TRUSTPOWER LIMITED

MANGOREI HYDRO-ELECTRIC POWER SCHEME

Applications for Resource Consent and
Assessment of Environmental Effects

25 November 2020

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Resource Consent Application

FORM 9

APPLICATION FOR RESOURCE CONSENT OR FAST-TRACK RESOURCE CONSENT

Sections 88 and 145, Resource Management Act 1991

To Taranaki Regional Council
Private Bag 713
Stratford 4352

1. Trustpower Limited apply for the following types of resource consent:

All necessary resource consents to authorise the operation and maintenance of the Mangorei Hydro-Electric Power Scheme in the Waiwhakaiho River catchment, including, but not necessarily limited to:

- A water permit for the damming of water in the Waiwhakaiho River via an existing diversion weir and intake structure;
- A water permit for the diversion, take and use of water from the Waiwhakaiho River for hydro-electricity generation purposes;
- A land use consent for the disturbance / extraction of gravel from the bed of the Waiwhakaiho River in order to maintain the fish pass structure in an existing diversion weir;
- A water permit for the damming of water in the Mangamahoe Stream, and surrounding land, via the Mangamahoe Dam to form Lake Mangamahoe;
- A land use consent for the use and maintenance of the Mangamahoe Dam in the Mangamahoe Stream;
- A water permit for the diversion, take and use of water from Lake Mangamahoe, via a tunnel and penstocks, for hydro-electricity generation purposes at the Mangorei Power Station; and
- A discharge permit for the discharge of water from Lake Mangamahoe via a spillway to the Mangamahoe Stream, including the emergency discharge of water.

2. The activity to which the application relates (the proposed activity) is as follows:

Trustpower is seeking resource consents from the Taranaki Regional Council for the continued operation, use and maintenance of the Mangorei Hydro-Electric Power Scheme by way of generating electricity from the damming, diverting and use of water from the

Waiwhakaiho River and Lake Mangamahoe at the Mangorei Power Station (located off Hydro Road).

The Mangorei Hydro-Electric Power Scheme is located east of State Highway 3 and approximately 7 km southeast of New Plymouth. The Scheme diverts water from the middle reaches of the Waiwhakaiho River to the southern end of Lake Mangamahoe. Water is then diverted to the Mangorei Power Station and discharged back into the Waiwhakaiho River via a tailrace at a site located adjacent to the Meeting of the Waters Scenic Reserve (approximately 6 km downstream of the original diversion point in the Waiwhakaiho River).

The Mangorei Hydro-Electric Power Scheme has an installed generation capacity of 4.5 MW and generates approximately 20.9 GWh of electricity per annum. The Mangorei Hydro-Electric Power Scheme connects to Powerco's electricity distribution network in New Plymouth.

3. The sites on which the proposed activities are to occur are as follows:

The sites on which the structures and infrastructure of the Mangorei Hydro-Electric Power Scheme are located are summarised in the table below and held in Records of Title that are appended to the Assessment of Environmental Effects as **Appendix B**.

Part of the Mangorei Hydro-Electric Power Scheme	Landowner	Legal Description	Record of Title
Waiwhakaiho River diversion weir	The Crown	Waiwhakaiho River	-
Waiwhakaiho River intake structure	Trustpower Limited	Lot 4 Deposited Plan 20530	TNL2/194
Diversion tunnel from the Waiwhakaiho River to Lake Mangamahoe	New Plymouth District Council	Lot 3 Deposited Plan 439032	543567
Lake Mangamahoe	Trustpower Limited	Lot 3 Deposited Plan 20530	TNL2/193
Tunnel from Lake Mangamahoe to the	New Plymouth District Council	Lot 3 Deposited Plan 439032	543567

Part of the Mangorei Hydro-Electric Power Scheme	Landowner	Legal Description	Record of Title
Mangorei Power Station	Walter Gold Limited	Part Section 1 Hua & Waiwhakaiho Hundred and Part Section 3 – 4 Hua and Waiwhakaiho Hundred and Lot 4, 7 Deposited Plan 4885 and Part Lot 6 Deposited Plan 4885 and Lot 8 Deposited Plan 4886.	TNK4/449
	Trustpower Limited	Lot 2 Deposited Plan 20241	TNL1/695
Penstocks, Power Station and Tailrace	Trustpower Limited	Lot 3 Deposited Plan 20241	TNL1/696
	Trustpower Limited	Lot 2 Deposited Plan 313562	53661
	Trustpower Limited	Lot 7 Deposited Plan 19328	TNK3/621
	Powerco Limited	Lot 1 Deposited Plan 313562	53660
	Trustpower Limited	Lot 10 Deposited Plan 19328	TNK3/624
	Trustpower Limited	Lot 9 Deposited Plan 19328	TNK3/623
	Trustpower Limited	Lot 11 Deposited Plan 19328	TNK3/625

4. **The full name and address of each owner or occupier (other than the applicant) of the sites to which the application relates are as follows:**

- New Plymouth District Council – 84 Liardet Street, New Plymouth 4310;
- Walter Gold Limited – 13 Hydro Road, Rd 1, New Plymouth 4371; and
- Powerco Limited – 84 Liardet Street, New Plymouth 4310.

5. **The other activities that are part of the proposal to which this application relates are as follows:**

Other aspects of the proposal which are permitted activities under the relevant statutory planning documents are described in the attached Assessment of Environmental Effects.

6. **No additional resource consents are needed for the proposal to which this application relates.**

7. **I attach an assessment of the proposed activity's effect on the environment that—**

   (a) Includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and

   (b) Addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and

   (c) Includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

8. **I attach an assessment of the proposed activity against the matters set out in Part 2 of the Resource Management Act 1991.**

9. **I attach an assessment of the proposed activity against any relevant provisions of a document referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act.**

10. **I attach the following further information required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act:**

- Assessment of Environmental Effects; and
- Appendices:
  - Land Ownership Maps – Tonkin & Taylor;
  - Records of Title;
  - Natural Character, Landscape and Visual Assessment – Boffa Miskell;
  - Sediment Assessment – Tonkin & Taylor;
  - Hydrology Assessment – Tonkin & Taylor;
  - Aquatic Ecology Assessment – Ryder Environmental Limited;
  - Terrestrial Ecology Assessment – Ryder Environmental Limited;
  - Existing Resource Consent Conditions – Taranaki Regional Council;
  - Proposed Consent Conditions – Trustpower Limited;
  - Fish Passage and Fish Screening Assessment – Ryder Environmental Limited; and
  - Recreation Assessment – Rob Greenway & Associates.

Signed: 

(On behalf of Trustpower Limited by Lisa Mead)

Dated at Tauranga this 25th day of November 2020.

Address for Service: Trustpower Limited
Private Bag 12023
Tauranga 3143

Contact: Lisa Mead

Telephone: 022 318 3946

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B

PART B

Assessment of Environmental Effects

EXECUTIVE SUMMARY

The Mangorei Hydro-Electric Power Scheme ("**Mangorei HEPS**" or "**Scheme**") is owned by Trustpower Limited ("**Trustpower**") and is located within the Waiwhakaiho River catchment, southeast of New Plymouth. The Scheme has been in operation (in a variety of configurations) for over 100 years and currently generates electricity by:

- Damming and diverting / taking water from the Waiwhakaiho River via a diversion weir and intake structure;
- The damming of the Mangamahoe Stream to form Lake Mangamahoe and the regulating of levels in the lake; and
- The diversion / take of water from Lake Mangamahoe via a tunnel and penstocks for the purposes of electricity generation at the Mangorei Power Station (and subsequent discharge back to the Waiwhakaiho River).

The Mangorei HEPS has an installed generation capacity of 4.5 MW and generates approximately 20.9 GWh of electricity per annum. It connects to Powerco's electricity distribution network in New Plymouth – and thus contributes to security of electricity supply and the Government's strategic targets for the generation of renewable electricity in New Zealand.

The current resource consents for the Mangorei HEPS were granted by the Taranaki Regional Council ("**TRC**") in 1996 and are due to expire in June 2021. Based upon the annual monitoring reports prepared by the TRC, Trustpower have maintained a high level of environmental and compliance performance in relation to the operation of the Mangorei HEPS against the current resource consents.

A number of technical assessments have been commissioned by Trustpower in order to provide an understanding of the potential effects associated with the continued operation of the Mangorei HEPS. These assessments have considered the damming, diversion, take, use and discharge of water in the Waiwhakaiho River via the Mangorei HEPS, as well as the shared use / management of Lake Mangamahoe between Trustpower and the New Plymouth District Council ("**NPDC**").

The key conclusions from the technical assessments commissioned by Trustpower, and the Assessment of Environmental Effects, are summarised in Table 1 below.

Table 1: Summary of Effects of the Mangorei Hydro-Electric Power Scheme

Effect	Key Conclusions	Mitigation Measures
Positive Effects	▸ The Scheme is an established and reliable generator of electricity in the Taranaki Region, generating approximately 20.9 GWh of electricity that is embedded in the local network. It also enables Trustpower to support national strategic targets for the generation of renewable energy; and ▸ Economic and social benefits are provided through the provision of local employment, minimising costs associated with obtaining electricity from outside the Taranaki Region, and the recreational opportunities afforded by Lake Mangamahoe.	▸ N/A
Hydrology Effects	▸ No notable changes are proposed to the hydrological regime of the Scheme, such that the mean flow in the Waiwhakaiho River and mean diversion to Lake Mangamahoe will likely be maintained; ▸ Conditions are proposed to respond to high water temperatures and the proliferation of periphyton growth in the Waiwhakaiho River during summer. These changes address aquatic ecology effects and will have little impact on the overall hydrology or water balance of the catchment; and ▸ Natural variability in the climate may impact the Scheme and flows in the Waiwhakaiho River in the future. Increased temperatures or dry conditions are likely to further reduce and prolong summer low flows, however, this is likely to be offset by increased flows in winter and peak flow discharges as a result of increases in mean rainfall.	▸ N/A

Effect	Key Conclusions	Mitigation Measures
Recreation Effects	• Effects on recreation are broadly positive due to the provision of Lake Mangamahoe and the whitewater opportunities in the power station tailrace; • There are no indications that the Scheme has any effects on kayaking and rafting within the Waiwhakaiho River. Additional flow releases for the health of the river would have minimal impacts on the availability of kayaking flows; and • Low levels of adverse effects on angling (at a regional level) will continue in the residual reach of the Waiwhakaiho River in late summer.	• Retention of the existing residual flow / discharge regime for the Waiwhakaiho River; • Retention of the existing operating parameters for Lake Mangamahoe; • Additional flow releases in summer for the health of the Waiwhakaiho River; and • Use of warning signage at key locations around the Scheme.
Natural Character Effects	• The natural character attributes of the Waiwhakaiho River and Mangamahoe Stream will remain broadly as they have in the past (with the exception of potential natural variations resulting from changing climate conditions).	• Retention of the existing residual flow / discharge regime for the Waiwhakaiho River; and • Retention of the existing operating parameters for Lake Mangamahoe.
Landscape Effects	• The instream structures and power stations are not dominant, and do not impact on the character of the wider river / rural landscape; and • Lake Mangamahoe is well integrated into its landscape setting and is recognised as having high landscape, recreational and amenity values. The various structures are well integrated into the character of the surrounds, and the daily fluctuations of lake levels are part of the status quo. Overall, the character of Lake Mangamahoe benefits from the Scheme.	• Retention of the existing residual flow / discharge regime for the Waiwhakaiho River; and • Retention of the existing operating parameters for Lake Mangamahoe.

Effect	Key Conclusions	Mitigation Measures
Visual Amenity Effects	▸ The natural and man-made landscapes have enhanced the visual amenity of the surrounds and the accessibility and availability of the area for leisure activities. The Scheme will continue to provide moderate to high beneficial effects for visual amenity values.	▸ Retention of the existing residual flow / discharge regime for the Waiwhakaiho River; and ▸ Retention of the existing operating parameters for Lake Mangamahoe.
Terrestrial Ecology Effects	▸ Terrestrial ecology effects associated with the ongoing presence of structures in the Waiwhakaiho River will be negligible. Further, the flow regime in the river has generated limited changes in the extent of vegetation adjacent to the river, and riparian vegetation will have established along those sections where the flow has reduced; ▸ Lake Mangamahoe has resulted in positive terrestrial ecological effects; and ▸ Effects on the riparian vegetation / habitat of the Mangamahoe Stream are secondary to the effects of surrounding land uses. In addition, the lower dam creates a narrow reservoir, which replaces some of the original stream and associated riparian habitat.	▸ Retention of the existing residual flow / discharge regime for the Waiwhakaiho River; and ▸ Retention of the existing operating parameters for Lake Mangamahoe.
Fish Passage and Fish Screening	▸ The fish pass in the diversion weir is adequate to provide for fish species expected to migrate beyond the weir. Fish species with migratory life cycles have also been recorded upstream of the diversion weir - confirming that fish passage through the residual reach and the fish pass is effective; ▸ There are no fish screening measures in place on the intake structure in the Waiwhakaiho River, although the trash screen provides some deterrent to fish.	▸ Retention and maintenance of the existing fish pass on the Waiwhakaiho River; ▸ Retention and maintenance of existing trash screens on intake structures in the Waiwhakaiho River and Lake Mangamahoe; and

Effect	Key Conclusions	Mitigation Measures
	Retrofitting the intake structure would be challenging and impractical from an economic and engineering perspective due to floods sending boulders downstream; and › While some fish species thrive in Lake Mangamahoe, fish species with downstream migratory requirements may find their way down to the intake to the penstocks. The trash screen and the low water velocities in front of the intake structure may deter adult eel and other larger fish species but may not prevent larvae and small fish from entering the penstocks. There will be some mortality for larger fish that make it past the trash screen at the intake.	› The existing trap and transfer programme that operates in Lake Mangamahoe will be enhanced.
Aquatic Ecology	› Water temperatures in the residual reach of the Waiwhakaiho River are naturally high during summer (although the Scheme does also partly contribute to higher temperatures). Fish are also able to respond to higher water temperatures by temporarily moving to cooler locations; › The water temperatures in the Waiwhakaiho River account for some of the periphyton biomass in the river, along with multiple point and non-point discharges within the residual reach. Low, stable river flows in summer can mean that nuisance growths of periphyton are not flushed; › Water temperatures and nuisance periphyton proliferations that can occur during summer can also impact on the macroinvertebrate communities; › The flow regime in the Waiwhakaiho River has resulted in changes to water depths, velocities and channel widths. For some species, the amount of habitat increases as	› Retention of the existing residual flow / discharge regime for the Waiwhakaiho River; › Retention of the existing operating parameters for Lake Mangamahoe; › Additional flow releases in summer for the health of the Waiwhakaiho River; › Monitoring programme will be developed for the additional flow releases for several years to ensure appropriateness of mitigation;

Effect	Key Conclusions	Mitigation Measures
	flows increase (e.g. adult brown trout and torrentfish) and for other species it deceases (e.g. inanga feeding and redfin bully); › The Mangamahoe Dam and lower dam owned by the NPDC present barriers to fish passage within the Mangamahoe Stream. However, recent surveys have identified eels and redfin bullies in the lower sections of the Mangamahoe Stream - indicating that fish passage is possible in the lower stream at times; and › The water quality in the lower stream is sufficient to maintain a native fish community and, therefore, provision of a residual flow at the Mangamahoe Dam is not necessary.	› The existing trap and transfer programme that operates in Lake Mangamahoe will be enhanced.
Dam Safety	› Dams will continue to be managed by Trustpower, in accordance with the NZSOLD Guidelines; and › Dam reviewed every five years and Trustpower is undertaking an assessment of potential risk treatment options to determine risk reduction measures for aligning the Mangamahoe Dam and the Mangamahoe Saddle Dam with the NZSOLD Guidelines.	› Continue to manage dam structures in accordance with the NZSOLD Guidelines and Trustpower's Dam Safety Management System.
Sedimentation	› Sediment loads entering Lake Mangamahoe vary through time in response to factors such as land use changes and episodic events; and › The diversion tunnel may account for between 37% and 80% of the load entering Lake Mangamahoe. The remaining contribution of sediment to Lake Mangamahoe is mostly attributed to the upper Mangamahoe Stream and the Kent	› Retain existing consent conditions requiring cessation of diversion / take when flows in the Waiwhakaiho River exceed 85 m^3/s.

Effect	Key Conclusions	Mitigation Measures
	Road Stream. However, the current prediction of sediment yield from these tributaries may be underestimated and does not take into account episodic events. As such, it is possible that these tributaries are responsible for a much larger proportion of Lake Mangamahoe's sediment load.	
Cultural Values	› It is for the relevant iwi and hapu to describe any cultural or historical associations with the Waiwhakaiho River, and further information on these associations is intended to be provided as part of the cultural values assessment.	› To be further considered following the conclusion of discussions with representatives of the Mangorei Forum.

Overall, the technical assessments conclude that the continued operation of the Mangorei HEPS can be undertaken in a manner that will appropriately sustain the key environmental values and health of the Waiwhakaiho River catchment.

With respect to the National Policy Statement on Freshwater Management 2020, it is recognised that its fundamental concept is Te Mana o te Wai – which refers to the importance of water and seeks to ensure that natural and physical resources are managed in a way that (i) firstly prioritises the health and wellbeing of water bodies and freshwater ecosystems, (ii) then the health needs of people, and (iii) then the ability of people and communities to provide for their social, economic, and cultural wellbeing. Trustpower has given particular consideration to ensuring the flow regime proposed for the Waiwhakaiho River downstream of the diversion weir and intake structure is appropriate to sustain the health and wellbeing of the river, including through new consent conditions to ensure that the operation of the Scheme changes in response to monitored changes in ecosystem health.

Overall, it is considered that the continued operation of the Mangorei HEPS is broadly consistent with the overall management intentions specified in the relevant statutory planning documents and the sustainable management of natural and physical resources under the Resource Management Act 1991. It is, however, recognised that further analysis of the mitigation requirements may be necessary once the cultural values assessment is completed by the relevant iwi and hapu representatives is completed.

1. INTRODUCTION

1.1 BACKGROUND

This Assessment of Environmental Effects ("**AEE**") has been prepared in support of resource consent applications by Trustpower Limited ("**Trustpower**") under the Resource Management Act 1991 ("**RMA**") for the continued operation, use and maintenance of the Mangorei Hydro-Electric Power Scheme ("**Mangorei HEPS**" or "**the Scheme**").

The Mangorei HEPS is located within the Waiwhakaiho River catchment to the southeast of New Plymouth. The Mangorei HEPS has been in operation (in a variety of configurations) for over 100 years and generates electricity by damming, diverting, discharging, taking and using water from the Waiwhakaiho River and Lake Mangamahoe via the Mangorei Power Station, which is located off Hydro Road.

The Mangorei HEPS has an installed generation capacity of 4.5 MW and generates approximately 20.9 GWh of electricity per annum. The Scheme connects to Powerco's electricity distribution network in New Plymouth – enabling the supply of electricity to the local community.

Land ownership of the sites on which the structures and infrastructure associated with the operation of the Mangorei HEPS are located is presented in **Appendix A** to this AEE, and is summarised in Table 1 below. The respective Records of Title are provided in **Appendix B** to this AEE.

Table 2: Mangorei Hydro-Electric Power Scheme - Land Ownership Details

Part of the Scheme	Landowner	Legal Description	Record of Title
Waiwhakaiho River diversion weir	The Crown	Waiwhakaiho River	-
Waiwhakaiho River intake structure	Trustpower Limited	Lot 4 Deposited Plan 20530	TNL2/194
Diversion tunnel from the Waiwhakaiho River to Lake Mangamahoe	New Plymouth District Council	Lot 3 Deposited Plan 439032	543567
Lake Mangamahoe	Trustpower	Lot 3 Deposited Plan 20530	TNL2/193

Part of the Scheme	Landowner	Legal Description	Record of Title
Tunnel from Lake Mangamahoe to the Power Station	New Plymouth District Council	Lot 3 Deposited Plan 439032	543567
	Walter Gold Limited	Part Section 1 Hua & Waiwhakaiho Hundred and Part Section 3 – 4 Hua and Waiwhakaiho Hundred and Lot 4, 7 Deposited Plan 4885 and Part Lot 6 Deposited Plan 4885 and Lot 8 Deposited Plan 4886.	TNK4/449
	Trustpower Limited	Lot 2 Deposited Plan 20241	TNL1/695
Penstocks, Power Station and Tailrace	Trustpower Limited	Lot 3 Deposited Plan 20241	TNL1/696
	Trustpower Limited	Lot 2 Deposited Plan 313562	53661
	Trustpower Limited	Lot 7 Deposited Plan 19328	TNK3/621
	Powerco Limited	Lot 1 Deposited Plan 313562	53660
	Trustpower Limited	Lot 10 Deposited Plan 19328	TNK3/624
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	Trustpower Limited	Lot 11 Deposited Plan 19328	TNK3/625

1.2 TRUSTPOWER LIMITED

1.2.1 Overview

Trustpower is New Zealand's fourth largest electricity retailer and fifth largest electricity generator. It is a listed public company and is predominantly New Zealand owned. The company grew from the Tauranga Electric Power Board, which was established in 1924. Trustpower employs approximately 800 staff and services approximately 240,000 residential, commercial and industrial customers across New Zealand.

Trustpower's core business is the generation and retailing of electricity. Its business also incorporates the development of new electricity generation and water conveyance infrastructure, as well as the provision of telecommunication and broadband services. The Energy Companies Act 1992 requires that the principal objective of every energy company is to operate as a successful business. Consistent with this objective, Trustpower has built a reputation as a successful and responsible generator, developer and retailer of electricity. Trustpower considers that achieving strong environmental performance is an integral part of being a successful business.

Trustpower's electricity generation portfolio is predominantly derived from renewable energy sources. The company owns and operates 19 hydro-electricity generation schemes and a diesel peaking facility in New Zealand, which are geographically spread throughout the country.

Trustpower's electricity generation portfolio differs from other electricity generators in that its assets are typically of small to medium output, are relatively numerous, and are spread across a number of regions and districts. This electricity generation portfolio provides a number of benefits to Trustpower's customers, as well as to New Zealand as a whole. In this regard, several of the electricity generation schemes are embedded into the local electricity supply network and form a vital element in ensuring regional security of supply and a sustainable electricity supply within New Zealand. This commitment to local supply and proximity to demand centres is a key feature of Trustpower's generation philosophy and portfolio.

