

**Groundwater Monitoring and Contingency
Plan for the Other, Paparore, Motutangi
and Houhora sub-aquifers of the Aupōuri
Aquifer Management Unit**

May 2021

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GLOSSARY OF TERMS

Saline/saltwater intrusion	For the purposes of this Groundwater Monitoring and Contingency Plan, saline/saltwater intrusion refers to changes in salinity at nominated monitoring locations that exceed thresholds established to indicate elevated potential for adverse effects on groundwater quality for potable supply and/or irrigation use, and consequential effects on freshwater ecosystems
Efficient bore takes	An efficient bore take is when a bore fully penetrates the water bearing layer and takes water from the base of the aquifer.
Sub-aquifer	The Aupōuri Aquifer system is divided into 12 separate sub-aquifer units for the purposes of setting tailored aquifer-specific allocation limits. ¹
First in-first served	Under the Resource Management Act 1991, applications for water take are processed in the order in which they are lodged. The rights of parties associated with this Groundwater Monitoring and Contingency Plan are prioritised according to the order in which their permits are granted and added to this Plan.
Stage 1	The period up to the point that trigger levels have been set and irrigation has occurred for one full irrigation season, as applied for each individual take/consent
Full irrigation season	Irrigation that occurs within the entire period of a water year, being 1 July to 30 June, when irrigation is required, whether or not the full allocation for a stage is irrigated during a water

¹ Policy H.4.4.4 of the Proposed Regional Plan for Northland (Appeals Version) June 2020.

	year.
Sentinel bore	A monitoring bore specifically established to monitor groundwater levels and salinity indicators in a specified location. For the purposes of this Groundwater Monitoring and Contingency Plan, sentinel bores are those established and/or proposed monitoring bores (not production bores) in which piezometers are installed to measure groundwater levels and salinity indicators in the deep shellbed aquifer and/or the shallow sand aquifer.

1. INTRODUCTION

1.1 Scope and Objective of the GMCP

This document comprises a groundwater monitoring and contingency plan for the Motutangi, Paparore, and Houhora sub-aquifers of the Aupouri aquifer management unit ("the GMCP"). Much of the approach outlined in this GMCP has been informed by the technical assessment presented in the *Motutangi-[Waiparera]Waiharara Groundwater Model, Factual Technical Report – Modelling. Motutangi-[Waiparera]Waiharara Water User Group. WWA0026: Final – Rev. 9*, dated 31 August 2017 (hereon referred to as the MWWUG Model Report) and the *Aupouri Aquifer Groundwater Model, Factual Technical Report – Modelling – Aupouri Aquifer Water User Group. WWLA0184, Rev 3*, dated 5 February 2020 (hereon referred to as the AAGW Model Report). Both reports were prepared by Williamson Water & Land Advisory Ltd.

The GMCP covers the implementation and monitoring of the groundwater take consents listed in **Table 1** (hereafter referred to as the Consent Holders) and is a programme of adaptive management that is suitable to provide a platform for the implementation of these abstractions.

The Consent Holders listed in **Table 1** are a group of consents that have been jointly granted subsequent to the previous tranche of consents granted to other consent holders within the Motutangi-Waiharara Water User Group (MWWUG), which are subject to separate conditions and a separate GMCP. The MWWUG consents, and the AAWUG consents to which this GMCP applies, are distributed across a similar geographic area, abstracted from (generally) the same sub-aquifers, and share a similar radius of potential effects.

In accordance with the first in-first served approach to water allocation under the Resource Management Act 1991, applications for a resource are considered in the order in which they are lodged with Council. To ensure that the subsequent grant and exercise of these AAWUG consents does not derogate from the ability of the MWWUG consent holders to exercise their existing consents to their full authorisation, the conditions and this GMCP include clauses designed to retain the primacy of the MWWUG consents where remedial measures, including reductions, cessations, and staggered reactivation of takes, are required.

An adaptive management regime requires reasonably clear objectives against which the effects and management progress may be evaluated. The objective of this GMCP is that:

Objective 1: The abstractions must, individually and cumulatively, avoid:

- (a) **adverse effects of saltwater intrusion into the Aupouri aquifer;**
- (b) **adverse effects on the hydrological functioning, including changes to water levels², of natural wetlands, springs and dune lakes;**
- (c) **alteration to the extents of rivers, natural wetlands, springs and/or dune lakes;**
- (d) **adverse effects on the significant indigenous vegetation and habitats in (terrestrial and freshwater environments of) dune lakes, springs and natural wetlands; and**
- (e) **adverse effects on the significant indigenous vegetation and significant habitats of indigenous fauna in terrestrial and freshwater environments of the Kaimaumu-Motutangi wetland; and**

Commented [SK1]: DOC seeks removal "adverse effects of" or use natural levels of intrusion as qualifier; consistency with the Burgoyne decision

² Avoiding "change" means that as a result of the abstraction of water; median water levels, mean annual water level fluctuations and patterns of water level seasonality (relative summer vs winter) remain unchanged.

- (f) **Adverse effects on the flow levels and flow variability of rivers and streams and springs so that their habitat quality and sustainable mahinga kai, recreational, and other social and cultural values, are maintained (including sufficient flows and flow variability to maintain their habitat quality, including to flush rivers of deposited sediment and nuisance algae and macrophytes and support the natural movement of indigenous fish and valued introduced species such as trout; and**
- (g) **lowering of the groundwater levels of the Aupōuri aquifer such that existing efficient bore takes operating as a permitted activity or in accordance with resource consent conditions cannot access the authorised volume of groundwater.**

Extensive environmental monitoring is required to achieve avoidance of the effects listed above, and to support the proposed 'adaptive management' approach including a staged implementation of groundwater extraction. The purpose of the GMCP is to provide a framework that meets the requirements and principles of adaptive management. The GMCP provides a methodology for implementing adaptive management and prescribes specific monitoring requirements, establishes groundwater level and groundwater quality monitoring triggers and outlines a process for implementation of appropriate mitigation and remediation measures if nominated trigger values are exceeded.

The GMCP is intended to allow the early detection of any impact to the Other, Motutangi, Paparore, and (southern) Houhora sub-aquifers of the Aupōuri aquifer management unit, the Kaimaumu-Motutangi wetland (Kaimaumu Wetland) and surface water bodies associated with the exercise of groundwater take consent(s), by:

- Requiring regular monitoring of the groundwater system both on and off-site;
- Setting monitoring criteria to indicate potential impact(s) on the groundwater system, Kaimaumu Wetland and surface water bodies;
- Implementing mitigation measures including changes to the pumping regime if trigger levels are reached to ensure that Objective 1 continues to be met;
- Reviewing monitoring data before and after a step level increase in pumping rate;
- Ensuring that the monitoring data is available for regular review by the Council;
- Detailing a Contingency Plan to be implemented if an unanticipated impact(s) is identified;
- Providing information to quantify the actual effects of the abstraction on the groundwater resource; and
- Enabling validation of the numerical model by the Consent Holders for any replacement groundwater take consent applications.

1.2 Parties Associated with this GMCP

The parties who have been deemed to be associated with this GMCP at its inception are Northland Regional Council ("the Council"), the Consent Holders in **Table 1**, and the Director-General of Conservation.

The following sections provide a brief description of the roles and responsibilities of each party associated with this GMCP.

Should any of these parties change during the implementation of this GMCP, either through addition or removal, the process as set out in **Section 1.3** below shall be applied.

The rights of Consent Holders associated with this GMCP are prioritised according to the order in which their permits are granted and added to this GMCP, in accordance with the first in-first served approach to water allocation under the Resource Management Act 1991.

1.2.1 Northland Regional Council

The Council will undertake the ongoing monitoring requirements of the GMCP on behalf of the Consent Holders. The actual and reasonable cost of undertaking the ongoing monitoring of these consents for the Consent Holders will be charged in accordance with Council's Charging Policy.

The installation of sentinel bores and monitoring equipment is the responsibility of the Consent Holders.

1.2.2 Consent Holders

The Consent Holders identified in **Table 1** of this GMCP are required to exercise their consents in accordance with this GMCP.

The exercise of the consents will be in accordance with Council initiated instructions which will be issued once the actions and process established through this GMCP have been undertaken.

The Consent Holders may seek changes to the GMCP through either of the processes set out in **Section 1.3**.

Commented [SK2]: DOC does not support processes for changes.

1.2.3 Director-General of Conservation

The Director-General of Conservation is responsible for administering land and waterbodies subject to reserve status under the Reserves Act 1977 and conservation or stewardship area status under the Conservation Act 1987, along with [native fish and functions relating to protected species](#) under the Wildlife Act ~~1953 and Conservation Act~~. Within the Other, Motutangi, Paparore and (southern) Houhora sub-aquifers of the Aupōuri Aquifer management unit these areas include:

- Kaimaumu Wetland

The Director-General of Conservation is a party to this GMCP to ensure that the relevant provisions of these Acts, which the Director-General of Conservation administers, in particular that matters identified in Objective 1 of the GMCP are to be met.

