NORTHLAND REGIONAL COUNCIL STAFF REPORT

APPLICATION NO.:	**REQ-581172**	
REPORT BY:	Brydon Hughes – Consultant Hydrogeologist Catherine Reaburn – Consultant Planner	
SUB APPLICATION NOS.:	**APP.038328.01.01**	Bernard Kim & Sheryl Dianne Shine
	APP.039332.01.01	Candy Corn Limited, C/- Bryan Candy
	APP.038471.01.01	Honeytree Farms Limited, C/- Tony Hayward
	APP.038589.01.01	Neil & Alma Violet Thompson and Steven & Josephine Suzanne Thompson
	APP.039345.01.01	Ongare Trust, C/- Ian McLarnon & Jason McLarnon
	APP.038610.01.01	Mapua Avocados Limited, C/- Murray Forlong
	APP.038591.01.01	Cypress Hills Limited, C/- Alan Anderson & Carolyn Dawn Smith
	APP.038650.01.01	Tony & Diane Hewitt
	APP.027391.01.02	Ivan Anthony Stanisich
	APP.038454.01.01	Elbury Holdings Limited, C/- Kevin & Fiona King
	APP.038380.01.01	Daimen & Katherine Holloway
	APP.039381.01.01	Johno & Carol Brien (Lamb Road)
	APP.039244.01.01	Kevin & Dani Thomas
	APP.038420.01.01	Largus Orchard Limited Partnership, C/- Murray Forlong (changed from Matijevich)
	APP.038513.01.01	Te Rūnanga o Ngai Takoto, C/- Rangitane Marsden
	APP.038410.01.01	Georgina Tui & Mate Nickolas Covich
	APP.38732.01.01	Kathy Valadares
NATURE OF ACTIVITY:	Groundwater abstraction.	
LOCATION OF TAKES:	Refer Table 2 of “Groundwater Take Consent Application – Motutangai Waiharara Water User Group” dated 30 August 2017.	

LOCALITY:

DURATION OF CONSENT SOUGHT:	Not Stated.
RELEVANT STATUTORY PLANNING INSTRUMENTS:	§ National Policy Statement for Freshwater Management (NPSFM). § New Zealand Coastal Policy Statement (NZCPS). § Regional Policy Statement for Northland (RPS). § Proposed Northland Regional Plan (PNRP). § Operative Regional Water and Soil Plan for Northland (RWSP). § Resource Management Act 1991 (RMA).
ACTIVITY CLASSIFICATION:	Discretionary activity for groundwater take and use (Rule 23.3 of the RWSP).
ATTACHMENTS:	Attachment 1 – List of Submissions. Attachment 2 – Water Use Assessment Report.

1. ACTIVITY DESCRIPTION

1.1 Overview

1. During 2016 the Northland Regional Council (NRC) received multiple applications to abstract groundwater for irrigation of avocado orchards on the Aupōuri Peninsula. After reviewing information provided to support the individual applications, the NRC requested further information from each applicant under section 92(1) of the Resource Management Act 1991 in order to adequately assess the effects of the proposed abstraction.

2. In response to the request for further information, a total of 17 parties formed the Motutangi-Waiharara Water User Group (MWWUG) to collectively advance the applications, and engaged Williamson Water Advisory (WWA) to undertake appropriate analysis to respond to the initial NRC further information request.

3. In June 2017, WWA lodged two documents with the NRC on behalf of the MWWUG, comprising an assessment of environmental effects (AEE) and supporting technical assessment comprising analysis of pumping scenarios undertaken using a numerical groundwater model developed for the portion of the Aupōuri Peninsula subject to the applications.

1.2 Water Volumes Sought

4. The water volumes sought in the applications for avocado farm irrigation are as set out in Table 1 below.

5. All applications are for new groundwater takes, except for Mr IA Stanisich who has an existing consent APP.027391.01.01 for 720 m^3/day and 120,000 m^3/year. Mr Stanisich's application (APP.027391.01.02) is to increase the existing authorised daily volume by 430 cubic metres (m^3), which would give a new daily volume of 1150 m^3 if granted, but does include any increase to the current authorised annual total volume of water. Therefore, the volumes expressed in the application documents and in this report for Stanisich are only related to the requested 430 cubic metres per day (m^3/d) increase. However, for the purpose of the model used for the combined effects assessment for all the MWWUG applications, an estimated annual equivalent that reflects the implied annual change associated with this daily increase has also been included.

6. On Thursday 22 February 2018, NRC received an email from the applicants' planner advising of the following requested changes to the irrigation areas and volumes sought:

Honeytree (APP.038471.01.01)

- 70 ha irrigation area
- 200,000 m³/year

Valadares (APP.038732.01.01)

- 12 ha irrigation area
- 300 m³/day

§ 44,700 m³/year

7. In response to the Honeytree application, the revised irrigation area and volume sought is less than the original application. As the request is for less volume than assessed in the groundwater model, the revised figures have been accepted and form the basis of assessment throughout this report, including as set out in Table 1 below.

