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MWWUG_GMCP_Comments.doc

Motutangi Waiharara Water User Group (MWWUG) Groundwater Monitoring and Contingency Plan

Condition 17 proposed in the Officers Report for the Motutangi Waiharara Water User Group application required submission of a Groundwater Monitoring and Contingency Plan (GMCP) to the NRC for approval prior to exercise of the consent. At the MWWUG hearing, the Commissioners requested the applicant, reporting officers and other relevant parties provide additional information to provide greater certainty regarding aspects of the GMCP including:

- the process for establishing trigger levels
- locations and monitoring requirements for individual monitoring bores;
- contingency measures to be initiated in the event of a trigger level exceedance.

A draft of the GMCP (including initial input from the reporting officers) was circulated for comment on Monday 16th April. The following comments provide background to explain the overall structure and content of the GCMP (expanding on the suggested framework outlined in Schedule 1), as well as additional comments on the draft plan as circulated[1]. The following sections related directly to the equivalent numbered sections in the draft GMCP.

2. Framework for Adaptive Management

Section 2 articulates the 'adaptive management' approach outlined in the Officers Report, whereby allocation will increased in a stepwise manner until full development is reached. Prior to allocation increasing to the next development stage, the Council must be satisfied that the effects of the abstraction are no greater than that anticipated in the AEE.

2.1 Staged Implementation

This section provides an outline of suggested development stages based on anticipated increased in water use over time. It is noted that the proposed allocation volumes reflect the fact that some

[1] Document saved as MWWUG_GMCP_Rev4.doc

orchards are already development (so water requirements are near the maximum), while water requirements on newly planted orchards will increase over time.

Comment

Baseline monitoring forms a key part of the overall adaptive management approach. This enables data to be collected to characterise the existing condition of the groundwater resource to provide a reference 'baseline' for future monitoring. Due to the nature of developments already completed (or currently underway) it is not practicable to collect data which represents a true pre-development baseline. Rather, the baseline data will be collected during the initial 12-month period of the consent term while the level of development is relatively minor (and therefore unlikely to have significantly impacted on the overall condition of the resource).

In order to appropriately define the baseline period it is suggested that the initial development phase (Year 1-3) defined in the draft GMCP is further sub-divided to specify the volume of allocation available during the initial 12-month monitoring phase which will be used as the basis for setting trigger levels. This will provide some degree of confidence that trigger levels will be established on the basis of environmental conditions which reflect limited abstraction by consents included in the MWWUG (aside from those already being exercised). A suggested modification to the staged implementation is a follows:

Year 1 (baseline monitoring) - 25% uptake

Years 2-3 - 50% uptake

Years 4-6 - 80% uptake

Year 7+ - 100% uptake

The suggested amendment would require an amendment to Table 12 to reflect volumes available during the baseline period.

2.2 Trigger Level System

A two tier trigger level system is proposed for relevant monitoring sites included in the GMCP:

- An initial trigger level (TL1) that would indicate that monitoring results are approaching the typical range of natural variability.
- A second trigger level (TL2) established at a threshold that represents a 'significant' departure from 'background' conditions.

Comment

As proposed, the TL1 triggers are not necessarily intended to require a short-term intervention, rather they are intended to provide a 'heads up' to applicants and Council that management of the resource needs to be cognisant of any spatial and or temporal trends in monitoring data. An example, of long-term natural variation in background conditions (in this case chloride and sodium concentrations) is provided in Figure 7 of the Lincoln Agritech (2015) report. As shown, both short and long-term variations in background conditions may naturally occur over time so do not necessarily require any management intervention.

In contrast, exceedance of a TL2 trigger would initiate contingency options (detailed Section 4) which would apply until such time as the Council is satisfied that any adverse effects on the resource have been appropriately mitigated.

2.3 Timeframe for setting trigger levels

An initial 12-month monitoring period will be utilised to establish the TL1 and TL2 trigger levels.

Comment

Depending on the time taken to establish monitoring sites, it may not be practicable for all trigger levels to be established within 15 months of the consent being granted.

2.2 Environmental monitoring report

The Environmental Monitoring Report (EMR) described in this section is intended to provide the primary compliance reporting function for the MWWUG consents. As described, the report would require reporting of water use along with analysis and interpretation of monitoring results which would be reported to Council by 30 June each year. The EMR would be independent of any additional reporting requirements (e.g. for the review of staged implementation or in response to trigger level exceedances).

2.4 Staged Implementation and Monitoring Programme Review

The Staged Implementation and Monitoring Programme Review would give effect to the 'adaptive management' approach outlined in the Officers Report. The report would involve analysis of all monitoring results in terms of the magnitude of effects anticipated in the AEE, and require signoff from the Council before allocation could increase to the next incremental stage. The review would also provide for:

- A review of trigger levels for individual monitoring sites;
- Changes to the scope (e.g. location and frequency) of monitoring requirements; and
- Any changes to the GMCP required to incorporate or maintain consistency with new or replacement consents.

Again, any changes to trigger levels or monitoring would require approval from Council

3. Monitoring Plan

Section 3 provides a schedule of bores that are required to be monitored, details of the frequency and scope of monitoring at individual sites and a process for establishing trigger levels at the end of the baseline monitoring period.

Comment

This section would benefit from greater clarity regarding individual components of the proposed monitoring programme. For example, it could be useful to rearrange the table into separate listings for each component of the monitoring programme namely:

- Groundwater level and salinity monitoring
- Saline intrusion monitoring
- Groundwater level monitoring
- Water quality monitoring

It is also noted that several grid references provided in Table 3 are either incorrect (e.g. in the case of the Honeytree Farms shallow piezometer) or inconsistent with locations shown on Figure 2 (e.g. Shine, Holloway and Elbury Holdings production bores). Grid references for individual production bores should be confirmed by the applicant. The map should be updated to ensure consistency with grid references listed and provide a key to clearly differentiate different monitoring site types.

3.2 Groundwater level and salinity monitoring

This component of the monitoring programme requires continuous monitoring of water level and electrical conductivity (EC) in four sentinel bores distributed across the development area. Each sentinel bore would comprise a shallow piezometer (screened in the surficial sand aquifer) and a deep piezometer (screened in the shellbed (if present).

Comment

The suggested monitoring sites comprise a mix of two existing NRC monitoring sites and two piezometers that would be installed by the applicant. The proposed monitoring locations are intended to enable monitoring of cumulative drawdown in both shallow and deep aquifers at representative sites along or adjacent to both the coastal margin and Kaimaumau Wetland (cognisant of physical constraints on access in, and around, Kaimaumau Wetland).

The proposed monitoring sites include:

- Waterfront: an existing NRC piezometer installation on the foreshore at Houhora[2]. This site would reflect cumulative drawdown of existing and proposed abstraction near the northern boundary of the consent area;
- Kaimaumau: an existing NRC monitoring site comprising shallow and deep piezometers installed along the coastal margin approximately 2 kilometres south-east of Kaimaumau township. This site would reflect cumulative drawdown along the coastal margin at a point intermediate between the highest concentration of proposed abstraction (Norton Road/Turk Valley Road and Kaimaumau township);
- Norton Road: a sentinel bore installed by the MWWUG adjacent to Norton Road. This point represents the closest point on the coastal margin (Waiparera Stream) to an area of significant abstraction;

[2] This bore comprises 4 piezometers which range in depth between 19 and 74 metres. The shallow (piezometer 1) and deep (piezometer 4) intervals would be the primary references for this monitoring programme.