[It is also relevant to note that the Ngāti Kuri Claims Settlement Act 2015, Te Aupōuri Claims Settlement Act 2015, Ngāi Takoto Claims Settlement Act 2015, and the Te Rarawa Claims Settlement Act 2015 all contain provisions relating to a 'korowai redress' which set-out co-governance arrangements for conservation land known as the 'Korowai for Enhanced Conservation'. The Korowai for Enhanced Conservation recognises the historical, spiritual and cultural association Ngāti Takoto, Te Aupōuri, Te Rarawa and Ngāti Kuri iwi have with conservation land and the roles that the hapū and marae of each undertake as kaitiaki of the whenua and taonga of the conservation estate.](#)

Commented [SK3]: DOC fundamentally disagrees regarding what should be included in conditions and what can be deferred to a GMCP, and how amendments may be made to both/either.

DOC has concerns with the processes for changes, including amendments to the GMCP, trigger level setting processes and responses, and the SIMPR process, including:

High trust model that defers Council's decision making to outside the consent process
Complexities around response capabilities and timeframes for DOC District offices

DOC proposes a technical review panel made up of representatives from parties to the GMCP. Stipulations around representation, roles and scope would need to be included in the conditions.

1.3 Changes to the GMCP

This GMCP may be amended at any time to:

- Incorporate new or replacement water permits, or remove water permits, in the Other, Motutangi, Paparore, or (northern) Houhora sub-aquifers of the Aupōuri 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:
- Alter the nature and scope of the required monitoring (i.e. monitoring frequency and intensity (type and number of samples)) and associated trigger levels;
- Incorporate or remove parties who are, or may need to be, a part of this GMCP to ensure Objective 1 is met.

If either the Council or a Consent Holder wishes to amend the GMCP, then it must provide notice in writing of the proposed changes, along with any supporting technical documents, to the other Consent Holders, and the Director-General of Conservation.

Parties, given notice by Council of a change to the GMCP, have 20 working days to provide a response to the Council on the proposed changes to the GMCP.

If no response is received from a party within the stated timeframe, then Council will consider that the party has no concerns with the conclusion of the report.

If any party does not agree with the proposed change, that party shall engage a suitably qualified hydrogeologist and/or an ecologist to prepare a report detailing the reasons for the disagreement which shall be provided to Council within 30 working days from the date that the written notice of the proposed changes was sent to the party.

Any change to the GMCP will only be authorised by Council if the technical or administrative assessment of the proposed change clearly indicates that the change will meet Objective 1 of the GMCP.

The Council will provide a report to the Consent Holders detailing the reasons for its decision, including the identification and discussion of areas of agreement and disagreement. The report will also be provided to the Director-General of Conservation.

If any changes are made to the GMCP, then a copy of the amended GMCP will be provided to the Consent Holders and the Director General of Conservation.

Commented [SK4]: Concern re unreasonable timeframes for direct comment from DOC District offices. Would be more reasonable if a technical review panel was implemented.

Commented [SK5]: DOC does not support default approval. Applicants and NRC consistent on need to have an end point to the process; possibly less of an issue if tied to a technical review panel

Commented [SK6]: As above re DOC's concerns around timeframes

Commented [SK7]: DOC notes that Objective 1 is an 'avoid' provision and fundamentally disagrees that the level of information provided adequately ensures that Objective 1 will be/has been/can be/is met.

2. FRAMEWORK FOR ADAPTIVE MANAGEMENT

In summary, the following adaptive management techniques are applied in this GMCP:

- (a) Baseline monitoring – a monitoring programme has been developed for Stage 1 of the **Table 1** abstractions to establish robust existing environment baseline. This monitoring programme is contained in this GMCP, however, some monitoring detail is still required and this is indicated by the acronym 'TBC'.
- (b) Early warning systems – 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.
- (c) Staged development – Abstraction volumes will progressively be increased in a staged manner, with expansion contingent on compliance with yet to be established trigger levels and on regular reviews of groundwater level, freshwater and wetland ecology, hydrology, and salinity monitoring results. It is noted that the consent documentation requires that all development starts at Stage 1 volumes whether or not others have progressed to Stage 2 or further. This is an essential mechanism for staging as an adaptive management response.
- (d) Management of consents being exercised immediately after commencement – Until such time as there is adequate data to base the adaptive management on actual data and for Objective 1 of this GMCP to be achieved, the abstractions that will occur immediately after commencement (i.e. in the first year) will be subject to interim wetland water level and saline trigger levels and Trigger Exceedance Report procedures; and
- (e) Tiered approach to monitoring – Monitoring requirements will increase if and when site trigger levels are approached or exceeded. Likewise, monitoring intensity may decrease with evidence of sustained compliance and stability and only by way of the process outlined in **Section 1.3** of this GMCP; and
- (f) Ongoing adaptive management – The abstractions will be managed adaptively within the term of consent, in the event of trigger level exceedance through the implementation of the recommendations of a Groundwater Trigger Exceedance Report prepared by Council.
- (g) Suspension of abstractions – Should compliance with Objective 1 of this GMCP not be achieved, then the exercise of the consents to abstract and use groundwater will be suspended until such time as Council confirms in writing that compliance can be achieved.
- (h) Consent review – this GMCP does not override the ability for consents and/or consent conditions to be reviewed in circumstances stipulated in section 128 of the Resource Management Act 1991.

The following sections provide detailed information relating to the adaptive management framework to be imposed for the exercise of the consents.

2.1 Staged Implementation

The uptake of water by the Consent Holders will be over four (4) stages in accordance with the following factors:

- **Level of current orchard development – the following orchards are already well established:**
- A number of orchards that will be irrigated under these consents are already well-established and have been irrigating their trees under temporary consents issued by the Council.-

Commented [SK8]: Noted by both DOC and NRC that the SIMPR process does not provide certainty that all takes will reach maximum or be exhausted before moving to the subsequent level and this (a) leaves potential for 'leapfrogging' from 15% to 50% take etc and (b) a lag or lack of gradual increase in effects as per the intended scaling-up of takes.

Commented [SK9]: DOC notes that whilst the initial delay in takes coming online and/or reaching the full stage 1 allocation is beneficial for establishing a more conservative baseline, but this approach presents risk in being able to monitor and respond to effects as they are realised.

- **Rate of orchard development** – will occur at differing rates depending on the owner's cashflow and access to plants; and
- **Tree maturity** – approximately nine years to full maturity and plant water usage, hence irrigation requirements commensurately increase with tree growth.

The progressive increase in irrigation requirements on developing orchards, provides an opportunity to apply an adaptive management approach that establishes a baseline and allows the original hypotheses of avoidance of effects to be periodically re-evaluated to ensure Objective 1 of this GMCP continues to be met as development occurs.

The management approach provides a series of responses to be taken based on the monitoring results, including where monitoring shows that Objective 1 of this GMCP is not being met, as discussed in **Section 2.2**.

The uptake by Consent Holders of the consented total allowable water volumes will be permitted in four stages over seven-nine years, as shown in **Table 1** below, unless the outcome of the Staged Implementation and Monitoring Programme Review detailed in 2.1.1 shows that there should be a delay in moving to the next stage, or that the next stage should not occur.

Table 1. Summary of staged implementation annual volumes

Application Number	Consent Holder	Indicated year of irrigation start	Allowable Annual Volume (m3)			
			Stage 1 (Year 1) ¹	Stage 2 (Year 2-3) ¹	Stage 3 (Year 4- 86) ¹	Stage 4 (Year 79 - full consent term) ¹
Houhora sub area management unit						
APP.040919.01.01	NA BRYAN ESTATE, SG BRYAN, CL BRYAN, KY BRYAN VALADARES &D BRYAN (1)	2022/2023	20,000	40,000	60,000	80,000
Total (m³/year)			20,000	40,000	60,000	80,000
Total (% allocated per stage)			25%	50%	75%	100%
Motutangi sub area management unit						
APP.040130.01.01 ²	TUSCANY VALLEY AVOCADOS LTD (M BELLETTE)	2020/2021	16,200	22,680	29,160	36,000
APP.040918.01.01	NA BRYAN ESTATE, SG BRYAN, CL BRYAN, KY BRYAN VALADARES &D BRYAN (2)	2023/2024	40,000	80,000	120,000	160,000
APP.008647.01.06 ³	AVOKAHA LTD	2020/2021	600	1,600	3,600	4,800
<i>APP.008647.01.06 is an increase to current consented volume of 26,400 m³/year to totals as specified here.</i>			27,000	28,000	30,000	31,200
APP.039628.01.04 ³	KSL LTD	2020/2021	3,600	3,600	3,600	3,600
<i>APP.039628.01.04 is an increase to current consented volume of 26,400 m³/year to totals as specified here.</i>			30,000	30,000	30,000	30,000
Total (m³/year)			60,400	107,880	156,360	204,400
Total (% allocated per stage)			30%	53%	76%	100%
Paparore sub area management unit						
APP.040361.01.01 ²	TIRI AVOCADOS LTD	2020/2021	290,625	377,813	435,938	581,250
APP.040362.01.01 ²	VALIC NZ LTD	2020/2021	43,425	88,850	130,275	173,700

Commented [SK10]: DOC sought rationale for the exceedance of the standard percentages at these stages. KSL's level of orchard development suggests that they require the full allocation straight away to water their established orchard...

