BEFORE THE NORTHLAND REGIONAL COUNCIL

under:	the Resource Management Act 1991
in the matter of:	Resource consent applications by the Te Aupōuri Commercial Development Ltd, Far North Avocados Ltd, P McLaughlin, NE Evans Trust & WJ Evans & J Evans, P & G. Enterprises (PJ & GW Marchant), MP Doody & DM Wedding, A Matthews, SE & LA Blucher, NA Bryan Estate, SG Bryan, CL Bryan, KY Bryan Valadares & D Bryan (Property No 1), MV Evans (Property No 2), MV Evans (Property No 1), Tuscany Valley Avocados Ltd (M Bellette), NA Bryan Estate, SG Bryan, CL Bryan, KY Bryan Valadares & D Bryan (Property No 2), Tiri Avocados Ltd, Valic NZ Ltd, Wataview Orchards (Green Charteris Family Trust), Mate Yelavich & Co Ltd, Robert Paul Campbell Trust, Elbury Holdings Ltd (C/-K J & F G King) for new groundwater takes from the Aupōuri aquifer subzones: Houhora, Motutangi and Waiharara and applications by Waikopu Avocados Ltd, Henderson Bay Avocados Ltd, Avokaha Ltd (c/- K Paterson & A Nicholson), KSL Ltd (c/- S Shine), Te Rarawa Farming Ltd and Te Make Farms Ltd for increased existing consented takes from the Aupōuri aquifer subzones: Houhora, Motutangi, Sweetwater and Ahipara.

Legal submissions on behalf of the Director-General of Conservation

4 June 2021

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INTRODUCTION

1. In the adjournment, DOC sought that certain tasks be undertaken by the Applicants (Appendix 1 to these legal submissions). This included seeking further testing on the certainty of the groundwater computer model.

2. As outlined by DOC's experts in EIC, conceptualisation in the model is premised on there being no or limited groundwater inputs. In most cases, the Aupōuri Aquifer Water Users Group (AAWUG) applications use modelled data to assess effects and bores have not been drilled and tested.

3. The proposed adaptive management regime proceeds on the basis that staged implementation allows continual gathering of information - for model calibration as well as purposes precautionary - over 9 years.

4. As outlined in these submissions, DOC's experts have queried (in conferencing)[1] whether this system is working as intended. It is currently being trialled in consents granted to Motutangi-Waiharara Water Users Group (MWWUG).

5. Before it has been adequately tested in the MWWUG setting - closing the gap on uncertainty – the Applicant proposes it be trialled in a much wider setting and for greater volume.[2] DOC's position remains that, without further information, this is not consistent with the precautionary and adaptive

[1] 6 Expert conferencing Statements as follows, and additional Planning Conferencing statements:

JWS 1	22 September 2020 'AAWUG Expert Conferencing'
JWS 2	27 November 2020 'relating to hydrology, freshwater & ecology'
JWS 3	11 December 2020 'relating to shallow aquifer monitoring in relation to potential surface water impacts'
JWS 4	11 December 2020 Tasks 9(d) & (e) 'Requests for additional modelling & sampling'
JWS 5	16 December 2020 Task 6 List of AOI for Potential Wetlands Risk Analysis
JWS 6	Task (f) 'threatened species'

[2] If consents are granted for the AAWUG at 25% of volume sought (AAWUG Stage 1), an additional 1557665.5m3 would be drawn from the aquifer, equivalent to all the MWWUG consent holders going to maximum drawdown at Stage 3. (Other calculations can be made for comparison purposes with the MWWUG consents.)

management basis on which the MWWUG consents were granted.

6. In DOC's view, the uncertainty, risk and consequence of granting consent is magnified by the proposed use in both the existing MWWUG and AAWUG context. If further consents are to be granted in the face of such uncertainty they should only be granted on a very precautionary basis, and, for the Northern and South-Western groups, more information would be required.

7. DOC agrees with the s42A Officer's comments regarding model uncertainty, and, as recorded in Table 1, JWS 4 (Blyth):

> "Until further data is collected (a number of monitoring wells were dry over summer…) there would still be uncertainty when comparing/validating to a short observed record."

DOC Position

8. Three key issues remain:

A. Insufficient analysis (prediction) of potential adverse effects on an individual *and* cumulative basis: reply evidence of Dr West, Mr Baker and JWS's.

B. Insufficient evidence to support the adequacy of the monitoring regime that will inform the adaptive management system: reply evidence of Dr West, Mr Baker and JWS's.

C. Submitters are not given surety that effects will be managed appropriately - due to vital decisions being delegated from the decision-maker to the NRC executive. Important standards for containing potential adverse effects are "*left for another day*" (in management plans and not in consent conditions): planning JWS "*Statement of general concerns from the Department of Conservation*" at [11] – [17]; Christie/Familton comments on consent conditions,

Appendix 1 "*RMLR Best Practice"* attached thereto[3] and *TransTasman Resources* decision discussed below.

9. We deal with these 3 remaining concerns:

A. Insufficient analysis of potential adverse effects

10. For this analysis, we note that Policy D.2.4 of the Proposed Regional Plan for Northland (PRPN) refers to adaptive management,[4] and that the PRPN's definition of "precautionary approach" has recently been amended by an Environment Court decision.[5]

11. The Applicants do not agree the following tasks are necessary. DOC understands the Applicants' position is that the monitoring framework will pick up effects early, so that the following assessments are not required.

Task 1(d) Stream depletion effects & Lakes[6]

"Require site-specific investigations on potential stream flow depletion/lake water level for high risk areas (with highest known ecological values + hydraulic connection)."

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[3] Resource Management Law Association Roadshow, Conditions of Consent, Caldwell, Garbett, Logan and Williams 2014.

[4] The Policy is not under appeal but Royal Forest and Bird Protection Society of NZ have appealed the definition of "adaptive management" seeking the following changes (refer track-changes):

"~~A~~ means of managing activities whose effects are uncertain and the outcome of methods to avoid, remedy or mitigate those effects is also uncertain; primarily through the setting of consent conditions that ~~enable~~ allow activities to be managed in response to monitoring of the effects of the activity to meet specific outcomes/objectives/limits from methods used to address those effects."

[5] *CEP Services Matauwhi Ltd v Northland Regional Council* [2021] NZEnvC 039 at [30]:

D.2.18 Precautionary approach to managing effects on significant indigenous biodiversity

Decision makers adopt a precautionary approach where the adverse effects of proposed activities are uncertain, unknown or little understood, on:

- Indigenous biodiversity, including significant ecological areas, significant bird aras and other areas that are assessed as significant under the criteria in Appendix 5 of the Regional Policy Statement;
- The coastal environment where the adverse effects are potentially significantly adverse, particularly in relation to coastal resources vulnerable to the effects of climate change.

[6] Comments within DOC Task list at Appendix 1: *"Many of the potentially affected streams are small, with estimated MALFs of <10 L/s. Previous studies have shown smaller systems such as these to be most at risk from hydrological alteration (in terms of ecological protection of instream values). Notwithstanding the overall average/median modelled stream depletions, localised effects could be much higher. Takes may lead to flow reductions below the minimum flow for streams in the hydraulically connected area."*

12. DOC says that more is required than the bald assessment against the percentage thresholds in Policy H.5. Even for takes that are considered to have a 'low degree of stream depletion effect' under Policy H.5:

- understanding of the *existing* allocation status of the rivers and streams that may be affected, is required;[7] and
- on a cumulative and an individual basis.

13. Mr Baker's reply evidence addresses this matter. Dr West's reply evidence refers to the NRC Water Allocation Tool that is available to assist with these hydrological assessments.

14. NRC's position on Policy H.5 was not clear in the original s42A Report. Ms Kane subsequently clarified NRC's position as follows:[8]

> Regarding Additional Task #7 relating to the interpretation of Policies H.5 and D.4.11, NRC's interim [subsequently confirmed as final] position is that surface water depletion effects for groundwater takes that sit in the 'Other' category are excluded from the surface water allocation regime and the groundwater take is not subject to surface water minimum flows and water levels. However, this is not considered to constitute a permitted baseline, rather a direction that the stream depletion effects of 'Other' takes do not need to be considered under the pRPN water allocation framework. Nor does it mean that the actual and potential effects associated with stream depletion do not need to be assessed under s104. …."

15. Ms Kane also noted (in the same email): "*[t]he NPS FW 2020 provides a national policy direction for the consideration of effects on wetlands outside the 'allocation' framework"*.

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[7] E.g. the sort of analysis as undertaken in *Lynton Dairy Ltd* v *Canterbury Regional Council* C108/2005 at [141] – [142] *"... we look to see if the stream depletion effect can be quantified. ... The question is thus does the extra 4.35 Mm^3/yr in combination with existing abstractions result in effects that are more than minor?"*

[8] Email S Kane to S Ongley dated 2 February 2021 attached in Appendix 1.

16. We submit that there is also policy direction for consideration of effects on other waterbodies outside the 'allocation framework', as set out in Mr Christie's EIC – for example, threatened species may *also* occur in lakes, springs, rivers and streams.[9]

Lakes

17. Many lakes, or parts of lakes, are "wetlands" for the purpose of the higher level policy direction, including in the NPSFM 2020. Yet the same analysis undertaken for wetlands, has not been undertaken for lakes.

18. There is an assumption that shallow groundwater monitoring will pick up effects in dune lakes and that many dune lakes are perched. However at least one application document predicts effects on a dune lake that would breach the Lake level standard of 'no change' in Policy H.4.2.[10] Even if that standard does not technically apply so as to affect activity status (the take outside the 'allocation framework' due to the application of Policy H.5) the 'no change' threshold remains an indicator of the precautionary approach the PRPN takes to lakes (for the reasons discussed below in the context of *Minister of Conservation v Northland Regional Council* 2021 NZEnvC 001).

19. DOC considers that further predictive assessment of potential effects on lakes (as for rivers and streams) is required, for the purpose of section 104 consideration.

Task 1(e) Springs

20. This Task requested:

> "Identify example spring(s) (in discussion with iwi/NRC/DOC) for which baseline data (water level monitoring) occurs prior to any abstraction. Further survey/monitoring required should consents be granted."

[9] Refer Appendix 2 to Dr West's Reply evidence.
[10] Elbury Holdings Ltd – Lake Rotorua – as stated in Dr West's EIC at [29] the Sweetwater lakes have been identified as Outstanding Natural Features in the Proposed Regional Plan and Lake Rotoroa is in the top 10% of Northland Biodiversity Ranking - Lake Ranks.

21. This was not seen to be necessary by Applicant or NRC. Dr West continues to consider it important to assess potential effects on springs which often have high biodiversity values and may be one of the first places to show effects of drawdown.

Task 9(e) Threatened species

22. In this 'Task' DOC queried:

> "What does the Applicant propose regarding threatened species assessment given NZCPS Policy 11/NPSFM 2020?"

23. In conferencing Mr Williamson considered that threatened species assessments are required within the confirmed Areas of Interest (AOI) areas (i.e. after consents are granted). As Dr West's reply evidence states the assessments of the confirmed AOI in the GMCP's, inadequately references this commitment. In any event, DOC considers these assessments should be undertaken before consents are granted (see under next heading), and a similar approach should be taken to waterbodies other than wetlands that are at risk through assessment of factors including:

- higher level of predicted drawdown,
- known or predicted sensitivity.

24. The Applicants have not undertaken a full analysis of what *other* significant waterbodies exist in the drawdown area. This makes it difficult to understand which subclause of New Zealand Policy Statement (NZCPS) Policy 11 is applicable (subclause (a) or (b)).[11] We consider that in the absence of fuller assessment, the decision-maker must proceed on the basis of subclause (a). This means threatened or at-risk taxa may be present/there are other reserve areas within the domain/other outstanding waterbodies exist and that

[11] NZCPS Policy 11
"To protect indigenous biological diversity in the coastal environment:
(a) Avoid adverse effects of activities on….
(b) Avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on… ."

adverse effects on these areas, habitats and species that rely on them, must be avoided. This was the analysis that the Environment Court undertook when considering the protection level to be afforded to lakes in the Region i.e. if assessments have not been undertaken, then one must proceed on the basis that there *are* sensitive areas and habitats (discussed below under the heading "Legal developments"). There is evidence to support this approach for example, Dr West's Appendix 2 includes that "*most of the southern Northern ecologically significant unit of black mudfish populations (Barrier 2003) occur within the extent of the aquifer"*.

Wetland tasks

25. DOC, NRC and the Applicants have agreed upon wetland "Areas of Interest" or AOI's. DOC's technical expert Dr West did not agree that ground-truthing of these AOI's could be after consents are granted deferring to the planners on this point.[12]

26. The Commissioners asked the question:

> "[w]hether the relevant task(s) could be implemented and completed within a reasonable time period and the results confirmed before final decisions are made on the applications".

27. Counsel for the Applicants advised Counsel for DOC that 'benchmarking' wetland AOI's would take up to 1 week.[13] To-date, there has been no offer to carry out this work before final decisions are made on the applications. DOC had requested (Task requests) that ground-truthing be undertaken "*before groundwater monitoring bores are established.*"

28. Dr West's evidence comments on the wetland delineation protocols proposed in the GMCP's (these were not discussed in any detail in conferencing.)

[12] JWS 27/11/20 at paragraph 19, page 6.
[13] Email from R Ashton to S Ongley 10 May 2021 included in Appendix 1.

29. Further work has been undertaken on wetlands but DOC remains of the view that the information on the natural background environment, to enable triggers to be established, should be gathered *prior* to consents being granted. Methodology is discussed in Dr West's evidence, and Dr West offers to discuss this further with an ecologist expert retained by the Applicant.

30. Difficulties with attempting to establish triggers after consents are granted, based upon benchmarking against the natural environment, are discussed below in the context of the MWWUG regime. The proposed consent conditions will not (and are not) providing confidence that adverse effects will be avoided.

31. As stated, an "avoid" direction applies to wetlands.[14] As well as the higher level direction in the NPSFM 2020, there is a 'no change' direction for wetlands in Policy H.4.2 the PRPN (similarly as for lakes).[15] Benchmarking must be for the environment as it is unaffected by current takes i.e. for a naturalised environment. DOC rejects any argument that an additional 24 takes can be benchmarked against an environment that is currently being affected by approximately 16 takes, which are themselves being ramped up in stages. This creates difficulties - and may require

[14] Refer NPSFM higher level policy direction for wetlands. For the Kaimaumau Motutangi wetland refer also the Environment Court's comments in *Burgoyne v Northland Regional Council* [2019] NZEnvC 28 that *"... any change to that water level which is not a natural variation would be of concern."*
The *Burgoyne* decision records that the then 17 Applicants *acknowledged* that the consent conditions were to ensure the regime avoids adverse effects on the coastal environment, including the Kaimaumau-Motutangi Wetland, and avoids significant adverse effects on values and attributes of areas outside the coastal environment but within the drawdown area: at [36].

[15] PNRP Policy H.4.2 Levels for "Natural wetlands" states "There is no change in their seasonal or annual range in water levels." We understand that the reference to "seasonable or annual range" here, is not intended to create an allowance for changing wetland levels within the range. Rather it should be read similarly to the Notation for the water level standard for Lakes:
"as a result of the abstraction of water, median water levels, mean annual water level fluctuations, and patterns of water level seasonality (relative summer versus winter) remain unchanged". (Emphasis).
This accords with higher level policy direction.

further analysis. We submit such assessments are not suited to the delegated regime proposed.