8. The Valadares request is for approximately 50% for irrigation area and 100% greater volume of water than sought in the original application, and as assumed under the groundwater model. As no assessment of effects has been provided for the revised figures, and the scope of the requested volume is greater than provided for in the notification summary and accompanying technical documents, the reporting officers have not accepted this request. The original irrigation area and volumes sought provide the basis for the assessment in this report, including as set out in Table 1 below.

TABLE 1: Groundwater Extraction Volumes Sought

Application	Name	Zone	Canopy Area (ha)	Daily Volume (m^3)	Annual Volume (m^3)	Seasonal Application Depth (mm)
APP.39244.01.01	Kevin & Dani Thomas	Houhora	16	400	59,600	373
APP.039381.01.01	Johno & Carol Brien (Lamb Road)	Houhora	4	100	14,900	373
APP.039345.01.01	Ian McLarnon & Jason McLarnon	Houhora	6	200	29,800	497
APP.38732.01.01	Kathy Valadares	Houhora	8	150	22,350	279
APP.038610.01.01	Mapua Avocados Limited, C/- Murray Forlong	Houhora/ Motutangi	53	1,667	248,333	469
Houhora	*Total*			*2,517*	*374,983*	*87*
APP.038610.01.01	Mapua Avocados Limited, C/- Murray Forlong	Motutangi/ Houhora	107	3,333	496,667	464
APP.039332.01.01	Candy Corn Limited, C/- Bryan Candy	Motutangi	20	540	80,000	400
APP.038589.01.01	Neil & Alma Violet Thompson and Steven & Josephine Suzanne Thompson	Motutangi	9	320	47,680	530
APP.038591.01.01	Cypress Hills Limited, C/- Alan Anderson & Carolyn Dawn Smith	Motutangi	9	280	41,720	464
Motutangi	*Total*			*4,473*	*666,067*	
APP.038410.01.01	Georgina Tui & Mate Nickolas Covich	Waiparera	70	1,500	223,500	319
APP.038471.01.01	Honeytree Farms Limited, C/- Tony Hayward	Waiparera	70	3,500	200,000	286
APP.038513.01.01	Te Rūnanga o Ngai Takoto, C/- Rangitane Marsden	Waiparera	60	1,300	193,700	323
APP.038380.01.01	Daimen & Katherine Holloway	Motutangi	4	100	14,900	373
APP.038328.01.01	Bernard Kim & Sheryl Dianne Shine	Motutangi	10	268	40,000	400
APP.038454.01.01	Elbury Holdings Limited, C/- Kevin and Fiona King	Motutangi	30	763	113,700	379
APP.038650.01.01	Tony & Diane Hewitt	Waiparera	10	270	40,230	402
APP.038420.01.01	Largus Orchard Limited Partnership	Waiparera	60	1,300	193,700	323
APP.027391.01.02	Ivan Anthony Stanisich	Motutangi	17	430	64,070	377
Waiparera	*Total*			*9,431*	*1,083,800*	

2. SITE DESCRIPTION

2.1 Geology

9. The landform of the Aupōuri Peninsula comprises a relatively thick sequence of sedimentary deposits largely comprising sand, silt and organic materials which have formed as a tombolo (essentially a sand bar accumulated due to wave and current action) connecting outcrops of basement rocks at either end of Ninety Mile Beach.

10. The subsurface geology of the area consists of Pleistocene and Holocene unconsolidated sedimentary materials deposited in beach and dune environments (abandoned shorelines and marine terraces) and associated alluvial, intertidal estuarine, shallow marine, lakebed and wetland environments. These deposits overlie Cretaceous basement rocks of the Mount Camel Terrain, which typically comprises hard grey to dark green/black igneous rocks described in Isaac (1996)[1] as intercalated basalt and basaltic andesite lava, pillow lava, rhyolitic tuff, tuff-breccia, conglomerate, sandstone and mudstone.

2.2 Climate

11. The Northland Region experiences a mild, humid and relatively windy climate. Summers are warm and tend to be humid, while winters are mild with many parts of the Region experiencing few, if any frosts. Mean annual temperatures on the Aupōuri Peninsula range between 15.5 to 16.5^{o}C, with most areas receiving around 2,000 hours of bright sunshine each year.

12. Mean annual rainfall on the Aupōuri Peninsula generally increases to the south, ranging from around 1,000 mm/year at Cape Reinga to 1,370 mm/year at Kaitāia. Monthly rainfall totals exhibit a strong seasonal pattern with summer (December to March) totals around 50 percent of those recorded during the winter months (June to August). Potential evapotranspiration (PET) values calculated for Kaitāia also exhibit a significant seasonality ranging from a maximum of 174 mm in January to a minimum of 38 mm in June (NIWA, 2013[2]).

