



Assessment of Environmental Effects Report

# The Kāpiti Water Supply Project

Prepared for Kāpiti Coast District Council (Client)

By CH2M Beca Ltd (Beca)

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# Contents

<b>Executive Summary .....</b>	<b>1</b>
<b>1 The Need for a Reliable, Sustainable Water Supply.....</b>	<b>6</b>
1.1 Meeting Demand .....	6
1.2 Meeting Water Quality Expectations .....	7
1.3 Meeting Water Conservation Targets.....	8
1.4 Meeting the Goal of Sustainable Management .....	8
<b>2 The Kāpiti Water Supply Project .....</b>	<b>9</b>
2.1 Partnership Approach with Iwi .....	9
2.2 Technical Advisory Group.....	10
2.3 Community and Stakeholder Consultation .....	11
2.4 Process for Selecting a Preferred Solution.....	12
<b>3 The Solution: River Recharge with Groundwater.....</b>	<b>15</b>
3.1 Overall Concept .....	15
3.2 Extended Borefield and Pipeline .....	19
3.3 Waikanae Water Treatment Plant Site Works .....	29
<b>4 Consent Requirements .....</b>	<b>37</b>
4.1 Overview.....	37
4.2 Existing resource consents – Public Water Supply .....	38
4.3 Regional Consents Required.....	38
4.4 Other Consent Required.....	40
<b>5 Assessment of Environmental Effects .....</b>	<b>42</b>
5.1 Overview.....	42
5.2 The Existing Environment.....	44
5.3 Positive Effects .....	48
5.4 Construction Effects.....	49
5.5 Effects on the Waikanae River .....	50
5.6 Effects on Groundwater and the Aquifer .....	57
5.7 Effects on Terrestrial Ecology.....	67
5.8 Visual Effects and Amenity .....	67
5.9 Cultural Impact Assessment.....	67
<b>6 Statutory Assessment.....</b>	<b>69</b>
6.1 Resource Management Act: Section 104 .....	69
6.2 Resource Management Act: Section 105 .....	71
6.3 Resource Management Act: Section 107 .....	71
6.4 Resource Management Act: Part II .....	72
6.5 Summary.....	74

<b>7</b>	<b>Proposed Conditions of Consent.....</b>	<b>76</b>
7.1	Adaptive Management.....	76
7.2	Proposed Conditions of Consent.....	78
<b>8</b>	<b>Conclusion .....</b>	<b>80</b>

## Appendices

1. Location Plan: Waikanae Borefield
2. Existing Consents
3. Statutory Assessment
4. Proposed Conditions of Consent
5. Existing Monitoring Manuals
6. Water Chemistry Report

## Tables

- Table 1: Forecasted Peak Day Demands for WPR Water Supply
- Table 2: Ranked list of both in-catchment and out-of-catchment options
- Table 3: Top Ranked Options
- Table 4: Difference in river recharge use between a minimum flow of 750L/s and 850L/s
- Table 5: Chemical Characteristics of Waikanae River water and Waikanae borewater
- Table 6: Proposed discharge in relation to the conditions of Rule 1 of the Regional Freshwater Plan
- Table 7: Proposed staging of RRwGW
- Table 8: Maximum yield (L/s) for each production bore at each stage
- Table 9: Production bore depths
- Table 10: Indicative pipeline route description
- Table 11: Existing resource consents for public water supply
- Table 12: Regional resource consents required for RRwGW
- Table 13: Other resource consents potentially required for the full pipeline route
- Table 14: Key proposed activities and their actual and potential effects
- Table 15: Construction effects and mitigation measures
- Table 16: Effects on river flow and mitigation measures
- Table 17: Summary of main causal factors controlling cyanobacteria proliferations and the degree of effect these factors have on the Waikanae River under RRwGW and suggested mitigation/action
- Table 18: Effects on algae and mitigation measures
- Table 19: Effects on invertebrates and mitigation measures
- Table 20: Effects on fish and mitigation measures
- Table 21: Effects on saline intrusion and mitigation measures
- Table 22: Effects on existing well users and mitigation measures
- Table 23: Maximum Modelled Drawdown Effects in the Holocene Aquifer Underlying Wetlands Identified by Boffa Miskell
- Table 24: Effects on wetlands and mitigation measures
- Table 25: Potential adaptive management actions for identified risk/effects

## Figures

- Figure 1 WPR Peak Day Demand Forecasts with 490L/person/day
- Figure 2 Basic concept schematic of RRwGW
- Figure 3 50 year solution and 35 year consent
- Figure 4 Proposed staging of RRwGW
- Figure 5: Typical above ground wellhead arrangement
- Figure 6: Typical surge vessel arrangement
- Figure 7: Concept schematic minor modifications to the intake structure
- Figure 8: Concept drawing and visuals of the new discharge structure at the WTP
- Figure 9: Waikanae River Catchment
- Figure 10: A section of the Waikanae Aquifer Layers
- Figure 11: Drawdown contours for Scenario 4 for the shallow Holocene Sand in relation to existing wetlands
- Figure 12: Water levels for Nga Manu Wetland with and without RRwGW

## Executive Summary

Providing a reliable water supply for the communities of the Kāpiti Coast that is sustainable and will meet the expectations of consumers is a legislative (LGA) responsibility of Kāpiti Coast District Council (Council). This Assessment of Environmental Effects (AEE) focuses on the water supply for Kāpiti Coast's largest urban area – the Waikanae, Paraparaumu and Raumati (WPR) communities. This area has experienced one of the fastest growth rates of any district in the country in recent times, and continues to develop as a great place to live, work and play. A reliable and sustainable water supply underpins that development and provides for people's social, economic and cultural well-being.

The current water supply for the WPR area is based on a run-of-river system on the Waikanae River. Water is taken from the Waikanae River and treated at the Waikanae Water Treatment Plant (WTP) at Reikorangi Road, before being distributed to the community for consumption via Council's reticulated system. In dry summer periods, when the river is in low flow, the minimum flow requirements of the river mean that this run-of-river supply is supplemented or entirely provided by groundwater from a borefield in Waikanae. Water from the borefield, whilst meeting the New Zealand drinking-water standards, has been criticised by consumers for its taste and hardness. This has also caused problems with electrical appliances for consumers when Council switches to the 'harder' groundwater supply (for example kettles and water cylinders).

The existing water supply system is under stress in terms of its capacity to meet the community's peak daily water demand in summer. The Waikanae River and borefield currently supply up to a consented limit of 23,000 m<sup>3</sup>/day. Due to population growth, peak daily demand over recent summers has approached this limit and the continued use of borefield water for consumption is unacceptable to the community. Within the next few years, population growth and high water consumption will result in demand that exceeds the Council's currently consented limit for water abstraction of 23,000 m<sup>3</sup>/day. As a matter of urgency, Council must provide a long-term water supply solution that can meet future peak daily water demands. In 2009, Council proceeded with investigating all available solutions to provide a secure long-term water supply to be implemented with relative urgency. Through this robust process, 41 options were narrowed down to the preferred, which is RRwGW. Council wishes to establish a new water supply solution by 2015.

In consultation with the community, Council has developed a Sustainable Water Management Strategy (Water Matters Strategy) that sets out the vision for water management in the district over the next fifty years. The Strategy has a major focus on water conservation and commits the community to reduce peak daily consumption to 400 litres of water per person per day by the year 2014. This daily volume (plus an allowance for water losses of 90 litres per person per day) provides the basis for the projected future water needs for the community. In order to align with Council's long term water management strategy, a 50-year solution to water supply has also been sought out to the year 2060. By the year 2060 it is estimated that the WPR area requires a total of 32,300m<sup>3</sup>/day for water supply, based on high population growth and Council meeting its conservation targets.

The Water Matters Strategy also specifies that as a preference, water supply should be from "in-catchment" sources, providing for communities to use water efficiently and live within their means. For the WPR catchment this effectively means that the water source is either the Waikanae River surface water catchment or groundwater on the coastal plain.

Although the existing water supply for the WPR area is nearing its consented capacity, it is important to understand that the Kāpiti Coast in general terms has abundant water sources. There are a number of rivers, groundwater aquifers of varying depths, and a reasonably reliable level of rainfall. As noted, different options to provide a water supply to the WPR area have been investigated to varying degrees of detail over the years. A summary of that process is set out in Volume 4. In reaching its decision to pursue the water supply option set out in this AEE, Council has undertaken a rigorous assessment, starting with a long-list of 40 options and working towards the preferred solution over the last three years. The challenge and opportunity for the Kāpiti Water Supply Project was to identify a water supply solution that can overall best deliver on the full range of economic, social, cultural, technical and environmental requirements.

The Waikanae River is able to supply all the drinking water required over the next 50 years to meet the projected demands of the WPR community except during summer low flows. During low flows the peak daily demand places a stress on the need to maintain a flow of 750 L/s (or natural flow if that is lower) in the Waikanae River. To implement a water supply solution for these times, Council proposes to use groundwater from the Waikanae borefield to ensure the minimum flow (or natural flow) is maintained in the river downstream of the existing abstraction point. In this way, the river and groundwater work together to maintain a reliable water supply and a sustainable river flow.

The solution is called River Recharge with Groundwater (RRwGW).

The Waikanae aquifers provide a natural underground storage system that provides water to top-up the flow of the Waikanae River during low flow times and droughts, allowing more river water to be taken from the river for consumption (such that groundwater is feeding the river immediately downstream of the Waikanae WTP intake, while river water is being consumed by the local community).

Based on demand forecasts, RRwGW provides a 50-year solution that allows new bores to be added and therefore efficiently staged over time as demand increases, with the added benefit of making productive use of the existing and significant community investment in the current Waikanae borefield.

A range of water conservation and demand management measures are being implemented by Council to help ensure the efficient use and sustainable management of the precious water resource of the district – a conservation target of 490 litres per person per day has been set, consisting of consumption at 400 litres per person per day (L/person/day), with an additional allowance of 90 L/person/day for water losses. This includes the introduction of water metering, which is viewed by Council as an essential conservation tool to achieve a more efficient and sustainable level of water use in each household.

In addition to the RRwGW project for which consent is sought through this application, Council has identified a future water supply dam on the Maungakotukutuku Stream in the hills behind Nikau Valley. The required land has been purchased and this will secure a longer term (beyond 2060) option to build a storage reservoir in the future when required. The dam extends this water supply security out by a further 50 years. This combined 100-year solution is innovative, prudent and comprehensive as demonstrated by the various investigations that support it. Being an in-catchment solution, it importantly does not detract from the water supply to other parts of the district such as Otaki, Te Horo and Paekakariki.

Council seeks the following resource consents for the RRwGW proposal:

1. To take and use up to a maximum of 30,700m<sup>3</sup>/day of groundwater from within the Waikanae borefield as defined on Location Plan [Ref] for the purpose of supplementary public water supply through river recharge or emergency public water supply;
2. To construct and operate bores within the Waikanae borefield as defined on Location Plan [Ref] for the purpose of public water supply, including but not limited to the bores already consented, as well as new bores N2, N3, S1 and S2;
3. To take and use up to a maximum of 30,700m<sup>3</sup>/day of water from the Waikanae River at the Waikanae Water Treatment Plant for the purpose of public water supply;
4. To discharge groundwater up to a maximum of 30,700m<sup>3</sup>/day from the Waikanae borefield to the Waikanae River immediately downstream of the Waikanae Water Treatment Plant intake weir;
5. Works and structure within the bed of the Waikanae River – minor modifications to the existing intake structure and a new discharge structure at the Waikanae Water Treatment Plant site;

6. To discharge up to a maximum of 10,000m<sup>3</sup>/day of water from the Waikanae River into the Waikanae aquifer through bores within the Waikanae borefield abstraction area as defined on Location Plan [Ref] for the purpose of public water supply. Note that this amount of 10,000m<sup>3</sup>/day will be sourced from the overall river water take of 30,700m<sup>3</sup>/day, rather than being sourced in addition to that.

Council seeks a 35-year duration for the water take permits and the discharge permits, the maximum duration provided for under the RMA. Given Council's considerable investment in investigating the feasibility of this project and its investment commitment to deliver it in a staged manner over 50 years to meet public water demand, a 35-year duration is warranted in this case. The adaptive management approach proposed, the management framework set by conditions of consent, and GWRC's ability to review those conditions pursuant to s128 of the RMA provide further security and control to set a 35-year duration for this water supply solution.

A good portion of this project is already consented. Council has existing consents for the groundwater take from the Waikanae borefield and the Waikanae River up to a combined maximum take of 23,000m<sup>3</sup>/day. These consents expire on July 2025. To put this proposal in perspective; Council is seeking to increase their existing consented take of 23,000m<sup>3</sup>/day to 30,700m<sup>3</sup>/day – that is, one third more than the present consent. The proposed average withdrawal represents 7.3% of the total allocation for the lower aquifers and 2.6% of the total safe yield of the Waikanae groundwater zone as identified in the Regional Freshwater Plan. Given that the recharge scheme will not need to be operational for the full year, the proposed maximum allowable annual volume of groundwater take shall be 2.3 million cubic metres per year (from 1 July to 30 June).

The majority of the borefield wells and pipeline required are already in place, as is the existing Waikanae WTP. The project will build on that existing infrastructure and increase the amount of water being abstracted from the borefield and the river to provide for up to a 50-year public water supply. The consents sought at this point clearly focus on the next 35 years, given this is the maximum term permissible under the RMA.

This Assessment of Environmental Effects (AEE) in support of the resource consent applications addresses all effects both positive and adverse to meet RMA requirements. Overall, the AEE concludes that the environmental effects of this proposal are acceptable and can be sufficiently managed by way of conditions of consent, including a comprehensive monitoring and adaptive management framework to provide for sustainable management as required under Part II of the RMA.

The positive effects of this proposal are significant. The proposal is for a long-term community water supply that will enable people and communities to provide for their social, economic, and cultural well-being and for their health and safety. This RRwGW project will secure a reliable and sustainable water supply for the WPR area that best meets community expectations for quality of its drinking water. This proposal also provides additional resilience by using two sources of water. The project is readily stage-able to meet community water supply needs, providing a cost-effective solution that can be implemented over time to match demand. RRwGW is a reliable and cost-effective water supply solution for the WPR community.

The effects on the Waikanae River can be sufficiently mitigated, remedied and managed to ensure that an unacceptable adverse effect on water quality and in-stream health does not occur. In terms of the quality and amenity of the Waikanae River, Council proposes to implement RRwGW in a manner that is largely unnoticed by people and has a minor effect on aquatic life such as fish and the insects they feed on. The investigations undertaken to support this application demonstrate minor effects that can be comprehensively monitored and managed. It is acknowledged that the discharge of bore water to maintain minimum flow will likely cause an increase in algal growth in the river due to its higher nutrient levels. This is expected to be a temporary effect that will be limited to those periods when the recharge is occurring and impacts on ecology are expected to be minor and able to be sufficiently monitored and managed, including the ability of the Waikanae WTP to release a flushing flow to wash away algal growth from the bed of the river (in the event that a natural flushing event or 'fresh' does not occur).

Equally, the effects on the Waikanae aquifer can be sufficiently mitigated, remedied and managed to ensure that a significant adverse effect on the aquifer and surface water system does not occur. Groundwater investigations have demonstrated that the proposed extended borefield can be successfully operated as planned over the 35-year period to meet demand in a 50-year return period drought. A key concern identified early in our investigations was saline intrusion and this will be specifically monitored and timely response actions can be implemented to avoid saline intrusion risks. Council already has a saline monitoring system in place under its existing consent to use the Waikanae borefield. That monitoring and the further investigations undertaken as part of this application have shown that the existing freshwater/saltwater interface is several kilometres offshore and the current risk of saline intrusion is low. The proposed borefield has been placed inland (at least a 1km setback from the coast) as a conservative measure to minimise risk from seawater intrusion and allow a monitoring buffer area between the coast and the bores.

Similarly, drawdown effects on existing well users and wetlands/ surface waters within the Waikanae borefield area can be carefully monitored and managed to ensure any adverse effects are avoided, remedied or mitigated. Any adverse effect over and above natural variations in groundwater levels and natural periods of drought are considered to be minor and able to be sufficiently managed through the adaptive management procedures proposed by Council. The potential impact on local wetlands in a 50 year drought could see a lowering of water levels of 10-210mm over and above natural levels, in the context of natural variations in ground water levels over the year between 1 and 2 metres. These effects will be monitored over time, and there are a range of changes to the operation of the borefield that can be used to reduce any negative effects.

Any other environmental effect, including temporary construction effects as the project is staged over time, effects on terrestrial ecology and visual effects, will be no more than minor.

In terms of cultural effects, Council and Te Āti Awa ki Whakarongotai are working together in the spirit of partnership to explore practical, innovative, culturally appropriate management of water, including the supply of drinking water to all communities within the WPR catchment area. That partnership is endorsed by the shared Memorandum of Understanding in Relation to Water. The Cultural Impact Assessment provided in Volume 3 sets out a range of recommendations for Council and iwi to work together on water management. Council plans a comprehensive approach to sustainably managing the Waikanae River catchment over the long term in partnership with iwi. Specific measures have been budgeted for in the LTP to recognise the need to improve these values over time.

The process to assess alternative water supply options for the WPR community has been comprehensive and forward thinking. Council effectively has the means available to provide a 100-year solution, with the staged RRwGW scheme and future dam option. The process has involved an appropriate degree of technical investigations matched to the scale and nature of the proposal and has benefitted from extensive stakeholder consultation, a partnership approach with iwi and independent scrutiny from a Technical Advisory Group.

Inherent to any project of this nature and scale, there is a degree of uncertainty around the actual effects of RRwGW over time. While the extensive investigations undertaken have significantly narrowed that uncertainty, some does remain. That uncertainty is acknowledged and is considered as being able to be well managed through the monitoring and adaptive management approach proposed. The public water supply system is already comprehensively monitored – both the river and borefield – and well managed by both KCDC and GWRC and a number of other organisations and groups with an active interest in this matter. The adaptive management approach proposed as part of this application adds to that current water management framework, including the formalisation of an Adaptive Management Committee that includes local iwi to specifically address, and ideally reduce, uncertainty over time in relation to RRwGW. The staged nature of RRwGW is well suited to adaptive management, particularly given that the assessed effects are considered to be minor and can be monitored. This adaptive management approach is precautionary and consistent with sustainable resource management as promoted by the RMA.

This AEE (Volume 2) includes a detailed description of the proposed activities and an assessment of environmental effects in the detail that corresponds with the scale and significance of the effects that the proposed activities may have on the environment as required by the RMA. This AEE is supported by:

Volume 1: Summary Report

Volume 3: Technical Reports

- Demand Modelling Report
- Surface Water Modelling Report (Hydrology and Yield)
- Aquifer Testing and Groundwater Modelling Report
- NIWA River Investigation Reports (a total of 3 reports)
- Ecological Impact on Wetlands Report
- Cultural Impact Assessment Report

Volume 4: Background and Option Selection Reports

Overall, these documents support the resource consent applications and meet the RMA requirements of Section 88 and Schedule 4.

# 1 The Need for a Reliable, Sustainable Water Supply

## 1.1 Meeting Demand

With a growing population, having a reliable supply that can deliver water during a drought is essential to the WPR area. The existing water supply is under stress in terms of its capacity to meet the community's peak water demand in summer. Over the past decade water sourced from the Waikanae borefield that was established as a supplementary supply in 2004 has been used on a number of summer and early autumn occasions for community consumption during low flow periods since 2005.

Over the next 35 years, the Waikanae River cannot be relied on to provide the full future demand for the WPR community (because there is a need to maintain a minimum river flow). There is a risk that within the next few years population growth and high water consumption could result in demand that exceeds the Council's currently consented limit for water abstraction of 23,000 m<sup>3</sup>/day. Current projections are that consented capacity will be exceeded in 2015.

Water demands have been forecasted to predict the required amounts of water needed for the WPR community out to 2060. The Demand Modelling Report in Volume 3 provides a detailed description of the demand modelling assumptions and outcomes. Future gross peak day demand for the WPR water supply has been set at 490L/person/day for forecasting, which assumes that universal metering, water conservation measures and loss reduction work will achieve savings to reduce the current peak demands to 490L/person/day or less. Council anticipates that it will take two years from the first water meter bill (being issued July 2014) for peak demand to reduce from current levels (being around 590L/person/day) to the target 490L/person/day.

This per capita demand target is applied to Council's population projection data to derive a peak daily demand for the WPR area. Council's policy is to allow for a medium population growth scenario in its forecasting. As is typical for good practice water management forecasting, headroom has also been included to account for uncertainty in the population and demand forecasts. The allowance for headroom has simply been determined on the basis of the difference between the demands calculated from the high and medium growth population forecasts. The demand headroom in 2060 equates to about 6,000m<sup>3</sup>/day.

In terms of Council's Long Term Plan 2012-2032 no allowance has been made in this 20 year period for headroom, as Council considers that there is more certainty around population growth in that timeframe, and that per capita demand can be managed with a combination of water metering and water conservation measures. This means that there is a reasonable degree of confidence that demand can be managed within the forecast.

If in fact population growth does exceed the medium growth scenario within the consenting period, then the allowance for headroom in the consent, and the stage-able nature of the RRwGW solution, very easily allows for a stage to be brought forward. Effectively, this means connecting the next bore to the network. Given the potential for high population growth to occur at times in the WPR area this approach appears prudent.

The forecasted peak demand out to 2060, based on the above assumptions, is shown in Table 1 and Figure 1 below. The predicted maximum water volume requirement in 50 years' time is therefore 32,300m<sup>3</sup>/day. This prediction, as stated above, is dependent on the success of the proposed water conservation actions.

In addition to the community's water demand, allowance also needs to be made for around 300m<sup>3</sup>/day for water used by the water treatment process. This additional 300m<sup>3</sup>/day of water for WTP operation is the water required to operate the plant for various activities associated with the water treatment process.

Therefore, for the purposes of this consent application up to a maximum consent period of 35 years, Council seeks a total take of 30,700m<sup>3</sup>/day (being the total of 30,400m<sup>3</sup>/day for public supply + 300m<sup>3</sup>/day for the WTP operation).

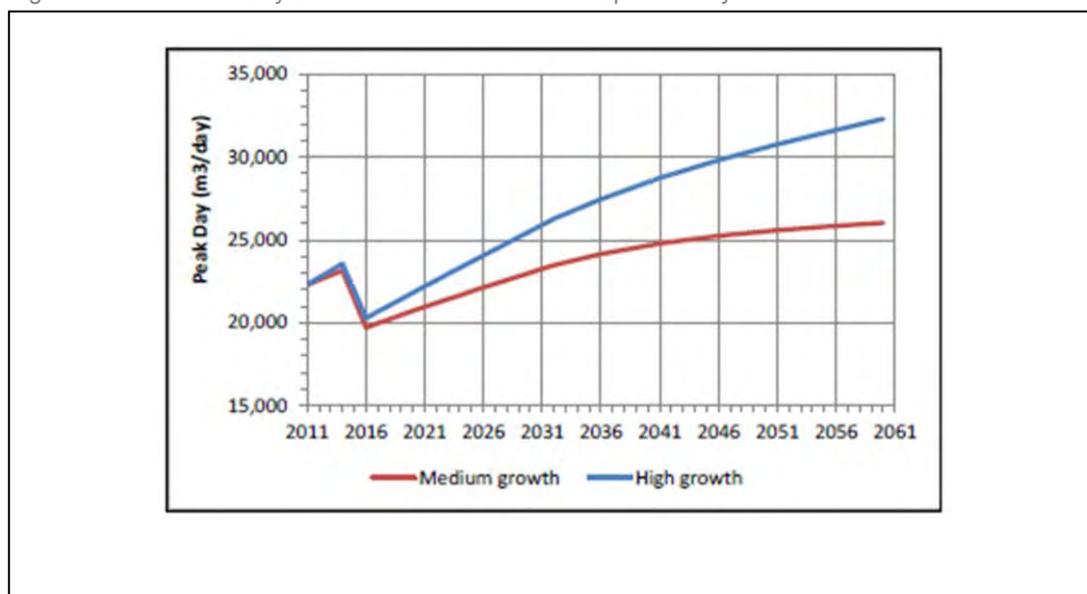
In terms of public supply, the demand rises over time in line with population growth, as shown on Figure 1.

Table 1 - Forecasted Peak Day Demands for WPR Water Supply

Year		Peak day demand (m <sup>3</sup> /day)	
		Medium popn growth	High popn growth
2016	Demand savings achieved	19,700	20,300
2032	20 year LTP period	23,500	26,300
2049	35 year consent period	25,400	30,400
2060	50 year solution	26,000	32,300

The selection of 2049 as a 'consent period' is based on a 35 year duration with a start date of 2014. The year 2014 is the anticipated start date for this project, assuming consent is granted by GWRC by early 2013.

Figure 1 - WPR Peak Day Demand Forecasts with 490L/person/day



## 1.2 Meeting Water Quality Expectations

Another key driver for the water supply is the acceptability of the water for consumption by the community. The nature of the existing water supply regime is such that when the flow in the Waikanae River approaches its minimum flow (750 litres/second), the WPR system switches to the use of Waikanae borefield water. During this switch, the quality changes rapidly from a 'soft' to a 'hard' water, and the taste changes. Although the bore water does meet the New Zealand drinking-water standards the hardness of the bore water has remained a key concern both in terms of taste and potential effects on electrical appliances such as kettles and hot water cylinders. The continued use of borefield water for consumption is not acceptable to the community. However, the borefield does provide a reliable water source during the summer dry period and it also represents a significant existing investment for the community. In terms of resilience, the borefield does provide an alternate source of drinking water in the event that for any reason the Waikanae River water cannot be used for potable water (for example if it was contaminated posing a risk to public health as a drinking source).

### 1.3 Meeting Water Conservation Targets

Council is implementing the Water Matters Strategy and working towards improving water conservation across the district. The district has historically been a high water consumer in comparison with other districts. The intention is to stabilise daily WPR consumption at 490 litres per person per day (L/person/day), which includes an allowance for water losses. This allowance is for unaccounted water lost from the reticulation, including unauthorised connections and loss through leaks from reservoirs, supply pipes, and connections.

RRwGW has been designed to deliver a peak of 490 L/person/day to an estimated population of between 53,120 and 65,940 by 2060.

“litres per person per day” is a common measure but does not mean that all of this water is used by individuals at home. The measure is an average figure for all users, including homes, businesses, industry, schools, hospitals, Council facilities, fire fighting, etc.

Peak daily use across the WPR area currently stands at around 590 L/person/day. Within the WPR area, the peak use averages around 550 L/person/day (Paraparaumu/Raumati) and around 720 L/person/day (Waikanae). These usage figures include water losses.

The importance of water conservation has been an ongoing theme during the community consultation for this project, with both Council and the community raising a range of methods to achieve lower consumption rates of drinking water. Council's water conservation initiatives go hand-in-hand with the water supply project. Council has a wide range of conservation initiatives for reducing demand, from the Green Plumber and the Green Gardener services; the Eco Design Advisor; the Kāpiti Coast Sustainable Home and Garden Show, the Summer On The Coast programme, Plan Change 75 (requiring a water tank/ grey water system for any new or relocated dwelling), education in local schools, water metering and financial incentives that provide loans for installation of non-potable water systems. Water metering is a critical element of Council's conservation strategy.

The conservation target of 490 L/person/day forms a fundamental design assumption for the Kāpiti Water Supply Project. Council believes it is an important and realistic target and has implemented a range of measures to help ensure ‘water wasters’ and inefficient users of drinking water are mindful of the need to reduce consumption and use water wisely. However, should the target not be achieved by 2016, the benefit of the RRwGW scheme is that its staged delivery can be brought forward if required. Council is committed to seeing its water supply infrastructure and associated consents as part of a long-term framework for water abstraction, environmental monitoring and responsible management of the district's water resource.

### 1.4 Meeting the Goal of Sustainable Management

Council is committed to the sustainable management of the district's water resources and has a responsibility to provide a sustainable and safe public water supply under the Local Government Act. Under the Resource Management Act, sustainable management means managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while –

- a. sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
- b. safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
- c. avoiding, remedying, or mitigating any adverse effects of activities on the environment.

This proposal is fundamentally about achieving that goal – a community water supply project, for the well-being and health and safety of the community (current and future generations) that safeguards the environment and the life-supporting capacity of the Waikanae River and the aquifer system.

## 2 The Kāpiti Water Supply Project

The consideration of a new water supply source for the Kāpiti Coast has had a long and interesting history. More recently, Council has been actively considering additional water sources and options for improving the security of supply since the early 1990s. Following various attempts to resolve water supply concerns, the Council developed a Sustainable Water Management Strategy in 2003. In the same year it proceeded with investment in the Waikanae borefield, alongside a comprehensive water conservation programme. However, current projections show that even with conservation improvements, additional supply will be needed soon (2015).