Tasks 9(d) and (e) Requests for additional monitoring

32. DOC put forward proposals whereby modelling uncertainty could be reduced including wider sensitivity analysis and model re-calibration within a smaller catchment area(s) and inclusion of groundwater inputs.[16]

33. Based upon Mr Blyth's advice (JWS 4)[17], DOC considers that these matters would be more usefully undertaken *after* the gathering further data (over the 2021 – 2022 summer period). That is, model recalibration and sensitivity analysis over a wider range of parameters would more usefully occur following monitoring data gathered in the 2021-2022 summer. An important and anticipated opportunity to gather information to enable better calibration of the model, was missed due to water level transducers at Wetland North and Wetland South running dry over the peak of the 2020 summer.

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[16] The following 'Tasks' that DOC requested:

- "Model re-calibration with a smaller catchment area and inclusion of groundwater inputs to evaluate if a calibration/validation is still possible with some groundwater contributions. A sub-model should be trialled to represent a smaller catchment contributing to the large standing water body each of loggers KM3 and KM4, which should be the focus of the groundwater evaluation."
- "Model sensitivity presented for other parameters, such as (but not limited to) the 1.4m level assigned to open water evaporation."

[17] "Future model updates should continue as part proof the Staged Implementation and Monitoring Programme Review (SIMPR), which would integrate:

- longer periods of monitoring data,
- recalibration and validation to revised catchments and longer datasets
- assessment of potential groundwater ingress during calibration/validation
- sensitivity analysis across a range of other modelling parameters not presented to date."

34. As recorded in Table 1 of JWS 4, DOC requested that:

> "Water level transducers at Wetland North and Wetland South should be deepened before summer 2021. No installation data has been provided, so it is not known if these are dipwells or simply transducers attached to a waratah/post. Both monitoring wells were dry over the peak of the 2020 summer, which is the most important period for monitoring and aids calibration/validation of the model."

35. Mr Hughes advised in conferencing that some of these matters had been directed by Council in the Staged Implementation and Monitoring Programme Review (SIMPR) to be completed for a sub-set of the MWWUG consents in early October 2020.[18] Under the SIMPR process, increase in volume can only be authorised by Council if it is clearly indicated that the increase in allocation would meet Objective 1. This analysis was required when MWWUG takes Mapua, Honeytree and Largus proposed to progress to Stage 2. For this SIMPR, Mr Hughes recommended telemetry at the northern wetland site using a lowered water sensor. This was supported in a brief email from Willdands (an ecological report is a requirement of the MWWUG SIMPR).[19] After an extensive period of time, DOC was advised that this recommendation was never implemented because:[20]

> "Council is in discussion with the MWWUG consent holders regarding telemetry of all the sentinel monitoring sites in the GMCP. Council cannot require the consent holders to do any additional work, as it is not required by the consents. There is also an additional cost associated with work which would need to be borne by the consent holders."

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18 JWS 5 final page:
a. A rain gauge be installed in the vicinity of the Motutangi sentinel monitoring site.
b. The Kaimaumau Wetland north monitoring site be deepened (to prevent it drying out as happened March-May 2020).
c. The wetland north monitoring site be telemetered.

19 Email from Wildlands Consultants Ltd to S Saville, NRC, 22 October 2020 included in Appendix 1.

20 Email from S Saville to S Ongley dated 1 June included in Appendix 1.

36. DOC considers the deepening of the Wetland North and South wells, and telemetry, must occur before summer 2021. If not a vital opportunity to provide information for model calibration will be missed.[21]

37. The intention of gathering information for model calibration progressively over time, is not working as intended, at these important Kaimaumau monitoring sites.

B. Monitoring regime that will inform adaptive management

38. The s42A Supplementary Report now recommends telemetry across the monitoring network.[22] This would resolve one concern regarding the Kaimaumau Wetland North and South sites, should the current consents be granted. It does not resolve the concern that a SIMPR review that raises matters – e.g. monitoring – outside current consent conditions will not be implemented in a timely way (DOC is unsure why a section 128 review was not initiated by NRC in the circumstances outlined above - the s42A Supplementary Report suggests a bond condition could resolve this matter but we anticipate this could only be for monitoring requirements in original consent conditions, and possibly in original GMCP's[23]).

39. The current consent applications are over a much wider area to just the Kaimaumau-Motutangi wetland/reserve areas. In December 2021, Drs West, Drinan and Mr Blyth raised more general concerns about the adequacy of the monitoring regime.[24] These concerns remain unresolved. It is understood there are seen to be *Newbury* issues with the

21 In so far as it is relevant, the DOC monitoring sites did not also run dry as raised by Mr Williamson in conferencing (refer JWS 4). This fact may however, be relevant to the issue of differing hydrology across the Kaimaumau-Motutangi wetland - the information JWS 5 presented by Mr Blyth regarding water table differences between the DOC wells KM3 and KM4 and the Wetland North and South transducers has not been adequately explained).

22 Supplementary s 42A report at [14].

23 Supplementary s42A report [42].

24 Appendix 3 to Mr West's Reply evidence Memorandum 16 December 2020 "Concerns with monitoring as proposed".

monitoring requested. Mr Baker's reply evidence comments further.

40. An applicant cannot 'have its cake and eat it too' - if an applicant wishes to rely heavily upon monitoring in the absence of a comprehensive effects assessment, very robust monitoring indeed would be required. If that applicant was to carry out a more appropriate effects-assessment, the monitoring cost may be less.

41. We submit there *is* a *Newbury* connection between the takes and the additional monitoring that has been sought - to-date in general terms - by DOC.[25] Without going into detailed legal analysis as to whether a clear causal nexus is required,[26] disputes about whether monitoring cost should fall on the Applicants or NRC should not override a monitoring regime that we can be confident will pick up early - and 'avoid' - adverse effects on sensitive waterbodies and the species that rely on those environments.

42. In addition to commenting on monitoring, Mr Baker's reply evidence (as did his EIC) recommends that should consents be granted, conditions would need to include site pump testing to validate the model in light of the take site conditions. Mr Familton and Mr Christie have recommended that *should* consents be granted, a condition be imposed

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[25] *Newbury District Council v Secretary of State for the Environment* [1981] AC 578 (HL) upheld in *Estate Homes Ltd v Waitakere City Council* 12 ELRNZ 169: Any condition had to be "fair and reasonable" in terms of the test laid down in The Environment Court summarised the Newbury requirements as follows at [16]:
(a) That the condition imposed must be for a resource management purpose and not for some ulterior purpose.
(b) The condition must fairly and reasonably relate to the development in question.
(c) The condition must not be so unreasonable that no reasonable consenting authority could have imposed it.

[26] Quoting from the Majority Judgment in *Waitakere Estates* above-cited at [161]: *"the concept of 'effects' is wide and consideration of it is essential not only under s 104 but also under s 108: power to impose conditions on a consent cannot permit the decision-maker to cut loose from the restrictions attending the consent itself. As foreshadowed by this Court in Housing New Zealand, the so-called "Newbury principles" are not to be disregarded; rather in their light the Environment Court on appeal is to take a broad view of how Estate's proposed subdivision would have effects on the environment… ."*

requiring re-assessment following continuous calibration over time.

C. Important standards for containing potential effects left for 'another day'

43. Planning JWS "*Statement of general concerns from the Department of Conservation*" contains concerns regarding the adaptive management framework, and DOC's actual experience with it in the context of the MWWUG applications. At [13] DOC's Planners state:

> "We do not necessarily feel that simply applying the same conditions for the Motutangi Waiharara Water users group (MWWUG) is appropriate in this case."

44. We do not repeat the planners' list of concerns on the GMCP's/conditions, but provide a stark illustration of the problem – one that we submit raises real concerns regarding the Court of Appeal's *"left for another day"* comment in *Trans Tasman Resources v Taranaki-Whanganui Conservation Board* [2020] NZCA 86.[27]

45. Under the conditions, as confirmed by the Court *Burgoyne*, 'Trigger 1' is a catalyst for investigation by wetland ecologists and hydrologists.[28] The further investigation is intended to ascertain whether change in levels is a natural fluctuation or related to abstraction (TL 1 does not trigger a

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[27]Case referred to in our Opening Submissions. At [255]: *"Key decisions, and the gathering of information on which those decisions are based, are impermissibly left for another day and another decision-maker. The EPA was obliged to make these decisions at the time of consent, and to ensure it had adequate information to do so. If it did not have adequate information to make those decisions, the consent should have been declined."*
The "fundamental" error in that case involved:

a. The high level of uncertainty of the information on marine mammals and seabirds (distribution/abundance/habitat) - such that it was difficult to confidently assess the risks or effects at scale.
b. Allowing Trans Tasman Resources to gather baseline information about the receiving environment during the 2 years after the grant of the consents – including in order to establish natural background levels.
c. The reliance on very general conditions about avoiding adverse effects on fauna - leaving specific controls required to avoid those effects to management plans.

[28] The Court commented in *Burgoyne v Northland Regional Council* [2019] NZEnvC 28 that "*... any change to that water level which is not a natural variation would be of concern*." This also accords with the higher level policy direction for wetlands.

'claw back'). This regime was formulated to directly respond to the mandate to "*avoid"* adverse effects on the relevant values - alarm bells require further analysis to determine whether the fluctuation is natural. DOC's Planners attach as Appendix 2 to the JWS (Planning) a letter from DOC, M Hardy-Birch to NRC, S Saville dated 20 October 2020. This letter sets out DOC's concerns on Groundwater Trigger Levels, Wetland trigger levels, and Wetland Monitoring (for the MWWUG consents) including*:*

> "Section 2.2.2 of the GMCP states the purpose of setting TL1 is to establish 'whether the parameter of concern is approaching outer limits of baseline data'. For the shallow sand monitoring bores this means TL1 should indicate when groundwater levels are approaching the outer limit, they should not be set at the outer limit. That is, TL1 should not equal or exceed the minimum groundwater level observed during baseline monitoring.
>
> … It was proposed in the GMCP to base TL2 on the median groundwater level ± times the standard deviation, or some other criteria determined with agreement of Council.
>
> The revised TLs have not followed the approach recommended in the GMCP. Instead the TLs for shallow monitoring bores [FN NRC Kaimaumau Rd, Norton Rd, Motutangi Sentinel] have been set outside the range of baseline data.
>
> …
>
> Given the summer 2019/20 period coincided with a significant drought of record in Northland when groundwater levels were observed to be considerably lower than the previous summer period we do not support setting TL1 and TL2 below the minimum groundwater levels.
>
> The consequence of setting TLs below the minimum groundwater levels observed in 2019/20 is it will potentially allow for groundwater extraction to deplete the shallow groundwater resource to a level greater than that observed in a relatively extreme climate event [FN https://niwa.co.nz/sites/niwa.co.nz/files/Climate_Summary_Su

mmer_2019-20_NIWA.pdf]. The total rainfall at Kaitaia during summer 2019/20 was the 2nd lowest recorded since records began in 1948.

46. DOC recommended that TLs for all shallow sand monitoring bores be consistent with the intent of the GMCP – specifically that TL1 and TL2 refer to the *median* observed water levels (± an appropriate variance calculation) and not equal or exceed the minimum groundwater level recorded during the 2019/20 summer period; a time of significant drought. The letter expressed similar concerns regarding daily recession rate trigger for the water levels in the Kaimaumau-Motutangi wetland - TL1 and TL2 recommendations being too high. DOC commented that 7mm daily recession rate for TL1 is based upon a relatively extreme drought event could impose "*significant hydrological stress on the wetland system*" and that this was never the intent of the GMCP as approved by the Environment Court. DOC's concerns were not adopted.[29]

47. DOC considers trigger levels set upon the basis of an extreme drought summer, represents a failure of the MWWUG consent conditions achieving policy direction as expressed in the *Burgoyne* decision. The MWWUG consents were granted by the Environment Court on what was seen at that time as a highly precautionary regime due to policies. Even for wetlands and lakes *other than* the Kaimaumau-Motutangi, we submit this approach to trigger levels, would not accord with the relevant policy direction.

48. Although the Objective of the GMCP's has been improved since first proposed, the Objective alone does not provide

[29] Letter LWP to S Saville 30 October 2020 (attached in Appendix 1) includes as reasons (pages 30-32) *"The proposed TL1 threshold is within the range of values measured during the 2019-2020 [sic] which appear to reflect an entirely natural water level response in wetland water levels during summer conditions. ... It is considered there is limited value in setting the wetland trigger level values as a threshold that is likely to be exceeded on a regular basis (i.e. < 7mm/day) during normal summer periods of low rainfall and high evapotranspiration ... It is recommended that the revised trigger level only apply to the southern monitoring site until such time as an alternative method for data retrieval (e.g. , telemetry) is available".*

sufficient confidence that appropriate limits will be set to contain potential adverse effects.

49. In conferencing Mr Hamilton and Mr Christie recommended that should consents be granted an Expert Review Panel may strengthen this process. The s42A Officer is not averse to this suggestion, however suggests "*nominating a suitably qualified and experienced hydrogeologist (and ecologist if required) to act as an independent expert for those processes where technical input or review is required*".[30] DOC would consider an Expert Review Panel necessary, given the complexity of the proposed adaptive management regime and experience to-date (i.e. while the regime has been in a trial phase). Deficiencies have been shown with the 'high trust' model that was imposed by the Environment Court, upon an *Augier* basis[31], and (we acknowledge) with a large degree of agreement by DOC at that time.[32]

Legal developments

50. As noted, the Environment Court has released its decision on appeals against the Water Quantity and Allocation provisions of the Proposed Northland Regional Plan.[33]

51. This Decision includes additional recognition for the Region's dune lakes. The Decision records that Northland Regional Council has ranked lakes of Outstanding or High value.[34] However only a fraction of Northland's dune lakes have been ranked (69 out of the possible 367) and many of

[30] S42A Supplementary Report at [37].
[31] *Burgoyne* at [38] last bullet point.
[32] A "Note" was included in the Director-General's submission in general support of that regime, but that was prior to the conditions being finalised by the Environment Court, and primary reasoning in the submission relates to inadequate assessment of effects.
[33] *Minister of Conservation & Ors v Northland Regional Council* (Topic 3 and 4) NZEnvC 001 (Interim Decision) NZEnvC 033 (Final Decision).
[34] a. Outstanding value lakes: Lakes Taharoa, Humuhumu, Waikere, Rotokawau (Pouto), Mokeno, Kai-Iwi, Ngatu, Wahakari, Kanono, Waiporohita, Waihopo and Morehurehu.
b. High value lakes: Lakes Kahuparere, Te Kahika, Te Werahi Lagoon, Karaka, Ngakapua, Te Paki Dune, Waiparera and Rotoroa

the unassessed lakes are likely to harbour significant ecological values. The Court commented:

> [126] The issues in this case turn upon whether nearly 300 dune lakes that have not been ranked contain significant ecological values. Only around one third of dune lakes assessed to date have been identified as having outstanding values. If that ratio applies for the remaining lakes, there is probably another 100 lakes out of 300 that may contain significant flora or fauna or be significant for other reasons.