Application Number	Consent Holder	Indicated year of irrigation start	Allowable Annual Volume (m3)			
			Stage 1 (Year 1) ¹	Stage 2 (Year 2-3) ¹	Stage 3 (Year 4-86) ¹	Stage 4 (Year 79- full consent term) ¹
APP.040363.01.01 ²	WATAVIEW ORCHARDS (GREEN CHARTERIS FAMILY TRUST)	2020/2021	8,438	16,875	25,313	33,750
Total (m³/year)			342,488	481,538	591,525	788,700
Total (% allocated per stage)			43%	61%	75%	100%
Aupōuri - Other sub area management unit						
APP.039841.01.02 ⁴	MATE YELAVICH & CO LTD	2020/2021	13,000	26,000	39,000	52,000
APP.040368.01.01	ROBERT PAUL CAMPBELL TRUST	2022/2023	90,000	180,000	270,000	360,000
Total (m³/year)			103,000	206,000	309,000	412,000
Total (% allocated per stage)			25%	50%	75%	100%
Notes:						
¹ The staged implementation is based on years when irrigation occurs following the granting of the consents. This differs between individual consent holders.						
² Well established orchards with existing consented allocation which now requires further water. The applicant of APP.040361.01.01 indicates that they have an existing consent to take and use surface water but that this expires in 2021 and will not replace it if they have consent to take groundwater of sufficient amount in the first years to irrigate their established crop.						
³ These consents are for variations to increase volumes of existing consented allocation and may be exercised up to their current consented annual volumes meaning that Stage 1 (Year 1) for these consents occurs when the takes exceed their current consented annual volumes.						
⁴ Trees were planted in 2019/2020 or have to be planted in the 2020/2021 period due to ordering system.						

Commented [SK11]: These numbers were provided by applicants based on need for established orchard

2.1.1 Staging: Implementation and Monitoring Programme Review

A Staged Implementation and Monitoring Programme Review (“the SIMPR”) will be required for Council to decide whether Consent Holders proceed to the next allocation stage. 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: A period where all or part abstraction of the Stage 1 annual volume is taken after commencement of the consent and after which a full 12 months of baseline monitoring data has been collected;
- End of Stage 2: 3 irrigation seasons following date of commencement of the consents; and
- End of Stage 3: 6 irrigation seasons following date of commencement of the consents; and
- End of Stage 4: 9 irrigation seasons following date of commencement of the consents.

Commented [SK12]: As noted, DOC has a fundamental disagreement re timing, allocation exhaustion and potential lag in effects being realised.

The main purpose of the SIMPR is to assess whether proceeding to the next stage would comply with Objective 1 of the GMCP.

The SIMPR will be commissioned by the Council and shall be prepared by a suitably qualified hydrogeologist and, in relation to monitoring of the Kaimaumu Wetland, a suitably qualified wetland ecologist. The Council will endeavour to ensure that both the hydrogeologist and the ecologist will have experience and knowledge of the locality.

The SIMPR will 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 including potential effects of groundwater abstraction on water levels in dune lakes and natural wetlands. The SIMPR will assess whether Objective 1 of this GMCP is being met at the current level of abstraction, and whether Objective 1 will be met at the next stage level of abstraction. The SIMPR may also consider the nature and scope of continued monitoring (i.e. monitoring frequency and intensity (type and number of samples)) and associated trigger levels.

The SIMPR will provide recommendations based on the assessment of the environmental monitoring data to date on:

- the setting or alteration of the trigger levels;
- whether any changes to the monitoring programme are required; and
- whether to advance to the next stage of abstraction or to remain at the current level of abstraction, or to reduce the level of abstraction.

A copy of the SIMPR will be provided to the Consent Holders and the Director-General of Conservation a minimum of three (3) months prior to the anticipated commencement of the subsequent irrigation season utilising volumes defined for the subsequent development stage as stated in **Table 1**. The Consent Holders and Director-General of Conservation have 20 working days to provide a response to the Council on the conclusions and recommendations of the SIMPR.

If no response is received from a party within the stated timeframe, then the Council will consider that the party has no concerns with the conclusions of the review.

If any party does not agree with the conclusions and recommendations of the SIMPR, then a report by a suitably qualified hydrogeologist and/or an ecologist, both with experience and knowledge of the locality if possible, detailing the reasons for the disagreement shall be provided to Council within 30 working days from the date that the review was sent to the party.

An increase in the volume of abstraction to the next development stage and any change to the monitoring programme will only be authorised by Council if the technical assessment of the monitoring data clearly indicates that the increase in the allocation and any necessary change to the GMCP would meet Objective 1 of this GMCP.

Council will provide a report to the Consent Holders and the Director General of Conservation detailing the reasons for its decision, including the identification and discussion of areas of agreement and disagreement.

If any changes are made to the GMCP, then a copy of the amended GMCP will be provided to the Consent Holders and the Director General of Conservation within five (5) working days of the change being authorised as final.

A summary of the above process is also included in the conditions of each consent that is covered by this GMCP.

2.1.2 Stage 1 (Year 1) Management Regime

Stage 1, from a management and perspective, is the initial development stage following first commencement of a consent listed in **Table 1**. This adaptive management plan recognises that the level of Stage 1 development occurring immediately upon commencement will be much lower, volumetrically, than is indicated above in **Table 1** but that interim trigger levels will still be required prior to exercise of consents where levels have not been established through the minimum baseline monitoring timeframe.

Much of the relevant trigger levels in Sentinel bores have already been established through the implementation of the MWWUG GMCP and these established triggers will be utilised to manage the takes in **Table 1**. It is a requirement of this GMCP that any changes to trigger levels in the MWWUG GMCP initiated through the Annual Environmental Monitoring Report process in that GMCP be equally applied in this GMCP using the process set out in **Section 3.7** during Stage 1.

All trigger level exceedance measures are those which sit in **Section 4** below.

The interim management regime established for Stage 1 (Year 1) will be superseded by the Monitoring and Trigger Level Setting components set out in **Section 2.2** of this GMCP.

2.1.2.1 Paparore Sentinel Bore Saline Intrusion & Groundwater Level: Monitoring and Triggers

Interim trigger levels for minimum groundwater levels and salinity indicators will need to be set in the new Paparore Sentinel bore identified in **Table 4 and Table 6** for Stage 1. Ongoing monitoring will be required to ensure that Objectives 1(a), (b), and (c) are met by implementing trigger level exceedance measures.

Once the Paparore Sentinel bore is drilled, groundwater level and salinity indicators will be measured and recorded. This information will be used to set interim trigger levels for these parameters as per the methodology established in **Section 2.2** below and shall be inserted into the GMCP through the

process set out in **Section 1.3**. Interim trigger levels must be set prior to exercise of consents³ located within the Paparore sub-aquifer unit.

2.1.2.2 Trigger Level Responses

In the event of an exceedance of a trigger level in the Paparore Sentinel bore applicable in Stage 1 (Year 1), the Trigger Level Exceedance response plan contained in **Section 4** of this GMCP shall apply.

2.1.2.3 Ceasing Interim Stage 1 (Year 1) Management Regime

This interim management regime shall remain in place until such time as the setting of trigger levels as per **Section 2.2** below has been given effect through amendment to this GMCP in accordance with the change process established in **Section 1.3** of this GMCP.

2.2 Trigger Level System

2.2.1 Timeframe for setting of trigger levels

The setting of trigger level values for each parameter (where TBC is indicated in the monitoring plan tables in **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 date of commencement of these consents. This approach recognises that:

- There is historical monitoring data available for most parameters;
- In some areas, no baseline data has been established by the Consent Holders or any of the key stakeholders in the area; and
- 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 baseline data collection period (i.e. generally 12 months following commencement of consent) will not vary significantly from existing conditions.

2.2.2 Method for setting of trigger levels

A two-tier trigger level system will be implemented on the consents:

- TL1 – The first-tier trigger level establishes whether the parameter of concern is approaching outer limits of baseline data (e.g. Median ± 2 times the standard deviation, or some other criteria determined with agreement of Council). If this trigger level is breached, then additional monitoring will be undertaken by the Council. This additional monitoring will assist characterisation of the nature and significance of changes to the baseline condition of the groundwater resource.
- TL2 – The second-tier trigger level is set at a threshold defining a 'significant' departure from baseline conditions and/or conditions where the risks of adverse environmental effects are increased. If this trigger level is breached, then the Consent Holders will be required to reduce their daily water take volume in a staged manner over a set period of time.

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

Table 2: Summary trigger level parameters by monitoring suite

³ APP.04361.01.01, APP.040362.01.01, APP.040363.01.01.