A more detailed history is provided in Volume 4. The process of assessing water supply options and systematically refining the selection to the preferred solution of RRwGW with a future dam site secured has been a comprehensive course of action. Together, these two infrastructure solutions provide up to 100 years of supply capacity. This section summarises some of the key pillars of that process – partnership with iwi; the Technical Advisory Group; and community and stakeholder consultation. This section ends with a brief summary of Volume 4: Background and Option Selection Reports. In relation to the resource consents sought for water abstraction and discharge, this process demonstrates a robust consideration of alternative options.

### 2.1 Partnership Approach with Iwi

Council is working in partnership with tāngata whenua in relation to water management, including both the water supply and conservation initiatives. Te Āti Awa, as the tāngata whenua of the water catchment area, has been actively involved in this project.

At a broader level, Council's strategic policy documents, such as the District Plan and the Water Matters Strategy, stress the importance of a partnership approach between Council and tāngata whenua in decision-making and resource management. This is consistent with the purpose and principles of the Resource Management Act and the Treaty of Waitangi. The core values of Te Āti Awa, such as kaitiakitanga, taonga, mauri and whakapapa are well documented in Council policy and provide an overarching framework for project-specific engagement.

These core values are important to all tāngata whenua of the district, including Ngāti Raukawa and Ngāti Toa Rangatira. All iwi have an active role in water management within the district and have been involved to some degree in this project, particularly early on during the consideration of many district-wide options. Ngāti Raukawa in particular has confirmed their support for an in-catchment water supply solution for WPR, as this in turn protects the Otaki River for use by the Otaki community in the future.

Te Āti Awa has worked in partnership with Council during all stages of this project, from the initial optioneering of some 40 water supply options, through to the short-listing of options and the selection of the long-term water supply solution (being the more immediate RRwGW solution and the future Maungakotukutuku dam).

Significantly, in May 2010 the Kaumatua Committee appointed a Water Working Group to represent iwi on water matters and to work closely with Council on the water supply project. The Water Working Group (a group of 3 iwi representatives) has been actively involved in the water supply project from their inception in 2010 and regularly contributed to the option selection process on behalf of iwi.

This has included involvement with the investigations into the river recharge and dam schemes, including river investigations, drilling activity at the Waikanae borefield, informing the assessment of environmental effects investigations; visiting the Maungakotukutuku dam site and later the Maitai Dam in Nelson to gain a better understanding of the longer-term effects of a water supply dam. A number of meetings and stakeholder hui have been held at the Whakarongotai Marae over the course of the project, involving iwi representatives and stakeholders such as Greater Wellington Regional Council, Department of Conservation, Fish and Game, Forest and Bird, Friends of the Waikanae River and the Kāpiti Fly Fishing Club.

This process of partnership on water management was further endorsed during October 2010 with a Memorandum of Understanding (MoU) in Relation to Water between Council and Te Āti Awa ki Whakarongotai signed at the Whakarongotai Marae. The MoU states that *–Council and Te Āti Awa will work together in the spirit of partnership to explore practical, innovative, culturally appropriate management of water, including the supply of potable water to all communities within the Waikanae, Paraparaumu and Raumati catchment area”.*

Te Āti Awa has recently completed their Cultural Impact Assessment (CIA) for both the river recharge and Maungakotukutuku dam projects, completed by Hāpai Whenua Consultants. The complete Cultural Impact Assessment is within Volume 3 and summarised in Section 6.9 of this Report. Council acknowledges the valuable input and guidance that the Water Working Group has provided over the course of this project and looks forward to that continuing as part of the implementation of this project and also the wider integrated catchment management programme.

## 2.2 Technical Advisory Group

An independent Technical Advisory Group (TAG) was established in 2009 to provide further independent rigor around the process of option assessment and technical investigations. At each key milestone over the last three years of the project they have produced independent advice to Councillors on the various reports that have been prepared. They have endorsed all of the recommendations made since 2009. Their independence and expertise has given Councillors further confidence in the decisions made at each milestone and provided specific guidance on technical issues requiring further investigation.

This volunteer group consists of local residents, all experts in their fields, who gave up their time to assist the decision-making process. The TAG included Don Hunn (Chair and Consultant); Roland Bishop (Civil Engineer); Robin Falconer (Scientist / General Manager); Bill Hall (Mechanical / Structural Engineer); John Harding (Public Health Engineer); Prue Hyman (Adjunct Professor of Economics); and Steven Roberts (Project Manager / Engineer).

The TAG has made the following final recommendations in relation to this proposal:

1. There should be consultation with owners of bores likely to be affected by draw-down in the borefield arising from the use of bore water as part of the Council's provision of future water supply to Paraparaumu/ Raumati/Waikanae;
2. The Council should carry out bore field testing to establish that saline intrusion into the western edge of the Waikanae borefield will not be a problem or that it can be managed by reinjection or other management;
3. The Council notes that issues on the interaction of bore field groundwater with the Waikanae River ecosystem need careful communication with authorities, special interest groups and the public;
4. The Council should ensure there is a comprehensive monitoring programme based on a well-developed and sensitive risk profile, especially in areas where current knowledge should be expanded;
5. Further work should be done on the financials to include the possibility that the second stage of the recharge might have to be implemented earlier than planned and a contingency built into the budget to allow for this.

Council has considered each of these recommendations and addressed each accordingly. Consultation with bore owners and community consultation regarding the implementation of the river recharge scheme has been an important part of this project and will be ongoing throughout the public notification process for this application and beyond as Council communicates the implementation activities over the staged delivery of the project. A comprehensive monitoring programme is proposed as part of the application. The river recharge scheme can be implemented to match demand and can be implemented earlier or extended based on community needs.

## 2.3 Community and Stakeholder Consultation

Consultation with the community and stakeholders has formed a significant part of this project. The issue of water supply for the district has high community awareness and a long history of debate. As a result, some of the community values around water supply, such as water quality and taste, are well understood and documented. The consultation for this project built on that understanding and is fully detailed in the reports of Volume 4.

During the course of the Kāpiti Water Supply Project there has been a great deal of community consultation. This occurred in the early stages of the option shortlisting process to clearly establish the values that are important to the community. Consultation continued in subsequent stages in relation to specific options and their potential effects; and more recently the more detailed engagement on RRwGW and the longer-term approach to future-proofing of the dam site by purchasing the required land.

A range of consultation activities have taken place, including public meetings, information days, stakeholder meetings and workshops, a water taste test, community newsletters and newspaper articles, local radio messages, hui at the Whakarongotai Marae, interest group and stakeholder meetings, one-on-one meetings with interested and affected parties; and information provided to the community on Council's website.

The earlier stages of consultation (Stages 1 and 2) focused on understanding and confirming community values for water supply to inform the development of selection criteria for the shortlisting of options. The key values of water quality, technical performance, economics; environmental and social factors were identified through community engagement and relevant documents such as the Long Term Plan and Water Matters Strategy. Consultation then moved to discussing the short-listed options with iwi, affected landowners, stakeholders and the wider community to inform the selection of a preferred option(s) (Stages 3 and 4). Unsurprisingly, the key community messages have largely related to people and groups wanting to ensure a secure and affordable supply of good quality water (including taste and removing the problems of bore water hardness).

There has also been support for systematically building a case towards a preferred solution, including using the TAG as a local review, and investigating in-catchment options as a first priority before looking to out-of-catchment options. That said, there was also an element of 'consultation fatigue' in terms of people just wanting Council to get on and deliver a solution. Equally, some people remain wedded to previously debated options such as the Otaki River source to supply the WPR area or were more keen to see a dam built at a higher upfront expense as a tried and tested concept for capturing and storing water.

The importance of water conservation has been an ongoing theme during the community consultation for this project, with both Council and the community raising a range of methods to achieve lower consumption rates of potable water.

Community and key stakeholder consultation will continue up until lodgement of this application and beyond as the project is staged over time. Council encourages both the community and key stakeholders to be actively involved in this community project.

As RRwGW became the preferred solution, a number of efforts were made to consult with river users and interest groups, ecologists and technical experts to inform the identification of issues and investigations around potential effects. Those more detailed discussions have informed the technical investigations that support this application and also the proposed conditions of consent. Council particularly acknowledges the valuable input that the 'Water Care Group' has provided over the course of this project and look forward to that continuing as part of the implementation of this project and also the wider integrated catchment management programme. The Water Care Group includes representatives from Fish & Game, Forest & Bird, Department of Conservation, Friends of the Waikanae River, and Kapiti Fly Fishing Club.

## 2.4 Process for Selecting a Preferred Solution

For a full discussion and explanation of the option selection process, refer to Volume 4 of the application suite which provides the 3 key reports: *the Preliminary Status Report* (December 2009); the *Option Selection Report* (March 2010); and the *Ranked Options Report* (August 2010).

### 2.4.1 Preliminary Assessment

A review of 40 earlier options was undertaken as the first stage of option selection, which included all options identified by Council in the preceding years, and a number of new options to ensure every possible option was explored and evaluated. There were six different option categories which described the water source. That is, whether water is sourced from a run-of-river, dam, storage pond, groundwater, river recharge or another source. The list was narrowed down to 31 options, with 9 being eliminated due to insufficient yield, excessive cost or major technical or consenting difficulties. The report on this process (*Water Supply Capacity Review and Options for Supplementary Supply: Preliminary Status Report*) was tabled with Council on 17th December 2009.

### 2.4.2 Option Selection

An evaluation of all 31 options was based on the values the community and relevant policy documents identified as being important in making a decision on water supply. Values from the community were established by a community survey sent to Kāpiti district ratepayers and advertised in the local newspapers asking people what was important to them with regards to water supply. Values relating to water quality; security of supply; affordability; social; and environmental factors were common responses – which supported Council's relevant policy documents and the consultation that had already occurred around those. Further investigations into each of the 31 options eliminated a further 11 based on yield, cost or other technical difficulties. A multi-criteria assessment was carried out on the remaining 20 options. The criteria were strongly informed by the results of community consultation and a preliminary assessment of each option.

The *Option Selection Report* on this process therefore recommended a short-list of six in-catchment options that was adopted unanimously by Council on 11th March 2010.

For a more thorough options assessment, Council considered it prudent to consider the merits of the Otaki River options in conjunction with the in-catchment options. A ranked list of both in-catchment and out-of-catchment options identified as being the top options according to the results of the multi-criteria assessment is presented in Table 2 below:

Table 2 - Ranked list of both in-catchment and out-of-catchment options

In-catchment solutions		Out-of-catchment solutions	
Rank	Option	Rank	Option
4	Lower Maungakotukutuku Dam	1	Ōtaki Well field and Pipeline
5	Aquifer Storage & Recovery	2	Ōtaki River Gorge
6	River Recharge with Groundwater	3	Ōtaki River Gorge Transfer
7	Kapakapanui Dam	9	Kāpiti district Integrated Water Supply
8	Ngātiawa Dam		
10	Borefield and Storage		

For a description of each of these options and the rationale behind their ranking refer to Volume 4. Interestingly, the out-of-catchment Otaki options ranked highly under the multi-criteria assessment, largely due to the high significance placed on the criteria of water quality (the Otaki River source scored well in that regard).

### 2.4.3 Ranked Options

The aim of this stage was to present a ranked list of options, and to recommend a preferred solution. Over the course of this stage, two important developments occurred:

1. At the conclusion of Stage 2, Ōtaki River source options were not pursued further due to Council's policy preference for in-catchment sources, and also the Ōtaki community concerns of using the Ōtaki River to provide a water supply source to the out-of-catchment WPR area. However, in order to ensure that Council had sufficient information in front of it to make the best decision possible, two of the Ōtaki options were designed and costed to the same degree of detail as the six in-catchment options. The Ōtaki options were found to not sustainably provide the required amount of water to supply the WPR community and be more costly than other in-catchment options short-listed for investigation. While consultation has occurred with the Ōtaki community in general terms, there was no specific consultation in relation to these options in this stage of the project. The Ōtaki Community Board and iwi sent a clear signal to Council that the Ōtaki community did not support any option involving abstracting Ōtaki River water to supply the WPR community.
2. In addition, as investigations occurred into each of the six in-catchment solutions, some options were eliminated. The Ngātiawa Dam and Kapakapanui Dam, as well as two variations of the borefield and Storage/Treatment option were eliminated as a result of an interim report adopted by Council on 24th June 2010. These options were going to be significantly over the capital budget Council had identified.

As a result of these developments, the ranked list was narrowed down to the following:

Table 3 - Top Ranked Options

Rank	Option
1	River Recharge with Groundwater
2	Lower Maungakotukutuku Dam
3	Aquifer Storage and Recovery
4	Borefield and Treatment

RRwGW was top ranked because it prudently uses the infrastructure of the existing borefield and can be efficiently staged over time to meet increasing demand, therefore being more economically viable than the immediate high upfront cost of building a dam. RRwGW had no identified fatal flaws in terms of environmental, social, cultural and technical matters.

Based on the final assessment of these options, Council endorsed the following recommendations in August 2010:

■ **Recommendation 1: Eliminate two options**

That Council eliminate Aquifer Storage and Recovery and Borefield and Treatment Options from further consideration due to:

- a. In the case of Aquifer Storage and Recovery, risk and uncertainty and the relative untested nature of the approach in New Zealand; and
- b. In the case of the Borefield and Treatment option, cost that is over Council's allocated budget.

### ■ Recommendation 2: Preferred Solution

That Council proceed with River Recharge with Groundwater as the preferred solution and undertake the following steps to confirm the feasibility of this option:

- a. Establish a monitoring program to establish the existing salt and freshwater boundary in the aquifer, and to monitor for signs of saline intrusion;
- b. Drill test wells for the three new bores that need to be added to the overall scheme;
- c. Further pumping tests of existing wells;
- d. Optimise the approach to staging; and
- e. Complete the investigations and stakeholder consultation.

### ■ Recommendation 3: Future-Proofing WPR Water Supply

That Council future-proof the WPR water supply for the long term (e.g. 50-100 years) by:

- a. Securing an option to buy land in the short term for the Lower Maungakotukutuku Dam site;
- b. Resolving the covenant on the site (i.e. through mitigation and discussion with DoC);
- c. If successful with above, exercise option to buy and purchase land; and
- d. Signal the long-term intention to develop a dam on the site (ie in the district plan).

### ■ Recommendation 4: Ōtaki

That Council reject all options to supply WPR from the Ōtaki River source, due to:

- a. Base capital costs for the two favoured Ōtaki River options being higher than for other acceptable in-catchment solutions;
- b. Concerns regarding the ability to secure the required volume of water under the minimum flow regime; and,
- c. Community and tāngata whenua opposition to abstracting Ōtaki River water for the WPR supply.

#### 2.4.4 Detailed Assessment of River Recharge with Groundwater

A number of detailed assessments have been undertaken since RRwGW was confirmed as Council's top-ranked option in August 2010. Those investigations have been comprehensive, and included:

- Further drilling investigations to better understand the Waikanae borefield and yield;
- Demand modelling to forecast the need for water over time;
- Surface water investigations to better understand the flow of the Waikanae River;
- Waikanae River investigations to assess the effects of RRwGW on the water quality and aquatic ecology of the river;
- Groundwater modelling to assess the effects of RRwGW on the aquifer system;
- Assessment of drawdown effects on wetlands and existing bore users.
- Cultural Impact Assessment to assess cultural values and a partnership approach to water management for the RRwGW and future dam solution.

The outcomes of those investigations are set out in Section 5.

## 3 The Solution: River Recharge with Groundwater

### 3.1 Overall Concept

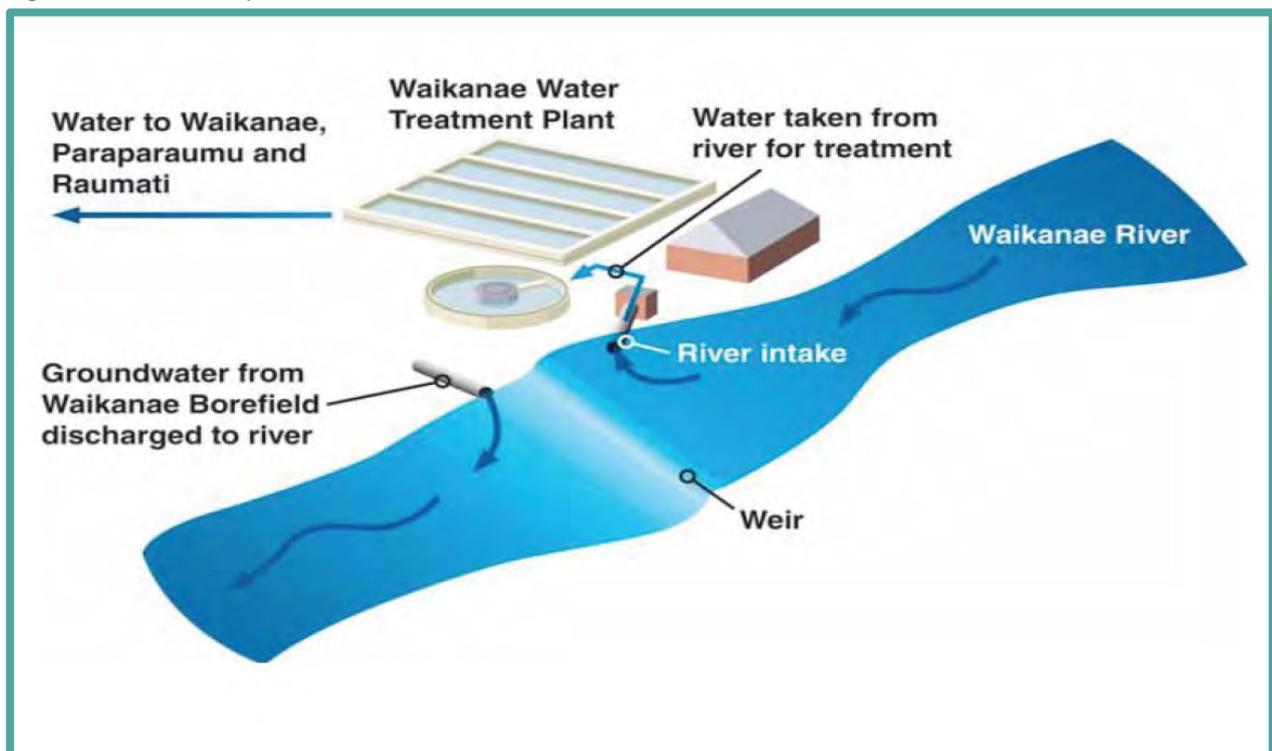
#### 3.1.1 Concept Design

The abstraction of water from the Waikanae River for water supply is limited by the minimum flow level (750 L/s) set in the Regional Freshwater Plan and Council's existing resource consent for water take. Council acknowledges that protecting the life-supporting capacity of the river with a minimum flow is critical and an important safeguard for the river. The river is in good ecological health now and Council is committed to playing its part in the sustainable management of the Waikanae River catchment. From time to time, river levels naturally fall below this minimum flow. In times of low flow (ie nearing 750 L/s), the current river water supply system switches over to groundwater supply which is piped to the Waikanae WTP from the Waikanae borefield.

The Waikanae aquifers provide a natural underground water storage system. Rainfall across the catchment is filtered through sands and gravels and seeps into the Waikanae aquifers and then very slowly travels west to the sea. The RRwGW solution continues to involve the abstraction of groundwater from the deeper Waikanae groundwater zone via the Waikanae borefield; the target aquifers being the deep Waimea aquifer and the overlying Pleistocene sand aquifer lying between approximately 40m and 80m below ground level.

However, rather than putting the groundwater into the water supply for community consumption, the water piped to the treatment plant is proposed to be discharged to the Waikanae River, immediately downstream of the water supply intake. The groundwater discharge would bolster river flows immediately downstream of the intake and thus enable more water to be taken from the river while maintaining the minimum flow. Figure 2 shows the basic concept design of RRwGW.

Figure 2 - Basic concept schematic of RRwGW



### 3.1.2 When River Recharge Would Occur

Groundwater would only be discharged to the Waikanae River during those times when the natural river flow was at a level such that demand could not be met without going below the minimum river flow of 750 L/s or natural flow if that was lower. During these low flow times, every additional litre abstracted from the river would be offset by a litre of groundwater discharged downstream. This effectively means the groundwater is supplying up to 65% of the minimum flow in the river in worst-case drought conditions, while river water is supplying the WPR community.

The recharge will occur during low river flow periods caused by extended periods of dry weather. Yield modelling has shown that with high population growth at year 2060, the recharge is expected to be needed on average on 21 days per year. Under a 50-year drought the annual use of recharge peaks at 93 days and the longest period of continuous recharge is 59 days. This statistic is the extreme scenario at full demand at 2060, but shows even then recharge will occur regularly during summer low flows rather than continuously throughout the year. In reality, the recharge project will be staged over time to incrementally match the increase in demand as illustrated in Figure 3. Therefore this proposal will be prudently staged and monitored to review environmental effects and allow adaptive management to occur over time. For example, with medium population growth at year 2016, the average recharge would be 12 days per year, with a maximum recharge of 77 days per year and the longest continuous recharge being 58 days.

Given that pumping from the groundwater bores for river recharge will not be required every day of the year and the groundwater pumping rate will often be less than the allowable maximum daily take, a maximum allowable annual volume of 2.3 million cubic metres per year (1 July to 30 June) is proposed for the groundwater take. This annual volume has been determined from modelling water demands and river flows, and includes some contingency in case the 50 year drought pattern is longer than the modelled 90 days, or in case river water cannot be used and groundwater is needed for emergency water supply (eg, severe algal bloom in river).

The existing consent to take from the river that is held by Council references the minimum flow of 750L/s as a condition of consent. It also includes as a note for Council to take best endeavours to meet a minimum flow of 850L/s. Under the proposed river recharge scheme, achieving a best endeavour flow of 850L/s would result in the need for additional bore field pumping and river recharge use as set out in Table 4. The minimum flow of 750L/s is considered to be appropriate minimum flow for the Waikanae River and Council proposes to adopt that legal minimum for this application. It is considered that the best endeavours flow will not be valid or necessary in the future.

Table 4 - Difference in river recharge use between a minimum flow of 750L/s and 850L/s

	750 L/s	850 L/s	Difference
Average number of days RRwGW used per year	15-21	23-29	+8 days
Maximum number of days RRwGW used in a year	84-93	96-99	+6-12 days
Longest continuous use of RRwGW (days)	59	69	+10 days
Average continuous RRwGW use (days)	8-10	11-13	+3 days
Average RRwGW volume (m <sup>3</sup> /day)	5,600 – 7,100	7,500 – 9,900	+1,900-2,800 m <sup>3</sup> /day
Max RRwGW volume (m <sup>3</sup> /day)	24,400 – 30,900	24,600 – 31,100	+200 m <sup>3</sup> /day

Under very unusual conditions it is possible for the WTP or the trunk mains to experience a failure for a couple of hours, that requires the WTP to abstract, treat and deliver the day's demand over less than 24 hours (for example 22 hours). If such an event coincided with the operation of RRwGW, and the borefield at that time had only sufficient capacity to meet the day's demand over 24 hours, then the borefield would not be able to match the recharge with the abstraction on a litre for litre basis. For this reason, and for the purposes of demonstrating compliance, the water abstracted and that recharged under RRwGW will be determined over a 24 hour period (midnight to midnight), rather than on an instantaneous basis.

This proposal is an efficient use of the already significant community investment in the Waikanae borefield. Under this scheme, the borefield can be expanded in stages when demand increases for more water. This application seeks to consent the water take required for up to a maximum consent period of 35 years (being 30,700 m<sup>3</sup>/day), with that water able to be taken from the Waikanae borefield as defined on the Location Plan in Appendix 1. While specific new bore locations are identified at N2, N3, S1 and S2, in order to maintain an ability to manage the potential effects for the borefield operation over time, consent is sought for the rate of abstraction from the bores as currently defined or from other locations within the aquifer area. In the event that bore locations do change, a condition of consent is proposed to ensure that at least one month prior to construction works commencing, Council shall submit to GWRC for approval a Construction Methodology Statement and Construction Environmental Management Plan that specifies the location of the bore and nature of the works proposed.

### 3.1.3 Quality of the Groundwater Discharged to the Waikanae River

The overall water quality from the borefield is of an acceptable quality to be discharged into the Waikanae River. It has a different chemical make-up than surface water, having been filtered through the aquifer and therefore having a higher mineral content (hardness). Its quality is similar to a naturally occurring spring-fed stream; RRwGW has been likened to introducing a spring-fed stream to the Waikanae River.

Table 5 - Chemical Characteristics of Waikanae River water and Waikanae borewater

Parameter	Units	Median (Range) for Waikanae River	Median (Range) for Waikanae bore water
pH		7.4 (6.8-8.2)	7.8 (7.5-8.3)
Conductivity	mS/m	10 (9-12)	100 (50-150)
Total Hardness	g/m <sup>3</sup> as CaCO <sub>3</sub>	19 (18-22)	140 (20-200)
Alkalinity	g/m <sup>3</sup> as CaCO <sub>3</sub>	20 (16-21)	210 (80-290)
Bicarbonate	g/m <sup>3</sup>	24 (19-26)	250 (100-360)
Calcium	g/m <sup>3</sup>	4.9 (4.5-5.9)	30 (3-52)
Magnesium	g/m <sup>3</sup>	1.8 (1.6-2.0)	13 (3-18)
Sodium	g/m <sup>3</sup>	10 (8-12)	160 (40-240)
Chloride	g/m <sup>3</sup>	15 (13-19)	180 (60-370)
Ammoniacal-Nitrogen	g/m <sup>3</sup>	0.005 (0.002-0.05)	0.16 (0.01-0.38)
Dissolved Reactive Phosphorus (DRP)	g/m <sup>3</sup>	0.008 (0.004-0.010)	0.09 (0.02-0.12)
Total Iron	g/m <sup>3</sup>	0.04 (0.01-0.06)	0.08 (0.01-0.90)
Total Manganese	g/m <sup>3</sup>	0.0011 (0.0007-0.0016)	0.09 (0.02-0.20)
Temperature	°C	13 (5-20)	15 (14-17)

A detailed water chemistry report is provided in Appendix 6 of this report. The Waikanae borefield water can largely meet the permitted activity standards of Rule 1 of the Regional Freshwater Plan (discharge of water and minor contaminants to surface water). Rule 1 specifies that the discharge of contaminants, or water, into surface water is a Permitted Activity provided the discharge complies with the conditions specified in Table 6 below.

Table 6 - Proposed discharge in relation to the conditions of Rule 1 of the Regional Freshwater Plan

Condition	Comment
(1) the discharge is not to any wetland, lake or river being managed in its natural state (Appendix 2, part A); and	Complies – the Waikanae River is not managed in its natural state below the Waikanae WTP site where the discharge will occur.
(2) the discharge shall not contain any contaminants other than [contaminants at concentrations specified in] conditions (3) to (7) below; and	Does not comply – technically ‘any contaminant’ includes some of those chemical components of groundwater that are different to Waikanae River water as listed in Table 5 (such as DRP for example)
(3) concentrations of free or combined residual chlorine in the discharge shall be no more than 0.5 g/m <sup>3</sup> ; and	Complies – No free or combined residual chlorine in the untreated borewater
(4) concentrations of suspended solids in the discharge shall be no more than 50 g/m <sup>3</sup> ; and	Complies – the properly designed and constructed wells will not produce water with a suspended solids concentration of this order
(5) concentrations of acid-soluble aluminium in the discharge shall be no more than 0.15g/m <sup>3</sup> ; and	Complies
(6) concentrations of fluoride in the discharge shall be no more than 1.5 g/ m <sup>3</sup> ; and	Complies
(7) the discharge temperature shall not differ from the ambient temperature of the receiving water by more than 5 degrees Celsius; and	Does not comply - conservatively the temperature of the groundwater may differ from the ambient temperature of the receiving Waikanae River water by more than 5 degrees Celsius (the groundwater will be cooler than the river water in summer and vice versa in winter)
(8) the discharge does not cause erosion at the point of discharge; and	Complies – the discharge point will be suitably designed so that it does not cause erosion at the point of discharge
(9) the discharge does not alter the natural course of the river or stream.	Complies - the discharge will be suitably designed so that it does not alter the natural course of the Waikanae River

The RRwGW scheme taps the deep aquifers of the Waikanae borefield located approximately 80m below ground level. The risk of contamination of the water stored in the aquifers at this level is very low. The Waikanae borefield aquifers are semi-confined and interconnected however, and there is some possibility that a land-based spill of contaminants could permeate to these deeper waters (for example a tanker spill on State Highway 1 or a contaminant spill at an industrial site). These types of rare hazard events will simply need to be monitored and assessed should they ever occur as they would currently be by GWRC and relevant public health organisations. Equally, there is some potential for the Waikanae River to become contaminated through a spill into the river or nearby. This is a potential water quality risk for any water supply (river or aquifer) through-out the country and there are existing emergency response procedures and protocols for contaminant spills in place for these types of events. Again, the scheme operating with two raw water sources provides additional resilience in the future if such an event were to occur.