13. While Northland experiences a relatively wet climate, extended periods of low rainfall and high evapotranspiration are frequently experienced during the summer and autumn. Such 'dry spells' have an average duration of around 20 days, but may extend much longer in dry years. Figures from Kaitāia Airport indicate, on average, soil moisture deficit occurs on 62 days/year, with a cumulative seasonal deficit of 254 mm occurring between November and April (NIWA, 2013).

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1 Isaac, M J (compiler), 1996: *Geology of the Kaitāia area*. Institute of Geological and Nuclear Sciences 1:250 000 geological map 1. 1 sheet + 43 p. Lower Hutt, New Zealand. GNS Science.

2 NIWA, 2013; The Climate and Weather of Northland. NIWA Science and Technology Series Number 59, 2013.

2.3 Hydrogeology

14. The Aupōuri Aquifer covers an area of approximately 75,000 hectares extending along the whole length of Ninety Mile Beach on the west coast, and from Kokota (The Sandspit) to Waimanoni on the east coast. It also includes the low-lying land between Waimanoni and Ahipara.

15. The unconsolidated sedimentary deposits of the Aupōuri Peninsula host a spatially extensive unconfined aquifer system. The sedimentary deposits can be broadly classified into two hydrostratigraphic units:

- The upper part comprises fine-grained sands, interspersed with sporadic iron pan, peat, lignite, silt, gravel and shellbeds. With distance inland from the coast, the sand deposits become progressively older and exhibit a higher degree of compaction and weathering compared to younger foredune sands at the coast. These shallower fine-sand dominated deposits host a low yielding unconfined aquifer.
- In many areas, the lower part of the sedimentary sequence (overlying the basement rocks) contains a high percentage of relatively coarse shell fragments. These deposits are commonly referred to as 'shellbeds' and exhibit significantly higher permeability than the overlying sands so are typically the target for larger scale groundwater development.

16. In most areas there is no clear hydraulic boundary between the shellbeds and overlying sand deposits. In many cases this is due to the discontinuous nature of lower permeability layers (iron pans, peat and lignite layers) within the sand deposits. As a result, the shellbeds are best characterised as forming a semi-confined water-bearing layer which exhibits varying degrees of hydraulic connection to the overlying sand deposits depending on the local geological setting (e.g. depth and lateral continuity of low permeability layers within the sand deposits). Vertical leakage from the overlying fine sand deposits provides a significant storage buffer which increases the effective yield available from the shellbeds.

17. Aquifer test data typically show aquifer transmissivity values of less than 100 m²/day in the sand deposits, increasing up to 500 m²/day in the shellbeds. Aquifer storage values vary according to bore depth (and presumably localised geology) with calculated values ranging between 0.06 and 0.0002 (typically <0.001 in bores recorded as being screened in the shellbeds).

18. Groundwater flow within the unconfined aquifer is interpreted to occur predominantly in the horizontal direction due to anisotropy of the sand deposits. As a result, groundwater flow is interpreted to occur from an approximate alignment along the axis of the Aupōuri Peninsula, approximately perpendicular to the coastline. The overall hydraulic gradient is determined by the elevation difference between the water table along the axis of the peninsula and sea level along the coastal margin. As a result, low-lying areas such as Kaumaumau which extend laterally some distance from the central axis exhibit a low hydraulic gradient toward the eastern coastline.

19. Although there is no laterally continuous confining layer within the sedimentary sequence of the Aupōuri Peninsula, the occurrence of numerous, low-permeability layers (e.g. iron pan, brown (organic) sand, silt, peat) that vary in depth and thickness, appear to collectively provide a degree of confinement to deeper water-bearing layers hosted in shellbed sediments. However, the degree of confinement of deeper water-bearing units varies spatially reflecting the geological heterogeneity of the aquifer materials. Localised perched water tables also occur in areas where infiltration is impeded by the accumulation of fine-grained sediments (typically silt or organic-rick sediments deposited in interdune areas) and iron pans within the sand deposits.

2.4 Recharge and Discharge

20. Groundwater underlying the Aupōuri aquifer is primarily recharged by infiltration of rainfall through the surficial sand deposits. This recharge varies temporally reflecting seasonal variations in rainfall and evapotranspiration with a majority of recharge occurring during the winter months.

21. Rainfall recharge model estimates indicate that average groundwater recharge across the Aupōuri Aquifer is likely to range between 10 and 43 percent of annual rainfall, depending on topography and soil hydraulic properties. Estimated recharge is highest in recent, unconsolidated sand deposits and lower in low-lying areas where peat soils overlie iron pans. Total annual average recharge to the Aupōuri Aquifer was estimated by Lincoln Environmental (2015) to be approximately 374 million m^3/year (equivalent to a spatial average of 4,968 m^3/ha/year). The rate of recharge may also be significantly influenced by overlying landcover, particular plantation forestry which reduces recharge due to canopy interception.