Commented [SK13]: DOC considers that this is not a precautionary approach as investigation does not provide an initial response (ie reduction or cessation) to a lower-level effect.

Applicant maintains that TL1 is an indicator that an adverse effect may occur as TLs are set near baseline to determine **potential** for effect, not necessarily effect.

Monitoring Suite	Parameters
Groundwater level and salinity monitoring	Groundwater level, electrical conductivity
Saline intrusion monitoring	Electrical conductivity, chloride, sodium, total dissolved solids.
Kaimaumu-Motutangi Wetland	Groundwater level in shallow sand aquifer. Kaimaumu Wetland surface water levels.

2.2.3 Response to exceeding trigger levels

The actions required should trigger levels be exceeded are set out in **Section 4** (Contingency Plan).

3. MONITORING PROGRAMME & TRIGGER LEVEL SETTING

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 parameters to be monitored. The resultant wetland monitoring location is to be hydrologically connected with the full range of water levels in the open water habitat of the Kaimaumu Wetland. The following sections of the GMCP provide the monitoring schedules (frequency and trigger levels) for the bores.

The locations of the production bores in **Table 3** are shown in **Figure 1**. An error accuracy level of +/- 50 metres is applicable to these bore locations. Any differentiation to the location by greater than 50 metres will result in a requirement of an application to the Council for a change of consent condition pursuant to Section 127 of the Resource Management Act 1991 (RMA). Assessment of the effects on the environment of the change will be required pursuant to Schedule 4 of the RMA.

Commented [SK14]: DOC does not accept the removal of the Kaimaumu North from the monitoring and notes that no s127 has been made for this (in relation to the MWWUG consents)

Table 3: Schedule of monitoring facility and production bore details.

Bore Name		Bore Owner	Coordinates (NZTM 2000)		Depth (m)	Dia. (mm)	Piezo. No.	Target aquifer	Purpose*
Generic	NRC ref.		Easting	Northing					
MONITORING BORES									
Fishing Club	LOC.200250	NRC	1611411	6146928	79			Deep shellbed	SI; MI
Waterfront	LOC.200210	NRC	1611712	6146689	19	32	1	Shallow sand	GLc, ECc
			1611712	6146689	74	32	4	Deep shellbed	GLc, ECc
Motutangi	TBC	NRC	1615677	6139811	<10	50	1	Shallow sand	GLc; ECc
			1615676	6139821	80-100 (TBC)	50	2	Deep shellbed	GLc; ECc
Norton Road	TBC	NRC	1619875	6134377	80-100 (TBC)	50	2	Deep shellbed	GLc; ECc
Kaimaumuau	LOC.316222	NRC	1622445	6134482	20		1	Shallow sand	GLc; ECc; SI; MI
	LOC.315766	NRC	1622426	6134466	72		2	Deep shellbed	GLc; ECc; SI; MI
Kaimaumuau Wetland	TBC	NRC	1616379	6140758	<1.5	50	1	Standing water in wetland	GLc
Honeytree	TBC	NRC	1618911	6136120	6	50	2	Shallow sand	GLc
Paparore	TBC	NRC	1619100	6130600	<10			Shallow sand	GLc; ECc
	TBC	NRC	1619100	6130600	80-100 (TBC)			Deep shellbed	GLc; ECc
Kaimaumuau Settlement	TBC	NRC	1624250	6135897	<20		1	Shallow sand	GLm, SI
	TBC	NRC	1624250	6135897	>50 (TBC)		2	Deep shellbed	GLm, SI
PRODUCTION BORES									

Bryan Estate 1	TBC	NA Bryan Estate, SG Bryan, CL Bryan, KY Bryan Valdares & D Bryan (1)	1613415	6143424	TBC		1	Deep shellbed	GLm, ECm
Bryan Estate 2	TBC	NA Bryan Estate, SG Bryan, CL Bryan, KY Bryan Valdares & D Bryan (1)	1613901	6142132	TBC		1	Deep shellbed	GLm, ECm
KSL	TBC	KSL Ltd	1614333	6138477	TBC		1	Deep shellbed	GLm, ECm
Tuscany Avocados	TBC	Tuscany Valley Avocados Ltd	1614490	6138367	TBC		1	Deep shellbed	GLm, ECm
Robert Campbell	TBC	Robert Paul Campbell Trust	1615813	6135787	TBC		1	Deep shellbed	GLm, ECm
Yelavich	TBC	Mate Yelavich & Co Ltd	1616833	6133996	TBC		1	Deep shellbed	GLm, ECm
Wataview	TBC	Wataview Orchards (Green Charteris Family Trust)	1619441	6132282	TBC		1	Deep shellbed	GLm, ECm
Tiri 1	TBC	Tiri Avocados Ltd	1618056	6130290	TBC		1	Deep shellbed	GLm, ECm
Tiri 2	TBC	Tiri Avocados Ltd	1618856	6130196	TBC		2	Deep shellbed	GLm, ECm
Valic 4	TBC	Valic NZ Ltd	1617589	6129130	TBC		1	Deep shellbed	GLm, ECm

Notes:

TBC = to be confirmed within 15 months of the date of commencement of these consents.

* Purpose key:

GLc = Continuous Groundwater Level;

GLm = Manual (monthly) Groundwater Level;

ECc = Continuous Electrical Conductivity;

ECm = Manual (monthly) Electrical Conductivity;

SI = Salinity Indicators (quarterly);

MI = Major Ions (quarterly).

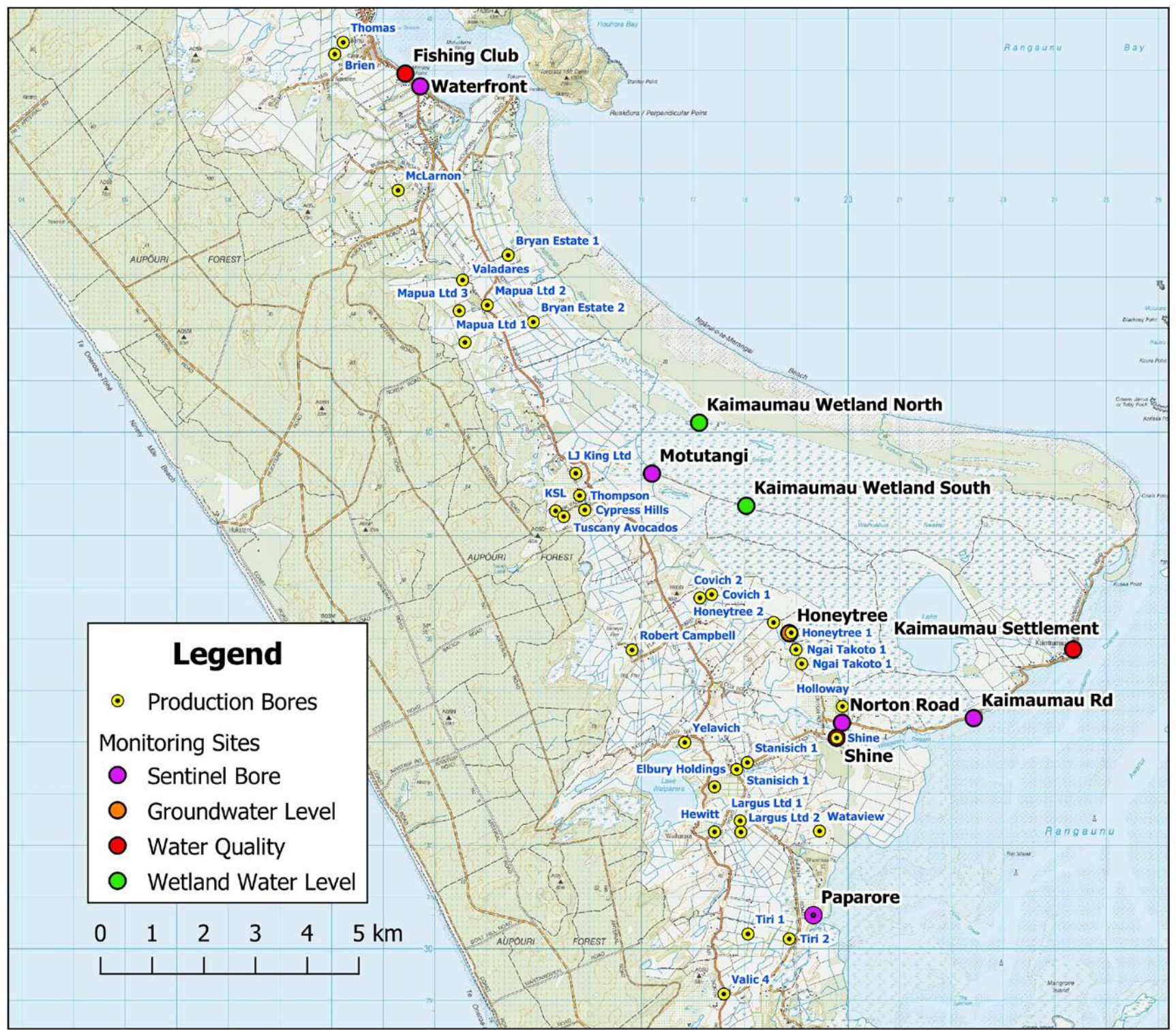


Figure 1. Monitoring and Production Bore Location Map (Note: includes consents included in this GMCP as well as existing MWWUG consented production bores).