## 3.2 Extended Borefield and Pipeline

### 3.2.1 Overview

The proposed RRwGW scheme comprises a staged extension to the existing Waikanae borefield to match the peak daily demand of the WPR community over time. The current Waikanae borefield was designed to supply 23,000 m<sup>3</sup>/day. Therefore, the borefield needs to be extended in order to meet the forecasted peak yield of 30,700 m<sup>3</sup>/day in 2049 (being the 35 year consent duration, ending 2049, based on start date of 2014). There will need to be some flexibility over time to allow Council to modify the staging of bore implementation; modify individual take volumes from bores based on performance and monitoring outcomes; modify or add new monitoring saline monitoring wells; and potentially decommissioning bores and/or introducing new working bores over time to provide for the total volume of 30,700 m<sup>3</sup>/day sought under this 35-year consent. Council is therefore seeking a total take of up to 30,700 m<sup>3</sup>/day, able to be taken from the Waikanae borefield as defined on the Location Plan in Appendix 1. The description provided below is indicative only at this stage and will be confirmed at detailed design. The information is provided to give a full description of the RRwGW scheme.

### 3.2.2 Staging over Time

Based on the forecasted peak daily demand for the WPR area out to 2060, the project will be broken down into four stages as summarised in Table 7. Note that Stage Four falls outside of the timeframe of a 35-year consent. The stages relate specifically to the yield required and not to the specific bores. The order of bore development and connection is proposed based on current information. It may be that as a result of monitoring effects that Council needs to commission new bores earlier and then spread the same rate of abstraction over a larger area. This could be done, for example, to reduce effects such as on wetlands or saline intrusion risk.

Table 7 - Proposed Staging for RRwGW

Stage	Indicative Scope of Work (subject to detailed design)	Total Yield#	Estimated Timing*
One	Wellheads for bores Kb7, K12 and N2 Pipeline from bore N2 along Ngarara Road and End Farm Road to Smithfield Road Pipeline from bore K12 along Smithfield Road to bore K6 on Ngarara Road Possibly duplicate or upgrade existing pipeline along Ngarara Road Further develop bore K10 and replace pump to increase yield Bore K13 taken out of service due to poor water quality New pipework within Waikanae WTP and recharge outfall Modifications to existing river intake at Waikanae WTP	23,600 m <sup>3</sup> /day	2014
Two	Construct and develop production bore N3, including wellhead Pipeline from N3 to N2 Possibly further duplicate or upgrade existing pipeline along Ngarara Road Replace pumps in bores, Kb4, K4 and K5 to increase yield	28,800 m <sup>3</sup> /day	2033
Three	Construct and develop production bore S1, including wellhead Pipeline from bore S1 to M2PP Expressway corridor, over Waikanae River to Te Moana Road and connecting to existing pipeline	30,900 m <sup>3</sup> /day	2041
Four	Construct and develop production bore S2, including wellhead Pipeline from bore S2 to bore S1	32,700 m <sup>3</sup> /day	2051

# Yield is dependent on further development at K10 and future production bore drilling.

\* Timing depends on actual growth and per capita peak demand – staging may be brought forward or extended - the nature of the RRwGW solution easily allows for this.

Figure 3 - 50 year solution and 35 year consent

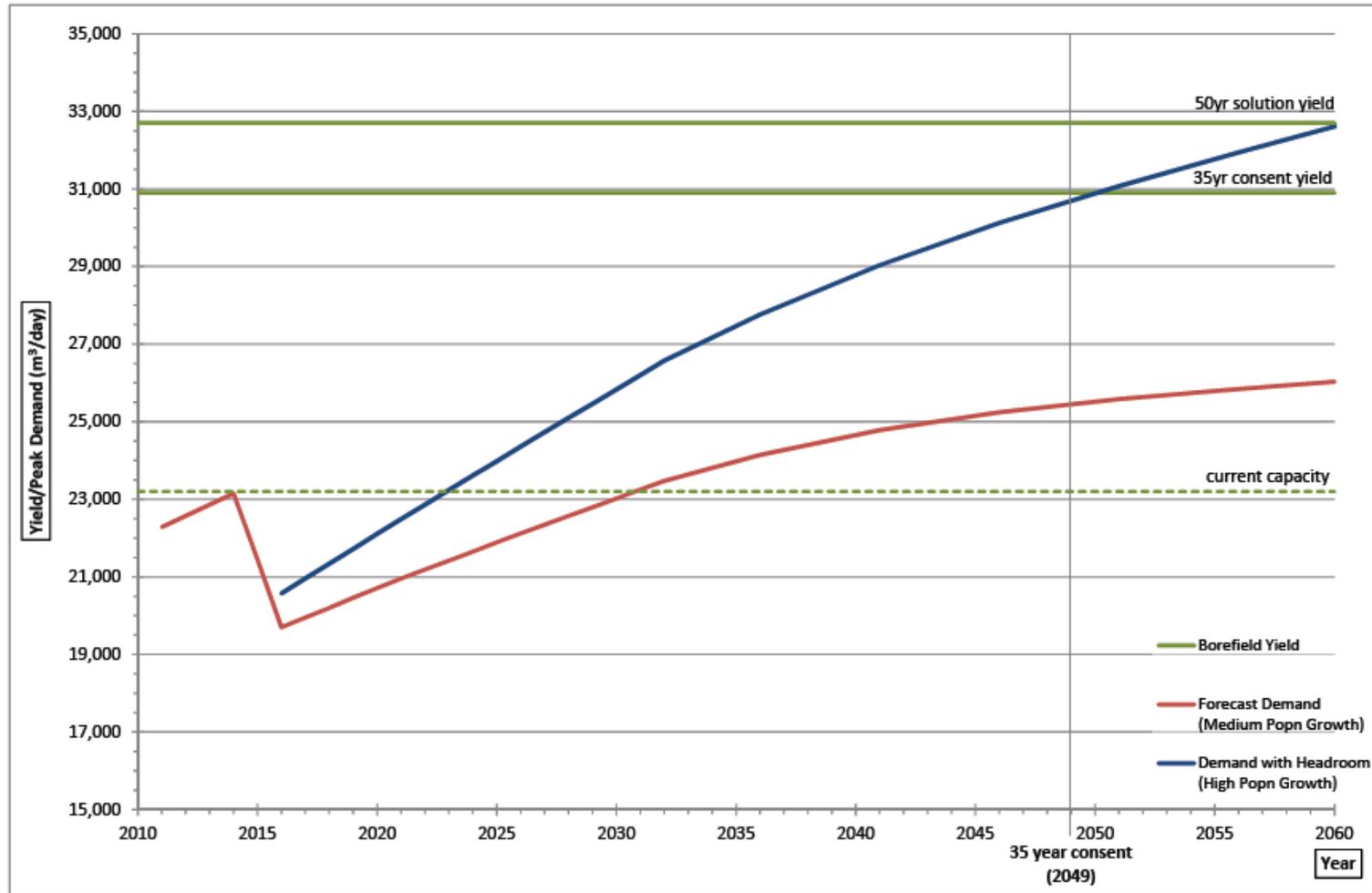
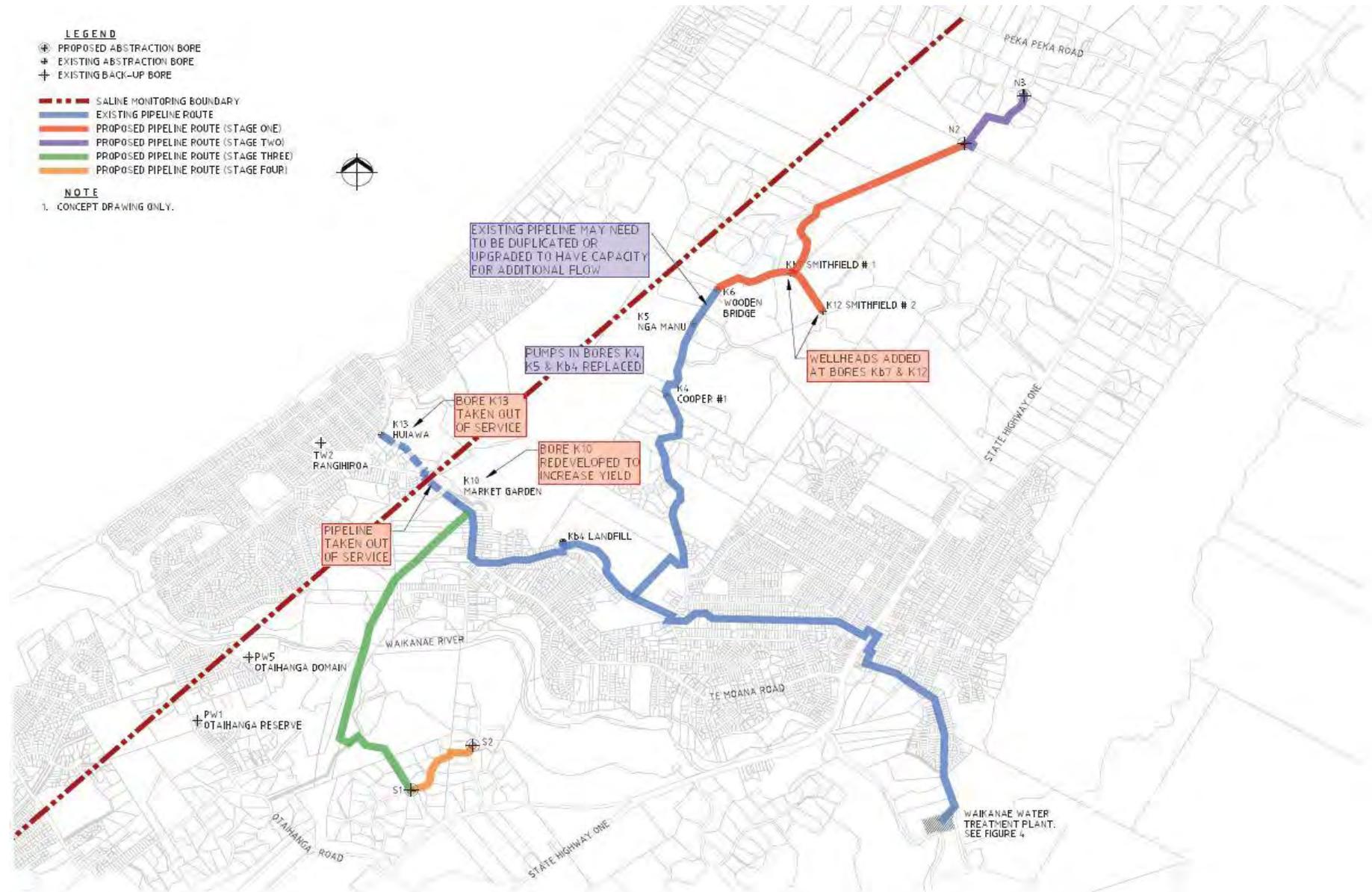


Figure 4 - Proposed staging of RRwGW



### 3.2.3 Bore Yields

Table 8 sets out the maximum yield for each completed production bore and also the expected yields for those wells that have not yet been constructed. Refer to the Location Plan provided at Appendix 1 for the location of each bore.

Table 8 - Maximum yield (L/s) for each production bore at each stage

Bore	Existing	Stage One	Stage Two	Stage Three	Stage Four
K13	58	-	-	-	
K10	17	36*	36	36	36
Kb4	35	35	45	45	45
K4	65	65	80	80	80
K5	36	36	46	46	46
K6	58	58	58	58	58
Kb7	-	8 <sup>∞</sup>	8	8	8
K12	-	10 <sup>∞</sup>	10	10	10
N2	-	25	25	25	25
N3	-	-	25 <sup>#</sup>	25	25
S1	-	-	-	25 <sup>#</sup>	25
S2	-	-	-	-	20 <sup>#</sup>
Total (L/s)	269	273	333	358	378
Total (m <sup>3</sup> /day)	23,200	23,600	28,800	30,900	32,700

\* This yield needs to be confirmed by further development at K10. Any shortfall will be made up by bringing forward the Stage Two work on bores Kb4, K4 and K5.

<sup>∞</sup> From *Waikanae Borefield Technical Report (update of report issued 27 July 2004)*, URS, December 2005

<sup>#</sup> These yields are estimated from the investigation bores. Actual yields are dependent on production well completion.

In addition to the identified bores above (a total of 11 when K13 is decommissioned), there will need to be some flexibility over time to allow Council to modify the staging of bore implementation; modify individual take volumes from bores based on performance and monitoring outcomes; modify or add new monitoring sentinel wells; and potentially decommissioning bores and/or introducing new working bores over time to provide for the total volume of 30,700 m<sup>3</sup>/day sought under this 35-year consent. Council is therefore seeking a total take of up to 30,700 m<sup>3</sup>/day, able to be taken from the Waikanae borefield as defined on the Location Plan in Appendix 1.

### 3.2.4 Production Bores

Table 9 - Production bore depths

Production Bore		Depth from which water is abstracted (m below ground level)	
K13	Huiawa	74-79	Note (1)
K10	Market Garden	60-97	
Kb4	Landfill	66-74	
K4	Cooper #1	68-73	
K5	Nga Manu	77-98	
K6	Wooden Bridge	64-66	
Kb7	Smithfield #1	73-82	
K12	Smithfield #2	67-76	
N2		53-58	
N3		62-70	Note (2)
S1		60-72	Note (2)
S2		40-50	Note (2)

(1) This bore will be decommissioned.

(2) Only investigation bores have been drilled at these sites. The production bores will be drilled in the future when required to meet demand. Locations and abstraction depths are indicative only.

### 3.2.5 New Wellheads (Kb7 and K12)

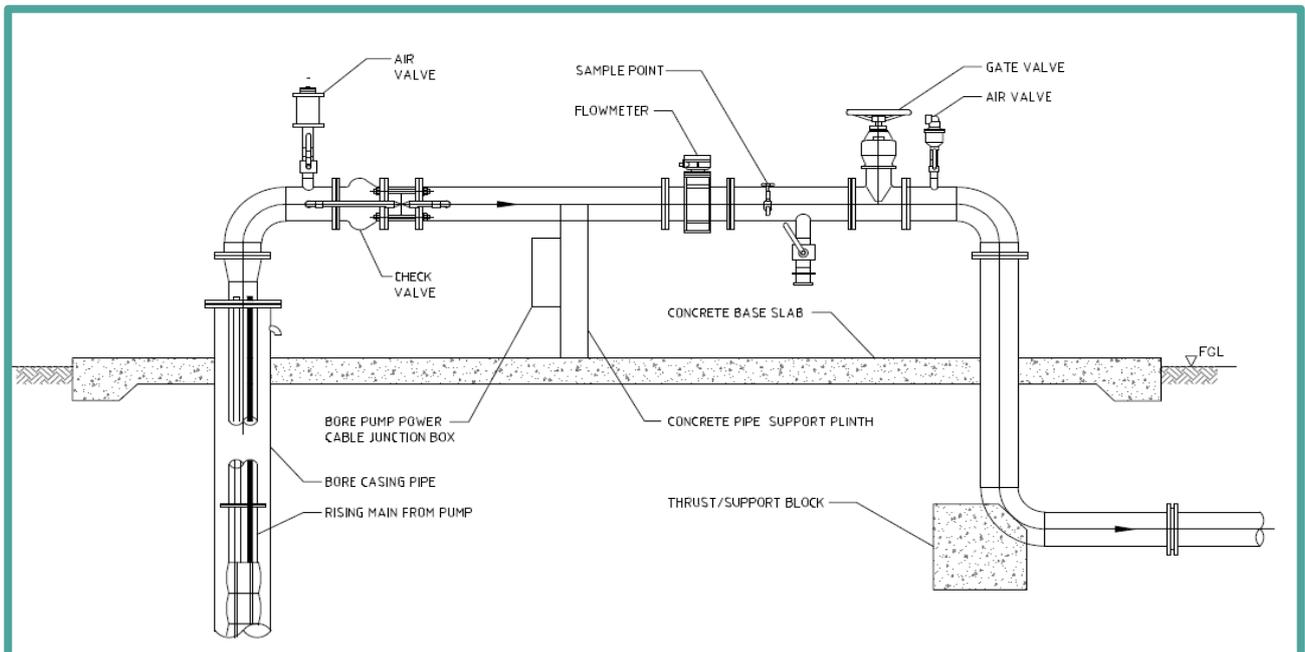
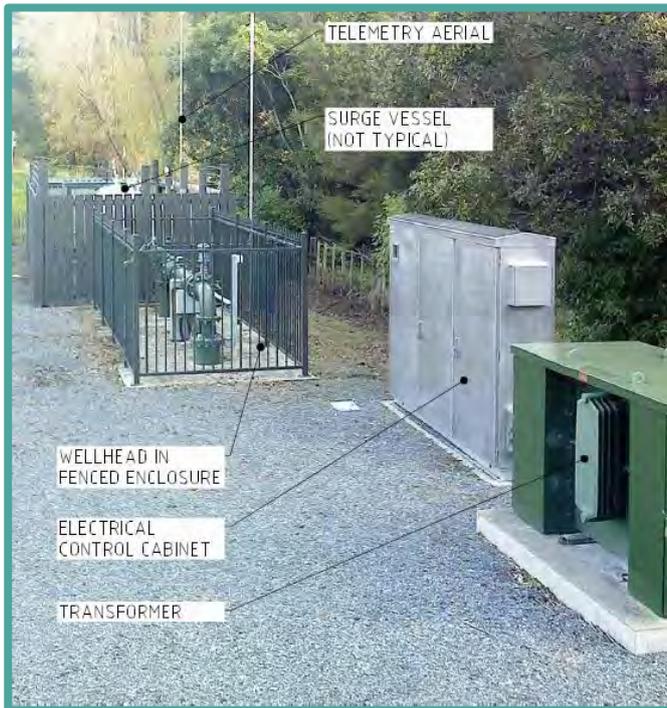
Bores Kb7 and K12 on Smithfield Road were drilled and completed as production wells in 2004, but they were not furnished with pumps or wellheads and they are not connected to the borefield pipeline. Nevertheless abstraction from these two wells is permitted under the terms of the current consent held by Council for the Waikanae borefield. Bore Kb7 is screened 73-82m below ground and bore K12 is screened 67-76m below ground. The well casings of both bores are 250mm diameter.

A wellhead arrangement, similar to the existing production bores, will be constructed at each bore location during Stage 1. This will include:

- a borehole pump located within the bore casing
- a concrete ground slab (approximately 6m x 2.5m in area)
- above ground pipework, with valves, sampling points, pressure monitoring and flow measurement
- a fenced enclosure (1.8m high) around the bore and pipework
- an electrical control cabinet
- mains power supply, which will require a transformer either at ground level or pole mounted
- telemetry to send/receive signals to/from the Waikanae WTP for remote monitoring and control
- provision for portable generator.

Figure 5 shows the typical arrangement for an above ground wellhead.

Figure 5 - Typical above ground wellhead arrangement



### 3.2.6 New Abstraction Bore (N2)

The production bore N2 at the northern extent of Ngarara (paper) Road has recently been constructed (consented under WGN110166 [30809]). This bore has a 300mm diameter casing and will be capped with a blank flange until the construction of the wellhead in 2013-2014. The bore is screened at 53-58m below ground with a 300mm diameter outer screen and 150mm diameter inner screen. At this location, a wellhead arrangement similar to the existing production bores will be constructed.

There is currently no mains power at site N2. Power is required to operate the borehole pump, instrumentation, controls and telemetry. Mains power could be brought to the site from Smithfield Road or Kensington Drive. This will require a transformer for the site either at ground level or pole mounted. Alternatively, or as an interim measure, an on-site generator could be used for power supply, which will need an enclosure to minimise noise and a diesel fuel storage tank. This will not require any specific resource consent.

There may need to be a surge vessel located adjacent to bore N2 to manage pressure variations in the pipeline that may occur when the bore pumps start and stop. This would be similar to the existing vessels at K13 and K6. A typical surge vessel arrangement is shown in Figure 6. The need for a surge vessel at this location will be determined by surge analysis as part of later design work.

Figure 6 - Typical surge vessel arrangement



### 3.2.7 Modified Bores (Kb4, K4 and K5)

Stage Two of RRwGW includes modifications to the existing bores Kb4, K4 and K5 to increase their yield. This will be achieved by replacement of the existing borehole pumps with larger pumps. This may also require further development of the wells and upgrades of the power supply and wellhead pipework at each bore site.

### 3.2.8 Proposed Bores (N3, S1 and S2)

Stage Two of RRwGW also includes construction of a production bore at site N3 on Kensington Drive.

Stages Three and Four of RRwGW involve construction of production bores south of the Waikanae River. A production bore at site S1 on Greendale Drive will be constructed as part of Stage Three. A production bore at site S2 on King Arthur Drive will be constructed as part of Stage Four.

The proposed production bores will be located in road reserve some 10-15m from the investigation bores that were drilled in 2011-2012 and have been completed as monitoring wells. The construction methodology for the proposed production bores will be very similar to the construction of the production bore N2.

The bores will be constructed with a sanitary seal to ensure that surface water or shallow groundwater cannot enter the deeper aquifers by moving down through the annulus between the well casing and the formation. The casings will likely be 300mm diameter and each bore will have a screen assembly (length and slot size) specifically designed according to the local geology and design yield.

Following drilling and completion of the screen assembly, the bore will be developed until the abstracted water is clear and sand free. This development will likely be carried out by a combination of air lift pumping, mechanical surging and pumping. Once the well is fully developed a stepped rate well test (5 hours duration) will be conducted, followed by a constant rate aquifer test for 14 days with a recovery period of approximately 10 days duration. The groundwater discharged from the pumping tests will need to be diverted to a stormwater drain or elsewhere that is not in direct contact with the aquifer system.

Each of the three new production bores will be completed with a wellhead arrangement similar to the existing production bores, or with appropriate technology available at the time of bore development.

There is mains power available at each of the three sites, although a transformer (at ground level or pole mounted) will be required. Figure 5 shows the typical arrangement for the wellhead.

There may need to be a surge vessel located at site S1 or S2. This would be similar to the existing vessels at K13 and K6 as shown in Figure 6. The need for this a surge vessel be determined by surge analysis as part of later detailed design work.

### 3.2.9 Indicative pipeline route

An indicative pipeline route required for the extended borefield is shown on the Location Plan in Appendix 1. Wherever possible the new pipes will be laid within public road reserve and where practicable in the road berm outside of the carriageway. The actual alignment will be confirmed at detailed design. The indicative route is described below in Table 10.

Table 10 - Indicative pipeline route description

Stage	Indicative description of the pipeline route and works
One (2014)	Stage One involves a new pipeline along Smithfield Road from bore K12 to bore K6, via bore Kb7. There will also be a new pipeline from bore N2 to Smithfield Road, via Ngarara paper road and End Farm road.
Two (2033)	Stage Two includes a new pipeline from bore N3 to bore N2. The route of this pipeline from Kensington Drive to Ngarara paper road will traverse private land. An easement will be needed for the pipeline in private property. The existing pipeline on Ngarara Road will likely need to be duplicated or upgraded as part of Stage Two to carry the additional flow resulting from the modifications to the existing bores (K4, Kb4 and K5) and a production well at N3. The extent of this work will be determined by hydraulic analysis as part of later design work.
Three (2041)	A new pipeline will be required to connect bore S1 to the existing borefield. It is proposed that the pipe run northwards through Greendale Reserve adjacent to the Muaupoko Stream, across private land and onto the proposed NZTA Mackays to Peka Peka expressway designation. From here the pipeline will follow the route of the expressway, crossing the Waikanae River attached to the proposed expressway bridge, and connect to the existing pipeline on Te Moana Road south of bore K10. This of course will be subject to the NZTA expressway proposal being approved and the Waikanae expressway bridge constructed around 2041.
Four (2051)	A new pipeline will be required to connect bore S2 to the borefield at bore S1. This pipeline will be routed via the reserve/accessway between King Arthur Drive and the end of Greendale Drive.

Pipe diameter, material and class selection and final route location will be confirmed at detailed design. The new pipes are likely to be 150-250mm diameter. The pipes will typically be installed approximately 1m below ground.

The pipelines will include line valves, air release valves and scour valves. Line valves and scour valves will be buried with a standard valve box above, while air release valves will be installed in a below ground chamber. Scour valves are used to drain the contents of the pipeline for maintenance or repairs, and these will be connected to Council's stormwater system or similar and are therefore not identified as requiring resource consent for discharge.

In addition to the Waikanae River crossing, there will be some minor stream crossings required (for example at Kakariki Stream and Ngarara Creek during Stage 1 and Muaupoko Stream during Stage 4). There may be other minor water crossings such as larger farm drains depending on the final route chosen. For these minor stream crossings it is expected that the pipeline will be installed beneath the stream. This will be confirmed at detailed design for each specific stream crossing. For deeper and wider stream crossings, the pipe may be installed over the stream with anchor blocks either side of the stream, similar to the existing pipe crossing over the Ngarara Stream near to bore K6. Council is not seeking resource consent for these minor stream crossings at this stage as it is more appropriate to seek these once a final route and detailed design is confirmed. Stage 1 stream crossings will be minor only; there are no stream crossings identified for Stage 2, the Waikanae River crossing for Stage 3 is some time away and reliant on the NZTA expressway to be approved and Stage 4 is decades away. Should the NZTA expressway not be approved, or approved via a different route, the Stage 3 crossing of the Waikanae River will be reconsidered and a route confirmed linking the southern bores to the Waikanae WTP. It is expected that the effects of stream crossings would be minor and manageable through conditions of consent and that any consent would be non-notified.

### 3.2.10 Operation, maintenance and monitoring

The operation, maintenance and monitoring of the extended Waikanae borefield will be similar to the current Waikanae borefield procedures undertaken by Council. The existing Waikanae Borefield Operating and Maintenance Manual and Waikanae Borefield Monitoring Manual will need to be updated at each stage of the project to reflect the additions or changes to the borefield over time. This is proposed as part of the conditions of consent.

When groundwater is required for river recharge, the production bores will be pumped according to a defined operating logic. Factors influencing this logic are bore yield, hydraulics, distance of the bore from other bores in use and bore water quality (particularly dissolved reactive phosphorus – where bores of lower concentrations will be used first). The maximum drawdown in the wells has been determined by the groundwater investigations and modelling. As with the existing borefield, volumes abstracted will be logged, shallow and deep groundwater levels will be monitored and conductivity will be monitored in saline intrusion monitoring wells.

When the RRwGW scheme is not in use, the bore pumps will be regularly exercised to check their operation. The pumps may also be used for groundwater quality sampling and flushing the borefield pipelines. Water abstracted from these operations will be either conveyed to the Waikanae WTP and discharged to the Waikanae River or discharged locally via scour valves to appropriate locations.

Each production bore will be visited periodically by Council staff or contractors for inspection of the wellhead condition. Any damage to the wellhead or faulty equipment will be remedied as soon as possible. The pumps, instrumentation and electrical equipment will be routinely serviced according to the manufacturers' recommendations. This may necessitate removal of the pump.

As is normal for groundwater wells, replacement of the screen and/or re-development of a bore may be required at some point in the future if the bore's performance declines.

Groundwater monitoring wells for which Council is responsible for (as opposed to GWRC's monitoring wells) will be visited periodically for inspection, manual level measurement or to install transducers for specific investigations. Maintenance of the monitoring wells will involve clearing vegetation or debris from the surface around the wells and if necessary, flushing to remove accumulated sediment from the well.

Operation and maintenance activities associated with the pipelines will include inspecting and exercising valves from time to time and servicing the valves if required. If there is a pipe burst or leak detected along the pipeline, the pipe will be excavated locally and repaired.

### 3.2.11 MacKays to Peka Peka Expressway considerations

The proposed NZTA MacKays to Peka Peka Expressway will cross the existing borefield pipelines at Te Moana Road (near bore K10) and at Ngarara Road (between bores K4 and K5). The expressway route will also cross the proposed pipeline on Smithfield Road between bores Kb7 and K12. It is proposed to locate the pipeline from the southern bores within the M2PP expressway corridor and use the expressway bridge to support the pipe across the Waikanae River. Discussions are ongoing between NZTA and Council with regards to the interaction between the expressway and the water supply project and it is expected these discussions will continue for detailed design of both projects in the future. As far as we are aware, there are no consenting implications for regional approvals between the two projects. This will be reconfirmed at the detailed design stage for both projects.

In terms of the existing environment, we have worked on the basis that the expressway is consented, acknowledging that planning approval and the timing of that NZTA project is uncertain. The key interaction will likely be the first few years of the expressway construction, when the NZTA project requires water for construction activities. Council is an alliance partner to that NZTA project and agreements are in place to ensure that the expressway project does not conflict with or jeopardise the RRwGW proposal.