52. The Court concluded:[35]

> "[131] We have concluded in the circumstances of this case that a cautious approach would be to maintain a non-complying status for all applications that would alter lake levels and require any person seeking to extract water from a lake to demonstrate by analysis of the flora and fauna of that lake, that it does not have any significant or outstanding values"
>
> (Emphasis)

53. For lakes such as Lake Rotorangi where an effect has been predicted, a similar analysis should be carried out. Other lakes that may be affected should be identified.

54. Further, the Court noted that many lakes contain wetland areas:

> [127] We note also that many of these shallow lakes will contain wetland areas around their margins which are protected by the NES-FW. The extent of this is unclear until mapping is concluded.

55. Dr West in reply also raises the issue of the interface between lakes and wetlands (the issue is also discussed in Draft MfE Guidance "*Essential Freshwater Interpretation Guidance: Wetlands Definitions*" at page 9).

56. In other Court decisions on the PRPN:

- An appeal has been lodged in the high Court, by the Minister of Conservation, against a decision of the Environment Court on what is a wetland for the purposes

[35] Reflected in Rule C.5.1.13Water take below a minimum flow or water level – non-complying activity:
"The taking of fresh water from a river, lake or natural wetland when the flow in the river or water level in the natural wetland or lake is below a minimum flow or minimum level set in H.4 Environmental flows and levels, and that is not permitted by a rule in this Plan, is a non-complying activity.
For the avoidance of doubt, this rule does not apply to non-consumptive takes."

of the NES (Freshwater).[36] Until this appeal is resolved, we note the Environment Court held that the NES's reference to wetlands does not extend to the CMA other than upstream of a river mouth.[37]

- The Environment Court has said, in the context of setbacks from wetlands and lakes for land disturbance activities:[38]

> "[100] We remain concerned at the decline in the number and quality of wetlands in Northland (and in New Zealand). The Northland Regional Plan takes a strong stand on the value and attributes of these water bodies. We conclude methods need to ensure these policies are complied with and the trend towards further depletion of wetland and lake areas halted."

Incorporating further consents required under the NES (Freshwater)

57. The Supplementary s42A Report raises the issue that further consents may be required under the NES (Freshwater), an issue discussed in planning conferencing.

58. Section 43B of the Act sets out how the NES-F interacts with resource consents. In the Environment Court decision *Director-General of Conservation v NZ Transport Agency* [2021] NZEnvC 27 (Mt Messenger Second Interim Decision), Waka Kotahi argued that the Court could grant further consents under Regulations 45, 57, 71 and 73 of the NES, even although applications had not been made under those Regulations. The Court said:[39]

> We do not consider it is possible in a jurisdictional sense to grant consent for an activity for which no consent was required as at the date the resource consent application was filed, notwithstanding the reference in the AEE to the application being for all consents required for the Project … .

[36] *Bay of Islands Maritime Park Incorporated v Northland Regional Council* [2021] NZEnvC 006
[37] That is, that the NES (Freshwater) applies to "the coastal marine area (CMA) only to the extent that they cover the area of CMA upstream of the 'river mouth' as defined in the Resource Management Act 1991."
[38] *Minister of Conservation v Northland Regional Council* [2021] NZEnvC 77.
[39] At [53] – [54].

…

… The Regulation require compliance with certain matters not explored with the Court during the hearing.

59. It is not open to the decision-maker to expand the scope of applications to include application for a consent that was not required previously, as is suggested in the s42A Supplementary Report.

60. We submit that analysis around the take locations should be undertaken *now* (before consents are granted) to ascertain what additional consents may be required under the NES-Freshwater.

Section 104(3)

61. The Applicants have not provided written consents from the MWWUG consent-holders and therefore effects on those consent holders, will need to be considered.

Conclusion

62. DOC's position remains that without further work on assessing potential adverse effects, and gathering baseline information, 'adaptive management' is pre-emptive – the framework set out *Sustain Our Sounds* is not adequately met.[40] DOC does not consider there is an adequate evidential foundation, to establish that the proposed approach will *sufficiently reduce uncertainty and adequately manage any remaining risk.*[41]

63. Without further information, the MWWUG regime does not form a 'precedent' that can simply be opened-up to other takes.

64. The level of risk is to be informed by the planning instruments – here most of the drawdown area is within the

[40] *Sustain our Sounds v New Zealand King Salmon Co Ltd* [2014] NZSC 40 at [129] where the Court stated the combination of factors required to be considered when considering whether the precautionary approach requires the activity to be prohibited until further information is available, rather than an adaptive management or other approach - including *"the extent of the environmental risk (including the gravity of the consequences if the risk is realised)"*.

[41] Using the words in *Sustain Our Sounds* above-cited at [125].

coastal environment, as expansively defined in *Burgoyne.* The Applicants have not undertaken a comprehensive analysis of potential adverse effects on rivers, streams, lakes and springs, preferring to rely on the groundwater computer model together with a monitoring network (also informed by that model).

65. Guided by the policy context, and cognisant of model uncertainties, DOC continues to differ from the s42A Supplementary assessment:

- For the Northern and South-Western Groups, without further baseline information on the environment, consents should be declined.
- For the Middle Group, any consents granted must include appropriate trigger levels in the consent conditions themselves. Based on actual experience, an inappropriate level of discretion is delegated to NRC under the adaptive management framework proposed. Mr Familton and Mr Christie have provided more detailed comments on the framing of consent conditions.

Dated this 4th day of June 2021

S Ongley & Lisa Sutherland
Counsel for the Director-General of Conservation

Appendix 1

Correspondence:

a. Email from S Ongley 16 October 2020 attaching DOC 'Task list' requests.
b. Email S Kane to S Ongley 2 February 2021 (confirmed 10 February 2021).
c. Email from R Ashton to S Ongley 10 May 2021.
d. Email from Wildlands Consultants to NRC 22 October 2020 (forwarded by S Saville to DOC).
e. Email from S Saville to S Ongley dated 1 June 2021.
f. Letter from LWP to S Saville 30 October 2020 (LWP amended Trigger Level Report).

Appendix 1 (a) – (e) to DOC Legal Submissions in Reply 04.06.21

a. Email from S Ongley 16 October 2020 attaching DOC 'Task list' requests.
b. Email S Kane to S Ongley 2 February 2021 (confirmed 10 February 2021).
c. Email from R Ashton to S Ongley 10 May 2021.
d. Email from Wildlands Consultants to NRC 22 October 2020 (forwarded by S Saville to DOC).
e. Email from S Saville to S Ongley dated 1 June 2021.

1 (a)

From: Sarah Ongley <sarah@ongley.co.nz>
Sent: Friday, October 16, 2020 2:31 PM
To: 'Martell Letica' <martell.letica@wwla.kiwi>; 'Stephanie Kane' <stephanie@landsandsurvey.co.nz>
Cc: 'Lisa Sutherland' <lsutherland@doc.govt.nz>
Subject: Task List

Dear Martell &Stephanie,
Further to your discussion with Lisa (cc) this week, I attach the additional tasks that DOC requests be included in the 'Task List'. This is for the purposes of paragraph 6 of the Commissioners Direction #2 (also attached for your easy reference).

I look forward to your consideration and response, in accordance with the consultation directed in that Direction.

Kind regards,
Sarah

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Additional tasks sought by DOC to be added to 'Task List'

Wetland identification/risk analysis	First pass method in GIS (using closed depression analysis) used to identify potential wetlands, however some wetlands may be an 'open environment', i.e. connected to a surface water course or at the headwaters of a gully/spring for example. The current approach may have missed these. Recommend ground truthing be undertaken on high risk wetlands identified from the analysis. This could be undertaken from the short listed at risk sites, with preference given to the *unmapped* wetlands (not in FENZ etc). This should occur before groundwater monitoring bores are established. Ground truthing should also evaluate why some wetland sites classified as high risk did not pick up nearby connected wetlands, which presumably could be due to discrepancies in the GIS based approach (and groundwater modelling outputs). An example of this is in the document 'WWLA_memo_depression_assessment_29092020'.pdf, Area of interest F (page 7) and K (page 14). This may highlight that there are unmapped wetlands of high risk which haven't been captured.
Wetland Baseline Monitoring	An ecological assessment should be conducted on the selected high risk wetlands for monitoring of groundwater. This should include establishment of permanent vegetation plots, invertebrate, fish and bird surveys. This information should be re-assessed on 3-5 year intervals in conjunction with reviews of water level monitoring data. Selection of the groundwater monitoring sites in the selected wetlands should be in conjunction with an NRC or DOC wetland specialist.
Water Balance Modelling - Kaimaumau	Model sensitivity should be presented for other parameters, such as (but not limited to) the 1.4 m level assigned to open water evaporation. Model should be re-calibrated with a smaller catchment area and inclusion of groundwater (GW) inputs to evaluate if a calibration/validation is still possible with some groundwater contributions. GW contribution is not likely to be occurring at all wetland areas (given the mosaic across the wetland and some perched rainfall fed systems), however a sub-model should be trialed to represent a smaller catchment contributing to the large standing water body east of loggers KM3 and KM4, which should be the focus of the GW evaluation.
Radon sampling	Further radon sampling in Kaimaumau Wetland over the peak of summer throughout the standing water body to the East of monitoring sites KM3 and KM4 (multiple samples across a grid area to capture a range of results, given if springs are present they may be localised). This may require helicopter or boat access (i.e. hovercraft).
Springs	Identify example spring(s) (in discussion with iwi/NRC/DOC) for which baseline data (water level monitoring) occurs prior to any

	abstraction. Further survey/monitoring required should consents be granted.
Threatened species	*What does the Applicant propose regarding threatened species assessment given NZCPS Policy 11 /NPSFM 2020?*
Stream depletion effects **Lakes**	Many of the potentially affected streams are small, with estimated MALFs of <10 L/s. Previous studies have shown smaller systems such as these to be most at risk from hydrological alteration (in terms of ecological protection of instream values). Notwithstanding the overall average/median modelled stream depletions, localised effects could be much higher. Takes may lead to flow reductions below the minimum flow for streams in the hydraulically connected area.[1] Require site-specific investigations on potential stream flow depletion/lake water level for high risk areas (with highest known ecological values + hydraulic connection). Concurrent flow gaugings (streams)/lake water level loggers in conjunction with pump tests. Note that there are a number of pre-existing GW takes in some areas that could be used to run these investigations before any well is dug. Assessing those AEEs that for these pre-existing GW takes would be useful to see what assessments were done.

16.10.20

[1] DOC does not agree with J Williamson Supplementary evidence 28.09.20 which appears to assert that H.5 Table 28 provides some form of 'permitted baseline'. These effects still need to be considered under RMA s104)

1 (b)

Sarah Ongley

From: Stephanie Kane <stephanie@landsandsurvey.co.nz>
Sent: Wednesday, February 10, 2021 12:09 PM
To: Sarah Ongley
Subject: RE: Mediation for the Aupouri Aquifer Water Take Consents

Kia ora Sarah,

Yes, this is NRC's formal position and I'm happy for it to be attached to your update for the Commissioners.

Thanks,
Steph

From: Sarah Ongley <sarah@ongley.co.nz>
Sent: Wednesday, 10 February 2021 12:04 PM
To: Stephanie Kane <stephanie@landsandsurvey.co.nz>
Subject: FW: Mediation for the Aupouri Aquifer Water Take Consents

I am intending to file a Memorandum with the Commissioners today with updates from DOC's perspective and was intending to attach your below email (not the full email chain). As it is not marked 'without prejudice' I am assuming this is okay with you i.e. it is NRC's formal position on-the-record?
I look forward to hearing.
Ta.
Sarah

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From: Stephanie Kane <stephanie@landsandsurvey.co.nz>
Sent: Tuesday, February 2, 2021 3:10 PM
To: Sarah Ongley <sarah@ongley.co.nz>
Cc: 'Brydon Hughes' <brydon@landwaterpeople.co.nz>; 'Lisa Sutherland' <lsutherland@doc.govt.nz>; 'Jon Williamson' <jon.williamson@wwla.kiwi>; 'Tom Christie' <tchristie@doc.govt.nz>; 'Stuart Savill' <StuartS@nrc.govt.nz>; 'Martell Letica' <martell.letica@wwla.kiwi>
Subject: RE: Mediation for the Aupouri Aquifer Water Take Consents

Kia ora Sarah,

I have been advised and can confirm that NRC's position on the interpretation and interaction of Policies H.5 and D.4.1 remains consistent with the 'interim position' as detailed previously and copied below for reference.

Regarding Additional Task #7 relating to the interpretation of Policies H.5 and D.4.11, NRC's interim position is that surface water depletion effects for groundwater takes that sit in the 'Other' category are excluded from the surface water allocation regime and the groundwater take is not subject to surface water minimum flows and water levels. However, this is not considered to constitute a permitted baseline, rather a direction that the stream depletion effects of 'Other' takes do not need to be considered under the pRPN water allocation framework. Nor does it mean that the actual and potential effects associated with stream depletion do not need to be assessed under s104. It is noted that Policy H.4.2 regarding minimum levels in natural wetlands references seasonal and annual range in water levels. Policy D.4.22 and Objective F.1.1 (particularly subclause 2) also provide relevant policy context regarding effects on natural wetlands and freshwater quality. Regardless, the NPS FW 2020 provides a national policy direction for the consideration of effects on wetlands outside the 'allocation' framework.

Ngā mihi,
Stephanie

1(c)

From: Rowan Ashton <ashton@brookfields.co.nz>
Sent: Monday, May 10, 2021 1:30 PM
To: Sarah Ongley <sarah@ongley.co.nz>
Cc: Andrew Green <green@brookfields.co.nz>; Stephanie Kane <stephanie@landsandsurvey.co.nz>
Subject: RE: Aupouri aquifer - Reconvening of hearing - Matter: 703563

Hi Sarah,

Ground truthing of the wetlands is the first task in the GMCPs. It is estimated that the work would take no more than one week in the field for the preliminary benchmarking assessment. This work would occur prior to abstraction commencing.

In relation to producing a JWS for the comments the planners have made on middle group GMCP, you are quite right that conferencing would technically continue for the purpose of preparing the covering statement. This is a fairly discrete task that the planners ought to be able to complete via correspondence. Please advise if there is any objection to that.

In the interim, we will file a memorandum with the Commissioners seeking the timetable below.

Kind regards,

Rowan

Rowan Ashton
Senior Associate

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Current Covid-19 Alert Level protocols are being observed. Visitors should wherever possible make a prior appointment. We encourage remote meetings. Our teams are available by phone, email or by video conference.

Please note Central Auckland is currently affected by further major road closures. This will affect access to car parking at our office.

General information can be found here: https://www.cityraillink.co.nz/cbd-wellesley-street-intersection-closure

1 (d)

Sarah Ongley

From: Stuart Savill <StuartS@nrc.govt.nz>
Sent: Thursday, October 22, 2020 10:32 AM
To: Andrew Green; Meirene Hardy-Birch
Subject: Ecologists comment for SIMPR process and effects on Kaimaumau Wetlands

Follow Up Flag: Follow up
Flag Status: Flagged

Tena korua

Please find below written confirmation from Dr Tim Martin, Wildlands Consultants Ltd, on the potential effects on Kaimaumau wetland as a result of the proposed increase to stage 2 allocation for Mapua, Honeytree, and Largus groundwater takes.