1.2.2 Trustpower's Interests in the Taranaki Region

In addition to the Mangorei HEPS, Trustpower owns and operates two other hydro-electricity generation schemes within the Taranaki Region:

- The Patea HEPS is located on the Patea River in the South Taranaki District, approximately 43 km from the coast. The Patea HEPS has an installed generation capacity of 30.7 MW and generates approximately 118 GWh of electricity per annum. The Patea HEPS consists of an 82 m high earth dam which has impounded water in the Patea River to create Lake Rotorangi. The lake is over 46 km long and provides storage within its consented 4.5 m operating range. The resource consents from the Taranaki Regional Council ("**TRC**") authorising the operation of the Patea HEPS expire in 2040; and
- The Motukawa HEPS is located in the Manganui and Waitara River catchments. The Motukawa HEPS operates by diverting water from the Manganui River and conveying it via a race to Lake Ratapiko. Water is diverted from Lake Ratapiko through penstocks to the Motukawa Power Station, which then discharges into the Makara Stream (a tributary of the Waitara River). The Motukawa HEPS has an installed generation capacity of 5 MW and generates approximately 22 GWh of electricity per

annum. The resource consents authorising the operation of the Motukawa HEPS expire in 2022.

1.3 REPORT STRUCTURE

This AEE complies with the relevant requirements in Schedule 4 of the RMA and is considered to address the relevant matters identified in the Taranaki Regional Fresh Water Plan ("**RFWP**") and the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 ("**Freshwater NES**"). It comprises nine sections as follows:

Section 1: This introduction.

Section 2: Provides a description of the existing environment.

Section 3: Provides a description of the proposal.

Section 4: Sets out the resource consent requirements for the proposal.

Section 5: Provides an assessment of the actual and potential environmental effects associated with the continued operation of the Mangorei HEPS.

Section 6: Outlines the consultation undertaken by Trustpower.

Section 7: Sets out the statutory framework within which the resource consent application has been made and assesses the proposal against the provisions of the relevant national and regional statutory planning documents.

Section 8: Addresses notification matters in accordance with sections 95A – 95E of the RMA.

Section 9: Provides a concluding statement.

2. EXISTING ENVIRONMENT

2.1 INTRODUCTION

This section of the AEE provides a summary of the existing physical, social, environmental and cultural values of the Mangorei HEPS and the Waiwhakaiho River catchment. A number of technical assessments have been commissioned by Trustpower to inform the description of the existing environment in this section of the AEE. These technical assessments are referenced, as appropriate, in the sections below and are appended to this AEE.

This description of the existing environment provides the context against which the actual and potential effects of the continued operation of the Mangorei HEPS have been assessed. The existing environment is the environment as it exists at the time of determining an application for resource consent. In *Queenstown Lakes District Council v Hawthorne* [2006] CA 45/05 the Court of Appeal found that the 'environment' embraces the future state of the environment as it might be modified by the utilisation of rights to carry out permitted activities under a plan. The Court found it also includes the environment as it might be modified by the implementation of resource consents which have been granted at the time a particular resource consent application is considered, where it appears likely that those resource consents will be implemented.

Differing approaches to defining the existing environment have been adopted when considering applications for replacement resource consents. The High Court in *Ngati Rangi Trust v Manawatu-Whanganui Regional Council* [2016] NZHC 2948 concluded that it should not be assumed that existing consents with finite terms will be renewed or renewed on the same conditions. The Court adopted the position that the existing environment cannot include, in the context of renewal applications, the effects caused by the activities for which the renewal consents are sought - unless it would be fanciful or unrealistic to assess the existing environment as those structures authorised by the consents being renewed did not exist.

As noted below in section 2.2 of this AEE, the existing environment has been modified since the commissioning of the Scheme in 1904 and the Mangorei HEPS has generally been in its current configuration since the formation of Lake Mangamahoe in 1931. In addition, and as set out in section 4 of this AEE, a number of activities associated with the Mangorei HEPS are permitted activities and form part of the existing environment as a consequence. Defining the existing environment for the purposes of assessing the effects of the resource consent applications does not require a decision maker to assume that the effects of the Mangorei HEPS never existed (that is, to postulate a return to a pristine and naturalised environment). Assuming that the Mangorei HEPS did not exist would be a fanciful and unrealistic exercise which does not reflect a 'real-world' approach. Having said that, the technical assessments have not discounted effects caused by the ongoing

activities for which the replacement consents are required. While legacy effects of the Mangorei HEPS have been recognised, so too have the on-going effects of the operation of the Scheme.

2.2 OVERVIEW OF THE MANGOREI HYDRO-ELECTRIC POWER SCHEME

The Mangorei HEPS is one of New Zealand's oldest operating hydro-electric power schemes, with the original power station having been commissioned in 1904, the lower dam on the Mangamahoe Stream in 1918, and the 25 m high dam on the Mangamahoe Stream (which formed Lake Mangamahoe) in 1931.

The Mangorei HEPS is located east of State Highway 3 ("**SH3**") and sits approximately 7 km southeast of New Plymouth. The Scheme diverts water from the middle reaches of the Waiwhakaiho River via a low-head concrete diversion weir (which includes a fish pass) located across the river and an intake structure - which is approximately 1.6 km downstream of SH3). Water is then conveyed via a 580 m long tunnel to the southern end of Lake Mangamahoe.

Lake Mangamahoe contains an earth dam and concrete spillway at its northern end, which is able to discharge water into the Mangamahoe Stream during high flows or outside normal operating conditions. An intake structure which is also located at the northern end of Lake Mangamahoe takes water to the Mangorei Power Station via a tunnel and penstocks before it is discharged back into the Waiwhakaiho River via a tailrace at a site located adjacent to the Meeting of the Waters Scenic Reserve (and approximately 6 km downstream from the diversion weir on the Waiwhakaiho River – which is also referred to as the 'residual reach' in this AEE). From this point the river flows north and discharges into the Tasman Sea approximately 11 km downstream (near the suburb of Fitzroy).

Lake Mangamahoe is also utilised for water supply purposes by the New Plymouth District Council ("**NPDC**"). In this regard, the NPDC is authorised by the TRC to take up to 60,480 m^3 per day at a maximum rate of 740 l/s of water from Lake Mangamahoe in the Waiwhakaiho Catchment for municipal water supply purposes.

An aerial overview of the Mangorei HEPS is provided in Figure 1 below.

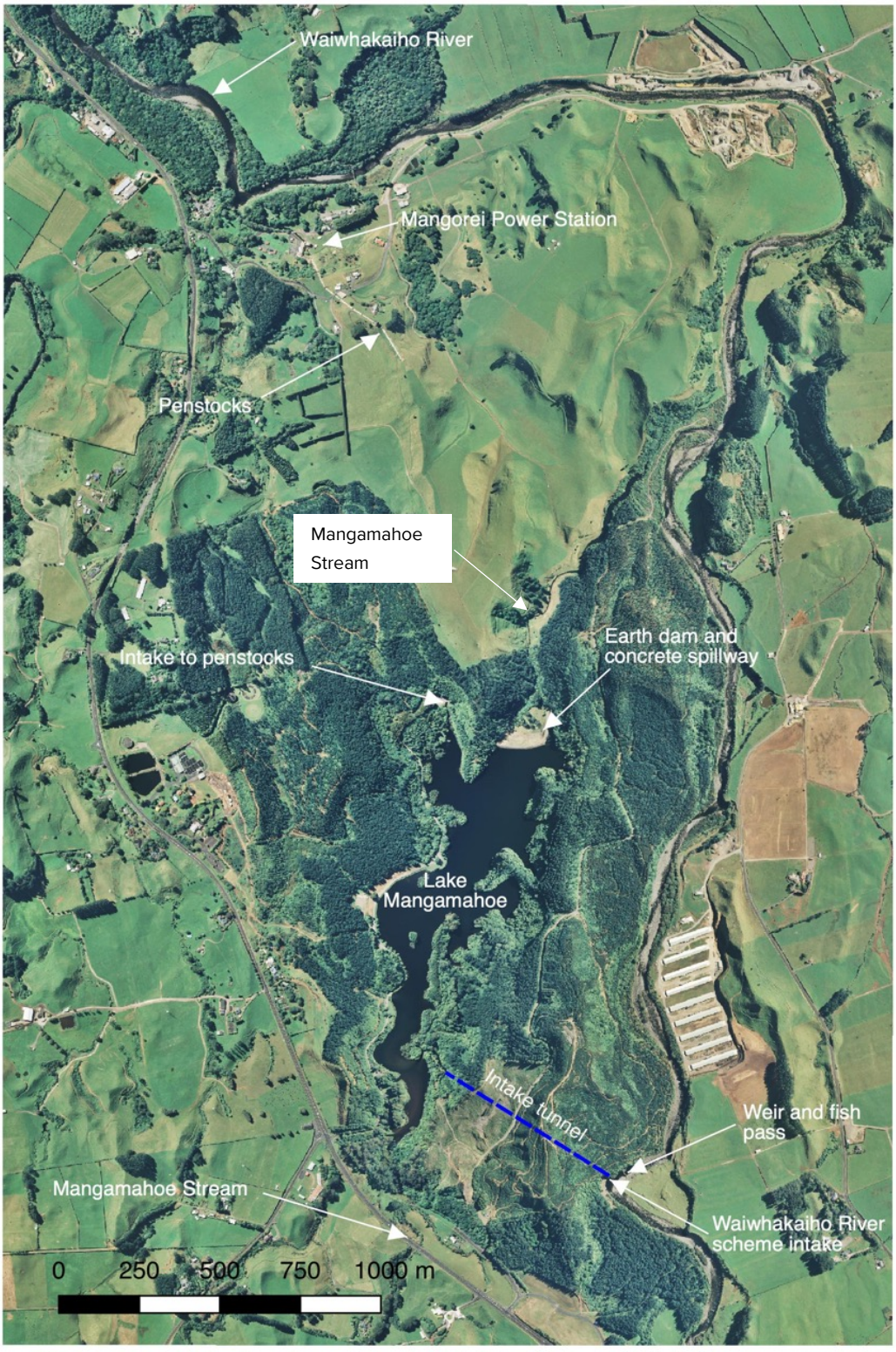

Figure 1: **Schematic of the Mangorei Hydro-Electric Power Scheme**

2.3 EXISTING RESOURCE CONSENTS

The existing resource consents held by Trustpower for the operation and maintenance of Mangorei HEPS are summarised in Table 1 below. Copies of the existing resource consents are provided as **Appendix C** to this AEE.

Table 3: Summary of Existing Resource Consents for the Mangorei HEPS

Consent Number	Consent Type	Activity	Summary of Key Conditions
2053	Water Permit	The diversion of up to 10 m^3/s of water from the Waiwhakaiho River and associated intake structures into Lake Mangamahoe, through the Mangorei Power Station, and back into the Waiwhakaiho River.	1. Maintain a continuous generation flow release downstream of the Mangorei Power Station of at least 950 l/s between 8 am and 6 pm each day; 2. Maintain a residual flow in the Waiwhakaiho River of: › 700 l/s between 1 January and 31 March; › 600 l/s between 1 April and 30 April; › 400 l/s between 1 May and 31 October; and › 600 l/s between 1 November and 31 December. 3. No water shall be diverted into the intake structure when the flow in the Waiwhakaiho River is greater than or equals 85 m^3/s; and 5. Maintain, as far as reasonably practicable, the river channel below the diversion weir to the `Meeting of Waters' for the purpose of enhancing available fish passage and habitat.

Consent Number	Consent Type	Activity	Summary of Key Conditions
2054	Land Use Consent	To dam the Mangamahoe Stream to form Lake Mangamahoe to act as a reservoir of water for hydro-electric generation purposes.	1. The dam shall be maintained and operated to the satisfaction of the TRC; 2. A minimum lake level of 750 mm below the crest of the Mangamahoe Spillway shall be maintained, except during lake weed maintenance periods; and 3. Notify the TRC at least seven days prior to temporary lowering of the level of Lake Mangamahoe for weed management purposes.
2056	Water Permit	To use up to 864,000 m^3 of water per day from Lake Mangamahoe for hydro-electric generation purposes.	1. Spread, as far as reasonably practicable, generation during daylight hours in order to maximise the beneficial effect of artificial flows in the lower Waiwhakaiho River.
4886	Land Use Consent	To erect and maintain structures in the Mangamahoe Stream to dam the stream to form Lake Mangamahoe for hydro-electric generation purposes.	1. The dam shall be maintained and operated to the satisfaction of the TRC.
4887	Land Use Consent	To erect and maintain structures associated with the diversion of water from the Waiwhakaiho River into Lake Mangamahoe for hydro-electric generation purposes.	1. The structures shall be maintained and operated to the satisfaction of the TRC. 2. Install and maintain a structure at the diversion weir to enable the passage of native fish, juvenile trout and adult trout. to the satisfaction of the TRC; and 3. Maintain a device capable of meeting the residual flow requirements of the consent, to the satisfaction of the TRC.
4888	Discharge Permit	To discharge up to 150,000 l/s of water from Lake Mangamahoe via a spillway into the Mangamahoe	N/A

Consent Number	Consent Type	Activity	Summary of Key Conditions
		Stream under emergency conditions associated with hydro-electric generation purposes.	
6810	Land Use Consent	To erect, place and maintain a culvert in an unnamed tributary of the Waiwhakaiho River for access purposes.	1. Adopt the best practicable option to avoid or minimise the discharge of silt or other contaminants into water or onto the riverbed and to avoid or minimise the disturbance of the riverbed and any adverse effects on water quality; 2. Notify the TRC, in writing, at least 48 hours prior to the commencement and upon completion of the initial installation and again at least 48 hours prior to and upon completion of any subsequent maintenance works which would involve disturbance of or deposition to the riverbed or discharges to water; 3. Any instream works shall take place only between 1 November and 30 April inclusive, except where this requirement is waived in writing by the TRC; 4. Ensure that the area and volume of riverbed disturbance shall, so far as practicable, be minimised and any areas which are disturbed shall, so far as practicable, be reinstated; 5. After allowing for reasonable mixing (being a mixing zone extending seven times the width of the surface water body at the point of discharge), the discharge shall not give rise to any of the following effects in any surface water body: a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;

Consent Number	Consent Type	Activity	Summary of Key Conditions
			b) any conspicuous change in the colour or visual clarity; c) any emission of objectionable odour; d) the rendering of fresh water unsuitable for consumption by farm animals; e) any significant adverse effects on aquatic life. 6. Except with the written agreement of the TRC, the structure[s] shall be removed and the area reinstated, if and when the structure[s] are no longer required. The TRC shall be notified at least 48 hours prior to the structure[s] removal and reinstatement; 7. The exercise of this consent shall not alter the natural flow of the river or restrict the passage of fish; 8. The exercise of this consent shall not result in the significant ponding of water upstream of the culvert; and 9. Prior to the exercise of this consent, the consent holder shall provide for the written approval of the TRC, a site erosion and sediment control management plan.

Based upon the annual monitoring reports for the Mangorei HEPS prepared by the TRC, it is considered that Trustpower have maintained a high level of environmental and compliance performance in relation to the operation of the Scheme against the consent conditions noted in Table 2.2 above.

The existing consents for the Mangorei HEPS expire on 1 June 2021, with the exception of Consent 6810 which expired on 1 June 2020. An application was made by Trustpower in January 2020 to renew the provisions of Consent 6810. This application was put on hold by the TRC so that it could be processed in conjunction with these applications.

2.4 GENERAL SURROUNDING CONDITIONS

The Mangorei HEPS is located within the Waiwhakaiho River catchment, which collects water from an approximately 136 km^2 catchment that originates near the summit of Mount Taranaki.

The climate is generally mild, with relatively high humidity and fairly high, evenly distributed annual rainfall - with a catchment-wide annual rainfall of approximately 3,500 mm. The soils are typically volcanic, and include deep ash soils and well-drained alluvial soils along the rivers. Slopes within the catchment range from gently undulating to strongly rolling.

The vegetation pattern in the catchment is predominantly developed pasture, with numerous patches of introduced and / or indigenous scrub and forest. Related to this, pastoral farming and agriculture are the predominant land uses within the immediate catchment.

Other notable land uses in the catchment include a wastewater treatment plant, a quarry and gravel extraction plant, green houses, timber processing facilities and poultry farms.

2.5 WAIWHAKAIHO RIVER

The Waiwhakaiho River is a narrow, single channel river that is typically 10 - 30 m wide. The banks of the river are frequently very steep and well-vegetated, and prone to fast-rising floodwaters. Within the vicinity of the Mangorei HEPS, the riparian margins of the Waiwhakaiho River support a mixture of indigenous and introduced vegetation.

For the upstream reach of the river running from SH3 to the diversion weir and intake structure, the river is generally a swiftly flowing single channel with rocky and gravel bottomed rapids and small pools. Vegetated islands occur in the bed at some locations.

The diversion weir (originally built in the 1930s with a fish passage structure added in 1992), occurs on a right bend in the Waiwhakaiho River. A maintenance access track is located in the river margin on the west bank and crosses a stream culvert near the intake. The bank immediately upstream of the intake has been armoured with large boulders.

At the diversion weir, and downstream of the weir for approximately 2.5 km, the margins on the true left of the river are characterised by heavily vegetated steep banks. On the true right of this reach vegetation is dominated by improved pasture, rough pasture and introduced shrub and trees. Similar vegetation to that on the true right of the reach is evident along most of the river on both banks from approximately 2.5 km downstream of the weir to the sea. There are also patches of vegetation along the river in which indigenous species comprise a substantial component of the vegetation. Several of these vegetative patches are recognised in the Operative and Proposed New Plymouth District

Plans as Significant Natural Areas ("**SNA**") and / or Key Native Ecosystems ("**KNE**") (as discussed further in section 2.7.3 of this AEE).

For the reach of the river that extends from the Meeting of the Waters to the Tasman Sea, a combination of scenic reserve, farmland, public parkland / reserves, and residential and industrial areas are located adjacent to the river. The lower reaches of the river are also utilised, in parts, for recreational activities.

2.5.1 Natural Character and Landscape Values of the Waiwhakaiho River

The Waiwhakaiho River has the following natural character values (as detailed in the Natural Character, Landscape and Visual Assessment prepared by Boffa Miskell and provided as **Appendix D** to this AEE):

- The reach of the river running from SH3 to the diversion weir and intake structure has a 'Moderate – High' level of natural character, due to a combination of the unmodified riverbed, river flows, intact river margin landform, mix of vegetation, remote experiential values, and somewhat degraded aquatic ecological values;
- The reach of the river surrounding the diversion weir and intake structure has a 'Moderate – Low' level of natural character, due to the combination of moderate to high water quality and in-stream aquatic communities, modifications resulting from the diversion / intake structures and access tracks, modified river flows, ongoing maintenance activities, and resultant moderate experiential qualities;
- The reach of the river that runs downstream of the diversion weir to the Meeting of the Waters (i.e. the residual reach) has a 'Moderate – Low' level of natural character, due to the reduced river flow, largely modified river margins with limited native vegetation, moderate aquatic health and water quality, and low experimental qualities due to adjacent land use activities; and
- The reach of the river that runs downstream of the Meeting of the Waters to the Tasman Sea has a 'Moderate – Low' level of natural character, due to the variable flow from the discharge from the Mangorei Power Station, the number of structures and highly modified river margins in the downstream urbanised area, and the reduced quality of experiential values.

The Mangorei HEPS is also set within a landscape characterised by undulating and rolling rural land that descends to the coast as the river winds its way through productive farmland and the residential / urban outskirts of New Plymouth. The land cover in the rural area is predominately covered in pasture but also consists of a mix of indigenous scrub and bush, and exotic forest along parts of the riverbank.

The Meeting of the Waters Scenic Reserve provide valuable recreational assets to the district, including scenic walks, mountain biking, horse riding, water sports, fishing, sightseeing, and picnic areas for visitors. These natural and man-made landscapes have a

range of qualities associated with water and vegetation that enhance the visual amenity of the surrounds and the experience for the general public.

2.5.2 Geology of the Waiwhakaiho River

The geology of the Waiwhakaiho River at the headwaters and on the ring plain consists of:

- Recent (Holocene) volcanic material dominated by multiple beds of unconsolidated deposits, mostly gravel and sands;
- Holocene lahar flow deposits made of gravel and sands, with occasional deposits of large boulders;
- Late Pleistocene lahar deposits; and
- Cobbles and boulders.

The geology of the Waiwhakaiho River downstream of the diversion weir and intake structure consists of Holocene river deposits of reworked volcanic material (i.e. boulders, gravels and sands). These deposits are typically unconsolidated and highly erodible, and contribute fine gravels and clays into the river flow. Ash and sand within debris deposits are also common in the river flow.

Soils within the Waiwhakaiho River are identified as allophanic soils, which mostly comprise of fines and have a low erosion rate, unless exposed or on steep slopes when they are likely to erode as sands, silts and clays.

The reach of the Waiwhakaiho River near the diversion weir and intake structure has been identified by Tonkin & Taylor (as per the Sediment Assessment provided as **Appendix E** to this AEE) as a 'storage reach', where sediment is deposited and temporarily stored within lateral bars, point bars and islands within the channel.

2.5.3 Hydrology of the Waiwhakaiho River

As detailed in the Hydrology Assessment prepared by Tonkin & Taylor (provided as **Appendix F** to this AEE), flow records from two gauges are available to characterise the hydrology and water resources of the Waiwhakaiho River. The longer record, Waiwhakaiho at SH3, has 40 years of data commencing in 1980 and is representative of the middle reaches of the river upstream of the Mangorei HEPS. The shorter record at Rimu Street has 11 years of data starting in 2009 and is considered to be representative of the lower river downstream of the tailrace of the Mangorei Power Station (with it being approximately 7.5 km downstream of the tailrace).

Tonkin & Taylor note that the driest summer in the 40-year record for the Waiwhakaiho at SH3 occurred in 2019 (December 2018 to February 2019), while the most recent summer (December 2019 to February 2020) was the fourth driest. However, based on the average

flow recorded between January and April each year, 2020 was the driest period on record.