22. Groundwater flow through deeper sections of the aquifer system is driven by the pressure of the overlying water column, including the unconfined aquifer. However, groundwater in the semi-confined shellbed layers has a reduced ability to discharge upwards because of structural confinement by overlying low permeability silt, clay and peat horizons. As a result, the shellbed aquifer can be considered to be a discharge-driven system rather than a recharge driven system as groundwater recharge can only enter the deeper water-bearing layers if there is discharge to accommodate it. The rate of groundwater flow in its natural state is likely to be small because the low vertical permeability of overlying sediments limits the rate of aquifer discharge to the sea. The rate of groundwater flow into the confined-leaky system can be increased by groundwater abstraction, which induces groundwater downwards via leakage from the overlying sand deposits.

3. SUBMISSIONS

3.1 Introduction

23. The application was notified on a limited basis to potentially affected bore owners; other potentially affected parties (e.g. surface water takes, communal water supplies, privately owned wetlands); mandated mana whenua representatives; within the area of influence and the Department of Conservation. It is noted that it is outside the scope of this report to re-visit the section 95 notification determination.

24. A list of submissions received is provided as **Attachment 1** to this report.

3.1.1 Potentially Affected Parties

25. Submissions were received from 58 potentially affected parties, comprising mainly surface and groundwater users from properties within the area between Houhora in the north, through to Waipapakauri in the south. For those submitters who were groundwater users that provided bore log information, depths of bores, where known, range between 6 metres and 95 metres. Submitter's water use activities included household/domestic use, stock drinking water, domestic and commercial orchard irrigation, shops and motel, council toilets and wharf, and as a water source for firefighting.

26. Of the 58 submissions received, 39 are in opposition, seven neutral, and twelve in support.

27. Submissions are addressed by theme below.

3.1.2 Department of Conservation

28. Department of Conservation ("DOC") were determined by the Northland Regional Council to be a potentially affected party as it administers land within the Kaimaumau area that has significant indigenous wetland on it.

29. DOC submitted in opposition to the proposed groundwater takes (submission 57 in Attachment 1). The submission states that this relief would be reviewed in the event that the applicant conclusively demonstrates that the actual and potential adverse effects on the Kaimaumau wetland from the proposed water abstractions will be avoided or are no more than minor.

30. On 11 January 2018, the NRC received additional information from DOC in support of its submission, on a "without prejudice" basis. This included a high level report prepared by Jacobs (dated 7 December 2017). The report concludes that additional assessment is required of the potential effects on the Kaimaumau wetland, and that if consents are granted, additional monitoring conditions are required to ensure that effects will be no greater than anticipated by the application.

31. Effects relating to the wetland, including consideration of the submission by DOC, are addressed at Section 4.11 of this report.

3.1.3 Mana Whenua

32. The notification determination stated that:

"The council has determined that there may potentially be adverse cultural effects from these applications on Maori relationship, culture and traditions with the area, including on sites, wāhi tapu, and other taonga. Therefore the 5 Iwi Authorities within Aupōuri and 4 Marae have been deemed affected persons."

33. The iwi and marae who were given affected persons status and directly notified of the applications are:

- Te Aupōuri
- Ngai Takoto
- Ngāti Kuri
- Te Rarawa
- Ngāti Kahu
- Te Potahi Marae
- Kaimaumau Marae
- Paparore Marae
- Waiora marae

34. The only submission received from the above listed parties was from Te Rūnanga Nui o Te Aupōuri Trust (C/- Mike Stevens) (Submission 58 in Attachment 1). Key concerns raised relate to:

- Reliability of the modelling and assessment provided with the application.
- Potential effects on all other users of the aquifer.
- Opposition to the "first come first served" approach to water management.
- Consider that NRC should manage the water more strategically.
- Availability of water for other uses.

35. Matters relating to legal process and the strategic approach to management of water resources in the Northland region are outside the scope of this report. As further addressed in Section 4 of this report, the applications for groundwater extraction are required to be considered and determined under section 104 of the Resource Management Act 1991. Section 3.2.7 addresses concerns raised in relation to the process and extent of consultation.

36. Matters relating to environmental and cultural effects are addressed by theme throughout Section 4 of this report, as further discussed below.

37. For clarity, it is further noted that:

- Ngai Takoto is also one of the applicants (refer APP.038513.01.01);
- Waiora marae provided some preliminary comments to NRC on earlier applications[3], with no significant issues raised subject to appropriate environmental assessment and conditions imposed, however, no submission from Waiora marae was received in response to the formal notification;
- NRC has received a submission from Mr Burgoyne, who purports to act on behalf of Ngāti Kuri. The Ngāti Kuri Trust Board, who are the mandated authority, has advised NRC that Mr Burgoyne does not represent them. However, Mr Burgoyne has a bore within the potentially affected area and therefore his submission has been accepted due to affected persons status being conferred on the basis of his bore (Submitter 56 in Attachment 1). It

[3] The reporting officers have been advised by NRC that the first 12 of the applications, received in 2016, were circulated to potentially affected iwi and marae. With the exception of Waiora marae, no comments were received.

is further noted that the potential effects of the groundwater abstraction are largely outside the rohe of Ngāti Kuri.

