority for Genesis Energy.

The Moawhango Dam Public Warning System outlines the notification procedure developed for both unplanned spill events and planned flushing flows from Moawhango Dam. The system was made operative in December 2004, prior to the release of the first flushing flow. The system was developed in consultation with:

- > the NZDF;
- > Whitewater New Zealand;
- > property owners and occupiers adjacent to the Moawhango River, from the dam to Moawhango village;
- > the Moawhango community;
- > Ruapehu District Council;
- > Rangitikei District Council; and
- > Manawatu Wanganui Regional Council.

Key components of the system include:

- > a contacts list of key agencies and property owners and;
- > public notification of planned spill events (i.e. flushing flows) via:
 - > newspaper notices;
 - > e-mail notices; and
 - > letter drops to houses in the vicinity of the river.

There were no spill events from the Moawhango Dam during the reporting period which meant the public warning system was not operated.

Moawhango Dam Discharge MWRC 101280 (1)

3.3.2 AQUATIC ECOSYSTEMS AND WATER QUALITY

The Eastern Diversion Monitoring Plan has been developed to measure outcomes of the minimum flows and flushing flows in controlling nuisance periphyton levels and achieving a river representative of "a healthy high country lake-fed water course". The plan includes monitoring of water quality, periphyton growth and macro-invertebrates. The monitoring programme comprises five sites. Three are located on the Moawhango River between the dam and Woollaston's Farm (approximately 43 km downstream); and two reference sites are located above the dam and Lake Moawhango: one on the Moawhango River and one on the Mangaio Stream. The Mangaio Stream site was shifted further downstream for the 2014/15 reporting period, after the original site went dry during low inflows in late summer 2014.

Semi-quantitative monitoring of periphyton (SHMAK) is undertaken pre and post each flushing flow during December, January, February and March. Quantitative assessments of nuisance periphyton build-ups (Chlorophyll a and Ash Free Dry Matter- AFDM) were also undertaken pre and post all flushes this reporting period to help assess any effects of the reduced duration flushing flows in February and March 2015 (see Flushing Flow Sediment Deposition Research section below). Quantitative assessments of macro-invertebrates and periphyton were repeated again in May to gain a better understanding of conditions in the river outside the flushing flow season, as requested by MWRC.

Moawhango Dam Discharge MWRC 101280 (12)

Monitoring results for the Eastern Diversion during the reporting period are summarised in Figure 4. The report prepared by Tonkin and Taylor details the in-stream ecology monitoring results from the Moawhango River for the reporting period (Tonkin and Taylor, 2015).

Water Quality Temperature, dissolved oxygen, pH and conductivity (dissolved nutrients) were recorded throughout the December 2014 to April 2015 period by Tonkin and Taylor at all monitoring sites. This monitoring continues to show that all parameters remain well within the range of tolerance for sensitive species such as trout, native fish and invertebrates.

Periphyton (Algae) Semi-quantitative periphyton coverage levels in the Moawhango River for 2014/15 were slightly lower than periphyton levels encountered in previous years, with no exceedance of MfE guidelines for nuisance periphyton. Periphyton levels peaked in January pre flush at 33% thick mats in the run habitat at Argo Valley, and 14% long filaments in the run habitat at Woollastons. This was due to a comparatively long accrual period before the January flushing flow (approximately 56 days) compared with the February and March flushing flows (accrual periods of 20 and 21 days respectively).

Quantitative periphyton results showed that chlorophyll a values were all below the MfE guideline, but exceeded the MWRC Proposed One Plan target pre-flushing flow in March at the Waiouru site (156.65 mg/m²). The Mangaio control site exceeded the more rigorous One Plan 50 mg/m² chlorophyll a target on both sampling occasions in March. Chlorophyll a values remained below the Horizons Regional Council target value at all other sites on all sampling occasions.

AFDM levels were found to exceed MfE guidelines at the Argo Valley site both pre and post flush from December to March but were below the MfE guidelines in May. AFDM levels also exceeded MfE guidelines at the Waiouru site pre flush December to March, post flush in February, and at the Mangaio control site on both sampling occasions in March.

Results indicate a general reduction in chlorophyll a and AFDM post flushing events. However, Waiouru and Argo Valley have a continual exceedance in AFDM levels since the commencement of ecological monitoring in 2006, due to the prevalence of thick and medium mats post flushing flow events. Genesis Energy intends to review the relevance of AFDM as a suitable flushing flow metric, with MWRC.

Macro-invertebrates Suren et al (2002) identified the macro-invertebrate fauna that would be representative of "a healthy, high-country lake-fed water course" similar to the Moawhango River below the Moawhango Dam. There should be a mixture of less than 15% Coleoptera (beetles) and greater than 50% mayflies, stoneflies and caddisflies (otherwise known as Ephemeroptera, Plecoptera, and Trichoptera [EPT], the three insect orders commonly used to test water quality), and one or more of the following: greater than 15% Diptera (midge, crane fly and hawthorn fly), greater than 10% Ephemeroptera (mayflies), or less than 5% Oligochaeta (worms), in such a system.

Total macroinvertebrate densities and richness values for the May 2015 samples were similar to the 2011 to 2014 data but were lower compared to pre 2011 data. This is most likely due to a difference in sample processing methods (sieve sizes) prior to 2011 and a change in the timing of sampling (from immediately after the March Flushing flow until at least one month later) rather than reflecting a change in environmental conditions in the Moawhango River since 2011.

Macroinvertebrate data from 2011 to 2015 have shown that MCI, QMCI and % EPT index values tend to be lower at all sites downstream of the Moawhango Dam compared to the control sites (see Figure 4). There was a decrease (not significant) in MCI and EPT taxa at all sites below the dam in 2015 when compared to 2014. However, all the index values are still within the range encountered since monitoring began in 2005.

TABLE 5 // Reference criteria developed by Suren et al. [2002] for the expected macro-invertebrate composition in a healthy high country lake-fed river (similar to below Moawhango Dam), with results from the 2014/15 monitoring sites above (reference sites), and below Moawhango Dam.

Criteria for healthy high country lake-fed river invertebrate community	Compliance at Site (Yes = lake-fed criteria met; No = lake-fed criteria not met)				
	Site 1a	Site 1b	Site 2	Site 3	Site 4
	Upstream of Dam (Reference 1)	Mangaio Stream (Reference 2)	Waiouru	Argo Valley	Woollastons
Both:					
> 50% EPT; and	YES (66.25%)	YES (65.25%)	NO (44.22%)	NO (42.13%)	YES (53.62%)
< 15% Coleoptera	YES (2.20%)	YES (6.00%)	YES (2.82%)	YES (0.00%)	YES (4.58%)
And either of:					
> 15% Diptera; or	YES (17.03%)	YES (23.04%)	YES (30.39%)	YES (44.28%)	YES (22.74%)
> 10% Ephemeroptera (E); or	YES (16.48%)	YES (22.16%)	YES (11.48%)	NO (6.12%)	YES (14.69%)
< 5% Oligochaeta	YES (3.86%)	YES (0.61%)	YES (4.19%)	NO (11.01%)	NO (10.01%)
Criteria Met	Not Lake Fed	Not Lake Fed	NO	NO	YES

The above Moawhango Dam control site had a significantly higher mean MCI score compared to the Argo Valley site downstream of the dam. The new Mangaio control site also had significantly higher MCI scores than all monitoring sites below the dam. The Above Moawhango Dam control site had a significantly higher QMCI score compared to all sites downstream of the dam. The Woollaston site was also found to have a significantly higher QMCI score than the Argo Valley site suggesting an improvement in habitat quality further downstream of the dam.

The same trend as QMCI scores was observed in the comparative Index of Biological Integrity (IBI) analysis which showed that the Waiouru and Woollaston sites were "slightly-impaired", whereas, the Argo valley site was "moderately impaired" compared to the above Moawhango Dam control site.

Macroinvertebrate community metrics met the Suren (Suren et al 2002) reference criteria for healthy high-country lake-fed streams at the Woollaston site only during the reporting period (see Table 5). The Waiouru site and the Argo valley site did not meet the Suren criteria due to the percentage of EPT taxa being less than the 50 % criteria threshold.

Flushing Flow Sediment Deposition Research The Moawhango flushing flows are designed to dislodge algal growth from the substrate and entrain fine-grained sediment which is then flushed from the river. Consequently, these flushing flows contain both organic and inorganic material which is transported down the Moawhango River and the Rangitikei River below the confluence. Depending on conditions in the Moawhango and Rangitikei rivers during the flushes, the dislodged material can be deposited along broad, shallow unconfined reaches in the Rangitikei River. The effect of this material on the river's recreational and ecological values has been investigated previously (Opus, 2009).

The seasonal composition of sediment entrained in the Moawhango flushing flows was investigated and reported by Opus International Consultants Ltd during the 2014 flushing flow season (Opus, 2014). One of the key findings was that the duration of the flushing flows (nine hours) was greater than required to exhaust the readily available fine sediment and organic material in the Moawhango River and that it is likely that the same environmental benefit could be achieved by lesser flows of shorter duration.

As discussed above, during the 2015 flushing flow season, agreement was obtained from MWRC, with the support of the community and key stakeholders, to test and monitor shorter flushing flows to see if these:

- › could reduce the amount of material deposited on the banks of the Rangitikei River as a result of flushes; but also
- › continue to provide for effective flushing of the Moawhango River.

Opus monitored a seven hour flush in February, a five hour flush in March, and compared these with a standard nine hour flush in December 2014 and January 2015 (see Figure 5). The results of the investigation are reported by Opus International Consultants Ltd (Opus, 2015). Key findings were:

- › The percentage of organic material deposited on the bank was greatest during the first monitored flush of 2015 (January). This was likely a function of summer conditions being conducive to the growth of algae [see "Periphyton (Algae)" Section above];
- › The percentage of organic material for the two February and March flushes was almost identical to the January flush. This would suggest that the duration of the flushing event has little effect on the entrainment of organic material, although it does reduce the amount of material deposited on the Rangitikei River bank;
- › The amount of material deposited on the river bank during each flushing flow is therefore at least partly a function of the duration of inundation;
- › The effect of the shorter duration flush in reducing the material deposited was greatest towards the upper limit reached by water during the flush i.e. less material was deposited further up the bank; and
- › In summary, the reduced duration flushing flows still removed the same amount of material from the Moawhango River, and deposited less of that material on the upper banks of the Rangitikei River.



FIGURE 5 // Sediment deposition on geotech fabric placed on the banks of the Rangitikei River to record sediment deposition during the February and March flushes (Photo: Opus).

Genesis Energy will discuss the results of the study with MWRC and the community to determine the need for further investigation and if, or how, flushing flows can maintain the benefits for the Moawhango River, while limiting the impacts on the Rangitikei River.

3.3.3 NATURAL CHARACTER AND AMENITY ISSUES

Moawhango Willow Management Plan The introduction of willows to the Moawhango River is unrelated to the development or ongoing operation of the TPS. However, flow reductions may have exacerbated the encroachment of willows into the river. Willow encroachment has further restricted water flows, causing blockages in the river which reduce the cleansing effect of flushing flows and create serious water quality issues. The water quality deteriorates when large volumes of willow leaves accumulate in backwaters and at the bottom of deep, slow pools, lowering oxygen levels and giving off unpleasant odours as they rot.

As part of a broad TPS mitigation programme, a Moawhango Willow Management Plan was developed in 2005. This plan sets out an annual programme for controlling willows over a minimum of a 200 m reach of the river per year and for maintaining the previously cleared reaches.

Moawhango Dam MWRC 101279 (3, 4)

The Moawhango Willow Management Plan, approved by the community and tangata whenua in 2005, has resulted in significant progress over the past eight years of active management, with almost 14 km of river treated and maintained in that time. Together with MWRC and community contributions to willow control, the overall programme has resulted in the virtual elimination of mature willows from the main stem of the Moawhango River above the Pungatawa Bridge.

Following the 2014 review of the willow management programme (Cumming, 2014), key workstreams were prioritised for the next few years. The priorities identified in the 2014 review are as follows.

- › Priority 1:
 - › Remove blockages and burn willow debris heaps.
 - › Cut, recover and burn debris from 2009-2010 treatment zones where digger can access and work on the lower bank.
 - › Spray or basal-bark live willow in areas already identified above the Moawhango Gorge, except if they require abseiling access.
- › Priority 2:
 - › Cut and recover edge vegetation only from 2009-2011 treatment zones where there is no digger access but material can be processed on site or floated to a recovery point .
- › Priority 3:
 - › Cut and recover edge vegetation only from 2006-2008 treatment zones or from 2009-2010 treatment zones where willow population is sparse.
 - › Spray or basal-bark live willows identified for abseiling and all others below Mahe's Drop.
- › Priority 4:
 - › Recovery work anticipated for debris created by the killing of willows below Mahe's Drop.
- › Priority 5:
 - › No recovery work required but there are blockages or debris that need to be managed as part of the Priority 1 category.

During the reporting period, the following works were completed, as reported by MWRC (Cummings, 2015):

- › Burning of logs that were removed from the river in 2014, below Jasmine Falls;
- › Mechanical clearing of 2.41 km of willow debris; and
- › Chemical control of 8.36 km of seedling willow.

See Figures 6 and 7 for photos of the works. The majority of willow debris from the 2009-2013 treatment works appears to have either been removed manually, or have moved through the river system naturally and decomposed. This has resulted in a reduction in log jams and lowers the risk of future jams.



FIGURE 6 & 7 // Before and after willow control works at Duncan's Ford on the Moawhango River.

Moawhango Amenity Area In 2004, Genesis Energy and the Moawhango community developed a plan for an amenity area adjacent to Moawhango River, near Moawhango village. Moawhango Dam MWRC 101279 (Advice Note)

These plans were set aside in 2008 following the realisation that a registered archaeological site in the proposed development area would seriously restrict the original development plans. Following this, Genesis Energy, with the agreement of the local Moawhango community and tangata whenua, redirected half of the funding set aside for the amenity area to progress the catchment wide willow management plan. As such, part of the funds set aside for the amenity area were redirected to this purpose during 2010/11, allowing a greater willow control effort during that period.

At the Moawhango community consultative meeting held in October 2012 it was unanimously decided that the remaining amenity area funding would go towards a Moawhango community hall upgrade, including: electrical wiring and lighting; sanding and polyurethane coating of the hall floor; interior painting; and plumbing. Genesis Energy passed over the funding to the Hall Committee during the 2013/14 reporting period, and a full electrical refit and other works have been completed.

3.3.4 RECREATION/TOURISM

The reduction in flow downstream of the Moawhango Dam resulted in less rainbow trout habitat in the Moawhango River, reducing angling opportunity and possibly creating additional pressure on other nearby rivers, in particular the Rangitikei River. As it was not considered realistic to attempt to re-create the rainbow trout fishery in the Moawhango River, Genesis Energy reached an agreement with the Wellington Region Fish and Game Council to undertake off-site mitigation, in addition to the minimum/flushing flow regime. A key part of this is the enhancement of the rainbow trout fishery in the upper Rangitikei River.

The long-term focus of the trout management work on the Rangitikei River is to undertake:

- > trout abundance, spawning and recruitment monitoring;
- > regulation compliance;
- > habitat protection for trout; and
- > research to:
 - > identify links between trout recruitment in the Rangitikei lower reaches and the headwaters;
 - > gain reliable estimates of backcountry angler use; and
 - > survey for pest plants such as *Didymo*.

Key initiatives and results were reported by the Wellington Region Fish and Game Council (Pilkington, 2015) for the reporting period. These are outlined below.

Monitoring In 2015, a Fish and Game drift diving programme was carried out to index trout populations. The programme included three sections of the Moawhango River and three sections of the mainstem on the Rangitikei River. The results are summarised in Table 6.

Sections of the Moawhango River have been dived since 2013, starting 1.5 km above the Moawhango Village bridge, and extending 1.1 km downstream of the bridge. This year the above-bridge section was dived on 26 January, the day before a flushing flow from the Moawhango Dam was released. Unfortunately visibility was very low at 2.8 m due to fine sediment entrained in the flow, and consequently the below-bridge section dive was abandoned.

Following a request at the Moawhango community meeting in September 2014, a new 700 m drift dive section of the Moawhango River above the confluence of the Rangitikei River was also dived. This section was dived on 26 January, with visibility of 4.0 m. Of note on this dive was a large accumulation of silt on the riverbed towards the lower end of the section. This observation was passed onto Genesis Energy and raised with MWRC. A subsequent site visit with Council's freshwater ecologist was undertaken. The sediment observed was confirmed as occurring at other confluence sites within the Rangitikei catchment and no further action or investigation was considered necessary.

The Moawhango River sites were drift dived again on 30 January, 3 days after the 27 January Moawhango Dam flushing flow, using the same dive team members. Visibility at the sites above and below the Moawhango village bridge was much better at 4.8 m, and a greater number of trout were observed. However, visibility at the confluence site was worse at 3.2 m, and accordingly fewer fish were seen.

Two sections on the Rangitikei River at Springvale were dived on 31 March 2015 - a 2.3 km section above the bridge and a 1.6 km section below the bridge. Visibility was good at 7.0 m. A 1.2 km section below the Mangaohane Bridge was also dived on 31 March. Visibility was good at 7.1 m, much better than the 3.2 m experienced the previous year. The results of the drift dive surveys are comparable with previous years, and are considered conservative due to difficulty viewing the bottom in some of the deeper pools.

Back Country License There are three regions within New Zealand that operate back country fishing licences – Otago, Southland, and Wellington. The Wellington Region back-country license covers both the upper Rangitikei and the Whakaurekou Rivers. For the 2014/15 fishing season, a total of 304 licenses were issued, although 119 of these licensees also ticked the two remaining regions on the license form, in addition to Wellington. Consequently, there could be more than the 185 individuals who just ticked the Wellington region who ventured into the back country this last fishing season. This is up from the 144 last fishing season.

3.3.5 NGATI WHITIKAUPEKA, NGATI TAMAKOPIRI AND NGATI HAUITI

Ngati Whitikaupeka, Ngati Tamakopiri and Ngati Hauiti have consistently stated that the damming of the Moawhango River, the reduction of flow downstream of the dam and the unnatural diversion of water from the Moawhango catchment into the Waikato catchment has ongoing physical and spiritual impacts on the environment. Genesis Energy has entered into long-term relationships with Ngati Hauiti, Ngati Whitikaupeka and Ngati Tamakopiri in regard to these matters.

Ngati Whitikaupeka and Ngati Tamakopiri Genesis Energy met with representatives of Ngati Whitikaupeka and Ngati Tamakopiri in June 2015, and both parties remained in regular contact throughout the reporting period.

During the reporting period, both Runanga continued to be actively involved in the following:

- > Environmental Working Party (EWP) - a partnership between Ngati Whitikaupeka and Ngati Tamakopiri aimed at addressing environmental impacts on their shared lands. The EWP continues to support another iwi within the

TABLE 6 // Wellington Fish & Game Council Drift Dive Survey Results for the Upper Rangitikei and Moawhango Rivers - 2015.

Date	River	Section	Distance (m)	Visibility (m)	Fish Seen				Fish/Km
					Large Brown	Medium Brown	Large Rainbow	Medium Rainbow	
26-Jan-15	Moawhango	Village Bridge (above)	1500	2.8	8	6	6	5	17
26-Jan-15	Moawhango	Confluence	700	4	9	22	1	3	50
30-Jan-15	Moawhango	Village Bridge (above)	1500	4.8	39	17	28	21	70
30-Jan-15	Moawhango	Village Bridge (below)	1100	4.8	22	11	13	8	49
30-Jan-15	Moawhango	Confluence	700	3.2	4	3	8	2	24
31-Mar-15	Rangitikei	Springvale (above Bridge)	2300	7	36	17	32	32	51
31-Mar-15	Rangitikei	Springvale (below Bridge)	1600	7	13	14	23	35	53
31-Mar-15	Rangitikei	Mangaohane	1200	7.1	5	12	14	35	55

rohe with their environmental matters. EWP representatives participated in the “Nga Pae o Rangitikei” forum, to support capacity and capability within this major area of iwi interest, the health and wellbeing of the Rangitikei Awa. During the reporting period, the EWP also looked at updating their Environmental Policy statement;

- › Planning and supporting their marae with development and renovation projects over the next three years;
- › Mokai Patea Waitangi Claims Trust - involvement in the iwi collective dealing with the Waitangi Tribunal Claims within the rohe;
- › Moawhango Rahi - Iwi are looking at supporting joint ventures that enhance the health, wellbeing and mauri of the Awa. There is ongoing support towards the willow management programme for the Moawhango River in the immediate vicinity of the village;

Ngati Hauiti Genesis Energy met with representatives of Ngati Hauiti in June 2015, and received an update on the following key projects:

- › During the reporting period the trust implemented a youth business programme which is an extension of the He Whetu Arataki development course. Two Ngati Hauiti youths were able to undertake training and work experience including time learning the Xero accounting programme at Whakauae Research Services Whanganui which is affiliated to Ngati Hauiti.
- › He Whetu Arataki (Ngati Hauiti Leadership Programme). There are currently nine Rangatahi active in the programme with four others in the seedling phase. This programme aims to provide for a succession of leadership within Ngati Hauiti. Four noho (gatherings) are held through the year at which many activities are undertaken and new skills are learnt with specific focus on four key areas:

1. Hawaitanga (Ngati Hauiti culture);
2. Rangatiratanga (Leadership);
3. Manaakitanga (Support); and
4. Kotahitanga (Unity).

One of these noho included an overnight stay in Tokaanu which included a site visit with Genesis Energy staff to the Moawhango Dam, and Rangipo Outfall and the Poutu Dam (Figure 8).

- › Project Pourewa (Pourewa Stream restoration works). Pourewa stream is a tributary of the Rangitikei River that runs through Rata and Hunterville. Ngati Hauiti undertake an annual programme stream restoration works, using funding from Genesis Energy. Willows have been removed from a 200 m section of the stream and 2 km of the stream has been fenced. During the reporting period there was limited activity with only scheduled weed clearance and spraying to manage the planted and fenced sections.



FIGURE 8 // Ngati Hauiti Rangatahi Noho at Poutu Dam.

3.3.6 MOAWHANGO COMMUNITY

Genesis Energy holds annual meetings with the Moawhango community to discuss flushing flow events, monitoring results, willow management and use of the amenity area funding. Meetings are well attended and excellent feedback is always received.

The annual Moawhango community meeting was held on 4 September 2014 at the Moawhango Community Hall. The meeting was well attended with 25 people from a range of backgrounds including: Rangitikei Community, Moawhango Community, Taihape Community, Fish and Game, Iwi, Rangitikei District Council and MWRC.

A summary and the results of 2014 drift dive surveys was presented by Fish and Game and discussed at the meeting. An update was also provided on the results of annual ecological monitoring, and the willow control programme.