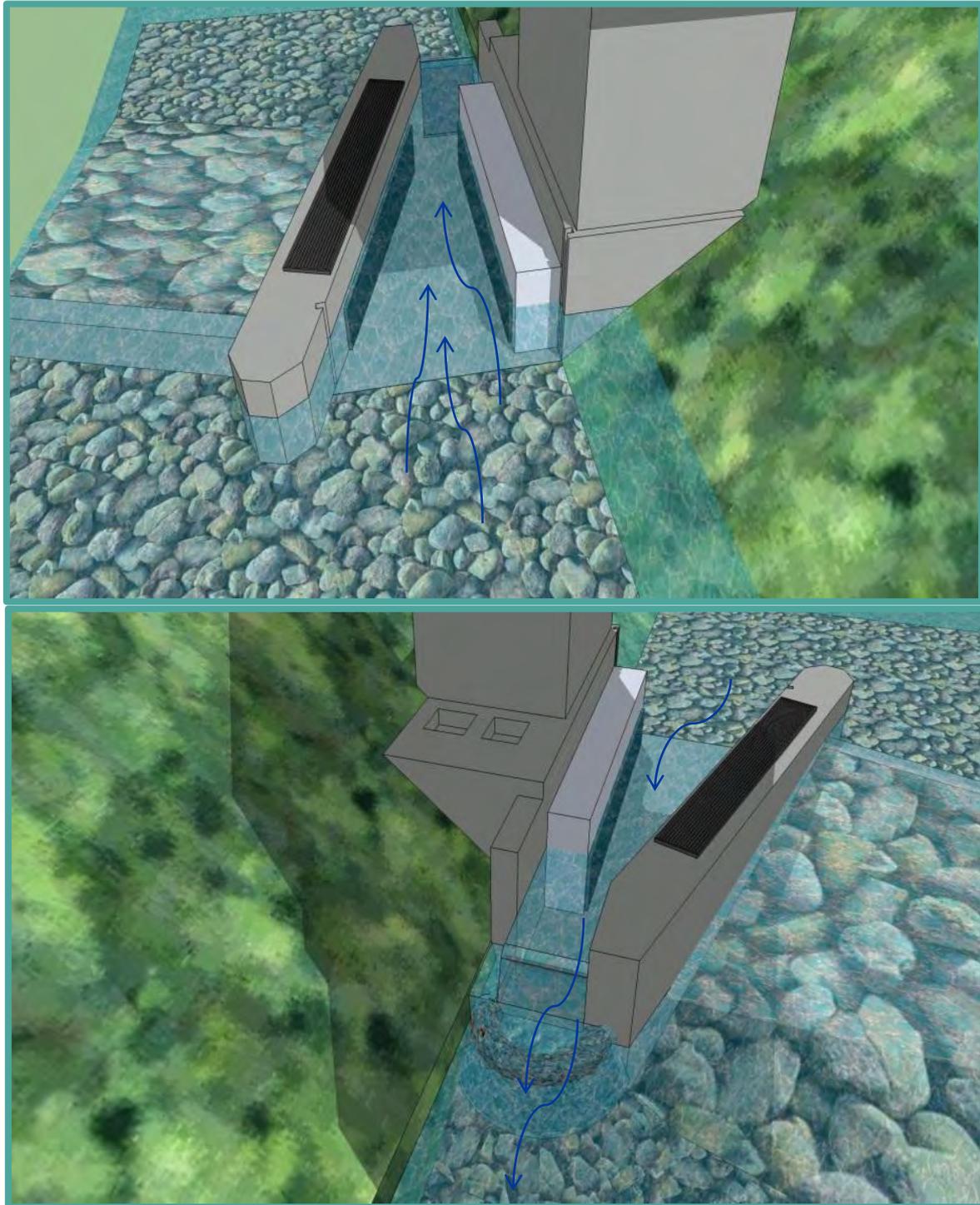
## 3.3 Waikanae Water Treatment Plant Site Works

### 3.3.1 Intake Structure

#### Concept design

The existing intake structure at the Waikanae WTP will remain largely as is, with some minor modifications proposed to improve fish passage and cleaning of the intake screen. A maximum velocity through the intake screens of approximately 0.12m/s and a maximum wedgewire slot size of 2mm is proposed as recommended by NIWA ( NIWA: 2007: Fish screening: good practice guidelines for Canterbury). To meet these guidelines the existing intake screen will be replaced and also a new vertical screen running the full length of the right side of the intake channel (on the pump station side) will be installed. The replacement screen will be fixed to the existing concrete structure, while the new screen will be supported by a new stainless steel frame which will be attached to the existing concrete structure. For the new screen, holes will be cut into the concrete floor of the intake channel so that screened river water can flow into the pump station wet well.

Figure 7 - Concept schematic minor modifications to the intake structure



A new control gate at the downstream end of the intake channel is proposed to replace the existing central pivoting gate. The new control gate will ensure the full screen area is utilised during low river flow conditions. The gate will be set such that at least 100 L/s passes over the gate to allow downstream fish passage. A new plunge pool (at least 0.5 m deep) will be formed on the downstream side of the gate to ease re-entry into the river for fish travelling downstream. Under these low flow conditions the minimum sweep velocity along the screen requirement will be met.

There are two low points (notches) in the existing weir across the river for fish passage upstream and downstream the river: one in the centre of the weir and the other toward the left bank. The central fish passage is lower than the left bank one and the weir either side of the notch is sloped to create a V-shape. Both notches are approximately 100-150 mm deep and 0.75 m wide. Council will maintain a flow over the intake gate and weir at all times to allow fish passage

To reduce manual cleaning of the intake screens an air-burst cleaning system is proposed which will operate periodically pushing compressed air back through the screens and dislodging any debris accumulated on the screen. The air compressor, receiver and controls will be located within the WTP site, with an air pipeline running from the compressor to pipework and nozzles positioned behind the vertical intake screens. The compressed air system will have an oil filter.

The existing intake has a horizontal storm screen on top of the intake structure that ensures water still flows into the raw water pump station wet well if the main screen is blocked by debris. The existing storm screen will be removed and replaced with wedgewire with 2 mm slot size. No air-burst system will be provided for this screen.

### Anticipated physical works

The following works are anticipated:

- Saw cut rectangular penetrations into the existing precast concrete intake channel floor.
- Replace the two existing screens (vertical and storm) with new prefabricated wedgewire screen units.
- Install prefabricated stainless steel screen box, including the new wedgewire screen, on the right hand side of the intake channel.
- Install air pipework within existing intake structure for new airburst cleaning system, plus an air pipeline down the river bank from the water treatment plant site to the intake.
- Remove old control gate and install the new control gate.
- Place rip-rap and pour concrete immediately downstream of control gate to form the plunge pool.

These works will need to be completed in stages during scheduled WTP shutdown periods (i.e. pumps would not be operational) and will require a dry working area, which will be created by diverting the river away from the intake channel by locating stop logs at the upstream end of the existing intake channel, possibly in conjunction with sand bags. These works will be confirmed at detailed design. Council proposes that a Construction Methodology Statement and a Construction Environmental Management Plan will be submitted to GWRC for approval at least one month prior to these works being undertaken.

### Operation, maintenance and monitoring

The operation, maintenance and monitoring of the Waikanae WTP intake structure will be similar to the current Waikanae WTP procedures undertaken by Council. The existing Waikanae WTP Operating and Maintenance Manual and Monitoring Manual will need to be updated to reflect the changes to the intake structure and operation. This is proposed as part of the conditions of consent.

Operation of the airburst system and control gate will be automated and controlled from the Waikanae WTP. The existing screens require manual cleaning of the screen surface with a brush. With the installation of the automated airburst system the need for manual cleaning should be minimal. Maintenance of the intake will likely involve servicing the airburst nozzles and control gate, and periodically removing any debris or gravels that may have accumulated in the intake channel. Occasionally large logs become trapped in the intake and need to be taken out. To maintain fish passage any build-up of fine material amongst the boulders on the downstream side of the weir crest should be removed.

### 3.3.2 Discharge Structure

#### Concept Design

Groundwater will be pumped from the Waikanae borefield to the Waikanae WTP site and then discharged to an open channel that will direct the recharge water to a series of discharge outfall pipes as shown in Figure 8.

The design of the discharge and open channel structure has been modified in response to recommendations by the Water Working Group (WWG) to normalise the water by exposing it to air and land prior to entering the Waikanae River. In consultation with the WWG, Council proposes to discharge the groundwater to an open channel to normalise the water, before again being discharged by a series of pipe portals into the Waikanae River. Normalise means in a cultural sense to reintroduce groundwater to the surface and allow some aeration and temperature moderation firstly, rather than being directly piped and discharged to the river. This discharge method to land first and then the river is proposed over the alternative to pipe and discharge groundwater directly to the river. The open channel will be designed to meander and will be planted with appropriate species either side to provide a degree of natural amenity. The channel will not be a permanently wet environment, but rather will be wet only during periods of discharge from the pipes above the channel. The final design of the channel and discharge structure will be confirmed at detailed design. Council considers this method will have less adverse effects on the receiving environment than a direct discharge of groundwater to the river (allowing for aeration and perhaps some temperature moderation) and is a good outcome of the working partnership with the WWG.

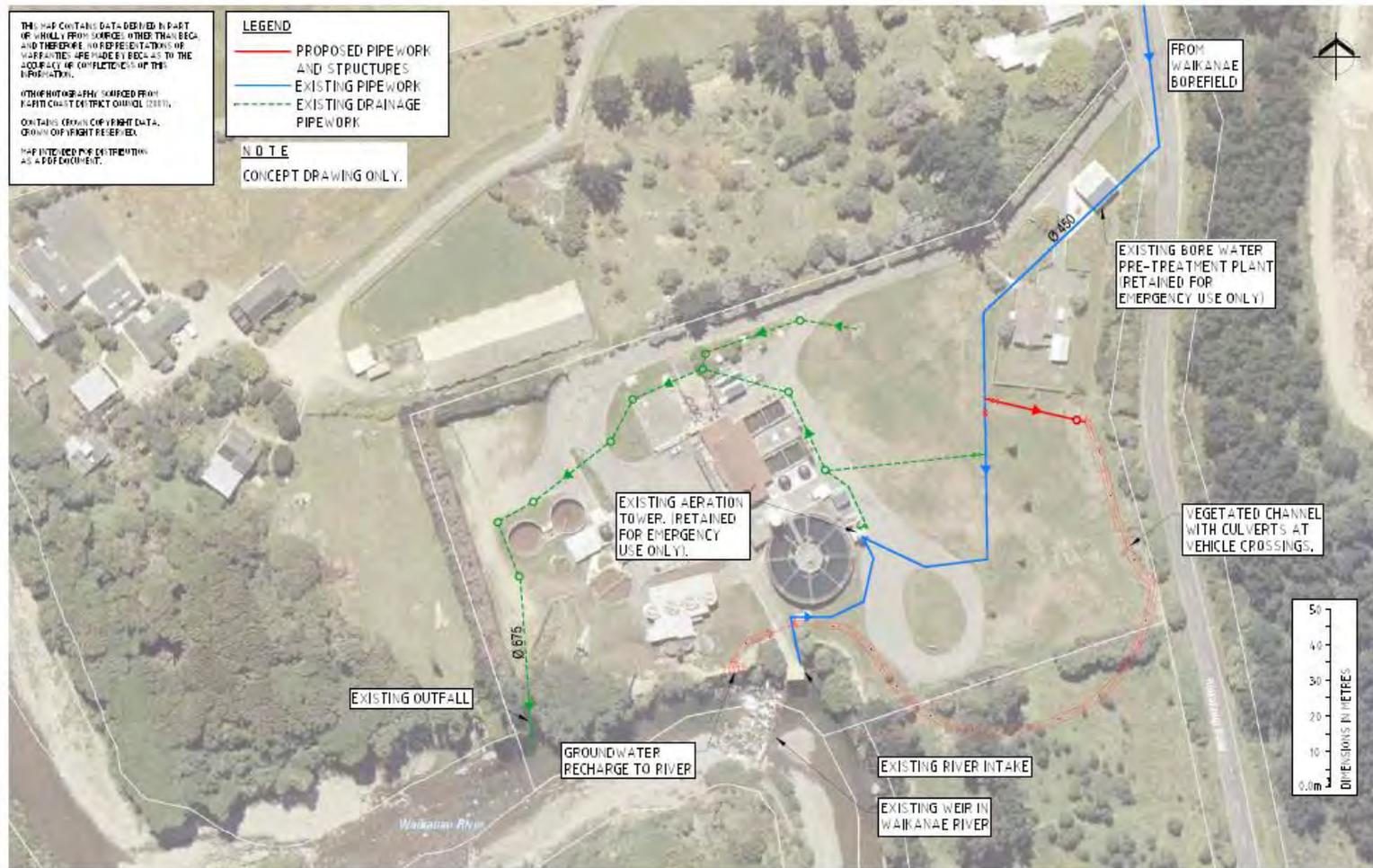
To minimise the length of river in between the abstraction and recharge points, the new discharge outfall is proposed immediately downstream of the existing intake structure. This means that the discharge is located as close as practicable to the intake structure, whilst remaining downstream of the intake to avoid groundwater being put into potable supply. This is preferred over alternatives to locate the discharge further downstream.

Groundwater will be discharged from approximately five ports near the top of the true right river bank, flow down the rock face (approximately 8 m vertically) and into the Waikanae River. The discharge is over a longitudinal length of approximately 7 m to avoid a point discharge which would result in a sudden change in water characteristics. To reduce jetting, each discharge port will be fitted with an enlarged pipe section with a weir plate end. This approach of multiple discharge points is preferred over the alternative to discharge from one pipe with potentially greater scour and physical effects generated by a larger jet of discharged groundwater.

The longitudinal discharge on the right bank avoids a marked water quality change for migrating fish, while the cascading discharge down the river bank helps to aerate and naturalise the groundwater, in addition to the aeration provided by the open channel. Suitable rock rip-rap will be placed at the toe of the bank to provide scour protection to the river bed and this will also aid aeration of the groundwater. At this stage, it is proposed that the recharge outfall is used only for river recharge and that the existing stormwater system and outfall continue to be used for stormwater, clearwater tank overflows or draining process tanks.

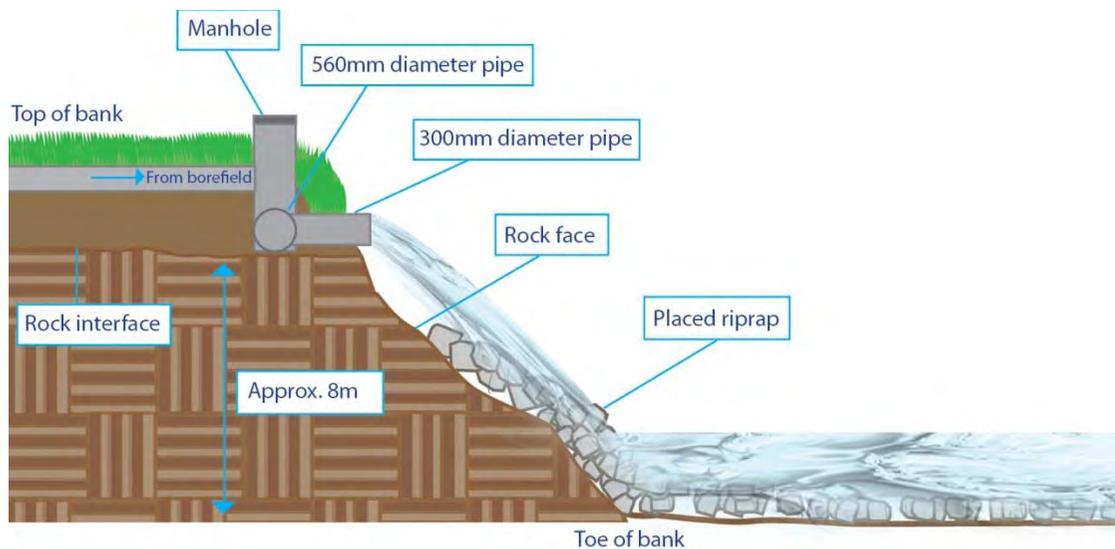
Given the quality of the groundwater to be discharged, no specific treatment of the groundwater is proposed over and above first discharging it to open channel before being fed to the river. Although the groundwater to be discharged is of a different chemical make-up than the receiving river water, in broad terms Council is proposing to discharge water to water and there are no significant contaminants that would require specific treatment prior to being discharged.

Figure 8 - Concept drawing and visuals of the new discharge structure at the WTP



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RIVER RECHARGE WITH GROUNDWATER



### Anticipated physical works

The following works are anticipated:

- Earthworks to create the open channel between the land discharge point and the Waikanae River discharge point.
- Integrate existing local stormwater flow into the open channel (but not the WTP stormwater system).
- Planting of the open channel and surrounds for land stability and amenity.
- Trenching within the WTP site to install the pipework.
- Placement of rock rip-rap at the toe of the river bank below the river discharge ports for scour protection.

### Operation and maintenance

The operation, maintenance and monitoring of the Waikanae WTP site will be similar to the current Waikanae WTP procedures undertaken by Council, with the addition of appropriate procedures for the new recharge discharge. The existing Waikanae WTP Operating and Maintenance Manual and Monitoring Manual will need to be updated to reflect the new recharge discharge structure and operation. This is proposed as part of the conditions of consent.

Groundwater will be discharged to the river during periods of low river flow. The quantity of water discharged to the river will be measured by an electromagnetic flowmeter connected to the WTP SCADA system.

Maintenance activities in relation to the recharge outfall are expected to involve calibration of the recharge flowmeter, maintaining isolation valves, and maintaining the open channel, pipes and rock rip-rap from time to time.

#### 3.3.3 Aquifer Injection

Because the bores are in close proximity to the coast, there is a risk that saline intrusion could occur. Saline intrusion is a process which occurs when freshwater is taken from aquifers close to the freshwater-saltwater interface. The removal of freshwater leads to the 'intrusion' of saltwater into the aquifer as the pressure at this interface is altered. The risk of saline intrusion has been mitigated to a significant extent by ensuring that the proposed borefield is a considerable distance from the coast (at least 1km inland), including the decommissioning of bore K13 (which is within this 1km buffer) and strengthening the 'saline monitoring area' between the borefield and the coast with additional monitoring points along the coast.

To mitigate the potential longer term risk around saline intrusion (should monitoring show that conductivity levels are elevated due to the use of the borefield), allowance has been made for a future aquifer injection pump station at the Waikanae WTP site to transfer river water to the Waikanae borefield (via the existing proposed pipeline) for recharging the aquifer during autumn and spring. The mitigation will be to inject river water into the aquifer at selected bores to bolster water in the aquifer and support the natural seaward flow of water through the aquifer (preventing the inland flow of marine water).

A volume of 10,000m<sup>3</sup>/day has been modelled as part of the groundwater investigations and found to be a potential mitigation measure for the risk of saline intrusion and also potentially managing the drawdown effect beneath selected wetlands. This amount of 10,000m<sup>3</sup>/day will be sourced from the overall river water take of 30,700m<sup>3</sup>/day, rather than being sourced in addition to that.

The quality of the Waikanae River water used for injection is expected to be such as to not cause an adverse effect on the aquifer (in its untreated state or otherwise treated to some degree prior to injection). Council will assess the water quality required and confirm the level of treatment prior to injection. This requirement is proposed as a condition of consent, should injection be required. To avoid clogging the injection bores and aquifer with fine silt or clay particles there would need to be limits on the quality of water for reinjection, for example turbidity may need to be less than 1 NTU. A 50 µm self-cleaning strainer or similar could be installed to the injection bores to reduce the risks of particulates being

injected. Further pre-treatment of the water for injection (e.g. pH adjustment or treatment to remove biological elements from the water) may be required. This would be determined prior to injection taking place.

The need for aquifer injection will be determined from ongoing modelling and monitoring at specific saline sentinel wells of the RRwGW scheme. Aquifer injection may prove to be a suitable mitigation measure for managing the risk of saline intrusion and also managing the drawdown effect under wetlands during dry periods when the wetlands are at risk of drying out. Aquifer injection would be a further mitigation measure in addition to operational changes such as decommissioning bores and creating new bores to spread the effects of drawdown further across the borefield or away from the coastline or affected wetlands. If aquifer injection is required, some of the existing bores will need to be modified to enable them to be used for recharge as well as abstraction.

Council will maintain a comprehensive monitoring regime for managing the risk of saline intrusion and implement a controlled adaptive management protocol based on agreed triggers and actions. The current trigger levels for conductivity is set at a 20% increase above the maximum 7 day moving average for each monitoring well.

## 4 Consent Requirements

### 4.1 Overview

A good portion of this project is already consented. Council has existing consents for the groundwater take from up to 8 wells within the Waikanae borefield and the Waikanae River up to a combined maximum take of 23,000m<sup>3</sup>/day. Many of the borefield wells and pipeline are already in place, as is the existing Waikanae WTP. Council proposes to build on that existing infrastructure and increase the amount of water being abstracted from the borefield and the River to provide for the public water supply for the next 35 years. The existing consents are provided in Appendix 2.

Council seeks the following resource consents for the RRwGW proposal:

1. To take and use up to a maximum of 30,700m<sup>3</sup>/day of groundwater from within the Waikanae borefield as defined on Location Plan [Ref] for the purpose of supplementary public water supply through river recharge or emergency public water supply;
2. To construct and operate bores within the Waikanae borefield as defined on Location Plan [Ref] for the purpose of public water supply, including but not limited to the bores already consented, as well as new bores N2, N3, S1 and S2;
3. To take and use up to a maximum of 30,700m<sup>3</sup>/day of water from the Waikanae River at the Waikanae Water Treatment Plant for the purpose of public water supply;
4. To discharge groundwater up to a maximum of 30,700m<sup>3</sup>/day from the Waikanae borefield to the Waikanae River immediately downstream of the Waikanae Water Treatment Plant intake weir;
5. Works and structure within the bed of the Waikanae River – minor modifications to the existing intake structure and a new discharge structure at the Waikanae Water Treatment Plant site;
6. To discharge up to a maximum of 10,000m<sup>3</sup>/day of water from the Waikanae River into the Waikanae aquifer through bores within the Waikanae borefield abstraction area as defined on Location Plan [Ref] for the purpose of public water supply. Note that this amount of 10,000m<sup>3</sup>/day will be sourced from the overall river water take of 30,700m<sup>3</sup>/day, rather than being sourced in addition to that.

Council seeks a 35-year duration for the water take permits and the discharge permit, the maximum duration provided for under the RMA. RRwGW will be implemented in stages over time, with Stage 1 giving effect to the full implementation programme over the 35 year period. Given Council's considerable investment in investigating the feasibility of this project and its investment commitment to deliver it in a staged manner over 50 years to meet public water demand, a 35-year duration is warranted in this case. The adaptive management approach proposed, the management framework set by conditions of consent, and GWRC's ability to review those conditions pursuant to s128 of the RMA provide further security and control to set a 35-year duration for this water supply solution.

The existing water take consents held by Council (from the Waikanae River and borefield) shall be surrendered on the successful completion of the granting of the new resource consents sought above to supersede them.

## 4.2 Existing resource consents – Public Water Supply

Copies of existing relevant resource consents held by Council for public water supply are provided in Appendix 2.

Table 11 - Existing resource consents for public water supply

File Reference	Consent Type	Details
WGN050025 [23852] Expires: 1 July 2025	Groundwater take	To take and use a combined total of 7,000 m <sup>3</sup> /day of groundwater from two bores (PW1 and PW5) to be used as a back-up public water supply.
WGN050025 [25865] Expires: 1 July 2025	Groundwater take*	To take and use a combined total of up to 23,000m <sup>3</sup> of groundwater from up to eight wells within the Waikanae borefield for the purposes of a supplementary public water supply for the communities of Waikanae, Paraparaumu and Raumati.
WGN050024 [23848] Expires: 1 July 2025	Surface water take*	To take water from the Waikanae River at the Water Treatment Plant for public water supply purposes. The maximum allowable take is 23,000 m <sup>3</sup> /day at a maximum rate of take of 463 L/s when river flows are above 1,400 L/s. Between river flows of 1,400 L/s and 1,100 L/s the maximum rate of take is 350 L/s. Once flows in the river fall below 1,100 L/s, the rate of take will drop proportionally such that a residual flow of 750 L/s (i.e. the Minimum Flow) is maintained in the river at all times except for when the river naturally recedes below this threshold.
WGN050024 [23850] Expires: 1 July 2025	Water discharge	To discharge water and sediment from the plant when the incoming water is highly turbid, during high flows of greater than 5000 L/s in the Waikanae River; and to discharge the contents of the clarifiers (2500m <sup>3</sup> ), rapid mix tanks (200m <sup>3</sup> ), and filters (360m <sup>3</sup> ) during maintenance activities. The discharge will occur approximately once every 2 to 5 years and can be scheduled to occur when flows in the Waikanae River are greater than 1000 L/s.
WGN110166 [30809]	Land use	To construct eight investigation bores (well number R26/7254) and one production bore (well number R26/7255) located in the Waikanae Groundwater Zone.
WGN110334 [31026]	Land use	To construct one investigation bore (wells number BP32/0022) and one production bore (wells number BP32/0003) (drilling option one) located in the Waikanae Groundwater Zone.

\* These existing consents will be surrendered once the new replacement water take consents sought by Council have commenced.

## 4.3 Regional Consents Required

Table 12 below provides an assessment of the proposal against the relevant WRF rules. Overall, the bundle of consents required is discretionary and therefore should be assessed under Section 104B of the RMA.

Table 12 - Regional resource consents required for RRwGW

Activity	Relevant Rule(s)	Assessment	Activity Status										
<b>Groundwater abstraction</b>													
Take and use groundwater from bores	Rule 16: Taking, use, damming or diversion of water, or the transfer to another site of any water permit to take or use water	Existing consent (WGN050025 [25865]) provides for the abstraction of 23,000 m <sup>3</sup> /day to be taken from the aquifer, subject to conditions. Council proposed to increase this amount of water take and provide for that take to be taken from across the full borefield. The proposed volume and rate of take will exceed the permitted activity thresholds and is not provided for elsewhere in the WRFPP therefore consent is required.	Rule 16: Discretionary Activity										
<b>River water abstraction</b>													
Take and use additional water from the Waikanae River (over that consented)	Rule 16: The taking, use, damming, or diversion of any fresh water, or the transfer to another site of any water permit to take or use water	Existing consent WGN050024 [23848] provides for water to be taken from the Waikanae River in accordance with the following table: <table border="1" data-bbox="758 981 1252 1317"> <thead> <tr> <th>River Flow above water treatment plant (L/s)</th> <th>Maximum instantaneous water abstraction (L/s)</th> </tr> </thead> <tbody> <tr> <td>&lt;750</td> <td>0</td> </tr> <tr> <td>750 – 1,100</td> <td>0 – 350 (maintaining minimum 750L/s residual flow)</td> </tr> <tr> <td>1,100 – 1,400</td> <td>350</td> </tr> <tr> <td>&gt;1,400</td> <td>463</td> </tr> </tbody> </table> Council proposed to increase this amount of water take. The abstraction of water from the Waikanae River will exceed the permitted activity thresholds and is not provided for elsewhere in the WRFPP therefore consent is required.	River Flow above water treatment plant (L/s)	Maximum instantaneous water abstraction (L/s)	<750	0	750 – 1,100	0 – 350 (maintaining minimum 750L/s residual flow)	1,100 – 1,400	350	>1,400	463	Rule 16: Discretionary
River Flow above water treatment plant (L/s)	Maximum instantaneous water abstraction (L/s)												
<750	0												
750 – 1,100	0 – 350 (maintaining minimum 750L/s residual flow)												
1,100 – 1,400	350												
>1,400	463												
<b>Discharges</b>													
Discharge groundwater to the Waikanae River	Rule 1: The discharge of contaminants, or water, into surface water is a Permitted Activity provided the discharge complies with the conditions specified	Can not comply as described in Section 4.1.3	Rule 5: Discretionary Activity										

Activity	Relevant Rule(s)	Assessment	Activity Status
<b>Land use activities</b>			
Construct a new discharge structure downstream of existing intake at the water treatment plant. Minor modifications to the existing intake structure.	Rule 49: The construction of a new intake/discharge structure is not specifically provided for in Rules 22 to 48	The construction of the new structure defaults to requiring consent under Rule 49 as it is not specifically provided for elsewhere. Rule 49 provides for the construction of the new structures, as well as the associated: <ul style="list-style-type: none"> <li>■ Disturbance of the river bed</li> <li>■ Deposition on the river bed, and,</li> <li>■ Temporary diversion of water</li> </ul>	Rule 49: Discretionary Activity
Construction of new bores, or any new bore within defined area, and others	Rule 15: The construction of any bore is a Discretionary Activity.	The construction of any new bore defaults to requiring resource consent.	Rule 15: Discretionary Activity

#### 4.4 Other Consent Required

Council is seeking consent for all of the key regional permits for RRwGW, being the water takes and discharge consents and including the works at the Waikanae WTP to allow for the intake and discharge. Once these key regional consents are approved, Council will move to detailed design, including confirming the pipeline route (which has been presented in this application as indicative only).