- Motutangi: a sentinel bore installed by the MWWUG located as close as practicable to the margin of the Kaimaimau wetland in proximity to the largest individual take (Mapua Ltd)[3]. This site would provide data to estimate piezometric levels along East Beach and adjacent to Kaimaumau Wetland.

As illustrated on Figures 26, 42, 43 and 44 of the AEE, drawdown in response to existing and proposed abstraction the proposed abstraction is likely to be concentrated in the Motutangi area and to immediately north of Norton Road. The proposed Norton Road and Motutangi sentinel bores are located on the seaward side of these areas (i.e. potentially areas with elevated potential for saline intrusion). The Kaimaumau and Waterfront sentinel bores would provide an indication of more general drawdown within the regional groundwater system.

The proposed trigger levels for EC in the sentinel bores represent a 25% (TL1) and 50% (TL2) increase over the medial value determined from the baseline monitoring period. Results of the groundwater quality survey in the Kaimaumau settlement area during February 2018 indicate EC values typically less than 50 mS/m. Based on this observation, potential EC triggers in this area would be of the order of 62.5 mS/m (TL1) and 75 mS/m (TL2). Figure 1 below illustrates the relationship between EC and Chloride from the Kaimaumau groundwater quality survey. Based on this relationship, the indicative EC triggers would equate to Chloride concentrations around 70 g/m^3 (TL1) and 80 g/m^3 (TL2) respectively. In comparison the aesthetic guideline value for Chloride specified in the NDSNZ is 250 g/m^3. This suggests that the proposed EC triggers in the Kaimaumau and Norton Road sentinel bores will be reached at a point well below that where water quality (for potable supply) is adversely impacted.

[3] It suggested that the location of the Motutangi sentinel bore shown on Figure 1 of the draft GCMP is shifted further north to a location at or about NZTM 1614900E 6141850N

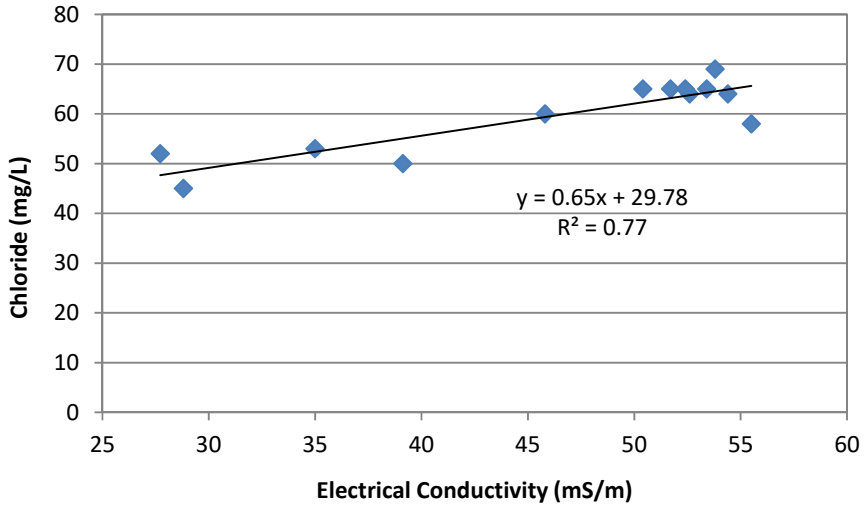

Figure 1. *Relationship between EC and chloride concentration from the 2018 NRC Kaimaumau groundwater quality investigation*

It is noted that sampling of chloride concentrations in the sentinel bores during the baseline period would enable validation of an EC vs Chloride relationship for each piezometer and prove a useful reference in the event of a TL2 exceedance or elevated salinity.

3.2.1 Shallow groundwater levels

The proposed monitoring programme would involve continuous monitoring of groundwater levels at 5 points around the periphery of the Kaimaumau wetland (the four sentinel bore plus the Honeytree Farms piezometer).

Comment

This section proposes an initial screening of shallow piezometric levels once all sentinel bores are established to evaluate the potential for hydraulic connection between the wetland and underlying aquifer. If this exercise indicates the potential for a hydraulic connection (i.e. the wetland is not perched above the regional water table), evaluation of potential impacts of abstraction on groundwater levels in (using data collected by DOC) and around the margin (using data from the shallow piezometers) of Kaimaumau Wetland will be undertaken as part of the Staged Implementation and Monitoring Programme Review.

Due to the range of factors that may potentially impact on wetland condition (e.g. climate variability, land drainage, peat mining etc) it is suggested that wetland monitoring may be difficult to interpret in the context of anticipated environmental effects associated with the proposed abstraction (unless the magnitude of drawdown is significantly greater than anticipated).

3.2.2 Production bore groundwater levels

The requirement for monthly monitoring of groundwater levels in production bores (following a nominal recovery period) is a standard NRC consent requirement

3.3 Saline Intrusion Monitoring

The proposed saline intrusion monitoring involves monitoring at six locations including

- Fishing club - an existing NRC monitoring site on the foreshore at Houhora;
- Kaimaumau settlement (shallow)[4] - a shallow bore (<20m) used for domestic supply in Kaimaumau settlement;
- Kaimaumau settlement (deep) - a new or existing deep bore (>50m) in the vicinity of Kaimaumau settlement accessing the shellbed aquifer.
- MWWUG bores - the three production bores located closest to Waiparera Stream in the vicinity of Norton Road (Shine, Holloway, Elbury Holdings).

Samples collected from the monitoring bores will be analysed for key salinity indicators including EC, Chloride, Sodium and Total Dissolved Solids. Samples will be collected at six weekly intervals during the baseline period and on a quarterly basis thereafter.

Comment

The proposed monitoring bores include an existing NRC groundwater quality site (Fishing Club) at Houhora, the three MWWUG production bores located closest to the coast (in the vicinity of Norton Road), plus two existing bores (1 shallow and screened in the shellbed) near the Kaimaumau where an anomalous reading was reported in a recently drilled bore. The proposed sites represent a selection of existing bores distributed around the coastal margin in the area assumed to have the highest potential for saline intrusion where groundwater is currently used (given there are no existing bores in the vicinity of East Beach).

As listed in the draft GMCP, the TL2 trigger is equivalent to the TL1 trigger. While median (from the baseline period) +/- 3 standard deviations may be suitable for TL1 trigger, it may be more appropriate to establish the TL2 trigger in terms of a nominal change from the background median value (e.g. a >50% variation from the median background concentration, consistent with the TL2 threshold proposed for EC monitoring in the sentinel bores).

It is noted NRC staff also suggest addition of a numerical trigger value of Chloride concentration >200 mg/L to the TL2 trigger. While it would seem unlikely that such a trigger would be reached prior to the TL2 exceedance based on the suggested trigger of >50% increase over median baseline concentration (typically observed to be less that 80 mg/L in the Aupouri aquifer), it would provide an absolute limit for groundwater salinity (at a threshold below the NZDWS aesthetic guideline value of 250 mg/L) which is independent of baseline water quality state.