Ngā mihi

Stuart Savill
Consents Manager
Northland Regional Council » Te Kaunihera ā rohe o Te Taitokerau

Phone 09 470 1210 ext 9101

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From: Tim Martin <Tim.Martin@wildlands.co.nz>
Sent: Thursday, 22 October 2020 8:37 am
To: Stuart Savill <StuartS@nrc.govt.nz>
Subject: RE: Kaimaumau Wetlands - effects from groundwater take resource consents

Kia ora Stuart

The potential for water takes from bores at Kaimaumau to have an effect on the wetlands is dependant on the degree of interaction or separation of the underlying aquifer from the surface water. The underlying aquifer lacks significant hydraulic connection with the wetland (as per the findings of the hydrologist on which we solely rely – refer to LWP Ltd 2020, p. 27) and therefore an increase in water take from the aquifer is not predicted to reduce surface water levels in the Kaimaumau-Motutangi Wetlands. On this basis, an adverse effect on the Kaimaumau-Motutangi Wetlands due to the increase in water take is unlikely.

Wildlands have established baseline monitoring of habitats within the wetland in early 2020. This monitoring should be repeated at intervals as per the resource consent conditions. Wildlands also support the recommendations of the hydrologist that:

- modelling should be used to further investigate and quantify the relationship between the aquifer and surface water levels
- collection of local rainfall data is undertaken to improve the calibration of the wetland model
- telemetered near-time water level monitoring occurs at the northern wetland site using a lowered water sensor.

If any additional monitoring data or modelling brings into question the separation of the aquifer from the surface water of the wetland, a detailed assessment of ecological effects of the water intakes on the wetland should be undertaken.

Ngā mihi

Tim

1 (e)

Sarah Ongley

From: Stuart Savill <StuartS@nrc.govt.nz>
Sent: Tuesday, June 1, 2021 9:27 AM
To: sarah
Cc: 'Stephanie Kane'
Subject: RE: Aupouri aquifer - applications for proposed takes

Tena koe Sarah

That is correct.

Responses in red text below.

Ngā mihi

Stuart Savill
Consents Manager
Northland Regional Council » Te Kaunihera ā rohe o Te Taitokerau

Phone 09 470 1210 ext 9101

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From: Sarah Ongley <sarah@ongley.co.nz>
Sent: Monday, 31 May 2021 5:25 pm
To: Stuart Savill <StuartS@nrc.govt.nz>
Cc: 'Stephanie Kane' <stephanie@landsandsurvey.co.nz>
Subject: RE: Aupouri aquifer - applications for proposed takes

Kia ora Stuart,
I don't believe I have had a response to the below?
Sarah

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From: Sarah Ongley <sarah@ongley.co.nz>
Sent: Thursday, May 20, 2021 5:10 PM
To: 'Stuart Savill' <StuartS@nrc.govt.nz>
Cc: 'Stephanie Kane' <stephanie@landsandsurvey.co.nz>
Subject: RE: Aupouri aquifer - applications for proposed takes

My apologies I neglected to request an Item 3 from you – in addition to the below – which is the Morphum Environmental Consultants work on wetlands – also mentioned during conferencing and that NRC undertook to provide.

This is a MfE run project and you will need to discuss with MfE if you require further details. Council had a briefing with MfE on initial output of mapping project which are summarised below:

- Some reports may be available by early June:
  - Lit review
  - report detailing what has been done to date (finalized version of the draft circulated previously)
  - data (scrips/code/models) to replicate what's been done to date
- Current output:
  - has limited potential for identifying new sites due to the number of false positives
  - could still be useful for updating polygons and removing errors from our current wetland database (if timeframes dictate this)
- Further refinement will happen in a Kaipara Moana stage due to run June-September.
- Refinements are needed to reduce false positives (particularly forested wetland).
- Even with method refinements, any output is going to need some involved validation, this may be:
  - Desktop (in house or external GIS resource) for significant sites
  - For smaller sites (may be very large in number) e.g. improved pasture and reverting wetlands, this is likely to best be done over time, such as part of farm environment planning work.

Thank you
Sarah

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From: Sarah Ongley <sarah@ongley.co.nz>
Sent: Thursday, May 20, 2021 5:05 PM
To: 'Stuart Savill' <StuartS@nrc.govt.nz>
Cc: 'Stephanie Kane' <stephanie@landsandsurvey.co.nz>
Subject: RE: Aupouri aquifer - applications for proposed takes

Thank you for your email Stuart.

In relation to item (1) is there a reason why these recommendations have not been carried out?

Council is in discussion with the MWWUG consent holders regarding telemetry of all the sentinel monitoring sites in the GMCP. Council cannot require the consent holders to do any additional work, as it is not required by the consents. There is also an additional cost associated with work which would need to be borne by the consent holders.

In relation to item (2), can NRC please provide further information on:

- What dune lakes are NRC currently monitoring and for what parameters (I understand NRC are presently monitoring 27 dune lakes in Northland as part of a state of the environment study); and

I will refer you to SOE report 2015, p 101 – 110 (of document, not page numbers).

- What is the future monitoring regime that is proposed for Dune lakes (Stephanie provided evidence verbally at the hearing last year that NRC said they planned on reducing the monitoring points to only lakes classified as Outstanding but for a wider variety of parameters). Any information you can provide on this future monitoring programme would be helpful.

The outcome of the review into SOE monitoring will not be finalised for at least another couple of months.

Regards,

Sarah

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From: Stuart Savill <StuartS@nrc.govt.nz>
Sent: Thursday, May 20, 2021 3:54 PM
To: sarah <sarah@ongley.co.nz>
Cc: 'Stephanie Kane' <stephanie@landsandsurvey.co.nz>
Subject: RE: Aupouri aquifer - applications for proposed takes

Tena koe Sarah

Council response to questions:

1 No these have not been carried out.
2 There has been no change in dune lake monitoring from what was previously being undertaken as part of the State of the Environment monitoring programme.

Ngā mihi

Stuart Savill
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From: Sarah Ongley <sarah@ongley.co.nz>
Sent: Thursday, 20 May 2021 8:40 am
To: Stuart Savill <StuartS@nrc.govt.nz>
Cc: 'Stephanie Kane' <stephanie@landsandsurvey.co.nz>
Subject: Aupouri aquifer - applications for proposed takes

Dear Stuart,

I am writing to follow-up some matters identified in Expert Conferencing in these proceedings. Can you please provide an update on the following two comments that I understand were provided by Brydon Hughes, as soon as possible (given DOC is under a deadline currently). Refer my bolded questions below:

1. Tasks 9(d) & (e) – (Requests for additional modelling & sampling) - JWS Finalised on 11 December 2020
   Comments on whole Table from Brydon Hughes (BH):
   Of possible relevance to the discussion, I note that the Staged Implementation and Monitoring Programme Review (SIMPR) completed for a sub-set of the
   MWWUG consents in early October 2020 included the following recommendations:
   a. A rain gauge be installed in the vicinity of the Motutangi sentinel monitoring site
   b. The Kaimaumau Wetland north monitoring site be deepened (to prevent it drying out as happened March-May 2020)
   c. The wetland north monitoring site be telemetered.

   Have these actions been carried out?

2. Dune lakes

NRC undertook to provide details of existing (and proposed) groundwater level monitoring sites, along with details of existing and proposed future dune lake monitoring and Northland wetland mapping being undertaken by Morphum Environmental Consultants

What is the current status of NRC's proposed monitoring regime for Dune Lakes, and for what parameters?

Thank you.

Regards

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Northland Regional Council
Private Bag 9021
Whangarei

Attention: Stuart Saville

Project Ref: NRC035

30 October 2020

Interim MWWUG Triggers.doc

Revised Trigger Levels for MWWUG Consents

The Motutangi-Waiharara Water User Group were granted consent to enable abstraction of groundwater from the Houhora, Motutangi and Waiharara sub-areas of the Aupouri Aquifer in early 2019. The consents are managed in accordance with a range of conditions that include reference to a Groundwater Monitoring and Contingency Plan (GCMP). The GCMP establishes the framework for an '*adaptive management*' approach to avoiding adverse effects on the environment and includes specifications for staged uptake of abstraction, monitoring of the condition (quality and quantity) of the groundwater resource and implementation of mitigation (contingency) measures should nominated trigger levels be exceeded.

Given the relatively limited information available to characterise the quality and quantity of the groundwater resource at sensitive locations (i.e. those areas with the greatest potential to be adversely affected by groundwater abstraction) the GCMP required establishment of groundwater level and quality monitoring at representative locations across the potentially affected area. The GCMP also specifies a process for establishment of initial 'interim' trigger levels which require updating after an initial 12 to 15 month period of 'baseline' monitoring, during which cumulative abstraction by the MWWUG consents was limited to less than 25 percent of the full authorised volume.

This report provides a review of the interim trigger levels established for the MWWUG consent in January 2019 utilising environmental monitoring data collected over the subsequent period.

Specific triggers for groundwater levels, electrical conductivity and wetland water levels are specified in Tables 1 to 5 below. Derivation of individual triggers is described in Sections 1 to 3 following.

Table 1. *MWWUG Sentinel Bore Groundwater Level Triggers*

Parameter	Monitoring Site	Interval	Bore ID	Interim Triggers		Proposed Triggers	
				TL1 (m asl)	TL2 (m asl)	TL1 (m asl)	TL2 (m asl)
Groundwater Level	NRC Kaimaumau Rd	Shallow (20m)	LOC.316222	1.25	1.15	**1.10**	**1.00**
		Deep (72 m)	LOC.315766	1.70	1.50	**1.70**	**1.50**
	Norton Road		LOC.323722	4.25	4.05	**3.10**	**2.90**
	Motutangi Sentinel	Shallow (8 m)	LOC.323721	6.35	6.25	**5.95**	**5.85**
		Deep (83 m)	LOC.323720	6.10	5.90	**5.70**	**5.50**
	Waterfront	Piezo 4 (21 m)	LOC.200210	0.75	0.65	**0.75**	**0.65**
		Piezo 4 (76 m)	LOC.200210	2.55	2.35	**2.20**	**2.00**

Table 2. *MWWUG Sentinel Bore Electrical Conductivity Triggers*

Parameter	Monitoring Site	Interval	Bore ID	Interim Triggers		Proposed Triggers	
				TL1 (µS/cm)	TL2 (µS/cm)	TL1 (µS/cm)	TL2 (µS/cm)
Electrical Conductivity	NRC Kaimaumau Rd	Shallow (20m)	LOC.316222	286	345	**290**	**345**
		Deep (72 m)	LOC.315766	435	520	**435**	**520**
	Norton Road		LOC.323722	590	710	**590**	**710**
	Motutangi Sentinel	Shallow (8 m)	LOC.323721	412	495	**400**	**485**
		Deep (83 m)	LOC.323720	681	818	**540**	**650**
	Waterfront	Piezo 4 (21 m)	LOC.200210	744	892	**740**	**890**
		Piezo 4 (76 m)	LOC.200210	555	666	**560**	**670**

Table 3. *Trigger Levels for MWWUG Saline Intrusion Monitoring Sites*

Site*	Bore No	Screened Interval	Parameter	Units	No of samples	Baseline Median	Proposed Trigger Levels	
							TL1	TL2
Fishing Club	324261	Shellbed	EC	µS/m	8	44.5	**56**	**67**
			Chloride	mg/L	8	64.2	**78**	**94**
			Sodium	mg/L	8	50	**63**	**75**
			TDS	mg/L	8	275	**344**	**413**
NRC Kaimaumau Rd	316222	Shallow sand	EC	µS/m	8	28.9	**36**	**43**
			Chloride	mg/L	8	55.8	**70**	**84**
			Sodium	mg/L	8	35.5	**44**	**53**
			TDS	mg/L	8	180	**225**	**270**
NRC Kaimaumau Rd	315766	Shellbed	EC	µS/m	8	39.3	**50**	**60**
			Chloride	mg/L	8	51.8	**65**	**78**
			Sodium	mg/L	8	56.5	**71**	**85**
			TDS	mg/L	8	235	**294**	**353**
Kaimaumau Settlement	317504	Shallow sand	EC	µS/m	8	47.1	**59**	**71**
			Chloride	mg/L	8	66.5	**83**	**100**
			Sodium	mg/L	8	45	**56**	**68**
			TDS	mg/L	8	305	**381**	**458**
Kaimaumau Settlement	324250	Shellbed	EC	µS/m	8	4,744	n/a	n/a
			Chloride	mg/L	8	18,450	n/a	n/a
			Sodium	mg/L	8	9,250	n/a	n/a
			TDS	mg/L	8	37,000	n/a	n/a

* Note: *no trigger levels are proposed for the Elbury Holdings production bore which is yet to be drilled.*

Table 4. *MWWUG Production Bore Electrical Conductivity Triggers*

Compliance Site No.*	Bore ID	Consent Holder	Interim Trigger Level		Proposed EC Triggers			
			TL1 (µS/cm)	TL2 (µS/cm)	No. samples	Median EC (µS/cm)	TL1 (µS/cm)	TL2 (µS/cm)
AUT.038610.01.01	LOC.315389	Mapua Avocados Ltd #1	430	510	9	334	**420**	**500**
AUT.038610.01.01	LOC.323163	Mapua Avocados Ltd #2	360	430	9	290	**360**	**430**
AUT.038610.01.01	LOC.323164	Mapua Avocados Ltd #3	430	510	9	285	**360**	**430**
AUT.038420.01.01	LOC.315384	Largus Orchard Ltd#1	630	750	9	491	**610**	**740**
AUT.039244.01.01	LOC.315061	Thomas & O'Connor	-	-	8	482	**600**	**720**
AUT.039381.01.01	LOC.316126	Thomas	600	720	9	47.7	**600**	**720**
AUT.038471.01.01	LOC.312333	Honeytree Farms Ltd#1	580	700	9	444	**560**	**670**
AUT.038589.01.01	LOC.209280	Watson	480	580	9	390	**490**	**590**
AUT.027391.01.01	LOC.310308	Stanisich	620	740	9	486	**610**	**730**
AUT.038591.01.01	LOC.313248	Cypress Hills Ltd	490	590	9	390	**490**	**590**
AUT.083880.01.01	LOC.312696	Hanui	620	740	9	485	**610**	**730**
AUT.038650.01.01	LOC.201366	Hewitt	500	600	9	385	**480**	**580**

** A number of proposed production bores are yet to be drilled*

As detailed in Section 3 below, the methodology adopted to establish interim triggers for the Kaimaumau Wetland is based on the best practicable means of establishing compliance with the baseline management regime outlined in Section 2.1.2.1 of the GCMP. 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 to provide as the basis for 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 revised triggers levels, with the magnitude of water level recession amended to reflect data collected over the 2019-20 summer.

Table 5. *Interim 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

* 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 Kaimaimau Wetland – South monitoring site, data will be collected from the Kaimaumau Wetland – North site to confirm trigger exceedance.