The mean annual flow of the Waiwhakaiho River at SH3 is 7.84 m^3/s over the 40-year record. The mean annual flow of the river at Rimu Street is 11.39 m^3/s. Monthly mean flows at each recorder are provided in Figure 2 below.

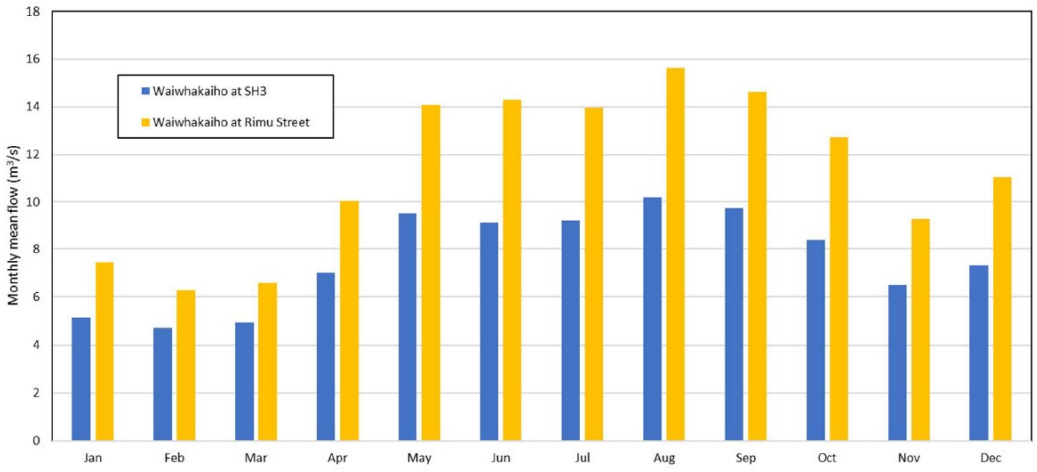

Figure 2: Monthly Mean Flows on the Main Stem of the Waiwhakaiho River

Figure 3 below presents flow duration plots of the recorders at SH3 and Rimu Street for their overlapping record period (i.e. April 2009 to April 2020). The median flow (i.e. the flow that is exceeded 50% of the time) is 3.94 m^3/s at SH3 and 6.65 m^3/s for Rimu Street.

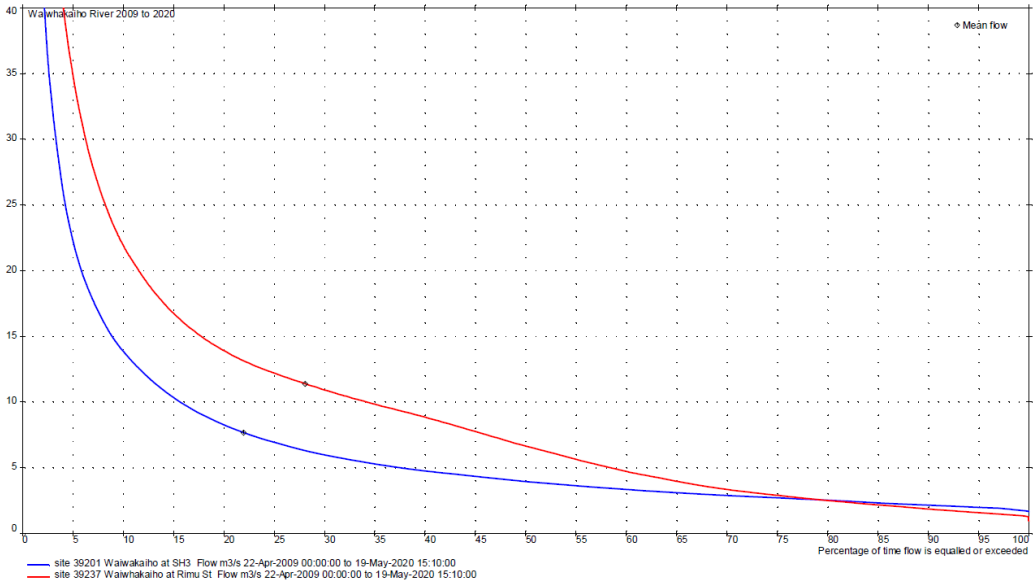

Figure 3: Waiwhakaiho River Flow Duration Curve (April 2009 to May 2020)

In terms of the flow limit for the cessation of the diversion / take under the existing resource consents for the Mangorei HEPS, Tonkin & Taylor notes that at a flow of 85 m^3/s at SH3 is only exceeded only 0.82% of the time (based on the full record from 1980 to 2020).

Large floods occur within the Waiwhakaiho River at any time of the year, and often occur as 'flashy' events in which floods rise extremely quickly and recede rapidly. The mean annual flood at SH3 and Rimu Street are 333 m^3/s and 353 m^3/s respectively.

Flows within the diversion tunnel to Lake Mangamahoe generally increase steadily with increasing flows in the Waiwhakaiho River, but begin to taper off at a tunnel flow of approximately 6.5 m^3/s - reaching 8 m^3/s at a river flow of approximately 20 m^3/s.

The discharge of water into the Waiwhakaiho River from the Mangorei Power Station generates either a purely diurnal (daily peak) or a semi-diurnal (two peaks per day) pattern in the Waiwhakaiho River that is reflective of daily energy generation profiles, with only minor attenuation (smoothing) of the generation pulse. There is typically an 8 to 10 hour period of no generation overnight on most days – which is reflective of the limited storage in Lake Mangamahoe.

2.5.4 Aquatic Ecology of the Waiwhakaiho River

The following sections have been informed by the Aquatic Ecology Assessment prepared by Ryder Environmental Limited (and provided as **Appendix G** to this AEE).

2.5.4.1 Water Quality

Nutrients, Clarity and Bacteria

Overall, 10 year trend analysis indicates that dissolved reactive phosphorus, total oxidised nitrogen and faecal bacteria concentrations are all increasing in the Waiwhakaiho River upstream of the diversion weir and intake structure. Nutrient and faecal bacteria concentrations in the Waiwhakaiho River reflect the agricultural nature of the catchment, with associated non-point source run-off and point source discharges. Phosphorus levels also reflect that the headwaters of the catchment drain Mount Taranaki, which is a naturally high source of phosphorus.

Median ammoniacal nitrogen concentrations can be up to three times higher within the residual reach of the Waiwhakaiho River, and two times higher downstream of the Mangorei HEPS, than the upstream section of the river. Furthermore, median values of nitrate nitrogen can be almost twice as high downstream of the Mangorei HEPS than the upstream sections of the river.

Median faecal bacteria concentrations were lowest within the residual reach of the Waiwhakaiho River, and highest upstream of the diversion weir and intake structure.

Monitoring of phosphorus concentrations in the Waiwhakaiho River indicates that concentrations, particularly dissolved reactive phosphorus, tend to be higher upstream at SH3 than within the residual reach and downstream of the Meeting of the Waters.

Water clarity is high at all monitoring sites in the Waiwhakaiho River. However, at times the upstream sections of the river are impacted by erosion events in the upper catchment.

Water Temperature

Water temperatures within the Waiwhakaiho River follow a seasonal pattern, with a gradual increase in temperatures from August to February before temperatures being to reduce again. During summer, water temperatures are typically higher in the residual river reach than upstream of the diversion weir and intake structure. Maximum daily average temperatures within the residual reach between 2008 to 2020 were 24.2˚C, whilst they were 21.7˚C upstream of the diversion weir and intake structure.

Water temperatures in the Waiwhakaiho River are typically maintained within the range of thermal preferences for native fish species, and also within the range when fish species behaviour / development occurs. There are occurrences when the acute thermal criteria for brown trout (24.6˚C) and the incipient lethal temperatures of 'sensitive' benthic macroinvertebrates taxa (21 – 23˚C) can be exceeded. In the case of brown trout, the acute thermal criteria was exceeded in 0.9% of the time in the residual reach of the Waiwhakaiho River.

However, it is typical for temperatures to naturally increase downstream in all rivers, and this is also the case with the Waiwhakaiho River. However, monitoring has identified that the discharge from the Mangorei Power Station to the Waiwhakaiho River appears to have a slight cooling effect on the temperatures downstream of the Meeting of the Waters.

Dissolved Oxygen

Dissolved oxygen concentrations immediately downstream of the tailrace of the Mangorei Power Station are typically above the minimum acceptable states set out in the National Policy Statement for Freshwater Management 2020 ("**NPSFM**").

Monitoring did indicate that oxygen concentrations did fall below the states specified in the NPSFM in late January 2020. During this period of low dissolved oxygen levels there was a pattern of daily minimum levels occurring late at night, then increasing the following morning. The low levels late at night coincided with times when there was no generation discharge from the Mangorei Power Station, and also when respiration by macrophytes and periphyton is known to dissolve oxygen levels. The morning increases in dissolved oxygen correlated with generation discharges from the Mangorei Power Station.

It is noted that while low dissolved oxygen levels were recorded in the Waiwhakaiho River during this period, they were not a result of the discharge of oxygen-depleted water from

the Mangorei HEPS. Rather, the generation discharge from the Scheme had the opposite effect of improving dissolved oxygen levels in the Waiwhakaiho River.

2.5.4.2 Periphyton

TRC monitors the periphyton community at two sites in the Waiwhakaiho River:

- At the SH3 (approximately 2 km upstream of the diversion weir and intake structure); and
- At Constance Street (approximately 15 km downstream of the diversion weir and intake structure).

New Zealand Periphyton Guidelines for Recreation are exceeded when filamentous algae cover at least 30% of the bed and / or thick mats of algae cover at least 60% of the bed. Thick mat coverage has never exceeded the guidelines within the Waiwhakaiho River at the two monitoring sites. However, long filamentous algae cover has exceeded the guidelines:

- On approximately 35% of monitoring occasions at SH3; and
- On approximately 12% of monitoring occasions at Constance Street.

Despite these exceedances, trend analysis has found no change in the percentage cover of thick mats or the cover of long filaments at either monitoring site.

Periphyton biomass within the Waiwhakaiho River (at both monitoring sites) has exceeded the guideline for benthic biodiversity (50 mg/m^2) at times. Monitoring has also indicated that chlorophyll *a* concentration in the river has exceeded 200 mg/m^2 on two occasions at SH3. Further monitoring is required, consistent with the requirements of the NPSFM, to determine how chlorophyll *a* concentration at the two monitoring sites align with the bands in the National Objectives Framework.

Overall, long-term monitoring indicates that long filamentous nuisance algae proliferations occur at times at both the upstream and downstream monitoring sites, albeit slightly more often at the upstream site.

2.5.4.3 Macroinvertebrates

Monitoring of benthic macroinvertebrate community health has indicated that community health reduces further downstream of the Waiwhakaiho River. These results are to be expected due to the rivers' transition from land use comprising the Egmont National Park to increased land use intensity in the downstream environment.

Macroinvertebrate community health has tended in the past to be higher upstream of the diversion weir. However, ten-year trend analysis of macroinvertebrate community scores indicates degrading health within all parts of the Waiwhakaiho River down to the Tasman Sea. This degradation has been particularly evident upstream of the diversion weir and

intake structure, and within the residual reach where statuses of 'poor' health have been identified.

2.5.4.4 Fish

The Waiwhakaiho River has one of the highest river fish diversities in the Taranaki Region, with 18 species of freshwater fish identified in the catchment.[1]

The New Zealand Freshwater Fisheries Database ("**NZFFD**") has records of banded, giant and shortjaw kokopu, koaro, lamprey, redfin bully, torrentfish and both longfin and shortfin eel upstream of the diversion weir and intake structure (which has included a fish pass since 1992). A number of the species are classified as 'threatened – nationally vulnerable' (including shortjaw kokopu and lamprey).

Brown trout and perch have also been recorded upstream of the diversion weir.

Within the residual reach of the Waiwhakaiho River, brown trout, inanga, redfin bullies, longfin eels and torrentfish have been identified.

2.5.5 Fish Passage and Fish Screening in the Waiwhakaiho River

The Fish Passage and Fish Screening Assessment by Ryder Environmental Limited (**Appendix H** to this AEE) notes that fish passage is provided past the diversion weir in the Waiwhakaiho River by a fish pass located on the true right side of the diversion weir. The current fish pass structure has been in place since 1998.

The flow through the fish pass is approximately 0.15 – 0.20 m^3/s, and suitable water velocities for fish passage have been established by an accumulation of rocks, boulders and general debris and the placement of wooden blocks within the pass. Under low flow conditions much of the residual flow required in the Waiwhakaiho River is passed through the fish pass structure. The steep gradient, boulder substrate and frequent freshes in the river mean the fish pass requires regular maintenance to remove boulders.

The 2017 – 2018 Annual Monitoring Programme Report for the Mangorei HEPS noted that within the residual reach there were no areas where fish passage appeared inhibited, and the 2018 – 2019 Annual Monitoring Report concluded that *"the fish pass is considered adequate to provide for the passage of all fish species expected to migrate up to and beyond the weir."*

There is no impediment on the Waiwhakaiho River preventing the upstream passage of migratory fish species and there are no fish screening / exclusion measures in place on / at the intake structure. However, it is noted that a trash screen installed at the intake

[1] Review of Minimum Flows and Water Allocation in Taranaki (TRC, 2018).

structure provides a level of deterrent to adult fish species entering the diversion tunnel to Lake Mangamahoe.

2.6 LAKE MANGAMAHOE

Lake Mangamahoe was formed as a result of the construction of the Mangamahoe Dam in 1931 to provide water supply storage for New Plymouth and, subsequently, for the Mangorei HEPS. Lake Mangamahoe is now also a wildlife refuge and is protected under section 14 of the Wildlife Act 1953.

Lake Mangamahoe sits across the Mangamahoe Stream, with the upper part of the stream acting as a tributary to the lake and the lower part of the stream providing a confluence from the Mangamahoe Dam spillway to the Waiwhakaiho River. The lake is contained at the downstream end by the 25 m Mangamahoe Dam, and part way along the western edge by a 6 m saddle dam.

The depth of Lake Mangamahoe varies, with the southern arm being the shallowest part of the lake. Lake levels change hourly and daily at levels typically ranging between 149.80 m RL (the Mangamahoe Dam spillway crest) and 149.05 m RL.

Lake Mangamahoe is set within production pine forestry, patches of regenerating indigenous forest, and parkland. The lake and surrounds have naturalised over the decades and provide habitat for at least 40 species of indigenous and introduced water birds and birds of forest / forest-edge / scrub. Further details of the species are provided in the Terrestrial Ecology Assessment prepared by Ryder Environmental Limited (provided as **Appendix I** to this AEE).

2.6.1 Natural Character of Lake Mangamahoe

The Natural Character, Landscape and Visual Assessment by Boffa Miskell considers that Lake Mangamahoe has a 'Moderate' level of natural character. This is reflective of the lake's modified water level regime for water supply and electricity generation purposes, water body and margin form, structures within the lake and margins (i.e. intake structures for water supply and electricity generation), the surrounding mix of native and exotic vegetation, and the valued experiential qualities associated with a natural lake.

2.6.2 Hydrology of Lake Mangamahoe

As detailed in the Hydrology Assessment prepared by Tonkin & Taylor, inflows to Lake Mangamahoe consist of the flow diverted from the Waiwhakaiho River (approximately 85% of inflows), flows from local tributaries (i.e. the upper sections of the Mangamahoe Stream and Kent Road Stream) and direct rainfall on the lake surface. Further details of the mean flows into Lake Mangamahoe are provided in Table 2.1 below.

Approximately 91% of the outflow from the lake passes through the Mangorei Power Station and discharges to the Waiwhakaiho River at a minimum continuous flow of at least

950 l/s, with the discharge typically spread between the hours of 8am – 6pm. The mean discharge from Lake Mangamahoe to the Mangorei Power Station is 3.82 m^3/s, and a bypass valve (which is used to maintain a flow in the tailrace when the power station is unable to generate) also contributes to the discharge from the Mangorei Power Station.

A nominal amount of water is also discharged from the Mangamahoe Dam to the Mangamahoe Stream through leakage underneath the flashboards, and as spill flow during high flow and flood events.

Water is also abstracted from Lake Mangamahoe by NPDC for water supply purposes, with a mean monthly take of 366 l/s.[2]

Table 4: Mean Flows (m^3/s) for Lake Mangamahoe

Item Description	Mean Flow (m^3/s)
Waiwhakaiho River diversion tunnel flow	3.56
Local catchment inflow	0.48
Sum of Lake Mangamahoe Inflows	**4.04**
Power Station discharge	3.82
Power Station bypass valve	0.01
Spill flow, leakage / seepage from dam	~0.03
NPDC water take	0.36
Sum of Lake Mangamahoe Outflows	**4.22**

Lake levels are required to generally be within 0.75 m of the 149.80 m RL concrete crest level of the Mangamahoe Dam spillway and typically range from 150.3 – 149.3 m RL on a daily or inter-daily basis. This high level of daily fluctuation reflects the pattern of electricity generation at the Mangorei Power Station. Daily fluctuations are also shown to correlate with the magnitude of lake inflow. Lake levels are often higher than the spillway crest, however it is noted that such levels do not necessarily indicate spilling as there are flashboards (approximately 0.5 m high) mounted on the crest of the spillway that permit a

[2] Based on the flow records between 2013 and 2019.

higher operating level. The water level time series for Lake Mangamahoe is provided in Figure 4 below.

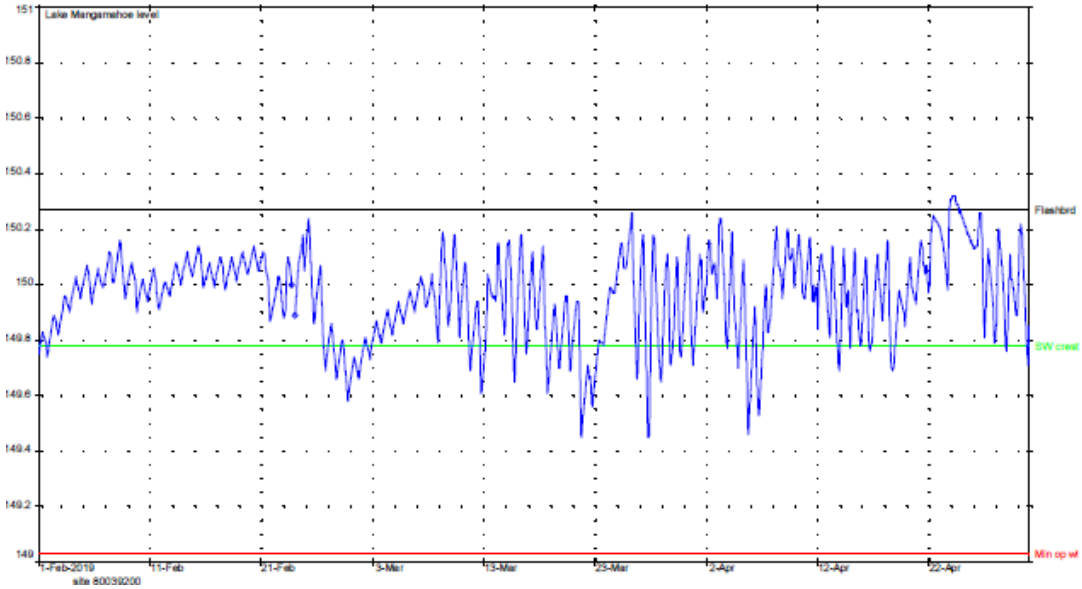

Figure 4: Lake Mangamahoe Water Level Time Series (February 2019 to April 2019)[3]

NPDC also have access to storage in Lake Mangamahoe below the consented minimum operating level for the Mangorei HEPS to 148.15 m RL (which is 0.88 m below the minimum consented operating level for the Mangorei HEPS).

Flood flows to Lake Mangamahoe come from the Waiwhakaiho River diversion tunnel, the upper Mangamahoe Stream, and the Kent Road Stream. The concrete-lined spillway adjacent to the Mangamahoe Dam provides flood passage and is able to convey the 100-year Average Recurrence Interval ("**ARI**") flood and pass the Probable Maximum Flood. The peak outflow in the 100-year ARI flood is 59 m^3/s and 160 m^3/s in the Probable Maximum Flood.

2.6.3 Fish Entrainment within Lake Mangamahoe

Due to the diversion from the Waiwhakaiho River to Lake Mangamahoe, downstream migrating fish can to be diverted into the lake (as discussed in the Fish Passage and Fish Screening Assessment by Ryder Environmental Limited). As a result of the diversion tunnel it is difficult for fish to naturally find their way back to the river.

Trustpower have voluntarily operated an adult eel trap and transfer operation in Lake Mangamahoe since 2009, immediately upstream of the intake structure to the Mangorei

[3] Red line is the minimum operating level, green line is the crest level of the concrete spillway and the black line is the top of the flashboards on the spillway.

Power Station (which consists of four intake gates and a manually operated trash screen). The trapping season typically starts in mid-March and extends into June. Throughout the trapping season Trustpower staff visit the site at least three times a week to inspect for migrant eels in the vicinity of the intake structure. The migrant eels are captured using a combination of scoop and set nets and released into the Waiwhakaiho River downstream of the Mangorei HEPS.

There are no fish screening / exclusion measures in place within Lake Mangamahoe, however, it is noted that the trash screen installed at the intake structure provides a level of deterrent to adult eel species entering the intake structure.

2.6.4 Aquatic Ecology of Lake Mangamahoe

Water quality in the lake broadly reflects that of the Waiwhakaiho River upstream of the intake structure (as detailed in section 2.4.4.1 of this AEE).

The NZFFD has no records for Lake Mangamahoe. However, Taranaki Fish & Game's website identifies the lake as the region's most popular lake fishery, holding brown trout and rainbow trout. Longfin and shortfin eels, and bullies are also common, and in 2008 a giant kokopu was found in the lake. There is recent DNA evidence that koaro may also be present.

2.6.5 Tributaries of Lake Mangamahoe

There are two natural tributaries to Lake Mangamahoe - the upper sections of the Mangamahoe Stream and the Kent Road Stream.