A key topic of discussion at the meeting was the rating change for the Moawhango at Waiouru flow station, which showed that the flushing flows being released from the dam were 26 m³/s rather than the consented 30 m³/s (see Section 3.3.1). Despite this rating change, all parties agreed that the flushing flow regime was achieving the desired outcome, and in combination with the minimum flow and willow control works, the Moawhango River has improved markedly. Genesis Energy advised the community of its intention to seek a variation to the resource consent to align the flushing flow requirement with the revised rating.

The results of sediment transport monitoring during flushing flows was presented at the meeting, and in particular the potential to reduce the duration of the flushing flows to achieve the same environmental outcomes, while reducing the impact of sediment deposition on the banks of the Rangitikei River. There was general support amongst the community for assessing the effectiveness of the flushing flows and investigating the options to reduce the impact on the Rangitikei River from a reduction in flushing flow duration. Genesis Energy advised that it would work with MWRC and the community to progress a trial of reduced duration flushing flows, and present the results at the 2015 Moawhango community meeting.

Moawhango Dam MWRC 101280 (9, 10)



TONGARIRO RIVER

04



04 TONGARIRO RIVER

The Tongariro River is highly valued for its ecology, as a recreational resource, its world-famous trout fishery, by tangata whenua and as a resource for hydroelectricity generation. The upper catchments are largely contained within the Kaimanawa Forest Park and the Tongariro National Park, both of which have particular ecological values and provide habitat for a wide range of native species, including the nationally endangered blue duck (whio). The lower river is partially contained within both parks and also flows through a modified landscape of exotic forest, pasture and urban development. It is in the lower river, downstream of Poutu Intake to Lake Taupo, where the highest value trout fishery occurs.

The continued operation of the Tongariro Power Scheme (TPS) results in reduced flows in the upper Tongariro River immediately downstream of Rangipo Dam and to a lesser degree the lower river downstream of Poutu Intake.

A significant amount of research and consultation has been undertaken on the Tongariro River to determine the effects of the ongoing operation of the TPS. Where appropriate, changes have been made to power scheme operations, monitoring programmes have been established or enhanced, or mitigation has been undertaken. Generally, additional monitoring is undertaken where there has been a change to the operations resulting from the consultative process, or where further monitoring is required to fully understand effects over the long term. Full details of the consultation process and monitoring undertaken in the lead up to the lodgement of resource consent applications in 2000 are described in the Tongariro Power Development Assessment of Environmental Effects (Genesis Power Ltd, 2000). Further details can be found in subsequent statements of evidence and monitoring reports.

A continuous minimum flow of 0.6 m³/s is released downstream of Rangipo Dam to provide aquatic habitat and to enhance natural character. Nuisance periphyton (algae) proliferations can result in degraded habitat or food sources for freshwater species. To ensure that this does not occur on the Tongariro River, periphyton levels are monitored and trigger levels are set. If a trigger level is reached, flushing flows are released to remove the periphyton growth.

An agreement was reached during the consultative process that it was not considered practicable to further increase the 0.6 m³/s minimum flow for the benefit of whio, specifically as the Tongariro River is susceptible to volcanic events such as lahars which can devastate whio and their habitat. Rather, Genesis Energy, the Department of Conservation (DOC) and the Royal Forest and Bird Protection Society agreed, as part of a wider mitigation programme, to develop a scheme-wide initiative to enhance whio populations. As a result, the Central North Island Blue Duck Conservation Charitable Trust was formed in 2002. The trust aims to enhance, protect and promote whio populations and their habitat (see Section 7.2).

In the lower river there are many competing demands for the same resource. A continuous minimum flow of 16 m³/s is released downstream of Poutu Intake. This provides for the downstream trout fishery as well as recreational opportunities, while allowing for the continued operation of the TPS.

DOC were concerned that stable flows downstream of Poutu Intake may promote or enhance the growth of nuisance periphyton build-ups, thereby changing the type and abundance of macro-invertebrates present, which could affect the growth rates and subsequent survival rate of juvenile trout. To address this concern an agreement was reached that provides for flushing flows from Poutu Intake, should specified periphyton trigger levels be exceeded. The agreement also provides for fishery science and research programmes to be undertaken and the enhancement of angling opportunities (see Section 4.2).

As part of the consultation process, Whitewater NZ and Hillary Outdoors raised concerns that reduced flows were limiting recreational opportunities within the Tongariro River. As such, Genesis Energy agreed to provide recreational releases from the Rangipo Dam and Poutu Intake as well as various wider initiatives discussed elsewhere in this report (see Section 4.4).

Other key issues identified for the Tongariro River and addressed through the consultation process were flood management, the flushing of Rangipo Dam and sedimentation of the Tongariro River Delta.

Key outcomes of the consultative process for the Tongariro River were:

- › maintain healthy ecosystems downstream of the structures achieved by:
 - › minimum flows;
 - › flushing flows (trigger-based); and
 - › outcomes measured through the monitoring of whio populations, water quality, periphyton growth and macro-invertebrates as defined in the Tongariro River Monitoring Plan (TRMP).
- › improve the sediment flushing regime of the Rangipo Dam;
- › increase recreational rafting/kayaking opportunity through:
 - › third party agreements with Whitewater NZ and Hillary Outdoors;
 - › recreational releases;
 - › a third party agreement with Lake Rotoaira Forest Trust to provide unrestricted recreational access via Kaimanawa Road to Poutu Intake; and
 - › removal of construction debris as defined in the Construction Debris Management Plan (CDMP).
- › no diversion of contaminated water bodies, with particular emphasis on:
 - › the Volcanic Activity Management Plan (VAMP); and
 - › real-time monitoring of water quality.
- › provision of river flow information via free phone and/or Genesis Energy's website;
- › an agreement with DOC with the key purpose of enhancing the Tongariro trout fishery, via a Tongariro Fisheries Enhancement Fund (TFEF);
- › an agreement with DOC and the Royal Forest and Bird Protection Society which outlines the requirement for the formation of the Central North Island Blue Duck Conservation Charitable Trust; and
- › an agreement with Waikato Regional Council's (WRC) Asset Management Group for Genesis Energy to provide flood warning information for the Tongariro River and agreed funding contributions to be made towards Project Watershed.

4.1 HYDROLOGY

Flows in the upper Tongariro River (above Rangipo Dam) were below average during the reporting period (Figure 9). Flows directly downstream of Rangipo Dam were below average, this flow is largely a controlled release with limited spill events during this reporting period. On average, 7.8 m³/s of water was diverted into the upper Tongariro River via the Moawhango Tunnel for generation through Rangipo Power Station. This was also well below the long term average at 81% which broadly mimics the inflow characteristics of the surrounding natural flow stations in the upper Tongariro River.

Annual flow records show that flows released downstream of Poutu Intake were 101% of the long term mean (see Figure 9). This site displays effects from the minimum flow consent requirement at Poutu Intake and the mean flow only increases if there are more frequent spill events during the year.

Minimum Flows There are three consents that require continuous minimum flows to be released from Genesis Energy's structures within the Tongariro catchment (Table 7).

During the reporting period there was a very high level of compliance at all sites within this catchment and no observed effects or public complaints resulting from the minor non-compliances.

At downstream Rangipo a non-compliance was caused by a fault to the primary and back-up power supplies on 3 March 2015.



FIGURE 9 // Tongariro River monitoring results for the reporting period. Flow measurements are shown as mean flow over the reporting period and % of long term average EPT measurements are shown as % of invertebrates that are mayfly (E), stonefly (P), and caddisflies (T). Periphyton measurements are shown as average % nuisance Periphyton cover.

This meant the flow dipped under 0.6 m³/s for 15 minutes with a minimum of 0.597 m³/s recorded during this time. There were no adverse effects as a result of this minor non-compliance.

At downstream Poutu Intake, where a 16 m³/s minimum flow is required, there were four non-compliances that totalled 20 minutes over the reporting period. The mean non-compliance was 15.915 m³/s. The minimum flow observed was 15.884 m³/s and this occurred after reinstating the Poutu Canal after a recreational canoe release. These four minor non-compliances in flow correspond to a few millimeters of river level over a maximum duration of five minutes on each occasion. No adverse effects resulted from these minor non-compliance events and no public complaints were received.

TABLE 7 // Tongariro River minimum flow compliance for the reporting period.

Location	Minimum Flows (m ³ /s)	Compliance (%)	Consent Number (condition)
Tongariro River at Downstream Rangipo	0.6	99.99	EW 103867 (4)
Tongariro River at Downstream Poutu Intake	16	99.96	EW 103875 (1, 3)
Poutu Stream at Ford	Minimum Flows (m ³ /s)	Compliance (%)	Consent Number (condition)
1 February–31 October	0.6	100	EW 103879 (2)
1 November – 31 December	0.3	100	EW 103879 (2)
1 January–31 January	0.45	100	EW 103879 (2)

Maximum Flows Several structures have maximum flow limits specified in resource consents, based on design criteria.

No modifications have been made to any of these structures. Specifically, this also includes no alterations to the Rangipo Dam Spillway Crest, which has been maintained at 818.4 m since the date of commencement of the consent. Genesis Energy was therefore fully compliant with these conditions during the reporting period.

- Moawhango Tunnel Discharge WRC 103863 (1)**
- Rangipo Power Station Take WRC 103867 (3)**
- Rangipo Power Station Discharge WRC 103870 (1)**
- Waihohonu Dam and Take WRC 103864 (1, 2)**
- Waihohonu Discharge WRC 103866 (1)**
- Poutu Intake Take WRC 103875 (15)**
- Poutu Canal Discharge WRC 103878 (1)**
- Poutu Canal to Poutu Stream WRC 103877 (1)**

Flood Management Once the flow on the Tongariro River downstream of Poutu Intake exceeds 250 m³/s, Genesis Energy is required to notify staff at WRC and Taupo District Council (TDC). During the reporting period, there were three instances where the respective councils were notified of high flow events. The dates for these high flow events were 3 August 2014, 27 April 2015 and 20 June 2015. On all occasions both TDC and WRC were notified via telephone.

There were no events that resulted in Lake Taupo rising above its maximum control level of 357.25 masl. This condition would require Genesis Energy to cease discharge from Moawhango Tunnel and Wairehu Canal if Lake Taupo exceeds, or is (in the view of WRC) clearly likely to exceed, the maximum control level.

- Moawhango Tunnel Discharge WRC 103863 (2)**
- Wairehu Canal Discharge WRC 103882 (1)**

Public Warning Genesis Energy maintains audible alarms at Poutu Intake and Poutu Dam to warn downstream river users of flow changes at these structures. The alarms are tested regularly to ensure that they are operative and perform to the required level.

Where there are planned maintenance activities that will alter the flows, Tongariro River users are notified via several mechanisms. Notification is via Genesis Energy's hydrology web page, e-mail, phone calls, newspapers and radio advertisements.

During the reporting period there were no planned maintenance activities that altered the flow in the Tongariro River.

- Poutu Intake WRC 103875 (5)**
- Poutu Dam WRC 103879 (5)**
- Poutu Dam Drum Gate Testing WRC 103881 (5)**

pH Monitoring Genesis Energy maintains a sensor that detects the pH at the Poutu Canal Diversion, to ensure that water is not taken from the Tongariro River via the Poutu Intake and into Lake Rotoaira when pH falls below six.

During the reporting period, there was one occasion where the pH dropped below this consented limit, this happened on 20 June 2015 during a high inflow event. The Poutu Intake was closed well before the pH dropped below the limit and was opened again after the pH had lifted above 6.0 as seen in Figure 10. The pH of the river dropped to a minimum of 5.73 during this period.

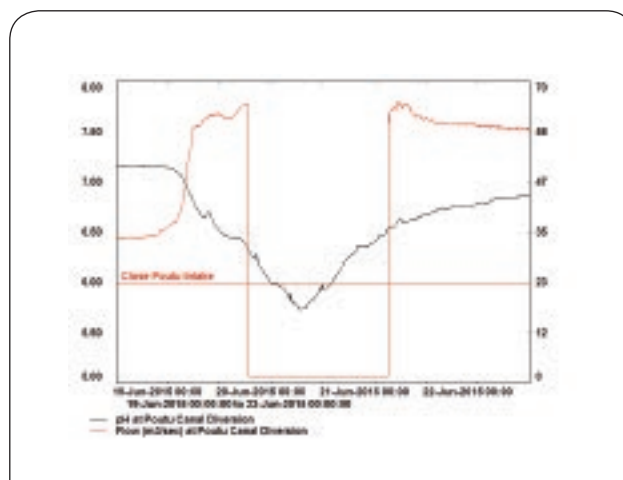


FIGURE 10 // Poutu Canal Diversion pH and Flow compliance.

Poutu Intake WRC 103875 (11)

Flow Measurement Accuracy Resource consents require that flow rating curves (that is, water level to flow relationships) are maintained so that the flow that the power station Generation Controllers observe is within ±8% of the true flow for 95% of the time (see Section 3.3.1 for more detail on the consent requirements).

Table 8 shows compliance with this condition on the Tongariro River at Downstream Poutu Intake monitoring site, as well as the number of river flow gaugings undertaken at the site during the reporting period. Non-compliance occurs when the data is not within the ±8% for 95% of the year. The site had full compliance during the reporting period. The operational flow was accurate to the true flow for 97.1% of the time.

TABLE 8 // Tongariro River and rating curve compliance for the reporting period.

Location	% time within ± 8%	Compliance	Number of gaugings	Consent number
Tongariro River at Poutu Intake	97.1	Full compliance	11	WRC 103875

4.2 AQUATIC ECOSYSTEMS AND WATER QUALITY

Good information is critical to the future management of the Tongariro River. Genesis Energy has worked closely with DOC Taupo Fishery staff, DOC threatened species staff, NIWA, Massey University and other stakeholders since 2005 to develop a comprehensive monitoring programme, co-ordinated through the Tongariro Section Monitoring Plan. This work has involved input from key technical experts and through the establishment of the

Tongariro Fishery Enhancement Fund (TFEF) via a Third Party Agreement with the DOC Taupo Fishery.

Key matters addressed through monitoring on the Tongariro River are: the effects of the flow regime on periphyton growth; macro-invertebrates; trout growth; whio (blue duck) numbers and density; and the effectiveness of flushing flows on removing any build-up of periphyton.

Semi-quantitative monitoring of macro-invertebrates, periphyton and sediment cover were undertaken monthly through the reporting period. Annual quantitative macro-invertebrates and periphyton assessments were also undertaken in March, when the river ecology is under most stress from warmer water temperatures, low flows and nuisance periphyton build-ups.

Rangipo Dam WRC 103867 (10)

Monitoring results for the Tongariro Section during the reporting period are summarised in Figure 9. Results for the reporting period for sediment, periphyton and macro-invertebrates at the four monitoring sites on the Tongariro River including Waipakihi River reference site, downstream Rangipo Dam, Tongariro at Puketarata confluence, and Tongariro at Judges Pool are reported by Tonkin and Taylor (2015).

Sediment Observations of sands and gravels at all four sites on the Tongariro River showed variability in sediment coverage between sites, within individual sites and over the sampling year. Sands were generally found in the highest proportion at the Waipakihi site while coverage by gravels was highest at the Waipakihi, Puketarata and Judge's Pool sites. The Rangipo site had very little fine sediment of either category present. No silts were found at any of the monitored sites during the reporting period. Overall, no specific trends were found over the sampling year.

Periphyton Trigger points for when flushing flows are required to remove periphyton are defined by both Resource Consent [Rangipo Dam WRC 103867 (10)] and the Ministry for the Environment (MfE) Guidelines for the protection of trout habitat and angling, which are:

- > greater than 30% cover by filaments longer than 2 cm; or
- > greater than 60% cover by mats 3 mm thick; or
- > chlorophyll a biomass (> 200 mg/m²); and
- > ash-free dry mass (AFDM) (> 35 g/m²).

Periphyton coverage and biomass levels were generally slightly lower to that encountered in previous years. In 2014/15 periphyton biomass and coverage of thick mat and long filamentous algae at the Waipakihi control site was lower than at the three sites below Rangipo Dam (see Figure 9). Levels of nuisance periphyton (both long filamentous algae and thick mats) at all sites remained well below MfE guidelines throughout the monitoring period.

Long filamentous algae coverage was generally highest at the Rangipo site compared to the other sampled sites, and peaked in December 2014 with 14.5% coverage within the run habitat. Thick mat coverage was highest in October at the Puketarata site (14.0%). Quantitative measurements of chlorophyll a and AFDM in March 2015 showed all sites were below the MfE guidelines, with the Puketarata site having the highest amounts of chlorophyll a (20.56 mg/m²) and AFDM (9.79 g/m²).

Macro-invertebrates Monthly SHMAK macroinvertebrate data for the 2014-15 reporting period showed a clear seasonal pattern in terms of percentage of EPT taxa that was similar to the previous data, with a reduction in the percentage of EPT taxa between January and March at all sites. However, this seasonal drop was not as severe as previous years, with all sites above 50% EPT taxa over this period (see Figure 9). This can be contributed to slightly lower periphyton coverage and biomass levels than previous years. In April, the percentage of EPT taxa increased once again with EPT taxa the dominant taxa type found at all sites. The percentage of EPT taxa dipped in October due to a flood event but increased again in November.



FIGURE 11 // Mayfly, Stonefly & Caddisfly (EPT)

The Puketarata and Judges Pool sites below Rangipo Dam were found to have a significantly greater mean number of individuals per stone compared to the Waipakihi control site and the Rangipo site. The mean number of individuals per stone at the Rangipo site was similar to the Waipakihi control site. Judges Pool had a significantly higher mean number of individuals per stone than all other sites.

Quantitative sampling in March 2015 found that taxa richness, total densities and EPT richness were similar between the Puketarata and Judges Pool sites and Waipakihi control site. Whereas, taxa richness and EPT density were significantly lower at the Rangipo dam site when compared to the Waipakihi control site. Total density and EPT density values were all comparable to results from 2011 to 2014 but were all lower compared to the 2010 data. Mean MCI scores were comparable between the Waipakihi control site and the Puketarata site but significantly higher at the control site than the Rangipo and Judges Pool sites. Mean QMCI scores at the Waipakihi control site were significantly higher than all sites below the Rangipo Dam.

Trout Studies Genesis Energy contributes annual funding towards trout fishery enhancement on the Tongariro River via the TFEF under an Agreement with DOC.

A key focus of the TFEF during the reporting period has been to contribute to the Waipa fish trap detection system, which is designed to automatically count trout moving upstream to spawn. It also detects any movement of PIT-tagged adult or juvenile trout passing through the trap. This information can be sent, on demand, via the cell phone network. In addition, rainfall data is telemetered via text message when a prescribed threshold is reached, indicating an imminent flood. A remote camera surveying the trap can also be triggered that sends images of the trap. The benefits of this system are that: staff no longer need to be sent out to clear the trap if there are no fish to process and staff know when there is a high number of fish to process or the trap is in flood.

However, there have been issues around the accuracy of the fish counter and rainfall recorder, as well as interference between the PIT tag detection system and the fish counter. The development of a reliable automated electronic communication system is important to obtaining critical fisheries data on age and size of the trout that return to spawn, in a cost effective way.

DOC have also started exploring the use of radio isotopic signatures in fish returning to spawn to provide a means of understanding the life cycle of trout in the Tongariro River system. The initial project involved isotopic analysis of different waterways that trout can live in during their life cycle. In light of the results, this analysis may form an exciting new line of research into better understanding the Tongariro River trout fishery and where trout spend their time. This new approach, combined with the routine trapping, will allow fisheries staff to monitor the survival of fish between spawning events and, combined with the monitoring of zooplankton, will hopefully help identify what is the most effective way of monitoring the state of the Taupo Fishery.

The TFEF also contributed to the development of an economic model and obtain data to help fishery managers understand the drivers of angling participation of the Tongariro Fishery; and to purchase five rugged, waterproof 'tablets' to undertake angler surveys and licence checks, primarily on the Tongariro River. These tablets make use of several Android applications to help rangers record angler and fish data electronically, removing the need for data entry and minimising further potential errors experienced using the paper based survey system. The data is also available for analysis immediately and can be sent back to the office via the cell phone network. They also allow instant online access to license databases for compliance purposes.

Blue Duck (Whio) Genesis Energy was granted a variation in 2009 to its resource consent for the upper Tongariro River to modify the whio monitoring regime from annual monitoring to 10 yearly monitoring. There is now 25 years of annual data since the commissioning of Rangipo Dam in 1983 showing a stable, though lower, whio population in the Rangipo reach (below the Dam). The potential loss of five or six pairs of whio from this section of river since 1983 has been successfully mitigated, through the Central North Island Blue Duck Conservation Charitable Trust, by significantly increasing whio populations on Western Diversion rivers (see Section 5.2) and at Taranaki (see Section 7.2). The national whio population has grown by more than 10% (300 ducks) as a direct result of the TPS mitigation package.

The whio monitoring regime for the Rangipo reach involves more extensive catchment wide surveys of the upper Tongariro River every ten years, with the next survey to occur in December 2018.

4.3 SEDIMENT (EROSION, TRANSPORT AND DEPOSITION)

The reduced flow velocities in Rangipo Dam have changed the sediment dynamics of the Tongariro River and result in sediment accumulation behind the Dam. For the vast majority of the time the flow downstream of the dam is clearer than it would be under natural conditions or in flood conditions, except during times when this sediment is flushed from the dam. To minimise the effect of flushing flows, flushes are only undertaken when inflows are greater than 60 m³/s upstream of the dam and are forecast to

exceed 100 m³/s, in order to maximise the transfer of sediment through the river. Sediment is scoured from behind the dam and is transported through the Tongariro River to Lake Taupo. This regime also requires the Poutu Intake to be shut so that the sediment is effectively routed through the Tongariro River.

The purpose of the flushing regime for Rangipo Dam is to release sediment early in a flood so that the flood wave "pushes" the sediment plume through the system, and then to reinstate Rangipo Power Station and Poutu Intake following a flush in a way that resembles the river's natural flood recession.

To assist with the pre-emptive release of sediment, Genesis Energy has developed a methodology for determining when flushing should occur using the Tongariro River at Waipakihi flow station and the relevant rainfall data. The Tongariro River at Waipakihi site is upstream of Rangipo Dam and the inflow forecast model generates data updates in 15 minute time-steps and predicts inflows up to two days in advance.

To prevent bed build up in Poutu Canal and Rotoaira Channel, Genesis Energy must also shut Poutu Intake when flows reach and exceed 160 m³/s. The flow is then routed through to the Tongariro River.