At that point there may be additional consents required as identified in Table 13, for example for earthworks and pipeworks in close proximity to streams under the District Plan and stream crossing consents for the new pipe under the Regional Freshwater Plan (WFWP). However such consents will be relatively minor and best dealt with at a later stage when detailed design has confirmed the exact pipeline route, design detail and construction methodology. We expect these consents would be non-notified, provided the appropriate approvals from affected parties are in place.

This approach is common for projects of this scale and long-term duration of staging. Rule 46 of the WFWP provides for the placement of pipes in or under a river as a Controlled Activity. The pipelines will likely cross a number of farm drains and ephemeral ditches that are technically excluded from the definition of 'river' under the WFWP. The need for resource consent for these types of ephemeral water courses can be confirmed with GWRC at detailed design as the specifics of each crossing are presented.

The Waikanae WTP site is designated under the District Plan and it is likely that works such as the discharge channel and potential new pump station for aquifer injection will require an outline plan process with KCDC.

Table 13 - Other resource consents potentially required for the full pipeline route

Stage	Description	Consents required (District & Regional) – indicative and subject to detailed design	Reason
Stage 1 (2014)	<ul style="list-style-type: none"> <li>■ Pipeline from bore N2 along Ngarara Road and End Farm Road to Smithfield Road.</li> <li>■ Pipeline from bore K12 along Smithfield Road to bore K6 on Ngarara Road.</li> <li>■ Possibly duplicate or upgrade existing pipeline along Ngarara Road.</li> </ul>	<ul style="list-style-type: none"> <li>■ Regional consent required for a controlled activity (FWP Rule 46)</li> </ul>	<ul style="list-style-type: none"> <li>■ Pipeline crosses under bed of Kakariki Stream and Ngarara Creek (possibly other streams/ farm drains).</li> </ul>
		<ul style="list-style-type: none"> <li>■ District consent required for a discretionary activity (Rule D1.2.1, D2.2.1, D11.2.1)</li> </ul>	<ul style="list-style-type: none"> <li>■ Earthworks will occur within 20 metres of a water body.</li> <li>■ Earthworks will likely exceed the permitted volume of land disturbance.</li> </ul>
Stage 2 (2033)	<ul style="list-style-type: none"> <li>■ Pipeline from N3 to N2.</li> </ul>	<ul style="list-style-type: none"> <li>■ No Regional consent required.</li> </ul>	<ul style="list-style-type: none"> <li>■ Does not cross any water bodies.</li> </ul>
		<ul style="list-style-type: none"> <li>■ District consent required for a discretionary activity (Rule D2.2.1)</li> </ul>	<ul style="list-style-type: none"> <li>■ Earthworks will likely exceed the permitted volume of land disturbance.</li> </ul>
Stage 3 (2041)	<ul style="list-style-type: none"> <li>■ Pipeline from bore S1 to M2PP Expressway corridor, over Waikanae River to Te Moana Road and connecting to existing pipeline.</li> </ul>	<ul style="list-style-type: none"> <li>■ Regional consent required for a discretionary activity (FWP Rule 49).</li> </ul>	<ul style="list-style-type: none"> <li>■ Pipeline crosses over bed of Waikanae River (provided bridge is in place). Consent may not be required if attached to an existing structure</li> </ul>
		<ul style="list-style-type: none"> <li>■ District consent required for a discretionary activity (Rule D2.2.1)</li> </ul>	<ul style="list-style-type: none"> <li>■ Earthworks will likely exceed the permitted volume of land disturbance.</li> </ul>
Stage 4 (2051)	<ul style="list-style-type: none"> <li>■ Pipeline from bore S2 to bore S1.</li> </ul>	<ul style="list-style-type: none"> <li>■ Regional consent required for a controlled activity (FWP Rule 46) if pipe is in/under bed of stream, discretionary activity (Rule 49) if pipe is over.</li> </ul>	<ul style="list-style-type: none"> <li>■ Pipeline crosses (in/under, although may be over) bed of Muaupoko Stream.</li> </ul>
		<ul style="list-style-type: none"> <li>■ District consent required for a discretionary activity (Rule D2.2.1).</li> </ul>	<ul style="list-style-type: none"> <li>■ Earthworks will occur within 20 metres of a water body.</li> <li>■ Earthworks will likely exceed the permitted volume of land disturbance.</li> </ul>

## 5 Assessment of Environmental Effects

### 5.1 Overview

The Assessment of Environmental Effects (AEE) undertaken to support this resource consent application has been comprehensive. The full technical reports are provided in Volume 3 and provide a detailed assessment of environmental effects, including:

- Demand Modelling Report;
- Surface Water Modelling Report (Hydrology and Yield);
- Aquifer Testing and Groundwater Modelling Report;
- NIWA River Investigation Reports (a total of 3 reports);
- Ecological Impact on Wetlands Report; and
- Cultural Impact Assessment Report.

This section provides a summary of these reports and completes the consideration of the full range of actual and potential environmental effects of this proposal. The key high level environmental effects of this proposal are shown in the table below:

Table 14 - Key proposed activities and their actual and potential effects

Proposed activity/ consent sought	Key actual and potential effects
Abstraction of river water from the Waikanae River for public water supply	<p>Positive effect – this will provide a reliable water supply into the WPR community and provide for their health and well-being.</p> <p>Neutral effect – this proposal will maintain the existing minimum low flow/ natural flow regime. During sustained low flow conditions, abstraction of river water (and its replacement by groundwater) will have no more effects than has been deemed acceptable by the setting of the minimum flow.</p>
Discharge of groundwater to the Waikanae River to maintain low/ natural flow	<p>Positive - the recharge will maintain the minimum flow/ natural flow regime of the river, allowing Council to take more river water to provide a reliable water supply to the WPR community and provide for their health and well-being.</p> <p>Negative – the discharge (increased nutrients/DRP) will likely result in increased algal growth downstream of the discharge point. The increased algal growth may result in adverse ecological, visual and public health effects.</p> <p>Negative – the change in chemical signature of the river water may discourage fish to migrate up the Waikanae River.</p> <p>Positive – the cooler temperature of the groundwater entering the river during summer may reduce algal growth where those algae are reliant on warmer temperatures to grow. Cooler temperatures are also favoured by trout.</p>

Proposed activity/ consent sought	Key actual and potential effects
Abstraction of groundwater from the Waikanae borefield for public water supply	<p>Positive - the abstracted groundwater provides a recharge to maintain the minimum flow/ natural flow regime of the river, allowing Council to take more river water to provide a reliable water supply to the WPR community and provide for their health and well-being.</p> <p>Positive – the supplementary groundwater supply provides an alternative water supply source to the river water in major hazard events that render the river water unsuitable for public consumption, providing for a more resilient water supply for the WPR community.</p> <p>Negative – the drawdown effects may result in an adverse effect of saline intrusion.</p> <p>Negative – the drawdown effects may result in an adverse effect on surface water and existing wetlands in terms of adding to the adverse effects on wetland habitat and ecology during natural drying-out in drought periods.</p> <p>Negative – the drawdown effects may result in an adverse effect on existing bore users in terms of lowering aquifer water tables during drought periods.</p>

There are some other lesser environmental effects identified in this section. Cultural effects are also summarised. In each section of 6.3-6.9 below, the general nature of the effect is summarised and where a potential adverse effect has been identified appropriate measures are identified to avoid, remedy or mitigate that effect.

Overall, the Council considers that the environmental effects of this proposal are acceptable and can be sufficiently managed by way of conditions of consent, including a comprehensive monitoring and adaptive management framework. On balance, this proposal is considered to be consistent with Part II of the RMA and the adverse environmental effects can be avoided, remedied or mitigated so as to be no more than minor.

The existing permitted and consented environment includes much of the physical infrastructure required to give effect to this proposal, including the Waikanae borefield, the pipe network, the Waikanae WTP, and the existing resource consents held by Council for water takes from the borefield and the Waikanae River up to a combined maximum of 23,000 m<sup>3</sup>/day. Council is seeking to increase their existing consented take of 23,000m<sup>3</sup>/day to 30,700m<sup>3</sup>/day – that is, one third more than the present consent. The proposed average withdrawal represents 7.3% of the total allocation for the lower aquifers and 2.6% of the total safe yield of the Waikanae groundwater zone as identified in the Regional Freshwater Plan.

The positive effects of this proposal are significant. The proposal is for a long-term community water supply that will enable people and communities to provide for their social, economic, and cultural well-being and for their health and safety. A reliable water supply is a fundamental requirement for health and well-being of the community and this proposal will provide a sustainable and long-term solution for the WPR community.

There will be some temporary and minor effects generated by construction activities during the staged extension of the borefield and during the Waikanae WTP site works (intake and discharge structures) at the Waikanae River. These construction effects (such as potential traffic, noise and vibration, dust and sediment effects) can be sufficiently mitigated and managed by way of appropriate site management and conditions of consent, including the implementation of a Construction Management Plan (CMP). These types of effects can be appropriately considered and controlled as part of detailed design and any future consent required as part of the pipeline construction.

The effects on the Waikanae River can be sufficiently mitigated, remedied and managed to ensure that a significant adverse effect on water quality and in-stream health does not occur. In terms of the quality and amenity of the Waikanae River, Council proposes to implement as far as possible RRwGW in a manner that is unnoticed by people and has a minor effect on aquatic life such as fish and the insects they feed on. The investigations undertaken to support this application demonstrate that should be the case and that those effects can be comprehensively monitored and managed.

Equally, the effects on the Waikanae borefield can be sufficiently mitigated, remedied and managed to ensure that a significant adverse effect on the aquifer system does not occur. Groundwater investigations have demonstrated that the proposed extended borefield can be successfully operated as planned over the 35-year period and beyond. The risk of saline intrusion can be carefully monitored over time, as can the effects on existing well users, wetlands and surface waterways. Based on monitoring results, appropriate response actions can be implemented to ensure that drawdown effects are managed to not generate a significant adverse effect.

Any other environmental effect, including effects on terrestrial ecology and visual effects, will be no more than minor.

In terms of cultural effects, Council and Te Āti Awa ki Whakarongotai are working together in the spirit of partnership to explore practical, innovative, and culturally appropriate water management, including the supply of drinking water to all communities within the Waikanae, Paraparaumu and Raumati catchment area.

## 5.2 The Existing Environment

For the purpose of this application the Waikanae River and the Waikanae coastal plain and aquifer system set the context of the existing environment. Council's water supply infrastructure, including the existing borefield wells, the water supply pipe network and the Waikanae WTP are all well established. In addition to this physical environment, the existing resource consents held by Council for public water supply purposes (a combined maximum take of 23,000m<sup>3</sup>/day from the river and/or borefield) are important.

A good portion of this project is already consented. Council has existing consents for the groundwater take from the Waikanae borefield and the Waikanae River up to a combined maximum take of 23,000m<sup>3</sup>/day. These consents expire on July 2025. To put this proposal in perspective; Council is seeking to increase their existing consented take of 23,000m<sup>3</sup>/day to 30,700m<sup>3</sup>/day – that is, one third more than the present consent. The proposed average withdrawal represents 7.3% of the total allocation for the lower aquifers and 2.6% of the total safe yield of the Waikanae groundwater zone as identified in the Regional Freshwater Plan. Given that the recharge scheme will not need to be operational for the full year, the proposed maximum allowable annual volume of groundwater take shall be 2.3 million cubic metres per year (from 1 July to 30 June).

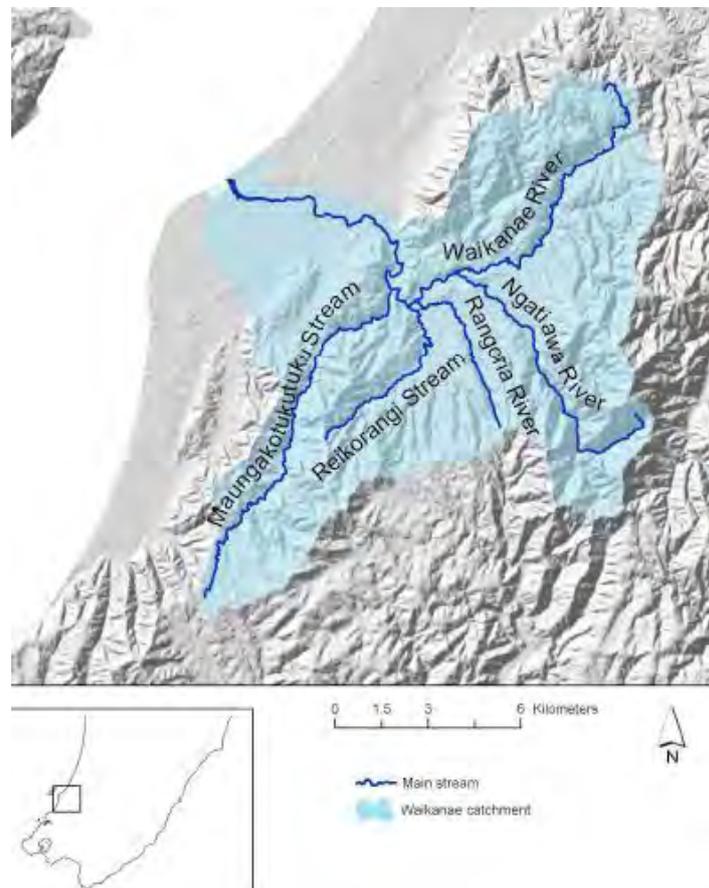
The majority of the borefield wells and pipeline required are already in place, as is the existing Waikanae WTP. The project will build on that existing infrastructure and increase the amount of water being abstracted from the borefield and the river to provide for up to a 50-year public water supply. The consents sought at this point clearly focus on the next 35 years, given this is the maximum term permissible under the RMA.

In terms of the water take and discharge consents sought by this application, the permitted baseline is limited. The type of activities sought under this application could not be undertaken as of right. For this application, the permitted baseline is of little value for an assessment of environmental effects.

### 5.2.1 The Waikanae River Catchment

The Waikanae River drains the western flanks of the Tararua Ranges, then passes to the south of the town of Waikanae before entering the Tasman Sea at Waikanae Beach. In addition to its main stem, the river has four main tributaries: Maungakotukutuku Stream, Reikorangi Stream, Rangiora River, and Ngatiawa River. The Maungakotukutuku Stream tributary is proposed (not part of this application) to be dammed in the future by Council to provide a future public water supply to add to the RRwGW solution. The Waikanae WTP is located downstream of the confluence with the Maungakotukutuku Stream. Downstream of the WTP, the Waikanae River flows across the coastal plain into the Waikanae estuary before discharging to the sea. The estuary of the river is a significant reserve that provides shelter and habitat for local and migratory seabirds. The urban areas of WPR are located on the coastal plain. The Waikanae Borefield and the location of the WTP is shown on the Location Plan at Appendix 1.

Figure 9 - Waikanae River Catchment



### 5.2.2 The Waikanae River

The Waikanae River is a key natural feature of the Kāpiti Coast and is highly valued for a range of environmental, social and cultural values. Overall, the river has high ecological and fisheries values, providing habitat for a wide range of fish, including bullies, shortfin and longfin eels, torrentfish, inanga, koaro, dwarf galaxias, and kokopu. The river and its corridor are well used for a range of active and passive recreation activities, including fishing and swimming, walking, picnicking, and viewing the river and its environment. The river also provides water for the WPR community.

There are good records of the Waikanae River's flow and health. The Waikanae River is gauged approximately 200m upstream of the intake to the Waikanae WTP by GWRC. There is 37 years (1975-2012) of daily mean flow data. Water temperature and rainfall are also measured at this site. GWRC undertake monthly water quality sampling and annual biological monitoring in the Waikanae River at Mangaone walkway (upstream of the WTP site) and at Greenaway Road (downstream of the WTP site). State of the environment reports on the Waikanae River show the river to be generally of good environmental health.

The Waikanae WTP take is the only consented abstraction in the Waikanae catchment. This resource consent is held by Council (WGN050024) to *take water from the Waikanae River at the Water Treatment Plant for public water supply purposes. The maximum allowable take is 23,000 m<sup>3</sup>/day at a maximum rate of take of 463 L/s when river flows are above 1,400 L/s. Between river flows of 1,400 L/s and 1,100 L/s the maximum rate of take is 350 L/s. Once flows in the river fall below 1,100 L/s, the rate of take will drop proportionally such that a residual flow of 750 L/s (i.e. the Minimum Flow) is maintained in the river at all times except for when the river naturally recedes below this threshold.*

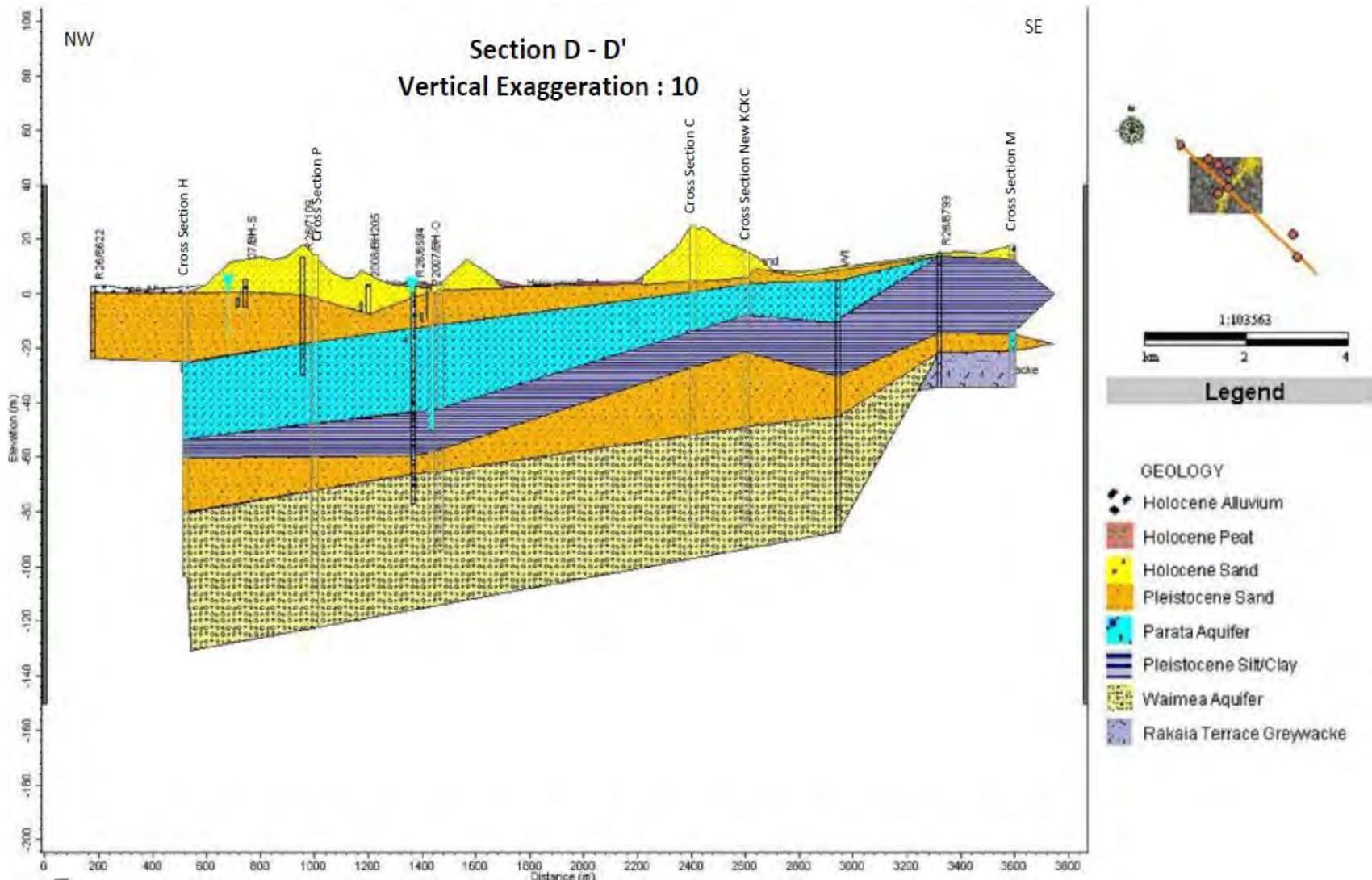
Rule 7 of the Regional Freshwater Plan (RFP) specifies that minor abstractions' of less than 20m<sup>3</sup>/day are a permitted activity, provided some conditions are met (including that the abstraction occurs at a rate of less than 2.5 L/s). GWRC are currently undertaking work to estimate the scale of permitted water takes in the region. This effect of these permitted uses is estimated to be less than 1% of the 7-day low flow (i.e. less than 10 L/s).

While the river is in a relatively good state, the proliferation of algae at low flows is probably the most obvious and well-documented management issue. The Waikanae River is one of only three rivers in the Wellington region (the Hutt and Waipoua rivers being the other two) for which potentially toxic blooms of benthic cyanobacteria compromise recreational values and create a serious management issue from time to time. Blooms of benthic mat-forming and filamentous algae are known to occur on the lower Waikanae River, typically as a result of periods of warm weather combined with long periods of stable flow. Occasionally, mats of potentially toxic benthic cyanobacteria (blue-green algae) form, posing a hazard to recreational river users. The most recent significant proliferation in the Waikanae River occurred during the spring of 2005. GWRC carry out weekly monitoring of recreational water quality (including visual estimates of periphyton cover) in the Waikanae River at State Highway 1 and at Jim Cooke Park during the summer bathing season.

### 5.2.3 The Waikanae Aquifer and Borefield

The geology of the Waikanae area relevant to this application is described in detail in Volume 3 of this application: Aquifer Testing and Groundwater Modelling Report. Figure 10 illustrates one section of the Waikanae Aquifer and its various layers – including the shallow aquifers, the Parata aquifer and the Waimea aquifer. A comprehensive range of cross-sections are provided in the Volume 3 Report. Each of these aquifer layers are semi-confined, meaning that although distinctive layers they are also partly interconnected in terms of their water tables. The RRwGW scheme taps the deep aquifers of the Waikanae borefield for the water naturally stored in that layer. Our understanding of the connection between these aquifers has developed during the comprehensive investigations in the last two years. Analysis of the pumping test results indicates that the Parata, Pleistocene Sand and Waimea aquifers are productive and capable of localised sustained well yields of up to 80 L/s.

Figure 10 - A section of the Waikanae Aquifer Layers



The Waikanae borefield was constructed by Council in 2004-2005 to provide a supplementary drinking water supply to the primary water source from the Waikanae River. The borefield comprises a network of six production wells in the Waikanae Groundwater Zone, abstracting groundwater from approximately 60-70 m depth. The water is pumped by submersible pumps via a raw water pipeline to the Waikanae WTP for treatment, prior to reticulation to the communities of WPR, through the existing reticulation network. The Waikanae borefield was officially commissioned in October 2005 and has been available for use as a supplementary supply since that time.

The existing production bores include K4, Kb4, K5, K6, K10 and K13. Existing wells that have not been brought into production include Kb7, K12 and TW2. Abstraction from the borefield is permitted by resource consent WGN050025[25865] granted by GWRC, effective 1 July 2005, expiring 1 July 2025. Consent has been granted to abstract up to 23,000 m<sup>3</sup>/day from any eight of the nine wells within the borefield.

In addition, existing bores PW1 and PW5 are located in Otaihanga. They draw water from the same deep aquifer that the borefield taps. PW1 and PW5 have been retained as back-up bores to the Waikanae borefield in certain circumstances. Abstraction of up to 7,000 m<sup>3</sup>/day in total from the backup bores is permitted by resource consent WGN050025[23852] granted by GWRC, effective 1 July 2005 and expiring 1 July 2025. A new production well, N2, has recently been constructed at the northern end of Ngarara (paper) Road.

### 5.3 Positive Effects

This proposal will have significant positive effects in terms of securing a reliable and sustainable water supply for the WPR area. The water supply proposed by this proposal is a fundamental foundation to provide for the Kāpiti Coast district to grow and prosper and for its people and communities to provide for their social, economic, and cultural well-being. This proposal will also allow Council to best meet community expectations for potable water quality and deliver on its commitment to a long-term secure solution to water supply.

RRwGW provides a 50-year water supply solution that can be efficiently staged over time as demand increases, with the added benefit of effectively using the significant community investment of the existing Waikanae borefield. Although not being consented under this application, the future dam extends this water supply security out by a further 50 years. This 100-year solution is a positive, prudent and comprehensive water supply solution for the WPR community.

Being an in-catchment solution, it importantly does not detract from the water supply to other parts of the district such as Otaki, Te Horo and Paekakariki. This is positive from a community consultation and policy context because it supports Council's Water Matters Strategy that sets a preference for in-catchment solutions to water supply and ensuring communities live sustainably and within their means.

While the scheme is not intended to work in this way in the ordinary course of events, Council is also mindful of the need for lifeline infrastructure to have available in the event of a major natural hazard or other disruption. Having both river and groundwater available as a raw water source therefore adds resilience to the water supply for the community.

The project is readily stage-able to meet community water supply needs, providing a cost-effective solution that can be implemented over time to match demand. The importance of RRwGW as a reliable and cost-effective water supply solution should not be understated.

## 5.4 Construction Effects

There will be some temporary and minor effects generated by construction activities during the staged extension of the borefield and during the Waikanae WTP site works (intake and discharge structures) at the Waikanae WTP.

The effects generated by the construction of the pipeline itself are not a consequence of the consents sought for this application (water take and discharge consents). The staged extension to the borefield will generate no more than a temporary minor nuisance and these construction effects (such as potential traffic, noise and vibration, dust and sediment effects) can be sufficiently mitigated and managed by way of conditions of consent, including the implementation of a Construction Management Plan (CMP). The use of a CMP to control such matters as hours of operation; construction methodology; construction noise and amenity is a standard approach to appropriately manage the effects on construction activities.

Construction of the pipeline will typically involve excavation of a trench, placement of imported pipe bedding and surround material, pipe laying in the trench, backfilling and surface reinstatement. Any surplus excavated material will be disposed of to an appropriate location off-site. Trenchless pipe laying techniques may be used at particular locations where surface disturbance is undesirable such as under roads.

Similarly, the proposed works at the Waikanae WTP site, including within the Waikanae River bed and surrounds to create the discharge channel and structure and the minor modifications to the existing intake structure are not expected to generate adverse environmental effects that are any more than minor. These works are relatively minor in nature and can be sufficiently mitigated and managed by way of conditions of consent, including the preparation of a Construction Methodology Statement and the implementation of a Construction Management Plan to the approval of GWRC. The Construction Methodology Statement would set out the procedures and timeframe for undertaking works within the stream bed, including any necessary diversion of the main river flow during the works.

Although no sites of cultural or archaeological significance have been identified within the area of the proposed works and indicative pipe route, there is always the potential that there are sites that have not yet been discovered. An accidental discovery protocol will be included in the Construction Management Plans for the borefield extension and Waikanae WTP site works as a standard and precautionary measure.

This table below summarises each potential effect and proposed mitigation/ condition of consent.

Table 15 - Construction effects and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
The staged extension to the borefield will generate no more than a temporary minor nuisance - construction effects (such as potential traffic, noise and vibration, dust and sediment effects)	The preparation and implementation of a Construction Management Plan (CMP) for the pipeline works – to be prepared for the approval of GWRC at the time of detailed design separate to this application (for stream crossing consents for example). KCDC approval may also be required for traffic management of local roads and/or earthworks subject to detailed design.
The proposed works at the Waikanae WTP site, including within the Waikanae River bed and surrounds to create the discharge channel and structure and the minor modifications to the existing intake structure will generate no more than a temporary minor adverse effect – river bed disturbance, potential sediment to waterways, amenity effects	The preparation of a Construction Methodology Statement and the implementation of a Construction Management Plan for certification by GWRC in order to avoid, remedy or mitigate construction related effects. This is proposed as a condition of consent to be prepared at the time of detailed design of the intake and discharge structures and submitted to GWRC for approval prior to any works commencing.

## 5.5 Effects on the Waikanae River

### 5.5.1 Overview

The three NIWA investigation reports provided in Volume 3 provide a detailed assessment of the environmental effects of this proposal on the Waikanae River. The proposal will have an effect on the Waikanae River, both positive and potentially negative. Positively, the recharge will maintain the minimum flow/ natural flow regime of the river, allowing Council to take more river water to provide a reliable water supply to the WPR community and provide for their health and well-being.