It is also noted that practical implementation of the MWWUG trigger levels would be assisted by automated data collection (telemetry), particularly for the Kaimaumau Wetland monitoring sites. At the current time manual retrieval of data recorded at individual monitoring sites significantly reduces the ability of Council to assess compliance with GCMP trigger levels in a timely manner.

1. Trigger Levels

The Groundwater Monitoring and Contingency Plan (GCMP) for the Motutangi-Waiharara Water Users Group (MWWUG) specifies an adaptive management framework for the staged implementation of the cumulative groundwater abstraction authorised by these water permit. Section 1.1 of the GCMP establishes overall objectives against which the effects of abstraction are evaluated against to ensure:

The abstractions must, individually and cumulatively, avoid:

(a) saltwater intrusion into the Aupouri aquifer;

(b) adverse effects on the hydrological functioning of the Kaimaumau-Motutangi wetland;

(c) *adverse effects on the significant indigenous vegetation and significant habitats of indigenous fauna in terrestrial or freshwater environments of the Kaimaumau-Motutangi wetland;*

(d) *lowering of the groundwater levels of the Aupouri aquifer such that efficient bore takes cannot access groundwater from these sub-aquifers.*

The GCMP requires the consent holders to undertake a range of environmental monitoring to determine the quality and quantity of the groundwater resource at representative locations. Trigger levels are established for environmental monitoring to provide "….*an early warning system that provides a response mechanism when differences between predicted and actual water levels, and/or salinity concentrations occur*".

Following granting of the water permits, interim trigger levels were established for an initial 12-month baseline monitoring period during which the volume of abstraction was limited to less than 25% of the total cumulative allocation authorised by the MWWUG water permits. Subsequent to the baseline monitoring period, the GCMP requires interim trigger levels to be reviewed to ensure they are consistent with data collected during the baseline monitoring period.

This report provides a review of the interim trigger levels established in the MWWUG GCMP based on monitoring data collected over the 2019-20 year.

2. Groundwater Level Triggers

The following section outlines groundwater level triggers (TL1 and TL2) for individual Sentinel bores monitored for the MWWUG consents. It is noted that the trigger levels are specified in terms of mean daily values to account for tidal fluctuations.

For shellbed monitoring bores, TL2 is based on the groundwater level required to maintain the saline interface below the underlying basement rock contact, calculated using the Ghyben-Herzberg relation. TL1 is set at a level 0.2 m above TL2.

For the shallow sand aquifer, Section 3.2.1.1 of the GCMP requires Council to set trigger levels for the 'shallow sand' aquifer if:

"……*technical assessment of the potential impact of shallow groundwater decline on the Kaimaumau Wetland clearly indicates that the adverse effects on the wetland as a result of groundwater takes cannot be avoided without trigger level response measures"*.

As detailed in Section 4 below, current information does not indicate a direct linkage between groundwater levels in the shallow sand aquifer and standing water levels in the Kaimaumau Wetland. As a result, there is no clear indication that adverse effects on the wetland are likely to result from groundwater abstraction covered by the MWWUG GCMP. Consequently, groundwater level triggers in the shallow sand aquifer are not recommended as a means to mitigate potential effects on Kaimaumau Wetland, based on current information.

Groundwater level triggers are however proposed for 'shallow sand' monitoring bores to avoid potential effects of saline intrusion into the shallow sand aquifer. Given limited indications of changes in salinity in the shallow sand aquifer occurring during the baseline monitoring period, the recommended triggers

are established on the basis of the minimum groundwater level observed during the 21019-20 summer, with an allowance of between 0.2 and 0.3 metres for longer-term inter-annual variability. TL2 is set 0.1 m below TL1.

2.1 NRC Kaimaumau Road

Groundwater level data available from the NRC Kaimaumau Road Sentinel site is summarised in Table 6 below, with the corresponding hydrograph shown on Figure 1.

Table 6. *Summary of groundwater level data from the NRC Kaimaumau Road sentinel bore*

Interval	Monitoring Record	Diurnal Tidal Variation (m)	Median Level (m asl)	Minimum Level (m asl)	2017-20 Seasonal Variation (m)	Vertical Gradient (m)
Shallow (20 m)	12/10/2017 - 16/7/2020	<0.45	1.71	1.28 (28/4/20)	<0.45	+0.51 to +0.80
Deep (76 m)	7/9/2017 - 14/7/2020	<0.6	2.33	1.90 (13/4/20)	<0.50	

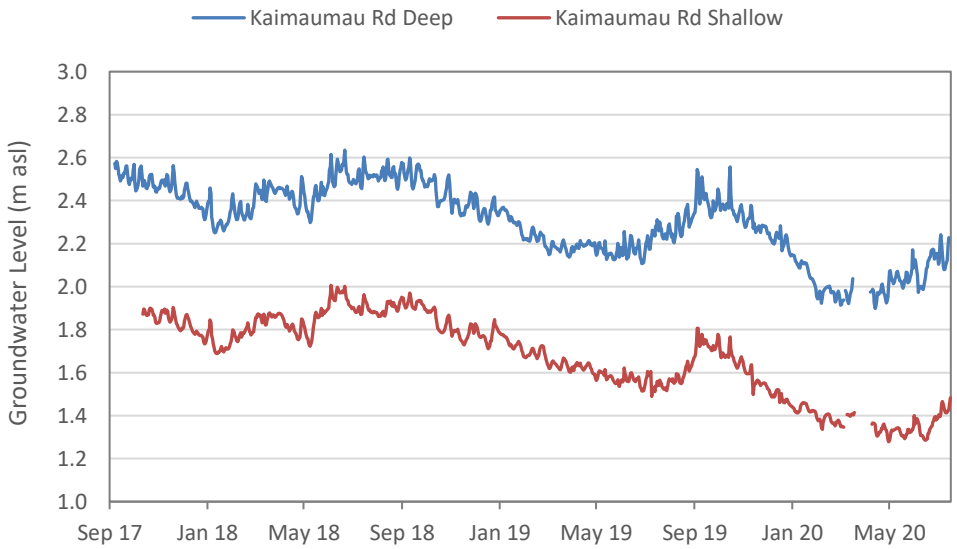


Figure 1. *NRC Kaimaumau Road Sentinel groundwater levels, 2017-20.*

Trigger Levels

Interim trigger levels for the NRC Kaimaumau Road Sentinel site were established from the mean daily groundwater level on 28 August 2019 minus the estimated seasonal variation, with an additional allowance for 50% of drawdown predicted to result from the proposed abstraction (0.1 m in the shellbed, 0 m in the shallow sand aquifer).

Minimum water levels during the 2019-20 summer were 1.28 m asl in the shallow aquifer (0.03 m above the interim TL1) and 1.90 m in the shellbed aquifer (0.2 m above the interim TL1).

Seasonal variation observed during the 2019-20 summer in the Kaimaumau Sentinel appears to largely reflect natural variation with no obvious effects of groundwater abstraction evident. To avoid trigger level exceedance as a result of natural seasonal variation during future 'dry' summers, it is proposed that trigger levels for the shallow piezometer are reduced by 0.15 m.

The screened interval in the Kaimaumau Deep piezometer is set between 66 and 72 m bgl. Based on the Ghyben-Herzberg relation, the interim TL2 (1.7 m asl) is adequate to maintain the top of the saline interface below the screened interval (i.e. at, or below the base of the shellbed aquifer). It is therefore proposed that the interim triggers for the deep piezometer are retained.

The interim and proposed Stage 1 groundwater level triggers for the Kaimaumau Rd Sentinel bore are listed in Table 7.

Table 7. *Interim and Proposed groundwater level triggers for the Kaimaumau Rd Sentinel bore.*

Piezometer	**Interim Triggers**		**Proposed Triggers**	
	TL1	**TL2**	**TL1**	**TL2**
Kaimaimau Rd Shallow	1.25	1.15	1.10	1.00
Kaimaumau Rd Deep	1.70	1.50	1.70	1.50

2.2 Motutangi Sentinel

Table 8 provides a summary of groundwater level monitoring data available from the Motutangi Sentinel site during the MWWUG GCMP baseline monitoring period.

Table 8. *Summary of groundwater level data available from the Motutangi sentinel bore*

Screened Interval	**Monitoring Record**	**Diurnal Tidal Variation (m)**	**Median Level (m asl)**	**Minimum Level (m asl)**	**2019-20 Seasonal Variation (m)**	**Vertical Gradient (m)**
Shallow (8 m)	5/7/2019 – 5/8/2020	<0.04	6.71	6.24 (23 May 2020)	0.6	+0.27 to -0.09
Deep (83 m)	5/7/2019 – 5/8/2020	<0.05	6.70	6.30 (5 March 2020)	0.5	

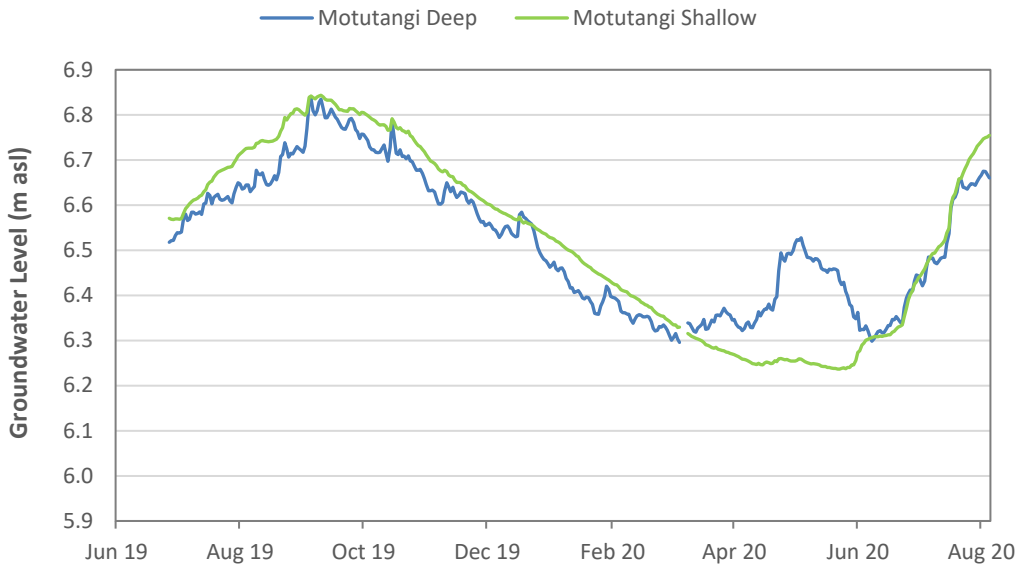


Figure 2. *Motutangi sentinel groundwater levels, 2018-2019*

Trigger Levels

Interim trigger levels for the Motutangi Sentinel piezometers were established on the basis of the mean daily groundwater level on 1 October 2019, minus the estimated seasonal variation and an allowance for 50% of predicted drawdown from proposed abstraction (0.2 m in the shellbed and 0 m in the shallow sand aquifer).

Minimum groundwater levels recorded at the Motutangi Sentinel site during the 2019-20 summer were 6.24 m asl in the shallow piezometer (0.11 m below the interim TL1 and 0.01 m below the interim TL2) and 6.30 m asl in the deep piezometer (0.2 m above the interim TL1).

Seasonal variation observed during the 2019-20 summer at the Motutangi Sentinel site appears to largely reflect natural variation with no obvious effects of groundwater abstraction evident. In order to avoid trigger level exceedance as a result of natural seasonal variation during future 'dry' summers, it is recommended that that trigger levels for the shallow piezometer are reduced by 0.4 m, with the interim triggers for the deep piezometer reduced by 0.2 metres.

The bore log from the Motutangi Deep piezometer records basement rock at a depth of 83 m bgl. Based on the Ghyben-Herzberg relation, the proposed TL2 of 5.90 m for the deep piezometer will maintain the surface of the saline interface well below (~240 m bgl) the basement contact at the sentinel site. The Motutangi Sentinel bore is located approximately 1.5 kilometres inland from the coastal margin. The 'naturalised' scenario (Scenario 1) calculated using the Aupouri Aquifer Groundwater Model (AAGM)[1] for the recent AAWUG consent application indicates a hydraulic gradient of approximately 0.0025 between the Motutangi Sentinel site and East Beach. Based on this gradient, a TL2 of 5.9 m asl at the Motutangi Sentinel site equates to a groundwater level of approximately 2.15 m in the shellbed aquifer at the East Beach coastline. While the exact geometry of the basement contact along East Beach is

unknown, the Ghyben-Herzberg relation indicates a head of 2.15 m will maintain the saline interface close to (if not below) the base of the Aupouri Aquifer (which is estimated to occur at around 85 m bgl[1]).

As further discussed in Section 4 below, monitoring of shallow groundwater levels at the Motutangi Sentinel and standing water levels in the Kaimaumau Wetland does not indicate any clear evidence of hydraulic connection between the wetland and underlying groundwater system. Consequently, there is limited justification for setting a trigger level in the shallow piezometer to manage effect of groundwater abstraction on wetland water levels.

Interim and proposed groundwater level triggers for the Motutangi Sentinel bore are listed in Table 9.

Table 9. *Interim and Proposed groundwater level triggers for the Motutangi Sentinel bore*

Piezometer	**Interim Triggers**		**Proposed Triggers**	
	TL1	**TL2**	**TL1**	**TL2**
Motutangi Shallow	6.35	6.25	5.95	5.85
Motutangi	6.10	5.90	5.70	5.50

2.3 Norton Road

Groundwater levels recorded at the Norton Road Sentinel site over the MWWUG baseline monitoring period are summarised in Table 10.

Table 10. *Summary of groundwater level data available from the Norton Road sentinel bore*

Interval	**Monitoring Record**	**Diurnal Tidal Variation (m)**	**Median Level (m asl)**	**Minimum Level (m asl)**	**2019-20 Seasonal Variation (m)**
Shellbed	29/8/2019 – 5/08/2020	<0.05	4.28	3.17 (29 Feb 2020)	1.8 m

[1] WWLA, 2020a; Aupouri Aquifer Groundwater Model. Factual Technical Report - Modelling. Williamson Water and Land Advisory Report WWLA0184 | 4, 28 February 2020.

Figure 3. *Norton Road Sentinel groundwater levels, 2019-20.*

Trigger Levels

Interim trigger levels were established for the Norton Road Sentinel based on the mean daily groundwater level on 1 October 2019 minus the estimated seasonal variation (0.5 m) including an allowance for 50% of predicted drawdown from proposed abstraction (0.15 m in the shellbed aquifer).

The minimum groundwater level recorded in the Norton Road Sentinel bore during the 2019-20 summer was 3.17 m asl recorded on the 29 February 2020 (1.08 m below TL1 and 0.88 m below TL2). The primary reason for the significant exceedance of the respective interim trigger levels at the Norton Road site was the much larger seasonal variation during the 2019-20 summer at this site (1.8 m) compared to other sentinel sites screened in the shellbed aquifer (0.5 m at the Motutangi and Kaimaumau Road Sentinel sites). The reasons for the larger seasonal variation at the Norton Road site are not entirely clear but may include:

- Localised drawdown associated with existing abstraction in the Norton Road area. The hydrograph shown in Figure 3 above appears to show cyclic, pumping induced drawdown of between 0.2 and 0.3 metres between early-January and mid-March 2020.
- Aquifer hydraulic properties, specifically lower storativity in the shellbed aquifer than at other Sentinel sites. This may reflect the greater thickness and more consolidated nature of the shellbed materials at the Norton Road site (described as ‘calcified shell’ or ‘shell rock’) compared to other sentinel locations (where shellbed sediments are generally described as ‘shelly sand’ or ‘sandy shell’).