Rangipo Dam was flushed once during the reporting period, the flush occurred over two days from 3 to 4 August 2014 (see Figure 12). The maximum flow during this period was 252 m³/s, and due to the extended nature of the flush, it was successful in removing most of the sediment that had settled in the intake forebay at Rangipo Dam. Once the flush was completed the dam was refilled and operations reinstated.

A diving inspection of the forebay area was completed on 26 May 2015, with the results showing that the area was clear of sediment. A further sediment survey was completed with acoustic sensors on 8 June 2015 which revealed the same results; that minimal sediment was present in the intake forebay. Under normal inflow scenarios, sediment inspections will continue to be undertaken on an annual basis. In the event of very high inflows, the need for additional surveys, and flushing, will be assessed.

Resource Consent 103867 (condition 16) defines how much generation can occur at Rangipo Power Station following a flush based on the turbidity of water as measured at Poutu Intake. Figure 12 shows the operation of Rangipo Power Station during the August flush event and demonstrates that full compliance was achieved.

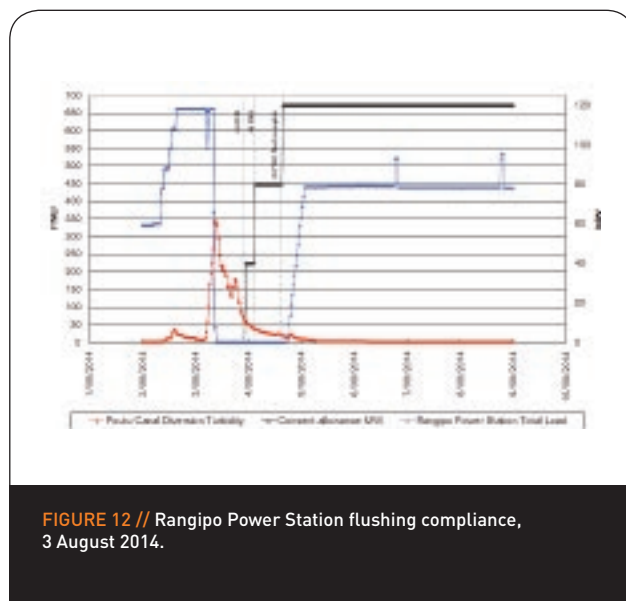


FIGURE 12 // Rangipo Power Station flushing compliance, 3 August 2014.

Resource Consent 103875 (condition 6) defines how much water can be diverted at Poutu Intake following a flush to prevent flushed sediment from being deposited into the Poutu Canal and Rotoaira Channel. Figure 13 shows compliance during the reporting period.

A non-compliance occurred on the re-instating of the canal and relates to the amount of water that could be taken as stipulated in the consent. The non-compliance was the result of a miscalculation of the consented flow rules for this operation. As a result, at the 36 and 48 hour steps respectively, a maximum of 4.8 m³/s and 3.6 m³/s over and above the consented allowance was diverted into Poutu Canal. A full investigation was undertaken and appropriate actions have been implemented to prevent this from happening in the future. The non-compliance was communicated to WRC at the time it occurred, along with the investigation outcomes. No adverse effects resulted from the non-compliance and no public complaints were received.

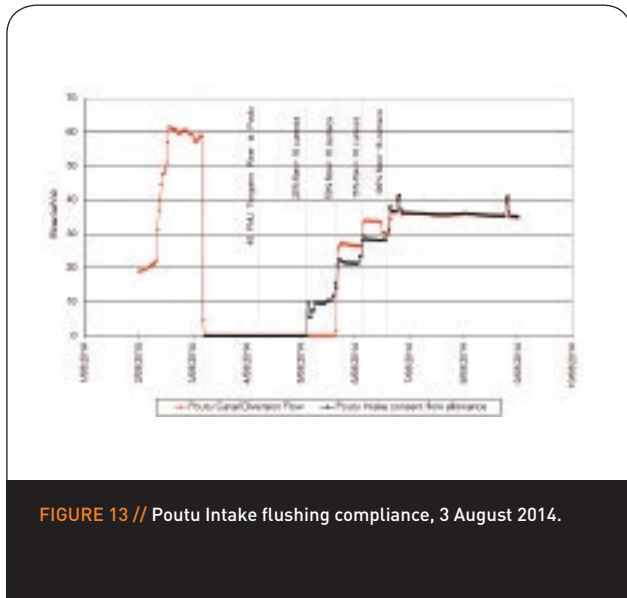


FIGURE 13 // Poutu Intake flushing compliance, 3 August 2014.

The flow into the Poutu Canal diversion was ceased five times in the reporting period due to a flow of 160 m³/s or more in the Tongariro River, under these circumstances the Poutu Intake must be closed. These high flows occurred on: 3 August 2014, 27 April 2015, 15 May 2015, 3 and 20 June 2015.

On 27 April 2015 the flow rose above 160 m³/s at 16:28, but the gate was not triggered to close until 17:10 meaning a non-compliance of 42 minutes for the gate to be triggered for closure. The non-compliance was communicated to WRC at the time it occurred, along with the outcomes of an internal investigation. No adverse effects resulted from the non-compliance and no public complaints were received.

The gate must also be fully closed within two hours of the flow being greater than 160 m³/s in the Tongariro River. All events in the reporting period were compliant with the two hour gate closure requirement.

The remaining four high flow events during the reporting period were fully compliant with the 160 m³/s consent conditions that is, for both the gate trigger and closure times specified.

Rangipo Dam WRC 103867 (14, 15, 16, 17)

Poutu Intake WRC 103875 (6)

4.4 RECREATION AND TOURISM

Legal access to the upper Tongariro River is extremely limited, as most of the key access roads are private roads. However, Genesis Energy has an agreement with the Lake Rotoaira Forest Trust, involving the payment of an annual fee, to provide unrestricted access to the Tongariro River for both recreational and commercial groups via Kaimanawa Road (otherwise known as Access 10).

In 2000, through consultation with Whitewater NZ and Hillary Outdoors, Genesis Energy agreed to provide recreational releases from Rangipo Dam and Poutu Intake. Three 30 m³/s flows are released for eight hours duration on separate weekends from Rangipo Dam and two 30 m³/s six-hour releases are provided on

the lower Tongariro River from Poutu Intake, which coincide with the Rangipo Dam releases. The timing of these releases is set well in advance so that kayakers and rafters can make the most of the increased flows.

Public safety, both in terms of those people participating in the recreational releases and downstream river users, is of critical importance. Genesis Energy works closely with relevant stakeholders to ensure that appropriate signage and public notification is in place.

Rangipo Dam WRC 103867 (7)

Poutu Intake WRC 103875 (7)

Five recreational flow release weekends were held on the Tongariro River during the reporting period (Table 9).

TABLE 9 // Tongariro recreational flow releases during the reporting period.

Release location and date	Average flow (m ³ /s)	Duration (hrs)	Compliance
Rangipo Dam			
Sunday 14 September 2014	32.57	8 hrs 25 min	Full compliance
Saturday 14 February 2015	29.7	8 hrs 5 min	Minor non-compliance
Sunday 19 April 2015	30.47	8 hrs 3 min	Minor non-compliance
Poutu Intake			
Saturday 13 September 2014	31.21	6 hrs 25 min	Full compliance
Saturday 18 April 2015	32.37	6 hrs 2 min	Full compliance

On 13 and 14 September 2014 recreational flows were released from Poutu Intake and Rangipo Dam respectively. These two releases were fully compliant for both flow and duration of the release. The release from Poutu Intake on 18 April 2015 as also fully compliant in terms of both flow and duration.

On 14 February 2015 a recreational flow was released from Rangipo Dam. There was a minor non-compliance as the mean flow during the release was slightly less than the required 30 m³/s. River flow exceeded 30 m³/s for the first time at 0700 hours. All available flow into Rangipo Dam (including with the Moawhango valve fully open) was released from this time until the conclusion of the release at 1505 hours. The flow varied around the 30 m³/s mark for the duration of the release, with the mean flow being 29.7 m³/s.

The possibility that the release may not reach 30 m³/s was discussed with White Water New Zealand and the WRC in the days preceding the release and the decision was made to proceed. No complaints were received regarding this release.

On 19 April 2015 a similar situation occurred for the Rangipo Dam release where Genesis Energy released an average flow of 30.5 m³/s for a duration of 8 hours and 3 minutes, however there was a minor non-compliance as the flow dropped below 30 m³/s several times.

Flows exceeded 30 m³/s for the first time at 0757 hours and flows were around 30 m³/s until 1601 hours. All available flow from Rangipo Dam (including with Moawhango valve fully open) was utilised. Despite this, there were seven, five minute periods where the flow dipped under 30 m³/s. The minimum flow of 29.6 m³/s was recorded at the Tongariro at Rangipo flow station. For this reason, the release was designated as a minor non-compliance. Again, no public complaints were received about this release.

The release weekends were, highly successful. They were actively promoted by Whitewater NZ, and more than 100 people attended each of the release days. Feedback from kayakers and rafters was positive for both the Rangipo Dam and Poutu Intake releases.

With many visitors coming to the Tongariro River for the recreational releases, there may be an increased risk of aquatic weeds being transferred into the area. Genesis Energy has

continued to work closely with relevant stakeholders to educate kayakers on the risks of didymo and other aquatic weeds and effective ways to clean equipment. During the releases, decontamination stations were provided by Genesis Energy at all entry and exit points on the river. The didymo decontamination and education measures are part of Genesis Energy's on-going commitment to educate the community about aquatic weeds and reduce the risk of didymo spreading to the North Island (see Section 8.5).

Since the South Island outbreak of didymo in 2005, Genesis Energy has worked closely with relevant stakeholders to develop a central North Island response to didymo. The response is focussed on changing the behaviour of river users and the precautions taken during the recreational releases are carefully aligned with the Central North Island response plan.



WESTERN DIVERSION

25



05 WESTERN DIVERSION

The Western Diversion is located in the headwaters of the Whanganui River (see scheme map inside the back cover). This part of the Whanganui catchment is located primarily within the Tongariro National Park and Tongariro Forest Conservation Area, both of which are highly valued for their ecology, recreation, and by tangata whenua for their cultural and spiritual values and as a food source. Sections within the catchment area have been severely modified through logging operations, exotic forestry, farming and urban development. The Western Diversion diverts water from eight tributary rivers and streams of the upper Whanganui River, including the main stem of the Whanganui River, through two man-made hydro lakes (Te Whaiiau and Otamangakau).

A significant amount of research and consultation has been undertaken on the rivers, streams and lakes of the Western Diversion to determine the effects of the ongoing operation of the Tongariro Power Scheme (TPS). Where appropriate, changes have been made to power scheme operations, monitoring programmes have been established or enhanced, or mitigation has been undertaken. Generally, additional monitoring is undertaken where there has been a change to the operations resulting from the consultative process, or where further monitoring is required to fully understand effects over the long term. Details of the consultation process and monitoring undertaken are described in the Tongariro Power Development Assessment of Environmental Effects (Genesis Power Ltd, 2000). Further details can be found in subsequent monitoring reports.

In order to maintain healthy and functioning ecosystems downstream of the diversions, minimum flows on both the Whakapapa and Whanganui rivers, implemented as a result of the 1991 Whanganui River Minimum Flows Hearing, have been maintained. Additional minimum flows have been implemented downstream of both the Mangatepopo and Whanganui intakes, to enhance the amount of habitat available for freshwater ecology, including native fish and blue ducks (whio).

Lakes Te Whaiiau and Otamangakau were formed as part of the TPS, and have since become renowned as a trophy trout fishery. The consultation process and subsequent outcomes ensured that these values are maintained.

No meaningful dialogue was established with Whanganui River Iwi until 2010 when Genesis Energy and the iwi entered into lengthy but very constructive discussions. The relationship agreement signed in December 2010 between Whanganui River Iwi and Genesis Energy paves the way for Whanganui River Iwi and Genesis Energy to work together on initiatives and other issues relating to the health and wellbeing of the Whanganui River (see Section 5.5).

Key outcomes of the consultative process for the Western Diversion were:

- › maintain healthy ecosystems downstream of intake structures through:
 - › continuing minimum flows downstream of the Whakapapa Intake and on the Whanganui River at Te Maire;
 - › new minimum flows downstream of the Whanganui and Mangatepopo intakes; and
 - › measuring outcomes through the monitoring of whio, water quality, periphyton growth and macro-invertebrates as defined in the Western Diversion Monitoring Plan.
- › increase recreational rafting/kayaking opportunity through:
 - › recreational releases; and
 - › agreements with Hillary Outdoors and Whitewater New Zealand with the common purpose of enhancing recreational canoeing/rafting opportunities.
- › no diversion of contaminated water bodies, with particular emphasis on:

- › development of a Volcanic Activity Management Plan (VAMP); and
- › real-time monitoring of water quality.
- › provision of river flow information via a free phone number and/or visit Genesis Energy's website;
- › the establishment of a relationship agreement with Whanganui River Iwi;
- › an agreement with the Whanganui and Ruapehu District Councils with a key objective of enhancing the water quality of the Whanganui River;
- › an agreement with Auckland/Waikato Region Fish and Game to address issues resulting from the loss of fishing opportunity within the rivers and streams of the Western Diversion; and
- › an agreement with Department of Conservation (DOC) and Royal Forest and Bird Society to protect, enhance and promote whio populations and their habitat, particularly in the central North Island.

5.1 HYDROLOGY

Flow records for the reporting period mirrored the patterns seen on the Eastern Diversion where the inflows were 90% of the long term mean for the first nine months of the reporting period. This meant that the Western Diversion was turned out for long periods over the summer period, in order to meet consented minimum flow requirements on the Whanganui River at Te Maire. The period from April to June saw much higher inflows which resulted in the mean annual inflow being 3% higher than the long term mean. This was observed in the rainfall records where there was above average rainfall in the upper Whanganui catchment for the reporting period with the mean being 109% and 112% for the Ruapehu and Whakapapanui rainfall sites respectively.

Flows downstream of the intake structures were close to the mean when compared to long-term data (calculated as if the present resource consent limits had always been in place) (see Figure 14). Wairehu Canal recorded a flow very close to the long term mean while Whakapapa at Footbridge was 4% higher than the long term mean. The Whakapapa River was used to meet the minimum flow requirement at the Whanganui at Te Maire flow station from December to May, resulting in the higher mean annual flow for the reporting period.

Flow measurement sites show mean flow over the reporting period and percentage of the long term average.

Minimum Flows To maintain the quality and, to a significant degree, the quantity of habitat available downstream of the intakes, minimum flows are released at key locations. A continuous minimum flow of 3 m³/s is provided below the Whakapapa Intake. A minimum flow of 29 m³/s must be met on the Whanganui River at Te Maire from December to May (inclusive) each year. Maintaining this minimum flow typically results in no water being diverted from the Western Diversion for up to two months each summer/autumn.

Continuous minimum flows of 0.5 m³/s and 0.3 m³/s are released from the Mangatepopo and Whanganui intakes, respectively, to provide for aquatic and whio habitat (whio are an indicator species of a healthy in-stream habitat). These flow releases also provide significant enhancement to the ecology, natural character and visual amenity of these streams.

As a result of below average summer inflows the Whakapapa Intake was not diverting water, either partially or completely, for large periods of time between December and April to comply with the Whanganui at Te Maire minimum flow requirement. In total the Whakapapa Intake was not diverting water either partially or fully for 109 days out of a total of 182 days of the Te Maire minimum flow period (December–May inclusive).

Full minimum flow compliance was achieved at all sites during the reporting period (Table 10).

TABLE 10 // Whanganui River catchment minimum flow compliance for the reporting period. *The minimum flow of the Whanganui River at Te Maire must be 29 m³/s from 1 December - 31 May each year.

Location	Minimum Flows	Compliance	Consent Number
	(m ³ /s)	(%)	(condition)
Whakapapa River at Footbridge	3	100	MWRC 101282 (2, 3, 4)
Mangatepopo Stream at Downstream Intake	0.5	100	MWRC 101286 (4, 5, 6)
Whanganui River at Downstream Intake	0.3	100	MWRC 101288 (4, 5, 6)
Whanganui River at Te Maire	29*	100	MWRC 101282 (7, 8, 9, 10)

Maximum Flows Several structures have maximum flow limits specified in resource consents, based on design criteria. No modifications that could have resulted in changes to the maximum flow capacities have occurred to any of these structures. Compliance with this resource consent requirement was therefore achieved during the reporting period.

- Whakapapa Intake MWRC 101282 (1)**
- Okupata Intake MWRC 101283**
- Taurewa Intake MWRC 101284**
- Tawhitikuri Intake MWRC 101285**
- Mangatepopo Intake MWRC 101286**
- Te Whaiiau Canal MWRC 101287**
- Whanganui Intake MWRC 101288**
- Te Whaiiau Culvert MWRC 101289**

- Te Whaiiau Canal MWRC 101290**
- Otamangakau Canal MWRC 101291**
- Otamangakau MWRC 101292**
- Wairehu Canal WRC 103882**

Flow Measurement Accuracy Resource consents require that flow rating curves (that is, water level to flow relationships) are maintained so that the flow the power station Generation Controllers observe is within ±8% of the true flow for 95% of the time (see Section 3.3.1 for more detail on the consent requirements).

Table 11 shows the level of compliance with these conditions, as well as the number of river flow gaugings undertaken at each site during the monitoring period. Non-compliance occurs when the data is not within ±8% for 95% of the year.

During the reporting period, a new flow station was installed at the Otamangakau Valve which now records the valve discharge using acoustic pipe flow sensors. These sensors will allow the site to record flow data more accurately than the downstream flow station that this site has replaced.

Full compliance was achieved at all of these sites during the reporting period.

Lake Levels Resource consent MWRC 101293 (condition 1) requires Lake Otamangakau to be maintained between 610.75 m and 611.98 m during 1 November to 31 March inclusive, and between 610.50 m and 611.98 m during 1 April to 31 October inclusive. Full compliance was achieved (Table 12).

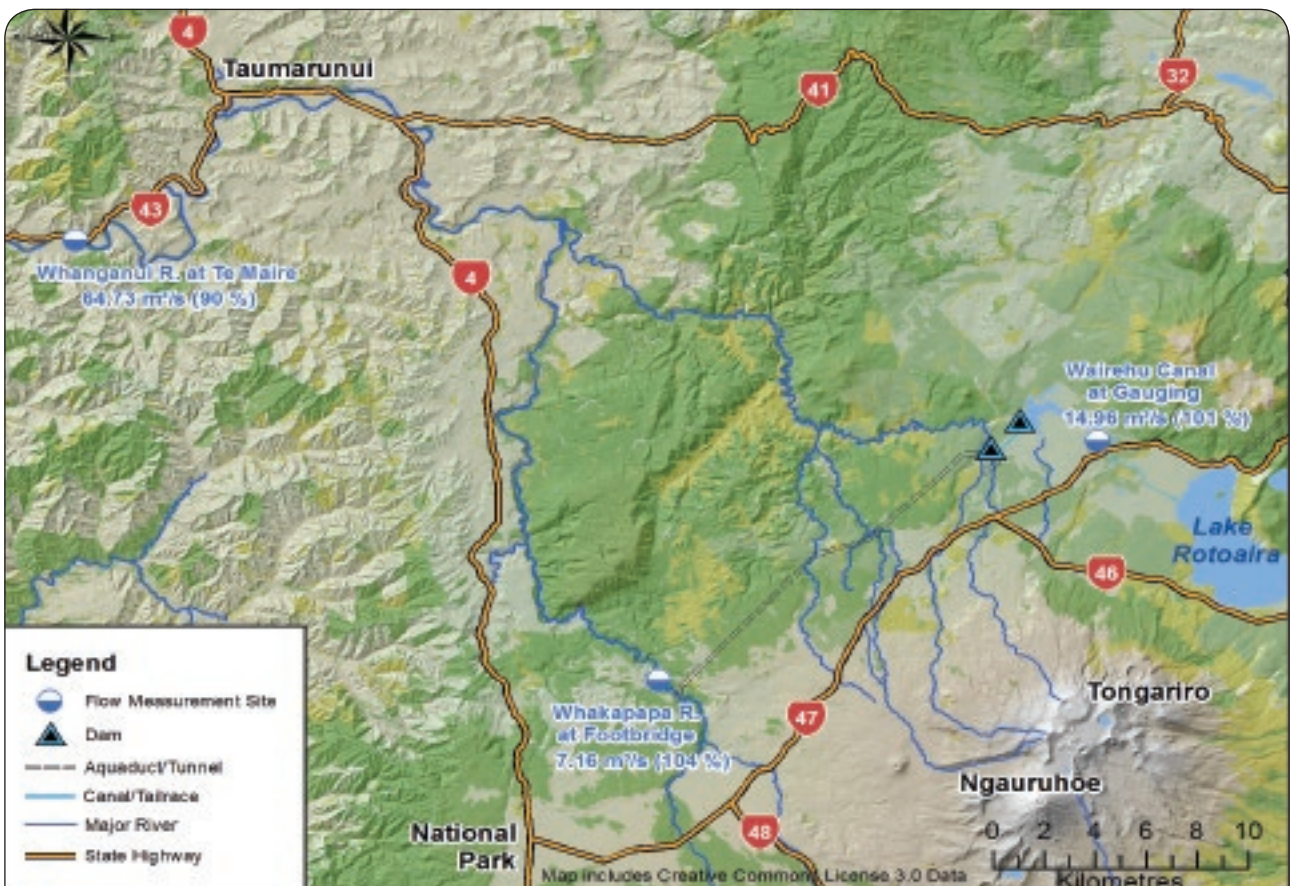


FIGURE 14 // Western Diversion Hydrology Monitoring sites for the reporting period.

TABLE 11 // Whanganui River catchment rating curve compliance for the reporting period.

Location	% time within $\pm 8\%$	Compliance	Number of gaugings	Consent number
Whakapapa River at Footbridge	99.4	Full compliance	9	MWRC 101282 (5)
Whanganui River at Downstream Intake	99.4	Full compliance	26	MWRC 101288 (6)
Whanganui River at Otamangakau*	100.0	Full compliance	N/A	MWRC 101294 (3)
Whanganui River at Te Maire	98.7	Full compliance	13	MWRC 101282 (10)

TABLE 12 // Lake Otamangakau lake level compliance for the reporting period.

Parameter	Value (masl)	Compliance (%)	Consent Number (condition)
Minimum level	610.75 (Nov-Mar)	100	MWRC 101293 (1)
	610.50 (Apr-Oct)		
Maximum level	611.98	100	MWRC 101293 (1, 3)

5.2 AQUATIC ECOSYSTEMS AND WATER QUALITY

The Western Diversion Monitoring Plan has been developed to measure the results of the minimum flow releases outlined in Section 5.1 and includes monitoring of periphyton, macro-invertebrates, whio, trout and native fish.