[4] Appropriate NRC bore references will be available once specific monitoring locations have been identified

3.4 Water Quality Monitoring

Water quality monitoring is proposed to address concerns related to the potential for adverse groundwater quality effects associated with losses of nutrients and pesticides. The proposed monitoring would involve collection of samples on a six monthly basis from 3 to 5 'representative' sites. Samples would be analysed for key parameters including EC, DRP, Nitrate-Nitrogen, Ammoniacal Nitrogen and Total Nitrogen, with annual screening for pesticides.

Comment

There are a range of considerations related to the proposed water quality monitoring including:

- Due to the presence of significant amounts of organic matter within the shallow sand deposits, shallow groundwater is likely to be reducing. Under such conditions, nitrate concentrations are likely to be low in groundwater (consistent with available groundwater quality data) due to denitrification within the aquifer system. The presence of organic matter is also likely to substantially decrease the mobility of any pesticide compounds prone to leaching;
- One potential pathway for losses of nutrients would be via throughflow of shallow groundwater flow above hard pan layers. Unless specifically constructed, shallow monitoring bores (screened beneath hardpan layers) may not intercept soil moisture infiltration from surrounding land use;
- Orchard developments associated with the MWWUG consents will potentially occur in 17 separate locations. It is unlikely to be practicable to undertake monitoring at each location;
- It is not clear that the proposed 'representative' monitoring sites (except possibly the Honeytree shallow piezometer) are suitably located with respect to the proposed orchard developments.

Based on these considerations it is not clear if the proposed groundwater quality monitoring would provide a useful means to identify any water quality effects associated with the proposed use of water for horticultural irrigation.

4. Contingency Plan

4.1 Exceedance of TL1

A series of measures are proposed in response to an exceedance of the TL1 trigger. These include notification of the Regional Council of the trigger level exceedance, initiation of weekly monitoring in the monitoring bore where a trigger level exceedance is recorded (in the case of a saline intrusion monitoring bore), preparation of a Groundwater Trigger Exceedance Report (GTER) within six weeks of the exceedance being recorded.

Comment

As previously, noted the TL1 triggers are intended to serve as an initial indicator that the condition of the groundwater resource is approaching the bounds of natural variability, rather than having reached a point where specific mitigation actions are required. For example, it is likely that TL1 triggers may be exceeded in individual monitoring bore as a result of natural variability (see for example Figure 7 in the Lincoln Agritech (2015) report). In this case, additional sampling in specific monitoring will clarify if the observed exceedance represents short-term variability rather than a longer-term trend.

Production of a GTER over a period of six-weeks will enable evaluation of the significance of any TL1 exceedance, along with appropriate management recommendations for management of the resource if the exceedance represents a longer-term change in the condition of the resource.

4.2 Exceedance of TL2

Section 4.2 lists a sequence of actions that have to be initiated in response to a TL2 exceedance. These include notification of the Regional Council, implementation of a schedule of pumping restrictions (based on locations of individual consents with respect to specific monitoring sites), initiation of more frequent monitoring (weekly) in all saline intrusion monitoring bores and updating of the GTER to provide a specific programme of mitigation. In the event that water level and/or quality indicators continue to deteriorate, abstraction will be reduced to the minimum volume required for rootstock protection.

Comment

The only practicable mitigation option to address the onset of saline intrusion is to reduce the volume of abstraction from the aquifer.

The TL2 triggers are intended to be initiated at a point well before the quality of the resource is adversely impacted. However, as suggested by NRC staff it may also be useful to include an additional criterion to implement the TL2 triggers whereby:

"In the event of a TL2 exceedance, or a Chloride concentration in excess of 200 mg/L (or an equivalent EC value) being recorded in any monitoring bore , the members of the MWWUG identified as being in the area of effect through the GTER review process, shall…."

This would provide additional surety that groundwater quality is not adversely impacted by saline intrusion. An EC value equivalent to a Chloride concentration of 200 mg/L could be estimated for sentinel bores based on sampling undertaken during the baseline period (see comments on Section 3.2 above).

It is also suggested interim pumping restrictions outlined in Table 8 is amended to include saline intrusion monitoring bores in addition to the sentinel bores as follows:

Monitoring site where TL2 water level/salinity exceedance recorded	Priority 1 Consents (50% reduction in maximum daily rate of take)	Priority 2 Consents (25% reduction in maximum daily rate of take)
Waterfront sentinel, Fishing Club	Brien Thomas McLarnon	Valdares Mapua Ltd
Motutangi	Candy Corn Thompson Cypress Hills	Mapua Ltd Covich Honeytree
Norton Road sentinel, Kaimaumau sentinel, Kaimaumau shallow, Kaimaumau deep, Elbury	Elbury Shine Holloway	Covich Stanisich Largus

Holdings, Shine, Holloway	Ngai Takoto Honeytree	Hewitt

Yours Sincerely

Brydon Hughes
Hydrogeologist

Motutangi-Waiharara Water Users Group

Groundwater Management and Contingency Plan

JW = Jon Williamson

L / BH= Brydon Hughes

Contents

1. Introduction

This document comprises a groundwater monitoring and contingency plan (GMCP) for the operation and management of the groundwater takes. The GMCP has the overarching objectives of:

ensuring compliance with the consent conditions for members of the Motutangi-Waiharara Water Users Group (MWWUG); and

providing early detection of any impact to the Motutangi-Waiharara groundwater system associated with the exercise of the groundwater take consents.

Extensive environmental monitoring is required to ensure the effects on the environment are no greater than those anticipated in the AEE, and to support the proposed 'adaptive management' approach involving a staged implementation of groundwater extraction. The purpose of the GCMP is to formalise specific monitoring requirements, establish groundwater level and groundwater quality monitoring triggers and outline a process for implementation of appropriate mitigation measures in the event that nominated trigger values are exceeded.

The GCMP is intended to allow the early detection of any impact to the Motutangi-Waiharara groundwater system associated with the exercise of groundwater take consent(s), by:

Ensuring regular monitoring of the groundwater system both on and off-site;

Setting monitoring criteria to indicate potential impact on the groundwater system;

Informing the Northland Regional Council when changes in the pumping regime are required;

Reviewing monitoring data after a step level increase in pumping rate;

Ensuring that the monitoring data is available for regular review by the Northland Regional Council; and

Detailing a Contingency Plan to be implemented if an unanticipated impact(s) is identified.

The GMCP also provides information as to the actual effects of the abstraction on the groundwater resource and will enable validation of the numerical model by the Consent Holders for any replacement groundwater take consent applications.

1.1 Scope and Purpose of the GMCP

The GMCP addresses the potential effects on groundwater, saline intrusion, and water levels within the shallow aquifer and the Kaimaumau wetland. Specifically, the GMCP is aimed at:

a) Providing procedures to avoid, remedy and mitigate changes in groundwater and wetland water levels, and salinity concentrations in the aquifer at the coast;

b) Ensuring the owners and operators of the consents understand their legal responsibility and how to go about implementing their consents within the legal limits; and

c) Providing all stakeholders and the Regional Council assurance that the Consent will be exercised in compliance with the conditions.