§ NRC has also received a submission from Mr Awarau. However, according to the Crowns database Te Rūnanga o Ngai Takoto is the iwi authority (on behalf of Ngai Takoto) for the purposes of the Resource Management Act. NRC has been advised by Te Rūnanga o Ngai Takoto that Mr Awarau is not a mandated representative authorised to speak on behalf of the iwi. As Mr Awarau is not a mandated representative of iwi with affected persons status, and does not own a bore within the potentially affected area, the submission has not been accepted by NRC. However, it is noted that matters raised in the submission have been addressed throughout this report.

3.2 Summary of Key Issues

3.3 Volume of Water Take

38. ***Submissions:*** *1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 14, 17, 19, 20, 23, 24, 25, 32, 33, 34, 35, 36, 37, 39, 40, 42, 43, 44, 45, 46, 48, 53, 54, 56 in Attachment 1.*

§ *Water volume sought by some applicants is greater than 25 m³/day/ha which is the industry standard.*

§ *Some applicants are seeking water based on site area rather than actual irrigated/canopy area.*

§ *Volumes calculated based on 162 irrigation days per year which is unlikely to be necessary.*

§ *Concern regarding water banking, rates sought being for 1 in 20 year drought rather than usual use which does not allow other water users access.*

§ *Allocation in the Motutangi subzone exceeds the proposed regional plan limit.*

§ *Will prevent future uses of the aquifer water resource.*

§ *No allowance provided for a reticulated water system as set out in the Pukenui/Houhora Community Development Plan.*

Comments

39. Following close of submission, NRC has undertaken additional analysis of water use for existing avocado orchards in the area to determine appropriate rates for economic and efficient use of water (refer **Attachment 2**). An analysis of the appropriateness of the volume of water takes being sought, and the justification provided by applicants of their water needs, is provided in Section 4.2. The appropriate proportion of aquifer recharge to be allocated, and the applicability of the proposed regional plan subzone limits, is discussed in Section 4.4. In summary, reduced volumes for some applications is recommended by the reporting officers' in response to submissions and the policy framework, to ensure water is efficiently utilised for avocado farm irrigation. Should consents be granted, recommended conditions address irrigation management and water efficiency, with the potential for volumes to be revised by NRC if required.

40. With regard to future users, and alternative demands for groundwater from the aquifer, it is necessary to examine the case law to inform the extent to which these concerns can be addressed. The case law on competing resource consents for water resources is complex. The following comments outline the approach that has been established by case law, but do not constitute a legal opinion.

41. Case law under the Resource Management Act has established that competing resource consent applications for the same resource are to be dealt with in order, on a "first come, first served" basis (commonly referred to as the "*Fleetwing Farms*" criteria). As the Resource Management Act 1991 ("RMA") sets specific timeframes to process a resource consent application, the statute "requires each applicant's application or applications to be determined on their own merits"[4]. The decision states there is no provision which allows for a comparative assessment of competing claims to the same resource. This approach to water allocation priority was also confirmed by the Court of Appeal in the *Synlait* decision.[5] This decision confirmed that the first application to be accepted by the consent authority under section 88 would have priority over applications lodged at a later date. The applicant who first lodged a complete application was entitled to the first hearing on its own merits.

42. In addition, other case law has established that consent authorities do not have responsibility for determining the relative efficiency of the use of resources proposed, compared with other possible uses of those resources (refer Swindley v Waipa[6]). Similarly, when assessing the effect of the water take on the environment, the environment does not include potential future resource consent applications[7]. Further, the objectives and policies of both the operative and proposed regional plans do not set out specific priority order for allocation of groundwater resources in the Aupōuri aquifer. There is therefore no scope under the RMA or current statutory planning framework to assess whether other uses of the water, such as for a reticulated water supply that is currently not included in the Long Term Plan (budget) by the Far North District Council (FNDC) or other uses not currently subject to an application, would be a more efficient use, and to subsequently refuse consent on that basis.

43. Consideration is, however, required of the importance of water allocation to natural, ecological, cultural and recreational values and domestic and stock drinking water prior to allocation for other uses.

3.3.1 Effect on Existing Bores

44. ***Submissions:*** *1, 2, 4, 15, 35, 47, 50, 53 in Attachment 1 (and generally in submission received from potentially affected bore owners).*

- *Concern regarding impacts on the reliability of existing groundwater supplies.*
- *Potential for drawdown to require deeper bores.*

4 Fleetwing Farms Ltd v Marlborough District Council [1997] 3 NZLR 257(CA).
5 Central Plains Water Trust v Synlait Ltd [2010] NZRMA 237 (CA).
6 Swindley v Waipa District Council (A075/94).
7 Queenstown Lakes DC v Hawthorn Estate Ltd (2006) 12 ELRNZ 299; [2006] NZRMA 424.