The Western Diversion Monitoring Plan was updated during the 2013/14 reporting period to reflect feedback from Manawatu Wanganui Regional Council (MWRC) on the monitoring results from 2012/13. Minor amendments were incorporated as required, refining techniques to better align with other in-stream monitoring occurring around the region.

Quantitative monitoring of periphyton and macro-invertebrates occurs at sites upstream and downstream of the Whakapapa, Mangatepopo and Whanganui Intakes on one occasion per year in late summer/autumn. This captures the period when river ecology is under most stress from warmer water temperatures, low flows and potential nuisance periphyton build-ups.

Whakapapa Intake MWRC 101282 (18, 19)

The Western Diversion monitoring results during the reporting period are shown in Figure 15. Monitoring results for periphyton and macro-invertebrates are reported by Tonkin and Taylor (2015).

Periphyton As with previous years, the data show periphyton levels were low in all three rivers, both upstream and downstream of the intake structures, with the highest periphyton levels recorded at Whanganui River sites (see Figure 15). Chlorophyll a levels at all sites were found to be below the MWRC target value of 50 mg/m². The highest value of chlorophyll a (4.94 mg/m²) was measured below the Whanganui intake. AFDM levels were also found to be below the MfE guideline at all sites.

Macro-invertebrates The mean percentage of EPT taxa, mean MCI and mean QMCI scores were high for both the above intake and below intake sites for all of the rivers. Average MCI and QMCI scores at all sites were indicative of excellent habitat and water quality. The highest average MCI score was recorded at the below Mangatepopo intake site (148). The highest QMCI was score recorded at the above Whakapapa intake site (8.12), which was significantly higher than the below Whakapapa intake site (7.77).

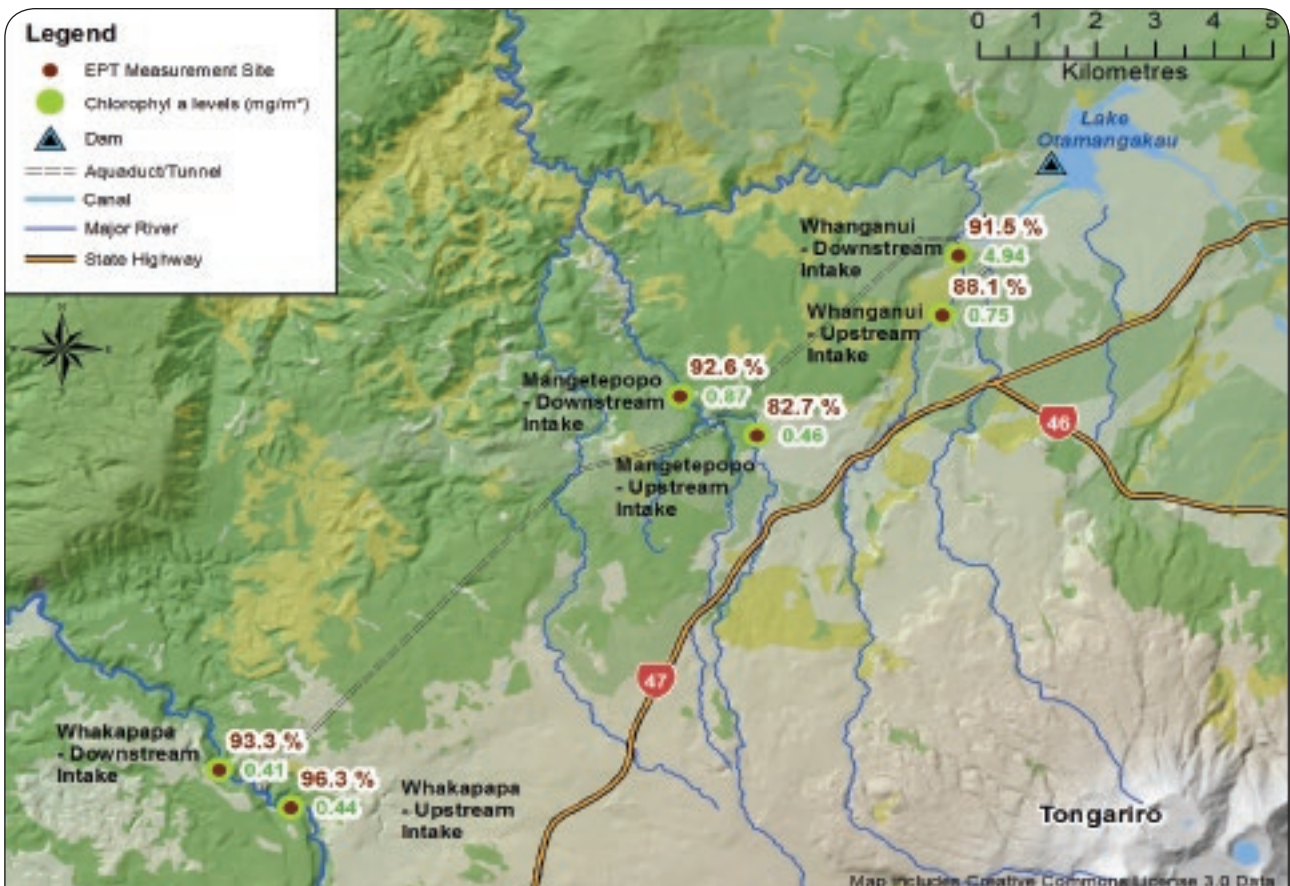


FIGURE 15 // Whakapapa, Mangatepopo Stream and Whanganui River monitoring results for the reporting period. EPT measurements are shown as % of invertebrates that are mayfly (E), stonefly (P), and caddisflies (T). Chlorophyll A levels are shown as mg/m².

Overall, the 2014-15 monitoring round shows no significant adverse ecological effects as a result of the diversions in the three rivers of the Western Diversion.

Whio Annual whio surveys, as per the Western Diversion Monitoring Plan, began on the Western Diversion rivers in 2003, with one other replicable survey completed in 1998. The rivers surveyed include the Mangatepopo, Whanganui and Whakapapa. These surveys initially served to determine the distribution patterns of whio downstream of the intake structures, and to assess the effectiveness of minimum flows established in 2004. In recent years the focus of the surveys has changed to understanding the population response to ongoing predator control. In 2011, the Western Diversion Monitoring Plan was amended to reduce whio monitoring from annual surveys to three yearly surveys.

Two surveys were completed in December 2014 on each river reach. The results are reported by DOC (Swanney, 2015). On the 47.9 km of river surveyed, 114 pairs of whio were recorded. This is an increase of 21 pairs from the last survey in 2011, and the total number of pairs has almost quadrupled since 1998 (from 30 pairs) (See Figure 16).

Pair densities are now very high in some reaches, with the average territory length on one of the Whanganui Reaches being just 170 m. The Whanganui River and Mangatepopo Stream have shown a dramatic upwards trend in pair numbers since minimum flows were established in December 2004. Also of note is the substantial increase in pairs on the Whakapapa River since the last survey period, from just five pairs in 2011 to 20 pairs in 2014. This season was a record year for whio productivity, with 218 ducklings being counted. There were four contributing factors to the high productivity:

- › Stable winter flows resulting in high invertebrate numbers;
- › Stable flows during nesting and brood rearing;
- › An aerial 1080 operation by TB Free New Zealand and DOC throughout Tongariro Forest; and
- › Predator trapping along the rivers.

This year showed the breeding potential of the Western Diversion population in the absence of floods and with effective predator control measures in place (trapping and aerial 1080). Nine surveys have now been completed since minimum flows were established in December 2004. Pair numbers have increased substantially over time, and productivity has spiked in years with stable flows and predator control. The Western Diversion now holds the densest population of whio in the country.

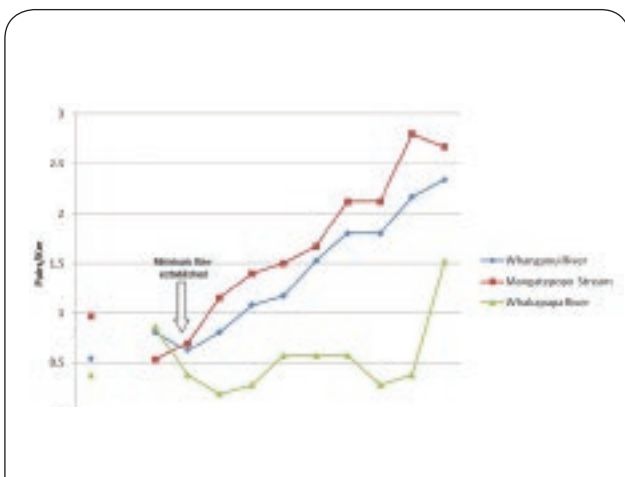


FIGURE 16 // Whio pairs per kilometre on the TPS Western Diversion monitored rivers, 1998 & 2003-2014.

The next Western Diversion whio monitoring survey is scheduled for December 2017.

Fish Surveys The rivers and streams of the Western Diversion do not naturally support large populations of native fish. This is characteristic of New Zealand native freshwater fish communities, which show a strong longitudinal gradient of reducing diversity and abundance with altitude and distance inland, as the life cycles of about half of the freshwater fish species in New Zealand move between the sea and freshwater. The Western Diversion intake structures are some 300 km from the coast and have an elevation of between 600 m and 700 m above sea level.

In March 2007, an electric fishing and habitat monitoring programme was initiated on the Whakapapa, Mangatepopo and Whanganui Streams in reaches below the intake structures (Bowman, 2007). These surveys were repeated in February 2008 and December 2008 and the results compared with those obtained in a similar survey undertaken in 1999, prior to the current minimum flow requirements. Based upon the results of these surveys it was clear that the reaches that were dry prior to the establishment of minimum flows had been recolonised by the fish communities present in the upper Western Diversion tributaries. As per the recommendation by Stevenson (2009), the Western Diversion Monitoring Plan was amended to reduce fish surveys to a three year sampling regime. A further survey was conducted in December 2011.

Three-yearly electro-fishing surveys and habitat monitoring below the intake structures on the TPS Western Diversion were undertaken in December 2014 and are reported by NIWA (Boubee et.al 2015).

Members of Ngati Hikairo ki Tongariro were involved in the survey to share knowledge and increase tangata whenua awareness of resource consent management and monitoring at the TPS (Figure 17). This year's surveys also involved an investigation into tuna stocks in Lake Otamangakau (using fyke netting) and further electro-fishing in the headwaters of the Whanganui River upstream of intake/dam structures.

Low densities of fish were recorded at most of the ten sites surveyed downstream of the intakes, with rainbow trout, brown trout and longfin eels present in all three rivers surveyed and shortfin eels found only at sites sampled on the Whanganui River. Freshwater crayfish (koura) were also recorded on the Whanganui and Mangatepopo. A wide range of eel sizes, including elvers (juvenile eels less than 120 mm long) were recorded indicating regular recruitment.

The survey of Lake Otamangakau and associated tributaries recorded juvenile rainbow and brown trout, goldfish, common bully and koura. Two large longfins were also captured in the lake.

Based upon the results of surveys undertaken to date, it is clear that the areas that were dry prior to the establishment of minimum flows have now been re-colonised by fish. NIWA have recommended that, unless physical changes to the habitat occur, a five year sampling regime will be adequate to monitor fish populations that inhabit the streams and watercourses of the Western Diversion. This will be discussed with MWRC and if agreed, the next survey would occur in December 2019.



FIGURE 17 // Ngati Hikairo Hapu members Richard Barrett and Lena Morgan help with a NIWA electro-fishing survey in the upper Whanganui River (Photo: Lena Morgan)



FIGURE 18 // Ngati Hikairo Hapu member Richard Barrett with two large long-fin tuna from the Lake Otamangakau stock assessment survey (Photo: NIWA)

Migrant Tuna Management at Wairehu Drum Screens

The 'stranding' of migrant tuna on the Wairehu Drum Screens has been an ongoing issue since the TPS was commissioned. When mature tuna from the headwater tributaries of the Western Diversion (and Lake Otamangakau) begin their migration to the sea to spawn, they follow flood flows downstream. Some are washed over spillways and can continue their migration, but others swim into intake structures and/or follow the water-flow to the outlet of Lake Otamangakau. The purpose of the Wairehu Drum Screens is to stop fish access for tuna, lamprey and brown trout into Lake Rotoaira where they do not naturally occur. When fish become stranded on the drum screens, they are often targeted as a food source by local people.

While weed and fish caught on the screens are transferred to an area that is accessible to the public, some people continue to break into the secure compound around the screens to collect tuna, putting themselves at risk from the mechanical equipment (which operates automatically). The stranding and subsequent harvest of migrant tuna at the Wairehu Drum Screens also reduces the potential recruitment of tuna stocks generally, through removal of breeding aged tuna. Proactively managing tuna stranding at Wairehu is seen as a means of addressing both tuna sustainability and the health & safety risks at the site.

In October 2012, Genesis Energy engaged members of Te Runanganui O Ngati Hikairo Ki Tongariro to monitor and salvage tuna stranded at Wairehu (Figure 18). The team continued the project for a third season this reporting period. They recovered stranded tuna and recorded species, weight, length, and eye size, before tagging and releasing them back into the Whanganui River downstream of intake structures. Records were also kept of the moon phase, weather conditions, rainfall, water clarity, water flow and temperature, to help further understand the timing of, and potential environmental triggers for, tuna migration.

A total of 27 tuna were recovered from Wairehu during the reporting period. These included 24 long-fin and three short-fin tuna. Peak catch this year was in December 2014 when nine tuna were recovered in a single night, all long-fins ranging from 0.68 kg to 8.55 kg. Similar to previous years a second (autumn) peak occurred in May 2015 when six tuna were recovered in a single 24 hour period – five long-fin and one large short-fin female of 3.2 kg.

The presence of other local tuna fishers at Wairehu continues to be significant during rain events. In addition to the 26 tuna recovered by the Ngati Hikairo tuna team, at least 20 further tuna are known to have also been taken by other eel fishers. Three trespass notices were issued to people who were recorded on security camera climbing over the security fence to gain access to the drum screen compound. Lighting has been upgraded and new security fencing is being investigated.

Elver Transfer Of significance during the reporting period was the discovery of elvers on the Otamangakau Valve while the valve was operating to meet Te Maire summer minimum flows (see Section 5.1). Following the detection of elvers downstream of structures in the upper Whanganui River during fish surveys in December 2014 (see Section 5.2) a small attractant flow was established on both the Otamangakau Valve and Whanganui Intake. Night time inspections of these structures during peak elver migration season (January/February) found elvers at both sites, and large numbers at the valve. From late January to late March, a total of 5,067 elvers were collected from the valve for relocation above the Whanganui Intake (approximately 3,000) and into Lake Otamangakau and its tributaries (approximately 2,000) (see Figure 19). These elver transfers represent the first significant recruitment of tuna into these waterways for over 40 years.



FIGURE 19 // Ngati Hikairo tuna team member Lena Morgan collects elvers at the Otamangakau Valve. The 'attractant flow' delivery pipe is seen to the left on the valve-house wall. (Photo: John Morgan)

Trout The initial operation of the TPS resulted in a decrease of rainbow trout populations below the Whakapapa Intake due to a reduction in habitat as a result of the lower flows. Genesis Energy has mitigated the reduction of trout numbers in the Whakapapa River by undertaking enhancement measures in partnership with the Auckland/Waikato Fish and Game Council. This was considered more appropriate than a release of additional water, as any significant benefits to the fishery would only occur if the releases were a significant proportion of the natural flow (which would significantly reduce flow). Key objectives of the agreement are to:

- > mitigate the effects of the TPS on trout habitat;
- > enhance angling opportunities; and
- > support ability to meet statutory responsibility.

Activities on the Whakapapa River during the reporting period are summarised by Auckland/Waikato Fish and Game (Daniel, 2015). Two drift dive surveys were carried out in the headwaters of the Whakapapa River during January 2015: one at the regular site below the Whakapapa footbridge gauging station; and one at the new site established near Owhango in 2014. Results of all drift dive surveys in the headwaters of the Whakapapa River since 1994 are shown in Figure 20.

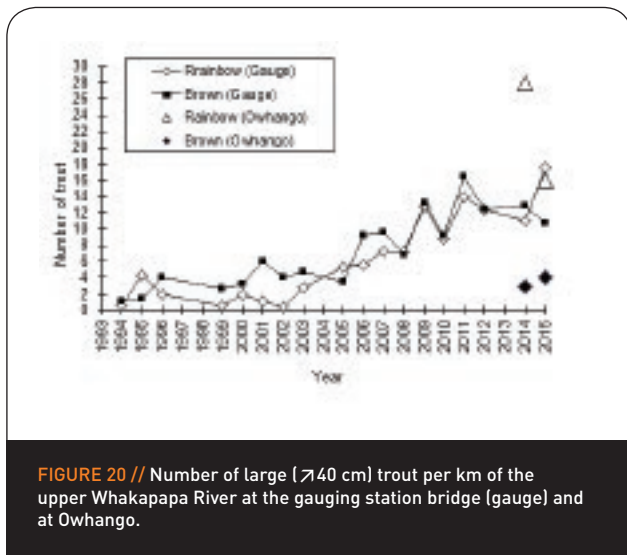


FIGURE 20 // Number of large (>40 cm) trout per km of the upper Whakapapa River at the gauging station bridge (gauge) and at Owhango.

Rainbow and brown trout numbers appear to have stabilised since establishment of the 3.0 m³/s minimum flow below the Whakapapa Intake in 1992 and the river may now be at its maximum carrying capacity under the existing flow regime. The controlled flow regime in the Whakapapa headwaters can have a considerable impact on the number of days that the river is fishable over summer. During dry summers the headwaters will rarely be fishable due to high flows (to meet minimum flow requirements at Te Maire), while in wet summers the headwaters will often be one of the few rivers in the region providing fishing opportunities due to the controlled flows and water diverted by the TPS.

Overall the Whakapapa fishery has high numbers of oversized (40+ cm) rainbow and brown trout and is meeting the management goal of providing a trophy fishery. Although oversized rainbow numbers were slightly down in the Owhango Bridge reach, the decline was not significant and was well within the variability between surveys that is expected with drift-diving. In recent years there has been a trend of increasing trout numbers and the density of oversized rainbows in the Whakapapa Footbridge reach was the highest recorded since records began in 1994.

In response to concerns of increased angling pressure caused by mountain bike and ATV tracks Fish and Game staff conducted an extensive angler monitoring program using 18 game cameras at randomly selected monitoring locations on the Whakapapa and Upper Whanganui Rivers during the 2014/2015 fishing season. The study had a secondary goal of determining if additional public access was needed on the Whakapapa River between the Whakapapa Footbridge gauging station and Owhango. This section of the river is not easily accessible because it is landlocked by private property requiring a long hike up or down the river.

From a review of over 10,000 photos, the first year of the study yielded valuable data that has provided a good basis for future management of both the Whakapapa and Whanganui Rivers. The ability to see anglers using the resource allows for a much better understanding of not only the fishers in the area but the potential impacts of additional improvements in access. The secondary goal of assessing anglers' use of the mid Whakapapa is largely unanswered and will be addressed in 2015/16. The initial study has provided a great platform to improve data collection in the coming year.

5.3 WHANGANUI RIVER ENHANCEMENT TRUST

To assist wider community aspirations for enhancing the Whanganui River, Genesis Energy, the Wanganui District Council (WDC) and Ruapehu District Council (RDC) have formed the Whanganui River Enhancement Charitable Trust (WRET). Genesis Energy provides funds annually to allow the Trust to meet its objectives.

The Trust aims to:

- > promote enhancement of the quality of waters and catchment of the Whanganui River;
- > make funding available for social, economic and environmental river enhancement projects; and
- > contribute to education about the health and well-being of the Whanganui River.

TABLE 13 // Whanganui River Enhancement Charitable Trust (WRET) result areas during the reporting period.

Project	Objective	Result Areas
Water Quality Enhancement Project (Manawatu Wanganui Regional Council)	> To promote water quality enhancement in the Whanganui catchment by targeting erosion "hotspots", implementing farm plans and education.	<ul style="list-style-type: none"> > Work continued on the demonstration farm concept with Evan and Roseanne Parkes (Farm Owners) to undertake an array of works and promote the model farm to other farmers. > Poplar Pole Nursery - two nurseries have been established, and further sites have been identified by Horizons for development. > 51 new erosion programmes approved. > 206.91 ha of area protected by erosion control works in 2014/15.
Model Catchment Project (The Catalyst Group)	> To promote water quality enhancement in the Whanganui catchment by targeting smaller catchments.	> The Piopotea and Kakahi Stream model catchment projects have been progressed, with a high level of community interest and involvement in the Piopotea water quality sampling programme.
River Enhancement Funding - social, economic and environmental projects	> To promote projects in the Whanganui catchment that are focused on social, economic and environmental outcomes that relate to the use and enjoyment of the Whanganui River or its tributaries and show clear benefit to a wide component of the community.	<ul style="list-style-type: none"> > Moore Family Biodiversity Project - wetland reinstatement. > Mangaturuturu Gorge Fence - funding for fencing to exclude stock from gorge margins. > Awarua and Kaikokopu Stream rejuvenation - funding for improvements to these streams. > Te Hokinga Mai - funding for two environmental / leadership camps.

The three year strategic plan (2013-16) outlining the major funding initiatives that the Trust is supporting, continued to be implemented during the reporting period. Table 13 identifies key projects underway and the outcomes to date.

Key highlights for the reporting period were the Model Catchment project and the Demonstration Farm Plan concept. Both projects seek to demonstrate medium term gains in water quality within priority Whanganui River catchments.

During the reporting period the Catalyst Group continued to implement a programme of works for the Piopotea Stream catchment and collecting baseline monitoring information from the Kakahi Stream catchment.

No scholarships were granted during the reporting period as no applications were received. The scholarship funding was instead used to fund Resource Management Act (RMA) training to up-skill nominees in the RMA process. Nominees were identified through RDC and WDC.

5.4 RECREATION AND TOURISM

5.4.1 RECREATIONAL RELEASES

The reduced flow on the Whakapapa River has limited recreational opportunities on this river. In recognition of this there are two recreational releases per year on dedicated weekends when the natural flow of the Whakapapa River exceeds 16 m³/s, and for a period of eight hours the full flow is released.

The timing of these releases is set well in advance so that kayakers and rafters can utilise the opportunity as much as possible. If the flow on the set release date is not expected to reach the required 16 m³/s, the release is deferred to the following day. If there is still insufficient flow, the release is cancelled. Genesis Energy liaises with Whitewater NZ which regularly updates its website, www.rivers.org, on the status of releases. **Whakapapa Intake MWRC 101282 (6)**

Recreational releases on the Whakapapa River were planned for 15 August and 5 September 2014. Unfortunately, due to insufficient natural flow in the river, neither recreational release or the designated back up days were able to proceed.