The Mangamahoe Stream catchment is approximately 4.5 km^2 with a stream length of 8 km to Lake Mangamahoe. The mean annual flood is 13.5 m^3/s. The Kent Road Stream has a catchment size of 3 km^2 with a stream length of 7 km. The mean annual flood is 8.3 m^3/s.

Both tributaries are deeply incised, single thread streams with channel widths ranging from 1 – 3 m. Pasture is the dominant land us - representing approximately 97% of the land use across the tributary catchments.

2.6.5.1 Geology of the Lake Mangamahoe Tributaries

The geology of the upper section of the Mangamahoe Stream and the Kent Road Stream consist of mid-pleistocene debris avalanche deposits, which are predominantly debris cobbles overlain by sand and ash. Due to the age of these deposits, they are likely to have a higher content of clay due to weathering processes and are less erodible.

Large boulders are evident in those areas where the tributaries enter Lake Mangamahoe, and fine sediments exist near the headwaters and in the pools behind the boulders.

Ash and sand is prevalent within debris deposits, and soils are identified as allophanic soils.

2.6.5.2 Lake Sedimentation Conditions

The Sediment Assessment by Tonkin & Taylor notes that:

- Sources of sediment, and consequently sediment loads entering Lake Mangamahoe, vary through time. Ongoing and historic land use changes may be increasing sediment loads, with pasture and pine forestry likely to be contributing to any increase in sediment loads. Episodic events (e.g. landslides, bank erosion and infrastructure failures) are unpredictable and difficult to quantify in annual load calculations, but have the potential to contribute large pulses of sediment that may last between several years to several decades;
- Estimated sediment yields and suspended sediment concentration monitoring indicate that the Waiwhakaiho River may be the main contributor of sediment to Lake Mangamahoe via the diversion tunnel. The Mangamahoe Stream and Kent Road Stream also contribute sediment to Lake Mangamahoe, however as episodic events are not accounted for in catchment estimates of sediment yield, it is possible that the Mangamahoe Stream and Kent Road Stream may be responsible for a much larger proportion of sediment load than is currently predicted; and
- The NPDC water supply pipe that lies across the bed of Lake Mangamahoe appears to be having a considerable effect on sedimentation patterns in the lake, with the greatest accumulations of sediment occurring upstream of the pipe in the southern arm of the lake.

2.7 LOWER MANGAMAHOE STREAM

The lower Mangamahoe Stream conveys a small flow from the spillway of the Mangamahoe Dam, plus catchment runoff, approximately 1.4 km to its confluence with the Waiwhakaiho River. The stream is typically 1 – 2 m wide with some wider pools evident in places.

The lower dam on the Mangamahoe Stream, located approximately 900 m downstream of Lake Mangamahoe, creates a small reservoir that is approximately 300 m long, 30 m wide, and provides habitat for waterbirds. This dam is owned by the NPDC.

The lower Mangamahoe Stream is densely vegetated with forest and shrubland growing to the margins and forming a near closed canopy. This vegetation is dominated by pine forest but also supports a diverse sub-canopy of exotic and indigenous species similar to those found around Lake Mangamahoe. A central 600 m section of the stream flows through farmland, at which point riparian vegetation comprises mainly rough pasture.

2.7.1 Natural Character of the Lower Mangamahoe Stream

The lower Mangamahoe Stream is considered to have a 'Low' level of natural character as it is highly modified (as detailed in the Natural Character, Landscape and Visual Assessment by Boffa Miskell).

2.7.2 Hydrology of the Lower Mangamahoe Stream

No residual flow is required in the lower Mangamahoe Stream downstream of the Mangamahoe Dam under the existing resource consents held by Trustpower. However, the stream receives spill flow from Lake Mangamahoe on occasion and a nominate amount of leakage / seepage underneath the flashboards on the Mangamahoe Dam.

The peak discharge to the Mangamahoe Stream via the Mangamahoe Dam spillway in the 100-year ARI flood is 59 m^3/s, and 160 m^3/s in the Probable Maximum Flood.

2.7.3 Fish Passage in the Lower Mangamahoe Stream

Fish passage in the Mangamahoe Stream has been restricted since the construction of the lower dam on the stream in 1918. The Mangamahoe Dam provides an additional barrier to fish passage that has been in place since the 1930's.

2.7.4 Aquatic Ecology of the Lower Mangamahoe Stream

As detailed in the Aquatic Ecology Assessment prepared by Ryder Environmental Limited, the benthic macroinvertebrate communities in the lower Mangamahoe Stream (near its confluence with the Waiwhakaiho River) are indicative of 'poor' health and dominated by snails and worms. Monitoring of periphyton cover in the lower Mangamahoe Stream has indicated a dominance of mat algae, but at a level that does not exceed the 60% bed coverage guideline.[4] Periphyton biomass has, however, at times been slightly over the guideline of 50 mg/m^2.

Water temperature within the lower Mangamahoe Stream (approximately 50 m downstream of the Mangamahoe Dam) is lower than near the confluence of the stream with the Waiwhakaiho River. This is to be expected as temperature typically increases downstream.

Monitoring of dissolved oxygen concentrations within the Mangamahoe Stream has generally met the NPSFM national minimum acceptable states, with the exception of that part of the stream near the confluence with the Waiwhakaiho River, which at times has had oxygen concentrations that are just below the seven-day mean minimum standard of 5.0 mg/L.

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[4] New Zealand Periphyton Guideline: Detecting, Monitoring and Managing Enrichment of Streams (Biggs, 2000).

Water quality in the lower Mangamahoe Stream is sufficient to maintain a native fish community, and eels and redfin bullies have been found both upstream and downstream of the lower dam owned by NPDC.

2.8 RECOGNISED FEATURES, LANDSCAPES, AREAS, ECOSYSTEMS AND TREES

A number of natural features, landscapes, areas, ecosystems and trees within the vicinity of the Mangorei HEPS are recognised by the Regional Policy Statement ("**RPS**") and the relevant regional and district plans. These are discussed further in the sub-sections below.

2.8.1 Natural Features and Landscapes

The RPS and the RFWP identify the Waiwhakaiho River as a catchment with high natural, ecological and amenity values. The TRC[5] also acknowledge the regional significance of the Waiwhakaiho River for:

- Aesthetic and scenic values:
- Contact recreation:
- Trout fishing;
- Whitebaiting; and
- Native fishery habitat values.

Additionally, the RFWP identifies the upper and middle reaches of the Waiwhakaiho River as having *"high natural, ecological and amenity values"*.

The Operative New Plymouth District Plan and the Proposed New Plymouth District Plan identify the Waiwhakaiho River, Lake Mangamahoe and the Mangamahoe Stream as priority / significant waterbodies with biodiversity, ecological, natural character, cultural, amenity, scenic, water quality and recreational values.

2.8.2 Significant Natural Areas

The Operative New Plymouth District Plan does not identify any SNAs in the vicinity of the Mangorei HEPS. However, the Proposed New Plymouth District Plan identifies two on the Waiwhakaiho River.[6]

One of the SNA is located on the true right of the Waiwhakaiho River near the Royal Heights cul-de-sac (off Queens Road), and approximately 7.5 km downstream of the Mangorei Power Station. This SNA is contiguous with a QE2 covenant along the river

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[5] *Freshwater bodies of outstanding or significant value in the Taranaki region – Review of the Regional Fresh Water Plan for Taranaki* (2016).

[6] Sites 258 and 260.

margin to the south. Further details of this SNA are provided in the Terrestrial Ecology Assessment by Ryder Environmental Limited.

The second SNA is located in Burgess Park on Hydro Road, on the true left of the Waiwhakaiho River and immediately upstream of the Meeting of the Waters. It is on the opposite side of the river from the Meeting of the Waters Scenic Reserve, which is also listed as a KNE.

2.8.3 Key Native Ecosystems

TRC recognise two KNEs within the vicinity of the Mangorei HEPS:

- The Meeting of the Waters Scenic Reserve, described as supporting 'an excellent example of lowland podocarp broadleaved forest'; and
- Canaan Bush, which is described as a 'remnant of semi-coastal forest'.

Further details of these KNEs are provided in the Terrestrial Ecology Assessment by Ryder Environmental Limited.

2.8.4 Significant Trees

The Operative New Plymouth District Plan and the Proposed New Plymouth District Plan identify a number of 'significant trees' along the Waiwhakaiho River, which are predominantly introduced species with the exception of a group of rimu. The significant trees are located in the immediate vicinity of the Meeting of the Waters, and at 361 Junction Road.

Further details of the significant trees are provided in the Terrestrial Ecology Assessment.

2.9 RECREATIONAL FEATURES AND RECOGNITION

As noted in the Recreation Assessment prepared by Rob Greenaway & Associates (provided as **Appendix J** to this AEE), recreational activities that are undertaken within the vicinity of the Mangorei HEPS include trout fishing, kayaking, rafting, swimming, whitebaiting, hunting and terrestrial recreation (such as mountain biking, equestrian, running and walking).

Lake Mangamahoe is a popular recreational area with high amenity values. While it is used for scenic recreation purposes, the lake has no status as a reserve under the Reserves Act 1977 or other protection for recreation purposes. However, it is subject to a Reserves Management Plan that was prepared in 2011.

The Lake Mangamahoe Management Plan outlines the agreement between NPDC and Trustpower that enables NPDC to utilise Lake Mangamahoe 'as if it were a local purpose reserve under the Reserves Act 1977, or for such public amenity as may be approved by

Trustpower'. The Management Plan also acknowledges that utilisation of the lake as a water supply source takes precedence over any recreational activities.

Public foot and cycle access and service vehicle access to the intake structures on the Waiwhakaiho River is provided via a Local Purpose (Cemetery) Reserve located to the south of Lake Mangamahoe. Access is also available within the bed of the river.

3. PROPOSAL

3.1 INTRODUCTION

As noted in section 1 of this AEE, Trustpower is seeking all necessary resource consents from the TRC for the continued operation, use and maintenance of the Mangorei HEPS in response to the forthcoming expiry of the existing resource consents for the Scheme in June 2021. In essence, Trustpower is not proposing any material changes to the hydrological regime of the Mangorei HEPS.

The key activities that comprise the continued operation and maintenance of the Mangorei HEPS are summarised as follows:

- The damming of water in the Waiwhakaiho River via an existing diversion weir and intake structure;
- The diversion, take and use of water from the Waiwhakaiho River via a diversion weir and intake structure;
- The use and maintenance of an existing diversion weir, intake structure and fish pass in the Waiwhakaiho River (including the removal of gravel and debris from the fish pass);
- The discharge of water over the diversion weir in the Waiwhakaiho River;
- The discharge of water from the Waiwhakaiho River via a tunnel to Lake Mangamahoe;
- The use and maintenance of an existing discharge structure in Lake Mangamahoe;
- The damming of the Mangamahoe Stream via a dam structure to form Lake Mangamahoe and the regulating of levels in the lake;
- The use and maintenance of an existing dam structure in the Mangamahoe Stream;
- The abstraction of water from Lake Mangamahoe via a tunnel and penstocks for the purposes of electricity generation at the Mangorei Power Station;
- The use and maintenance of an existing intake structure in Lake Mangamahoe;
- The discharge of water to the Waiwhakaiho River via a tailrace from the Mangorei Power Station; and
- The discharge of water from Lake Mangamahoe via a spillway to the Mangamahoe Stream, including the emergency discharge of water.

Further details on each of these key components, and the operating conditions proposed by Trustpower, are provided in the following sub-sections.

3.2 WAIWHAKAIHO RIVER DIVERSION

3.2.1 Water Diversion / Abstraction to Lake Mangamahoe

As discussed in section 2 of this AEE, a low-head concrete diversion weir is located across the Waiwhakaiho River approximately 1.6 km downstream of SH3. Trustpower proposes to continue to impound and divert water from the Waiwhakaiho River via this weir to an intake structure located on the true-left of the river.

The maximum rate of diversion / take from the Waiwhakaiho River proposed by Trustpower is 10 m^3/s (which is the same as the existing resource consent conditions). Based on the Hydrology Assessment by Tonkin & Taylor, the mean diversion / take from the river has been calculated to be approximately 3.54 m^3/s.

Trustpower proposes to continue to cease the diversion / take of water from the Waiwhakaiho River when the river flow at SH3 is greater than or equal to 85 m^3/s (which is also the same as the existing consent conditions[7]) – with an allowance of 30 minutes to provide for the time it will take for the intake structure to be closed. Based on the Hydrology Assessment by Tonkin & Taylor, it is expected that a flow of 85 m^3/s in the river will be exceeded approximately 0.82% of the time.

Trustpower also proposes to maintain the following residual flows in the Waiwhakaiho River downstream of the diversion weir and intake structure (which is the same as the existing resource consent[8]):

- 1 January to 31 March – 700 l/s;
- 1 April to 30 April, and 1 November to 31 December – 600 l/s; and
- 1 May to 31 October – 400 l/s.

The expected mean flow in the Waiwhakaiho River downstream of the diversion weir with the residual flow regime in place, and based on average hydrological conditions over the last seven years, is presented in grey in Figure 5 below.

[7] Resource Consent 2053-3.2, Condition 3.

[8] Resource Consent 2053, Condition 2.

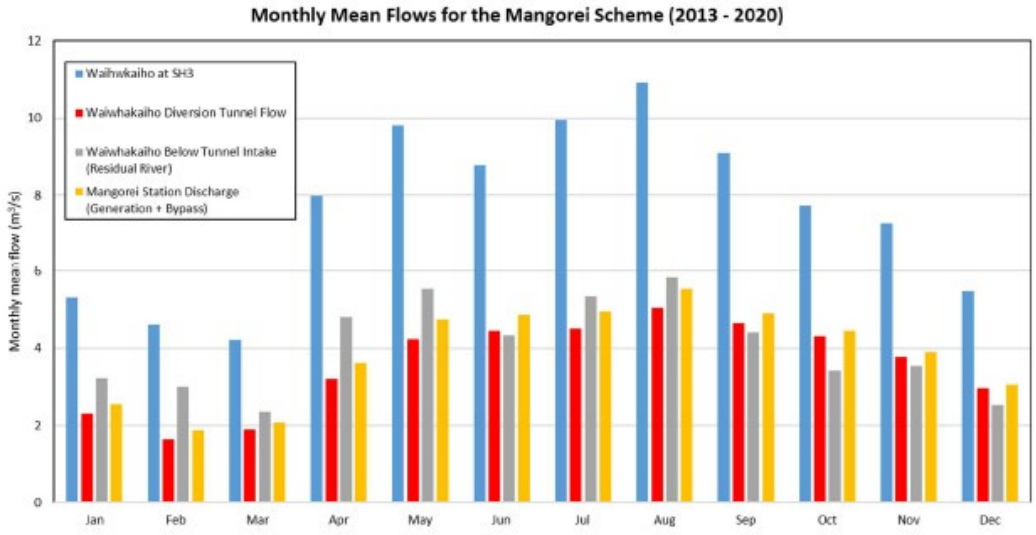

Figure 5: Mean Flow Distribution by Month

With the purpose of mitigating the effects of water temperature increases within the residual reach of the Waiwhakaiho River, Trustpower proposes to provide an additional 100 l/s of water down the residual reach in the event:

- That water temperature in the residual reach exceeds 25 ˚C (based on a one hour rolling average) and the water temperature upstream of the diversion weir is 25 ˚C or lower (also based on a rolling one hour average); or
- That water temperature upstream of the diversion weir exceeds 25 ˚C (based on a one hour rolling average) and there is a greater than 3 ˚C water temperature increase within the residual reach of the Waiwhakaiho River relative to upstream of the diversion.

The additional 100 l/s will be in addition to the flow being provided immediately downstream of the diversion weir at the time either of the above triggers were met. This additional flow shall be maintained for a period of 24 hours and then until such time as:

- The water temperature in the residual reach reduces below 25 ˚C (based on a rolling one hour average); or
- The water temperature upstream of the diversion weir exceeds 25 ˚C (based on a rolling one hour average) but there is less than a 3 ˚C temperature difference within the residual reach relative to upstream of the diversion.

Further detail on these operating parameters is provided in the consent conditions proposed by Trustpower (and attached as **Appendix K** to this AEE).

Furthermore, Trustpower is proposing to provide a flushing flow down the residual reach of the Waiwhakaiho River in the event that the flow has not exceeded 12 m^3/s for a consecutive 30 day period commencing on 1 November and concluding on 31 March. In

these circumstances the diversion / take of water from the Waiwhakaiho River will be reduced for six hours during the next fresh event that exceeds three times the median flow in order to allow a flushing flow of at least 12 m^3/s to pass down the Waiwhakaiho River.

Further details on the basis for these residual flow limits, temporary diversion and abstraction reductions, and the flushing flow regime in the Waiwhakaiho River are provided in section 5 of this AEE (and in the Aquatic Ecological Assessment by Ryder Environmental Limited).

3.2.2 Maintenance of the Diversion Weir and Intake Structure

No changes are proposed to the existing configuration or maintenance regime for the diversion weir, fish pass or intake structure in the Waiwhakaiho River. In this regard, no changes are proposed to the existing trash screen on the intake structure which is designed to deflect large debris (i.e. branches and small boulders) away from the intake tunnel via vertical bars that are spaced 180 mm apart.

Retrofitting of a fish screen is not proposed across the intake structure and is discussed further in section 5 of this AEE.

A 6 m long culvert was established in an unnamed tributary of the Waiwhakaiho River in 2006, just upstream of the diversion weir and intake structure, which enables access for light vehicles and equipment to the diversion weir, fish pass and intake structure via the access track located off Plantation Road.

The dynamic nature of the Waiwhakaiho River (i.e. steep gradient, boulder substrate and frequent freshes) has meant the diversion weir and fish pass requires regular maintenance to remove boulders / debris. This maintenance involves Trustpower clearing boulders, small rocks and debris after high flow events, and it is proposed that maintenance of the diversion weir and fish pass include the use of machinery operating in the Waiwhakaiho River (along with the removal of small rocks / debris by hand).

Boulders removed from the fish pass by machinery or hand will be placed on the true-right bank of the Waiwhakaiho River (see Figures 6 and 7 below), allowing them to mobilise down the river during the next high-flow event.

Figure 6: Aerial Image of Area for Deposition of Boulders / Debris

Figure 7: True Right Bank of the Waiwhakaiho River where Boulders and Debris are Placed Following Removal

3.3 LAKE MANGAMAHOE

As discussed in section 2 of this AEE, Lake Mangamahoe is utilised to provide water storage for hydro-electricity generation by Trustpower and water supply for the NPDC. The lake also provides a valuable recreational resource for the community.

The following sub-sections detail how Trustpower intends to operate Lake Mangamahoe as part of the resource consent applications it is seeking from TRC (which will be consistent with the existing consent conditions for the Mangorei HEPS).

3.3.1 Discharge of Water to Lake Mangamahoe

As noted in section 2 of this AEE, Trustpower propose to discharge up to 10 m^3/s of water into Lake Mangamahoe from an outlet structure located in the south-western end of the lake via a 580 m long tunnel from the Waiwhakaiho River. The mean discharge to the lake from the Waiwhakaiho River will be approximately 3.54 m^3/s).

As noted in section 3.2.1 of this AEE, the discharge of water to Lake Mangamahoe will cease when the flow in the Waiwhakaiho River at SH3 is greater than or equal to 85 m^3/s (which is also the same as the existing consent conditions).

3.3.2 Diversion / Take to the Mangorei Power Station

As discussed in section 2 of this AEE, the intake to the tunnel and penstocks for the Mangorei Power Station are located at the northern end of Lake Mangamahoe. Trustpower proposes to divert / take up to 864,000 m^3 of water per day from Lake Mangamahoe, and discharge it back to the Waiwhakaiho River via the Mangorei Power Station. The diversion / take will be operated such that a continuous generation flow of at least 950 litres / second is released into the Waiwhakaiho River via the tailrace from the Mangorei Power Station between 8:00 am and 6:00 pm each day.

3.3.3 Discharge to the Mangamahoe Stream

The earth dam across the Mangamahoe Stream includes a steep, concrete spillway that allows for the discharge of water from Lake Mangamahoe to the Mangamahoe Stream. The discharge of water via the spillway is not controlled via a gate structure, instead water will overtop the flashboards mounted on the top of the spillway crest when the level of Lake Mangamahoe exceeds 150.27 m RL or by way of seepage.

In accordance with the existing resource consents for the Mangorei HEPS,[9] Trustpower is seeking resource consent from the TRC to discharge water from Lake Mangamahoe via a spillway to the Mangamahoe Stream. Water that is discharged from the spillway will be conveyed down the Mangamahoe Stream for a distance of approximately 1.4 km (including via the lower dam structure), before converging with the Waiwhakaiho River.

Trustpower does not propose to provide a residual flow in the lower Mangamahoe Stream downstream of the Mangamahoe Dam. In this regard, flows and fish passage in the lower Mangamahoe Stream have been restricted for over 100 years (since the construction of the lower dam owned by the NPDC) and the fish passage barrier on the lower dam owned by NPDC is unrelated to the on-going operation of the Mangorei HEPS. The water quality in the lower stream is sufficient to maintain a native fish community that includes migratory species.

Provision of a residual flow at the lake dam spillway is, therefore, not considered to be required, and the continued presence of the lower dam would not improve habitat greatly in the stream downstream. There is a functioning native fish community in the lower section of the stream.

Adult migrating longfin and shortfin eel will continue to be caught in the vicinity of the intake to the Mangorei Power Station on Lake Mangamahoe. In addition, the programme will be enhanced by adding trap and transfer sites downstream of the NPDC dam.

[9] Resource Consent 4888.

3.3.4 Operation of Levels in Lake Mangamahoe

Trustpower is seeking to operate Lake Mangamahoe for hydro-electricity purposes within an operating range of 750 mm below the crest of the spillway (149.78 m RL) to the Mangamahoe Dam – as per the existing resource consents[10]. However, it is recognised that the NPDC can draw the lake level lower for water supply purposes

Fluctuations in the level of Lake Mangamahoe will continue to be principally dictated by the following:

- Inflows from the Waiwhakaiho River via the diversion tunnel (which contributes a mean flow of approximately 3.64 m^3/s);
- Local catchment inflows from the Mangamahoe Stream and Kent Road Stream catchments (which contribute a mean flow of approximately 0.44 m^3/s);
- The diversion and abstraction of water for water supply purposes by NPDC (a mean rate of abstraction of 0.36 m^3/s); and
- The diversion and abstraction of water for hydro-electricity generation purposes by Trustpower (a mean rate of abstraction of 3.82 m^3/s).