- *Concern about water quality in bores as a result of avocado farm irrigation and pesticides.*
- *Applicants should pay for redrilling of bore if necessary.*

45. The RMA provides for persons to take fresh water without consent for an individual's reasonable domestic needs, or the reasonable needs of an individual's animals for drinking water, provided that the take does not have adverse effects on the environment (section 14(3)(b)). Existing resource consent holders' privilege to take the water allocated to them is also protected[8]. However, case law has established that the RMA grants rights to take up to a given amount of water from a given resource, but does not specify the means by which that right is exercised. There is no requirement to ensure that existing water users can access the water from their existing bores; only that existing water users can continue to access the water, which may involve deepening a bore or installing a pump in a bore which formerly provided artesian flows[9]. This is also set out in Policy 10.5 of the Northland Regional Water and Soil Plan, which states in its explanation:

"This policy also promotes "efficient bore takes". An example of an efficient bore take is when a bore fully penetrates the water bearing layer and takes water from the base of the aquifer. The water level in a bore, which is only partially penetrating an aquifer or is drawing water from the top of the aquifer, may be drawn below the bottom of that bore as a result of water being taken (at a sustainable rate) from another deeper bore. The user of the shallow bore has not lost his or her use of the groundwater resource. Rather, the method of extraction is no longer effective. It would be wasteful management of the groundwater resource, should shallow water supply bores restrict the use of an available resource."

46. Potential adverse effects on existing water users should therefore be balanced against other section 104 of the RMA considerations, provided that their right to take water continues to be protected. Potential adverse effects on existing water users in the area are addressed in Section 4.5 of this report.

3.3.2 Water Quality

47. ***Submissions:*** *1, 5, 6, 7, 8, 20, 25, 36, 45, 49, 54 in Attachment 1.*

- *Effects of the use of water for avocado farm irrigation, including pesticides, on the aquifer resource.*

Comments

48. Effects on water quality in the aquifer from the proposed water takes and use for irrigation of avocado farms are assessed in Section 4.7 of this report.

3.3.3 Ecological

49. ***Submissions:*** *5, 47, 49, 57 in Attachment 1.*

- *Linked to reduction in water quality (above).*

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8 Aoraki Water Trust v Meridian Energy Ltd [2005] 2 NZLR 268; (2005) 11 ELRNZ 207; [2005] NZRMA 251 (HC).

9 Opiki Water Action Group Inc v Manawatu Wanganui Regional Council (W64/2004).

§ *Effects on water take on wetlands, including Kaimaumau wetland and wetlands on privately owned land.*

Comments

50. Effects on flora, fauna and biodiversity, including on the Kaimaumau and private wetlands, from the proposed water take are assessed at Section 4.11.

3.3.4 Salt Water Intrusion

51. ***Submissions:*** *22, 23, 25, 44, 48, 49, 54 in Attachment 1.*

§ *Insufficient certainty about potential for salt water intrusion*

Comments

52. Salt water intrusion is a key consideration for assessment of the applications, and is addressed in Section 4.6 of this report.

3.3.5 Lack of Consultation

53. ***Submissions:*** *3, 6, 7, 8, 22, 36, 48, 58, 59 in Attachment 1.*

§ *Lack of consultation by applicants with neighbouring land owners, downstream water users, mana whenua, and the wider community*

§ *Should have been publicly notified*

Comments

54. Lack of consultation by an applicant, in itself, is not a relevant consideration when assessing the effects of a proposal under section 104 of the RMA, which is the scope of this report. There is no duty for an applicant to consult any person about the application as stated in section 36A(1)(a) of the RMA. The limited notification process allows for potentially affected parties to provide information to the Hearings Committee to allow a fully informed assessment of the proposal. Affected parties were determined to be all bore owners within a zone of influence of the cumulative effects from all applications (based on the most conservative modelled scenarios for each of the deep and shallow aquifers); mandated iwi and marae representatives with mana whenua within the zone of influence; and the Department of Conservation due to potential effects on the Kaimaumau wetland.

55. The reasons for limited, rather than public notification, were addressed in the section 95 report. In summary, the potential adverse effects were assessed as being likely to be no more than minor. In addition, as groundwater takes for horticulture uses is envisaged in the RWSP, there were no special circumstances that warranted public notification. Public notification was not considered necessary to understand the adverse effects on the environment.

56. As noted above, it is outside the scope of this report to assess the appropriateness of the notification decision. The reporting officers wish to clarify that this report provides an assessment of the applications under section 104 of the RMA only.

3.3.6 Inadequacy of Assessment and Monitoring

57. ***Submissions:*** *16, 17, 19, 23, 25, 32, 33, 34, 41, 44, 48, 50 in Attachment 1.*

- § *Scale of potential adverse effects requires more certainty in assessment.*
- § *Need to more clearly assure other water users they will not be affected.*
- § *Insufficient monitoring proposed.*

Comments

58. The Hearings Committee has the ability to decline the application if it considers there is insufficient information to allow an informed decision (section 106(6) of the Resource Management Act) or alternatively the committee may request further information from an applicant under section 41(4) of the Resource Management Act.