Commented [SK15]: Figure being updated to differentiate/remove MWWUG takes

3.2 Sentinel Bores – Monitoring and Establishment of Trigger Levels

3.2.1 Continuous Groundwater Level Monitoring

Sentinel bores will collect data continuously for water levels and electrical conductivity in individual piezometers and will be utilised as the primary reference sites for regional monitoring of potential effects associated with saline intrusion. Data will be telemetered to the Council.

Groundwater levels will be monitored in the shallow sand and deep shellbed aquifers to quantify the magnitude of drawdown resulting from the proposed abstraction in the deep shellbed and unconfined shallow sand aquifers to ensure it is within the magnitude anticipated in the AEE and meets Objective 1 of this GMCP.

These bores will provide early detection or warning of:

- Groundwater levels around the coastal margin 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; and
- Groundwater levels in the shallow sand aquifer lowering and having a potential adverse effect on surface water bodies, springs, dune lakes or natural wetlands.

Details of the sentinel bores are summarised in **Table 5** below. All sentinel monitoring bores listed in **Table 5** will be installed prior to the exercise of the consents.

Checking of the sensors required for continuous monitoring will be undertaken on a monthly basis, and any faults will be recorded and remedied immediately. Data will be collected, processed and managed in accordance with the Council's quality standards.

3.1.1

Sentinel bores as described in **Table 4** will collect groundwater level data continuously (and electrical conductivity) in individual piezometers. Data will be telemetered to the Council.

Groundwater levels will be monitored in the shallow sand and deep shellbed aquifers to quantify the magnitude of drawdown resulting from the proposed abstraction in the deep shellbed and unconfined shallow sand aquifers to ensure it is within the magnitude anticipated in the AEE and meets Objective 1 of this GMCP.

Details of the groundwater level monitoring bores are listed in **Table 4** below. The majority of the bores listed are existing monitoring bores, some of which were established as part of the GMCP for the MWWUG consents.

3.1.2.2 Schedule of Groundwater Level Monitoring & Trigger Levels

The two-tier trigger level system (TL1 and TL2) for groundwater levels in all Sentinel bores, excluding the new Paparore Sentinel bore, is set-out in **Table 4**. Electrical conductivity trigger levels for these bores are contained in **Table 6**.

Groundwater level triggers will be established in the deep shellbed aquifer in the new Paparore sentinel bore as follows:

Commented [ML16]: Comparative to the other GMCP's, there was no monthly monitoring of GL's in monitoring bores?

- Using the baseline groundwater level data gathered during the initial 12 months following the commencement of consents in **Table 1**, allowing for the predicted magnitude of drawdown resulting from existing and proposed abstraction outlines in the AAGW Model Report.

As a general guide TL2 for the shallow sand aquifer should be no less than 1.0 mAMSL and 1.5 mAMSL for deep shell bed groundwater levels. As a general guide TL2 for deep shellbed groundwater levels should be no less than 1.5 mAMSL (noting that changes in electrical conductivity are also a key indicator of saline intrusion). If necessary, water level records for individual sentinel bores will be correlated with existing monitoring sites to provide historical context for estimating the trigger levels in the new Paparore Sentinel bore.

Table 4. Monitoring & Trigger Levels – Groundwater Levels.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Waterfront (LOC.200210)	21	4	Shallow sand	GL	mAMSL	Continuous	0.75	0.65
				EC	µS/cm	Continuous	740	890
	72	4	Deep-shellbed	GL	mAMSL	Continuous	2.20	2.00
				EC	µS/cm	Continuous	560	670
72	1	shellbed	GL	mAMSL	Continuous	2.20	2.00	
Motutangi (LOC.323721)	8	1	Shallow sand unconfined	GL	mAMSL	Continuous	5.95	5.85
				EC	µS/cm	Continuous	400	485
Motutangi (LOC.323720)	83	2	Deep-shellbed	GL	mAMSL	Continuous	5.70	5.50
Norton Road (LOC.323722)	80-100 (TBC)	1	Deep-shellbed	GL	mAMSL	Continuous	3.10	2.90
				EC	µS/cm	Continuous	590	710
Paparore	<20	1	Shallow sand unconfined	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
	80-100	2	Deep-shellbed	GL	mAMSL	Continuous	TBC	TBC
				EC	µS/cm	Continuous	TBC	TBC
Kaimaumau Road (LOC.316222)	20	1	Shallow sand unconfined	GL	mAMSL	Continuous	1.10	1.00
				EC	µS/cm	Continuous	290	345
Kaimaumau Road (LOC.315766)	72	2	Deep-shellbed	GL	mAMSL	Continuous	1.70	1.50
				EC	µS/cm	Continuous	435	520

Notes:
 * Parameter key: GL = Groundwater Level; EC = Electrical Conductivity;
 TBC = to be confirmed within 15 months of the date of commencement of these consents.
 GL TL1s (where provided) have been calculated from long term monitoring data.
 GL TL2s (where provided) have been interpolated from Table F1, WWA Groundwater Modelling Report.

3.23.3 Kaimaumau Wetland

3.2.13.3.1 Water Level Monitoring and Trigger Levels

Available data indicate significant spatial and temporal variability in water levels both in the Kaimaumau Wetland and the underlying shallow sand aquifer. This variability makes it very difficult (if

not impossible) to establish an appropriate reference against which departure from 'relative water level' can be assessed on the basis of the current water level monitoring.

As a proxy measure, the relative rate of decline in static water levels in Kaimaumau Wetland was adopted for the interim wetland water level triggers that would indicate hydrological function of the wetland is departing from 'natural' conditions. Given the lack of a suitable alternative, this approach has been retained for setting trigger levels, with the magnitude of water level recession amended to reflect data collected over the 2019-20 summer, which was an extreme drought event.

Table 5: Kaimaumau Wetland Water Level Triggers

Monitoring site	TL1	TL2
Kaimaumau Wetland - North	n/a*	n/a*
Kaimaumau Wetland - South	7-day moving average water level recession exceeding 7 mm/day	7-day moving average water level recession exceeding 8 mm/day

NOTES

* Due to access constrains at the northern site (helicopter access only), interim wetland water level triggers are proposed for the Kaimaumau Wetland - South monitoring site only. Available data indicates temporal response at both sites are virtually identical. If TL1 is exceeded at the Kaimaumau Wetland – South monitoring site, data will be collected from the Kaimaumau Wetland – North site to confirm trigger exceedance.

Commented [SK17]: DOC's technical experts disagree with lack of feasible alternative methodology.

Commented [SK18]: DOC does not agree to the removal of the Kaimaumau North site and maintains the need for its inclusion in the monitoring regime, despite access issues.

Commented [SK19]: DOC does not agree with this value.

3.2.23.3.2 Vegetation Survey

An initial survey of the Kaimaumau Wetland was carried out in April 2020.

This GMCP requires that Council commission, in consultation with the Director-General of Conservation and the Consent Holders, a suitably qualified and experienced ecologist to undertake wetland vegetation survey and subsequent reporting every five (5) years from the original date of survey at around the same time of year as the original survey. The repeat survey(s) must be designed in a way that enables ecologically meaningful and statistically robust scoring of the wetland condition in order to analyse changes to the wetlands condition resulting from the groundwater abstraction.

Commented [SK20]: DOC does not agree with this timeframe.

This repeat survey must be completed once after the initial vegetation survey (to provide an accurate baseline) but thereafter will only take place where technical assessment carried out according to Section 2.1.1 confirms that there is a decline in standing water level of the Kaimaumau Wetland resulting from groundwater abstraction.

A decline in standing water level of the Kaimaumau Wetland attributable to groundwater abstraction will be determined from the monitoring and analysis of temporal groundwater level variations in the shallow Motutangi piezometer in relation to the Kaimaumau Wetland Standing Wetland Water Level facilities as described in Table 5 above.

3.33.4 Saline Intrusion Monitoring & Establishment of Trigger Levels

Sentinel bores will be utilised as the primary reference sites for monitoring of potential effects associated with saline intrusion. These bores are/will be positioned between existing/proposed abstraction and the coastline to provide early detection or warning of:

- Groundwater levels around the coastal margin 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.

Details of the sentinel bores are summarised in Table 5 below.

3.3-13.4.1 Stage 1 Monitoring

During the initial 12-month monitoring period, sampling for the following salinity indicators in the new sentinel bore at Paparore will be undertaken at 6-weekly intervals⁴:

- Electrical conductivity;
- Chloride;
- Sodium;
- Total Dissolved Solids.