The log from the Norton Road Sentinel bore indicates basement rock was encountered at a depth of 116 m bgl. Based on the Ghyben-Herzberg approximation, a groundwater level exceeding 2.9 m asl is required to maintain the saline interface below the base of the basement contact at this site. Based on

this estimate, and the observed seasonal groundwater level variation during the 2019-20 summer, it is proposed to reduce the interim trigger levels by 1.15 metres.

Interim and proposed Stage 1 groundwater level triggers for the Norton Road Sentinel bore are listed in Table 11.

Table 11. *Interim and Proposed groundwater level triggers for the Norton Road Sentinel bore*

Piezometer	**Interim Triggers**		**Proposed Triggers**	
	TL1	**TL2**	**TL1**	**TL2**
Norton Road	4.25	4.05	3.10	2.90

2.4 Waterfront

Groundwater level monitoring data available from the Waterfront Road Sentinel site is summarised in Table 12.

Table 12. *Summary of groundwater level data available from the Waterfront bore*

Interval	**Monitoring type**	**Monitoring Record***	**Diurnal Tidal Variation (m)**	**Median Level (m asl)**	**Minimum Level (m asl)***	**Vertical Gradient (m)**
Piezo 4 (shallow)	Manual	28/1/1987 - 2/6/2020	-	0.93	0.25 (2/9/1994)	+1.35 - 2.36 (manual)
	Automatic	19/9/2019 – 21/11/2019	<1.05	1.09	0.92 (14/6/2020)	
Piezo 1 (shellbed)	Manual	28/1/1987 - 2/6/2020	-	2.80	2.13 (6/12/93)	+1.54 - +1.96 (auto)
	Automatic	6/7/2019 – 21/11/2019	<0.9	2.93	2.66 (11/2/2020)	

*Note: Manual readings do not account for tidal variation whereas automatic data are reported as daily average values (i.e. effectively eliminating a significant proportion of tidal variation)

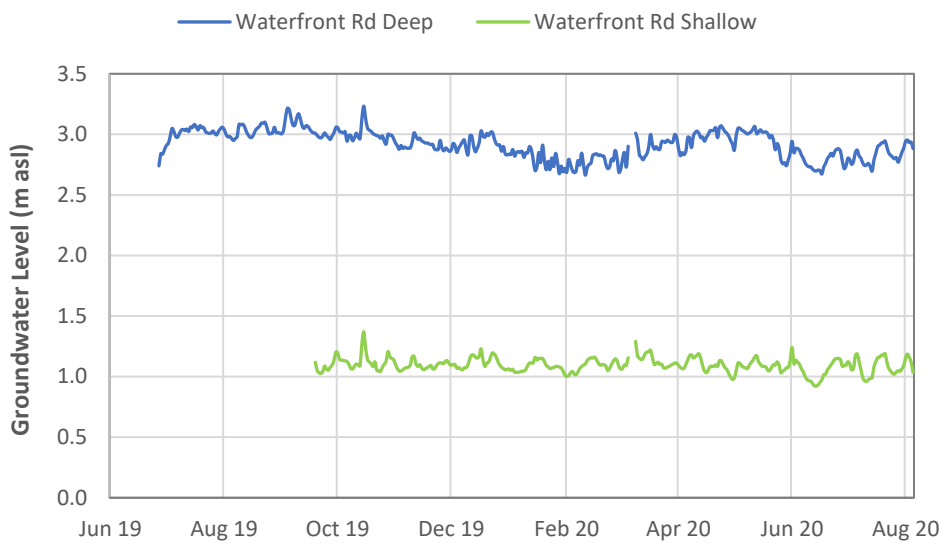


Figure 4. *Groundwater levels* ***at*** *the Waterfront Road Sentinel* ***site****, 2019-20.*

Trigger Levels

Interim trigger levels for the Waterfront Sentinel site were established as equal to the mean daily level on 1 October 2019, minus estimated seasonal groundwater level variation (0.45 m unconfined, 0.5 m shellbed).

Minimum groundwater levels recorded at the Waterfront Road Sentinel site during the 2019-20 summer were 0.92 m asl in the shallow piezometer (0.23 m above the interim TL1) and 2.66 m asl in the deep piezometer (0.11 m above the interim TL1).

It is noted that historical groundwater level measurements indicate that groundwater levels at the Waterfront Road site in recent years (2017-20) are appreciably higher than those recorded historically. As illustrated on Figure 5 below, even allowing for tidal variation, manual groundwater levels recorded in the shellbed aquifer at the Waterfront site during the mid-1990s were appreciably lower than recorded in recent years. As outlined in LWP (2020)[2] historical low groundwater levels are interpreted to reflect an extended period of below normal rainfall combined with a reduction in land surface recharge due to variation in landcover (specifically plantation forest) during the 1990s. It would therefore be reasonable to take into account observed long-term variations in aquifer storage (to the extent practical) when establishing trigger levels (i.e. to avoid trigger level exceedance associated with natural variation)[3].

[2] LWP, 2020. Water Permit Application - Aupouri Aquifer Water User Group. Letter to Northland Regional Council, 27 July 2020.

[3] This is not possible at other Sentinel monitoring sites where the period of record is considerably shorter.

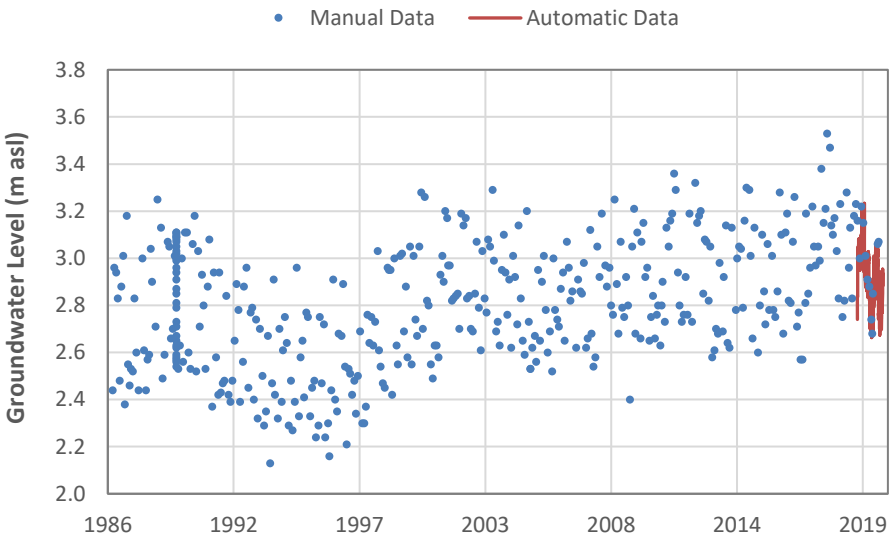


Figure 5. *Groundwater levels in the Waterfront Road Deep piezometer, 1986 to 2020.*

The bore log from the Waterfront site indicates that basement rock was intercepted at a depth of 79.6 m bgl. Based on the Ghyben-Herzberg relation, a groundwater level of approximately 2 m asl is required to maintain the top of the saline interface below the basement contact. Given this estimate, it is proposed that revised trigger levels in the deep piezometer are established based on the Ghyben-Herzberg approximation (i.e., allowing additional headroom for natural variations in excess of that provided for by the interim triggers).

Interim and proposed Stage 1 groundwater level triggers for the Waterfront Sentinel bore are listed in Table 13.

Table 12. *Interim and Proposed groundwater level triggers for the Waterfront Sentinel bore*

Piezometer	**Interim Triggers**		**Proposed Triggers**	
	TL1	**TL2**	**TL1**	**TL2**
Waterfront Shallow	0.75	0.65	0.75	0.65
Waterfront Deep	2.55	2.35	2.20	2.00

3. Electrical Conductivity

Electrical conductivity (EC) triggers for the Sentinel monitoring bores are based on median EC values from the baseline monitoring period, following Section 3.3.1 of the GCMP whereby:

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

3.1 Kaimaumau Road

3.1.1 Kaimaumau Road- Shallow

Monitoring Record: 19/9/2019 – 05/08/2020

Median EC: 231 µS/cm

Interim Triggers: TL1 = 286 µS/cm / TL2 = 345 µS/cm

Comments: As illustrated on Figure 6, EC values remained relatively stable through the monitoring period. An offset of approximately 10 µS/cm in March 2020 appears to be associated with replacement of the sensor.

Proposed Stage 1 Triggers: TL1 = 290 µS/cm / TL2 = 345 µS/cm

Figure 6. *Electrical conductivity (EC) in the Kaimaumau Road Sentinel shallow piezometer, 2019-20.*

3.1.2 Kaimaumau Road- Deep

Monitoring Record: 22/9/2019 – 03/08/2020

Median EC: 348 µS/cm

Interim Trigger Levels: TL1 = 435 µS/cm / TL2 = 520 µS/cm

Comment: EC remained stable, ranging between 344 and 349 µS/cm over the baseline monitoring period (Figure 7)

Proposed Stage 1 Triggers: TL1 = 435 µS/cm / TL2 = 520 µS/cm

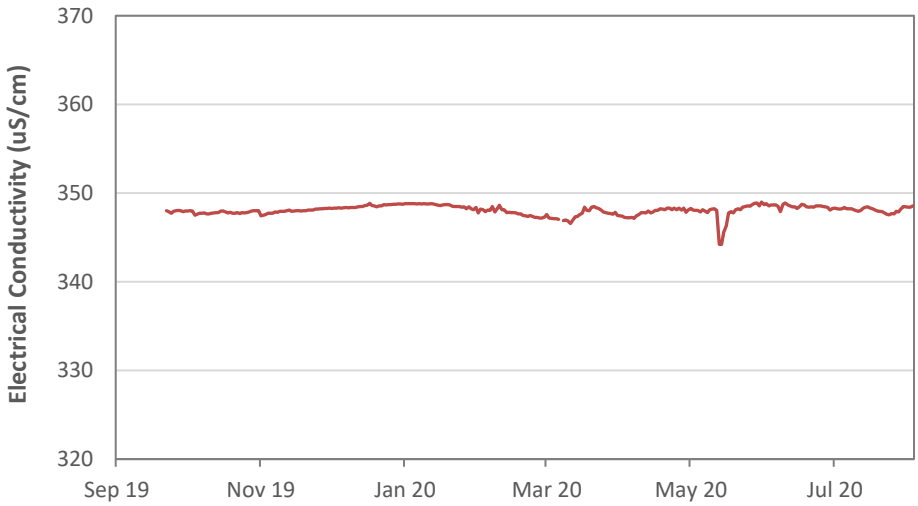


Figure 7. *Electrical conductivity (EC) in the Kaimaumau Road Sentinel deep piezometer, 2019-20.*

3.2 Motutangi Sentinel

3.2.1 Motutangi Sentinel - Shallow

Monitoring Record: 27/6/2019 – 05/08/2020

Median EC: 323 µS/cm

Interim Triggers: TL1 = 412 µS/cm / TL2 = 495 µS/cm

Comments: As shown on Figure 8, EC values were slightly elevated (345 µS/cm) during the initial monitoring period before declining sharply through to a minimum of 290 µS/cm in mid-September then recovering to around 330 µS/cm in early November 2019. EC values then stabilised between 320 and 330 µS/cm for the remainder of the monitoring period. The reason for the variation in EC during the initial monitoring period is uncertain but may (at least in part) be associated with adjustments to the EC sensor calibration.

Proposed Stage 1 Triggers: TL1 = 400 µS/cm / TL2 = 485 µS/cm

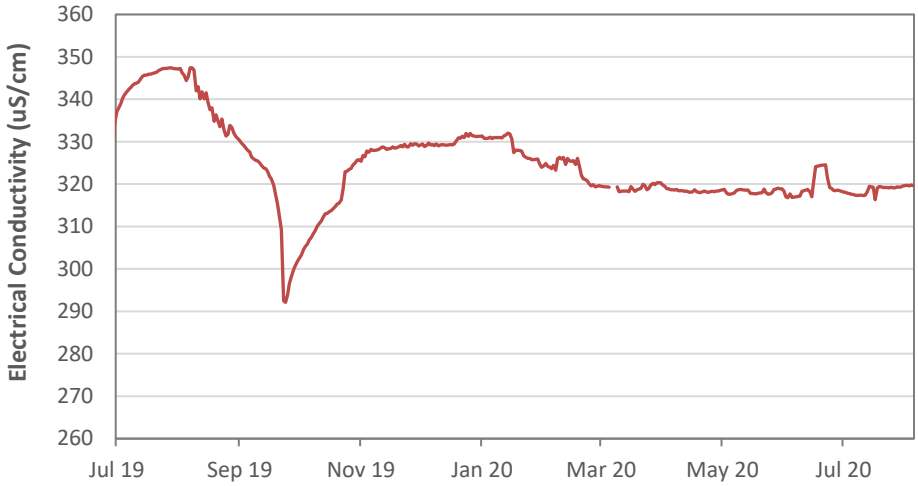


Figure 8. *Electrical conductivity (EC) in the Motutangi shallow piezometer, 2019-20.*

3.2.2 Motutangi Sentinel - Deep

Monitoring Record: 18/9/2019 – 05/08/2020

Median EC: 432 µS/cm

Interim Triggers: TL1 = 681 µS/cm / TL2 = 818 µS/cm

Comments: EC remained stable at approximately 510 µS/cm from mid-September 2019 until early-November 2019 (Figure 9). Over the subsequent months until August 2020, EC values exhibit a progressive decline to around 390 µS/cm (approximately 24% lower than initial values).

Proposed Stage 1 Triggers: TL1 = 540 µS/cm / TL2 = 650 µS/cm

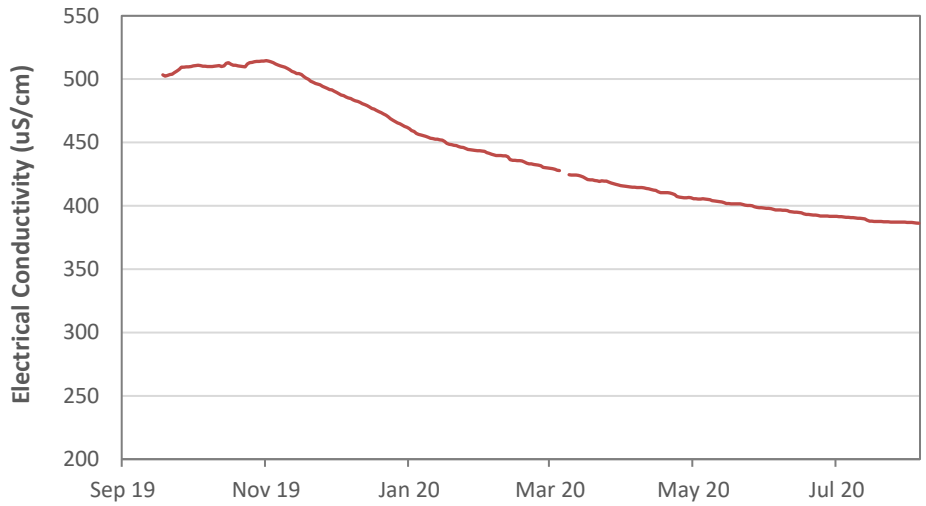


Figure 9. *Electrical conductivity (EC) in the Motutangi Sentinel deep piezometer, 2019-20.*

3.3 Norton Road

Monitoring Record: 1/08/2019 – 05/08/2020

Median EC: 472 µS/cm

Interim Trigger Levels: TL1 = 572 µS/cm / TL2 = 687 µS/cm

Comments: EC exhibits a gradual increase from 450 to 470 µS/cm (~4%) from September 2019 to ~March 2020 before levelling off for the remainder of the monitoring period (Figure 10).