2. Framework for Adaptive Management

The uptake of water under the MWWUG consents will steadily increase over time in accordance with the following factors:

Level of current orchard development – noting the following orchards are already well established:

APP.027391.01.02 – Stanisich;

APP.038650.01.01 – Hewitt;

APP.039345.01.01 – McLarnon;

APP.038380.01.01 – Huanui Orchards (Holloway);

APP.038589.01.01 – Thompson;

APP.038591.01.01 – Cypress Hills Ltd;

Rate of orchard development - will occur at differing rates depending on the owner's cashflow and access to plants; and

Tree maturity - approximately 9 years to full maturity and plant water usage[1], hence irrigation requirements commensurately increase with tree growth.

The steady progressive development of the orchards, particularly the new large developments, provides an opportunity to apply an adaptive management approach that establishes a baseline and allows potential groundwater, wetland and coastal salinity effects to be checked against the predictions made in the AEE, specifically the following:

The groundwater drawdown predictions in both the shallow and deep aquifer;

Impacts on wetland water levels by inference from shallow ground monitoring adjacent to the wetland; and

Salinity at key coastal locations.

The management approach provides a series of responses to be taken should effects develop or trend outside those predicted in the AEE, as discussed in **Section 2.2**.

2.1 Staged Implementation

To allow for the establishment of baseline monitoring conditions the uptake of the water volumes granted under these consents will be permitted in three stages over nine years, with each stage of three years in duration. For the purposes of the staged implementation, it has been assumed that:

For new orchards - full uptake for new orchards will be required at the end of the nine years and applicants have agreed to the following schedule (subject to Regional Council approval):

Years 1-3 – 50% uptake;

Years 4-6 – 80% uptake; and

Year 7-9 – 100% uptake.

For established orchards – full uptake is required immediately (**Table 2**).

[1] Kaneko, T., 2016. Water requirements for 'Hass' avocado flowering and fruit development in New Zealand. A thesis submitted in partial fulfilment of the requirements for the degree of Master of Science in Biological Sciences at The University of Waikato.

Table 1. Summary of staged implementation annual volumes.

Application Number	Consent Holder	Consented Annual Volume (m^3)	Allowable Annual Volume (m^3)		
			Stage 1 (Year 1-3)	Stage 2 (Year 4-6)	Stage 3 (Year 7-9)
APP.038610.01.01	Mapua Avocados Ltd, C/o Murray Forlong	745,000 **624,000**	372,500 **312,000**	596,000 **499,200**	745,000 **624,000**
APP.038471.01.01	Honeytree Farms Limited, C/o Tony Hayward	372,000 **200,000**	186,000 **100,000**	297,600 **160,000**	372,000 **200,000**
APP.038410.01.01	Georgina Tui and Mate Nickolas Covich	223,500	111,750	178,800	223,500
APP.038420.01.01	Largus Orchard Ltd Partnership, C/o Murray Forlong (Changed from Matijevich)	193,700	96,850	154,960	193,700
APP.038513.01.01	Te Runanga o Ngai Takoto, C/o Rangitane Marsden	193,700	96,850	154,960	193,700
APP.038454.01.01	Elbury Holdings Limited, C/o Kevin and Fiona King	113,700	56,850	90,960	113,700
APP.039332.01.01	Candy Corn Ltd, C/o Bryan Candy	80,000	40,000	64,000	80,000
APP.027391.01.02	Ivan Anthony Stanisich*	64,070	64,070	64,070	64,070
APP.039244.01.01	Kevin and Dani Thomas	59,600	29,800	47,680	59,600
APP.038589.01.01	Neil & Alma Violet Thompson and Steven & Josephine Suzanne Thompson*	39,350	39,350	39,350	39,350
APP.038591.01.01	Cypress Hills Ltd, C/o Alan Anderson & Carolyn Dawn Smith*	41,720	41,720	41,720	41,720
APP.038650.01.01	Tony and Diane Hewitt*	40,230	40,230	40,230	40,230
APP.038328.01.01	Bernard Kim & Sheryl Dianne Shine	50,184 **40,000**	25,092 **20,000**	40,147 **32,000**	50,184 **40,000**
APP.039345.01.01	Ian McLarnon & Jason McLarnon*	24,000 **23,370**	24,000 **23,370**	24,000 **23,370**	24,000 **23,370**
APP.038732.01.01	Kathy Valadares	48,000 **22,350**	24,000 **11,175**	38,400 **17,880**	48,000 **22,350**
APP.038380.01.01	Daimen & Katherine Holloway*	14,900	14,900	14,900	14,900
APP.039381.01.01	Johno and Carol Brien (Lamb Road)	14,900	7,450	11,920	14,900
TOTAL		**2,318,554** **1,989,090**	**1,251,737** **1,106,365**	**1,891,827** **1,636,000**	**2,318,554** **1,989,090**
% of Total			**55%**	**82%**	**100%**
Note: *orchards already significantly developed					

Commented [L1]: Figures in red are the equivalent volumes based on recommended annual volumes in the Officers Report

Commented [JW2]: The annual volumes are disputed. Shown here are the volumes from Mr Williamson's evidence.

2.2 Trigger Level System

Trigger levels (TLs) will be established to set up an early warning system that provides a response mechanism when differences between predicted and actual water levels, and/or salinity concentrations occur. A trigger level is an environmental criterion that if reached or met, requires a certain response to be actioned.

A two-tier trigger level system will be implemented in this GCMP:

TL1 - The first-tier trigger level establishes whether the parameter of concern is approaching outer limits of background data (e.g. median ±3 times the standard deviation);

TL2 - The second-tier trigger level is set at a threshold defining a 'significant' departure from background conditions and/or conditions where the risks of adverse environmental effects such as saline intrusion are increased.

The TLs parameters required under this GMCP for the various suites are summarised in **Table 2**.

Table 2. Summary trigger level parameters by monitoring suite.

Monitoring Suite	Parameters
Groundwater level and salinity monitoring	Groundwater level, electrical conductivity
Saline intrusion monitoring	Electrical conductivity, chloride, sodium, total dissolved solids.
Water quality monitoring	Electrical conductivity, dissolved reactive phosphorus, nitrate, ammonium, total nitrogen, pesticide suite.

Commented [JW3]: This monitoring suite is disputed.

2.2.1 Timeframe for setting of trigger levels

The setting of TL1 and TL2 trigger levels values for each parameter (where TBC is indicated in the monitoring plan tables in the **Section 3**) will be undertaken during the first implementation stage after 12 months of monitoring data has been collected and within 15 months of the granting of the consents. This approach recognises that:

in some areas no baseline data has been established by the applicants or any of the key stakeholders in the area; and that

the manifestation of any effects from the exercising of these consents will steadily progress with time in accordance with the stages of orchard developments and age of the crop. The scale of abstraction during the background data collection period (i.e. 12 months following granting of consent) will not vary significantly from existing conditions.

2.2.2 Response to monitoring results

The monitoring results are to be compared against the TLs after each round of monitoring by a suitably qualified expert approved by NRC. The actions required should TLs be exceeded are summarised in **Section 4** (Contingency Plan) and shown in **Figure 3**.

2.3 Environmental Monitoring Report

The MWWUG must commission the preparation of an Environmental Monitoring Report (EMR) by a suitably qualified Hydrogeologist approved by NRC at the end of each irrigation season and this must be submitted to the Regional Council by 30 June each year.