3.3-23.4.2 Ongoing Monitoring

Ongoing monitoring of groundwater and electrical conductivity levels will be undertaken continuously via individual piezometers in sentinel monitoring bores. Monitoring data will be telemetered to the Council on a twice-daily basis. Sampling at the frequencies specified for the following salinity indicators will take place in the bores listed in Table 7 below:

- Electrical conductivity;
- Chloride;
- Sodium;
- Total Dissolved Solids.

3.3-33.4.3 Schedule of Saline Intrusion Monitoring & Trigger Levels

The monitoring and trigger level as discussed in this section are provided in **Table 6** below. Data will be collected, processed and managed in accordance with the Council's quality standards and *A National Protocol for State of the Environment Groundwater Sampling in New Zealand* (Ministry for the Environment, 2006).

A two-tier trigger level system (TL1 and TL2) for groundwater levels and electrical conductivity will be set in these bores.

As an initial guide, trigger levels for individual determinants will be established as follows:

- TL1 – Median concentration from the baseline monitoring period +25%.
- TL2 – Median concentration from the baseline monitoring period + 50%.

For the existing Sentinel bores, where trigger levels have been set as part of the MWWUG GMCP, these trigger levels will be utilised for the purposes of this GMCP as shown in **Table 6**.

The setting of TL1 and TL2 trigger levels for the remaining piezometers will be undertaken during the first implementation stage after 12 months of monitoring data has been collected and within 15 months of the date of commencement of these consents and replace the interim trigger levels outlined in **Section 2.1.2.1** above.

All sentinel monitoring bores listed in **Table 6**, with the exception of the Elbury Holdings bore, will be installed prior to the exercise of the consents.

⁴ This frequency applies to the initial 12-month monitoring period for the establishment of baseline information. The frequencies specified in Table 6 are for ongoing monitoring specifications.

Checking of the sensors required for continuous monitoring will be undertaken on a monthly basis, and any faults will be recorded and remedied immediately. Data will be collected, processed and managed in accordance with the Council's quality standards.

Table 6: Monitoring & Trigger Levels – Saline Intrusion.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Fishing Club	79	1	Deep-shellbed	EC	m µS/cm	Quarterly	56	67
				Chloride	mg/L	Quarterly	78	94
				Sodium	mg/L	Quarterly	63	75
				TDS	mg/L	Quarterly	344	413
Kaimaumu Road (LOC.316222) (Sentinel)	20	1	Shallow sand unconfined	EC	µS/cm	Continuously	36	43
				Chloride	mg/L	Quarterly	70	84
				Sodium	mg/L	Quarterly	44	53
				TDS	mg/L	Quarterly	225	270
Waterfront (LOC.200210)	21	4	unconfined	EC	µS/cm	Continuous	740	890
	72	1	shellbed	EC	µS/cm	Continuous	560	670
Kaimaumu Road (LOC.315766)	72	2	Deep-shellbed	EC	µS/cm	Continuously	435 50	520 60
				Chloride	mg/L	Quarterly	65	78
				Sodium	mg/L	Quarterly	71	85
				TDS	mg/L	Quarterly	294	353
	20	1	unconfined	EC	µS/cm	Continuous	290	345
Kaimaumu Settlement (ID TBC)	<20 (12)	1	Shallow sand unconfined	EC	µ mS/cm	Quarterly	59	71
				Chloride	mg/L	Quarterly	83	100
				Sodium	mg/L	Quarterly	56	68
				TDS	mg/L	Quarterly	381	458
	>50 (TBC)	2	Deep-shellbed	EC	m µS/cm	Quarterly	NA**	
				Chloride	mg/L	Quarterly		
				Sodium	mg/L	Quarterly		
TDS	mg/L	Quarterly						
Motutangi (LOC.323721)	8	1	unconfined	EC	µS/cm	Continuous	400	485
Motutangi (LOC.323720)	83	2	shellbed	EC	µS/cm	Continuous	540	650
Norton Road (LOC.323722)	80-100 (TBC)	1	shellbed	EC	µS/cm	Continuous	590	710
Paparore (Sentinel) (ID TBC)	<20	1	Shallow sand unconfined	EC	µS/cm	Continuously	TBC	TBC
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
	80-100	2	Deep-shellbed	EC	µS/cm	Continuously	TBC	TBC

Commented [ML21]: Assume its still quarterly?

Commented [ML22]: Assume EC still at quarterly for these sites?

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
				Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
				EC	µmS/cm	Quarterly	TBC	TBC
Elbury Holdings*** (ID TBC)	TBC	1	Deep-shellbed	Chloride	mg/L	Quarterly	TBC	TBC
				Sodium	mg/L	Quarterly	TBC	TBC
				TDS	mg/L	Quarterly	TBC	TBC
				EC	µmS/cm	Quarterly	TBC	TBC

Notes:

* Parameter key: GL = Groundwater Level; EC = Electrical Conductivity; SI = Salinity Indicators; TDS = Total Dissolved Solids.

**As part of the trigger level review for the MWWUG GMCP, no trigger levels were proposed for this piezometer. This is because the existing groundwater quality at this site is almost identical to sea water. While reasons for the presence of groundwater with significantly elevated salinity at depth below Kaimaumuau Settlement are (at present) uncertain, observed concentrations of indicator parameters at this site are unlikely to change as a result of seawater ingress, given current water quality.

*** No trigger levels have been set in this bore as it is a private bore (production) therefore the timing of drilling will be at the owners discretion.

TBC = to be confirmed within 15 months of the date of commencement of these consents.

3.4.3.5 Production Bores - Monitoring & Trigger Level Establishment

3.4.3.5.1 Stage 1 Monitoring

During the initial 12-month monitoring period, sampling for salinity indicators in the bores as set out in **Table 7** below will be undertaken at 6-weekly intervals⁵ for those production bores drilled during this period.

~~For the existing production bores, where trigger levels have been set as part of the MWWUG GMCP, these trigger levels will be utilised for the purposes of this GMCP to provide a consistent approach to managing the potential adverse effects of groundwater abstraction within the central part of the Aupōuri Aquifer, as shown in **Table 7**. This approach also recognises that the MWWUG consents were granted prior to these consents.~~

3.4.3.5.2 Ongoing monitoring

Monthly water level monitoring will be undertaken in the production bores listed in **Table 7**. During the winter months (nominally May to September) this monitoring will provide information to identify any inter-annual variations in aquifer storage which may be anomalous compared to regional trends. During the irrigation season, water level measurements will be undertaken a minimum of eight hours following the cessation of pumping.

Electrical conductivity (“EC”) values will also be measured at monthly intervals from the production bores during the irrigation season to check on any changes in salinity induced by the pumping.

Continuous water level monitoring is required in a shallow observation bore adjacent to the production bore for AUT.038471.01.01 to quantify any localised drawdown effects in the shallow sand aquifer in

⁵ This frequency applies to the initial 12-month monitoring period for the establishment of baseline information. The frequencies specified in Table 6 are for ongoing monitoring specifications.

Commented [SK23]: DOC has concerns around a potential lag in realising effects if monitoring data is only collected monthly. Applicant and NRC note that this is specifically in relation to production bores (and only those <10L/s) which are potentially affected by localised drawdown within the bore attributable to pumping. Sentinel bores will be continuously monitored and information telemetered to NRC.

the vicinity of a relatively large abstraction proximal to Kaimaumuau Wetland. This shallow sand aquifer monitoring will enable comparison between the shallow sand aquifer impact as modelled in the AAGMI Report and the data from the shallow piezometers in the sentinel bores listed in **Table 7**.

3.4.33.5.3 Schedule of Production Bore Monitoring & Trigger Levels

The schedule of monitoring and trigger levels as discussed in this section are provided in **Table 7** below. Data will be collected, processed and managed in accordance with Council’s quality standards and *A National Protocol for State of the Environment Groundwater Sampling in New Zealand* (Ministry for the Environment, 2006).

EC trigger levels will be established in the production bores listed in **Table 7** below.

During the initial 12-month monitoring period EC trigger levels will be no greater than:

- **TL1** – Departure exceeding 25% of the EC value from the initial monitoring round
- **TL2** – Departure exceeding 50% of the EC value from the initial monitoring round

Long-term EC triggers for individual production bores will be established following the initial 12-month monitoring period based on an assessment of spatial and temporal variation in EC observed during the initial period, in a manner consistent with EC trigger levels established in the sentinel monitoring bores.

For the existing production bores, where trigger levels have been set as part of the MWWUG GMCP, these trigger levels will be utilised for the purposes of this GMCP to provide a consistent approach to managing the potential adverse effects of groundwater abstraction within the central part of the Aupōuri Aquifer, as shown in Table 7. This approach also recognises that the MWWUG consents were granted prior to these consents.

No trigger levels 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.

Table 7: Monitoring & Trigger Levels – Production Bores.