Negatively, the recharge with groundwater will change the chemical make-up of the water flowing in the river downstream of the WTP site, with potentially the most noticeable impact being an increase in algal growth as a result of higher concentrations of DRP. That effect will be largely localised to the immediate vicinity of the Waikanae WTP site, being the location where water is abstracted from the river for water supply and where the groundwater will be discharged to the river to maintain the minimum (or natural) flow.

It is important to note that only during temporary periods of naturally low river flows will RRwGW be required. The recharge will occur during low river flow periods caused by extended periods of dry weather. Yield modelling has shown that with high population growth at year 2060, the recharge is expected to be needed on average on 21 days per year. Under a 50-year drought the annual use of recharge peaks at 93 days and the longest period of continuous recharge is 59 days. This statistic is the extreme scenario at full demand at 2060, but shows even then recharge will occur regularly during summer low flows rather than continuously throughout the year. In reality, the recharge project will be staged over time to incrementally match the increase in demand. For example, with medium population growth at year 2016, the average recharge would be 12 days per year, with a maximum recharge of 77 days per year and the longest continuous recharge being 58 days. During these times the water chemistry of the Waikanae River below the WTP will change to some extent as summarised in this section and described in detail in the technical reports contained in Volume 3.

On balance, having regard to the range of uses and values for which water is required, including the fundamental requirement of public water supply, the Council considers that the effects of this proposal on the Waikanae River are acceptable and can be sufficiently managed over time as proposed in this application. Firstly, the minimum flow regime of the river will be maintained. Secondly, the quality of the groundwater recharge water and the controlled manner in which it will be discharged, monitored and managed will, as far as practicable, safeguard the life-supporting capacity of the Waikanae River. Finally, Council has committed to a range of water supply catchment enhancements as part of a wider integrated catchment management approach in partnership with iwi. These wider integrated catchment management activities will enhance the Waikanae River environment through riparian planting of its tributaries and other activities.

In terms of the quality and amenity of the Waikanae River, Council proposes to implement as far as possible RRwGW in a manner that is unnoticed by people and has minor effect on aquatic life such as fish and the insects they feed on. The investigations undertaken to support this application demonstrate that while those effects are considered acceptable and can be appropriately monitored and managed, there is a need to actively respond to monitoring outcomes and be able to act in the event that unanticipated and unacceptable effects are identified.

Overall, it is unlikely that RRwGW will have a significant adverse effect on the Waikanae River over and above the usual effects that naturally occur during times of drought, high summer temperatures and low river flows. During those natural events, when RRwGW is proposed to be implemented, Council and other relevant authorities are typically undertaking a wide range of measures to safeguard the life supporting capacity of the Waikanae River, particularly water conservation initiatives to reduce peak demand and wasteful use of water. To some degree, this proposal and the measures proposed to give effect to it (including the comprehensive monitoring and adaptive management approach) will positively add to the sustainable management of the water system from the Tararua Ranges to the sea – adding to the already comprehensive management of the river and borefield system.

### 5.5.2 Effect on River Flow

The full Surface Water Modelling Report is provided in Volume 3. The proposal will not have any effect on the flow of the Waikanae River and its tributaries above the WTP site. Downstream of the WTP site, the proposal will maintain a residual flow of 750 L/s in the river when the river flow is at or above this value. When the river naturally falls below 750 L/s, it will maintain the natural flow. This approach is consistent with Table 6.1 and related policy in the Regional FWP. The river recharge will be carefully controlled by an automated system at the WTP.

The operation of the recharge and how it will be implemented in relation to the natural flow of the Waikanae River can be sufficiently controlled by way of a specific condition of consent.

The proposal potentially creates a short ‘gap’ in the river between the abstraction point and the discharge point. Council will maintain a flow over the intake gate and weir at all times to allow fish passage (at least greater than 100L/s).

Council will continue to exercise consent WGN050024 [23850] on occasion to discharge water and sediment from the plant when the incoming water is highly turbid, during high flows of greater than 5000 L/s in the Waikanae River; and to discharge the contents of the clarifiers (2500m³), rapid mix tanks (200m³), and filters (360m³) during maintenance activities. Given these set requirements for this discharge to occur, it is highly unlikely that this discharge would coincide with recharge. For the maintenance discharge that occurs very infrequently, it is likely that Council can schedule it outside peak demand periods where recharge may be required. For example, if the WTP can schedule the maintenance discharge to occur when abstraction is less than 250 L/s if river flow is at or greater than 1000L/s, then recharge would not be occurring.

This table below summarises the potential effect and proposed mitigation/ condition of consent.

Table 16 - Effects on river flow and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
Without the groundwater recharge, the abstraction at the rate required to serve future population demand may not provide for the minimum flow of the Waikanae River to be maintained.	Council will ensure that a residual flow of 750 L/s in the river is maintained, unless the river naturally falls below that level. This is proposed as a condition of consent.
Without the groundwater recharge and a residual flow of 750 L/s in the river being maintained, unless the river naturally falls below that level, the proposal may not provide for adequate river flow for fish passage	Council will ensure that a residual flow of 750 L/s in the river is maintained, unless the river naturally falls below that level. Council will maintain a flow over the intake gate and weir at all times to allow fish passage (at least 100L/s).

### 5.5.3 Effect on Aquatic Ecology

NIWA has concluded that the effects of the proposed RRwGW scheme on aquatic ecology will be minor and can be sufficiently mitigated and managed by way of conditions of consent (including setting out a monitoring regime and adaptive management framework).

The in-river and out-of-river experiments undertaken by NIWA are provided in Volume 3 of this application and the methodology of undertaking the experiments are described in detail. Importantly, these studies were based on a worst case scenario of a 1 in 50 year low flow and projected peak water demand of 32,000 m³/day in the year 2060, with approximately 70% of the flow being groundwater, discharging continuously over a 60-day period. This is an extreme and

worst-case scenario. In reality, there would be some years where there will be no need to implement RRwGW and when recharge is required it will not be continuously at the day peak demand rate.

Further, when RRwGW is implemented, 32,000 m<sup>3</sup>/day of groundwater will not be discharged from day 1. In the years that it is required, the discharge of groundwater will gradually increase to meet rising demand over the years to a maximum discharge ratio of around 65% to 35% river water in the year 2060 when a 50-year drought occurs. In 2049 (the period of 35 year consent duration) the maximum ratio will be 59% groundwater to 41% river water if a 50 year drought occurs at the same time as the peak abstraction of 355 L/s. While in 2016 the maximum ratio in a 50 year drought is forecasted to be around 38% groundwater to 62% river water.

The key findings are summarised below.

#### 5.5.3.1. Effect on Periphyton/Algae

Periphyton/ algae occur naturally in the Waikanae River and are a common feature of this river system. Too much algae, no matter what the type, is problematic in waterways and can dominate aquatic habitats to the detriment of other aquatic life. Cyanobacteria (blue-green algae) can be of particular health concern when blooms create toxins. Cyanobacterial mats occur naturally in the Waikanae River, and as with other rivers in the Wellington region, can dominate the periphyton community during warm, dry summer months when river flow is low and stable.

The key controlling factor for algae proliferation in the Waikanae River is flushing flows or 'freshes' that can break up low stable flows of higher temperature and dislodge algal growth from the river bed substrates. RRwGW will have no effect on the magnitude or frequency of natural flushing flows in the Waikanae River and will maintain the existing minimum flow regime.

In terms of algal growth, the proposed changes in nutrient levels (increased levels of DRP in the groundwater) and to a lesser degree temperature (groundwater is cooler than river water in the summer and vice versa in the winter) are considered to be the most influential change generated by the RRwGW proposal. These changes will likely generate increased periphyton/ algae biomass downstream of the WTP, over and above that naturally occurring. The increase in periphyton biomass is expected to be acceptable, both from an ecological and public health perspective. However, if following regular visual inspection and observation of periphyton biomass GWRC considers the effect to be unacceptable, there are a number of measures that can be taken to avoid, remedy or mitigate the effect as set out in Table 17. Other factors that influence periphyton biomass would not be affected by RRwGW (e.g. sunlight, grazing by invertebrates, substrate stability).

Overall, although the water chemistry of the Waikanae River below the WTP will change during periods when RRwGW is implemented (ie primarily of concern is increased DRP), the addition of groundwater to the river is unlikely to result in a significant adverse effect on the river ecology.

NIWA's investigations have concluded that:

- there was a difference in biomass between periphyton exposed to groundwater / river water and periphyton exposed to river water only. Bore-mix water (with higher concentration of DRP and warmer temperatures) significantly increased periphyton biomass, but did not stimulate *Phormidium*<sup>1</sup> growth;
- there was no significant difference in community composition of periphyton exposed to groundwater / river water compared to periphyton exposed to river water only; and

<sup>1</sup> *Phormidium* is a cyanobacteria

- invertebrate communities present within both bore-mix and river channels at the end of the experiment were similar, comprising of taxa indicative of healthy river ecosystems. This is in agreement with earlier studies that show invertebrate communities within the Waikanae River would not be adversely affected by RRwGW under a worst-case scenario (Suren et al. 2010; Suren et al. 2011).

NIWA has summarised their findings in the following table:

Table 17 - Summary of main causal factors controlling cyanobacteria proliferations and the degree of effect these factors have on the Waikanae River under RRwGW and suggested mitigation/action.

Causal Factor	Degree of effect of RRwGW	Suggested mitigation/ action
Reduced or no flushing flow events	No effect. RRwGW will have no effect on the magnitude or frequency of flushing flows in the Waikanae River.	No specific mitigation required.
Elevated water temperatures.	Low effect if RRwGW is implemented during Autumn. Groundwater temperature was warmer than river water during the late autumn / winter out-of-river channel experiment, which may have stimulated periphyton growth in the experimental channels and slowed algal growth in the river channels. Unlikely to have an effect if RRwGW is implemented during Summer. Groundwater is likely to be cooler than river temperatures during summer months.	Repeat out-of-channel periphyton experiment under a summer scenario to further test the hypothesis that biomass and cover of <i>Phormidium</i> is unlikely to increase over and above what is found presently during summer low flows in the Waikanae River.  <i>[Note: subsequent consultation with the WWG and ecological experts confirmed that a repeat summer experiment would not add value to the current body of knowledge. The adaptive management framework as proposed and the potential benefits to be gained from Council's wider integrated catchment activities such as riparian planting were considered to be a more valuable action rather than further experiments].</i>
Sustained low flow conditions	No effect. RRwGW will have no effect on the low flows in the Waikanae River. The minimum flow of 750 m/s to protect in-stream river values will be maintained and not be affected.	No specific mitigation required.
Nutrient inputs	Low effect. RRwGW will increase dissolved reactive phosphorus concentration. RRwGW will likely lower soluble inorganic nitrogen concentration.	Consider developing a hierarchy of bore preference to use when implementing RRwGW; discharge water first from bores where phosphorus concentration in groundwater is lowest. Implement a periphyton monitoring regime in conjunction with RRwGW following protocols by Wood et al. (2009). Monitor nutrient concentration of groundwater discharge, and river water upstream and downstream of discharge point

Causal Factor	Degree of effect of RRwGW	Suggested mitigation/ action
Season	No effect if RRwGW is implemented during Autumn. Unlikely to have an effect if RRwGW is implemented during Summer.	Repeat out-of-channel periphyton experiment under a summer scenario to further test the hypothesis that biomass and cover of <i>Phormidium</i> is unlikely to increase over and above what is found presently during summer low flows in the Waikanae River.  <i>[Note: subsequent consultation with the WWG and ecological experts confirmed that a repeat summer experiment would not add value to the current body of knowledge. The adaptive management framework as proposed and the potential benefits to be gained from Council's wider integrated catchment activities such as riparian planting were considered to be a more valuable action rather than further experiments].</i>

The flushing of the river at the WTP during such periods is a potential measure to mitigate and remedy algal proliferation downstream of the WTP. Should algal growth downstream in the WTP discharge point be deemed unacceptable by GWRC and attributed to the river recharge, a short flushing flow discharge can be generated at the WTP to dislodge algal growth as a first mitigation measure. The flush will be manually initiated at the WTP. The recharge flow from borefield will be maximised (if it is not already), and the abstraction from the intake ceased. In a 50 year drought this would increase the flow downstream from 600 L/s to about 950 L/s (i.e. about a 50% increase in flow). The water quality downstream when flushing will be closer to river water than when normally recharging as there is a higher percentage of river water.

Flushing flows are a natural part of river ecosystem dynamics. The increase in water velocity will be the main (desired) effect, and intended to slough periphyton from the riverbed. This flush will simulate an event that occurs naturally, reducing periphyton biomass. Potential exposure to a high groundwater concentration at relatively high flows depends on the duration of the flush, but is likely to be one to a few hours (i.e. a temporary disturbance). The NIWA studies provided in Volume 3 that have assessed groundwater effects on fish and invertebrates have shown that there were minimal adverse effects to these communities when exposed to around 70% groundwater/30% river water mix up to 60 days.

The extent that the flush event will remove periphyton is unknown and depends on the volume and velocity of water as well as the species of algae (e.g. species that adhere loosely to substrate, or those that form a much stronger bond to substrate). It is likely that periphyton cover will grow back quickly in summer after a flushing event when the river flow return to low stable flows. However, it is understood that natural 'freshes' in the Waikanae River successfully wash away the filamentous algae that tends to form on the lower Waikanae River, albeit that algae can reappear quite quickly during low summer flows.

There are a number of other methods to remove algal growth from the river, including physical disruption of the river bed to dislodge algal mats and physically scrubbing the river bed substrates to remove algae.

The *New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters – Interim Guidelines* (Ministry for the Environment and Ministry of Health 2009) incorporate a monitoring and management action sequence which regulators can use for a graduated response to the onset and progress of a cyanobacterial bloom or benthic proliferation in the water body. The thresholds can also be applied when responding to an unexpected cyanobacterial bloom event. Two

separate frameworks are given: one for planktonic (water column) cyanobacteria and the second for benthic (attached to substrate) cyanobacteria. Council proposes to use these guidelines in partnership with GWRC as part of the proposed Monitoring Manual and as guidelines for the Adaptive Management Committee.

This table below summarises the potential effect and proposed mitigation/ condition of consent.

Table 18 - Effects on algae and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
<p>The RRwGW discharge may result in an unacceptable proliferation of algal growth downstream of the WTP site.</p>	<p>Council shall implement a hierarchy of bore preference, using bores supplying groundwater with the lowest DRP concentrations in the first instance. This hierarchy shall be set out in the Operations and Maintenance Manual.</p> <p>Council shall implement the recharge in accordance with a Monitoring Manual which shall be prepared and submitted to the Manager, Consents Management, and Wellington Regional Council for certification. The Monitoring Manual shall set out a comprehensive monitoring and adaptive management approach to algae management.</p> <p>The Monitoring Manual shall implement a monitoring regime in the river above and below the groundwater discharge point to record periphyton cover and water quality (including nutrients). The monitoring and response procedures shall be in accord with the Ministry for the Environment and Ministry of Health. 2009. New Zealand Guidelines for Cyanobacteria in Recreational Fresh Waters – Interim Guidelines or similar as deemed appropriate by GWRC.</p> <p>Continue with monitoring protocols and action plans currently in place by GWRC and KCDC to assess cyanobacteria cover that naturally occurs during summer months to manage the risk to public health.</p> <p>An Adaptive Management Committee shall be established, with representatives from KCDC; GWRC; Te Āti Awa or appointed representatives. The Adaptive Management Committee shall make recommendations for any adaptive management procedures. Adaptive Management actions may include:</p> <ul style="list-style-type: none"> <li>■ Generate a flushing flow at the Waikanae WTP to wash away algae (replicating a natural fresh)</li> <li>■ Dislodge algae from substrate by physical removal (scrubbing for example)</li> <li>■ Adhere to and implement national guidelines for surveillance, alert and action.</li> </ul>

**5.5.3.2. Effects on Invertebrates**

NIWA investigations found that the invertebrate fauna of the Waikanae River is typical of a river in good ecological condition. The NIWA investigations showed that groundwater discharge caused subtle changes to the abundance of some taxa, but the overall community composition in the experimental channel remained the same. Overall, the RRwGW scheme will have a minor effect on the invertebrate community in the Waikanae River. Changes to the invertebrate communities appear driven more by natural algal growth associated with warm water temperature and stable flows. In that regard, algal growth will be carefully monitored as summarised in Section 6.5.3.1 as a key indicator of in-stream health for invertebrates.

This table below summarises the potential effect and proposed mitigation/ condition of consent.

Table 19 - Effects on invertebrates and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
The RRwGW discharge may result in an unacceptable adverse effect on invertebrate communities	The proposed Monitoring Manual shall implement a monitoring regime in the river above and below the groundwater discharge point to record the health of the river. The Plan will focus on monitoring algal growth as a key indicator of in-stream health, however from time to time monitoring of invertebrate communities may be deemed appropriate by GWRC as consent authority or by the Adaptive Management Committee.

**5.5.3.3. Effects on Fish**

NIWA investigations concluded that RRwGW will have no significant adverse effect on fish survival or growth. Results also suggested that fish did not swim away from areas where groundwater was being discharged. In terms of fish passage, the minimum flow regime of the river will be maintained and sufficient flow will be maintained at the intake structure and at points along the existing weir.

In terms of fish health, the quality of the groundwater recharge water and the controlled manner in which it will be discharged, monitored and managed will as far as practicable safeguard the life supporting capacity of the Waikanae River. Adequate flow for fish passage is relatively easy to monitor and maintain. However, the actual effects of RRwGW on fish health over and above the range of other effects occurring within the Waikanae River naturally or otherwise are more difficult to determine. Based on evidence at hand, and having regard to the quality of the groundwater proposed to be discharged, Council considers that the effects on fish are acceptable and can be monitored over time (3-yearly) in accordance with relevant national fish monitoring protocols to study trends in fish species and numbers and make appropriate adaptive management changes if deemed necessary.

The WWG has also identified concerns that the change in chemical signature of the water could discourage migratory species from entering the Waikanae River mouth. While this potential effect is acknowledged, demonstrating this effect is scientifically challenging given the vast range of variables affecting the Waikanae River water quality and the marine environment beyond and how that may or may not influence fish migration patterns and preference for swimming upstream in any one year. It was also accepted by the WWG and their advisors that the effect would only be temporary (ie the following year, if no recharge was implemented, migratory species would return as normal).

However, in order to monitor fish numbers over time, a 3-yearly fish survey shall be carried out. Council has also committed in its Long Term Plan to working with iwi to replenish fish stocks and improve catchment habitat as part of a long-term programme of riparian replanting in the catchment. This is an action intended to remedy or mitigate these potential effects on fish, albeit that these cannot be currently measured or attributed to RRwGW. That notwithstanding, Council's wider catchment management initiatives such as riparian planting are expected to have a positive impact over time in improving water quality and fish habitat along the Waikanae River and its tributaries.

This table below summarises the potential effect and proposed mitigation/ condition of consent.

Table 20 - Effects on fish and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
The proposal may not provide for adequate river flow for fish passage	Council will maintain a flow over the intake gate and weir at all times to allow fish passage.
The RRwGW discharge may result in an unacceptable adverse effect on fish, including discouraging fish to migrate up the Waikanae River.	The proposed Monitoring Manual shall implement a monitoring regime in the river above and below the groundwater discharge point to record the health of the river. Fish will be monitored at least 3 yearly in accordance with relevant national fish monitoring protocols to study trends in fish species and numbers and make appropriate adaptive management changes if deemed necessary. Council has committed in its Long Term Plan to working with iwi to replenish fish stocks and improve catchment habitat as part of a long-term programme of riparian replanting in the catchment.

## 5.6 Effects on Groundwater and the Aquifer

### 5.6.1 Overview

Overall, the effects of the proposed RRwGW scheme on groundwater and the Waikanae aquifer system are acceptable and can be sufficiently mitigated and managed by way of conditions of consent. The Groundwater Report is provided in Volume 3 of this application. The findings of that report indicate that the proposed extended borefield can be successfully operated as planned over the 35-year period and beyond. Analysis of the pumping test results indicates that the Parata, Pleistocene Sand and Waimea aquifers are productive and capable of sustained well yields of up to 80 L/s.

The testing and modelling indicates that RRwGW can operate for the requested 35-year consent period with relatively small effects that can be mitigated through adaptive management. Monitoring is recommended to quantify these effects and as a trigger for implementation of mitigation. Revised pumping schedules, altered well pumping hierarchy or injection during high river-flow periods may help to mitigate the environmental effects, should the need be indicated by monitoring.

The following four scenarios were simulated by the groundwater model:

- Scenario 1: A constant population equal to that at 2049, under an assumption of moderate growth. Under this scenario the maximum combined pumping rate, averaged over the peak week was 23,500 m<sup>3</sup>/day from a total of up to eight wells, all of which are existing;
- Scenario 2: A constant population equal to that at 2049, under an assumption of high population growth. Under this scenario the maximum combined pumping rate, averaged over the peak week was 28,000 m<sup>3</sup>/day from a total of up to ten wells, eight of which are existing with two additional wells planned for future construction;
- Scenario 3: A constant population equal to that at 2060, under an assumption of moderate population growth. Under this scenario the maximum combined pumping rate, averaged over the peak week was 24,000 m<sup>3</sup>/day from a total of up to eight wells, all of which are existing or; and
- Scenario 4: A constant population equal to that at 2060, under an assumption of high population growth. Under this scenario the maximum combined pumping rate, averaged over the peak week was 29,700 m<sup>3</sup>/day from a total of up to eleven wells, eight of which are existing or with three additional wells planned for future construction

Modelled maximum changes to water levels in coastal wells under the worst-case pumping of Scenario 4 results in a drawdown of 5+ m in the deeper Pleistocene Sand and Waimea aquifers. A drawdown of 5 m is equivalent to a deep aquifer water level about 2 m below mean sea level based on water level data collected from Sentinel Well 1.

Modelling showed that the worst case pumping of the Council wells under Scenario 4 might result in drawdowns of up to 2+ m in the Parata aquifer in two wells located in the northeast portion of the study area.

Drawdown effects for the shallow aquifers are much less and overall considered to be minor. The modelling of effects on shallow groundwater, as indicated by the worst-case drawdowns in the Holocene Sand Aquifer, suggest that water level changes beneath wetlands range between 0-210 mm as shown for each specific wetland in Table 23. The changes are much less than the normal variations in water levels of 1 m to 2 m observed in wells completed in the shallow aquifers. Up to 49 wells identified in the GWRC database completed to depths of 20 m or less could potentially be affected by summer-long water level reductions between 200 mm and 500 mm caused by pumping of the Council wells under the worst-case Scenario 4. These Holocene Sand and Upper Pleistocene Sand aquifers drawdowns are less than recorded natural variations in groundwater level and are likely to be unnoticed by well users.

There are three key effects that the proposed RRwGW scheme may generate as a result of drawdown, being:

- Increasing the risk of saline intrusion into the freshwater aquifers;
- Effects on existing well users; and
- Effects on wetlands and surface waters

These effects are assessed in detail in the Groundwater and Wetlands Reports contained in Volume 3 and are summarised in the sections below.

### 5.6.2 Managing the Risk of Saline Intrusion

The intrusion of marine (saline) water is a potential risk because much of the borefield is located close to the coast and abstracts water primarily from the Waimea and lower Pleistocene Sand aquifers, which underlie a system of leaky alluvial aquifers. The abstraction of water from the deeper aquifers results in a lowering in pressure in those aquifers, with the resultant movement of water laterally, towards the abstraction point. This effect could cause the seawater interface to move eastwards (landwards). Modelled maximum changes to water levels in coastal wells have the potential to cause saline water to move inland under the worst-case pumping scenarios. The maximum effect under a 50-year drought in 2060 is a short-term drawdown of approximately 5+ m in the deeper Pleistocene Sand and Waimea aquifers. Water level recovery occurs within weeks of pumping ceases such that groundwater returns to its "normal" off-shore flow direction.

Water quality samples analysed as part of the permeability testing of Investigation wells N2, N3, S1 and S2 do not indicate the presence of marine water at depth and neither do the analyses of water samples collected from the Council production wells and therefore 'up-coning' appears to be a low risk.

The borefield has been placed inland (at least a 1km setback from the coast) to minimise risk from seawater intrusion and the contact of these aquifers with seawater is expected to be some several kilometres offshore. Water level recovery occurs after pumping ceases such that groundwater returns to its "normal" off-shore flow direction. The modelling has shown that the long-term likelihood of significant intrusion of seawater is minor and can be monitored and managed over time.

The effects of the current borefield use are well known and have been monitored regularly and reported annually by URS. Although the use of the borefield has been limited to date, URS has predicted that the contact interface of the aquifers with seawater is a considerable distance offshore and monitoring results do not indicate a current high risk of saline intrusion. Given this current situation of relatively low saline intrusion risk, it is considered that the staged implementation of the proposed scheme can be comprehensively monitored and responded to through adaptive management measures such as reconfiguring bore use and pumping rates, spreading the use of bores further across the borefield to spread associated drawdown effects and implementing aquifer injection.

As a precautionary measure, additional saline monitoring wells will be installed along the coastline to monitor for early signs that the saltwater interface may be moving inland. The current trigger levels for conductivity is set at a 20%

increase above the maximum 7 day moving average for each monitoring well. The Groundwater Report provided in Volume 3 provides recommendations on the location of new saline monitoring wells.

Modelling has shown that aquifer injection offers a potential mitigation measure to manage the risk of saline intrusion. The model indicated that the best potential for mitigation of saline intrusion is injection along the coast. Based on our understanding of the hydrogeology of the Waikanae borefield area, we consider that the results are sufficient to show that the risk of saline intrusion can be appropriately monitored and managed, particularly given the staged nature of the RRwGW scheme over time.

Table 21 - Effects on saline intrusion and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
<p>The proposal may increase the risk of saline intrusion</p>	<p>The proposed borefield will be located at least 1km from the coastline as a precautionary measure. A saline monitoring buffer area shall be established between the borefield and the coast.</p> <p>Council will maintain a comprehensive monitoring regime for managing the risk of saline intrusion and implement a controlled adaptive management protocol based on agreed triggers and actions. The current trigger levels for conductivity is set at a 20% increase above the maximum 7 day moving average for each monitoring well.</p> <p>Adaptive management actions may include:</p> <ul style="list-style-type: none"> <li>■ Reconfigure bore use (reduce take from bores near the coast)</li> <li>■ Decommission bores, create new bores to spread the effects appropriately across the borefield</li> <li>■ Aquifer injection should monitoring show increased levels of conductivity caused as a result of RRwGW.</li> </ul>

### 5.6.3 Effects on Existing Well Users

The proposed abstraction of groundwater from the deeper Waimea aquifer that is the target of the RRwGW scheme is not expected to have any significant effect on mid-depth and shallow bores (less than approximately 40 m deep). Noticeable drawdowns over and above natural variations in water levels in wells completed in the shallowest aquifer, the Holocene sand, are unlikely. The predicted water level changes are less than recorded natural variations and are therefore considered minor and able to be monitored and managed over time.

The model indicates that 35 wells completed in the Parata, Pleistocene Sand and Waimea aquifers may be affected by pumping of the borefield with drawdowns of more than 5 m. Of these, 17 are owned by Council. The maximum worst-case (Scenario 4, Year 27.8) simulation indicates short-term, temporary drawdowns of 15+ m in the Pleistocene Sand and Waimea aquifers near the pumping centres of Kb4 to K6, although it is understood that these existing wells have been pumped in the past and therefore much of this drawdown would already have been experienced.

Two wells completed in the Parata aquifer in the northeast portion of the study area, could be affected by pumping of the Council wells with drawdowns of up to 5 m. These Parata aquifer wells are completed near Council wells N2 and N3.

Up to 49 wells identified in the GWRC database completed to depths of 20 m or less could potentially be affected by summer-long water level reductions between 200 mm and 500 mm caused by pumping of the Council wells. These Holocene Sand and Upper Pleistocene Sand aquifers drawdowns are less than recorded natural variations in groundwater level and are likely to be unnoticed by well users.

Figure 11 of the Groundwater Report provided in Volume 3 shows wells identified that could be affected by drawdown range and well depth/aquifer completion under the maximum drawdown of the 50-year drought. The owners of these wells as listed in the Council database were contacted by telephone. The owners were surveyed on whether the well was still in operation, the performance of the well and other details. A total of 89% of the well owners responded to the survey. They indicated that 41% no longer had operating wells or were duplications of other entries in the data base. Of the remaining 59% (wells in current operation), 43% had surface mounted pumps, 41% had submersibles and 16% did not know. Based on this summary we estimate that only about 60% of the affected well totals are likely to exist as operating wells and that about 40% of these are likely to have surface-mounted pumps that would be more likely to have their ability to pump affected by large drawdowns than their submersible counterparts. The details of the survey that include the well owner’s name and contact details are held in confidence by Council for future contact should monitoring indicate that specific wells might be affected by the pumping proposed. We also recommend that these bore owners be notified directly as part of any public notification process.