Proposed Stage 1 Triggers: TL1 = 590 µS/cm / TL2 = 710 µS/cm

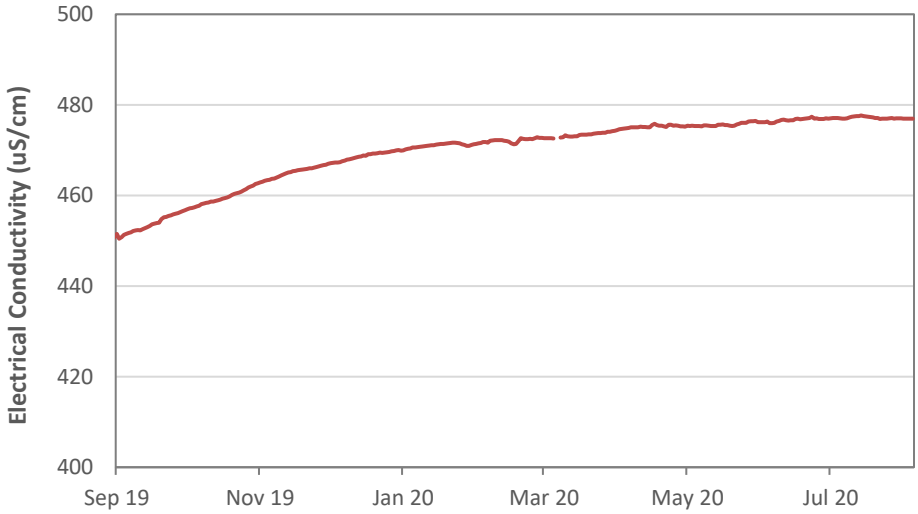


Figure 10. *Electrical Conductivity in the Norton Road Sentinel piezometer, 2019-20.*

3.4 Waterfront

3.4.1 Waterfront Rd Shallow

Monitoring Record: 19/09/2019 – 05/08/2020

Median EC: 592 µS/cm

Interim Trigger Levels: TL1 = 740 µS/cm / TL1 = 892 µS/cm

Comment: EC values exhibit a steady decline from mid-Sept 2019 until mid-April 2020 when values increased by approximately 25 uS/cm (~5%) over a period of 3 weeks (Figure 11). The observed increase in EC in late April 2020 (575 to 600 µS/cm) is unexplained as it does not appear to correspond with any noticeable change in groundwater level (or significant recharge event) and no recalibration/adjustment of the sensor is noted over this period.

Proposed Stage 1 Triggers: TL1 = 740 µS/cm / TL2 = 890 µS/cm

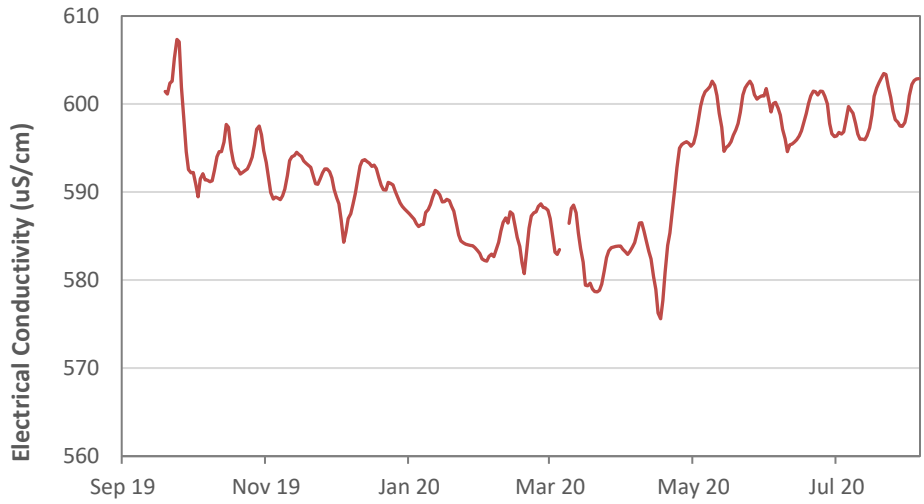


Figure 11. *Electrical Conductivity in the Waterfront Road Sentinel shallow piezometer, 2019-20.*

3.4.2 Waterfront Rd Deep

Monitoring Record: 27/06/2019 – 05/08/20

Median EC: 445 µS/cm

Interim Trigger Levels: TL1 = 555 µS/cm / TL2 = 666 µS/cm

Comment: EC values were relatively stable from late July 2019 to mid-January 2020 then steadily increased from 445 to 460 µS/cm (3%) through to mid-July 2020 (Figure 12).

Proposed Stage 1 Triggers: TL1 = 560 µS/cm / TL2 = 670 µS/cm

Figure 12. *Electrical Conductivity in the Kaimaumau Road Sentinel deep piezometer, 2019-20.*

3.5 Saline Intrusion Monitoring

The MWWUG GCMP specifies that monitoring of salinity indicators is undertaken at six sites distributed across the Houhora and Waiparera sub-areas. Parameters included in the sampling program include electrical conductivity (EC), Chloride, Sodium and total dissolved solids (TDS). Sampling of salinity indicators commenced at five of the six monitoring sites on 23 October 2019, with eight sample rounds completed by July 2020[4]. Section 3.4 of the MWWUG GCMP specifies that trigger levels will be established for saline intrusion monitoring sites as follows:

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

Baseline saline intrusion monitoring results and associated trigger levels are outlined in Table 14 below.

It is noted that while trigger levels for saline intrusion indicators have been proposed for four monitoring sites (Fishing Club, Kaimaumau Rd Sentinel shallow/deep and Kaimaumau Settlement shallow) no trigger levels are proposed for the Kaimaumau Settlement deep monitoring site. This reflects existing groundwater quality at this site which is almost identical to sea water. While reasons for the presence of groundwater with significantly elevated salinity at depth below Kaimaumau Settlement are (at

[4] The production bore at the remaining site (AUT.038454.01.01 - Elbury Holdings) is yet to be drilled.

present) uncertain, observed concentrations of indicator parameters at this site are unlikely to change as a result of seawater ingress, given current water quality.

Table 13. *Stage 1 triggers for MWWUG saline intrusion monitoring sites*[5]

Site	Bore No	Screened Interval	Parameter	Units	No of samples	Baseline Median	Trigger Levels	
							TL1	TL2
Fishing Club	324261	Shellbed	EC	µS/m	8	44.5	56	67
			Chloride	mg/L	8	64.2	78	94
			Sodium	mg/L	8	50	63	75
			TDS	mg/L	8	275	344	413
NRC Kaimaumau Rd	316222	Shallow sand	EC	µS/m	8	28.9	36	43
			Chloride	mg/L	8	55.8	70	84
			Sodium	mg/L	8	35.5	44	53
			TDS	mg/L	8	180	225	270
NRC Kaimaumau Rd	315766	Shellbed	EC	µS/m	8	39.3	50	60
			Chloride	mg/L	8	51.8	65	78
			Sodium	mg/L	8	56.5	71	85
			TDS	mg/L	8	235	294	353
Kaimaumau Settlement	317504	Shallow sand	EC	µS/m	8	47.1	59	71
			Chloride	mg/L	8	66.5	83	100
			Sodium	mg/L	8	45	56	68
			TDS	mg/L	8	305	381	458
Kaimaumau Settlement*	324250	Shellbed	EC	µS/m	8	4,744	*	*
			Chloride	mg/L	8	18,450	*	*
			Sodium	mg/L	8	9,250	*	*
			TDS	mg/L	8	37,000	*	*

* Median parameter concentrations in the Kaimaumau Settlement Deep monitoring bore are close to those of seawater (i.e., EC = 4,800 mS/m, Chloride = 19,000 mg/L, Sodium = 10,500 mg/L and TDS = 35,900 mg/L)

[5] No trigger levels are proposed for the Elbury Holdings production bore which is yet to be drilled. No trigger levels are proposed for the Kaimaumau Settlement deep (shellbed) monitoring bore given existing indicator parameter concentrations are similar to seawater.

3.6 Production Bore Monitoring

Groundwater levels and electrical conductivity (EC) values have been measured in all MWWUG production bores which have been drilled to date on a ~monthly basis since December 2019. As outlined in Section 3.5.1 of the MWWUG GCMP, proposed trigger levels for EC in these bores has been established in a manner consistent with the interim triggers whereby:

- TL1 - Median EC from the baseline monitoring period +25%
- TL2 - Median EC from the baseline monitoring period +50%

Proposed Stage 1 EC triggers for MWWUG production bores are outlined in Table 15 below.

Table 14. *Electrical Conductivity (EC) trigger levels for MWWUG production bores*

Compliance Site No.	Bore ID	Consent Holder	Interim EC Triggers		Proposed EC Triggers			
			TL1 (µS/cm)	TL2 (µS/cm)	No. samples	Median EC (µS/cm)	TL1 (µS/cm)	TL2 (µS/cm)
AUT.038610.01.01	LOC.315389	Mapua Avocados Ltd #1	430	510	9	334	420	500
AUT.038610.01.01	LOC.323163	Mapua Avocados Ltd #2	360	430	9	290	360	430
AUT.038610.01.01	LOC.323164	Mapua Avocados Ltd #3	430	510	9	285	360	430
AUT.038420.01.01	LOC.315384	Largus Orchard Ltd#1	630	750	9	491	610	740
AUT.039244.01.01	LOC.315061	Thomas & O'Connor	-	-	8	482	600	720
AUT.039381.01.01	LOC.316126	Thomas	600	720	9	477	600	720
AUT.038471.01.01	LOC.312333	Honeytree Farms Ltd#1	580	700	9	444	560	670
AUT.038589.01.01	LOC.209280	Watson	480	580	9	390	490	590
AUT.027391.01.01	LOC.310308	Stanisich	620	740	9	486	610	730
AUT.038591.01.01	LOC.313248	Cypress Hills Ltd	490	590	9	390	490	590
AUT.083880.01.01	LOC.312696	Hanui	620	740	9	485	610	730
AUT.038650.01.01	LOC.201366	Hewitt	500	600	9	385	480	580

4. Kaimaumau Wetland

4.1 Baseline Monitoring

Standing water levels were recorded at two sites in Kaimaumau Wetland during the MWWUG baseline monitoring period. The monitoring sites are located in two separate areas of open water across the northern section of the wetland. As shown on Figure 13, the wetland water level monitoring sites are located approximately 1,850 metres apart, and 1,350 metres north-east (Wetland North) and 1,930 meters east-south-east (Wetland South) of the MWWUG Motutangi Sentinel monitoring site respectively.

***Figure 13**. MWWUG Kaimaumau Wetland monitoring sites*

Baseline monitoring of Kaimaumau Wetland water levels was undertaken between 8 July 2019 and 5 August 2020, including an extended period of low rainfall experienced between late-December 2019 and late-May 2020. Figure 14 shows hydrographs from the two wetland monitoring sites over this period. The figure indicates:

- Standing water levels at the northern monitoring site remained consistently around 2.8 metres lower than those recorded at the southern monitoring site.
- Both monitoring sites exhibit a similar temporal response indicating that, although the sites do not appear to be in direct hydraulic connection (i.e., exhibit different relative water levels), they respond in an almost identical manner to temporal variations in the localised water balance.

- Of note is an almost identical, linear recession in water levels at both monitoring sites from late-December to the loss of standing water at the respective sites. Over this period the rate of water level recession at both sites was between 5.5 and 7.0 mm/day.
- Both monitoring sites experienced a loss of standing water (the 'flat line' section of the respective hydrographs) during the latter part of the 2019-20 summer (Mid-March to mid-May at the northern monitoring site and early-February to late-May at the higher elevation southern monitoring site).

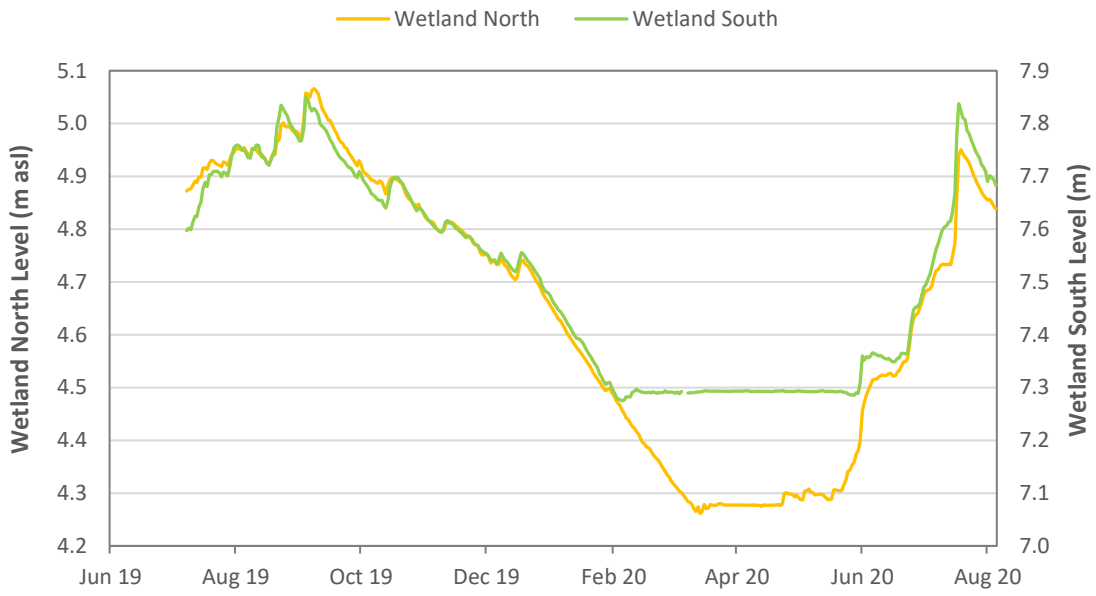
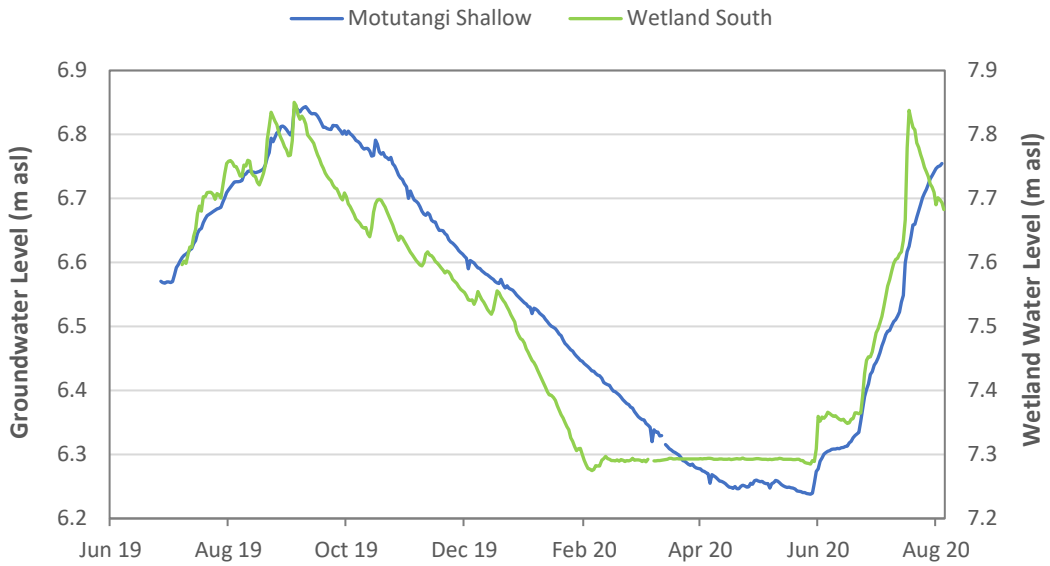


Figure 14. Standing water levels (msl) at the MWWUG Kaimaumau Wetland North and Kaimaumau Wetland South monitoring sites, 2019-20.