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Thomas and O'Connor	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	600	720
Valadares	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
McLarnon	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Elbury Holdings	TBC	1	Deep shellbed	GL, SI	mAMSL	Monthly	EC TBC	EC TBC
Huanui	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	610	730

Commented [ML24]: Need to finish splitting EC and GL rows. How can EC be

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Ngāi Takoto	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
	TBC	4	Deep shellbed	EC, GL, EC	mAMSL	Monthly	EC TBC EC TBC	EC TBC EC TBC
	TBC	1	shellbed	GL, EC	mAMSL	Monthly		
				EC			EC TBC	EC TBC
Cypress Hills	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	490	590
				EC			490	590
Stanisich	95	1	Deep shellbed	GL, EC	mAMSL	Monthly	640	730
				EC			610	730
Honeytree	112	1	Deep shellbed	GL, EC	mAMSL	Monthly	560	670
	6	2	Shallow sand	EC, GL, EC	mAMSL	Continuous	560 EC TBC	670 EC TBC
	644	23	Shallow sand Deep shellbed	GL, GL, EC	mAMSL mAMSL	Continuous Monthly	EC TBC	EC TBC
				EC			EC TBC	EC TBC
	111	3	Deep shellbed	GL	mAMSL	Monthly		
				EC			EC TBC	EC TBC
Watson	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	490	590
L J King Limited	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Mapua	111	1	Deep shellbed	GL, EC	mAMSL	Monthly	420	500
	422	2	Deep shellbed	GL, EC	mAMSL	Monthly	360	430
	12297	23	shellbed Deep shellbed	GL, EC, GL, EC	mAMSL mAMSL	Monthly Monthly	360 480	430 580
	97	3	Deep shellbed	GL, EC	mAMSL	Monthly	480	580
Hewitt	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Shine	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Largus	94	1	Deep shellbed	GL, EC	mAMSL	Monthly	610	740

Bore Name	Depth (m)	Piezo. No.	Target aquifer	Parameter*	Units	Frequency	Trigger Levels	
							TL1	TL2
Covich	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Thomas	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	600	720
Bryan Estate 1	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Bryan Estate 2	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
KSL	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Tuscany Avocados	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Robert Campbell	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Yelavich	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Wataview	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Tiri 1	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Tiri 2	TBC	2	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC
Valic 4	TBC	1	Deep shellbed	GL, EC	mAMSL	Monthly	EC TBC	EC TBC

Notes:
* Purpose key: GL = Groundwater Level; EC = Electrical Conductivity.
All trigger limit values in this Table to be confirmed by Council.

3.53.6 Unmapped Natural Wetlands

Natural wetland means a wetland (as defined in the RMA) that is not:

- (a) a wetland constructed by artificial means (unless it was constructed to offset impacts on, or restore, an existing or former natural wetland); or
- (b) a geothermal wetland; or
- (c) any area of improved pasture that, at the commencement date, is dominated by (that is more than 50% of) exotic pasture species and is subject to temporary rain derived water pooling.

Some wetlands in this area have been mapped from prior studies and surveys⁶, however, there are sites that may be classified as natural wetland that are currently unmapped.

In cases of uncertainty or dispute about the existence or extent of a natural inland wetland, the National Policy Statement for Freshwater Management 2020 directs that regard must be had to the

⁶ Northland Regional Council top wetland study, Protected Natural Areas Programme survey reports.

Commented [SK25]: DOC maintains that all wetlands should be mapped prior to granting of consents.

Wetland Delineation Protocols⁷ as a robust method for delineating wetlands based on the United States delineation system. This protocol uses three criteria for identifying and delineating wetlands: vegetation, soils, and hydrology. The vegetation and soils components have been adapted to New Zealand conditions and the hydrological component is currently under development.

3.5-43.6.1 Unmapped Wetland Delineation Procedure


The Wetland Delineation Procedure is deemed appropriate for identifying whether three Areas of Interest (Aoi) (Appendix A) contain natural inland wetland areas in the Ahipara and Sweetwater sub-aquifers. The Wetland Delineation Procedure is therefore replicated in below in **Table 8**.


Procedures which were completed prior to the commencement of the consent are referenced as having been completed and no further action is required against those particular procedures.

For all other procedures which were not completed prior to commencement of the consents, **Table 8** contains the steps that shall be taken to complete that procedure within this adaptive management regime.

⁷ <https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/wetland-delineation-protocols.pdf>

Table 8: Unmapped wetland delineation procedure.

No	Delineation Procedure	Completed Prior to Commencement of Consents (Yes/No)	Comment
1.	Determine the project area (the putative wetland).	Yes	See Areas of Interest map attached (Appendix A).
2.	Decide if 'normal circumstances' are present, ie, typical climatic/hydrologic conditions, and no recent disturbances or modifications to the project area. If yes, proceed to step 3. If no, proceed to step 7.	Yes	<p>Area N contains three high-risk sites, as generally shown in the aerial below. Area (N)1 has been allocated to the Northern GMCP group.</p>  <p>Area N2 extends over privately owned orchard and residential properties. All residential development has been in place on the properties since 2007 however clearance of some hedging is visible between 2016-2018. No major modifications are observable on the orchard property. All sites shall be considered to be in 'normal circumstance' based on the land use activities which have been in existence at this site since at least 2007.</p>

No	Delineation Procedure	Completed Prior to Commencement of Consents (Yes/No)	Comment
			 <p data-bbox="1010 869 1659 997">Area N3 is on a generally undeveloped property with built development sporadically disbursed across the property joined by a primary access road. The high risk area mapped in the Aol is located in an area that was transitioned from viticulture crop (or other form of vine crop) to grass paddock between 2009-2013. No further modifications are visible in this environment.</p> <p data-bbox="1010 1002 1144 1023">ADD OBLIQUES</p>
3.	Identify and map the major vegetation types using aerial photographs, maps, contours, inventory reports, other data, and, if necessary, on-site field verification.	No	Within one month of commencement of the consents, the Council, in consultation with the Director-General of Conservation and the Consent Holders, will commission a suitably qualified and experienced ecologist to undertake the desktop and field analysis established under Procedures 4, 5 and 6.
4.	Off-site methods to identify wetland presence and sketch approximate boundaries. Wetlands may be confirmed without an on-site inspection depending on: <ul style="list-style-type: none"> <li data-bbox="232 1177 741 1225">i. the amount and quality of data (vegetation, soils, hydrology, topography) <li data-bbox="232 1230 658 1257">ii. wetland ecological expertise to interpret the data. 	No	A Wetland Delineation Report (WDR) containing details of the assessment approach and outcomes shall be prepared by the same ecologist commissioned to undertake the desktop and field analysis. The WDR shall be circulated to the Consent Holders listed in Table 1 and the Director-General of Conservation a minimum of 40 working days prior to the anticipated commencement of the subsequent irrigation season.
5.	On-site methods to delineate wetland presence and accurate boundaries:	No	

No	Delineation Procedure	Completed Prior to Commencement of Consents (Yes/No)	Comment
	<ul style="list-style-type: none"> i. for small areas (≤ 2 ha), establish a representative plot in each major vegetation type and record the plot vegetation in three strata: tree, sapling/shrub, herb ii. for larger areas, establish representative plots along transects (as per Clarkson 2014) and sample the vegetation in three strata: tree, sapling/shrub, herb. 		<p>The Consent Holders and Director-General of Conservation have 20 working days to provide a response to the Council on the conclusions and recommendations of the WDR. If no response is received from a party within the stated timeframe, then Council will consider that the party has no concerns with the conclusions of the WDR. If any party does not agree with the conclusions and recommendations of the WDR, then a report by a suitably qualified hydrogeologist and/or an ecologist, both with experience and knowledge of the locality, detailing the reasons for the disagreement shall be provided to Council within 30 working days from the date that the assessment was sent to the party. Council has the final authority over the delineation of a natural wetland and will provide a report to the Consent Holders and the Director-General of Conservation detailing the reasons for its decision, including the identification and discussion of areas of agreement and disagreement within 5 working days of receipt of the disagreeing parties report.</p>
6.	<p>Hydrophytic vegetation determination. Based on the data gathered, conduct a hydrophytic vegetation determination using the following flow chart (figure 1).</p>	No	

Commented [SK26]: DOC maintains previous comments in relation to SIMPR; potential for review panel

No	Delineation Procedure	Completed Prior to Commencement of Consents (Yes/No)	Comment
	<p>Figure 1: Flow chart of steps for hydrophytic (wetland) vegetation determination. Wetland indicator status abbreviations: FAC= facultative; FACW = facultative wetland; OBL = obligate wetland.</p> <pre> graph TD RT["Off-Site or On-site Rapid Test All dominant species OBL or FACW"] -- Pass --> W1["Wetland (hydrophytic) vegetation"] RT -- Fail --> DT["On-site Dominance Test > 50% dominants OBL, FACW or FAC"] DT -- Pass --> W2["Wetland vegetation"] DT -- Fail --> Q1["Are all/most dominants FAC?"] Q1 -- No --> W2 Q1 -- Yes --> I["On-site Indicators of hydric soil and wetland hydrology present?"] I -- No --> N["Non-wetland vegetation"] I -- Yes --> PI["On-site Prevalence Index PI ≤ 3.0"] PI -- Pass --> W3["Wetland vegetation"] </pre> <p>Wetland indicator status ratings for species are in Clarkson et al. 2013 and subsequent updates.</p>		

3.5-23.6.2 Repeat Survey

For sites delineated as natural wetland from the procedure set out at **Section 3.6.1**, the Council shall commission, in consultation with the Director-General of Conservation and the Consent Holders, a suitably qualified and experienced ecologist to undertake wetland vegetation survey and subsequent reporting within five (5) years from the original date of survey at around the same time of year as the original delineation survey. The repeat surveys must be designed in a way that enables ecologically meaningful and statistically robust scoring of the wetland condition in order to analyse changes to the wetland's condition resulting from the groundwater abstraction.