59. The reporting officers, however, consider that there is sufficient information to assess the effects of this application on other users of the resource, as detailed in Section 4 of this report. The applicants provided an outline of the proposed groundwater monitoring and contingency plan ("GMCP") and this has been further developed and refined by the reporting officers. Accordingly, the reporting officers have set out a proposed monitoring schedule in the recommendation.

60. It is noted that there is always inherent uncertainty in groundwater models, and particularly in the case of cumulative effects from a number of proposed takes over a wide area with diverse geology. Although sufficient information is available to be able to make a determination, residual risk of effects above what has been assessed remains. This is appropriately addressed through ongoing monitoring and review of the water takes, should they be approved. Further discussion is provided in Section 6 of this report.

3.3.7 Cultural

61. ***Submissions:*** *45, 48, 56, 58, 59 in Attachment 1.*

- § *Te mana o te wai has not been considered*
- § *Treaty principles have not been applied to the decision-making process*

Comments

62. Cultural matters relating to the involvement of mana whenua and the community in decision making were raised by a number of submitters. This is addressed in Sections 4.10 and 7.4 of this report.

4. ASSESSMENT AND ANALYSIS

63. This section adopts an integrated approach to assessing the effects of the applications and the consistency with the relevant planning framework. This is as the objectives, policies and assessment criteria of the relevant planning documents provide guidance as to the appropriateness of effects and the matters to be considered. The assessment is undertaken by topic, with the relevant provisions first being identified, then an analysis provided.

64. The relevant planning documents are as set out below (note a Part 2 assessment is undertaken in Section 7 of this report):

Planning Document	Description
National Policy Statement for Freshwater Management 2014 (updated August 2017)	In a nutshell, the Freshwater NPS directs regional councils, in consultation with their communities, to set objectives for the state of fresh water bodies in their regions and to set limits on resource use to meet these objectives. Some of the key requirements of the Freshwater NPS are to: § consider and recognise Te Mana o te Wai in freshwater management § safeguard fresh water's life-supporting capacity, ecosystem processes, and indigenous species § safeguard the health of people who come into contact with the water § maintain or improve the overall quality of fresh water within a freshwater management unit § improve water quality so that it is suitable for primary contact more often § protect the significant values of wetlands and outstanding freshwater bodies § follow a specific process (the national objectives framework) for identifying the values that tāngata whenua and communities have for water, and using a specified set of water quality measures (called attributes) to set objectives § set limits on resource use (e.g. how much water can be taken or how much of a contaminant can be discharged) to meet limits over time and ensure they continue to be met § determine the appropriate set of methods to meet the objectives and limits § take an integrated approach to managing land use, fresh water and coastal water § involve iwi and hapū in decision-making and management of fresh water. The Freshwater NPS is generally focussed on the development of policy and provisions for the management of freshwater through regional plans, however, some interim policy direction is given for the assessment of resource consents prior to new management frameworks being developed.
New Zealand Coastal Policy Statement (NZCPS)	The New Zealand Coastal Policy Statement (NZCPS) guides local authorities in their day to day management of the coastal environment. Potential effects of groundwater abstraction on the ecological and natural character values of the coastal environment require assessment under the NZCPS. The coastal environment. Policy 1(2) of the NZCPS clarifies that the coastal environment includes coastal wetlands, and inter-related coastal marine and terrestrial systems, including the intertidal zone
Northland Regional Policy Statement (RPS)	The Regional Policy Statement (RPS) was made operative on 9 May 2016, except for the provisions that relate to the use of genetic engineering and the release of genetically modified organisms to the environment, as they are still subject to legal challenge. The NPS sets out policies and methods to achieve integrated management of Northland's natural and physical resources.
Proposed Northland Regional Plan	The proposed Northland Regional Plan seeks to manage the use, development, and protection of Northland's natural and physical

Planning Document	Description
	resources. The plan was notified in September 2017, after the lodgement of the applications. Pursuant to section 88A of the RMA, the activity status of the applications is not altered by the notification of the proposed plan. However, the objectives, policies and rules are relevant matters for consideration under section 104 when determining the resource consents. Water allocation limits are proposed for each of the three water management sub-zones within the Aupōuri aquifer affected by the proposed groundwater takes (i.e. Houhora, Motutangi and Waiparer) based on a report prepared by Lincoln Agritech (2015).
Northland Regional Water and Soil Plan	The operative Northland Regional Water and Soil Plan sets out objectives, policies and rules for the management of groundwater. All applications subject to this report are a discretionary activity subject to Rule 25.3 as the relevant permitted activity thresholds of Rule 2.51 are exceeded, and Rule 25.2 for control activities does not apply.
Proposed National Environmental Standard on Ecological Flows and Water Levels (2008)	The proposed NES on Ecological Flows and Water levels (2008) seeks to set interim limits on the alteration to flows and/or water levels where limits have not been imposed through regional plans or water conservation orders providing a process for selecting the appropriate technical methods for evaluating the ecological component of environmental flows and water levels. The NPS in Freshwater Management became operative after the proposed NES and provides for a more holistic approach to managing freshwater. However, the proposed NES provides some guidance when considering the interrelationships between freshwater levels and ecological values. The NES only has a "proposed" status (and is nearly 10 years old), it is addressed as a relevant matter for consideration under section 104(1)(c) only.
Pukenui/Houhora Community Development Plan	The local community, in collaboration with the Far North District Council (FNDC), developed a Community Development Plan for the Pukenui/Houhora area in 2007. The plan sets out community values and aspirations, including in relation to groundwater management and economic development. As a non-statutory document, it is a relevant matter for consideration under section 104(1)(c).