5.4.2 RECREATIONAL INITIATIVES

Hillary Outdoors Genesis Energy Kayak Education Fund Hillary Outdoors (formerly Sir Edmund Hillary Outdoor Pursuits Centre) raised concerns that reduced flows were limiting recreational opportunities on the Western Diversion rivers. In addition to the recreational releases, Genesis Energy agreed to provide educational opportunities through the Hillary Outdoors Genesis Energy Kayak Education Fund (KEF). The fund was established in 2003 and aims to:

- › provide sponsorship for students and teachers to attend kayak courses at Hillary Outdoors;
- › run workshops on advanced techniques and/or provide funding for instructors to attend courses elsewhere in New Zealand to raise the level of recreational kayaking and kayaking instruction in New Zealand; and
- › purchase resources for the development of kayaking students on courses.

Committee members met throughout the reporting period to discuss the direction of the KEF. Key results for the KEF for the reporting period are provided in Table 14.

TABLE 14 // Hillary Outdoors Genesis Energy Kayak Education Fund result areas for the reporting period.

Aims	2014-15
Hillary Outdoors staff kayak training	1 weekend course (8 participants)
1-day youth kayak course	5 courses (50 participants)
Whitewater kayaking helmets	16 purchased

Wairehu Playhole In addition to the recreational releases and the KEF, agreement was reached with Hillary Outdoors and Whitewater NZ to provide for the development of a kayaking playhole on the Wairehu Canal or some other recreational resource of broad recreational benefit.

The Wairehu Canal Kayak/Canoe Playhole opened in March 2010 after six years of design, testing and modification. The central North Island now has a playhole facility of international standard which has the potential to attract paddlers from throughout New Zealand as well as overseas.

The facility is used by Hillary Outdoors, school groups and the wider community. Given the time and resources that was put into the development of the playhole, Genesis Energy is eager to see it utilised as much as possible, and continues to work with Hillary Outdoors and Whitewater NZ to explore options to promote it.

During the reporting period the playhole was used by Hillary Outdoors for their tertiary group courses. The playhole is also used by Hillary Outdoors instructors, for their own recreation and upskilling, and also by the public.

5.5 WHANGANUI IWI

The iwi, hapu and whanau of the Whanganui River consider that the TPS has adverse effects on the river and on the relationship between tangata whenua and the river. Whanganui Iwi remain opposed to the diversion of the headwaters of the Whanganui River. In December 2010 a relationship agreement was reached between the Whanganui Maori Trust Board (representing the iwi, hapu and whanau of the Whanganui River) and Genesis Energy to begin to address these matters.

The Relationship Agreement (Hei Whakaaro Tahī Ki Te Mana O Te Awa) provides the framework and mechanisms to enable the Whanganui River Iwi and Genesis Energy to work together on initiatives and other issues relating to the health and wellbeing of the Whanganui River.

The Relationship Agreement is supported by an Initiatives Agreement (Hei Whāinga Ki Te Mana O Te Awa) and a Resourcing Agreement (Hei Whakamahinga). These contain further detail around the objectives and implementation of the relationship. A Relationship Group involving representatives from both parties has been formed to implement the agreements. The group has met regularly and completed the Governance Plan, Implementation Plan and a work programme for three years, which was endorsed by the high level Governance Group of representatives from both parties.

During the reporting period the responsibility for the relationship agreement was transferred from the Whanganui Maori Trust Board to Nga Tangata Tiaki, the post-treaty settlement entity representing Whanganui River Iwi. Genesis Energy and Whanganui Iwi continue to affirm their commitment to strengthening and improving their relationship at a governance level. This is an area of focus, while continuing to achieve the outcomes from Hei Whāinga Take ki te Mana o Te Awa.

In 2014 an action plan was completed and agreed by the Relationship Group. In early 2015, a programme manager was appointed to manage the implementation of the action plan and significant progress has been made in this regard, with the majority of work streams underway and on track.

A contestable fund, Te Mana o Te Awa (Figure 21), has been established. The purpose of this fund is to resource projects that

enhance and protect the health and wellbeing of both Te Awa Tupua and Whanganui Iwi. The strategic objectives of the fund are to promote and support projects that:

- › Enhance and protect the environmental, cultural and spiritual health and wellbeing of Te Awa Tupua;
- › Enhance and protect the cultural, environmental, social, political and economic development of Whanganui Iwi;
- › Strengthen the relationship of Whanganui Iwi with Te Awa Tupua;
- › Strengthen and grow the capacity of Whanganui Iwi to undertake and exercise a primary role in planning, management and regulation in respect of Te Awa Tupua.

Scholarships under Te Mana o Te Awa are also being progressed, as is a research and monitoring programme, and a governance training programme.

During the reporting period, the Relationship Group continued to support iwi led initiatives and wananga that focus on ensuring the health and wellbeing of Te Awa Tupua, including the Tira Hoe Waka and Rangatahi Summit.

For further information on Te Mana o Te Awa see the Nga Tangata Tiaki website - www.ngatangatiaki.co.nz



FIGURE 21 // Te Mana o Te Awa logo.



06



LAKE ROTOAIRA / LAKE TAUPO



06 LAKE ROTOAIRA BASIN/LAKE TAUPO

6.1 LAKE ROTOAIRA

Lake Rotoaira is a privately owned lake, administered by the Lake Rotoaira Trust on behalf of approximately 11,500 owners.

The lake acts as a reservoir for Tokaanu Power Station and is able to retain some water in storage. The Tongariro Power Scheme (TPS) has increased inflows to Lake Rotoaira via the Eastern and Western Diversions, and as a consequence, has reduced the average residence time of water within the lake from 247 days to 28 days.

The level of the lake has been raised by between 500 and 600 mm, and the natural seasonal 400 mm fluctuation in water level has been replaced with a daily and weekly fluctuation of approximately 300 mm. The lake circulation patterns have also changed from being wind-driven to being driven by water inflows from the Poutu and Wairehu canals and outflows via the Tokaanu Intake.

Lake Rotoaira has maintained excellent water quality and supports a healthy and productive ecosystem. However, there have been some changes in the structure of the lake fishery. In particular, a reduction in koaro numbers has been observed, and there are now fewer, but larger rainbow trout in the lake.

There were no studies of the koaro population prior to the TPS, so it has been difficult to assess the direct impact of the scheme. Predation by trout has suppressed the koaro population, though probably no more than prior to the scheme. Entrainment of koaro larvae in the Tokaanu Power Station Intake, and their movement into the Poutu and Wairehu canals, may also contribute to the population reduction.

Key outcomes of the consultative process for Lake Rotoaira were:

- > limits placed on the lake level operating range; and
- > an agreement between Genesis Energy and the Lake Rotoaira Trust to enhance the health of the lake and the trout fishery.

In 2014 Genesis Energy entered into an easement arrangement between the Lake Rotoaira Trust and Lake Rotoaira Forest Trust (who own much of the surrounding land) which recognises Genesis Energy’s use of the lake and surrounding land for hydro generation (see Figure 22). The easement also provides Genesis Energy with greater long term certainty for their current activities.



FIGURE 22 // Attendees at the signing of the Lake Rotoaira Relationship Agreement in September 2014.

6.1.1 HYDROLOGY

Lake Rotoaira receives a mean inflow of almost 50 m³/s: 30.4 m³/s from the Eastern Diversion via Poutu Canal; 19 m³/s from the Western Diversion via Wairehu Canal; and less than 0.5 m³/s from its own catchment area. The mean flow of water through the lake has increased by a factor of seven due to the Eastern and Western

Diversions and the Tokaanu Power Station. Originally, Lake Rotoaira had a natural flow rate of 6.9 m³/s.

Maximum Flows Several structures have maximum flow limits specified in resource consents, based on design criteria. There have been no modifications to any of these structures which could alter flow capacities. Compliance with these conditions was therefore achieved during the reporting period.

Poutu Canal Discharge to L Rotoaira WRC 103878

Wairehu Canal Discharge WRC 103882

Tokaanu Power Station Take WRC 103883

Lake Levels Lake Rotoaira has a normal operating range of 0.39 m, between 564.25 masl and 564.64 masl, but may go above this level in extraordinary flood conditions. There was one non-compliance on 3 August 2014 where the lake level breached the maximum control level by a maximum of 0.02 m for 2 hours and 5 minutes, the compliance data is shown in Table 15 and Figure 23 below. The non-compliance occurred during a high inflow event and the lake level was brought under control as quickly as possible via increased generation at Tokaanu Power Station. Lake Rotoaira Trust and WRC were advised of the minor non-compliance and the outcomes of the event investigation.

The definition of ‘extraordinary flood conditions’ is “the lake level continuing to rise when both Wairehu and Poutu canals are shut down and Tokaanu Power Station is operating fully (taking into account operational and maintenance constraints such as weed blockages and shut downs). Everything practicable must be done to alleviate any operational and maintenance constraints in this circumstance”.

TABLE 15 // Lake Rotoaira level compliance during the reporting period.

Parameter	Value (masl)	Compliance (%)	Consent Number (condition)
Minimum level	564.25	100	WRC 103879 (1)
Maximum level	564.64	99.98	WRC 103879 (1)

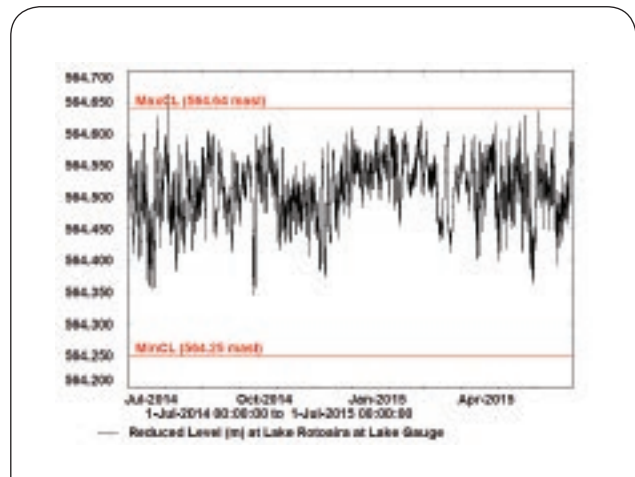


FIGURE 23 // Lake Levels at Lake Rotoaira during the reporting period.

Dam Specifications The specifications of Poutu Dam are defined in resource consents, based on design criteria. There have been no modifications to the dam, and therefore compliance was achieved during the reporting period.

Poutu Dam WRC 103879 (8)

6.1.2 AQUATIC ECOSYSTEMS AND WATER QUALITY

Genesis Energy is working with the Lake Rotoaira Trust to address the effects of the TPS on the lake, and promote and enhance the lake fishery. Lake Rotoaira Trust is working on implementing a management plan for the lake (see Section 6.1.3) which will include:

- > water quality monitoring;
- > macrophyte (aquatic weed) surveys; and
- > trout fishery monitoring.

In advance of this work, Genesis Energy undertook a lake monitoring programme between September 2006 and June 2009.

Aquatic Weed Management The hot, sunny, calm weather during the 2014/15 summer resulted in spectacular weed (Hornwort and Lagarosiphon) growth in Lake Rotoaira. Some 20 – 30 ha of dense weed beds developed off the Tokaanu Intake, waiting to be entrained on the intake screen during periods of high wind and high generation (Figure 24). Previously this situation has resulted in significant generation constraints at Tokaanu Power Station. In April 2015, Genesis Energy and Lake Rotoaira Trust worked together to start a weed harvesting trial. A weed harvesting vessel belonging to the Bay of Plenty Regional Council was deployed between 11 May and 8 June 2015 and harvested almost 2,610 m³ (783 ton) of green weed to reduce potential generation constraints (Figure 25). This weed will be delivered to the Tongariro Prison Farms, as well as local Marae and schools, as compost for vegetable gardens.

Lake Rotoaira Trust and Genesis Energy will use information from the weed harvesting trial to develop a longer term weed management strategy.

A Section 52 Permit, issued by Ministry for Primary Industries (MPI) under the Biosecurity Act, allows Genesis Energy to transport Hornwort and Lagarosiphon off site from the Tokaanu Intake weed compound, to local gardens. This permit dictates strict conditions, including transport routes, for such disposal.



FIGURE 24 // Aquatic weed beds off the Tokaanu Intake at Lake Rotoaira during April 2015.



FIGURE 25 // Weed harvesting operation in action at Tokaanu Intake.

6.1.3 LAKE ROTOAIRA TRUST

In 2000 Genesis Energy and the Lake Rotoaira Trust (who own the bed of Lake Rotoaira) reached a third party agreement that deals with the environmental and cultural impacts of the TPS on Lake Rotoaira. In 2011 the Lake Rotoaira Trust and Genesis Energy varied the agreement with the aim of facilitating better engagement between the two organisations. As a result a Relationship Group has been established with representatives from both groups.

The objectives of the Relationship Group are:

- > to assist the development, review and implementation of the Lake Management Plan;
- > to continue to take steps to ensure the environmental effects of the TPS are avoided, remedied and mitigated during the term of the resource consents; and
- > to further strengthen and develop the relationship between the parties.

The development of the Lake Management Plan is underway. The Plan focuses on the ecological, cultural and economic health of the lake and its tributaries. Both parties are committed to developing a meaningful and enduring relationship.

6.2 TOKAANU STREAM

The design of the Tokaanu Stream Diversion, where peak flows are discharged into the Tokaanu Tailrace, results in reduced incidences of floods in the lower reaches of the Tokaanu Stream. The reduced floods in the lower reaches of the Tokaanu Stream reduce the ability of the stream to clear itself of sediment.

Key outcomes of the consultative process for the Tokaanu Stream are:

- > consent conditions as to how and when desilting of the Tokaanu Stream Diversion channel can occur;
- > development of a Tokaanu Stream Management Plan and associated consultation framework; and
- > annual consultative meetings with the Tokaanu community, via the Tokaanu Stream Management Group (TSMG)

Genesis Energy maintains the Tokaanu Stream canal and aqueduct so that they are free from sediment build-up and maintain their hydraulic capacities. The spillway to the Tokaanu Tailrace is operated and maintained so that normal flows remain in the Tokaanu Stream and are not lost to the tailrace.

Genesis Energy contributes expertise and funds to the Tokaanu Stream community to assist with the development and implementation of the community's Tokaanu Stream Management Plan.

Tokaanu Stream Diversion WRC 103885 (1, 3, 4, 5)

During the reporting period, the Tokaanu stream community group elected a new chairman and representatives. Genesis Energy met several times with the new chairman and community group and discussed a number of issues and potential ways forward. At the request of the community group, Genesis Energy funded the preparation of a detailed work plan and costing for stream maintenance works. The community group is currently working to find a way forward for the works to be undertaken.

6.3 TOKAANU TAILRACE AND LAKE TAUPO

Water entering Lake Taupo via the Tokaanu Tailrace contains a mixture of Tongariro River water, Western Diversion water, Moawhango and Whangaehu catchment water and local inflow. The increased water inflow into the lake corresponds with an increased outflow from the lake to the Waikato River of approximately 29 m³/s, or 20% on average.

During the consultative process, issues were raised about the potential for additional water from the Eastern and Western Diversions to enhance the likelihood, or severity of, flooding around Lake Taupo and within the lower Waikato River. Although history has shown that on average the level of Lake Taupo has been managed lower than would have occurred naturally since the commissioning of the TPS, additional precautions have been put in place.

For purposes of clarification, the level of Lake Taupo is managed via the Lake Taupo Control Gates located on the Waikato River near the Lake Taupo outlet. These gates are owned and operated by Mighty River Power. Genesis Energy has worked closely with Mighty River Power and Waikato Regional Council (WRC) to develop a set of principles and rules to guide flood management on Lake Taupo and the Waikato River.

The key outcomes of the consultative process for Lake Taupo is consent conditions that require Genesis Energy to cease the diversion of foreign water from the TPS when Lake Taupo is at, or clearly likely to reach, its maximum control level (i.e. 357.25 masl).

6.3.1 HYDROLOGY MAXIMUM LEVELS

Genesis Energy is required to cease the diversion of foreign water, that is, water from the Moawhango Tunnel and Wairehu Canal, whenever Lake Taupo exceeds, or is clearly likely to exceed, its maximum control level (MCL) of 357.25 masl. During the reporting period there were no occasions where Genesis Energy was required to cease the diversion of foreign water.

Figure 26 shows the level of Lake Taupo for the reporting period. The lake level did not exceed 73% (356.87 m) at any point during the year, which reflects the moderate inflows during winter 2014 and the extended period of low inflows from early summer to late autumn.

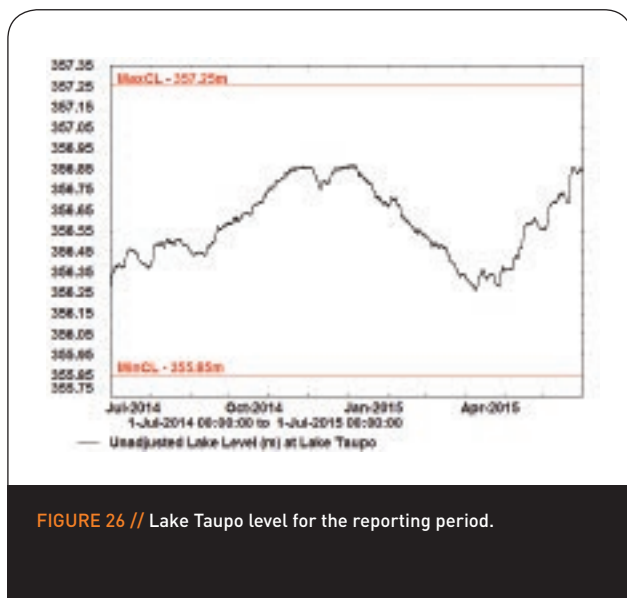


FIGURE 26 // Lake Taupo level for the reporting period.

Moawhango Tunnel Discharge WRC 103863 (2)
Wairehu Canal Discharge WRC 103882 (1)

6.3.2 AQUATIC ECOSYSTEMS AND WATER QUALITY

The residence time for water in Lake Taupo has reduced from approximately 13.5 years to 10.6 years as a result of the additional water from the TPS. A shorter residence time can potentially reduce the level of biological production, but it has not affected phytoplankton or zooplankton levels in the lake due to the generation time of these organisms, being in the order of days.

Other concerns raised in regards to the additional water from the Eastern and Western Diversions were the potential impact of additional nutrients being supplied to Lake Taupo and the effects of high water levels on erosion. Although the additional water does contain nutrients, it has been shown that the quality of the additional water is higher than that within Lake Taupo and as such the additional water could be of some benefit in diluting nutrients already in the lake. For a full discussion on the impacts of the TPS on Lake Taupo see the Tongariro Power Development Assessment of Environmental Effects (Genesis Power Ltd, 2000).

Genesis Energy contributed to the Taupo District Council (TDC) and WRC Lake Taupo Erosion and Flood Strategy development through 2007-09. The 2009 Strategy identifies a monitoring regime and funding mechanisms to address erosion and flooding issues on Lake Taupo.

During the reporting period Genesis Energy continued to engage with TDC and WRC, as part of the Generators Collective including Mighty River Power, King Country Energy and Trust Power, to help TDC and WRC implement the Erosion and Flood Strategy.

Genesis Energy also continued to work with wider Lake Taupo stakeholders through a representative on the Lake Taupo Catchment Committee, convened by WRC. The Committee meets four times a year to provide industry and public input to Council on issues such as: lake management planning and strategy; flooding and erosion management; and biosecurity.



07



SCHEME-WIDE OUTCOMES



07 SCHEME-WIDE OUTCOMES

A number of issues have been addressed on a scheme-wide basis for the Tongariro Power Scheme (TPS). Key outcomes of the consultative process include:

- › An agreement between Genesis Energy and the Tuwharetoa Maori Trust Board;
- › Central North Island Blue Duck Conservation Charitable Trust;
- › Provision of hydrology information;
- › Volcanic Activity Management Plan (VAMP);
- › Maintenance activities;
- › A run-off management plan;
- › Dam safety; and
- › Public Feedback.

Rather than deal with maintenance activities on a site by site basis, a suite of scheme-wide resource consents has been granted, allowing all common maintenance activities to be undertaken under a pre-defined set of conditions, across the scheme. The conditions require, among other things, the development of annual maintenance schedules, management plans associated with specific activities (for example, run-off from disposal sites) and a public complaints register.

7.1 NGATI TUWHARETOA – GENESIS ENERGY COMMITTEE

The TPS sits within the rohe of Ngati Tuwharetoa. A significant outcome from the re-consenting of the TPS in 2000 was an agreement reached between Genesis Energy and the Tuwharetoa Maori Trust Board (on behalf of nga hapu o Ngati Tuwharetoa). The purpose of the agreement is to directly address the environmental and cultural issues raised by Ngati Tuwharetoa. The key objectives of the agreement are to:

- › facilitate and promote environmental/cultural projects involving waterways influenced by the TPS and adjacent lands;
- › maximise the involvement of Ngati Tuwharetoa people in the monitoring activities undertaken by Genesis Energy;
- › undertake activities and promote projects to support the kaitiaki role of Ngati Tuwharetoa generally;
- › undertake activities and promote projects to facilitate the education, health and well-being of Ngati Tuwharetoa; and
- › establish stronger communication and relationship links between Genesis Energy and Ngati Tuwharetoa.

To implement the objectives of the agreement, the Ngati Tuwharetoa Genesis Energy Committee was formed.

During the reporting period, 42 projects were supported by the Committee. Two of the key projects for the Committee this year include:

- › The Kaitiaki Punawai Project from the Waihi Kahakaharaoa Maori Reservation Trust (Waihi Marae Trust). This project focuses on three key workstreams which include; improved recreational and swimming areas in and around Waihi papakainga, creating a cultural health index for Turumakina tributaries from source to lake and improving taonga species through restoration of flora and fauna in and around tributaries and the papakainga. (see Figure 27 and 28)
- › Te Wai O Tokaanu from Nga Uri o Te Po ki Tuwharetoa. This project is to restore and preserve the Tokaanu Stream by removing noxious plants and weeds on either side of the stream.

Charles Wall, Heemi Biddle and Maria Nepia are the current Ngati Tuwharetoa representatives and will serve a three year term.



FIGURE 27 & 28 // The Kaitiaki Punawai project before and after plant weed eradication and riparian planting for Te Mimi o Te Oinga.

7.2 CENTRAL NORTH ISLAND BLUE DUCK CONSERVATION CHARITABLE TRUST

Genesis Energy, Department of Conservation (DOC) and the Royal Forest and Bird Protection Society reached agreement to mitigate effects of the TPS on blue duck (whio). As a result, the Central North Island Blue Duck Conservation Charitable Trust was formed in 2002. The Trust aims to enhance, protect and promote whio populations and their habitat, in particular to:

- › create new self-sustaining whio populations in appropriate locations - not necessarily limited to the TPS region;
- › enhance existing whio populations by prioritising aquatic indigenous ecosystems and threatened species within catchments affected by the TPS; and
- › inform and educate the general public about the work of the Trust.