The EMR must provide an analysis and interpretation of the results of bore water meter (use) records, groundwater level and water chemistry monitoring data, and compare the monitoring data to predicted impacts within the AEE.

2.4 Staged Implementation and Monitoring Programme Review

At the following times the volume of abstraction authorised will be reviewed against the staged implementation outlined in **Section 2.1 at the minimum intervals of**:

End of Stage 1 - three years following granting of the consents;

End of Stage 2 - six years following granting of the consents; and

End of Stage 3 - nine years following granting of the consents.

The Staged Implementation and Monitoring Programme Review will be prepared by a suitably qualified expert approved by NRC and include a detailed assessment of all environmental monitoring data including groundwater levels, salinity indicators, and water quality, and include consideration of spatial and temporal trends. The report will be provided to NRC a minimum of three months prior to the anticipated commencement of the subsequent irrigation season utilising volumes defined for the subsequent development stage. An increase in the volume of abstraction to the next development stage will only occur upon receipt of written approval of the NRC monitoring manager indicating the Regional Council is satisfied that environmental effects resulting from abstraction are no more than those anticipated in the AEE.

The review may also consider the nature and scope of continued monitoring (i.e. monitoring frequency, intensity (type and number of samples)) and associated trigger levels. No changes shall be undertaken or implemented without the prior written approval of the NRC monitoring manager. The report and recommendations for any changes shall be provided to the NRC for review and approval at least 3 months prior to the irrigation season that the requested changes are required to be implemented

Review of the monitoring programme may also occur to incorporate new or replacement water permits in the Waiharara, Motutangi or Houhora sub-areas of the Aupouri aquifer management unit that have overlapping and/or additional monitoring requirements or which are subject to different trigger levels or trigger levels based on monitoring described in this GMCP.

2.5 Timeline of Management Actions

Figure 1 provides a timeline indicating when reporting and management decisions are required.

Figure 1. Timeline of reporting and management decisions.

3. Monitoring Plan

3.1 Bore Locations and Details

A consolidated summary of the schedule of bores that are required to be monitored as part of this GMCP is provided in **Table 3**. Along with the bores identified for monitoring, the table provides key details relating to the bores physical attributes and monitoring to be undertaken. The following sections provide monitoring schedules (frequency and trigger levels) for the relevant bores under each suite of monitoring bore.

The locations of the bores are show in **Figure 2**, which also shows the location of the MWWUG bores for reference.

Table 3. Schedule of bores and monitoring details.

Bore Name		Bore Owner	Coordinates (NZTM 2000)		Depth (m)	Dia. (mm)	Piezo. No.	Target aquifer	Purpose*
Generic	NRC ref.		Easting	Northing					
Fishing Club	LOC.200250	NRC	1611411	6146928	79			Deep shellbed	SI; MI
Waterfront	LOC.200210	NRC	1611712	6146689	19	32	1	Shallow sand	GL
			1611712	6146689	37	32	2	Intermediate	
			1611712	6146689	57	32	3	Intermediate	
			1611712	6146689	74	32	4	Deep shellbed	
Motutangi	TBC	TBC	1615707	6139818	<10	50	1	Shallow sand	GL; EC
			1615707	6139818	80-100 (TBC)	50	2	Deep shellbed	GL; EC
Norton Road	TBC	TBC	1619772	6134408	<10	50	1	Shallow sand	GL; EC; N; P
	TBC	TBC	1619772	6134408	80-100 (TBC)	50	2	Deep shellbed	GL; EC
Kaimaumau	LOC.316222	NRC	1622445	6134482	20		1	Shallow sand	GL; EC; SI; MI; N; P
	LOC.315766	NRC	1622426	6134466	72		2	Deep shellbed	GL; EC; SI; MI
Kaimaumau Settlement	LOC.200097	Private (Wilson Kaimaumau)	1624293	6135696	<20 (12)		1	Shallow sand	SI
	TBC	TBC	1624253	6135897	>50 (TBC)		2	Deep shellbed	SI
Lamb Road	TBC	J. & C. Brien	1610222	6147542	TBC		1	Deep shellbed	GL
Valadares	TBC	K. Valadares	1611284	6144679	TBC		1	Deep shellbed	GL
McLarnon	TBC	I. & J. McLarnon	1610058	6147313	TBC		1	Deep shellbed	GL
Elbury Holdings	TBC	Elbury Holdings Limited	1611872	6142927	TBC		1	Deep shellbed	GL; SI
Holloway	TBC	Huanui Avocados Ltd	1610366	6143906	TBC		1	Deep shellbed	GL; SI
Ngai Takoto	TBC	Te Runanga o Ngai Takoto	1611284	6144679	TBC		1	Deep shellbed	GL
			1619904	6133984	TBC		1	Deep shellbed	GL
Cypress Hills	TBC	Cypress Hills Ltd	1619097	6135520	TBC		1	Deep shellbed	GL
Stanisich	TBC	I.A. Stanisich	1618987	6135795	95	104	1	Deep shellbed	GL
Honeytree	TBC		1617128	6136793	112	310	1	Deep shellbed	GL

Commented [BH4]: Grid references require confirmation

Bore Name		Bore Owner	Coordinates (NZTM 2000)		Depth (m)	Dia. (mm)	Piezo. No.	Target aquifer	Purpose*
Generic	NRC ref.		Easting	Northing					
		Honeytree Farms Limited	1617128	1617128	6	50	2	Shallow sand	GL; N; P
			1614898	6138495	111	310	3	Deep shellbed	GL
Thompson	TBC	N. & A. V. Thompson and S. & J.S. Thompson	1617846	6133480	TBC		1	Deep shellbed	GL
Candy Corn	TBC	Candy Corn Ltd	1618903	6136060	TBC		1	Deep shellbed	GL
Mapua	TBC	Mapua Avocados Ltd	1618611	6136321	111	100	1	Deep shellbed	GL
			1614798	6138773	122	100	2	Deep shellbed	GL
			1614723	6139203	97	100	3	Deep shellbed	GL
Hewitt	TBC	T. & D. Hewitt	1612541	6141795	TBC		1	Deep shellbed	GL
Shine	TBC	B. K. & S. D. Shine	1612979	6142360	TBC		1	Deep shellbed	GL; SI
Largus	TBC	Largus Orchard Ltd Partnership	1612784	6142645	94	100	1	Deep shellbed	GL
			1617436	6132318	TBC	100	2	Deep shellbed	GL
Covich	TBC	G.T. & M. N. Covich	1619411	6134224	TBC		1	Deep shellbed	GL
			1619702	6134754	TBC		1	Deep shellbed	GL
Thomas	TBC	K. & D. Thomas	1618003	6133379	TBC		1	Deep shellbed	GL

* Purpose key: GL = Groundwater Level; EC = Electrical Conductivity; SI = Salinity Indicators; MI = Major Ions; N = nutrients; P = pesticides.