Furthermore, and given that the Mangorei Power Station is principally used to provide electricity supply during the morning and / or early-evening peaks, the level of Lake Mangamahoe will generally cycle within the operating range on a daily or inter-daily basis.

3.3.5 Maintenance of Intake Structure and Mangamahoe Dam

No changes are proposed to the existing configuration or maintenance regime for the Mangamahoe Dam, and the dam will continue to be operated subject to the surveillance and monitoring requirements in the New Zealand Society of Large Dams Guidelines.

No changes are proposed to the existing intake structure in Lake Mangamahoe, the four intake gates, or the manually operated trash screen (which has 20 mm spacings).

Retrofitting a fish screen is not proposed across the intake structure in Lake Mangamahoe, which is discussed further in section 5 of this AEE. However, with the purpose of improving fish passage for longfin and shortfin eels (the 'target species') that become entrapped in Lake Mangamahoe, Trustpower proposes to operate and maintain a trap and transfer programme to facilitate passage of the target species upstream and downstream (which is discussed further in section 5 of this AEE).

[10] Resource Consent 2054, Condition 2.

3.4 DISCHARGE OF WATER TO THE WAIWHAKAIHO RIVER

Water that is diverted to and abstracted from Lake Mangamahoe will be conveyed through a tunnel and penstocks to the Mangorei Power Station, and then discharged back into the Waiwhakaiho River approximately 6 km downstream from the diversion weir.

As per the consented maximum diversion / take from Lake Mangamahoe, Trustpower proposes to discharge up to 864,000 m^3 of water per day and provide a minimum continuous flow of at least 950 L/s between 8 am and 6pm in order to maximise the beneficial effect of artificial flows in the lower Waiwhakaiho River. In the event that Trustpower are required to release an additional 100 l/s down the residual reach of the Waiwhakaiho River (with the purpose of mitigating the effects of water temperature increase, as detailed in section 3.2.1 of this AEE), the continuous flow discharged from the Mangorei Power Station may also be reduced by 100 l/s (i.e. a continuous flow of at least 850 l/s will occur).

3.5 OVERVIEW OF PROPOSED CONTROLS FOR THE MANGOREI HEPS

Table 3.1 below provides a summary of the controls proposed by Trustpower as part of this resource consent application on the various activities that comprise the operation of the Mangorei HEPS. Further discussion on the basis for the proposed controls in Table 4 is provided in section 5 of this AEE.

Table 5: Proposed Controls for the Mangorei HEPS

Activity	Proposed Controls
The damming of water in the Waiwhakaiho River, and the diversion, take and use of water from the Waiwhakaiho River.	1. The diversion and take of up to 10 m^3/s from the Waiwhakaiho River. 2. A residual flow of: › 700 l/s between 1 January and 31 March; › 600 l/s between 1 November and 31 December, and during April; and › 400 l/s between 1 May and 31 October. 3. When the flow of the Waiwhakaiho River exceeds 85 m^3/s upstream of the intake structure, the diversion and abstraction of water from the river will cease. 4. In the event that: › The water temperature in the residual reach exceeds a rolling one hour average of 25 ˚C and the rolling one hour average water temperature upstream of the diversion weir is lower than 25 ˚C (based on a rolling one hour average); or › The water temperature upstream of the diversion weir exceeds a rolling one hour average of 25 ˚C and there is a greater than 3 ˚C temperature

Activity	Proposed Controls
	increase within residual reach relative to upstream of the diversion; a flow in the residual reach that is 100 litres / second greater than the flow being provided immediately downstream of the diversion weir at the time either of the above conditions were triggered shall be maintained. This will be maintained until the conditions above are no longer exceeded. 5. In the event that the flow in the residual reach has not exceeded 12 m^3/s for a consecutive 30 day period commencing on 1 November and concluding on 31 March, the diversion or take of water from the Waiwhakaiho River shall be reduced for 6 hours during the next fresh event that exceeds three times the median flow in order to allow a flushing flow of at least 12 m^3/s to pass down the Waiwhakaiho River. 6. Notices and other warnings will be erected and maintained as required for adequate protection of public safety to warn the public using the upstream section of the Waiwhakaiho River of the proximity of the diversion weir and intake structure. 7. The maintenance, as far as reasonably practicable, of the river channel below the diversion weir / intake structure and the Meeting of the Waters for the purposes of enhancing fish passage and habitat.
The use and maintenance of a diversion weir in the Waiwhakaiho River.	1. Regular maintenance will be undertaken on the fish pass to remove any boulders or debris that may be blocking the passage of fish.
The discharge of water from the Waiwhakaiho River via a tunnel to Lake Mangamahoe.	N/A
The damming of the Mangamahoe Stream via a dam structure to form Lake Mangamahoe and the regulating of levels in the lake.	1. A minimum lake level of 149.05 m RL (750 mm below the crest of the Mangamahoe spillway) will be maintained.
The use and maintenance of a dam structure in Lake Mangamahoe.	1. Maintain and operate the dam in accordance with NZSOLD Guidelines. 2. Operate a trap and transfer programme to assist with the maintenance of populations of longfin and shortfin

Activity	Proposed Controls
	eels in the Waiwhakaiho River catchment and Lake Mangamahoe catchment.
The diversion, take and use of water from Lake Mangamahoe via a tunnel and penstocks for the purposes of electricity generation at the Mangorei Power Station.	1. The diversion and take of up to 864,000 m^3 of water per day.
The use and maintenance of an intake structure in Lake Mangamahoe.	N/A
The discharge of water from Lake Mangamahoe via a spillway to the Mangamahoe Stream, including the emergency discharge of water.	1. Notices and other warnings will be erected and maintained as required for adequate protection of public safety to warn the public using the Mangamahoe Stream and Waiwhakaiho River of fluctuations in river flow and of the potential extent of those fluctuations.
The discharge of water to the Waiwhakaiho River via a tailrace from the Mangorei Power Station.	1. A minimum continuous flow of at least 950 L/s downstream of the Power Station will be maintained during the daytime electricity generation hours of 8am – 6pm. 2. In the event that there is a requirement to increase the flow in the Waiwhakaiho River in order to comply with the water temperature conditions, the continuous generation flow release from the Mangorei Power Station may be reduced by 100 l/s.

Where relevant, these controls have been integrated into the consent conditions proffered by Trustpower.

4. RESOURCE CONSENT REQUIREMENTS

4.1 OVERVIEW

Trustpower is seeking all necessary resource consents from TRC to authorise all activities associated with the continued operation, use and maintenance of the Mangorei HEPS.

Table 4.1 identifies the resource consents required for the continued operation, use and maintenance of the Mangorei HEPS in accordance with the RFWP and the Freshwater NES. Table 5 also identifies those activities which will be undertaken in accordance with a permitted activity rule in the RFWP.

Table 6: Resource Consent Requirements for the Mangorei HEPS

Activity	Commentary
The damming of water in the Waiwhakaiho River via a diversion weir and intake structure.	As the upstream catchment is greater than 25 ha,[11] the damming of water will be a **discretionary activity** under Rule 20 of the RFWP.
The diversion, take and use of water for hydro-electricity generation purposes from the Waiwhakaiho River.	As the rate of water abstraction is greater than the 1.5 l/s permitted standard,[12] the take and use of water will be a **discretionary activity** under Rule 16 of the RFWP. As the upstream catchment is greater than 25 ha,[13] the diversion of water will be a **discretionary activity** under Rule 20 of the RFWP.
The use and maintenance of an existing diversion weir, intake structure and fish passage in the Waiwhakaiho River.	The use of the existing diversion weir, intake structure and fish pass in the bed of the Waiwhakaiho River will be a **permitted activity** under Rule 52 of the RFWP. The maintenance of the existing diversion weir, intake structure and fish pass in the bed of the Waiwhakaiho River will be a **permitted activity** under Rule 53 of the RFWP. The removal of gravel, rocks, boulders and debris from the fish passage and diversion in the

[11] RFWP Rule 18.

[12] RFWP Rule 15.

[13] RFWP Rule 18.

Activity	Commentary
	Waiwhakaiho River will be a **discretionary activity** under Rule 72 of the RFWP. The diversion weir is an existing structure and is, therefore, not subject to the Freshwater NES in accordance with Regulation 60.
The discharge of water over the diversion weir in the Waiwhakaiho River.	The discharge of water into the Waiwhakaiho River will be a **permitted activity** under Rule 21 of the RFWP.
The use and maintenance of an existing discharge / outlet structure in Lake Mangamahoe.	The use of the existing discharge structure in the bed of Lake Mangamahoe will be a **permitted activity** under Rule 52 of the RFWP. The maintenance of the existing discharge structure in the bed of Lake Mangamahoe will be a **permitted activity** under Rule 53 of the RFWP.
The discharge of water from the Waiwhakaiho River to Lake Mangamahoe via a diversion tunnel and discharge / outlet structure.	The discharge of water to Lake Mangamahoe will be a **permitted activity** under Rule 21 of the RFWP.
The damming of the Mangamahoe Stream via a dam structure to form Lake Mangamahoe.	As the Mangamahoe Dam is higher than the 3 m permitted standard, and the dam restricts the passage of fish,[14] the damming of the Mangamahoe Stream will be a **discretionary activity** under Rule 20 of the RFWP.
The use and maintenance of an existing dam structure in the Mangamahoe Stream.	As the Mangamahoe Dam restricts the passage of fish,[15] the continued use of the existing dam will be a **discretionary activity** under Rule 64 of the RFWP. The maintenance of the existing dam in the bed of the Mangamahoe Stream will be a **permitted activity** under Rule 53 of the RFWP.

[14] RFWP Rule 18.

[15] RFWP Rule 52.

Activity	Commentary
The diversion, take and use of water from Lake Mangamahoe via a tunnel and penstocks for hydro-electricity generation purposes at the Mangorei Power Station.	As the rate of water abstraction is greater than the 1.5 l/s permitted standard,[16] the take and use of water from Lake Mangamahoe will be a **discretionary activity** under Rule 16 of the RFWP.
The use and maintenance of an existing intake structure in Lake Mangamahoe.	The use of the existing intake structure in the bed of Lake Mangamahoe will be a **permitted activity** under Rule 52 of the RFWP. The maintenance of the existing intake structure in the bed of Lake Mangamahoe will be a **permitted activity** under Rule 53 of the RFWP.
The discharge of water from Lake Mangamahoe via a spillway to the Mangamahoe Stream, including the emergency discharge of water.	As the discharge of water to the Mangamahoe Stream has the potential to cause erosion, scour or disturbance to the bed of the stream, the discharge will be a **discretionary activity** under Rule 43 of the RFWP.
The discharge of water to the Waiwhakaiho River via a tailrace from the Mangorei Power Station.	The discharge of water to the Waiwhakaiho River via the tailrace will be a **permitted activity** under Rule 21 of the RFWP.

Based on the above, the overall status of the consents being sought from the TRC is a **discretionary activity** under the RFWP and Freshwater NES.

4.2 CONSENT DURATION

Given the need for investment certainty associated with the continued operation and maintenance of the Mangorei HEPS, Trustpower consider that a 35 year consent duration is appropriate for the resource consent applications being sought as part of this AEE. The reasoning for this as follows:

- It is apparent from the annual monitoring surveys conducted by the TRC that there has been a high level of environmental compliance by Trustpower;
- It is apparent from the technical assessments that the environmental effects of the Mangorei HEPS are well known and understood;

[16] RFWP Rule 15.

- The proposed operating regime for the Scheme will safeguard the health and wellbeing of the Waiwhakaiho River – such that the sustainable management purpose of the RMA will be achieved;
- The investment value of the Mangorei HEPS is approximately $10 Million, and offers a wide range of benefits from at a regional and local level; and
- Whilst it is recognised that the national policy framework regarding freshwater has been subject to recent change (and has changed multiple times in the last ten years), the review provisions under the RMA provide adequate safeguards to re-evaluate the conditions of consents (if necessary) in the future.

5. ASSESSMENT OF ENVIRONMENTAL EFFECTS

5.1 INTRODUCTION

This section addresses the actual and potential effects associated with the continued operation and maintenance of the Mangorei HEPS.

The assessments consider the integrated management of the damming, diversion, take, use and discharge of water in the Waiwhakaiho River via the Mangorei HEPS, including the shared use / management of Lake Mangamahoe between Trustpower and the NPDC. That is, the assessments of the hydrological and aquatic ecology effects of the Scheme consider the potential effects associated with the diversion / take of water from the Waiwhakaiho River, and the subsequent use of water for consumptive and non-consumptive purposes by Trustpower and the NPDC.

A number of technical assessments have been prepared to inform this AEE. These technical assessments are referenced, as appropriate, in sections 5.2 to 5.13 below. In summary, sections 5.2 to 5.13 address the following matters:

Section 5.2 Positive Effects;

Section 5.3 Hydrology Effects;

Section 5.4 Recreation Effects;

Section 5.5 Natural Character Effects;

Section 5.6 Landscape Effects;

Section 5.7 Visual Amenity Effects;

Section 5.8 Terrestrial Ecology Effects

Section 5.9 Fish Passage and Fish Screening Effects;

Section 5.10 Aquatic Ecology Effects;

Section 5.11 Dam Safety Effects;

Section 5.12 Sedimentation Effects;

Section 5.13 Cultural Values; and

Section 5.14 Conclusion.

Within these sections, a number of measures to avoid, remedy or mitigate the actual and potential effects of the Mangorei HEPS are identified. These measures form the basis of the proposed resource consent conditions for the continued operation of the Mangorei HEPS.

5.2 POSITIVE EFFECTS

The benefits provided by the Mangorei HEPS contribute to local, regional and national communities.

The Mangorei HEPS is an established and reliable generator of renewable electricity in the Taranaki Region The approximately 20.9 GWh of electricity generated by the Scheme per annum is embedded in the local supply network, and the continued operation of the Scheme would enable these benefits to be maintained.

The Scheme's utilisation of water diverted from the Waiwhakaiho River for the sustainable generation of electricity positively contributes to New Zealand's renewable energy productivity, and the continued operation of the Mangorei HEPS would ensure that Trustpower can maintain their support of the Government's national strategic target to generate 90% of electricity from renewable energy sources by 2025 (noting that the Labour Party has indicated a goal of achieving 100% renewable energy by 2030).

The operation and maintenance of the Mangorei HEPS also provides economic benefit through the provision of local employment, assisting security of supply, and by way of minimising costs associated with obtaining electricity from outside the region (and therefore providing electricity consumers in the Taranaki Region with fair and affordable electricity pricing).

The ability to realise these beneficial outcomes is reliant on the flexibility afforded through the operating conditions for the Mangorei HEPS. The embedded nature of the Scheme within the local supply network mean that renewable energy generation is available to be placed into the local demand centre. This has the benefit of reducing losses associated with transmission and therefore makes the delivery of renewable energy from the Mangorei HEPS more efficient.

Lake Mangamahoe, which was created for water storage purposes and then hydro-electric generation purposes, offers additional benefit by way of providing water for the NPDC, and offering a valued recreational location / facility for the Taranaki Region (as discussed in greater detail in section 5.3 of this AEE).

For the reasons detailed above, it is considered that consent for the continued operation and maintenance of the Mangorei HEPS will ensure that the positive effects provided by the Scheme can be maintained in a manner that will be beneficial for the wellbeing of the Taranaki Region.

5.3 HYDROLOGY EFFECTS

As detailed in the Hydrology Assessment by Tonkin & Taylor, the hydrological operation of the Mangorei HEPS will remain predominantly unchanged - with the exception of the proposed flushing flow regime and temporary increase in flows in order to respond to temperate increases in the residual reach of the Waiwhakaiho River. As such, the hydrological effects of the Scheme, including its inter-relationship with the water supply take from Lake Mangamahoe by the NPDC, will remain largely unchanged.

Tonkin & Taylor also note that natural variability in the climate will impact the behaviour of the Mangorei HEPS and its effects on the flow regime in the Waiwhakaiho River. In this regard, the future climate in the Taranaki Region by 2040 is predicted to:

- Be warmer by approximately 0.9˚C;
- Have a higher rainfall of approximately 5%;
- Have an increase in droughts;
- Have double the average number of both 'hot days' and 'dry days'; and
- Have a decreased average number of 'cold nights'.

An increase in temperature has the potential to reduce catchment runoff and river flows (particularly over the summer and autumn seasons), and an increase in 'hot days' and 'dry days' is likely to further reduce and prolong summer low flows. However, Tonkin & Taylor note that this flow reduction is likely to be offset by an increase in mean flows in winter and peak flow discharges as a result of the projected increase in mean rainfall. As a result of these changes, it is likely that there will be alterations to the volume of inflows into Lake Mangamahoe.

While many of the historical impacts of the Mangorei HEPS are considered to be part of the existing environment, Tonkin & Taylor acknowledges that the following operational matters of the Scheme have the potential to generate consequential effects on a range of environmental and socio-economic values:

- The modified flow regime in the residual river reach;
- Increasing sedimentation in the lake (and its effect on the storage capacity of the lake);
- Diurnal lake level fluctuations; and
- Modified flow regime downstream (below the tailrace), including daily flow fluctuations.

Tonkin & Taylor conclude that these hydrological changes, and those associated with climate change in the region, are not expected to be large enough to significantly affect the current operating regime of the Mangorei HEPS.

5.4 RECREATION EFFECTS

The Recreation Assessment by Rob Greenaway & Associates involved an extensive literature review of recreational values and uses of areas located within the vicinity of the Mangorei HEPS, as well as interviewing and correspondence with key recreational users within the vicinity in order to obtain an understanding of users' perceptions of the quality and nature of the recreational experience within the vicinity of the Scheme.

The recreation effects of the continued operation of the Mangorei HEPS are broadly positive due to the Scheme's provision of two regionally significant recreation resources - the park and fishing setting of Lake Mangamahoe; and the whitewater opportunities in the tailrace of the Scheme.

While providing recreational opportunities for the Taranaki Region, the interviews and correspondence with recreation users identified the following potential issues associated with the Mangorei HEPS:

- Effects on kayakers, anglers, and whitebaiters associated with the diversion of water from the Waiwhakaiho River and the creation of the residual flow reach;
- Effects on kayakers and anglers associated with the location of the diversion weir, intake structure and fish pass in the bed of the Waiwhakaiho River;
- Effects on trout from varying generation discharges; and
- Effects on whitewater activities below the tailrace from flow variability.

Taking these potential issues into consideration, Rob Greenway & Associates found no indications that the operation of the Scheme has, or will have, any effect on kayaking and rafting within the Waiwhakaiho River - which occurs predominantly following recent rainfall when flows are above 20 m^3/s. When flows are above this level the diversion weir and intake structure are easily navigable. Any changes in flow availability represent minor changes in whitewater availability.

Low levels of adverse effects on angling (at a regional level) will continue as they have previously done in the residual reach of the river in late summer.

Rob Greenaway & Associates note that in the event that the proposed additional flow and flushing flows are implemented, the availability of kayaking flows in the tailrace of the Mangorei HEPS could be reduced due to the reduced volume of water being diverted and discharged into the tailrace of the Mangorei Power Station. However, the proposed additional flows are considered appropriate in order to sustain the health of the Waiwhakaiho River.

Rob Greenway & Associates note that as there are no proposed changes to the operational regime of the Mangorei HEPS, the continued operation of the Scheme will have no adverse effects on Lake Mangamahoe. Any effects of the operation of the Mangorei Power Station below the tailrace (when considering flow variability) will continue to be minor.

Overall, it is considered that the Mangorei HEPS contributes positively to the recreation opportunities in the Taranaki Region.

5.5 NATURAL CHARACTER EFFECTS

As detailed in the Natural Character, Landscape and Visual Assessment by Boffa Miskell, the primary impact of the Mangorei HEPS on natural character is the reduced flow in the Waiwhakaiho River. The reduced flow is largely limited to the 6 km residual reach running from the diversion weir / intake structure to the tailrace of the Mangorei Power Station.

Natural character values in the vicinity of the Mangorei HEPS have previously been reduced as a result of changes to the flow regime, morphology, vegetation and habitat of the Waiwhakaiho River and Lake Mangamahoe. With the proposed continued operation of the Mangorei HEPS, natural character attributes will remain broadly as they have in the past - with the exception of potential natural variations resulting from changing climate conditions.

In summary, the continued operation of the Mangorei HEPS will:

- Have no effect on the natural character values of the reach of the Waiwhakaiho River running from SH3 to the diversion weir and intake structure;
- Continue to have moderate adverse effects on the natural character values of that part of the Waiwhakaiho River containing the diversion weir and intake structure;
- Continue to generate moderate to low adverse effects on the natural character values of the residual reach of the Waiwhakaiho River;
- Continue to generate low adverse effects on the natural character values of the reach of the Waiwhakaiho River that runs from the Meeting of the Waters to the Tasman Sea;
- Result in low beneficial ongoing natural character effects on Lake Mangamahoe; and
- Continue to generate moderate adverse effects on that part of the Mangamahoe Stream located below the Mangamahoe Dam.

5.6 LANDSCAPE EFFECTS

As detailed in the Natural Character, Landscape and Visual Assessment by Boffa Miskell, the landscape effects currently associated with the Mangorei HEPS will not change as Trustpower is not proposing substantial changes to the Scheme's operating regime.

In summary, with regard to the existing landscape effects of the Scheme, it is noted by Boffa Miskell that:

- The instream structures located in close proximity to the diversion weir have weathered to a natural grey stone colour similar to surrounding rocks and boulders, and as such are not dominant and do not impact on the character of the wider landscape. Any associated adverse landscape character effects are considered to be low;
- Lake Mangamahoe is well integrated into its landscape setting and is now recognised as having high landscape, recreational and amenity values. The outlet structure, dam and spillway structures within the lake have become well integrated into the character of the lake surrounds, and the daily fluctuations of lake levels have been accepted as part of the status quo. Due to the scale and age of the structural elements of the Scheme, it is considered that they do not create an adverse effect on the landscape resource or character of the lake water body, margin or surrounding area. Therefore, it is considered that the physical and landscape character of Lake Mangamahoe benefits from the Mangorei HEPS to a moderate level; and
- The Mangorei Power Station, penstocks and tailrace of the Mangorei HEPS have become an established part of the landscape character of the river terrace and northern extent of the foothills within the river catchment. As the surrounding landscape is modified, the structures of the Scheme do not alter the rural character of the area to any more than a limited extent. As such, the Mangorei Power Station results in no more than low adverse effects on physical elements and landscape character.