This repeat survey must be completed once after the initial delineation Wetland Delineation Procedure (to provide an accurate baseline) but thereafter will only take place every five (5) years where technical assessment carried out according to **Section 2.1.1** confirms that there is an adverse decline in wetland levels resulting from groundwater abstraction.

A decline in wetland water level attributable to groundwater abstraction will be determined from the monitoring and analysis of temporal groundwater level variations in the sentinel bores set out in **Table 4**.

3.63.7 Environmental Monitoring Report

At the end of each irrigation season, the Council will commission the preparation of an Annual Environmental Monitoring Report (AEMR) by a suitably qualified hydrogeologist and, in relation to monitoring of the Kaimaumu Wetland, a suitable qualified wetland ecologist. The Council will endeavour to ensure that, if possible, both the hydrogeologist and the ecologist will have experience and knowledge of the locality. A copy of the AEMR will be provided to the Consent Holders and the Director-General of Conservation by 31 July each year.

The purposes of the AEMR are :

- To provide a summary of the monitoring results for the previous year, including trends, against Objective 1 of the GMCP;
- To assess the monitoring undertaken over the previous year against the standards set out in Objective 1;
- To identify any changes/amendments to monitoring locations/parameters/frequencies that could be incorporated in future SIMPR;
- To report on any issues apparent with the monitoring; and
- To identify any improvement that could be made with respect to the monitoring.

The AEMR will also contain an evaluation of whether the observed effects of the groundwater takes are consistent with the predictions of environmental response contained in the the *Aupouri Aquifer Groundwater Model, Factual Technical Report – Modelling – Aupouri Aquifer Water User Group. WWLA0184, Rev 3*, dated 5 February 2020. Both reports were prepared by Williamson Water & Land Advisory Ltd.

Commented [SK27]: Technical input necessary for DOC to determine whether additional surveys regardless of effect should be included, eg continue for one additional 5yr cycle.

DOC does not accept shallow groundwater levels as proxy for surface water monitoring.

NRC notes that this approach is consistent with the monitoring of Kaimaumu under MWWUG and as proposed in this GMCP.

An 'adverse decline in wetland levels' would be determined through monitoring of shallow and deep aquifers and technical assessments.

Commented [SK28]: DOC disagrees with assumptions that the aquifer is primarily rainfed and has concerns about this being the 'angle' upon which the reporting is undertaken. Technical input required to confirm.

4. CONTINGENCY PLAN

Exercise of the consents is subject to compliance with Objective 1 of this GMCP.

As described in **Section 2**, a trigger level system is used to define environmental criteria that signal changes may be occurring outside of what is normal (TL1) or at a point where remedial action is required to avoid Objective 1 not being met (TL2).

This section details the responses that will be undertaken where trigger levels are exceeded under any of the monitoring suites discussed in [Sections 2.1.2.1, 0, 3.2, 3.3, and 3.5](#) this GMCP.

Where a trigger level is exceeded the Council will commission a Groundwater Trigger Exceedance Report (GTER). [The objective of the GTER is to establish the cause of a trigger level exceedance and to determine a programme of action to end the exceedance.](#)

Commented [SK29]: The GTER could be within the scope of the technical review panel suggested by DOC.

A GTER shall include:

- Review of the monitoring results collected and establish why the breach has occurred;
- Set out requirements for more intense monitoring of the breach;
- Set out environmental monitoring to detect effects of breach, such as changes in extent of rivers, natural wetlands, springs and/or dune lakes;
- Update the report on a regular basis as more data becomes available; and
- Recommend actions to end the breach, this could include;
 - A staged reinstatement of abstraction levels to pre-breach levels,
 - Reduced levels of abstraction for all or some of the consent holders covered by the GMCP, or
 - [Suspension of abstraction by all or some of the consent holders covered by the GMCP.](#)

Commented [SK30]: DOC has concerns about the use of a high trust model and would prefer the implementation of expert reviews for these processes. The GTER needs to include reversibility as key tenet of adaptive management.

4.1 Exceedance of TL1

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

- (a) The Council will notify the Consent Holders within two (2) working days of when the TL1 exceedance became known.
- (b) If the exceedance is of a salinity indicator in the bores listed in **Table 6**, then sampling of the monitoring bore(s) in exceedance shall immediately be upgraded to a weekly frequency for four (4) weeks following the first exceedance of the TL1. Weekly monitoring shall continue until sample results are consistently below TL1 values for a period of four weeks or as directed by Council.
- (c) If after four (4) 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 Council, then a Groundwater Trigger Exceedance Report (“the GTER”) by a suitably qualified hydrogeologist (and ecologist if the exceedance concerns the Kaimaumu Wetland) shall be commissioned by the Council.
- (d) The GTER shall assess the significance of the exceedance against the requirements of Objective 1 of the GMCP. The GTER shall assess why trigger levels have been breached,

identify the pumping bores in the area(s) of effect and will review all of the available data collected in the affected area(s), in particular the data collected pursuant to this GMCP.

4.2 Exceedance of TL2

In the event of a TL2 exceedance, which represents significant departure from normal groundwater and/or Kaimaumu Wetland conditions, with either continuously declining groundwater levels and/or Kaimaumu Wetland water levels, or rising salinity indicators:

- (a) The Council will immediately inform the Consent Holders upon TL2 exceedance becoming known.
- (b) Consent Holders must reduce their abstraction to 50% of the current average daily quantity, as calculated using the previous months water use records required to be kept in accordance with the conditions of its groundwater take consent. If the exceedance occurs within one month of a Consent Holder first taking water for irrigation purposes within an irrigation season, then the average shall be calculated using the water use records for this period only. The Council will advise the Consent Holder in writing of any breach and the required reduction in the daily water take volume.
- (c) A GTER by a suitably qualified hydrogeologist (and ecologist if the exceedance concerns the Kaimaumu Wetland) shall be commissioned by Council. The GTER shall assess why the TL2 has been breached, identify the pumping bores in the area of effect, and include a review of all available data collected for the affected area(s), in particular, the data collected under this GMCP.
- (d) Once (b) above has been complied with, a Consent Holder may apply to the Council's Compliance Manager for an alternative reduction in its daily water take volume. The Council's approval for an alternative reduction value will only be given if it is satisfied that relevant TL2 values will not be exceeded. Approval for an alternative reduction will be given to MWWUG Consent Holders first. The Council will use the GTER to inform its decision on any alternative reduction value for a Consent Holder.
- (e) If the TL2 exceedance is in a bore(s) that is/are not continuously monitored, then weekly groundwater level measurements and/or sampling of saline intrusion (depending on which trigger level is breached) in all bores where TL2 trigger levels are breached will commence 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 the Council.
- (f) If salinity indicators continue to increase or groundwater levels continue to decline after 21 days following the implementation of (b), then Consent Holders' abstraction must be reduced to 25% of the current average daily quantity, as calculated for (b) above. The Council will advise the Consent Holder in writing of this further reduction and the required reduction in the daily water take volume.
- (g) If (f) is implemented, then the Council will commission a review and update of the GTER report by a suitably qualified hydrogeologist (and ecologist if the exceedance concerns the Kaimaumu Wetland) with a longer-term programme of recommended responses incorporating observed responses to interim pumping rate reductions. The updated GTER will include a specific programme (including timeframes) of actions which would achieve compliance with Objective 1 of this GMCP. The actions may include, but not be limited to incremental

Commented [SK31]: DOC is not confident on the basis for this level of reduction and whether it considers the reversibility of effects – technical input required.

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 that are efficiently utilising the aquifer and are potentially impacted by saline intrusion, and if necessary, the provision of temporary water supplies to any affected parties (excluding any of the Consent Holders) in the event that Chloride concentrations exceed 250 mg/L (being the guideline value for taste prescribed in New Zealand Drinking Water Standards for New Zealand 2005 (Revised 2008)). The GTER will also identify a methodology which the Council will utilise to increase abstraction back to the volumes applicable to the relevant stage of taking (see Section 2.1), where this can be done such that Objective 1 of this GMCP will be met. If it is not possible to increase abstraction back to the relevant stage of taking, then the GTER will identify a methodology to increase abstraction to a lesser volume such that Objective 1 of the GMCP will be met. Any increase in abstraction will be provided to MWWUG Consent Holders first.

- (h) Actions from the GTER shall continue as long as the issue continues.
- (i) Implement additional remedial measures as directed by Council, including of the suspension of taking.

5. REFERENCES

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