Commented [BH4]: Grid references require confirmation

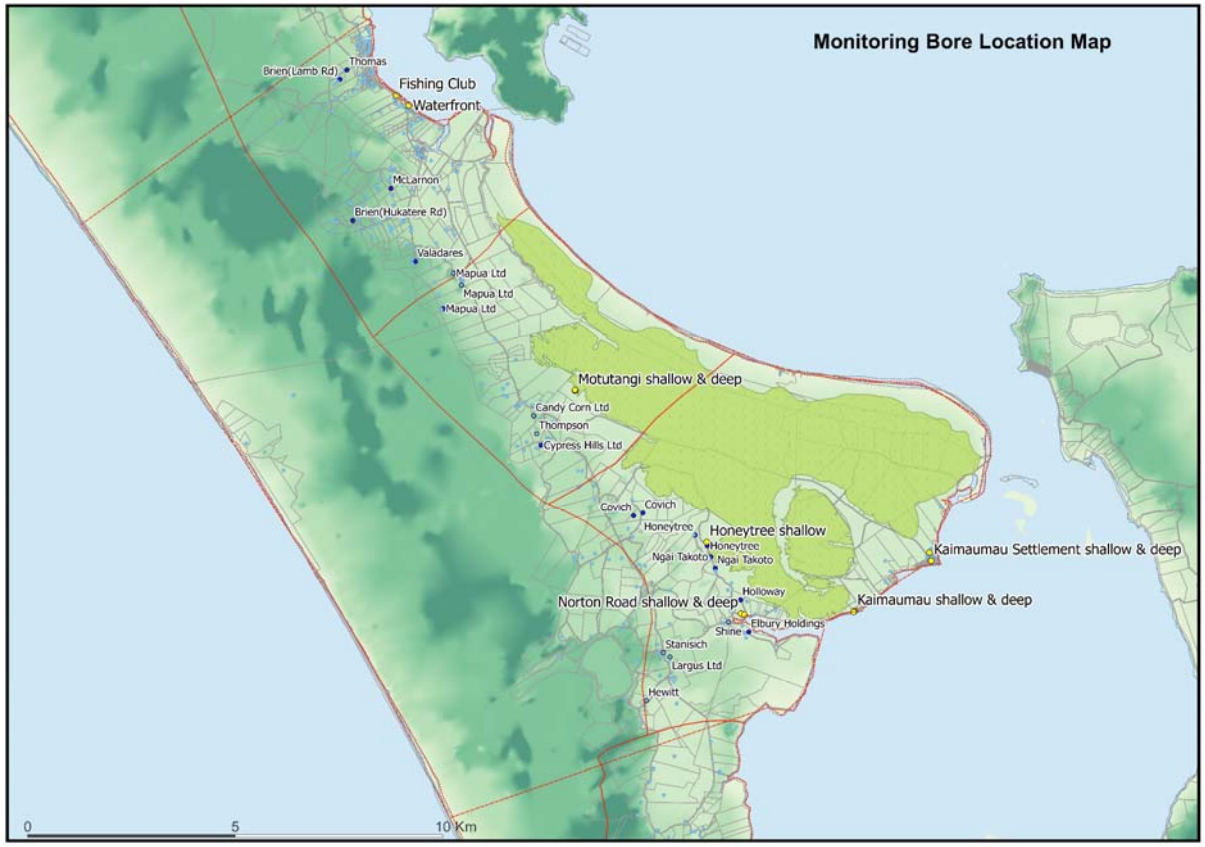

Figure 2. Monitoring Bore Location Map.

3.2 Groundwater Level and Salinity Monitoring

Sentinel bores are monitoring bores located near a discharge boundary or in close proximity to a discharge receptor, and therefore provide early detection or warning of potential concerns. In this GCMP sentinel bores will be utilised as the primary reference sites for regional groundwater levels and salinity monitoring.

Sentinel bores will collect data continuously (daily basis) for water levels and electrical conductivity in individual piezometers to provide an indication of:

- drawdown in shallow groundwater levels in the vicinity of Kaimaumau Wetland attributable to abstraction of deeper groundwater authorised by MWWUG consents;
- groundwater levels around the coastal margin lowering and approaching a threshold that could indicate a greater risk of saline intrusion; and
- any reduction in water quality that could indicate the landward migration of the saline interface.

Checking of the datalogging sensors required for continuous monitoring shall be undertaken during the irrigation season on a monthly basis. The data will be reviewed and any faults shall be reported to the Regional Council and remedied immediately, and TL exceedances should follow the procedures in the Contingency Plan described in **Section 4**.

Sentinel bores will be installed within 3 months of the issue of consents for the MWWUG. Trigger levels (TL1 and TL2) for groundwater level will be determined once individual piezometers are constructed and level surveyed. TL1 will be based on the baseline data, while TL2 will be no less than 0.5 mAMSL in the shallow aquifer and 1.0 mAMSL in the deep aquifer (noting that changes in EC are also a key indicator).

Electrical conductivity triggers for the sentinel bores will be established as follows:

- **TL1** - Median (weekly rolling average) EC from baseline monitoring period +25%
- **TL2** - Median (weekly rolling average) EC from baseline monitoring period + 50%

Details of the sentinel bores to be used as groundwater level and salinity reference points are summarised in **Table 4**.

Table 4. Schedule of sentinel monitoring bores for groundwater level and salinity indicators.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Purpose*	Units	Frequency	Trigger Levels	
							TL1	TL2
Waterfront	19	4	Shallow sand	GL	mAMSL	Continuous	2.3	0.5
	37	3	Intermediate	GL	mAMSL	Continuous	2.9	0.6
	57	2	Intermediate	GL	mAMSL	Continuous	4.5	1.1
	74	1	Deep shellbed	GL	mAMSL	Continuous	4.4	1.8
Motutangi sentinel	<10	1	Shallow sand	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
	80-100 (TBC)	2	Deep shellbed	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
Norton Road sentinel	<10	1	Shallow sand	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
	80-100 (TBC)	2	Deep shellbed	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
Kaimaumau sentinel	20	1	Shallow sand	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
	72	2	Deep shellbed	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC

* Purpose key: GL = Groundwater Level; EC = Electrical Conductivity; SI = Salinity Indicators; MI = Major Ions.

Notes:

TBC = to be confirmed within 15 months of granting of the consents.

GL TL1s (where provided) have been calculated from longterm monitoring data.

GL TL2s (where provided) have been interpolated from Table F1, WWA Groundwater Modelling Report.

3.2.1 Shallow Groundwater Levels

The purpose of shallow groundwater level monitoring in sentinel bores is to specifically address concerns related to water level reductions in shallow groundwater and potential effects on the Kaimaumau wetland.

The existing conceptual understanding in the shallow groundwater regime is that groundwater levels within the wetland are higher than groundwater levels in the shallow aquifer outside of the wetland, due to land drainage of adjacent farm land.

Following installation of the sentinel bores, groundwater levels around the wetland margin (at the Motutangi, Norton Road and Honeytree Farms monitoring sites) will be compared to the wetland ground levels in the wetland to assess any difference in relative water levels. Depending on results of this assessment, monitoring and reporting of shallow groundwater levels will be undertaken as follows:

If comparison of relative groundwater levels indicates clear separation between standing water levels in the wetland and the regional piezometric surface, the potential for hydraulic connection with the wetland is limited. In this case, no specific assessment of shallow groundwater levels will be required.