Overall, it is considered that the landscape elements and ongoing effects of the Mangorei HEPS are neutral, with any potential adverse effects compensated for by the landscape quality and character offered by Lake Mangamahoe and its wide public use and enjoyment.

5.7 VISUAL AMENITY EFFECTS

As detailed in the Natural Character, Landscape and Visual Assessment by Boffa Miskell, an environment with a range of amenity values has been established since the establishment of the Mangorei HEPS - particularly around Lake Mangamahoe and the Meeting of the Waters.

The natural and man-made landscapes have enhanced the visual amenity of the surrounds and the accessibility and availability of the area for leisure activities. With the proposed continued operation of the Mangorei HEPS, there will be no further changes to the landscape qualities and character of the river and lake. Accordingly, the ongoing operation of the Scheme will continue to produce moderate to high beneficial effects on visual amenity values.

5.8 TERRESTRIAL ECOLOGY EFFECTS

The potential effects of the proposed continued operation and maintenance of the Mangorei HEPS on the terrestrial ecology located within the vicinity of the Scheme have been assessed in the Terrestrial Ecology Assessment by Ryder Environmental Limited, and are discussed in the sub-sections below.

5.8.1 Mangorei HEPS Infrastructure

When the Mangorei HEPS was constructed, areas of terrestrial vegetation (and habitat for terrestrial fauna) were removed in order to enable the construction of the various structures and infrastructure of the Scheme. Ryder Environmental Limited consider that as any effects associated with the ongoing presence of these structures are small and localised, they have negligible effect on terrestrial ecological values. It is also noted that based on the areas of vegetation and habitat adjacent to the structures, if the structures did not exist, ecological values would be low.

Taking the above into consideration, and acknowledging the establishment of Lake Mangamahoe for water storage purposes and the positive terrestrial ecological values associated with the lake, the Mangorei HEPS has generated a net positive effect on terrestrial ecological values in the area.

5.8.2 Waiwhakaiho River

Reductions in flow downstream of the diversion weir and intake structure, and daily flow fluctuations below the tailrace of the Mangorei HEPS are likely to have generated changes in the extent of vegetation located adjacent to the Waiwhakaiho River. However, as detailed in the Terrestrial Ecology Assessment by Ryder Environmental Limited, the extent of these changes is limited and it is anticipated that riparian vegetation will have established along those parts of the river where the flow has reduced.

As such, any potential effects of the flow regime in the Waiwhakaiho River on riparian vegetation are of negligible ecological consequence.

While located in close proximity to the water, the SNAs, KNEs and significant trees located within the vicinity of the Mangorei HEPS (identified in section 2.7 of this AEE) are essentially located within terrestrial ecosystems and are not in areas affected by the flow

of the Waiwhakaiho River. As such, these areas are entirely or almost entirely unaffected by river flow changes.

5.8.3 Mangamahoe Stream

Any potential effects of the Mangamahoe Dam on the riparian vegetation and habitat of the Mangamahoe Stream are overwhelmed by the effects of surrounding land uses (forestry and agriculture, and native regeneration and exotic weed invasion). In addition, the NPDC dam creates a narrow reservoir, about 300 metres long, which replaces some of the original stream and associated riparian habitat.

In light of the above, the alteration in flow of the Mangamahoe Stream as a result of the operation of the Mangorei HEPS will have negligible effects on terrestrial ecology.

5.8.4 Lake Mangamahoe

The formation of Lake Mangamahoe resulted in the inundation and loss of 0.25 km^2 of farmland, and the establishment of the same area of aquatic habitat, in the 1930's. The current vegetation and habitat of the lake and its surroundings provide valuable habitat for both introduced and indigenous plants and animals. As such, it is considered that the creation of the lake and the associated management of the land surrounding it has resulted in a net positive effect on terrestrial ecological values.

5.9 FISH PASSAGE AND FISH SCREENING EFFECTS

As detailed in the Fish Passage and Fish Screening Assessment by Ryder Environmental Limited, there will not be any substantial changes to the Mangorei HEPS as part of these resource consent applications. As such, the effects of the Scheme on fish passage and fish screening remains predominantly unchanged.

A summary of the fish passage and fish screening effects by Ryder Environmental Limited is provided in the sub-sections.

5.9.1 Waiwhakaiho River

As detailed in the 2018 – 2019 Annual Monitoring Programme Report for the Mangorei HEPS, the fish pass that is located within the Waiwhakaiho River *"is considered adequate to provide for the passage of all fish species expected to migrate up to and beyond the weir"*.

The assessment by Ryder Environmental Limited also shows fish species with migratory life cycles (e.g. banded and shortjaw kokopu, brown trout, koaro, lamprey, redfin bullies, torrentfish and both longfin and shortfin eels) have been recorded upstream of the intake and fish pass - confirming that fish passage through the residual reach and the fish pass through the diversion weir is effective.

For downstream migration, while there are no fish screening / exclusion measures in place along the Waiwhakaiho River, the trash screen located at the diversion weir provides some deterrent to fish entering Lake Mangamahoe via the diversion tunnel. However, the location of the intake structure is such that retrofitting infrastructure that would screen the intake effectively and safely for fish is challenging and impractical from both economic and engineering perspectives, as acknowledged by the Select Committee reviewing the Conservation Act Amendment Bill when rejecting the notion of requiring retrofitting of existing hydro-electricity schemes under the Freshwater Fisheries Regulations 1983.

5.9.2 Lake Mangamahoe

Fish enter Lake Mangamahoe via the Waiwhakaiho River diversion tunnel, the upper Mangamahoe Stream and the Kent Road Stream. While some fish species may be able to thrive in the lake for variable lengths of time (e.g. eel and trout), there is a possibility that other fish species with downstream migratory requirements (e.g. adult eel, giant and shortjaw kokopu, larvae of bully and koaro, and juvenile lamprey) may find their way down to the intake to the penstocks at the northern end of the lake. While the trash screen and the low water velocities in front of the intake structure have the effect of deterring impingement of adult eel and other adult / larger fish species, it may not prevent larvae and small fish from entering the penstocks.

For any fish that make it past the trash screen at the intake to the penstocks, the Fish Passage and Fish Screening Assessment predicts that passage through the Mangorei Power Station turbines will result in mortality for some fish, with fish over 20 cm in length having a predicted mortality of at least 50% and fish of approximately 5 cm in length having a predicted mortality of approximately 23%. Larval fish and very small fish have a low predicted mortality rate due to turbines, however mortality of larvae caused by pressure changes may be high.

5.9.3 Mitigation Measures

The Fish Passage and Fish Screening Assessment by Ryder Environmental Limited recommends that in order to strengthen the fish passage provisions of the Mangorei HEPS, and minimise the possibility of fish mortality, the existing upstream and downstream trap and transfer programme that operates in the tailrace of the Mangorei Power Station and in Lake Mangamahoe should be improved. Further details of the proposed trap and transfer programme investigations are provided within the draft consent conditions attached as **Appendix K** to this AEE. This will include Trustpower undertaking investigations, with input from iwi, on possible improvements around the period of time trapping is undertaken, the trapping technique that is utilised, and transfer locations.

In addition, the expansion of the trap and transfer programme to the lower Mangamahoe Stream, below the lower dam owned by NPDC, will be investigated with input from iwi

(particularly to see if elver are seeking to migrate up the stream). This is proposed to occur in conjunction with NPDC.

With regard to fish screening and fish passage, Ryder Environmental Limited have undertaken an assessment of the possibility of integrating fish screening and / or additional fish passage measures into the Scheme. The assessment does not recommend fish screening be retrofitted as:

- Due to the location of the Waiwhakaiho River intake structure, the effective and safe retrofitting of a fish screen would be challenging and impractical from both economic and engineering perspectives;
- To exclude fish from entering the Waiwhakaiho River intake structure, a much larger intake opening (potentially up to five times the area of the current opening) would need to be screened to avoid fish impingement given the location of the intake structure;
- The spacings on the screen would need to be no closer than 20 mm (currently 180 mm). This would exclude adult eel and trout, and probably giant and shortjaw kokopu, however small species and life stages may not be able to avoid the screen;
- The construction and maintenance of such a screen would pose significant challenges to the river, and there might be a high risk of damage due to flooding and debris and boulder movement; and
- The current 20 mm spacings of the Lake Mangamahoe penstocks intake trash screen present a low risk of entrainment to adult longfin eels and downstream migrating adult giant and shortjaw kokopu. Small fish that may pass through the trash screen have a higher chance of survival through the station turbines.

The modification of existing structures to provide unimpeded fish passage is impractical because the existing spillway from Lake Mangamahoe into the Mangamahoe Stream is the only location where alternative fish passage could be provided. However, due to the gradient and length of the spillway, the absence of a pool at the tail of the spillway, the absence of a residual flow sufficient in volume to convey fish safely, and the restriction to passage over the lower dam owned by NPDC, safe passage via the spillway would be extremely challenging and impractical to achieve.

5.10 AQUATIC ECOLOGY EFFECTS

The Aquatic Ecology Assessment by Ryder Environmental Limited, which examined the effects of the Mangorei HEPS on the aquatic ecology of the Waiwhakaiho River, Lake Mangamahoe and the Mangamahoe Stream is summarised in the sub-sections below.

5.10.1 Flow Reductions in the Waiwhakaiho River

The effect of the operation of the Mangorei HEPS on water temperature, nuisance algae growths, macroinvertebrate community health and fish habitat within the Waiwhakaiho River is summarised in the following sub-sections.

5.10.1.1 Effects on Water Temperature

Ryder Environmental Limited identify that water temperatures in the residual reach of the Waiwhakaiho River are naturally high during summer, and can exceed the recommended thermal criteria for brown trout. The operating regime of the Mangorei HEPS can contribute to these higher temperatures – although it is also noted that the magnitude of the increase is within the guideline limit for a 3 °C temperature change downstream (temperature guideline for the discharge of contaminants in the RFWP.

Although very high water temperatures can be detrimental, warm water temperature can also increase productivity in aquatic communities. Fish are also able to respond to water temperatures above their thermal preferences by temporarily moving to cooler locations (e.g. where a tributary or groundwater inflow enters).

However, in order to ensure that water temperatures in the residual reach of the Waiwhakaiho River do not remain at very high temperatures for an extended period, Ryder Environmental Limited recommend an additional 100 l/s of water be provided down the residual reach in the event:

- That water temperature in the residual reach exceeds 25˚C (based on a one hour rolling average) and the water temperature upstream of the diversion weir is 25˚C or lower (also based on a rolling one hour average); or
- The water temperature upstream of the diversion weir exceeds 25˚C (based on a one hour rolling average) and there is a greater than 3˚C water temperature increase within the residual reach of the Waiwhakaiho River within the residual reach of the river.

The additional 100 l/s will be in addition to the flow being provided immediately downstream of the diversion weir at the time either of the above triggers were met. This additional flow shall be maintained for a period of 24 hours and then until such time as:

- The water temperature in the residual reach reduces below 25˚C (based on a rolling one hour average); or
- The water temperature upstream of the diversion weir exceeds 25˚C (based on a rolling one hour average) but there is less than a 3˚C temperature difference within the residual reach and relative to upstream of the diversion.

5.10.1.2 Effects on Nuisance Algae Growth

Proliferations of long filamentous nuisance algae occur at times at the two monitoring sites within the Waiwhakaiho River. Monitoring over the 2019 - 2020 summer period indicated that periphyton biomass was higher at the monitoring site downstream of the Mangorei HEPS (as compared to the monitoring site at the SH3 bridge).

The water temperatures in the Waiwhakaiho River will account for some of the periphyton biomass at the monitoring site downstream of the Mangorei HEPS, with multiple point and non-point discharges within the residual reach of the Waiwhakaiho River also contributing nutrients. The diversion and take of water for the Mangorei HEPS does not directly result in elevated nutrient concentrations in the river - the reduced water levels downstream mean that there is less water available to dilute the increasing nutrient inputs from surrounding land uses.

At flows from 300 l/s up to approximately 2,200 l/s the amount of available habitat for long filamentous algae is fairly consistent (approximately 7.5 m^2/m), however as flows increases the habitat begins to decline - as high flows scour periphyton off the riverbed. Depending on the river flow at the time of the diversion / take from the river, there is potential for a relatively large amount of downstream surface flushing to reduce nuisance growths of periphyton.

In order to mitigate nuisance growths of periphyton within the Waiwhakaiho River, Ryder Environmental Limited have recommend that a flushing flow regime be implemented during summer when periphyton biomass levels in the residual reach exceed the *New Zealand Periphyton Guideline: Detecting, Monitoring and Managing Enrichment of Streams (Biggs, 2000).*

As such, Trustpower proposes that the Mangorei HEPS is subject to a consent condition that integrates a flushing flow regime into the operation of the Scheme. Trustpower proposes that in the event that the flow in the reach of the Waiwhakaiho River between the diversion weir and the tailrace of the Mangorei Power Station has not exceeded 12 m^3/s for a consecutive 30 day period commencing on 1 November and concluding on 31 March, the diversion or take of water from the Waiwhakaiho River will be reduced for six hours during the next fresh event that exceeds three times the median flow in order to allow a flushing flow of at least 12 m^3/s to pass down the Waiwhakaiho River.

5.10.1.3 Effect on Macroinvertebrate Community Health

High summer water temperatures in the Waiwhakaiho River can impact macroinvertebrate community health. Importantly, this is apparent at sites both upstream and downstream of the diversion weir and intake structure for the Mangorei HEPS. Likewise, and in line with regional trends, the macroinvertebrate health in both the upstream and downstream sites on the Waiwhakaiho River has been lower during summer than in spring.

Macroinvertebrate community health has generally been higher within the upstream site on the Waiwhakaiho River. However, Ryder Environmental Limited note that at times in 2019 (February and November) and 2020 (February), both the upstream and downstream sites presented 'poor' health scores. The degraded macroinvertebrate health in 2019 and 2020 does not appear to be related to nuisance algae growth, as periphyton biomass was mostly below guideline levels within the upstream area.

However, the water temperatures and nuisance algae proliferations that can occur during summer (particularly the 2018 - 2019 and 2019 - 2020 summer periods) were found to have impacted on the macroinvertebrate communities within both the upstream and downstream monitoring sites. Mayflies and stoneflies have been identified as being the most sensitive to high temperatures.

As detailed in section 5.10.1.1 of this AEE, the magnitude of water temperature increase due to the diversion and take for the Mangorei HEPS is within the RFWP guideline limits for temperature change relating to the discharge of contaminants (i.e. 3°C change downstream). That said, Trustpower are proposing changes to the operation of the Scheme to assist with minimising water temperature increases in the Waiwhakaiho River – which will also assist in the maintaining the health of macroinvertebrate communities.

5.10.1.4 Effects on Fish Habitat

The long standing operation of the Mangorei HEPS has resulted in changes in the flow regime in the residual reach of the Waiwhakaiho River, resulting in changes to water depths, velocities and channel widths. However, as noted by Ryder Environmental Limited the amount of habitat available for a species depends on its habitat requirements. For some species the amount of habitat increases as flows increase (e.g. adult brown trout and torrentfish) and for other species it deceases (e.g. inanga feeding and redfin bully).

The operation of the Mangorei HEPS has reduced the amount of available habitat for most fish species and food resources in the residual reach relative to 'without-scheme' conditions (e.g. worst-case scenario), with a predicted decline in habitat for:

- Redfin bully and shortfin eels, ranging from 1 – 33%;
- Brown trout, ranging from 28 – 75%; and
- Torrentfish, ranging from 63 – 84%.

The species which experience a predicted increase in habitat as a result of the operation of the Mangorei HEPS include Crans bully, inanga feeding, lamprey and shortjaw kokopu (ranging from 9 – 84%).

It is noted, however, that the predicted habitat changes above are to be interpreted as worst-case scenarios, as they have been calculated based on a 'without-scheme' flow regime that also does not factor in the natural increase of flow along the residual reach, or

that for approximately 20% of the time flows within the residual reach are greater than those expected under natural low flow conditions. As such, the predicted declines in habitat presented above will be less.

Furthermore, and despite the modelled changes to habitat identified above, recent fish community surveys have confirmed that brown trout, inanga, redfin bullies, longfin eels and torrentfish are all present within the residual reach of the Waiwhakaiho River. Additionally, Fish and Game (2019) found that juvenile brown trout density in the residual reach was similar to upstream of the diversion weir and intake structure, and that density of redfin bullies was higher in the residual reach that at any other mainstream sites surveyed.

Banded and shortjaw kokopu, brown trout, koaro, lamprey, redfin bullies, torrentfish and both longfin and shortfin eels have all previously been recorded upstream of the residual reach, indicating that passage for these species through the residual reach is provided and fish passage is effective. As such, Ryder Environmental Limited consider that operation and maintenance of the fish pass should continue.

5.10.2 Lake Mangamahoe

The Aquatic Ecology Assessment does not identify any adverse effects on Lake Mangamahoe but acknowledges the lake's role as a popular lake fishery, and that the lake also supports a native fish community (including bullies and longfin / shortfin eels).

5.10.3 Lower Mangamahoe Stream

The water temperatures in the lower Mangamahoe Stream, downstream of Lake Mangamahoe, during the 2019 - 2020 summer period were found to be lower than those in the residual reach of the Waiwhakaiho River, and dissolved oxygen concentrations were above the NPSFM acceptable states.

Near the confluence of the Waiwhakaiho River with the lower dam owned by NPDC, did show that benthic macroinvertebrate communities were indicative of 'poor' health and in late November / early December 2019 dissolved oxygen concentrations did not meet the minimum acceptable states in the NPSFM. Ryder Environmental Limited note that at this time there was minimal flow in the lower Mangamahoe Stream downstream of the old NPDC dam, with the only water passing the dam coming from leakage at the base of the dam.

While the Mangamahoe Dam and lower dam owned by the NPDC present barriers to upstream and downstream fish passage within the Mangamahoe Stream, recent surveys have identified two migratory fish species (eels and redfin bullies) in the lower sections of the Mangamahoe Stream. This indicates that fish passage must be possible in the lower stream at times.

Ryder Environmental have confirmed that the water quality in the lower stream is sufficient to maintain a native fish community and, therefore, provision of a residual flow at the Mangamahoe Dam is not required. The continued presence of the lower dam owned by NPDC would also not improve habitat greatly in the downstream area.

5.10.4 Flow Fluctuations in the Waiwhakaiho River Downstream of the Mangorei HEPS Tailrace

Flows within the Waiwhakaiho River at the Meeting of the Waters can range from 0.48 m^3/s (0.95 m^3/s during daylight hours) to 10 m^3/s (typically 8.3 m^3/s) within a day depending on Scheme operation. The variation in generation outflow continues downstream and is reflected in river level variation of up to 450 mm (measured at Rimu Street).

The low flow range in the lower Waiwhakaiho River (Rimu Street) is in the range of 1.8 – 2.1 m^3/s, and is similar to the low flow range upstream of the Mangorei HEPS intake structure which ranges from 2.0 – 2.1 m^3/s. Median flows are higher downstream than upstream, and flood flows are similar at both sites.

Flow fluctuations in the lower river result in changes to water depth, velocities and channel widths. This results in changes to habitat available for aquatic communities, which is most prominent on the margins of the river channel. Aquatic communities in the varial zone are exposed to large changes in short periods of time, and as such, species within this environment need to be tolerant to changing conditions. Fish are able to move in and out of the varial zone as the environment changes, however the macroinvertebrate community that lives in this zone tends to be dominated by species indicative of lower health (e.g. snails and worms).

The macroinvertebrate community in the lower river (at Constance Street, approximately 9 km downstream of the Mangorei HEPS discharge) is similar to that of the residual reach. Ryder Environmental Limited consider that the health of the macroinvertebrate communities in the lower river is not purely a result of the Mangorei HEPS, but also due to other industrial discharges in the area.

The generation discharges from the Mangorei HEPS are also recognised as having beneficial effects on the lower Waiwhakaiho River, slightly cooling water temperatures, increasing dissolved oxygen levels, and effectively flushing nuisance periphyton growths.

5.11 DAM SAFETY EFFECTS

Trustpower's dams structures throughout New Zealand are managed in accordance with the New Zealand Society on Large Dams ("**NZSOLD**") Dam Safety Guidelines and Trustpower's Dam Safety Policy and Dam Safety Management System ("**DSMS**"). The Dam Safety Policy outlines Trustpower's approach to dam safety and the implementation of the DSMS.

Trustpower's DSMS largely aligns with DSMS set out in Module 5 of the NZSOLD Guidelines. As part of the DSMS, dam safety experts carry out routine monitoring and surveillance on Trustpower's dam structures - identifying any dam safety recommendations or inconsistencies with the NZSOLD Guidelines. All potential dam safety issues are identified, recorded, managed and tracked on a Dam Safety Deficiency Management Program.

Each of Trustpower's dam structures has a unique monitoring and surveillance network. Routine reviews of the network take place, with the Mangorei HEPS reviewed every five years. The most recent review of the Mangorei HEPS was completed by AECOM in 2017, and the next review is scheduled for 2022.

The AECOM Dam Safety Review assessed the Mangamahoe Dam and the Mangamahoe Saddle Dam against the NZSOLD Guidelines. The NZSOLD Dam Safety Risk Management Process stipulates that upon identification of any elements that no longer meet the NZSOLD Guidelines, dam owners are to undertake an assessment of potential risk treatment options that are available to assist with realigning a dam with the NZSOLD Guidelines, prior to implementing any improvements / changes.

The assessment identified the following elements that required further assessment under the NZSOLD Guidelines:

- The minimum freeboard requirements for the Mangamahoe Dam;
- The capacity of the Mangamahoe Dam spillway to pass the Inflow Design Flood and minimum freeboard requirements; and
- The minimum freeboard requirements for the Mangamahoe Saddle Dam.