The ability of these wells to produce at their current rates has the potential to be affected by the pumping of the Council wells. Drawdowns caused by Council pumping could cause wells with shallow pumps or surface mounted pumps reliant on vacuum lift to stop producing water requiring lowering of pumps or, in extreme cases of wells too small in diameter for use of a submersible pump, well replacement. However, if properly constructed and completed with submersible pumps placed near the bottom of the well, they should still be capable of their permitted or consented yields. The adverse effects to these wells are considered to be low because they can be readily managed by lowering their pumps.

It is estimated that approximately 3,000 domestic garden irrigation wells are spread across the populated area of the borefield. The pumping schemes are not known for these wells and the abstractions are not metered. The wells are generally between 3 m and 5 m deep and abstract approximately 1 - 5 m<sup>3</sup>/day. These very shallow bores will not be affected by the RRwGW proposal over and above natural variations given their very shallow depth.

Well specific trigger levels have been developed for the existing borefield (Existing Monitoring Manual attached at Appendix 5), and agreed with GWRC. If a trigger level is reached the data is looked at closely to see why the trigger level has been reached and whether it could possibly have been caused by operation of the borefield. The monitoring is reviewed to see if additional data should be gathered to enable further review. On the basis of that review, action may be taken to remedy or mitigate any effects that maybe occurring as a result of the abstraction. Existing trigger levels are detailed in the existing Monitoring Manual prepared by URS, 31 March 2010, provided in Appendix 5 of this report.

Table 22 - Effects on existing well users and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
The proposal may have adverse drawdown effects on existing well users	<p>Council will maintain a comprehensive monitoring regime for managing the risk of effects on existing well users and implement an adaptive management protocol based on agreed triggers and actions.</p> <p>Adaptive management actions may include:</p> <ul style="list-style-type: none"> <li>■ Reconfigure bore use (reduce take from bores near affected area)</li> <li>■ Decommission bores, create new bores (spread the effects appropriately across the borefield)</li> <li>■ Aquifer injection</li> <li>■ Replace or upgrade affected bores (deeper for example/ better pump)</li> </ul>

#### 5.6.4 Effects on existing wetlands and surface water

The potential effects of RRwGW on existing wetlands within the Waikanae borefield area have been assessed as part of the Groundwater Report and also supported by the Ecological Impact on Wetlands Report provided in Volume 3 (prepared by Boffa Miskell Ltd).

In a similar way to existing well users, wetlands may also be affected by drawdown effects from the RRwGW scheme. The worst-case Scenario 4 drawdown contours in relation to existing wetlands are shown in Figure 11. There are 47 wetlands which are potentially affected by the RRwGW Scenario 4. Of these wetlands, 17 are nationally or regionally significant, 15 are locally significant, and a further 15 wetlands are of lower or unknown value.



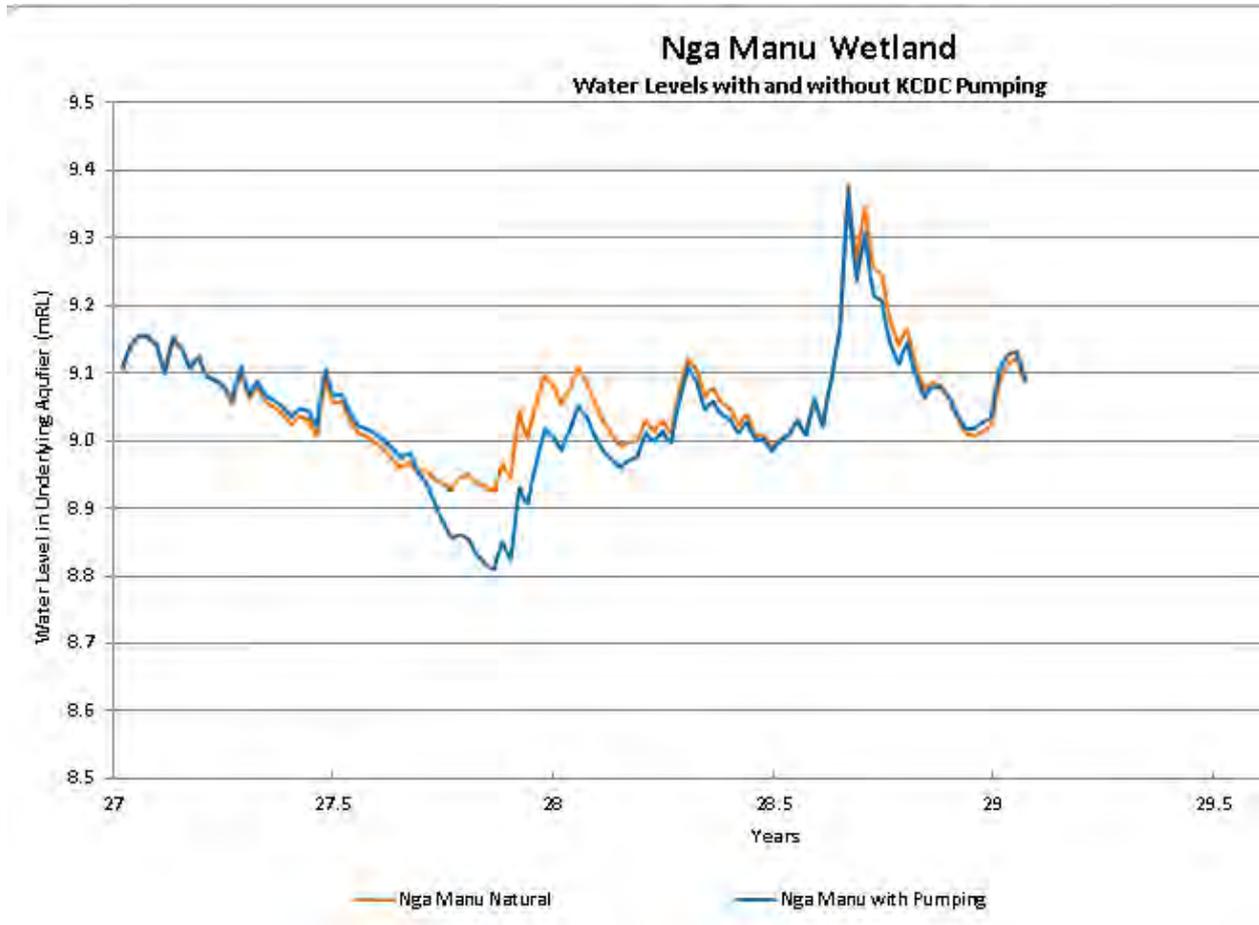
The modelling of effects on shallow groundwater, as indicated by the worst-case drawdowns in the Holocene Sand Aquifer, suggest that water level changes beneath wetlands range between 0-210 mm as shown for each specific wetland in Table 23. The changes are much less than the normal variations in water levels of 1 m to 2 m observed in wells completed in the shallow aquifers. Because the predicted changes in water levels beneath wetlands are less than the actual water level variations that naturally occur in these areas, the effects may be unnoticeable.

Table 23 - Maximum Modelled Drawdown Effects in the Holocene Aquifer Underlying Wetlands Identified by Boffa Miskell

Likely Nationally or Regionally Significant <i>Drawdown [mm]</i>	Significant at District Level / May Be Regional Significant w/ Additional Investigation <i>Drawdown [mm]</i>	Limited Value / May Be Significant at District Level <i>Drawdown [mm]</i>	May Not Be Significant or Insufficient Information <i>Drawdown [mm]</i>
Muaupoko Swamp Forest <b>110</b>	El Rancho Wetlands <b>50</b>	Andrews Pond <b>30</b>	Crown Hill Manuka Bush <b>110</b>
Nga Manu Wetland <b>140</b>	Osbornes Swamp <b>60</b>	Kaitawa Reserve Swamp Forest <b>10</b>	Kāpiti Airfield Raupo Swamp <b>10</b>
Raumati South Peatlands B <b>10</b>	Pekapeka Road Swamp <b>160</b>	Kāpiti Airfield Wetland A <b>10</b>	Kāpiti Airfield Wetland B <b>10</b>
Te Hapua Swamp Complex A <b>90</b>	Ratanui Swamp <b>90</b>	Kowhai Stream Mouth (Hadfields) <b>80</b>	Kāpiti Road Wetland A <b>10</b>
Te Hapua Swamp Complex D <b>100</b>	Raumati South Peatlands A <b>10</b>	Ngarara Bush <b>190</b>	Lions Down Bush <b>80</b>
Te Hapua Wetland Complex D <b>100</b>	Te Hapua Wetland Complex B <b>110</b>	Ngarara Road Wetland D <b>150</b>	Ngarara Lake <b>20</b>
Te Harakeke Wetland <b>170</b>	Te Hapua Wetland Complex C <b>100</b>	Otaihanga Landfill South <b>90</b>	Ngarara Road Wetland A <b>150</b>
Waikanae Saltmarsh <b>10</b>	Tini Bush <b>210</b>	Poplar Ave Wetland <b>10</b>	Ngarara Road Wetland B <b>150</b>
	Waimeha Lagoon – Victor Weggery Reserve <b>80</b>	Te Hapua Swamp Complex E <b>100</b>	Ngarara Road Wetland C <b>150</b>
		Te Hapua Swamp Complex F <b>100</b>	Otaihanga Landfill Central <b>90</b>
		Turf Farm Dune Forest <b>160</b>	Otaihanga Landfill North <b>90</b>
		Unsurveyed site 5 <b>170</b>	Reikorangi Road Bush D <b>0</b>
		Waimanu Lagoons <b>20</b>	Unsurveyed Site 11 <b>150</b>
		Waimeha Stream Mouth <b>80</b>	Unsurveyed site 12 <b>150</b>
		Wharemauku Stream Mouth <b>10</b>	Waikanae River Oxbow <b>50</b>

These are drawdowns over and above what is occurring naturally during 1 in 50 year drought under Scenario 4 of the Groundwater Report, as shown by way of example for Nga Manu Wetland in Figure 12. The key effects to monitor and manage are the drawdown and recovery period over and above the natural wetland cycles of dry-out and replenish. What these figures show is that drawdowns are expected to be slightly (in the order of tens of centremeters) more than normal, with no dramatic difference in overall recovery period.

Figure 12 - Water levels for Nga Manu Wetland with and without RRwGW



As noted in the Groundwater Report, these predicted water level change effects do not translate directly to changes to water levels in the wetlands – as these areas can have sources of water other than the underlying groundwater (e.g. surface water runoff and direct rainfall can create a wetland in areas with low permeable substrates – a “recharge” or “through-flow” wetland). In other situations where a wetland is fed by groundwater (a “discharge” wetland) a lowered groundwater level beneath the wetland may or may not result in a lowered water level in the wetlands. If a discharge wetland has an elevation-controlled outlet, then a lowered groundwater level may not change the level in the wetland, as long as the groundwater discharge to the wetland remains sufficient to maintain the wetland water level to the elevation of the outlet. It is important to reiterate that the predicted changes in water levels beneath the wetland serve as an indicator of the “worst-case” changes that could occur. These worst-case changes are considered to be minor and manageable.

While the modelled changes are less than the normal variations in water levels of 1m to 2 m observed in wells completed in the shallow aquifers, Boffa Miskell note that the effects on some wetlands have the potential to be significant under this worst case scenario. However, determining at what stage drawdown will have an adverse effect depends on the ecological and hydrological characteristics of the individual wetlands present. Boffa Miskell state that there are good indications that despite their groundwater dependency, the wetland water levels are not likely to be affected by groundwater abstraction for the following reasons:

- The main input of water for the wetlands is from local rainfall, local runoff, and shallow groundwater from nearby dunes;
- There are multiple confining layers between the surface and the deepest confined aquifers which would almost certainly limit surface water exchange with deep groundwater;
- It appears that the pressure heads of deeper aquifers are higher than those of shallower aquifers, creating a hydraulic gradient that would, if conditions allowed, induce upward leakage, not downward leakage. Downward leakage is a threat to wetland water levels, not upward leakage.
- The estimated transmissivity, specific yield and hydraulic gradient of the aquifers that underlie the wetlands are particularly low.

Very few wetlands potentially affected by the RRwGW Scheme Scenario 4 drawdown have direct hydrological inputs other than groundwater. Accordingly, peat depth, scale of surrounding peat deposits and dune landforms will be the primary influencing factors on the ability of each wetland system to tolerate potential drawdown effects. While groundwater drawdown remains the principal effect of concern, the scale and depth of peat will determine the time lag of potential effects, with more extensive and deeper peats more likely to withstand longer-term drawdowns.

Wetlands, by their nature are also highly tolerant of environmental stresses and are generally capable of adapting to variations of hydrology. This is supported by NIWA's brief investigation of three local wetlands. While acknowledging that the knowledge of wetland invertebrate communities is in its infancy, NIWA concluded that if reduced water levels did cause a wetland to dry out, much of the fauna is highly mobile and capable of rapidly re-colonising the wetland once water returned. NIWA concluded that it is highly likely that the effects on the fauna communities would be less than minor. Kapiti Coast wetlands have natural cycles of dry-out and replenish and fauna communities within these wetlands decrease and increase over these cycles.

There are a range of measures that can be put in place to manage wetlands should under high drought periods it be deemed necessary to manage their water levels. Measures may include controlling water levels through placement of weirs, redirecting drains, direct wetting of wetlands, restricting bore use in the area of wetlands during significant drought periods. Some of these measures are already in place for some existing wetlands, such as Nga Manu and El Rancho wetlands. Managed 'wetlands' and pond areas are popular within the WPR area and are a common feature of some retirement villages or new subdivision developments such as Jade Garden and Kotuku Park, providing a 'wetland habitat' that can be controlled to some degree during drought periods.

Modelling has shown that aquifer injection will also cause water levels in the Holocene Aquifer to rise and offers a potential mitigation measure for managing the effects on wetlands. Depending on the location of the wetland and where water is injected, the rise in water levels in the Holocene Sand aquifer before withdrawal begins could be as high as 700mm (Tini Bush with coastal injection). Additional modelling could be used to refine and optimise such mitigation by finding the optimal locations, rates and timing to control water level changes to acceptable levels.

Overall, as long as Scenario 4 of the RRwGW drawdown is not permanent and does not substantially exceed 15 weeks before aquifer recharge, Boffa Miskell consider these predicted drawdowns are unlikely to have a major effect on most of these wetlands, with any effects being short-term. However, in the absence of detailed hydrological and wetland class information and long-term monitoring of this uncertainty over the extent and magnitude of potential hydrological effects, a monitoring and adaptive management approach is recommended by Boffa Miskell – as proposed as part of this application by Council and involving the range of measures discussed above.

Similar to wetlands, drawdowns may potentially affect surface waterways in proximity to the borefield. Flows in the Waikanae River will be affected by pumping from the Council wells. A zone-budget analysis of changes in flows into the river from groundwater discharge and out of the river to recharge groundwater were modelled for the 35 years of Scenario 4. In this scenario the changes in flow in the river were tracked for each time step of the 35 years modelled in both the unpumped and Scenario 4 simulations. The differences tracked for the generally losing reach (between SH1 and Jim Cooke Memorial Park) and the generally gaining reach (between Jim Cooke Memorial Park and the river mouth)

The graph showed that pumping the Council wells causes an increase in recharge to groundwater from the losing reach and a decrease in groundwater discharge to the river in the gaining reach. Typically pumping changes river flow by around 10 L/s with some higher decreases during extreme pumping events. The model predicts that the largest effect of a net decrease in river flow of just under 18 L/s would occur during the peak of the 50-year drought modelled for year 27.8. This net decrease represents about 3% of the river flow in a 50-year drought, and much of the effect would already occur under the current borefield consent. Therefore this effect is considered to be minor. A possible mitigation measure may be for the Council wells to recharge an additional amount to the river to offset the river loss caused by pumping, should the available headroom not be required to meet water supply demands.

Pumping may affect other streams and drains in the area. The Mazengarb drain, Waimeha Stream Ngarara Stream, Kakariki Stream and Wharemauku Stream are all included in the model. Other streams in the area such as the Tikotu, the Muaupoko and the un-named stream in the north of the model area are not. There is insufficient flow and level data along various reaches of these streams and drains to properly calibrate the model for groundwater inflow/outflow calculations. Without proper calibration any calculated changes in flow derived from the model would not be meaningful.

Because there is insufficient calibration data, we have assessed the effects on these streams qualitatively. On that basis, the predicted maximum drawdowns are less than 50 mm for the Holocene Sand Aquifer beneath the Waimeha, Wharemauku and Tikotu streams with drawdowns of 50 to 100 mm in the Holocene Sand Aquifer beneath the Ngarara and the unnamed stream in the north of the model area and beneath much of the Mazengarb drain. Higher drawdowns of up to approximately 400 mm are indicated beneath portions of the Kakariki and Muaupoko streams close to the eastern edge of the coastal plain. Refer to the Groundwater Report in Volume 3 for a full description (refer to Figures 12a and 12b of that report).

The actual effects induced by these drawdowns will depend on river levels, streambed conductances and groundwater levels at the time of pumping. Without detailed knowledge of these factors, effects cannot be meaningfully quantified. However, in areas where the predicted drawdowns are less than 50 mm, we believe that such drawdowns are likely to cause less than minor changes in flow. In addition, based on our experience with streams and rivers in New Zealand, we believe that during the conditions of the 50-year drought simulated under Scenario 4 at 27.8 years, it is likely that portions of these streams, especially the upper reaches where predicted drawdowns are greatest, would already be dry. In dry reaches the additional drawdown caused by the Council pumping would have no effect on flow the stream as it would already be dry.

The upper reaches of the streams with the highest indicated drawdowns in the Holocene Sand aquifers could be monitored to indicate whether the Council pumping had any effects. Such monitoring could be used as part of an adaptive management programme and in conjunction with additional stream gauging to generate the information needed to properly calibrate the model so that it could be used to quantify effects.

Table 24 - Effects on existing wetlands and/or surface waters and mitigation measures

Actual/potential effect	How the effect can be avoided, remedied or mitigated
The proposal may have adverse drawdown effects on existing wetlands and/or surface waters	<p>Council will maintain a comprehensive monitoring regime for managing the risk of effects on wetlands and surface waterways and implement a controlled adaptive management protocol based on agreed triggers and actions.</p> <p>Adaptive management actions may include:</p> <ul style="list-style-type: none"> <li>■ Reconfigure bore use (reduce take from bores near affected wetlands)</li> <li>■ Decommission bores, create new bores (spread the effects appropriately across the borefield)</li> <li>■ Management of wetland system (controlling water levels through placement of weirs, redirecting drains, direct wetting of wetlands, restricting bore use in the area of wetlands during significant drought periods)</li> </ul>

### 5.7 Effects on Terrestrial Ecology

RRwGW is highly unlikely to have significant adverse effects on terrestrial ecology, such as birds, land-based insects and animals. The effects of RRwGW are confined to the Waikanae River (downstream of the WTP) and the Waikanae aquifer system and should not result in a detrimental effect to the vast land-based terrestrial habitats of the district. That notwithstanding, it is acknowledged that terrestrial ecology is inextricably linked to some degree to the water cycle and shares a relationship with aquatic ecosystems of the area. In that regard, the effects on the Waikanae River and aquifer system will be monitored and managed as far as practicable to safeguard their life supporting capacity for terrestrial ecology. Therefore, no specific mitigation is proposed over and above that proposed to monitor and manage the water take and discharge consents.

### 5.8 Visual Effects and Amenity

The long-term visual effects of this project (other than short-term visual effects of construction covered in section 6.4) are minor and limited to a few discrete areas only – being the existing Waikanae WTP site and the Waikanae borefield at those places where a bore exists. Once the Project is operational, the visual effects of RRwGW will be relatively minor and generally un-noticeable. The existing minimum flow regime of the river will be maintained and the overall amenity of the river and surrounds will not change significantly. In that regard, people’s enjoyment of the river environment and expectation of flow will be maintained and the range of recreational activities enjoyed in and along the river and wider catchment will remain unaffected. As covered in Section 6.5.3.1, the visual effects of algal growth in the Waikanae River will be routinely monitored by inspection and management procedures are in place to appropriately manage public health risks and recreational use of the river environment. Therefore, no specific mitigation is proposed over and above that proposed to monitor and manage the water take and discharge consents.

### 5.9 Cultural Impact Assessment

Te Āti Awa has recently completed their Cultural Impact Assessment (CIA) for both the river recharge and Maungakotukutuku dam projects, completed by Hāpai Whenua Consultants. The complete CIA is provided in Volume 3 and the partnership approach between Council and iwi in relation to water management is summarised in Section 3.1 of this report. The CIA makes two overarching recommendations regarding future water supply options for the Kāpiti Coast:

1. Council recognise the rangatiratanga of Te Āti Awa ki Whakarongotai through partnering with the iwi to establish co-management and co-governance arrangements regarding fresh water resources based on the principles of Te Tiriti o Waitangi.
2. Council acknowledges the kaitiaki role of Te Āti Awa ki Whakarongotai and proceeds with the installation of water meters in the communities that are supplied water from the Waikanae River.

In addition to these overarching recommendations, a number of recommendations have been made in relation to iwi values of Tino Rangatiratanga; Whakapapa; Kaitiakitanga; Taonga and Mauri. In terms of cultural effects, Council and Te Āti Awa ki Whakarongotai are working together in the spirit of partnership to explore practical, innovative, culturally appropriate management of water, including the supply of potable water to all communities within the Waikanae, Paraparaumu and Raumati catchment area. In the context of that partnership, and as endorsed by the shared Memorandum of Understanding in Relation to Water, the cultural effects of RRwGW are considered to be acceptable. This approach is consistent with Objectives 5.1.3, 6.1.4 and 7.1.4 of the Regional FWP that seeks that the quality and flow of water and the uses of water are, as far as practicable, consistent with the values of the tāngata whenua.

Council and iwi will continue to work together in partnership around water matters and the staged implementation of RRwGW over time, set within the wider context of integrated catchment management initiatives and co-management opportunities.

## 6 Statutory Assessment

### 6.1 Resource Management Act: Section 104

Under Section 104(1) of the RMA, and subject to Part 2, the consent authority must have regard to any relevant provisions of the following statutory instruments when considering this resource consent application:

- a national environmental standard;
- other regulations;
- a national policy statement;
- a New Zealand coastal policy statement
- a regional policy statement or proposed statement;
- a regional plan or proposed regional plan;
- a district plan or proposed district plan;
- other matters the consent authority considers relevant and reasonably necessary to determine the application.

A full statutory assessment is provided in Appendix 3 of this Report. Overall, this proposal is considered to be consistent with the relevant national statements, regional and district policy and plans.

The National Policy Statement for Freshwater Management (NPSFM) directs local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits. Two policies were inserted into the Wellington Regional Freshwater Plan (by Plan Change 4) in December 2011 to give effect to the interim policies of the NPSFM (being Policy 5.2.10A and 6.2.4A). The matters listed for consideration under those policies have been thoroughly regarded as part of this application. Council has undertaken a rigorous assessment of the potential effects of the proposed activity, concluding that any potential effects will not adversely affect safeguarding the life-supporting capacity of freshwater and associated ecosystems, where those effects cannot be avoided.

Overall, this application provides for the sustainable management of freshwater and proposes a comprehensive monitoring and adaptive management framework to ensure that any significant adverse effects can be appropriately mitigated and managed over time.

The proposal is also consistent with the proposed National Environmental Standard on Ecological Flows and Water Levels and the National Environmental Standard for Sources of Human Drinking Water.

The Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 seeks to ensure consistent and accurate measuring and reporting of water takes. Council proposes to measure and report on the proposed water takes in accordance with this regulation.

The Wellington Regional Policy Statement (RPS) identifies the regionally significant issues around the management of natural and physical resources and sets out what needs to be achieved (objectives) and the way in which the objectives will be achieved (policies and methods). Both the Operative and Proposed Wellington RPS need to be given regard to for this application, although more weight can be afforded to the Proposed RPS due to the fact that decisions have been released by GWRC. For completeness, the most relevant objectives and policies of both the Operative and Proposed (version incorporating decisions) RPS are identified and assessed in Appendix 3.

Objective 12 of the proposed RPS is particularly relevant, seeking that the quantity and quality of fresh water meets the range of uses and values for which water is required; safeguards the life supporting capacity of water bodies; and meets the reasonably foreseeable needs of future generations (a similar outcome is sought by Objectives 1 and 2 of the operative RPS combined). Supporting policies of both the operative and proposed RPS seek to manage the quantity of freshwater sustainably, promote efficient use of water and control the allocation of groundwater so that it is not depleted in the long term and seawater intrusion is minimised. The RRwGW proposal aligns well with these provisions.

The Wellington Regional Freshwater Plan (WRFP) contains objectives, policies and rules seeking to avoid, remedy or mitigate potential adverse effects of the use and development of waterbodies, including the discharge of contaminants to water. Objectives 4.1.1-3 and the policies that flow from them seek that the relationship of tāngata whenua and their culture, values and traditions with fresh water, are recognised and provided for and that the mauri of water bodies is protected. Objectives 5.1.3, 6.1.4 and 7.1.4 of the Regional FWP that seeks that the quality and flow of water and the uses of water are, as far as practicable, consistent with the values of the tāngata whenua. This proposal and the partnership approach to water management between Council and iwi aligns well with these policies.

Objective 4.1.11 seeks that people and communities are able to use and develop freshwater resources to provide for their social, economic, and cultural well-being and for their health and safety. Policy 4.2.23 has regard to the benefits arising from any proposal for the use and development of water. This proposal has significant benefits for the social, economic, and cultural well-being of people and communities.

Those benefits must be appropriately balanced with sustainable management of resources and environmental effects. In that regard, Objective 4.1.5 and supporting policies seek that the life-supporting capacity of water and aquatic ecosystems is safeguarded from the adverse effects of any use and development. In addition, Objective 4.1.7 seeks that the amenity and recreational values of wetlands and rivers are maintained and, where appropriate, enhanced. The RRwGW proposal is consistent with these policies.

Council's approach is precautionary and proposes a comprehensive monitoring and adaptive management framework. This approach can be appropriately managed by way of conditions of consent and this is consistent with Objective 4.1.17 that supports conditions placed on resource consents as a means of avoiding, remedying or mitigating adverse effects. Council's approach is particularly consistent with Policy 4.2.26 that seeks a 'precautionary approach' to the management of freshwater where information is incomplete or limited. The potential effects of the RRwGW scheme are predicted to be minor with considerable certainty. However, to address any potential uncertainties in information, Council is proposing a comprehensive programme of monitoring and adaptive management that it is sufficiently precautionary. That approach involves iwi and key stakeholders and is forward thinking towards an overall 100-year solution for water supply under an integrated catchment management framework. This is consistent with Policy 4.2.25 that encourages users of fresh water to adopt an ethic of guardianship for future generations.

Clearly, a safe and secure public water supply is a fundamental priority for the people that live, work and visit the WPR area. Council holds the only consented water take from the Waikanae River and a significant take from the Waikanae borefield – both for public water supply. Policy 6.2.5 gives priority over other users to the abstraction of water for the public health water needs of people including the use of water by any statutory authority which has a duty for public water supply such as Council when water takes exceed core allocation and safe yields or under a water shortage direction. Policy 4.2.29 recognises the needs of existing lawful users of fresh water by allowing existing users to upgrade progressively their environmental performance where improvements are needed to meet the provisions of the Plan; and/or giving priority to existing users over new users at locations where the demand for the use of water is greater than the resource can sustain. Under these policies, it is important that Council secure water for public water supply.

The Kāpiti Coast District Plan reinforces Council's special relationship with iwi and the partnership approach to resource management. A key vision is a *district which provides and maintains public utility services at an affordable cost to meet needs, with minimal adverse effects on the environment, and with particular regard for water quantities and respect for cultural sensitivities*. Plan Change 75 is a recent example of Council's commitment to sustainable water management, seeking to ensure that the demand for public potable water supply from new development does not adversely reduce water available to existing residents. The Kāpiti Coast District Sustainable Water Management Strategy: Water Matters (2003) set out Council's vision for sustainable water management in the district over a fifty year timeframe. The RRwGW proposal aligns well with district policy. Council's Long Term Plan 2012-2032 identifies water supply as a priority service, with RRwGW and water meters stated as a key priority. This is further supported in the Annual Plan 2011/12 which allocates funding for the RRwGW project in addition to the future-proofing of the dam site.