The Trust approved its third five year strategic plan (2013-18) in 2013 which outlines its major funding initiatives for the reporting period. Key Trust projects (managed by DOC) for 2013-18 are:

- › Securing and maintaining 50 pairs of whio on rivers in Tongariro Forest Security Site;
- › Securing and maintaining 50 pairs of whio on the Manganui-o-te-Ao River Security Site; and
- › Securing 50 pairs of whio at the Mt Taranaki Recovery Site.

The success of the projects supported by the Trust is outlined in Table 16.

DOC Projects A key highlight is another fantastic season at the Mt Taranaki Recovery Site, with a record 33 pairs of whio located. Productivity rates were similar to last year's record breaking season with 42 ducklings observed, of which at least 25 fledged. In addition to this, 17 captive breed whio were released.

The Tongariro Forest Security Site reported the most successful breeding season on record, with a total of 218 ducklings recorded with 185 ducklings surviving through to fledge. The number of pairs in the Security Site has decreased slightly from 114 pairs

last season to 109 pairs this season. This variance at such high carrying capacities is to be expected. This gives a total of 3.1 pairs per kilometre on the 35 km of river protected by traps.

While the number of who protected within the Manganui o te Ao - Retaruke Security Site has continued to decline (22 pairs protected), a recovery from the previous year has begun, with 29 ducklings hatching and an estimated 17 fledging. In response to the continued decline of who pairs at this site, trapping has been significantly intensified. It is predicted that as the number of fledglings continues to increase alongside the increased trapping effort, recruitment within the security site will allow this population to bounce back from the current low numbers.

Community Projects This year the Trust continued to implement its initiative to distribute funds across a wider range of community projects aimed at protecting existing who populations. A contestable fund was available to projects from interested individuals or community groups that support the recovery of who in the central North Island and surrounding districts. Projects are required to have community support.

The Trust is pleased to report that all four applications received were able to be funded in whole, or in part. Projects funded during the reporting period are outlined in Table 16.

7.3 PUBLICLY AVAILABLE HYDROLOGY INFORMATION

Genesis Energy has an extensive hydrology monitoring network around the TPS. A variety of flow, water level, rainfall and water quality data is collected in real-time and telemetered near real time. A selection of this data is freely available to the public via telephone and the internet via a personal computer or smartphone. www.genesisenergy.co.nz/rivers-lakes-rainfall

Members of the public can also obtain hydrological information updated routinely via the Tokaanu flow phone, (07) 386 8113.

Moawhango Dam Discharge MWRC 101280 (11)

Whakapapa Intake MWRC 101282 (11)

Rangipo Dam WRC 103867 (9)

Poutu Intake WRC 103875 (9)

TABLE 16 // Central North Island Blue Duck Conservation Charitable Trust result areas during the reporting period.

Project	Objective	Result Areas (14/15)
Tongariro Forest Security Site (including Whanganui, Mangatepopo and Whakapapa Rivers) (2013- 18).	<ul style="list-style-type: none"> > Support the Department of Conservation's proposal to secure and maintain 50 pairs of who. > Focus: predator control management and intensive monitoring. 	<p>Predator Control:</p> <ul style="list-style-type: none"> > 1080 aerial drop. > 35km of river protected with upgraded DOC 200 traps and refurbished A24 traps. <p>Monitoring:</p> <ul style="list-style-type: none"> > 109 pairs (a decrease of 5 pairs from last year). Pair density is very high at 3.1 pairs per kilometre. > Mild weather during the spring months coupled with a 1080 drop and trap replacement programme culminated in the most succesgul breeding season ever - a total of 215 ducklings recorded with 185 surviving through to fledge.
Retaruke-Manganui-o-te-Ao Security Site (2013- 18).	<ul style="list-style-type: none"> > Support the Department of Conservation's proposal to secure and maintain a minimum population of 50 pairs of who. > Focus: predator control management and intensive monitoring. 	<p>Predator Control:</p> <ul style="list-style-type: none"> > Trapping has been significantly intensified, with the addition of 70 Timms traps (to target cats) and 200 additional DOC 200 traps. > 71km of river protected. <p>Monitoring:</p> <ul style="list-style-type: none"> > While the population has continued to decline (22 pairs protected), a recovery from the previous year has begun, with 29 ducklings hatching and an estimated 17 fledging.
Mt Taranaki Recovery Site (2013- 18).	<ul style="list-style-type: none"> > Support the Department of Conservation's project to create a self-sustaining who population with a minimum of 50 pairs on Mt Taranaki. > Focus: integrated pest control, monitoring of the population and refining pest control techniques and techniques for translocating wild and captive-bred who. 	<p>Predator Control:</p> <ul style="list-style-type: none"> > Trap replacement and maintenance is ongoing. <p>Population:</p> <ul style="list-style-type: none"> > A record number of pairs (33) were located at the Site. > Productivity rates were also high with 42 ducklings observed with at least 25 surviving to fledge.
		Contestable Fund Recipients (14/15)
Contestable Fund 2015.	<ul style="list-style-type: none"> > Support Community-driven projects that work towards the recovery of who and protection of their habitat in the Central North Island and surrounding districts. 	<p>Ecological Solutions: Funding received to restore Who on the Tauranga-Taupo River.</p> <p>Black Fern Lodge: Funding received to help continue implementing their Who recovery programme on the upper Ongarue River.</p> <p>Aorangi Awarua Trust: Funding received for pest control and a who survey on the Ohuitu and Waikotore Streams.</p> <p>NZ Deerstalkers Association (Te Awamutu): Funding received to assist with repairs, replacement and additions to trap numbers along the Maramataha River.</p>

7.4 VOLCANIC ACTIVITY MANAGEMENT PLAN (VAMP)

The Volcanic Activity Management Plan (VAMP) defines how Genesis Energy will operate prior to, during and after a volcanic event. The plan sets out where Genesis Energy has monitoring instruments, how Genesis Energy will respond to this instrumentation and how the company will interact with other organisations. The VAMP was adopted in September 2006 and reviewed in June 2013 and 2014

Key agencies involved with the development of the plan were:

- › Manawatu Wanganui Regional Council;
- › Waikato Regional Council;
- › Department of Conservation;
- › Taupo District Council;
- › Ruapehu District Council; and
- › New Zealand Defence Force.

During the development of the VAMP, Genesis Energy worked closely with stakeholders in the central North Island to develop an emergency response plan, commonly known as the Eastern Ruapehu Lahar Alarm and Warning System (ERLAWS).

Genesis Energy has actively participated in the development of ERLAWS and has made its extensive communications network available to transport early warning information from remote sensors located near the crater rim on Mount Ruapehu, back to a base located at the Tokaanu Power Station. Once at the base this information is automatically sent to key agencies to put their response plans into action.

Genesis Energy has also established further early warning sites on the Waikato Stream and the Mangatoetoe Stream to provide early warning of an event that affects the Tongariro Catchment. This information, together with information from Genesis Energy's pre-existing sensors is provided to ERLAWS.

The VAMP was revised during the 2012/13 reporting period to incorporate the wider central North Island Volcanic Zone hazards as highlighted by the Te Maari Crater on Mount Tongariro in 2012. New monitoring sites and infrastructure were incorporated to manage the key risks including three continuous monitoring sites at: Whanganui Intake, Poutu Dam and Tokaanu Intake. In addition, three hand held monitors were purchased to enable spot measurements to be taken. Routine testing of lahar protection systems throughout the TPS also continues as part of the VAMP.

During the reporting period, regular tests were undertaken to ensure detection equipment is operating in accordance with the VAMP.

Discharge to Mangaio Stream MWRC 101277 (8)

Whakapapa Intake MWRC 101282/1 (12)

7.5 MAINTENANCE ACTIVITIES

Tables 17 and 18 describe the scheduled and unscheduled maintenance activities and related discharges in the Manawatu/Wanganui and Waikato regions, respectively.

Maintenance of Structures MWRC 101296 (25)

Maintenance Activity Discharges MWRC 101302

Abrasive Blasting MWRC 101303 (8)

Maintenance of Structures WRC 103887 (26)

Maintenance Activity Discharges WRC 103897

Abrasive Blasting WRC 103898 (9)

A number of other larger plant maintenance projects were also undertaken around the TPS during the reporting period:

Lake Moawhango Erosion Protection Repairs Shoreline erosion has been observed since initial impoundment of Lake Moawhango, particularly around the southern shore that is exposed to the prevailing northwest wind. An agreement between Genesis Energy and the New Zealand Defence Force (NZDF) sets out a process to monitor and manage erosion where appropriate (see Section 3.2.2.).

Erosion protection measures have been constructed at a number of sites along the southern shoreline, the majority of which were constructed in 2004/05. These works were constructed to protect

the access road and to prevent erosion of the low saddle just west of Moawhango Dam. The protection works are predominantly gabion basket walls with 'reno mattresses' at the toe, although bound riprap has also been used. Most recently geobags and geotextile matting were used as a low cost alternative in an area south of Saddle Bay. The gabion baskets and reno mattresses have proved to be effective in reducing shoreline erosion (Figure 29).

Recent areas of erosion around the southern shoreline now require additional protection measures in order to maintain the access road. Five areas have been identified; south of Boat Ramp Bay, north and south of Saddle Bay, the right abutment and the southeast corner. Of these, the areas around Saddle Bay should have the highest priority because of the proximity of the erosion face to the access track, the speed of erosion and the potential for erosion through the low saddle. Work got underway in early 2015 to address the North and South of the Saddle Bay. The north portion was almost completed when several heavy rain events and snow forced the project to be suspended over winter. The south portion will be carried out in summer 2016.



FIGURE 29 // Reno mattress construction, Autumn 2015.

Tokaanu Stores Gull Colony The black-billed gull colony that nested on the Tokaanu Power Station stores building during 2013/14 tried to re-establish their colony again for the 2014/15 season. The species is listed as 'nationally critical', which limits control methods that might have any population impact so a range of new devices were trialled to discourage the colony establishing. Motion activated water sprayers; bird scare audio; as well as bird spikes and wires on roosting areas, were all installed in an attempt to avoid the aggression and mess that resulted in previous seasons. The colony was persistent but eventually moved on without nesting.

Drainage Projects Planning for a number of drainage upgrade projects around the TPS was undertaken during the reporting period. These included: the access road to the Whakapapa Footbridge flow monitoring site downstream of the Whakapapa Intake; the Whanganui Pipe Bridge that carries the Western Diversion water over the Whanganui River downstream of the Whanganui Intake; the Tokaanu Penstock Slope drains; and the Tokaanu Power Station Emergency access road. These works are planned for later in 2015.

Tokaanu Excitation Replacement Project During the reporting period, the 1970's vintage excitation systems on the four Tokaanu Power Station generators were upgraded with modern systems. The excitation system creates the magnetism within the generator that allows it to generate electricity. The project was a significant one, requiring each generator to be out of service for up to two weeks between September and December 2014 and costing almost \$2million.

Mangatepopo Slip In late June 2014 following a sustained period of rainfall, a large slip came down in the Mangatepopo Gorge, just downstream and opposite the Mangatepopo Intake. During July 2014, a further slip came down at the Intake, closing off access (see Figure 30). This slip was cleared; drains opened up above and below the slip to manage water flow; and a fence built at its base to reduce risk to people and plant. However, in June 2015 this slip reactivated taking out the fence near the intake. These incidents are natural events and Genesis Energy is considering the implications and remedial actions to manage the slip and access to the site.

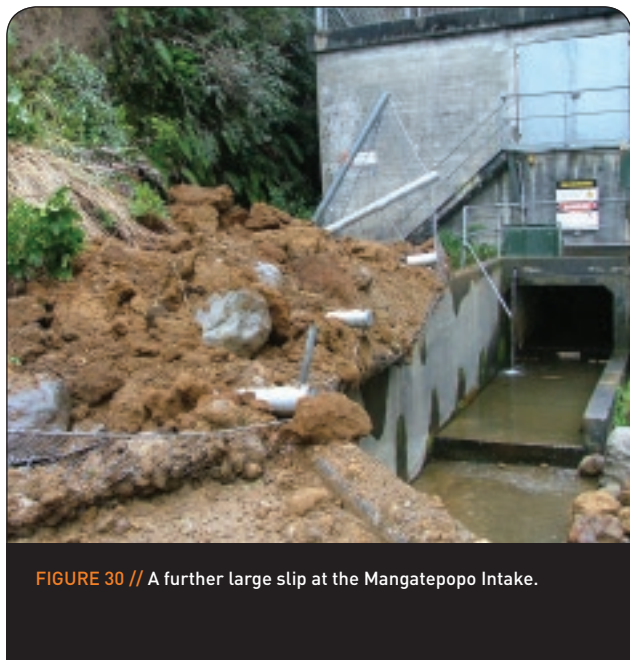


FIGURE 30 // A further large slip at the Mangatepopo Intake.

Totara Log Removed from Mangatepopo In March 2015, a large Totara tree became unstable at the Mangatepopo Intake, threatening to fall onto the road at the ford and block access. Following a karakia from Ngati Hikairo Kaumatua Te Ngahe Wanikau, the tree was felled and transported to Oputaka at Lake Rotoaira to be used for traditional carving (Figure 31).



FIGURE 31 // A large Totara tree is transported from Mangatepopo to Oputaka for use by Ngati Hikairo for carving.

Generation Efficiency Project Significant generation efficiency gains were made on the two Rangipo and four Tokaanu Power Station generators this reporting period. The project used knowledge of the most efficient running ranges of each generator, to develop software that automatically delivers the generation requirements of each power station in the most efficient way possible. This increase in “water to wire” efficiency has resulted in significant efficiency gains at both stations. Roll out of the software to all Genesis Energy hydro power stations in the coming months will enable the hydro generation assets to be operated in a more efficient manner.

Mangaio By-pass Valve Replacement An overhaul of the Mangaio Power Station by-pass valve was undertaken during the reporting period. Gear boxes were removed and replaced during the month long outage. The Mangaio Tunnel continued to divert water from the Wahianoa Aqueduct during the outage. Genesis Energy also used the outage to undertake maintenance and vegetation clearance on the 33kV line from Tokaanu to Moawhango Dam.

TABLE 17 // Tongariro Power Scheme maintenance activities and discharges in the Manawatu Wanganui Region during the reporting period.

Area	Description	Date	Quantity	Disposal Site
Scheduled Maintenance Activities - MWRC 101296 (25)				
Wahianoa Aqueduct (Intake 118)	gravel/silt removal	6/8/14	300 m ³	Stockpiled at Intake
Wahianoa Aqueduct (Intake 21)	gravel/silt removal	7/8/14	50 m ³	Stockpiled at Intake
Wahianoa Aqueduct (Intake 4)	gravel/silt removal	22/5/15	98 m ³	Stockpiled at Intake
Wahianoa Aqueduct (Intake 5)	gravel/silt removal	22/5/15	112 m ³	Stockpiled at Intake
Wahianoa Aqueduct (Intake 10)	gravel/silt removal	22/5/15	192 m ³	Stockpiled at Intake
Wahianoa Aqueduct (Intake 18)	gravel/silt removal	22/5/15	60 m ³	Stockpiled at Intake
Wahianoa Aqueduct (Intake 21)	gravel/silt removal	22/5/15	140 m ³	Stockpiled at Intake
Access Roads	Routine Maintenance	various	minor drain clearance	on site
Unscheduled Maintenance Activities				
Volcanic Eruptions	Removal of ash/lahar debris	Not required	n/a	n/a
Slip Debris	Removal of slip debris	Not required	n/a	n/a
Scheduled Abrasive Blasting - MWRC 101303 (8)				
There was no scheduled abrasive blasting in the Manawatu /Wanganui Region				
Unscheduled Abrasive Blasting				
There was no unscheduled abrasive blasting in the Manawatu /Wanganui Region				

Erosion Control There was no requirement for any erosion control actions at the sites authorised by the following consents, during the reporting period:

Moawhango Tunnel Discharge WRC 103863 (3)

Waihohonu Tunnel Discharge WRC 103866 (2)

Rangipo Power Station Discharge WRC 103870 (4)

Tokaanu Power Station Discharge WRC 103884 (4)

7.6 RUN-OFF MANAGEMENT PLAN

Genesis Energy has developed a Run-off Management Plan for the Tongariro Power Scheme. The plan is required by resource consents which permit the discharge of materials onto or into land associated with the removal of sediment, weed, debris or other material from, or adjacent to, watercourses of the scheme. The plan describes how the deposition activities will be managed and the methods adopted to achieve compliance. A maintenance plan is required to be submitted to councils annually. Records are kept of all material removed.

Maintenance Activity Discharge MWRC 101302 (10)

Maintenance Activity Discharge WRC 103897 (11)

The Run-off Management Plan was reviewed during the 2014 reporting period and was signed off by Waikato Regional Council (WRC) and MWRC. The Plan will be reviewed again in 2016 or as any relevant new operational issues arise.

The Run-off Management Plan includes an indicative list of sediment, weed and debris that is regularly removed from around the TPS. The rain storm that hit the lower and central North Island on 20 June 2015 in particular, caused significant sediment problems along the Wahianoa Aqueduct.

In accordance with the Plan and the resulting annual maintenance schedule, the respective volumes of material cleared from intakes and structures during the reporting period, and the means of disposal, are shown in Tables 17 and 18 (see Section 7.5).

7.7 DAM SAFETY

The Building Act contains extensive provisions for Dam Construction and Safety. The Dam Safety Guidelines (2015) published by the New Zealand Society on Large Dams (NZSOLD) provide the current framework for managing and monitoring the hydraulic structures of the TPS.

Dam safety surveillance involves routine monitoring and inspections at pre-determined intervals. On a monthly basis, assets are inspected and data is collected at a number of locations. An experienced professional engineer reviews the data and provides Genesis Energy with a monthly dam safety report, which is internally reviewed by an engineer.

An Annual Dam Safety Review is carried out by specialist professional engineers as suggested by the NZSOLD (2015) Dam Safety Guidelines. Copies of the Monthly and Annual Dam Safety Review reports are available on request.

A Comprehensive Safety Review (CSR) of the dams and associated appurtenant structures is carried out at intervals based on the dams' Potential Impact Category and involves independent civil, mechanical and electrical engineering experts, again in accordance with the recommendations of the NZSOLD (2015) Dam Safety Guidelines.

The introduction of new dam safety Regulations to implement the Government's Dam Safety Scheme under the Building Act (2004) has been delayed on a number of occasions over recent years. The Government has now decided that dam safety is better suited to being managed under the Resource Management Act (RMA) rather than the Building Act. As such, the Building (Dam Safety) Regulations 2008 have been revoked with effect from 30 June 2015. There is currently no indication of a work programme for Government departments to progress bringing dam safety into the RMA. In the meantime, Genesis Energy will continue to apply the NZSOLD (2015) Dam Safety Guidelines.

During the reporting period, an Annual Dam Safety Review was carried out in accordance with the NZSOLD Dam Safety Guidelines 2000 (because the inspection was carried out prior to the 2015 guidelines being released) at Moawhango Dam, Rangipo Dam, Poutu Intake, Poutu Canal, Poutu Dam, Otamangakau Dam, Te Whaiu Dam and Wairehu Control Structure.

7.8 OIL SPILL RESPONSE

All oil storage areas at Genesis Energy sites are bunded and compliant with statutory requirements. Comprehensive oil spill kits are situated at strategic locations at Tokaanu and Rangipo Power Stations and key intake structures. Regular staff training exercises are undertaken, spill kits checked monthly and response preparedness procedures are reviewed every two years.

TABLE 18 // Tongariro Power Scheme maintenance activities and discharges in the Waikato Region during the reporting period.

Area	Description	Date:	Quantity	Disposal Site:
Scheduled Maintenance Activities - EW 103887 (26)				
Rangipo Dam	Debris/pumice/gravel/silt removal	Not Required	n/a	n/a
Poutu Intake	Debris removal (Puketarata Culvert)	May-15	1 large log	Released downstream
Poutu Dam	Debris/gravel/silt removal	Not Required	n/a	n/a
Wairehu Canal	Removal of weed from intake screens	Weekly (Dec - June)	Total of 120 m ³ fresh weed	Forestry land next to screens
Access Roads	Routine Maintenance	various	minor drain clearance	on site
Tokaanu Intake	Removal of weed from intake	Aug-14	230 m ³ decaying weed	Tongariro Prison Gardens (Section 52 Permit held)
Tokaanu Intake	Removal of weed from intake	May-15	60 m ³ decaying weed	Tongariro Prison Gardens (Section 52 Permit held)
Unscheduled Maintenance Activities				
Volcanic Eruptions	Removal of ash/lahar debris	Not Required	n/a	n/a
Slip Debris	Removal of slip debris	Not Required	n/a	n/a
Scheduled Abrasive Blasting - EW 103898 (9)				
There was no unscheduled abrasive blasting in the Waikato Region				
Unscheduled Abrasive Blasting				
There was no unscheduled abrasive blasting in the Waikato Region				

No oil spill emergencies occurred within the TPS during the reporting period. Oil Spill Response procedures at Tokaanu Power Station were reviewed during the 2014/15 reporting period. This comprehensive document has been used as a benchmark from which the TPS spill response preparedness can be enhanced. Although site-specific with a Tokaanu station stormwater drainage map for reference, many of its practices and equipment references are relevant to other TPS assets (and wider Genesis Energy hydro generation assets).

7.9 PUBLIC COMPLAINTS

Genesis Energy records all public complaints via an Event Management System. Complaints are documented along with relevant recommendations. These are sent to appropriate staff to action.

Table 19 details the four public complaints received for the reporting period, and the actions taken to address the issues raised.

7.10 WAIKATO REGIONAL COUNCIL AUDIT

WRC has developed a system of ranking all sites within its region that hold resource consents, based on a variety of factors including the scale of activity and the likely effect the site may have on the environment. Sites are assigned a priority ranking ranging from 1 to 4, with 1 being the highest or most likely to have effects on the environment, and 4 being sites with very minor and/or stable effects.

The purpose of the priority ranking is to direct the WRC monitoring effort. Accordingly, the WRC is required to undertake an annual compliance audit for every Priority 1 site, while at least 75% of all priority 2 sites are audited each year. The TPS has been assigned Priority 2 status. Genesis Energy holds 19 consents granted by WRC to operate and maintain the TPS.

The WRC assigned the TPS a 'high level of compliance' for the 2013/14 reporting period with particular comment from officers that the site achieved the very top of this category. Genesis Energy is pleased with this result, which reflects the emphasis placed on environmental responsibility and resource consent compliance. It also reflects the significant amount of work undertaken to clarify consent condition wording with the WRC, and to improve reporting. Genesis Energy appreciates the consultative approach taken by the WRC with respect to the audit.