If comparison of relative groundwater levels indicate standing water levels in the wetland are close to, or below the regional piezometric surface, it will be assumed the potential for hydraulic connection between the wetland and aquifer exists. In this case, assessment of localised and sub-regional trends in shallow groundwater (including groundwater levels recorded by DOC in the Kaimaumau Wetland) will be provided in the

Environmental Monitoring Report (**Section 2.3**), and evaluation of the potential magnitude and significance of effects will be a consideration for the review and approval of the proposed staged development (outlined in **Section 2.4**).

3.2.2 Production Bore Groundwater Levels

Monthly water level monitoring is required in all MWWUG production bores during the winter months (nominally May to September) to provide information to identify any inter-annual variations in aquifer storage which may be anomalous compared to regional trends (**Table 5**). Water levels will also be measured in all production bores at nominal monthly intervals during the summer months, with measurements undertaken a minimum of 8 hours flowing the cessation of pumping.

However, no specific trigger level will be established for groundwater levels in the production bores as water levels in the production bores can be impacted by well efficiency and pumping schedules so are not necessarily representative of groundwater levels in the surrounding aquifer.

Continuous water level monitoring is also required in a shallow observation bore adjacent to the APP.038471.01.01 production bore (Honeytree Farms) to quantify any localised drawdown effects in the shallow sand aquifer in the vicinity of a relatively large abstraction proximal to Kaimaumau Wetland.

This shallow aquifer monitoring will enable comparison between the area of maximum shallow aquifer impact modelled in the AEE, with the shallow piezometers in the four sentinel bores (**Table 4**) distributed across the wider Aupōuri Aquifer.

Table 5. Proposed Monitoring Schedule – Production Bore Water Levels.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Lamb Road	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Valadares	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
McLarnon	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Elbury Holdings	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Holloway	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Ngai Takoto	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Cypress Hills	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Stanisich	95	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Honeytree	112	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
	6	2	Shallow sand	GL	mAMSL	Continuous	n/a	n/a
	111	3	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Thompson	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Candy Corn	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Mapua	111	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
	122	2	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
	97	3	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Hewitt	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Shine	TBC	1	Deep shellbed	GL; SI	mAMSL	Monthly	n/a	n/a
Largus	94	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Covich	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a
Thomas	TBC	1	Deep shellbed	GL	mAMSL	Monthly	n/a	n/a

* Purpose key: GL = Groundwater Level; EC = Electrical Conductivity; SI = Salinity Indicators; MI = Major Ions.

3.3 Saline Intrusion Monitoring

Quarterly monitoring of key salinity indicators in new or existing bores at key locations around the northern margin of Rangaunu Harbour is required. This area is adjacent to the largest concentration of proposed abstraction, in an area where the potential for saline intrusion is elevated due to a flat hydraulic gradient (particularly toward Kaimaumau settlement where groundwater is used for potable and farm water supply). Reference to the existing NRC state of the environment monitoring sites at Houhora and Kaimaumau which are monitored quarterly is also required.

Proposed monitoring sites include:

the existing Fishing Club bore at Houhora (monitored quarterly by NRC).

the existing shallow and deep Kaimaumau sentinel bores (monitored quarterly by NRC).

a new or existing bore in or near the Kaimaumau settlement accessing the shallow sand aquifer (<20 metres).

a new or existing bore in or near the Kaimaumau settlement accessing the shellbed aquifer (>50 metres).

proposed production bores in the Norton Road area located within 1 km of the coastal marine area.

Salinity indicators and major ions monitored shall include:

Electrical conductivity.

Chloride.

Sodium.

Total Dissolved Solids.

Samples will be collected in accordance with A National Protocol for State of the Environment Groundwater Sampling in New Zealand (Ministry for the Environment, 2006)

Trigger levels for individual determinants will be established as follows:

- **TL1** - Median concentration from the baseline monitoring period +3 standard deviations
- **TL2** - Median concentration from the baseline monitoring period + 3 standard deviations

During the initial baseline period (12 months), sampling for salinity indicators will be undertaken at 6 weekly intervals. Subsequent monitoring will be undertaken following the schedule set out in **Table 6**.

Table 6. Proposed Monitoring Schedule – Saline Intrusion.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Fishing Club	79	1	Deep shellbed	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
Kaimaumau	20	1	Shallow sand	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
	72	2	Deep shellbed	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
Kaimaumau Settlement	<20 (12)	1	Shallow sand	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
	>50 (TBC)	2	Deep shellbed	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
Elbury Holdings	TBC	1	Deep shellbed	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
Holloway	TBC	1	Deep shellbed	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
Shine	TBC	1	Deep shellbed	EC	µS/cm	Quarterly	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC

* Parameter key: GL = Groundwater Level; EC = Electrical Conductivity; SI = Salinity Indicators; MI = Major Ions.

3.4 Water Quality Monitoring

Water quality monitoring shall be established in shallow piezometers located down-gradient of representative orchard areas in the Motutangi and Waiparera sub-areas.

Piezometers shall be sampled:

- On a six-monthly basis for representative nutrients.
- On an annual basis for any pesticides identified in the GCMP which exhibit characteristics which increase the potential to leach to groundwater (e.g. persistent, soluble, mobile).

As indicated in **Section 2.4**, periodic review of groundwater quality monitoring results as well as the nature and scope of continued monitoring. Any changes to the monitoring schedule require approval by NRC.

Table 7. Proposed Monitoring Schedule – Water Quality Monitoring.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameters*	Frequency	Trigger Levels	
						TL1	TL2
Motutangi sentinel	<10	1	Shallow sand	EC	Six monthly	TBC	TBC
				DRP	Six monthly	TBC	TBC
				NO_3	Six monthly	TBC	TBC
				NH_4	Six monthly	TBC	TBC
				TN	Six monthly	TBC	TBC
				PS	Annually	TBC	TBC
Norton Road sentinel	<10	1	Shallow sand	EC	Six monthly	TBC	TBC
				DRP	Six monthly	TBC	TBC
				NO_3	Six monthly	TBC	TBC
				NH_4	Six monthly	TBC	TBC
				TN	Six monthly	TBC	TBC
				PS	Annually	TBC	TBC
Honeytree	6	2	Shallow sand	EC	Six monthly	TBC	TBC
				DRP	Six monthly	TBC	TBC
				NO_3	Six monthly	TBC	TBC
				NH_4	Six monthly	TBC	TBC
				TN	Six monthly	TBC	TBC
				PS	Annually	TBC	TBC

* Parameter key: EC = Electrical Conductivity; DRP = Dissolved Reactive Phosphorus; NO3 = Nitrate; NH4 = Ammonium; TN = Total Nitrogen; PS = Pesticide Screen.

Commented [JW5]: This is a point of contention with the applicant. The Applicants are opposed to monitoring for an effect that is envisaged as part of the baseline for a Permitted Activity in the plan. This type of monitoring is typically Regional Council SOE monitoring.

See the supplementary evidence of Ms Letica.

Commented [BH6]: The requirement for water quality monitoring is in response to concerns raised regarding nutrient and pesticide use.
The proposed monitoring only has value if it is undertaken immediately down gradient of orchard developments. If the sentinel bores are located away from development, there is little value in sampling them

4. Contingency Plan

Exercising of the consents is subject to maintenance of aquifer conditions that do not indicate on-going unsustainable groundwater level decline or increase in salinity at the coastal margins (saline intrusion).