Figure 15 shows groundwater levels in the Motutangi shallow piezometer were between 0.8 and 1.0 metres lower than water levels at the southern wetland site indicating the southern wetland site is perched above the underlying aquifer system (given the virtually equivalent groundwater levels measured in the shallow and deep piezometers shown on Figure 2 above). The figure also shows that, while the rate of groundwater level recession in the shallow sand aquifer remained relatively constant across the 2019-20 summer, the rate of wetland water level recession was variable, with wetland water levels declining at an appreciably higher rate than groundwater levels during the period of low rainfall from late-December 2019 until the southern wetland monitoring site lost standing water in early February 2020.

***Figure 15**. Standing water level at the MWWUG Kaimaumau Wetland South monitoring site and*



groundwater level in the Motutangi Sentinel shallow piezometer, June 2019 to August 2020.

Figure 16 shows a plot of groundwater levels in the Motutangi Sentinel deep piezometer and water levels at the northern wetland monitoring site. In this case groundwater levels remained around 1.8 m higher than those in the wetland, indicating an upward hydraulic gradient. While the rate of groundwater and wetland water level recession was similar from September to late-December 2019, the rate of water level decline in the wetland accelerated through to loss of standing water at the northern site in mid-March 2020, while the rate of groundwater level recession slowed over the corresponding period.

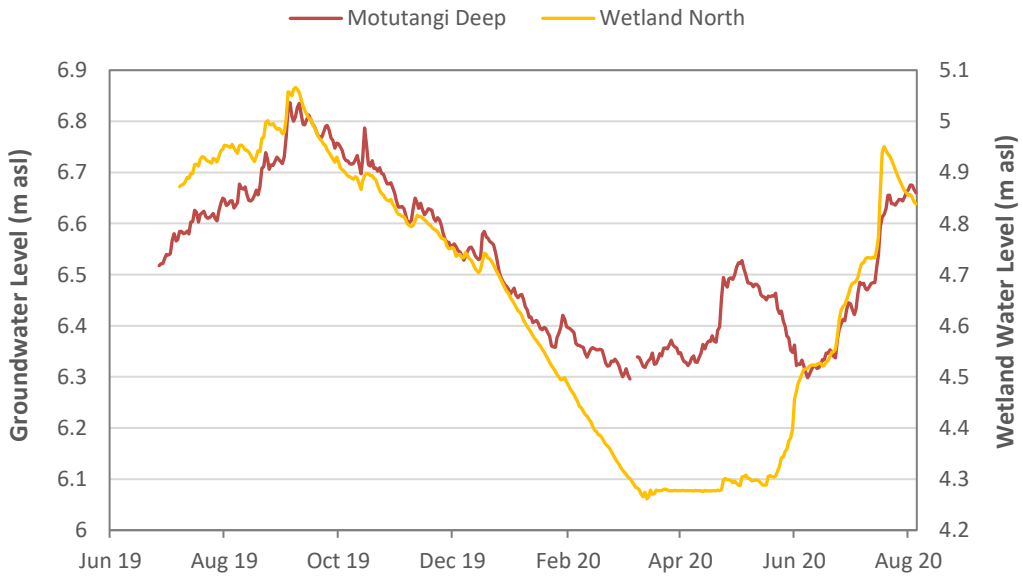


***Figure 16.** Standing water level at the MWWUG Kaimaumau Wetland North monitoring site and groundwater level in the Motutangi Sentinel deep piezometer, June 2019 to August 2020*

Overall, monitoring of groundwater levels in the shellbed and unconfined aquifer at the Motutangi Sentinel site and water levels in two areas of standing water across the northern portion of the Kaimaumau Wetland over the baseline monitoring period indicates that:

- Groundwater levels (both shallow and deep) along the western margin of the wetland are approximately 1.8 m higher than those recorded at the northern MWWUG wetland monitoring site, and approximately 1 metre lower than those observed at the southern monitoring site. These observations indicate a positive hydraulic gradient between the aquifer system and the Kaimaumau Wetland at the northern monitoring site, while water levels at the southern wetland monitoring site are perched above the underlying aquifer.
- The timing of the seasonal peak in shallow groundwater and wetland water levels coincides.
- Wetland water levels respond to larger rainfall events while shallow groundwater levels exhibit little, if any, immediate response to rainfall.
- The relative elevation of standing water levels in the Kaimaumau Wetland varies spatially. This suggests relatively poor hydraulic continuity across the wider wetland area.
- Despite differing relative water levels, both wetland monitoring sites exhibit a very similar temporal water level response characterised by an almost linear recession between individual rainfall events. During a period of low rainfall during the 2019/20 summer, the rate of water level recession at both wetland sites averaged between 5.5 to 7.0 mm/day.
- Temporal response of standing water levels in the wetland differs from that observed in the aquifer system. While similar prior to late-December 2019, water level recession in the wetland occurred at an appreciably faster rate during the subsequent period of low rainfall (until the point at which standing water was lost at the respective wetland monitoring sites).
- The overall magnitude of water level variation in the wetland over the 2019-20 summer exceeds that observed in the underlying aquifer (by >0.2 metres at the time standing water was lost at the northern wetland site).

Overall, although the monitoring period is short, based on available data there are no clear indications of any significant hydraulic connection between the Kaimaumau Wetland and the underlying Aupouri Aquifer. Wetland water levels appear to function as a (relatively) linear storage that responds to rainfall events independently of the underlying groundwater system (which is also influenced by the same rainfall events), with the rate of recession significantly influenced by the rate of open water evaporation and evapotranspiration from the wetland.

4.2 Wetland Trigger Levels

Available data do not appear to indicate any significant hydraulic connection between the Kaimaumau Wetland and surrounding shallow sand aquifer. Standing water levels in the wetland appear to increase in response to significant rainfall events then recede at a relatively consistent rate that is influenced by the rate of open water evaporation / evapotranspiration.

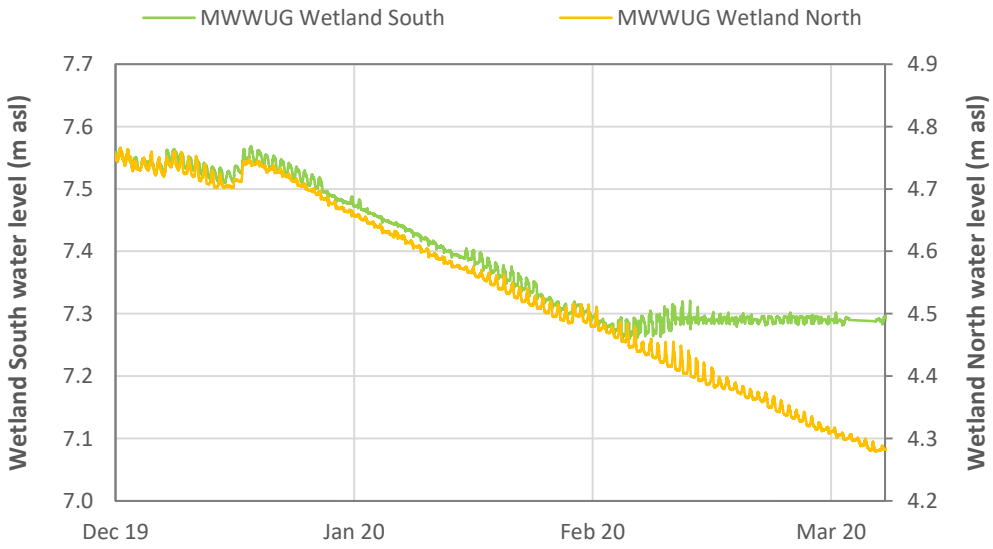
Shallow groundwater levels exhibit limited response to rainfall but follow a broadly similar seasonal variation to wetland levels. The lack of response to rainfall in the shallow sand aquifer may reflect the presence of a laterally continuous peat layer (recorded to a depth of 4.5 m bgl on the Motutangi shallow piezometer bore log) overlying the water-bearing sand. The low permeability of the peat materials is likely to significantly attenuate infiltration of local rainfall into the shallow aquifer.

Temporal variations in groundwater levels and standing water levels in the wetland appear to be relatively poorly correlated across the 2019-20 summer. Although the timing of the seasonal peak was similar, the timing, rate and magnitude of water level recession were appreciably different. This indicates groundwater levels recorded in the shallow sand and shellbed aquifers at the Motutangi Sentinel are a relatively poor proxy for standing water level in the wetland and therefore there is limited justification for establishing a shallow groundwater trigger level for the Kaimaumau Wetland, as per section 3.2.1.1 of the GCMP.

Similarly, given spatial variations in water levels across the Kaimaumau Wetland and the loss of standing water at both wetland monitoring sites, there is limited value in establishing fixed water level triggers for water levels in the wetland itself. In addition, fixed wetland water levels would not achieve the objective for wetland water level triggers to identify departure "*…from the relative water level*" (as outlined in Section 2.1.2.1 of the MWWUG GCMP). Such an effect could theoretically occur when wetland water levels were above any given level based on the historical range.

While wetland water levels vary spatially and temporally, both wetland monitoring sites exhibit an almost identical rate of water level recession (particularly during periods of low rainfall such as the 2019-20 summer) when potential effects on the wetland water levels may have greatest ecological significance. It is there recommended that a trigger level for wetland water levels is established based on observed water level recession, following the methodology used to establish interim wetland triggers.

Figure 17 shows a plot of 5-minute water level data from both wetland monitoring sites over the 2019-20 summer from 1 December 2019 until 10 March 2020 (when the northern monitoring site lost standing



water). The plot shows a virtually linear water level decline over this period at both sites punctuated by small diurnal variations (possibly reflecting variations in evaporation rate, wind etc).

Figure 17. *Kaimaumau Wetland water levels (5-minute data), 1 Dec 2019 to 10 March 2020*

Figure 18 shows a plot of 7-day average water level decline calculated over the same period illustrated on Figure 17. The figure shows water level recession at both monitoring sites ranged between 5 to 7 mm/day over this period from 20 December 2019 onward (the last >30 mm rainfall event until mid-April), until standing water was lost at the respective sites.

Given the limited rainfall and high evapotranspiration from late-December 2019 on, it is reasonable to assume that the calculated rate of water level recession over this period is close to the maximum likely to occur under natural conditions (allowing for day-to-day variations due to wind etc). Recession of wetland water levels at a 7-day average rate exceeding 7 mm/day is likely to be at the upper-end of recession occurring under natural conditions, and rates in excess of this figure may potentially reflect the influence of factors other than evaporation/evapotranspiration (i.e. pumping-induced groundwater level decline in the shallow sand aquifer) on the wetland water balance.

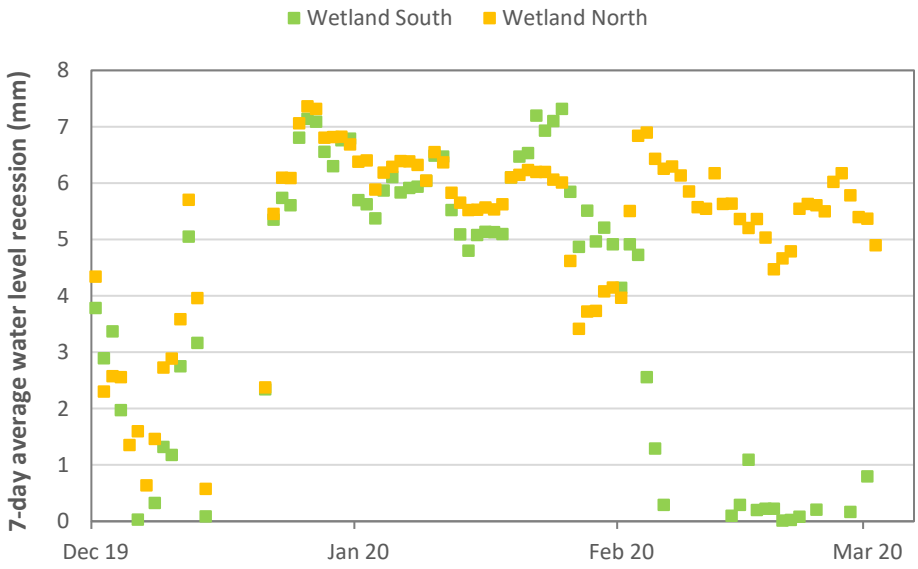


Figure 18*. 7-day average Kaimaumau Wetland water levels, 1 December 2019 to 10 March 2020*

It is therefore recommended that the first wetland water level trigger (TL1) is amended to a 7-day average water level recession exceeding 7 mm/day, with the second trigger level (TL2) set at 8 mm/day. The proposed TL1 threshold is within the range of values measured during the 2019-20 which appear to reflect an entirely natural water level response in wetland water levels during summer conditions. While this may result in occasional TL1 exceedance during natural conditions (extended periods of hot, dry and/or windy conditions), it would serve as an indicator that the rate of decline in wetland water levels is approaching the maximum expected under natural conditions, with exceedance of TL2 for any extended period likely to indicate effects on wetland water balance due to external factors (such as groundwater abstraction). It is considered there is limited value in setting the wetland trigger level values

at a threshold that is likely to be exceeded on a regular basis (i.e. <7mm/day) during normal mid-summer periods of low rainfall and high evapotranspiration.

As with the interim wetland water level triggers, given access constraints to the northern wetland monitoring site (helicopter access only), it is recommended that the revised trigger level only apply to the southern monitoring site until such time as an alternative method for data retrieval (e.g., telemetry) is available.

Yours Sincerely

Brydon Hughes
Hydrogeologist