7.11 MANAWATU WANGANUI REGIONAL COUNCIL AUDIT

Manawatu Wanganui Regional Council ('Horizons') has developed a system of categorising those sites that are within the Industry Programme, which include hydro-electricity operations. Genesis Energy holds 31 consents granted by MWRC to operate and maintain the TPS.

The TPS is prioritised based on the following criteria:

- › The nature and scale of the activity;
- › The actual and potential environmental effects of the activity;
- › The profile of the site; and
- › Compliance History.

The TPS has been assigned a Category 2 status and therefore Horizons will inspect the Scheme up to four times per year (this includes data assessment such as quarterly and annual reports, and site inspection compliance reports). There are two categories as part of the assessment – comply or does not comply.

This is the fourth full review that MWRC has undertaken on the TPS consent compliance. MWRC assigned the TPS an overall rating of 'Comply - Full' for the 2013/14 reporting period. Genesis Energy is pleased with this result and ongoing communication and feedback on resource consent compliance. Special note was once again made of Genesis Energy's high performance in RMA compliance on a large and complex operation.

TABLE 19 // Public complaints during the reporting period.

Location	Complaint	Corrective Action
Tongariro River.	Rapidly rising water levels, putting recreational users at risk.	This complaint relates to high flows from a natural flood event, not Genesis Energy's activities. Hydrology information was provided to the member of the public who raised this complaint, and a letter was sent to key stakeholders reminding river users of the rapidly-rising nature of rivers in the central North Island.
Whakapapa River.	Rapidly rising water levels, putting recreational users at risk.	This complaint relates to high flows from a natural flood event, not Genesis Energy's activities. A response was provided to the complainant, explaining that the rising water level was a natural occurrence resulted from the flashy nature of the catchment.
Lake Otamangakau.	Potholes on road at Lake Otamangakau.	Inspected Otamangakau Road and found one pot hole approx 10 inches in diameter. Pothole repaired.
Genesis Web Site.	Poor information on the web site on hydrology.	Hydrology data failed to update on the website due a technical issue. This caused the website to display outdated hydrology information. The technical issue has been resolved with hydrology data now directly updated to the website.



COMMUNITY & ENVIRONMENTAL INITIATIVES

08



8.0 COMMUNITY AND ENVIRONMENTAL INITIATIVES

8.1 WHIO FOREVER

In 2010, Genesis Energy received an exclusive invitation from DOC's National Whio Recovery Group to become the corporate sponsor of whio. The Whio Forever Investment Agreement was subsequently signed by DOC and Genesis Energy on 31 August 2011 in Wellington. The agreement commits, in full, \$2.5 million over five years to fully implement the National Whio Recovery Programme thereby securing the future of whio.

During the last year significant work has been achieved by Genesis Energy and DOC working together to implement the Whio Forever Management Plan. Investment in predator control has been a key focus with 17 whio protection sites receiving support to better manage stoats and other predators. Most sites reported average to good numbers of ducklings this season. Unfortunately one security site, Manganui/Retaruke has continued to decline, as the trap network at this site is no longer effective (Table 20). An upgrade to the trap network has been planned and is currently being installed for the 2015/16 breeding season.

Eight sites received a boost through "Battle for our Birds" (BFOB) 1080 operations and this has led to exceptional years at three security sites; Tongariro has had a record 218 ducklings, Wangapeka/ Fyfe reports its most productive season since management began and Clinton/ Arthur had its third best season in 15 years.

Population management continues to be improved with the use of data loggers and a national database to capture whio related information from protection sites. This has allowed open public access to critical whio data from protection sites across the country, allowing better integration of whio management nationally.

The Whio Nest Egg project (WHIONE) continues to progress with funding supporting captive breeding sites and duckling rearing facilities nationwide. The construction and opening of a hardening facility at the Tongariro National Trout Centre in Turangi was a significant milestone during the year (Figure 32). The facility enables ducklings to develop their whitewater and foraging skills before being released into the wild where they are less susceptible to predation.



FIGURE 32 // Representatives of DOC, Ngati Tuwharetoa and the TNTCS, The Honourable Maggie Barry, and Genesis Energy's Chief Executive Albert Brantley releasing whio at the opening of the Whio Hardening Facility at the Tongariro National Trout Centre in Turangi.

In addition, the Whio Awareness campaign in March 2015 worked to raise awareness of the status of the whio through a national advertising campaign and the Whio Family weekend at Auckland Zoo. During the month other initiatives were run including visitor centre displays, press releases and an above-the-line marketing campaign to drive traffic to the Whio Forever website www.whioforever.co.nz

8.1.1 SPONSORSHIP FOR LOWER TONGARIRO COMMUNITY BLUE DUCK PROJECT

Genesis Energy, together with the Central North Island Blue Duck Conservation Charitable Trust, supported annual whio surveys on the lower Tongariro River for the first five years on that part of the river subject to a community based predator trapping programme. The programme is undertaken by the Tongariro Blue Duck Project Charitable Trust and is aimed at increasing whio numbers in what is New Zealand's only "urban" whio population.

The 2013/14 season was the fifth and final survey. No Genesis Energy contribution was made in 2014/15, however, Genesis Energy notes that the programme continues to make significant progress and that whio are now a well-established part of the lower Tongariro River ecosystem enjoyed by large sectors of the community.

TABLE 20 // Whio pairs protected at eight security sites since the start of the Whio Investment Agreement in 2011.

Security Sites	Pairs 2011/12	Pairs 2012/13	Pairs 2014/15	Increase in pairs over term of Genesis Energy funding
Te Urewera	7	21	21	14
Whirinaki	15	16	23	8
Tongariro Forest	43	114	109	66
Manganui/Retaruke	51	37	22	-29
Wangapeka	20	29	30	10
Clinton/Arthur	40	38	41	1
Oparara/Ugly (Solid Energy and Genesis Energy funding)	20	34	32	12
Styx/Arahura (Solid Energy and Genesis Energy funding)	10	13	30	20
Total	206	302	308	102

8.2 TONGARIRO NATIONAL TROUT CENTRE

The Tongariro River is a key component of the TPS, an a key resource for recreation in the Taupo region. Genesis Energy saw an opportunity to work alongside DOC and other key stakeholders to share information on how multiple resource users could co-exist. The TNTC was a prime location for such a partnership.

In 2004 an exciting education partnership was formed between Genesis Energy, DOC and the Tongariro National Trout Centre Society (the society). In 2009 the agreement was renegotiated and extended for 5 years and in 2013 a further 3 year extension was agreed. Funding includes the education programme, funding for administration support and site development projects at the Tongariro National Trout Centre (TNTC). The partnership is situated at the TNTC, alongside the Tongariro River, a fantastic educational resource accessible to the public and school groups. The education programme, *Taupo for Tomorrow*, was launched in 2005.



The TNTC has had another successful year during the reporting period. Highlights and updates from the TNTC during the reporting period include:

Whio Hardening Facility During the reporting period, construction of the new whio hardening facility at the TNTC was completed. A celebration to mark the opening of the facility was held on 4th December 2014 (see Figures 32 and 33). Construction of the facility involved conversion of a trout raceway into a stretch of fast flowing river complete with rocks and gravel to mimic a natural stream bed. The facility provides a safe environment for young birds from the whio captive breeding programme to develop their white water skills before they are released into the wild. During the reporting period, whio from the hardening facility were released into the Tongariro and Whanganui catchments as well as Egmont National Park. Plans are also underway for the facility to be utilised as a 'retirement home' for some of the older birds that have played an important part in the whio captive breeding programme.

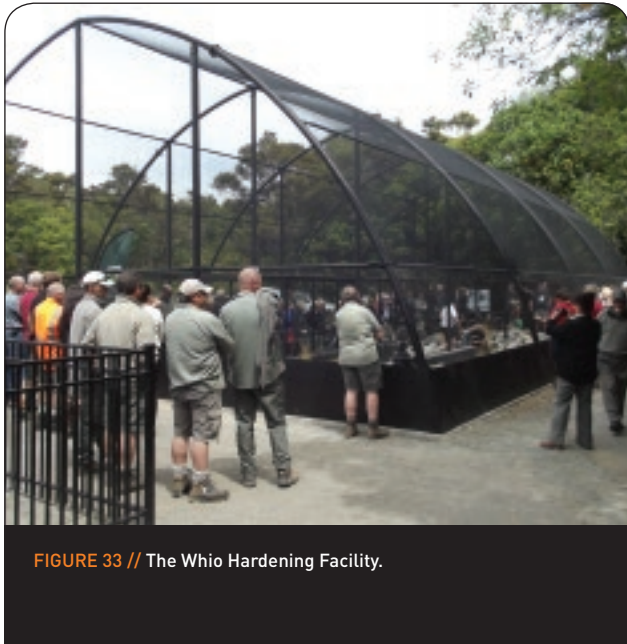


FIGURE 33 // The Whio Hardening Facility.

Genesis Energy Freshwater Aquarium The Genesis Energy Freshwater Aquarium has continued to attract local and overseas tourists, and is proving to be an integral component of the Taupo for Tomorrow education programme run at the Trout Centre. The aquarium is a unique resource, being the only public aquarium in the country to focus on New Zealand's native fish and the threats

to our freshwater ecosystems. School children and families delight in looking under the rocks and logs for the aquariums native kokopu and bullies, interacting with the native eels and discovering the brown mudfish which often bury themselves in the mud or under objects in their tank. Feeding time is particularly popular with visitors. Trout centre staff have worked to improve visitor experiences by redesigning fish tanks and displays.

Museum and Library The Visitor's Centre, including the Museum and Library adds a vital component to the TNTC, telling a comprehensive story of the central North Island's Trout Fishery, and the importance of managing our water resources appropriately to sustain this world-class trout and endemic fishery. The Visitor's Centre includes an interactive Genesis Energy display, which highlights the variety of values people place on water, including that of recreation, fisheries, mauri (life force), in-stream ecology, and power generation. New additions to the Visitor's Centre this year include a display in the Sargood Gallery telling the story of many of the 'Pioneers' who lived in the area and played a significant part in the development of the fishery. New panels in the same gallery provide illustrative details of the history behind the introduction of rainbow trout into the Taupo region.

Children's Fishing Days Children can enjoy the challenge of landing a trout (often their first) as part of their school visit with the Education Programme or on one of the regular 'Kids Fishouts' held during school holidays and long weekends (see Figure 34). All 'Kids Fishout' activities are supported by a keen group of volunteers who enjoy passing on their skills to the youngsters. Often mum or dad, or even granddad or grandma, who accompany the young fishermen, give vivid recollections of catching their first trout in the very same pool.



FIGURE 34 // Mike Nicholson (Taupo for Tomorrow Educator) showing Katie Lawrence how to fly-fish in the Kids Fishing Pond.

8.2.1 TAUPO FOR TOMORROW EDUCATION PROGRAMME

Taupo for Tomorrow endeavours to assist students in widening their appreciation of what fresh water and the species that live in it bring to their personal lives in a recreational and cultural sense, but also to recognise how important our rivers are in meeting the energy needs of our nation. In terms of 'big picture' learning, students are encouraged to recognise that fresh water sustains us in a multitude of ways, not least recreationally through our world famous trout fishery, but also in meeting the energy needs of New Zealanders. They are asked to view fresh water as an 'essential service' that needs to be carefully monitored and cared for into the future.

All programmes on offer are grounded by some big ideas designed to accommodate the vision and learning needs of the partners at the site. Big ideas like 'striking a balance' and 'everything is connected' are threaded through all programmes offered and the Taupo for Tomorrow staff work hard to ask learners to explore these ideas and what they mean to us as individuals and communities.



Taupo for Tomorrow has enjoyed another busy year assisting students to develop their thinking and learning about freshwater and its role as an essential service, both on site at the Tongariro National Trout Centre and off-site at various other locations and schools.

During the reporting period, 2717 students visited the programme, participating in a range of programmes and learning opportunities. This number was made up of 117 groups from 65 schools and learning institutions. Pleasingly, 30% of schools visiting this year were from secondary or tertiary providers.

Taupo for Tomorrow Highlights:

- › **Fantastic Whio** Whio are an extremely interesting and entertaining freshwater indicator species and as such make an excellent engagement tool when asking learners to think about fresh water ecology, resource use, and 'deep' learning ideas such as 'striking a balance'. Existing Taupo for Tomorrow programmes like 'Fantastic Whio' have benefited hugely from having whio on site, at the whio hardening facility.
- › **Genesis Energy Freshwater Aquarium** The role of the Genesis Energy Freshwater Aquarium is significant as it encourages learners to engage with our native freshwater fish and in turn it is hoped that they will become advocates for them themselves in the future. Many students are amazed and engaged when they understand more about whitebait species, the incredible journey of tuna (long fin eels), and the need to be aware about pest fish and aquatic plants and the threats they pose to our freshwater resources.
- › **Wonderful Wai** Wonderful Wai continues to be one of the mainstays of learning at the Taupo for Tomorrow programme. This programme has a local focus, in that it is targeted at local schools using their special freshwater areas and the values surrounding them as key concepts for learning. As such, we are able to support these learners on site at the National Trout Centre, in classrooms at their schools and on-line. Thirteen classes from our local region choose to participate in the Wonderful Wai programme this year.
- › **Kiwi Forever** Taupo for Tomorrow again had a significant presence at this year's 'Kiwi Forever' programme in Ohakune. This year students completed invertebrate surveys on streams running from the flanks of Mt Ruapehu that local iwi are inextricably connected to and Genesis Energy use as part of the Tongariro Power Scheme.
- › **LEARNZ** A Freshwater Ecology fieldtrip was held in July 2014. This fieldtrip once again aimed to tell the story of the uses and values surrounding freshwater in the central region. During the fieldtrip, online learners get to link with freshwater scientists and freshwater fishery managers. They also learn about threats to our freshwater resources and the business of freshwater – in that they are challenged to investigate the relationship between business and freshwater, and how the needs of industries such as tourism and hydroelectric generation that rely on the river, are balanced with the needs of ecology.

This year's field trip saw 2587 students from 104 classes from around New Zealand follow the fieldtrip.

For more information about the Taupo for tomorrow learning Programme, visit www.taupofortomorrow.co.nz

8.3 KIWI FOREVER

The Kiwiforever programme provides a unique opportunity for high school students in the central North Island region to get hands-on conservation experience, while learning about inter-related environmental management issues and the Ngati Rangī world view. The programme is a partnership between Untouched World, DOC, Ngati Rangī and Genesis Energy. The 20 students spend a week staying at Tīrorangi Marae where they gain an appreciation of the Maori world view while experiencing field excursions each day with Ngati Rangī, DOC, Genesis Energy staff and other agencies.

2015 marked the 10 year anniversary of the programme, and is the third year that Genesis Energy has been involved. In 2014 the focus of the programme was extended to include whio conservation, healthy waters, and 'striking the balance' – all key themes of environmental management in and round the TPS. Genesis Energy staff were involved in presenting to students during the week-long programme and the students who participated in this years programme gained a huge amount of knowledge and experience in their week at Tīrorangi Marae, and are now ambassadors for conservation and resource use in their respective schools and communities (Figure 35).



FIGURE 35 // Kiwiforever students about to release a whio in the Whakapapanui Stream.

8.4 HILLARY OUTDOORS SPONSORSHIP

Within the TPS, Hillary Outdoors is an important stakeholder. Genesis Energy has partnered with Hillary Outdoors to support their vision of developing potential through outdoor education (with a focus on New Zealand's youth).

Genesis Energy Secondary School Hillary Challenge Between 17 – 22 May 2015, eleven New Zealand secondary school teams and one secondary school team from Australia competed in the annual Genesis Energy Hillary Challenge at Hillary Outdoors, adjacent to the Tongariro National Park.

This event attracts the very best secondary school adventure racers from around New Zealand who battle it out in a wide variety of outdoor challenges. The challenges are designed to test outdoor skills, endurance, mental acumen and teamwork, culminating in an 18 hour rogaine expedition and 53 km multisport race.

After 15 years of trying, Thames High School took first place and lifted the Genesis Energy trophy for the first time (Figure 36). Thames was followed closely by New Plymouth Boys and Girls High Schools in second place (last year's victors) and Whangarei Boys and Girls High Schools in third place.

To find out more about the Genesis Energy Secondary School Hillary Challenge visit the Hillary Challenge website www.hillaryoutdoors.co.nz, and the Hillary Outdoors Facebook page www.facebook.com/hillaryoutdoors.



FIGURE 36 // The winning team from Thames High School (Photo: Hillary Outdoors).

Hillary Step The Hillary Step programme was developed by Hillary Outdoors to enable students from low decile schools to participate in a week-long outdoor education programme. During the reporting period, Genesis Energy funding gave 85 students from four schools located near our generation assets the chance to learn valuable life-skills at the Hillary Outdoors Tongariro Centre. These schools were Tongariro School, Ruapehu College, Wairoa College and Huntly College – all of which have a decile rating of one or two, meaning they are in the lowest socio-economic areas of New Zealand. As the experience these students gained was so positive, all of these schools have booked to take more students next year.

8.5 AQUATIC BIOSECURITY

Didymosphenia geminata (Didymo), together with a range of other aquatic weed species such as Hornwort and Lagarosiphon, have the potential to seriously impact on Genesis Energy's operations and the aquatic environments in which Genesis Energy operates.

Genesis Energy is working with a number of organisations to help prevent the spread of aquatic pests in the North Island and to limit the effects of those aquatic weeds that are already present. These organisations include:

- > Ministry of Primary Industries (MPI) – Biosecurity;
- > Department of Conservation;
- > Fish and Game;
- > Tuwharetoa Maori Trust Board;
- > Lake Rotoaira Trust;
- > Waikato Regional Council;
- > Manawatu Wanganui Regional Council;
- > Bay of Plenty regional Council;
- > Taupo District Council;
- > Whitewater New Zealand;
- > The Advocates for the Tongariro River; and
- > Local Tourism Industry.

Genesis Energy is involved at a national level in the MPI Aquatic Pest Long Term Management Steering Committee and has attended various meetings and workshops to help ensure aquatic pest management remains as coordinated and effective as possible at a national level. Genesis Energy also contributes to regional partner groups formally established by MPI Biosecurity that play a critical role in helping to manage the threat of aquatic pests at a more local level. The Central North Island Partner Group is one of six in the North Island.

Didymo has not reached the North Island in the 11 years since it was first detected in the southern South Island. This gives some hope that the highly invasive algae may be able to be kept out of North island waterways. Prevention remains a far better and cost effective option than management of didymo in the North Island, so on-going public awareness campaigns continue to be the focus of didymo actions locally. As part of the regional didymo action plan, Genesis Energy and DOC continue to undertake monthly surveillance monitoring on key local rivers including those on the Western Diversion of the TPS and the major tributaries of Lake Taupo.

Locally there is also a focus on other invasive aquatic weeds such as Hornwort. A weed cordon that was installed at the Lake Otamangakau boat ramp in September 2011 to reduce the risk of Hornwort establishing in the lake, was inspected by a dive team in April 2015. It was found to be free of any new invasive weeds. However, the cordon required maintenance at numerous places during the reporting period, where propeller damage had cut the nets.

Boat wash down facilities and signage at Tokaanu Marina and the Lake Rotoaira Motor Camp were also maintained during the reporting period.

8.6 TURANGI COMMUNITY HEALTH CENTRE

The TPS is a significant asset and employer within the town of Turangi and Genesis Energy considers itself to be a significant member of the Turangi community. It follows that the company feels a sense of social responsibility, as any other member of the community, to provide support in a range of areas to ensure the town and community continue to prosper.

Genesis Energy is proud to be a major sponsor of the Turangi Community Health Centre, which addresses a significant gap in the provision of health care services in Turangi. Also contributing to the Health Centre are the Bay Trust, Taupo District Council and a range of other supporters. The Health Centre is owned on behalf of the community by the Southern Lake Taupo Health Trust and was opened in 2008. The one-stop health-shop houses GPs, MedLab, diabetic and other clinics, public health nurses, elderly care, hearing assessments, medical emergency care, a physiotherapist, mental health services, and visiting medical specialists from Taupo and Rotorua.

The Turangi Community Health Centre continues to provide a much needed facility for the district.

With the regions susceptibility to volcanic activity and power shutdowns, the Southern Lake Taupo Health Trust recognised the need to provide electricity during these times to protect the health and safety of the community who use the health services provided in the centre.

The Turangi Community Health Centre embarked on a project to purchase and install an emergency generator that would start automatically in the event of a power shutdown and one large enough that would keep all services running. With the initial support of Genesis Energy a fundraising project was started and was completed recently.

Raewyn Judd project member and trustee said " the Trust were delighted with the response from Genesis Energy who saw the project as benefitting their environmental and community initiatives and was an extremely worthwhile project. Without their support, our small community would not be able to have the amazing medical centre that we have. With the generator, we will be able to continue to provide medical services in the case of a civil defence emergency or power shutdown".

8.7 GENESIS ENERGY TURANGI AQUATIC CENTRE

In January 2008 Genesis Energy agreed to be the naming rights sponsor of the upgraded Turangi Aquatic Centre. The eight year sponsorship of the aquatic centre is a community investment, like the Turangi Community Health Centre, in Turangi's long term economic and social prosperity and fits well with Genesis Energy's sustainability strategy of making a difference to local communities.

The Genesis Energy Turangi Aquatic Centre (GETAC) has now completed a full year with extended hours, which have been a great success. Aquatic classes held on Mondays and Wednesdays have been running well and a number of locals who suffer from health problems have been using the pool complex frequently during the extended hours on Tuesdays and Thursdays, which is fantastic.

The swim club has also grown and is at capacity, with the increase mainly due to an influx of families living in the National Park area, where they don't have the facilities or services offered by the GETAC. About 40 families travel from National Park on Tuesday nights to be part of this club.

There has also been a lot of community use of the facility and in-house swimming lessons are proving popular, particularly baby lessons on Wednesdays. This class is regularly full and families are travelling from as far afield as Taumarunui and National Park to attend.

The Turangi Women's Club held its biennial food festival at the pools this year, which attracted about 150 locals and fundraised to help buy a cover for the emergency generator discussed in Section 8.6. This year the club also fundraised for a defibrillator for the community which now resides inside the GETAC building. The local St John ambulance depot got on board and a training session was held for the community at GETAC to teach people how to use a defibrillator. Great feedback was received from the community regarding the training.

Plans continue to encourage the local community to further make use of GETAC are already in motion for 2015/16.