Trustpower are currently undertaking an assessment of potential risk treatment options, so to determine the most suitable risk reduction measures for aligning the Mangamahoe Dam and the Mangamahoe Saddle Dam with the NZSOLD Guidelines. Once the most suitable risk reduction measures have been determined, Trustpower will apply for any associated building or resource consents that are required.

As demonstrated by the processes described above, the dam safety of the Mangorei HEPS is, and will continue to be suitably managed by Trustpower, in accordance with the NZSOLD Dam Safety Guidelines.

5.12 SEDIMENTATION EFFECTS

The Sediment Assessment by Tonkin & Taylor examines how the Waiwhakaiho River, upper Mangamahoe Stream and Kent Road Stream deliver sediment to Lake Mangamahoe. Like most lakes, Lake Mangamahoe is effectively a 'closed system' that does not have sufficient flow velocities to flush out sediment, and therefore acts as a sediment sink.

Suspended sediment faction in the Waiwhakaiho River, Mangamahoe Stream and Kent Road Stream originates almost entirely from the underlying geology and surface soils, with land-cover, river behaviour and flow dynamics all influencing the volume and concentration of fine-grain sediment held in suspension. Trustpower's operational and maintenance activities have no effect on suspended sediment in the Waiwhakaiho River, other than routine and infrequent clearing of the weir pool by the intake structure.

While noting that sources, and consequently sediment loads entering Lake Mangamahoe vary through time in response to factors such as land use changes and episodic events, Tonkin & Taylor acknowledge that the Waiwhakaiho River diversion tunnel may be the main contributor of sediment to the lake, accounting for anywhere between 37% and 80% of the load. The remaining contribution of sediment to Lake Mangamahoe is mostly attributed to the upper Mangamahoe Stream and the Kent Road Stream. However, Tonkin & Taylor note that the current prediction of sediment yield from these tributaries may be underestimated, and does not take into account episodic events, and as such it is possible that these tributaries are responsible for a much larger proportion of Lake Mangamahoe's sediment load.

Tonkin & Taylor note that the installation of the NPDC water supply pipe in Lake Mangamahoe in 1970 appears to have affected the sedimentation deposition process in the lake, increasing sediment deposition in the southern arm of Lake Mangamahoe, with well-established areas of sedimentation evident on the western shore and at the mouth of the diversion tunnel (approximately 4.5 – 5 m deep). Bathymetric surveys have identified a greater than 0.8 m increase in elevation in the southern arm of the lake between 2013 and 2017. While the installation of the pipe provides a partial barrier to the movement of sediment to the northern side of the lake, at times (such as flood scenarios), sediment held in suspension passes over the NPDC supply pipe and deposits in the larger lake area.

Overall, and based on the suspended sediment load for the tunnel outlet channel from Beca (2012), and the sediment loads for the Mangamahoe Stream and the Kent Road Stream from NIWA (2017), Tonkin & Taylor have determined the depth of sediment within Lake Mangamahoe to be approximately 3.9 m.

Overall, there is a gradual loss of potential water storage capacity in Lake Mangamahoe, noting that the effects of deposited sediment are concentrated to the southern arm of the lake and generally result in small annual volumetric change. However, as these gradual water storage capacity changes are minimal they have not impacted on the live lake storage or operation capabilities associated with the Mangorei HEPS over the last 70+ years, and Trustpower do not anticipate any associated storage or operation issues during the prospective term of these resource consents. As such, Tonkin & Taylor conclude that if necessary, in the future, low impact sediment removal could be considered as an appropriate sediment management tool in Lake Mangamahoe in order to restore the storage volume in the lake if deemed necessary by Trustpower.

5.13 CULTURAL VALUES

Trustpower understands that it is for the relevant iwi and hapu to describe any cultural or historical associations with the Waiwhakaiho River, and as noted in section 6 of this AEE, further information on these associations is intended to be provided as part of the cultural values assessment.

However, it is noted that the Waiwhakaiho River is a statutory acknowledgement area in favour of Te Atiawa.

5.14 CONCLUSION

This section of the AEE has been informed by a number of comprehensive technical assessments commissioned by Trustpower to assess the potential environmental effects associated with the continued operation and maintenance of the Mangorei HEPS.

Overall, and based on the technical assessments that have been prepared, it is considered that the continued operation and maintenance of the Mangorei HEPS will appropriately avoid, remedy or mitigate potential adverse effects on the environment. It is acknowledged that further evaluation of cultural effects may be required once the cultural values assessment is available.

A number of the measures that have been identified within this section for avoiding, remedying or mitigating adverse effects are also reflected in the proposed resource consent conditions proffered by Trustpower.

6. CONSULTATION

6.1 INTRODUCTION

Section 36A of the RMA confirms that an applicant has no duty to consult any person on their resource consent application. However, clause 6 (1)(f) of the Fourth Schedule to the RMA also states that an AEE should identify those persons affected by the proposed activity, detail the consultation undertaken with those persons, and outline any response to the views of those persons consulted.

In light of the above, this section provides an overview of the consultation that has been undertaken by Trustpower with key stakeholders in the preparation of the resource consent applications.

6.2 CONSULTATION WITH IWI

Trustpower commenced engagement with the iwi and hapu who have interests in the Waiwhakaiho River catchment in 2018. Individual meetings were initially held with individual iwi / hapu representatives to best determine a way forward for engagement during the resource consent process for the continued operation of the Mangorei HEPS.

This engagement ultimately resulted in the formulation of the Mangorei Forum Collaboration Agreement ("**Forum**"), which includes representation from the following iwi and hapu:

- Te Kotahitanga o Te Atiawa Trust;
- Manukorihi hapū;
- Nga Mahanga a Tairi;
- Ngati Rahiri Hapū o Te Atiawa (Taranaki) Society Inc;
- Ngāti Tawhirikura hapū;
- Ngāti Te Whiti;
- Ngāti Maru;
- Ngāti Mutunga;
- Otaraua hapū;
- Pukerangiora hapū; and
- Puketapu hapū.

The function and purpose of the Forum is to consider any technical and scientific information provided by Trustpower, be engaged to inform the preparation of an archaeological review and cultural values framework for the resource consent applications

for the Mangorei HEPS, and be engaged to inform the technical and scientific assessments commissioned by Trustpower from a cultural perspective.

Hui and site visits with the representatives of the Forum occurred during Winter 2019, with the frequency of engagements increasing over the last 12 months as the preparation of the resource consent applications advanced. In this regard, hui and other engagements were held in December 2019, February 2020, July 2020, September 2020 and November 2020.

Trustpower has provided draft versions of all technical assessment reports, along with summary presentations, to the Forum for review. Further, the authors of the technical assessments relating to aquatic ecology, fish passage / screening, sediment transport, and hydrology have participated in hui with the Forum.

Key matters relating to the operation of the Mangorei HEPS raised during the various meetings and discussions between Trustpower and members of the Forum have included, but not limited to:

- Changes to statutory planning framework in the NPSFM and its implications for the resource consent applications by Trustpower;
- The process by which the cultural values of the Waiwhakaiho River might be identified;
- The duration of the resource consents that are being sought by Trustpower;
- The hydrological and geomorphological effects of the operation of the Mangorei HEPS, and the potential for further changes due to climate change;
- Fish passage along the Waiwhakaiho River and Mangamahoe Stream;
- Screening of intake structures and the survivability of native fish going through the penstocks / turbines;
- The effectiveness of the existing upstream and downstream tuna trap and transfer programme and ways for improvement;
- The availability of habitat in the residual reach of the Waiwhakaiho River, and in the Mangamahoe Stream downstream of the Mangamahoe Dam. This included concerns regarding the mauri of the Mangamahoe Stream and the lack of residual flow in the stream;
- Concerns regarding commercial eeling in the Waiwhakaiho River catchment;
- The protection of mahinka kai sites; and
- Possibility for decreasing the take and / or increasing flows.

It is recognised that the list reflects Trustpower's understanding of the matters raised by iwi / hapu to date, and that further matters may be identified during the preparation of the

cultural values assessment. The Forum have advised that they intend to provide one cultural values assessment for the resource consent applications by Trustpower and NPDC – which will be provided in due course.

6.3 CONSULTATION WITH OTHER STAKEHOLDERS

Trustpower's engagement with other key stakeholders with an interest in the Waiwhakaiho River catchment and the resource consent applications for the Mangorei HEPS has include:

- Trustpower facilitated at site visit to the Mangorei HEPS in November 2018 for staff from TRC, NPDC (as the operator of the water supply infrastructure at Lake Mangamahoe), Fish and Game and the Department of Conservation in order to introduce the consenting process, provide familiarity regarding the operation of the Scheme for all stakeholders, and to develop an understanding of the key issues for stakeholders;
- Regular meetings have been held with NPDC in 2020 regarding the consenting process so as to ensure that there is consistency between the resource consent applications for the Mangorei HEPS and the water supply take from Lake Mangamahoe. This has included the authors of the technical assessments presenting to the NPDC;
- Draft copies of the technical assessments were provided to Fish and Game and the Department of Conservation in September 2020, with the authors of the key technical assessments also presenting to both parties;
- Fish and Game and the Department of Conservation have both provided feedback on aspects of the technical assessments – with the focus being on the management of high temperatures in the Waiwhakaiho River, the effects of the flow regime on nuisance algae growths in the residual reach of the river, the potential utilisation of the full operating range of Lake Mangamahoe (and the impact on the trout fishery in the lake), and the potential for fish entrainment in the intakes on the Waiwhakaiho River and Lake Mangamahoe; and
- Trustpower has given consideration to this feedback and sought to develop operating conditions around (i) the management of the take / diversion during high water temperatures in the residual reach of the Waiwhakaiho River, and (ii) the provision of flushing flows in summer months when sustained low flows have occurred.

7. STATUTORY CONSIDERATIONS

7.1 INTRODUCTION

The RMA is the principal statutory document governing the use of land, air and water. The purposes of the RMA, as set out in section 5, is to *"promote the sustainable management of natural and physical resources"*. This section of the AEE sets out the framework under the RMA that applies to the resource consents that are being sought from TRC – which are collectively classified as a discretionary activity.

7.2 SECTION 104 ASSESSMENT

7.2.1 Introduction

Section 104 of the RMA lists the matters that a consent authority must, subject to Part 2, have regard to in determining whether a resource consent application should be granted. It states:

> *(1) When considering an application for a resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to–*
>
> *(a) any actual and potential effects on the environment of allowing the activity; and*
>
> *(ab) any measure proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment that will or may result from allowing the activity; and*
>
> *(b) any relevant provisions of—*
>
> *(i) a national environmental standard:*
>
> *(ii) other regulations:*
>
> *(iii) a national policy statement:*
>
> *(iv) a New Zealand coastal policy statement:*
>
> *(v) a regional policy statement or proposed regional policy statement:*
>
> *(vi) a plan or proposed plan; and*
>
> *(c) any other matter the consent authority considers relevant and reasonably necessary to determine the application.*
>
> *(2) When forming an opinion for the purposes of subsection (1)(a), a consent authority may disregard an adverse effect of the activity on the environment if a national environmental standard or the plan permits an activity with that effect.*
>
> *(2A) When considering an application affected by section 124 or 165ZH(1)(c), the consent authority must have regard to the value of the investment of the existing consent holder.*

Section 104 of the RMA does not give any of the matters to which a consent authority is required to have regard primacy over any other matter. All of the relevant matters are to be given such weight as the consent authority sees fit in the circumstances and as

directed by the relevant statutory planning documents. All of the provisions are subject to Part 2 of the RMA, although it is understood that a consent authority is not required to have recourse to Part 2 of the RMA unless there is uncertainty or a lack of competent preparation of the relevant statutory planning documents. This may be because the statutory planning documents are outdated, there are fundamental planning flaws demonstrating the plan has not been prepared in a manner that reflects Part 2 of the RMA, or the statutory planning framework pulls in different directions.

The matters for consideration under sections 104(1)(a), (ab), (b), (c) and (e2A) of the RMA are assessed in the sub-sections below.

7.2.2 Actual and Potential Effects

With respect to section 104(1)(a) of the RMA, the actual and potential effects on the environment relating to the continued operation and maintenance of the Mangorei HEPS are set out in section 5 of this AEE and the relevant technical assessments.

Trustpower has given particular consideration to how the operation of the Mangorei HEPS can appropriately sustain the health and wellbeing of the Waiwhakaiho River. As noted in section 5 of this AEE, the company is proposing changes to the flow regime in the river to further ensure it is responsive to potential changes in environmental conditions, particularly during the summer months. Trustpower is also proposing improvements to the upstream and downstream trap and transfer programme it undertakes. The various measures proposed by Trustpower are documented in the proposed conditions of consent.

Furthermore, and consistent with the focus on all actual and potential effects in section 104(1)(a) of the RMA, it is considered that the Mangorei HEPS will have demonstrable positive effects in terms of sustaining the social and economic wellbeing of the local / regional communities. In particular, the Mangorei HEPS contributes to security of electricity supply and the Government's strategic targets for the generation of renewable electricity.

With respect to section 104(1)(ab) of the RMA and the requirement for a consent authority to consider any measure proposed by an applicant to ensure positive effects by offsetting or compensating for any adverse effects on the environment, it is noted that the conclusions reached with respect to the actual and potential environmental effects of the continued operation of the Mangorei HEPS mean that no additional compensatory or offsetting measures are warranted or considered necessary by Trustpower.

7.2.3 Relevant Statutory Planning Documents

For the purpose of section 104(1)(b) of the RMA, the relevant statutory planning documents are considered to be:

- Freshwater NES;
- National Policy Statement for Renewable Electricity Generation 2011 ("**NPSREG**");
- NPSFM;
- RPS; and
- RFWP.

Each of these policy statements and plans are considered further in the sub-sections below.

7.2.3.1 National Environmental Standards for Freshwater

The Freshwater NES came into effect on 3 September 2020.

The various regulations in the Freshwater NES apply to resource consent applications that involve farming activities, the modification of natural inland wetlands, reclamation of rivers and the passage of fish affected by structures. The Freshwater NES is intended to increase regulatory consistency and certainty across New Zealand, and ensure that any environmental effects of freshwater activities are appropriately managed.

Of relevance to the Mangorei HEPS is Subpart 3 of the Freshwater NES. Regulation 60 within this subpart states that the 'Passage of fish affected by structures' provisions of the Freshwater NES do not apply to existing structures that were in a river or a connected area to the river at the close of 2 September 2020. As such, the continued use and maintenance of the existing diversion weir in the Waiwhakaiho River is not subject to the Freshwater NES.

7.2.3.2 National Policy Statement for Renewable Electricity Generation

The NPSREG came into effect on 13 May 2011. It seeks to enable the sustainable management of renewable energy generation under the RMA.

The sole objective of the NPSREG is to provide for the development, operation, maintenance and upgrading of new and existing renewable electricity generation activities, so to increase the national level of electricity generated from renewable energy sources to a point that meets or exceeds the Government's national target for renewable electricity generation. The continued operation and maintenance of the Mangorei HEPS contributes to the achievement of this objective.

Policy A of the NPSREG focuses on recognising the benefits associated with renewable electricity generation activities. The continued operation and maintenance of the

Mangorei HEPS would realise benefits by way of maintaining the electricity generation capacity of the Scheme, and assisting with the maintenance of the security of local electricity supply in the Taranaki Region. Additionally, the Scheme's utilisation of renewable natural resources assists in supporting the avoidance of reliance on thermal generation.

Policy B of the NPSREG requires decision-makers to have particular regard to the practical implications of achieving the national target for electricity generated from renewable energy sources. The NPSREG notes that even minor reductions in renewable energy generation have the potential to have significant adverse effects on generation output. As noted in the Fish Passage and Screening Assessment by Ryder Environmental Limited, to exclude fish from entering the intake on the Waiwhakaiho River would require a reduction in approach velocities to avoid impingement against the screen and a much larger screen surface. However, such design options would result in head losses, unacceptably high approach velocities and a high risk of damage due to flooding and large boulder movement in the river- impacting on the ability of the Mangorei HEPS to provide renewable electricity on a consistent basis. Overall, the continued operation and maintenance of the Mangorei HEPS, subject to the flow regime documented in this AEE, is considered to appropriately safeguard the health and wellbeing of the Waiwhakaiho River and ensure particular regard is given to minimising reductions in renewable generation output.

Policies C1 and C2 of the NPSREG require decision makers to have particular regard to the practical constraints associated with the development, operation, maintenance and upgrading of new and existing renewable energy generation activities. The Mangorei HEPS has been operating on the Waiwhakaiho River for over 70+ years – relying on the consistent river flows and head through the middle reaches of the river to generate renewable electricity. As such, the utilisation of the renewable resource needs to occur in this location due to technical practicalities. However, and as noted above and in section 5 of this AEE, modifying the intake structures to preclude all fish would not be effective and impact on the ability of the Mangorei HEPS to provide renewable electricity.

With respect to Policy C2, it seeks that decision-makers have regard to any offsetting measures or environmental compensation when considering any residual environmental effects associated with renewable electricity generation activities that cannot be avoided, remedied or mitigated. The *"National Policy Statement for Renewable Electricity Generation – Implementation Guidance"* by the Ministry for the Environment notes that it is up to the resource consent applicant to volunteer the offsetting of compensatory measures.

Based on the conclusions reached with respect to the actual and potential environmental effects of the Mangorei HEPS, no additional compensatory or offsetting measures are proposed or considered necessary by Trustpower.

For the reasons detailed above, it is considered that the continued operation and maintenance of the Mangorei HEPS is consistent with the relevant objectives and policies of the NPSREG.

7.2.3.3 National Policy Statement for Freshwater Management

The NPSFM came into effect on 3 September 2020. It replaces the National Policy Statement for Freshwater Management 2014 (amended 2017) that preceded it, and every local authority is required to give effect to the NPSFM as soon as reasonably practicable.

The fundamental concept of the NPSFM encompasses Te Mana o te Wai, a concept that refers to the fundamental importance of water and recognises that protecting the health of freshwater will protect the health and wellbeing of the wider environment. The sole objective of the NPSFM follows this concept – and seeks to ensure that natural and physical resources are managed in a way that (i) firstly prioritises the health and wellbeing of water bodies and freshwater ecosystems, (ii) then the health needs of people, and (iii) then the ability of people and communities to provide for their social, economic, and cultural wellbeing.

While this prioritisation approach will ultimately flow through to the establishment of allocation regimes and water quality limits for rivers in the Taranaki Region, it is noted that Trustpower has given particular consideration to ensuring the flow regime proposed for the Waiwhakaiho River downstream of the diversion weir and intake structure is appropriate to sustain the health and wellbeing of the river. In particular, Trustpower are proposing new consent conditions managing the operation of the Mangorei HEPS to ensure that the operation of the Scheme changes in response to monitored changes in ecosystem health - especially during the summer months when water temperatures and algae blooms can cause undue adverse effects on the environment.

The policies of the NPSFM of potential relevance to the Mangorei HEPS relate to:

- The active involvement of tangata whenua in freshwater management;[17]
- The implementation of an integrated freshwater management approach;[18]
- Management of freshwater through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved;[19]
- The habitats of indigenous freshwater species are protected;[20]

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17 NPSFM Policy 2.

18 NPSFM Policy 3.

19 NPSFM Policy 5.

20 NPSFM Policy 9.

- The habitat of trout and salmon is protected, insofar as such an outcome is consistent with the protection of indigenous species;[21]
- Freshwater is allocated and used efficiently; and
- The passage of fish is maintained, or is improved, by instream structures (except where necessary to protect desired fish species).[22]

With respect to these matters, the following points are noted:

- Trustpower has sought to engage with representatives of the Forum throughout the preparation of resource consent applications for the Mangorei HEPS, and this engagement is expected to continue once the applications are lodged via the preparation of a cultural values assessment. As such, further analysis of iwi and hapu interests in the Waiwhakaiho River may be required once the cultural values assessment is available;
- Trustpower has sought to adopt an integrated approach to the assessment of the potential effects of the Mangorei HEPS. This has included an assessment of the integrated management of the damming, diversion, take, use and discharge of water in the Waiwhakaiho River via the Mangorei HEPS, and particularly the shared management of Lake Mangamahoe with the NPDC. Furthermore, the various technical assessments have focussed on how the operation of the Mangorei HEPS impacts on the full extent of the Waiwhakaiho River – not just the residual reach of the river;
- While it is for the TRC to establish a National Objectives Framework for waterbodies in the Taranaki Region, Trustpower have sought to ensure that the condition framework for the management of flows in the Waiwhakaiho River addresses the potential for adverse effects in the river that are potentially related to the operation of the Scheme;
- With respect to the protection of habitat of indigenous freshwater species, the flow in the residual reach of the Waiwhakaiho River does result in changes to water depths, velocities and channel widths. The amount of habitat available for a species depends on its habitat requirements – with the amount of habitat decreasing as flows are reduced downstream and for other species it increases. Despite this, recent fish community surveys have confirmed that inanga, redfin bullies, longfin eels and torrentfish are all present within the residual river reach and it is considered that passage through the residual reach and fish pass to the upper sections of the river upstream is maintained;
- Trustpower is not proposing to alter the habitat available for trout as part of this resource consent application. In this regard, the existing residual flow regimes that

[21] NPSFM Policy 10.

[22] NPSFM Policy 3.26 (1).

apply throughout the year will not be altered and additional conditions will be imposed in order to minimise the potential for high water temperatures / algal blooms in the residual reach does not preclude the movement of trout through the river. Additionally, the existing fish pass will continue to provide passage for trout movement within the Waiwhakaiho River; and

- The diversion, take and use of water for the Mangorei HEPS is considered an efficient use of water. Trustpower seeks to maximise the use of water for the generation of electricity, subject to the capacity of the infrastructure in place. Furthermore, the diversion of water from the Waiwhakaiho River to Lake Mangamahoe enables / facilitates NPDC's taking of municipal water supply.