As described in **Section 2.2**, a trigger level system is used to define environmental criteria that signals changes may be occurring outside of what is normal (TL1) or at a point where mitigation is required (TL2). This section details the responses that that will be undertaken where TLs are exceeded under any of the monitoring suite discussed in **Sections 3.2, 3.3, and 3.4**.

Figure 3 provides an overview diagram of the contingency plan.

4.1 Exceedance of TL1

In the event of a TL1 exceedance, which may represent declining groundwater levels or rising salinity indicators, the following actions must be undertaken:

a) Notify the Regional Council within 2 working days of when the TL1 exceedance became known.

b) Sampling of the monitoring bore(s) in exceedance shall immediately be upgraded to a weekly frequency for four weeks following the first exceedance of the TL1 and results reported to the Regional Council at weekly intervals. Weekly monitoring shall continue until sample results are consistently below TL1 values for a period of 4 weeks or as directed by NRC.

c) If after four weeks following the first exceedance of the TL1, the initiation of seawater intrusion and/or water level decline cannot be discounted to the satisfaction of the Regional Council, then within six weeks of the initial breach, the MWWUG shall prepare and submit to the Regional Council a Groundwater Trigger Exceedance Report (GTER).

d) The GTER shall assess the significance of the exceedance in terms of saline intrusion of the aquifer, effects on the Kaimaumau wetland or ongoing declining groundwater levels (including effects on existing groundwater users). The GTER shall assess why TLs have been breached, identify the pumping bores in the area of effect, and include a review of all of the available data, including groundwater levels, groundwater use and groundwater quality, and shall be completed by a suitably qualified Hydrogeologist approved by NRC.

4.2 Exceedance of TL2

In the event of a TL2 exceedance, which represents significant departure from normal groundwater conditions, with either continuously declining groundwater levels or rising salinity indicators, the members of the MWWUG identified as being in the area of effect through the GTER review process, shall:

a) Inform NRC immediately upon TL2 exceedance becoming known.

b) Implement an interim schedule of pumping restrictions commensurate with **Table 8**.

c) Commence weekly sampling of saline intrusion monitoring bores listed in Table 6 within one week of the TL2 trigger level exceedance. Monitoring will continue until such time as

- Three consecutive samples in an individual monitoring bore are below all TL2 thresholds established for that piezometer; or
- As directed by NRC

d) If salinity indicators continue to increase or groundwater levels continue to decline after 7 days following the implementation of the interim pumping restrictions, abstraction for the consents identified in Table 8 will reduce to volumes required for rootstock protection

Commented [BH7]: Requires definition

e) Review and update the GTER report within 20 working days with a longer-term programme of recommended responses incorporating observed response to interim pumping rate reductions. The updated GTER will include a specific programme (including timeframes) of remedial actions to mitigate saline intrusion risk over the medium and long term. The remedial actions may include, but not be limited to incremental reductions in the daily quantity of groundwater taken as a percentage of the allowable daily pumped volume, as well as testing of domestic/stock water supplies in bores potentially impacted by saline intrusion and, if necessary, provision of temporary water supplies to effected parties outside of the MWWUG in the event water quality exceeds MAVs or aesthetic guidelines prescribed in NZDWS (potable supplies).

f) Actions from the GTER shall continue as long as the issue continues.

g) Implement additional mitigation measures as directed by NRC

Table 8. Interim pumping restrictions following TL2 exceedance.

Piezometer where TL2 water level/salinity exceedance recorded	Priority 1 Consents (50% reduction in maximum daily rate of take)	Priority 2 Consents (25% reduction in maximum daily rate of take)
Waterfront	Brien Thomas McLarnon	Valdares Mapua Ltd
Motutangi	Candy Corn Thompson Cypress Hills	Mapua Ltd Covich Honeytree
Norton Road/Kaimaumau	Elbury Shine Holloway Ngai Takoto Honeytree	Covich Stanisich Largus Hewitt

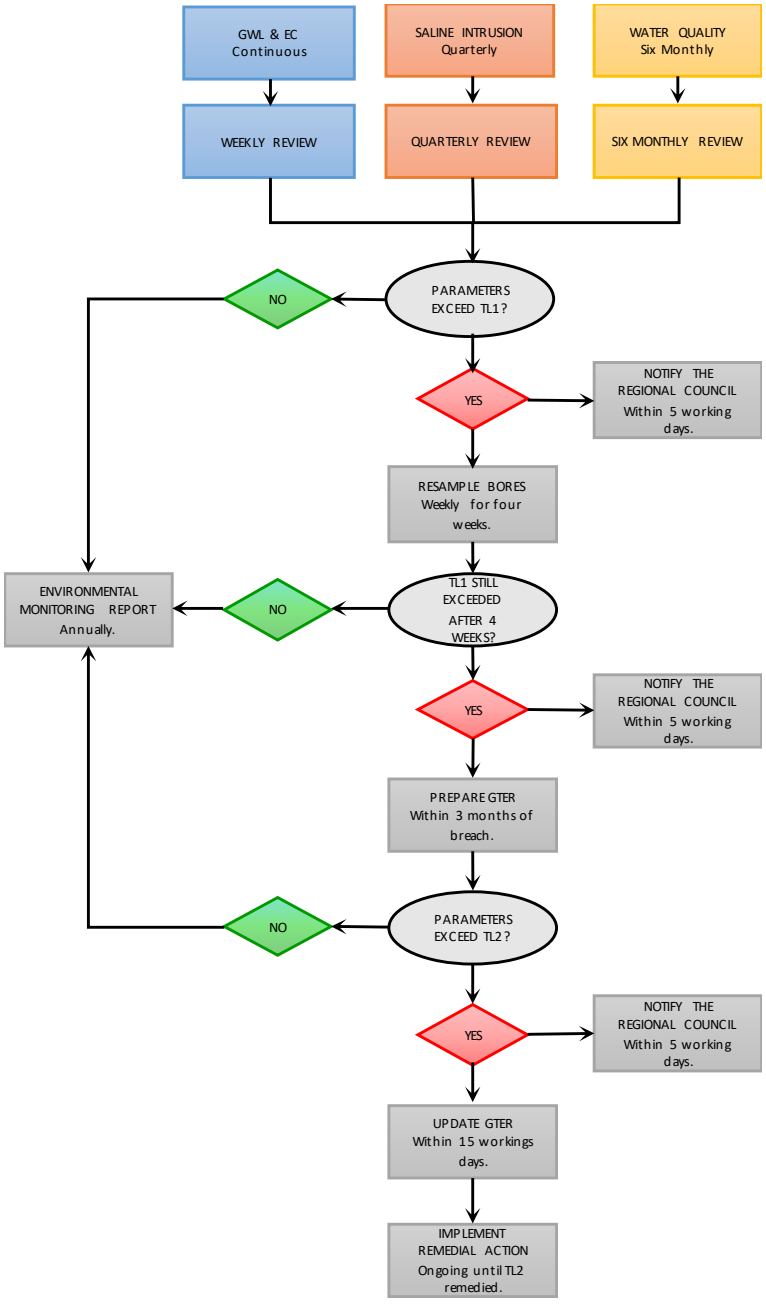

Figure 3. Overview diagram of the Contingency Plan.