8.8 TURANGI PUBLIC LIBRARY – SUMMER READING PROGRAMME SUPPORTED BY GENESIS ENERGY.

During the reporting period Genesis Energy continued to sponsor the very successful Turangi Library Summer Reading Programme. The programme is designed to reduce the Summer Slump phenomenon that can see children's reading level slide backwards over the long holidays.

Local kids have fun with books, get a one-on-one reading session with a library staff member, as well as an incentive gift each time they visit the library as part of the reading programme. Children get to know how the library operates, use their own library card, find out where to put their book returns and feel comfortable in the building. They especially enjoy having a librarian get to know them and then recommend books to them that they would enjoy.

A feedback form completed during the reporting period saw 17/21 students who filled out the form, describe the programme as 'awesome'.

The Turangi Library also runs school holiday programmes which are always well attended.

8.9 TE WHARE WAKA -TOKAANU WATER SPORTS CENTRE

The Tokaanu Water Sports Centre is managed by the Tokaanu Maritime Charitable Trust. Trust members continue to promote the centre to make the concept of the Trust a vibrant and viable attribute for the region, with the key objective being to promote water related sport or recreation activities and raise funds to support these.

The centre is currently utilised by rowing groups, boaties, local waka, kayakers and fishing enthusiasts. Funds are generated through hall hire for private functions, boat storage fees and from the Harbour Master via berth charges.

8.10 JOHN BALL FILMS – HISTORY OF THE TONGARIRO POWER DEVELOPMENT

The Tongariro Power Development was one of New Zealand's biggest and most ambitious engineering and construction projects and plenty has been written and documented about it. The human stories behind the power scheme and the people who worked on it are every part as interesting and absorbing as the engineering feats themselves, and this is an area that Turangi filmmaker John Ball is documenting.

"Turangi - A Town with Heart" is the final documentary film in the trilogy about the History of the Tongariro Power Development by John Ball. The film is based around the development of Turangi, before, during and after the power development phase. In just six years the population grew from 500 to 10,000 and despite the challenges presented by this unprecedented growth a vibrant and strong community developed and flourished. Turangi's population has declined since the completion of the power scheme yet the spirit of the town remains strong and it is truly "A Town with Heart" (Figure 37).

This documentary follows on from two very successful films "The Kerry Scott Story" and "Underground - Tunnelling for Power".

The film was supported by Genesis Energy and copies are available from Turangi library.

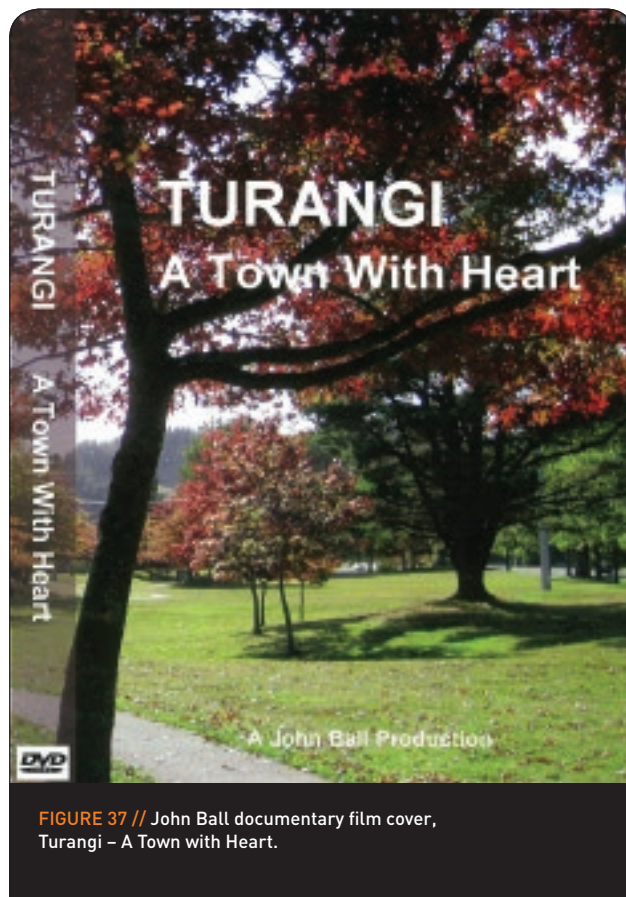


FIGURE 37 // John Ball documentary film cover, Turangi – A Town with Heart.

8.11 CONSTRUCTION DEBRIS REMOVAL

During the consultation process for the TPS resource consents, rafting and kayaking enthusiasts raised the safety hazard posed by the presence of historical construction debris to recreational users in the Tongariro River. Consent conditions (Rangipo Dam and Power Station take 103867) were agreed and a process was developed to identify and where possible remove construction debris from the river. The condition had a 5 year timeframe and concluded in 2009.

Significant work was undertaken to remove debris in 2005 and 2006. In 2013, recreational users alerted Genesis Energy to new construction debris at a number of sites around the TPS. Although no longer a consent requirement, Genesis Energy takes health and safety matters very seriously and worked closely with local rafters and kayakers to remove the debris where possible.

TPS rivers continue to be monitored by Genesis Energy in conjunction with local rafting and kayaking enthusiasts for new construction debris uncovered by flood events. During the reporting period no removal of construction debris was required.



KEY OBJECTIVES

09



9.0 KEY OBJECTIVES 2014-15 REVIEW

9.1 REVIEW OF KEY OBJECTIVES FOR 2014-15

TABLE 21 // Review of key objectives for 2014-2015

Outcome/Initiative and Objectives	Action 2014-15	How did we do?
<ul style="list-style-type: none"> › Whanganui Iwi / Genesis Energy Initiatives Agreement - Implement the Relationship, Initiatives and Resourcing agreements. 	<ul style="list-style-type: none"> › Employ and support Project Coordinator to implement 3 year work programme, including deciding if connective flow will proceed on Western Diversion. 	<ul style="list-style-type: none"> › In 2014 an action plan was prepared by the project coordinator and agreed to by the Relationship Group. In early 2015, a programme manager was appointed to manage the implementation of the action plan and significant progress has been made in this regard and the majority of work streams have commenced and are on track.
<ul style="list-style-type: none"> › Ngati Rangī / Genesis Energy Relationship Agreement - Implement the Relationship Agreement. 	<ul style="list-style-type: none"> › Implement Tokiahuru Agreed Flow; Begin Investigations into Agreed flows on Wahianoa, Makahikatoa and Tomowai. 	<ul style="list-style-type: none"> › Tokiahuru flow delivery design has been delayed due to engineering challenges and sediment management issues. A process for agreed flow assessments on other three awa is under development with Ngati Rangī and consultants.
<ul style="list-style-type: none"> › Lake Rotoaira Trust - Implement the Relationship Agreement. 	<ul style="list-style-type: none"> › Re-establish Relationship Group meetings and support trust to develop and implement Lake Rotoaira Management Plan including water monitoring and aquatic weed management. 	<ul style="list-style-type: none"> › A new Relationship Agreement was signed with the Lake Rotoaira Trust and Lake Rotoaira Forest Trust that provides for an operating easement for the TPS. A weed harvest trial was completed at Lake Rotoaira in partnership with the Lake Rotoaira Trust.
<ul style="list-style-type: none"> › Biosecurity and Aquatic Pest Management - Maintain or improve the current biosecurity status of waterways within the TPS. 	<ul style="list-style-type: none"> › Participate in Central North Island Freshwater Pest Regional Partner Group; Undertake dive survey of Lake Otamangakau Boat Ramp Weed Cordon in April/ May; 	<ul style="list-style-type: none"> › Two dive surveys were undertaken at Lake Otamangakau boat ramp weed cordon (February & April). Repairs were undertaken in February. Tokaanu wash down hoses were maintained. Summer advocacy was supported. Monthly Didymo testing of Western Diversion rivers from October to June was completed.
<ul style="list-style-type: none"> › Signage - All signage is relevant and reflected in the Signage Management System. 	<ul style="list-style-type: none"> › Signage management system to be reviewed and updated. 	<ul style="list-style-type: none"> › The Geographic Information System (GIS) was updated during the reporting period. This provides a platform for the Signage Management System which will be reviewed in the 2015/16 year.
<ul style="list-style-type: none"> › Moawhango flushing flows and Rangitikei River - Reassess timing and flows of Moawhango flushing flows. 	<ul style="list-style-type: none"> › Liaise with stakeholders and Horizons over Resource Consent variation around Moawhango Flushing Flows. 	<ul style="list-style-type: none"> › Seven hour and five hour flushes were trialled in February and March respectively. Deposition zone on Rangitikei River was monitored in Jan, Feb and Mar. Additional quantitative monitoring was undertaken at all sites (Dec, Jan, Feb, Mar) to assess effectiveness of flushes on periphyton removal.
<ul style="list-style-type: none"> › RCMS Reporting - Enhance RCMS reporting capabilities. 	<ul style="list-style-type: none"> › Work with IT to complete the development of the RCMS reporting process. 	<ul style="list-style-type: none"> › A project was planned to incorporate these changes in the RCMS in the reporting period, but due to IT infrastructure upgrades and the possible re-development of our resource consent system this project had to be deferred.
<ul style="list-style-type: none"> › Environmental Management System - Integrate the Environmental Management System into the company's new Business Management System. 	<ul style="list-style-type: none"> › Ensure consistency of the framework and alignment across the business. 	<ul style="list-style-type: none"> › Genesis Energy's Environmental Management and Community Engagement Policy Statement was approved by the Genesis Energy Board, and is now one of the overarching guiding documents for the new Business Management System.
<ul style="list-style-type: none"> › Moawhango Willow Review - Implement Moawhango Willow Management Review. 	<ul style="list-style-type: none"> › Liaise with stakeholders and contractors to deliver willow management in accordance with the review document; › Undertake Priority 1 Workstreams; › Determine budget requirements to implement other priorities. 	<ul style="list-style-type: none"> › Willow control works were completed on the Moawhango River, in accordance with the priorities identified in the 2014 review. During the reporting period, 2.41 km of willow debris was mechanically cleared and 8.36 km of seedling willow was chemically sprayed.
<ul style="list-style-type: none"> › Western Diversion Fish Survey - Undertake 3-Yearly Western Diversion Fish Survey. 	<ul style="list-style-type: none"> › Repeat 2011 Survey; Involve Tangata Whenua; Investigate elver records at Wairehu Culvert; 	<ul style="list-style-type: none"> › Survey completed. Good numbers of elvers found on upper Whanganui River sites. Trap & transfer system actioned, resulting in over 5000 elvers being transferred by Tangata Whenua, to upstream environments.
<ul style="list-style-type: none"> › Whio Monitoring - Undertake 3-Yearly Western Diversion Fish Survey. 	<ul style="list-style-type: none"> › Liaise with DOC to repeat 2011 Surveys. 	<ul style="list-style-type: none"> › Survey completed. A record 114 breeding pairs with 218 ducklings were detected.

9.2 KEY OBJECTIVES 2015–2016

Key environmental objectives for the 2015-16 year build on many initiatives and programmes that are already underway.

TABLE 22 // Key objectives for 2015–2016

Outcome/Initiative	Objective	Action 2015 -16
> Whanganui Iwi / Genesis Energy Initiatives Agreement.	> Implement the Relationship, Initiatives and Resourcing agreements.	> Continue to support programme manager to implement 3 year action plan, and commence involvement in Whanganui River strategy group.
> Ngati Rangī / Genesis Energy Relationship Agreement.	> Implement the Relationship Agreement.	> Implement the Tokiahuru agreed flow delivery and progress agreed flow assessments on remaining three awa.
> Biosecurity and Aquatic Pest Management.	> Maintain or improve the current biosecurity status of waterways within the TPS.	> Participate in central North Island Freshwater Pest Regional Partner Group; Undertake dive survey of Lake Otamangakau Boat Ramp Weed Cordon in April/May.
> Signage.	> All signage is relevant and reflected in the Signage Management System.	> Signage Management System to be reviewed and updated, as required.
> Moawhango flushing flows and Rangitikei River.	> Reassess timing and flows of Moawhango flushing flows.	> Present results of flushing flow trials to community and council, and where appropriate, seek approval for any flow changes.
> RCMS Reporting.	> Enhance RCMS reporting capabilities.	> Investigate RCMS transition and/or enhancements as part of wider Maximo upgrade.
> Environmental Management System.	> Continue with integration of the Environmental Management System into the company's new Business Management System.	> Review Genesis Energy's Environmental Standards and integrate in the company's Environmental Management System and Business Management System.
> Western Diversion elver recruitment.	> Eel recruitment at Lake Otamangakau.	> Install and run Lake Otamangakau elver trap.
> Moawhango Erosion Trans-sect	> Monitoring Lake Moawhango shoreline erosion.	> Complete 5 yearly erosion transect assessment.
> Lake Rotoaira Environmental Management.	> Work with Lake Rotoaira Trust and Lake Rotoaira Forest Trust around lake management issues.	> Confirm operating easement and implement. Development long-term weed management strategy. Develop water quality monitoring regime.

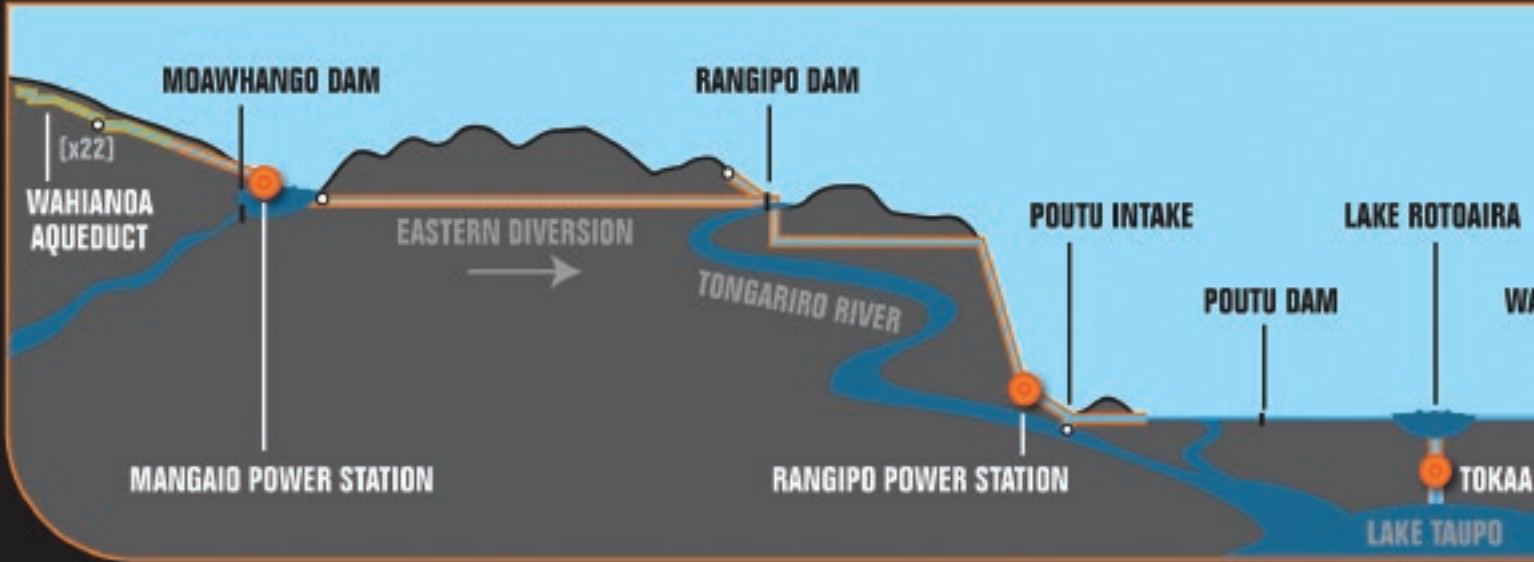
10 REFERENCES

- Baldwin, T., Boubee, J., and Smith, J., 2012: Fish in the Upper Whanganui River Catchment below the Western Diversion – 2011. NIWA Client Report HAM2012-063. NIWA Project: GPL12203. Unpublished Report to Genesis Energy. NIWA Hamilton. 43pp.
- Bergey, E.A., 2000: Summary of Assessment of summer river condition and flushing flows in the Moawhango River. NIWA Client Report CH00/36 GPL0503. Report to Genesis Power Ltd. NIWA Christchurch. 11pp.
- Cawthron Institute, Tipa & Associates, 2014: Cultural Flow Preference Assessment and Hydraulic Modelling to Inform an Agreed Flow Regime on the Tokiahuru Stream. Client Report No. 2510. Unpublished Report to Genesis Energy. Cawthron Institute, Nelson, 127pp.
- Cheal Consultants Ltd, 2015: Lake Moawhango, Waiouru - Erosion Monitoring Survey Report. Report No. 2014-061-02, June 2015. Unpublished Report for Genesis Energy. Cheal Consultants Ltd, Taupo. 94pp.
- Cumming, J. 2014: Review of Willow Control Operations on the Moawhango River by Genesis Energy. Report No.: 2014/EXT/1376. Unpublished Report to Genesis Energy, June 2014. Manawatu Wanganui Regional Council, Palmerston North. 48pp.
- Cumming, J. 2015: 2015 Willow Control Operations Report. Unpublished Report to Genesis Energy, July 2015. Manawatu Wanganui Regional Council, Palmerston North. 10pp.
- Daniel, A., 2015: 2015 Whakapapa River Drift Dive Survey. Unpublished Report to Genesis Energy. Auckland/Waikato Fish & Game Council, Hamilton. 13pp.
- Electricity Authority, 2013. Residential Electricity Costs Fact Sheet March 2013. 3pp.
- Genesis Power Limited, 2000: Tongariro Power Development – Assessment of Environmental Effects.
- Genesis Power Limited, 2013: Tongariro Power Scheme – Annual Environmental Report – 1 July 2012 to 30 June 2013. Unpublished Report, Genesis Energy, Tokaanu. 50pp.
- Ministry of Economic Development, 2012. New Zealand Energy Data File 2012. 172pp.
- Opus International Consultants Ltd, 2009: The effects of flushing the Moawhango River on sediment deposition and ecology of the Rangitikei River. Client Report Reference 350734.00. Unpublished Report prepared for Genesis Energy. Opus International Consultants Ltd, Environmental, Wellington. 61pp
- Opus International Consultants Ltd, 2014: Composition and Monitoring of Flushing Flows for Moawhango Dam. Client Report Reference 3-53113.00. Unpublished Report prepared for Genesis Energy. Opus International Consultants Ltd, Environmental, Wellington. 51pp
- Opus International Consultants Ltd, 2015: Material deposition during flushing flows from Moawhango Dam. Client Report Reference 3-53182.00. Unpublished Report prepared for Genesis Energy. Opus International Consultants Ltd, Environmental, Wellington. 44pp
- Pilkington, S., 2015: Rangitikei River Catchment Trout Monitoring, June 2015. Report to Genesis Energy. Wellington Fish & Game Council, Palmerston North. Unpublished Report for Genesis Energy. 6pp.
- Smith, J.; Boubée, J.; Morgan, J.; Morgan, L.; Barrett, R.; 2015: TPS Western Diversion Fish Monitoring 2014/15. Client Report Number HAM2015-055; NIWA Project: GPL15213. NIWA, Hamilton, 77pp.
- Suren, A., Biggs, B. and Weatherhead, M. 2002: Moawhango River: Suggested biological metric to meet consent requirements, and quantification of the effect of increased residual flows. NIWA Ltd, Christchurch.
- Swanney, M., 2015: Blue duck (whio) monitoring on Western Diversion Streams- Mangatepopo, Whanganui & Whakapapa December 2014. Report to Genesis Energy Ltd. Department of Conservation, Tongariro District Office, 27pp.
- Tonkin & Taylor Limited, 2015: Tongariro Power Scheme River Monitoring Programme 2014-2015. Tonkin & Taylor Limited, Auckland. Client Report, Job Ref No: 27156, Prepared for Genesis Energy.



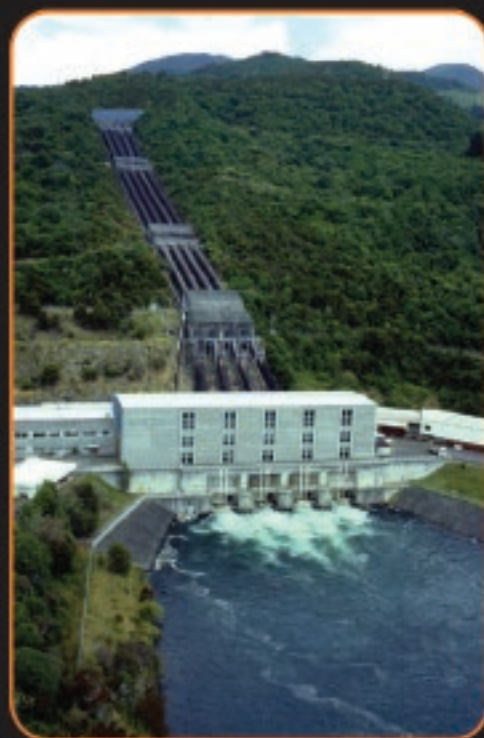


TONGARIRO POWER SCHEME

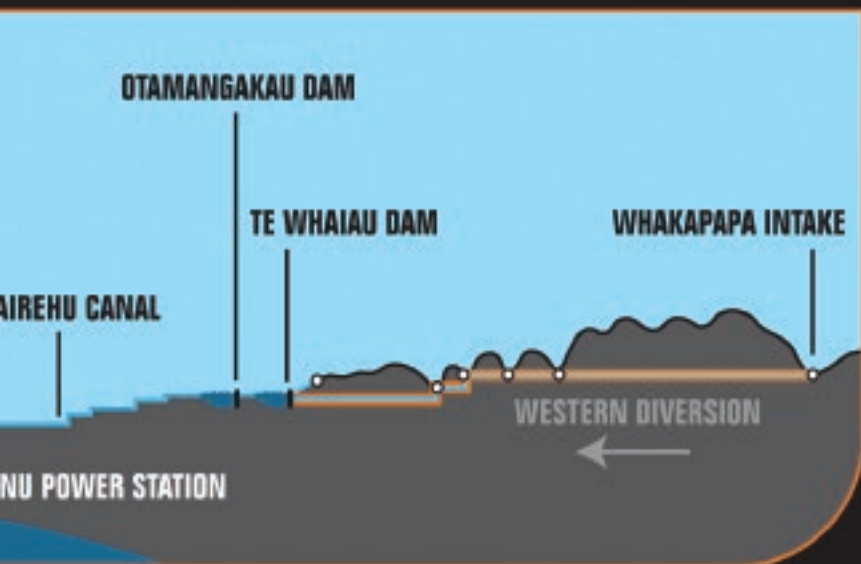




RANGIPO POWER STATION (120 MW)
[underground]



TOKAANU POWER STATION (240 MW)



MANGAIO POWER STATION (2 MW)



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