For the reasons detailed above, it is considered that the continued operation and maintenance of the Mangorei HEPS can occur in a manner that is consistent with the relevant objective and policies of the NPSFM. However, it is recognised that further assessment with some of the objectives and policies of the NPSFM will be made once representatives of the Forum have provided further details on their associations with the Waiwhakaiho River, and the measures by which such associations may be able to be managed.

7.2.3.4 Regional Policy Statement for Taranaki

The RPS became operative on 1 January 2010. The RPS provides an overview of the resource management issues of significance to the Taranaki Region and the objectives, policies and methods to be adopted to address those issues and achieve integrated management of natural and physical resources.

The objectives and policies in the RPS cover a broad range of topics that are relevant to the Mangorei HEPS. The topics of relevance are discussed in further detail below and include the use and development of resources; fresh water; indigenous biodiversity; natural features and landscapes, and amenity values; natural hazards; and energy. However, it is noted that the RPS has not been updated to give effect to the NPSFM.

Use and Development of Resources

Objective UDR 1 of the RPS seeks to recognise the role of resource use and development in the Taranaki Region, and its contribution to enabling people and communities to provide for their social, economic and cultural wellbeing. Due to the benefits of the Mangorei HEPS, the continued operation and maintenance of the Scheme would contribute to the wellbeing of the region.[23]

[23] RPS Policy UDR 1.

Fresh Water

The fresh water objectives of the RPS seek to sustainably manage the taking, use, damming or diversion of fresh water to enable people to meet their needs for water while safeguarding the life-supporting capacity of water and ecosystems, and protecting the natural character of water bodies.[24] These objectives need to be considered in light of the revised overarching direction provided by the NPSFM.

As noted in section 5 of the AEE, it is considered that the continued operation of the Mangorei HEPS can occur in a manner that will safeguard the existing values of the Waiwhakaiho River. This will include the provision of conditions that provide for additional flows in the residual reach to manage high water temperatures and flushing flows to address any nuisance periphyton growth during summer. Furthermore, an enhanced trap and transfer regime will be implemented by Trustpower to strengthen the existing fish passage provided throughout the Mangorei HEPS (by the existing Waiwhakaiho River fish pass and the current upstream and downstream trap and transfer programme that is undertaken in the northern reaches of Lake Mangamahoe and below the power station) to ensure the passage of indigenous species within the catchment.

The fresh water policies of the RPS encourage the utilisation of surface water for hydro-electric power generation when it will positively contribute to the wellbeing of people and communities.[25] The Mangorei HEPS generates power for the Taranaki Region, and as such would continue to have a positive influence on the wellbeing of people and communities.

The provisions of the RPS also encourages the maintenance or enhancement of natural water levels and flows in order to maintain natural character, instream values and life supporting capacity of water bodies.[26] The proposed continued operation and maintenance of the Mangorei HEPS will maintain water levels and flows within the residual reach of the Waiwhakaiho River, however the implementation of the proposed new conditions (relating to temporary reductions in water diversion when water temperatures are high, and the release of flushing flows when substantial flows have not occurred in the last 30 days) will assist in maintaining and instream and natural character values of the river.

The fresh water objectives of the RPS also strive to maintain and enhance the quality of water in rivers, streams and lakes, particularly when the waterbodies are recognised as having high natural character, ecological and amenity values.[27] The potential effects of the

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[24] RPS Objectives WAL 1 and WAL 2.

[25] RPS Policy WAL 1.

[26] RPS Policy WAL 2 and WAL 3.

[27] RPS Objective WQU 1.

continued operation of the Mangorei HEPS are discussed in section 5 of this AEE, however it is noted that nuisance growths of periphyton occur in the residual reach of the Waiwhakaiho River at times and this is due to a combination of factors (including naturally high water temperatures and nutrient inputs from discharges within the residual reach). A flushing flow regime is now proposed by Trustpower to minimise potential water quality effects.

When considering the continued utilisation of structures located within the beds of the Waiwhakaiho River and Lake Mangamahoe, the RPS seeks to ensure that use is appropriate, and any associated disturbance is minimised.[28] As the structures of the Mangorei HEPS are already established, their continued utilisation and maintenance will not generate substantial effects on the environment.[29]

The RPS encourages the maintenance and enhancement of appropriate access along rivers and lakes in the Taranaki Region.[30] The areas surrounding the Mangorei HEPS are already highly accessible to the public, and the continued operation and maintenance of the Scheme will not alter this.

Indigenous Biodiversity

Objective BIO 1 of the RPS seeks to maintain and enhance indigenous biodiversity in the Taranaki Region and Policy BIO 2 refers to adverse effects on indigenous biodiversity from the use and development of natural and physical resources being avoided, remedied or mitigated as far as is practicable.

As previously discussed, the Aquatic Ecology Assessment has considered the potential effects of the continued operation of the Mangorei HEPS on indigenous biodiversity (particularly native fish). Further, the Fish Passage and Fish Screening Assessment has considered the implications of the intake structures and Mangamahoe Dam for fish passage. Whilst adverse effects cannot be avoided, Trustpower is proposing conditions relating to minimum residual flows, temporary reductions in diversion, fish passage, water temperature, flushing flows, and an upstream and downstream trap and transfer programme that support the maintaining and enhancing of indigenous biodiversity within the vicinity of the Mangorei HEPS.[31]

Amenity Value

Objective AMY 1 of the RPS seeks to recognise the positive contributions of appropriate use in terms of providing for the maintenance and enhancement of amenity values in the

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[28] RPS Objective RLB 1.

[29] RPS Policy RLB 1.

[30] RPS Objective WPA 1 and Policy WPA 1.

[31] RPS Policy BIO 7.

Taranaki Region. Within the vicinity of the Mangorei HEPS, the Waiwhakaiho River is recognised as being valued for aesthetic and scenic values, contact recreation, trout fishing, whitebaiting and native fishery habitat values. As noted in the Natural Character, Landscape and Visual Assessment, the Mangorei HEPS has positively contributed to natural and man-made landscapes that have enhanced the visual amenity of the surrounding areas.[32]

Natural Hazards

Objective HAZ 1 of the RPS is to avoid or mitigate natural hazards within the Taranaki Region by minimising the net costs or risks of natural hazards to people, property and the environment.

The dam structures at the Mangorei HEPS are inspected and maintained in accordance the NZSOLD guidelines, so as to ensure that they can be operated in a manner that avoids or mitigates the potential for natural hazard events (i.e. earthquakes and floods). Furthermore, potential flood risks in the Waiwhakaiho River are reduced with flood waters being able to flow over the diversion weir in the river and the cessation of the diversion / taking of water when flows exceed 85 m^3/s.

Energy

The provisions of the RPS relating to energy promote the efficient development and production of renewable energy to meet the energy supply needs of the region and New Zealand.[33] These provisions largely reflect the direction provided by the NPSREG and the analysis provided in relation to that planning document is considered to also apply to these provisions of the RPS. That is, the Mangorei HEPS will contribute to the generation of renewable energy for the region.

Issues of Significance to Iwi Authorities

Chapter 16 of the RPS addresses the issues of resource management significant to iwi. Key aspects of the objectives and policies in this chapter relate to taking into account the principles of the Treaty of Waitangi and giving particular regard to the concept of kaitiakitanga in managing the use, development and protection of natural and physical resources. There is also emphasis on accommodating the views of individual iwi and hapu.

Trustpower has sought to engage with the Forum in an early and transparent manner so to establish an understanding of how their cultural or historical associations with the Waiwhakaiho River may be affected by the continued operation of the Mangorei HEPS,

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[32] RPS Policy AMY 1.

[33] RPS Objectives ENE 1, ENE 2 and ENE 3.

and what measures may be implemented to address any potential associations. Further information on these associations is intended to be provided by representatives of the Forum as part of the Cultural Values Assessment that is to be prepared. Further analysis of the provisions noted above may, therefore, be necessary at this time.

Summary

Overall, it is noted that the RPS has a focus on providing for social and economic wellbeing, as well as renewable electricity generation infrastructure. The Mangorei HEPS is consistent with these expectations.

With respect to the management expectations regarding the protection and management of natural resource values, and cultural values, it is considered that the Mangorei HEPS will be operated in a manner that is able to safeguard the key values of the Waiwhakaiho River with the imposition of the conditions proposed.

Further assessment of the consistency of the Mangorei HEPS with the objectives and policies of the RPS will be made once representatives of the Forum have provided their Cultural Values Assessment.

7.2.3.5 Regional Fresh Water Plan for Taranaki

The RFWP became operative on 8 October 2001. The RFWP promotes the sustainable management of the freshwater resources of the Taranaki Region. The RFWP outlines important freshwater issues in the region, and provides objectives, policies and methods that are to be adopted when managing and addressing these issues.

The objectives and policies in the RFWP cover a broad range of topics that are relevant to the Mangorei HEPS. The topics of relevance are discussed in further detail below and include natural, ecological and amenity values and public access; tangata whenua; use and development of fresh water; and resource issues in the Taranaki Region. However, it is noted that the RFWP has not been updated to give effect to the NPSFM or the RPS.

Natural, Ecological and Amenity Values and Public Access

The natural, ecological and amenity values objectives of the RFWP seek to sustainably maintain, enhance and protect the stream, river and lake environments in the Taranaki Region.[34] As already noted above, particular consideration has been given to ensuring the flow regime proposed for the Waiwhakaiho River downstream of the diversion weir is appropriate to sustain the health and wellbeing of the river. In particular, Trustpower are proposing to introduce new consent conditions managing the operation of the Mangorei

[34] RFWP Objectives 3.1.2, 3.1.3, 3.1.4, 3.1.5 and 3.1.6.

HEPS that are intended to ensure that the operation of the Scheme changes in response to potential changes in ecosystem health - especially during the summer months.

Objective 3.2.1 of the RFWP seeks to maintain and enhance public access along the regional fresh waterbodies.[35] Public access around the Mangorei HEPS, particularly around Lake Mangamahoe, is widely available and will continue to be so with the continued operation and maintenance of the Scheme.[36]

Tangata Whenua

Objective 4.1.1 of the RFWP seeks to recognise and provide for the cultural relationship and values held by iwi and hapu of the region with fresh water in a manner that is reflective of their status as tangata whenua. Trustpower is continuing to consult with representatives of the Forum to ensure that their relationship with the Waiwhakaiho River is maintained.[37]

Further analysis of these provisions may be necessary once the cultural values assessment is available from the Forum.

Use and Development of Fresh Water

Objective 5.1.1 of the RFWP supports the sustainable use of freshwater resources (inclusive of the use of the beds of rivers and lakes) when the use will positively influence the social, economic and cultural wellbeing, and health and safety of people and communities.

The Mangorei HEP's and its sustainable utilisation of freshwater for the purpose of generating renewable energy and producing electricity for the Taranaki Region has been contributing to regional wellbeing since its establishment in 1904, and the beneficial influence of the Scheme will be maintained with the continued operation and maintenance of the Mangorei HEPS.[38]

Resource Issues in the Taranaki Region

Objective 6.1.1 of the RFWP seeks to promote the sustainable management of surface water while avoiding, remedying or mitigating any actual or potential adverse effects arising from the taking, use, damming or diversion of surface water.

The utilisation of surface water for the purpose of electricity production by way of renewable energy development has been occurring for several decades, and providing community and regional benefit by way of electricity provision and the security of supply,

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35 RFWP Objective 3.2.1.

36 RFWP Policy 3.2.1.

37 RFWP Policies 4.1.1 and 4.1.2.

38 RFWP Policy 5.1.1.

and via the enabling / facilitation of an important recreational resource (whitewater activities in the tailrace) as a result of the discharge of water from the Mangorei Power Station.[39] As such, the effects of the Mangorei HEPS on the natural, ecological and amenity features of the Taranaki Region have now normalised in the surrounding environment, and the continued operation of the Scheme will not alter these features any further.[40] This application does not propose to alter the quantity of water diverted and abstracted from the Waiwhakaiho River (and then returned to the river post electricity generation), however with the purpose of improving water levels and flows and aquatic habitat conditions within the residual reach downstream of the intake structure, Trustpower are proposing to implement flushing flows and temporary diversion / abstraction reductions beyond those provided for in the existing consent.[41]

Objective 6.6.1 of the RFWP seeks to promote the sustainable management of the beds of rivers and lakes by avoiding, remedying or mitigating any adverse effects of the use of the beds of rivers or lakes.

As the structures of the Mangorei HEPS are already established in the Waiwhakaiho River, Lake Mangamahoe and the lower Mangamahoe Stream, the potential effects of the use of the beds of the waterbodies relate to the maintenance of the structures (as opposed to the development or deconstruction of the structures). Trustpower does not propose to alter the existing maintenance regimes of the Mangorei HEPS (many of which are permitted activities), and as such regular maintenance activities will continue to be undertaken throughout the Scheme in a controlled manner that avoids, remedies or mitigates any adverse effects on aquatic habitats and life, terrestrial flora and fauna, fish passage, water quality, flood risk, and the erosion or accretion of river and lake beds or banks.[42]

The Mangorei HEPS has provisions for fish passage throughout, with the fish pass integrated into the diversion weir on the Waiwhakaiho River, and the eel trap and transfer programme implemented in the tailrace and Lake Mangamahoe. Assessment of these provisions has determined that the current fish passage provisions are effective, and, therefore, Trustpower proposes to continue to operate and maintain a trap and transfer programme that will facilitate fish passage upstream and downstream in the catchment. These measures will assist in maintaining populations of longfin eels and shortfin eels in the major areas of suitable habitat in the Waiwhakaiho River and Lake Mangamahoe.[43]

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39 RFWP Policy 6.1.5.

40 RFWP Policy 6.1.3.

41 RFWP Policies 6.1.3, 6.1.4, 6.1.5 and 6.1.8.

42 RFWP Policy 6.6.1, 6.6.3 and 6.6.9.

43 RFWP Policy 6.6.2.

Regional Fresh Water Plan Summary

Overall, for the reasons outlined above, it is considered that the continued operation and maintenance of the Mangorei HEPS would be consistent with the relevant objectives and policies of the RFWP that seek to promote the sustainable management of freshwater resources in the Taranaki Region.

7.2.4 Tai Whenua, Tai Tangata, Tai Ao – Section 104(1)(c)

Tai Whenua, Tai Tangata, Tai Ao (Environmental Management Plan) is considered to be a 'relevant other matter' in accordance with section 104(1)(c) of the RMA. It is an expression of rangatiratanga and kaitiakitanga from Ngā Uri o Te Atiawa (descendants of Te Atiawa) over the environmental and cultural resources within our Te Atiawa rohe.

Tai Whenua, Tai Tangata, Tai Ao seeks to enable central government agencies, regional and district councils and any other consenting authority to acknowledge and provide for the relationship of Te Atiawa with the whenua, waters, taonga species, wāhi tapu / wāhi taonga, urupā and sites of significance to Māori within the Te Atiawa rohe.

Tai Whenua, Tai Tangata, Tai Ao includes a number of objectives and policies of potential relevance to these resource consent applications, which include:

- Ensuring the principles of Te Mana o Te Wai in the NPSFM are implemented in the Te Atiawa rohe;
- Te Atiawa's relationship with water resources is recognised, respected, enhanced and protected;
- Te Atiawa's rights to freshwater be acknowledged through all allocation mechanisms and policies;
- The mauri of freshwater resources is protected and enhanced in order to protect indigenous flora and fauna, provide a supply of drinkable water and enable the continuation of customary activities;
- Te Atiawa's rights and interests in freshwater resources in our Te Atiawa rohe are cultural, customary and economic in nature and that future allocation mechanisms should reflect this;
- Remediate and protect statutory acknowledgement waterways (which includes the Waiwhakaiho River and its tributaries);
- Discharges of contaminants, low flows and loss of wetlands and riparian areas are managed to ensure water quality is improved;
- Water quality is of a sufficient standard within the Te Atiawa rohe to enable mahinga kai species to thrive;

- Require that all structures in beds and margins of waterways and lake support and enable fish passage for migratory native species.

As noted in section 6 of this AEE, Trustpower is engaged in a process with representatives of the Forum to build further understanding of the values attributed to the Waiwhakaiho River catchment and how the potential effects of the Mangorei HEPS may be appropriately managed.

Notwithstanding the above, and as already discussed in this AEE, Trustpower is seeking to ensure that the continued operation of the Mangorei HEPS occurs in a manner that supports the health and wellbeing of the ecosystem values in the Waiwhakaiho River. This includes modifying the existing flow regime in the residual reach to respond to changes in water temperature and algae growth during summer periods, and expanding the trap and transfer programme so that it is more effective across the affected catchment. Whilst this approach does not involve the modification of the Mangamahoe Dam to facilitate fish passage, such an approach has been demonstrated in the Fish Passage and Fish Screening Assessment as being unachievable due to a variety of functional constraints.

It is considered that further assessment of Tai Whenua, Tai Tangata, Tai Ao may occur once the cultural values assessment is provided by representatives of the Forum.

7.2.5 Value of Investment – Section 104(2A)

In addition to the matters referenced above, section 104(2A) of the RMA requires the consent authority when considering a renewal of an existing consent to *"have regard to the value of the investment of the existing consent holder"*.

The value to Trustpower of its investment in the Mangorei HEPS can be considered in terms of either the insured value of the Scheme (approximately $10 million) or the foregone future earnings of the Scheme if it was forced to close. By both of these measures, the value of the Mangorei HEPS is significant to the existing consents' holder.

Further to its individual contribution economically, the Mangorei HEPS provides support for the broader portfolio managed by Trustpower. Trustpower's geographically spread portfolio delivers a more secure and reliable supply for New Zealand when variable weather and hydrology in specific areas can impact supply across the National Grid. The Mangorei HEPS being embedded into the local distribution network means that when there are supply issues on the National Grid, supporting local demand can be directly contributed to by the Mangorei HEPS.

7.2.6 Part 2 of the Resource Management Act 1991

It is understood that a consent authority is generally no longer required to consider Part 2 of the RMA beyond its expression in the relevant statutory planning documents, unless it is appropriate to do so. Notwithstanding the above, and for completeness, Part 2 of the RMA has been given consideration.

The Mangorei HEPS is also an existing physical resource which is required to be suitably managed. The continued operation of the Mangorei HEPS will enable the water resources available in the Waiwhakaiho River and Lake Mangamahoe to be utilised in a manner that will provide for the social and economic wellbeing of people and communities within the Taranaki Region. The use of the water resource to generate electricity will potentially avoid the depletion and use of non-renewable resources associated with other electricity generation facilities.

The continued operation of the Mangorei HEPS will also be undertaken in a manner that safeguards the life-supporting capacity of ecosystems. Furthermore, Trustpower is proposing to avoid, remedy or mitigate the potential effects of the Scheme on the environment as far as is practicable. The measures by which this will occur are set out in the proposed consent conditions.

With respect to the key matters in sections 6, 7 and 8 of the RMA, the following points are pertinent:

- The ongoing use of the Mangorei HEPS, broadly under the same operating parameters, will maintain the existing natural character values of the Waiwhakaiho River and the margins of Lake Mangamahoe;
- The Mangorei HEPS will not impact on the protection of any outstanding natural features and landscapes;
- The flow regime in the Waiwhakaiho River and proposed upstream and downstream trap and transfer regime has been proposed with consideration of the need to protect the habitat of indigenous fauna within the river;
- Trustpower has been consulting with representatives of the Forum in order to establish an understanding of their relationship with the Waiwhakaiho River and their role as kaitiaki, and how this may be provided for. Further analysis may be required on this matter once the cultural values assessment is completed;
- The Mangorei HEPS will enable the efficient use of natural and physical resources (being water and the infrastructure in the river / lakebed) via the generation of electricity, which will contribute approximately 20.9 GWh of electricity per annum;
- The Mangorei HEPS contributes positively to the recreation opportunities in the Taranaki Region, and provides public access to Lake Mangamahoe;

- Based on the conclusions made in section 5 of this AEE, particular regard has been given to the intrinsic values of ecosystems and the maintenance of the quality of the environment;
- There are multiple benefits to be derived from the development and use of renewable energy from the Mangorei HEPS. These range from national benefits (relating to contribution to the national renewable energy production targets) through to local benefits (and the provision of local security of electricity supply); and
- Although Trustpower is not *a "person exercising functions and powers under the RMA"*, they are undertaking consultation with representatives of the Forum in good faith, with transparency and in a manner that reflects the scale and significance of this proposal.

Overall, and based on the technical assessments that have been commissioned by Trustpower, it is considered that the Mangorei HEPS will continue to operate in a manner that will promote the sustainable management of natural and physical resources in accordance with Part 2 of the RMA.

8. NOTIFICATION ASSESSMENT

Sections 95A – 95E of the RMA set out the steps to be adopted in determining whether a resource consent application should be publicly notified and if there are any persons who will be affected by an application.

In accordance with Section 95A(3) of the RMA, Trustpower is requesting that this resource consent application be publicly notified. Therefore, no further analysis of the various steps under Sections 95A – 95E of the RMA is required.

9. CONCLUDING STATEMENT

Trustpower proposes to continue to operate and maintain the Mangorei HEPS near New Plymouth in the Taranaki Region. The proposed operation of the Scheme will generally align with the existing operational parameters and environmental conditions in the Waiwhakaiho River, although additional conditions are proposed to ensure that operations are responsive to potential changes in environmental conditions during summer months. The Mangorei HEPS will also continue to contribute to the security of electricity supply and the Government's strategic targets for renewable electricity generation.

A fulsome assessment of the actual and potential effects of the Mangorei HEPS on the environment is provided in section 5 of this AEE, as well as the various technical assessments commissioned by Trustpower. Overall, these assessments conclude that the continued operation of the Scheme can be undertaken in a manner that will appropriately sustain the key environmental values of the Waiwhakaiho River and wider catchment – recognising that the cultural values assessment is still being prepared and is also need to provide an overall assessment of the potential effects of the Scheme.

With respect to the statutory planning framework that applies to the Mangorei HEPS, the continued operation of the Scheme is broadly consistent with the overall management intentions specified in the objectives and policies of the relevant national, regional and district planning documents. It is, however, recognised that further analysis of these matters may be necessary once the cultural values assessment is completed by the Forum.

Overall, it is considered that the continued operation and maintenance of the Mangorei HEPS will be consistent with the purpose of the RMA and there are no impediments to the granting of the resource consents sought by Trustpower.