Overall, the critical need to deliver a safe and secure water supply to the community is of paramount importance. On balance, when the technical merits of using Council's existing borefield infrastructure and the cost and staging benefits associated with that over the range of other options identified, and having regard to the acceptable and manageable environmental effects and the reliability of this water supply solution the proposed RRwGW scheme is consistent with the relevant national, regional and district policy around sustainable water management.

## 6.2 Resource Management Act: Section 105

Section 105(1) sets out matters that a consent authority must have regard to when considering a resource consent application for a discharge permit as follows:

### Matters relevant to certain applications

- (1) If an application is for a discharge permit ... the consent authority must, in addition to the matters in section 104(1), have regard to—
- (a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and
  - (b) the applicant's reasons for the proposed choice; and
  - (c) any possible alternative methods of discharge, including discharge into any other receiving environment.

The nature of the proposed river recharge discharge will have a minor and manageable effect on the receiving environment of the Waikanae River. This proposal seeks to discharge 'water to water' and the nature of the groundwater discharge will cause effects on the Waikanae River that can be comprehensively monitored and managed to ensure any adverse effect will be minor. Council proposes this discharge to maintain the minimum (or natural) flow of the Waikanae River while providing for a greater take from the Waikanae River for public water supply purposes. Alternative methods of discharge have been considered as presented in Section 4.3.2 of this report.

In consultation with the WWG, Council proposes to discharge the groundwater to an open channel to 'normalise' the water, before again being discharged by a series of pipe portals into a cascading waterfall to further aerate and minimise an abrupt change to the Waikanae River water quality and flow. Normalise means in a cultural sense to reintroduce groundwater to the surface and allow some aeration and temperature moderation firstly, rather than being directly piped and discharged to the river. In that regard, the sensitivity of the receiving environment has been given careful consideration and the investigations undertaken by NIWA as provided in Volume 3 demonstrate that any adverse effects of RRwGW on the receiving environment of the Waikanae River will be minor and manageable. On this basis, full regard has been given by Council to Section 105 matters.

## 6.3 Resource Management Act: Section 107

Section 107 sets out particular restrictions on the granting of discharge permits as follows:

### Restriction on grant of certain discharge permits

(1) Except as provided in subsection (2), a consent authority shall not grant a discharge permit ...to do something that would otherwise contravene section 15 or section 15A allowing—

- (a) the discharge of a contaminant or water into water; or
- (b) a discharge of a contaminant onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of natural processes from that contaminant) entering water; ...

if, after reasonable mixing, the contaminant or water discharged (either by itself or in combination with the same, similar, or other contaminants or water), is likely to give rise to all or any of the following effects in the receiving waters:

- (c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials;
- (d) any conspicuous change in the colour or visual clarity;
- (e) any emission of objectionable odour;
- (f) the rendering of fresh water unsuitable for consumption by farm animals;
- (g) any significant adverse effects on aquatic life.

The river recharge discharge will not give rise to any of the effects listed in (c)-(g) above. The groundwater proposed to be discharged to the river is relatively good quality deep aquifer water that is naturally harder than surface water but certainly not of poor or harmful quality in the context of the monitoring and management proposed. The discharge has been carefully designed to be firstly discharged to land and open channel above the WTP river discharge point to allow for some aeration and contact with a surface environment to normalise before it is discharged to the Waikanae River. The recharge water will then be discharged from approximately five ports near the top of the true right river bank, flow down the rock face and into the Waikanae River to avoid a point discharge which would result in a sudden change in water characteristics. The cascading discharge down the river bank will further help to aerate and naturalise the groundwater, in addition to the aeration provided by the open channel. The final design of the discharge channel and discharge point will be confirmed at detailed design phase.

In this regard, there is no reason why Section 107 matters should come into play to cause any restrictions on this permit application and GWRC can grant these consents as they are consistent with Section 107.

## 6.4 Resource Management Act: Part II

### 6.4.1 Section 5

Section 5 of the RMA sets out the overall purpose of the Act to promote the sustainable management of natural and physical resources. Sustainable management is defined in section 5(2) as:

- managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—*
- (a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and*
  - (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and*
  - (c) avoiding, remedying, or mitigating any adverse effects of activities on the environment”*

This proposal is fundamentally about achieving the sustainable management of natural and physical resources as set out in Section 5 of the RMA – a community water supply project, for the well-being and health and safety of the community (current and future generations) that safeguards the environment and the life-supporting capacity of the Waikanae River and aquifer system. Specifically, the granting of this proposal will promote the sustainable management purpose of the RMA by:

- (a) Sustaining the potential of natural and physical resources of the Waikanae River and aquifer system to provide for a public water supply that can meet the reasonably foreseeable needs of future generations;
- (b) Safeguarding the life-supporting capacity of the Waikanae River and aquifer system and wider catchment environment; and
- (c) Providing an appropriate monitoring and adaptive management framework for avoiding, remedying or mitigating any adverse effects of the RRwGW Scheme on the environment.

Given the need to balance a range of freshwater management objectives and values and having regard to the fundamental necessity for safe and secure potable water for the well-being of people and communities, this RRwGW proposal is supported by Section 5 of the RMA, particularly given that all of the indicators of ecological health and the life-supporting capacity of the environment have been demonstrated to be relatively favourable and manageable over time.

### 6.4.2 Section 6

Section 6 of the RMA sets out matters of national importance that must be recognised and provided for by GWRC in exercising its powers and functions in making a decision to grant or decline this consent application. Of most relevance to this proposal:

Section 6(a) provides for the preservation of the natural character of rivers and their margins, and the protection of them from inappropriate subdivision, use, and development. The Waikanae River is not listed in the Wellington RFP under Part A: Surface Water to be Managed in its Natural State or Part B: Surface Water to be Managed for Aquatic Ecosystem Purposes. Much of the natural character of the Waikanae River is located above the Waikanae WTP site and that upstream natural character will not be affected by this proposal. At and downstream of the WTP site, the river environment is modified to some degree by development, flood protection measures, bridges, walkways – however these physical features of the river and its margin will remain unaffected by this proposal. In terms of natural character downstream, the key point is that this proposal will maintain the minimum flow (or natural flow if lesser) of the river.

Section 6(d) provides for the maintenance and enhancement of public access to and along rivers. The proposal will not adversely impact upon public access to the Waikanae River. Restricted access is only available from the Water Treatment Plant site (along the true right bank). Such restricted access will be retained for health and safety reasons.

Section 6(e) recognises the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga. This special relationship has been recognised and provided for as an integral part of the Kāpiti Water Supply Project.

These relevant matters set out in Section 6 of the RMA are recognised and provided for by this proposal. The other matters identified in section 6 are not considered applicable to the current proposal.

### 6.4.3 Section 7

Section 7 of the RMA provides a list of further matters that particular regard must be given to in relation to managing the use, development and protection of natural and physical resources. The most relevant matters are identified and assessed below:

Section 7(a) and (aa) provide opportunities through kaitiakitanga and the ethic of stewardship to be involved in the managing the use, development and protection of resources. Both kaitiakitanga and the ethic of stewardship have been promoted through the development of this project. The partnership approach between Council and iwi as endorsed by the project-specific MoU seeks to promote these sustainable management values.

Section 7(b) concerns the efficient use and development of natural and physical resources. The proposed RRwGW scheme provides for the efficient use and development of natural and physical resources by making efficient use of Council's existing borefield infrastructure and efficiently staging its development overtime to meet community demand for potable water. Council proposes to efficiently use the freshwater resource to meet public water supply needs and has a comprehensive water conservation strategy in place to help minimise the inefficient use of the freshwater resource.

Section 7(c) concerns the maintenance and enhancement of amenity values. The effects of this proposal on amenity values are not significant. The proposal seeks to maintain the existing minimum flow (or natural flow) of the Waikanae River to maintain its river flow amenity. The Wellington RFP lists the Waikanae River from State Highway 1 at R26 838 340 to the river mouth at R26 792 352 as an important area for swimming and angling. Those activities will not be significantly adversely affected by this proposal.

Section 7(d) and (f) relate to the intrinsic value of ecosystems and seeks to maintain and enhance the quality of the environment. The effects of this proposal on aquatic and terrestrial ecosystems have been carefully assessed. Overall, the aquatic ecosystem of the Waikanae River will be monitored and managed to ensure in-stream health is maintained. Under the worst-case scenario there will be drawdown effects on wetland ecosystems over and above those that occur naturally during drought periods. There are a number of monitoring and adaptive management measures proposed to ensure that those effects are avoided, remedied or mitigated.

Section 7(g) concerns the finite characteristics of natural resources. Council has considered the community needs for public water supply over the next 35 years and beyond and has sought water take consents to meet that demand. Council has a clear understanding of the finite characteristics of the freshwater resource and has prudently planned for the sustainable management of that local resource through its water supply and water conservation projects.

Section 7(h) concerns the protection of habitat of trout and salmon. The Wellington RFP lists the Waikanae River from R26 899 353 to R26 807 347 as having water quality to be managed for fishery and fish spawning purposes as an important trout habitat. NIWA has concluded that any adverse effects on fish will be minor. Council proposes 3 yearly fish surveys as part of its adaptive management approach. Council has also committed to a wider integrated catchment management approach that will enhance the Waikanae River habitat through riparian planting for example.

Section 7(i) concerns the effects of climate change. It is predicted that climate change will result in higher rainfall and elevated sea levels on the Kāpiti Coast. Those changes will be incremental over time and can be carefully monitored and assessed should they eventuate. The effects of both increased rainfall and sea-level rise may assist in balancing out the drawdown effects generated by this proposal. Although not quantified in the modelling undertaken to support this application, a sea level rise of 1 m was modelled as part of an assessment of environmental effects that the M2PP Expressway might cause. The predicted rises of 0.5 to 1.0 m in the shallowest aquifer could extend inland up to 2 km with rises of 0.2 m extending up to 4 km inland. Therefore, water level rises in the shallow aquifers underlying the wetlands of a similar magnitude to those predicted to be caused by this proposal, might be expected.

In developing this proposal, the Council has had particular regard to these relevant matters set out in Section 7 of the RMA.

#### 6.4.4 Section 8

Section 8 of the RMA requires that the Principles of the Treaty of Waitangi be taken into account. Te Āti Awa ki Whakarongotai has been an integral part of the Kāpiti Water Supply Project from the outset through to the identification of a preferred water supply option. Throughout the Kāpiti Water Supply Project investigations, Council is working in partnership with Te Āti Awa ki Whakarongotai to ensure the water supply project investigations respect as far as practicable the core iwi values, including Rangatiratanga, Kaitiakitanga, Taonga, Mauri and Whakapapa. The principles of the Treaty of Waitangi have been taken into account through the Kāpiti Water Supply Project and through the preparation of this resource consent application.

## 6.5 Summary

The critical need to deliver a safe and secure water supply to the community is of paramount importance. In light of the technical merits of using Council's existing borefield infrastructure and the cost and staging benefits associated with that over the range of other options identified, and having regard to the acceptable and manageable environmental effects and the reliability of this water supply solution, the Council considers that the proposed RRwGW scheme is consistent with the relevant national, regional and district policy around sustainable water management.

In addition, the Local Government Act has relevance in terms of the management of water supply issues. Council is taking a wider integrated catchment management approach to water management and has committed to a range of catchment improvements in partnership with iwi through its Long Term Plan. The Health (Drinking Water) Amendment Act 2007 also introduced the duty for water supply agencies to *take reasonable steps to contribute to protection of source drinking water*. This may include *contributing, directly or indirectly, to improved catchment management whether by planting of trees, promoting and assisting the use of integrated water resources, management, or through other means* (Section 69U(4)(c)). The statutory obligation to ensure sustainable management of freshwater resources is strong and this proposal aligns well with that goal, including Council's commitment to a long-term water supply solution for the WPR area.

## 7 Proposed Conditions of Consent

### 7.1 Adaptive Management

Inherently, the environment is complex and dynamic – therefore irrespective of the amount of research and assessment of natural systems, there will always be a level of uncertainty when planning for potential environmental effects. Equally, changes in technology, culture, human behaviour and demands on natural resources change over time and although these can be forecasted there always remains a level of uncertainty. Adaptive management is a framework for making good decisions in the face of such uncertainties, providing a formal process for reducing uncertainties over time. It is a systematic process that builds on learning - based on common sense, local knowledge, stakeholder involvement, experience, experimenting, and monitoring - by adjusting practices based on what is learned ("learning by doing").

However, adaptive management is not an ad hoc, trial-and-error process. It is a rigorous approach for deliberately learning from management actions with the intent to improve subsequent management over time. It is closely tied to the concept of adopting a "precautionary approach" - often involving the staging of projects over time. Staging allows the effects of a project to be assessed incrementally providing the confidence that key triggers are not being compromised before the next stage is implemented.

In that regard, it is a particularly relevant approach for the RRwGW scheme, which will be staged over time and monitored against a good level of baseline information about water quality, the health of the Waikanae River and wetlands and the Kāpiti Coast environment.

Designing adaptive management conditions in relation to water quality is relatively straightforward given that there are well accepted standards which apply to water quality parameters such as temperature, dissolved oxygen, chemical composition and water clarity. These standards are normally adopted as the trigger points that define when remedial action needs to be taken. Designing monitoring regimes to detect changes in water quality is also relatively simple (for example as undertaken by NIWA for the Waikanae River investigation studies to assess the effects of RRwGW).

In-stream health indicators are also available, a range of recognised indicators are used throughout New Zealand, including habitat monitoring, invertebrate and fish studies and a range of cultural health indicators that build on Mātauranga Māori and cultural values.

Both Council and GWRC (and a variety of other groups) already undertake varying degrees of environmental monitoring of the Waikanae borefield, Waikanae River and the wider water catchment area. This provides a good level of base information to assess changes in water quality and the water system over time. Further baseline monitoring is proposed as part of this application, specifically on wetlands. The RRwGW project will integrate with and add to that monitoring activity. Equally, the various technical investigations completed to determine the likely effects of RRwGW have all concluded that the effects will be minor and able to be sufficiently monitored and managed by way of conditions of consent. Those investigations have built up an understanding of the aquifer, the water quality of the aquifer and the Waikanae River, and the aquatic life in the river and have effectively set the 'hypothesis of minor effects' on which to monitor and test over time.

Wider environmental influences such as climate change can be considered and built into an adaptive management framework. For example, for the Kāpiti Coast, climate change and sea level rise are expected to cause a higher rainfall over time and also a relatively slow landward transgression of the saltwater-freshwater interface. This again, is another 'hypothesis' to be tested.

The effects of sea-level rise may assist in balancing out the drawdown effects generated by this proposal. Although not quantified in the modelling undertaken to support this application, a sea level rise of 1 m was modelled as part of an assessment of environmental effects that the M2PP Expressway might cause. The predicted rises of 0.5 to 1.0 m in the shallowest aquifer could extend inland up to 2 km with rises of 0.2 m extending up to 4 km inland. Therefore, water level rises in the shallow aquifers underlying the wetlands of a similar or greater magnitude to those predicted to be caused by this proposal, might be expected. This will be monitored and evaluated over time.

When adaptive management is applied to planning approvals under the Resource Management Act, there remains the requirement for resource consent conditions to be clear and certain. What will be monitored (for example surface water flows, chemical make-up of water, water levels in the aquifer and conductivity levels to monitor saline intrusion), where and when, monitoring methodology, and how that gathered information is reported, reviewed and acted on must all be clearly set out.

In terms of the adaptive management approach proposed, there are a number of actions that can be undertaken under the proposed Monitoring Manual as summarised in the table below.

Table 25 - Potential Adaptive Management Actions for identified risk/effects

Risk/ Effect	Potential Adaptive Management Action
Discharge (increased nutrients) leads to increased algal biomass downstream of the Waikanae WTP	<ul style="list-style-type: none"> <li>■ Generate a flushing flow at the Waikanae WTP to wash away algae</li> <li>■ Dislodge algae from substrate by physical removal (scrubbing for example)</li> <li>■ Adhere to and implement national guidelines for surveillance, alert and action.</li> </ul>
Borefield drawdown leads to increased risk of saline intrusion	<ul style="list-style-type: none"> <li>■ Reconfigure bore use (reduce take from identified bores near the coast)</li> <li>■ Decommission bores, create new bores to the south (spread the effects appropriately across the borefield)</li> <li>■ Aquifer injection</li> </ul>
Borefield drawdown leads to increased risk of wetland depletion/ dry-out	<ul style="list-style-type: none"> <li>■ Reconfigure bore use (reduce take from bores near affected wetland)</li> <li>■ Decommission bores, create new bores to the south (spread the effects appropriately across the borefield to minimise effect on wetlands)</li> <li>■ Aquifer injection</li> <li>■ Management of affected wetland system (controlling water levels through placement of weirs, redirecting drains, direct wetting of wetlands, restricting bore use in the area of wetlands during significant drought periods)</li> </ul>
Borefield drawdown leads to increased risk of unacceptable effects on existing bore users (shallow bores)	<ul style="list-style-type: none"> <li>■ Reconfigure bore use (reduce take from bores near the affected area)</li> <li>■ Decommission bores, create new bores to the south (spread the effects appropriately across the borefield to minimise effects on existing bore users)</li> <li>■ Aquifer injection</li> <li>■ Replace or upgrade affected bores (deeper for example/ better pump)</li> </ul>

## 7.2 Proposed Conditions of Consent

Council is proposing a comprehensive monitoring and adaptive management framework for the RRwGW scheme. A set of proposed conditions are provided at Appendix 4 for GWRC's consideration. These conditions build on the conditions from the existing resource consents held by Council and incorporate findings from the technical investigations undertaken for this project and also the feedback and input of iwi and stakeholders. Council considers that these conditions or similar will suitably mitigate and manage the effects of this proposal.

The monitoring manuals will set out how effects will be monitored and by whom, and set triggers for when action responses are required. It is envisaged that a separate monitoring manual will be maintained for the Waikanae Borefield take (based on the existing URS Monitoring Plan) and that a separate monitoring manual be maintained for the Waikanae River abstraction and discharge activities. However, there may be some benefit in combining these into a single comprehensive document.

For saline intrusion, well specific trigger levels have been developed for the existing borefield (Existing Monitoring Manual attached at Appendix 5). The current trigger levels for conductivity is set at a 20% increase above the maximum 7 day moving average for each monitoring well. If a trigger level is reached, the data is looked at closely to see why the trigger level has been reached and whether it could possibly have been caused by operation of the borefield. The monitoring is reviewed to see if additional data should be gathered to enable further review. On the basis of that review, action may be taken to remedy or mitigate any effects that may be occurring as a result of the abstraction. Council proposes to maintain this current approach.

For wetlands, Boffa Miskell has recommended a full monitoring and adaptive management approach for wetland management as set out in Volume 3. Council proposes to include these recommendations into the monitoring manual. The monitoring manual will need to establish a detailed baseline for water levels, wetland extent and plant communities. From this ecological and hydro-geological monitoring triggers can be determined. This approach is broadly consistent with the MacKays to Peka Peka monitoring regime and the existing Waikanae Borefield Monitoring Manual, which use monitoring information and triggers developed by URS from historical GWRC and KCDC bore information.

For those wetlands with established shallow groundwater monitoring information (e.g. Te Harakeke Wetland, Nga Manu Wetlands, Te Hapua Wetlands, El Rancho Wetlands), Boffa Miskell recommend that trigger levels for wetland well monitoring should be set as a reduction below the lowest recorded naturally occurring low level for the standpipe piezometers as determined by historical data as follows:

- Alert level: 0.2 m variation outside the naturally occurring range for the piezometers.
- Action level: To be set when the alert level is reached, relative to the potential for effects at that location.

Boffa Miskell recommend that the groundwater information gathered by URS (2010) based on analysis of 31 months of well data (October 2005 to April 2008) should be used to develop a 50% trigger level for shallow groundwater and wetlands based on the lowest historical level minus 50% of the historic variation. These triggers should then be refined for each wetland following gathering of sufficient monitoring information.

The Operations and Maintenance Manual will also monitor and report on the use of the Waikanae borefield, the pumping regime and operational log (building on the existing Operations and Maintenance Manual). This is proposed as a consent condition.

There are a range of adaptive management measures proposed to be implemented the monitoring show that drawdown effects are potentially generating adverse environmental effects, including:

- Reconfigure bore use (reduce take from bores near the affected area)
- Decommission bores, create new bores to spread the effects appropriately across the borefield

- Aquifer injection (saline intrusion and wetlands/ surface water)
- Management of affected wetland system (controlling water levels through placement of weirs, redirecting drains, direct wetting of wetlands, restricting bore use in the area of wetlands during significant drought periods)
- Replace or upgrade affected bores (deeper pump for example).

For the Waikanae River abstraction and discharge activities, Council proposes a comprehensive monitoring regime that will monitor the following:

- a) Water quality monitoring of each bore during its period of use for recharge (one sample after the bore has been operational for 3 days);
- b) Water quality indicators (regular monitoring during periods of recharge of at least temperature, dissolved oxygen, conductivity);
- c) Sampling of DRP (monthly sampling increasing to weekly during periods of recharge);
- d) Native fish surveys (at least at 3 yearly intervals) and the methodology for carrying out the survey in accordance with national fish monitoring protocols;
- e) Algae cover during recharge (at two week intervals during periods of recharge) and the methodology for carrying out the survey in accordance with national algae monitoring protocols, including guidelines for Cyanobacteria in recreational fresh waters (periphyton visual assessments shall be undertaken during summer months before recharge occurs to get baseline data on periphyton naturally occurring prior to recharge);
- f) Adaptive management procedures – including set trigger levels that if breached specific response actions will be taken. This shall include specific actions to mitigate high periphyton biomass;
- g) Frequency and method of reporting the monitoring information to the Wellington Regional Council.

These monitoring parameters have been discussed with the WWG and their appointed ecologist advisor, key stakeholders (particularly the Water Care Group) and technical experts. These monitoring parameters are considered to be appropriate to manage the full range of potential effects on the Waikanae River generated as a result of the proposed RRwGW scheme.

The Operations and Maintenance Manual will also monitor and report on the rate of discharge, volume, duration, date and time of each discharge and the flow in the Waikanae River and rate of abstraction at the time of discharge.

Council has therefore proposed a very comprehensive monitoring and adaptive management framework for both the use of the Waikanae borefield and the use of the Waikanae River for public water supply. Council is committed to ensure sustainable outcomes for this project and this can be sufficiently controlled by way of conditions of consent.

## 8 Conclusion

The Assessment of Environmental Effects (AEE) undertaken to support this resource consent application satisfies statutory and planning requirements. The full technical reports are provided in Volume 3. Overall, the assessment concludes that the environmental effects of this proposal are minor and can be sufficiently managed by way of conditions of consent, including a comprehensive monitoring and adaptive management framework.

A good portion of this project is already consented. Council has existing consents for the groundwater take from the Waikanae borefield and the Waikanae River up to a combined maximum take of 23,000m<sup>3</sup>/day. Many of the borefield wells and pipeline are already in place, as is the existing Waikanae WTP. Council proposes to build on that existing infrastructure and increase the amount of water being abstracted from the borefield and the River to provide for up to a 35 year public water supply.

To put this proposal in perspective; Council is seeking to increase their existing consented take of 23,000m<sup>3</sup>/day to 30,700m<sup>3</sup>/day – that is, one third more than the present consent. The proposed average withdrawal represents 7.3% of the total allocation for the lower aquifers and 2.6% of the total safe yield of the Waikanae groundwater zone as identified in the Regional Freshwater Plan.

The positive effects of this proposal are significant. The proposal is for a long-term community water supply that will enable people and communities to provide for their social, economic, and cultural well-being and for their health and safety. This RRwGW project will secure a reliable and sustainable water supply for the WPR area that best meets community expectations for quality of its drinking water. This proposal also provides additional resilience by using two sources of water. The project is readily stage-able to meet community water supply needs, providing a cost-effective solution that can be implemented over time to match demand. The importance of RRwGW as a reliable and cost-effective water supply solution should not be understated.

The effects on the Waikanae River can be sufficiently mitigated, remedied and managed to ensure that an unacceptable adverse effect on water quality and in-stream health does not occur. In terms of the quality and amenity of the Waikanae River, Council proposes to implement RRwGW in a manner that is largely unnoticed by people and has a minor effect on aquatic life such as fish and the insects they feed on. The investigations undertaken to support this application demonstrate minor effects and that those effects can be comprehensively monitored and managed. It is acknowledged that the discharge of bore water to maintain minimum flow will likely cause an increase in algal growth in the river. This is expected to be a temporary effect that will be limited to those periods when the recharge is occurring and impacts on ecology are expected to be minor and able to be sufficiently monitored and managed, including the ability of the to release a flushing flow to wash away algal growth from the bed of the river.

Equally, the effects on the Waikanae aquifer can be sufficiently mitigated, remedied and managed to ensure that a significant adverse effect on the aquifer system does not occur. Groundwater investigations have demonstrated that the proposed extended borefield can be successfully operated as planned over the 35-year period and meet the Council's objective of being able to meet demand in a 50-year return period drought. A key concern identified in our investigations was saline intrusion and this can be carefully monitored and timely response actions can be implemented to ensure that saline intrusion does not generate an adverse effect on the freshwater aquifer. Similarly, drawdown effects on existing well users and wetlands within the Waikanae borefield area can be carefully monitored and managed to ensure any adverse effects are avoided, remedied or mitigated. Any adverse effect over and above natural variations in groundwater levels and natural periods of drought are considered to be minor and able to be sufficiently managed through the adaptive management procedures proposed by Council.

Any other environmental effect, including temporary construction effects as the project is staged over time, effects on terrestrial ecology and visual effects, will be no more than minor.

In terms of cultural effects, Council and Te Āti Awa ki Whakarongotai are working together in the spirit of partnership to explore practical, innovative, culturally appropriate management of water, including the supply of potable water to all communities within the Waikanae, Paraparaumu and Raumati catchment area. In the context of that partnership, and as endorsed by the shared Memorandum of Understanding in Relation to Water, the cultural effects of RRwGW are considered to be acceptable.

The process to assess alternative water supply options for the WPR community has been comprehensive and forward-thinking ahead to a 100-year solution. The process has involved an appropriate degree of technical investigations relevant to the scale and nature of the proposal and has benefitted from extensive stakeholder consultation, a partnership approach with iwi and independent scrutiny from the Technical Advisory Group. Based on that process and the findings of this AEE, Council is proposing this RRwGW scheme as its preferred water supply solution for the next 50 or so years.

Inherent to any project of this nature and scale, there is a degree of uncertainty around the actual effects of RRwGW over time. While the extensive investigations undertaken have significantly narrowed that uncertainty, some does remain. That uncertainty is acknowledged and accepted as being able to be well-managed through the monitoring and adaptive management approach proposed by Council. The public water supply system is comprehensively monitored – both the river and borefield – and well managed by both KCDC and GWRC and a number of other organisations and groups with an active interest in this matter. The adaptive management approach proposed as part of this application adds to that current water management framework, including the formalisation of an Adaptive Management Committee to specifically address and ideally reduce uncertainty over time in relation to RRwGW.

This adaptive management approach is precautionary and consistent with sustainable resource management. The environmental assessments presented in this report is also precautionary - based on a conservative extreme scenario of a 1 in 50 year low flow and projected water demand of 32,000m<sup>3</sup>/day in the year 2060. However, in reality, in some years there will be no need for recharge at all, whilst in other years recharge may be discharged at lower volumes and for only short periods of time. The staged nature of RRwGW is well suited to adaptive management, particularly given that the assessed effects are considered to be minor and can be monitored.

Overall, this proposal is consistent with the relevant national policy statements, national environmental standards, regional and district policy and plans. The proposal will ensure that the quantity and quality of fresh water meets the range of uses and values for which water is required; safeguards the life supporting capacity of water bodies; and meets the reasonably foreseeable needs of future generations. Council seek to manage the quantity of freshwater sustainably, promote efficient use of water and control the allocation of groundwater so that it is not depleted in the long term and seawater intrusion is minimised.

Council's approach is precautionary and proposes a comprehensive monitoring and adaptive management framework. This approach can be appropriately managed by way of conditions of consent.

Clearly, a safe and secure public water supply is a fundamental priority for the people that live, work and visit the WPR area. That community need is pressing - current projections show that even with conservation improvements, additional supply will be needed by 2015. When that priority is balanced with the full range of uses and values of the Waikanae River and Waikanae borefield and environment, the granting of this application will promote the purpose of the RMA as set out in Section 5 of that Act. This proposal is fundamentally about achieving the sustainable management of natural and physical resources as set out in Section 5 of the RMA – a community water supply project, for the well-being and health and safety of the community (current and future generations) that safeguards the environment and the life-supporting capacity of the Waikanae River and aquifer system.

Pursuant to Section 104B of the RMA, Council seeks approval of the RRwGW proposal, subject to the conditions of consent or similar proposed. On the basis of this assessment and considering the importance of municipal water supply, a 35 year term of consents is sought to provide long-term security of supply for the Council and WPR community.