65. In addition to the above, the Resource Management (Measurement and Reporting of Water Takes) Regulations 2010 also apply. The regulations require a permit holder to keep records that provide a continuous measurement of the water taken under a water permit, including water taken in excess of what the permit allows. These records are to comprise measurements (in cubic metres) of the volume of water taken each day, and must be in a format the NRC considers suitable for auditing. The regulations also specify the required accuracy of any metering device (to within ±5% of the actual volume taken), and that the permit holder must provide records and evidence to the NRC of meter verification. Should the consents be approved, conditions in accordance with these regulations have been recommended.

4.1 Adequacy of Assessment

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Northland Regional Water and Soil Plan	Assessment criteria 36.2.1: *The adequacy of the Assessment of Environmental Effects, in terms of the Fourth Schedule of the Act*

Analysis

66. The applicants have provided an assessment of individual and cumulative effects of the groundwater takes. The estimates of potential cumulative drawdown effects are based on predictive simulations made using a numerical groundwater flow model which consider a range of abstraction rates and geological scenarios.

67. The WWA model report documents the conceptualisation and development of a sub-regional scale numerical groundwater model to enable assessment of potential cumulative effects of existing and proposed abstraction. The conceptual model utilised as the basis for development of the numerical model is broadly similar to that developed by previous investigations of the groundwater resources of the Aupōuri Aquifer (e.g. Hydrogeo Solutions, 2001; Lincoln Agritech, 2015). At a generalised level this model assumes the aquifer water balance is dominated by rainfall infiltration, with groundwater water moving laterally from a flow divide along the axis of the peninsula through a stratified aquifer system toward the coast.

68. The model domain extends over an area of approximately 203 km² from Pukenui in the north to Waiharara in the south (including all proposed groundwater takes). The model is constructed using an unstructured grid to enable refinement of mesh size in the vicinity of proposed abstraction points and other points of interest. Four hydrostratigraphic units are utilised to represent the aquifer system:

- **Unit 1:** An upper layer of unconsolidated fine sand with spatially varying hydraulic properties 40 to 70 metres thick;
- **Unit 2:** An upper shellbed layer representing the primary water-bearing interval targeted by deeper bores;
- **Unit 3:** a sand layer of variable thickness separating two shellbed layers;
- **Unit 4:** a lower shellbed exhibiting a coarser texture than the upper shellbed overlying basement rocks (assumed to form a no-flow boundary).

69. The discontinuous and irregular nature of iron pans and other low permeability layers within the sedimentary sequence were represented by varying the vertical anisotropy assumed for the varying model layers. This approach enabled simulation of vertical pressure gradients similar to those observed across the Aupōuri Aquifer system. It is noted that this model approach differs from that adopted previous earlier modelling exercises (e.g. Lincoln Agritech 2015) which utilised a specific layer in the model to represent a single laterally continuous leaky confining layer between the shellbed and overlying sand aquifers.

70. Model inputs representing land surface recharge, and abstraction were derived from a soil moisture water balance model used to simulate recharge and abstraction for irrigation over a 60 year climate record. Other model parameters such as boundary conditions and aquifer hydraulic properties are largely consistent with those utilised for previous modelling exercises.

71. Transient calibration of the model utilised a synthetic time series of recharge and water use data to represent a 70 year period (1956 to 2016). Calibration targets were established for the entire water level record from 17 piezometers. It is noted that the spatial distribution of bores with water level data suitable for model calibration was relatively limited, particularly in the Motutangi area. For individual monitoring locations, the model calibration data indicate a range of model errors. Some sites show a good fit to the available groundwater level records while others exhibit appreciable differences between modelled and actual temporal groundwater level variations or in terms of relative levels. No consistent difference in model accuracy (in terms of absolute or temporal variation) is observed between shallow and deep piezometers.

72. In response to initial technical comments, further verification of modelled water levels was undertaken by comparing modelled levels against relative groundwater levels measured in test pumping bores and comparing extrapolated water levels with those recorded in NRC monitoring bores located a relatively short distance south of the model domain. Results of this comparison again indicate that modelled groundwater levels generally match the overall magnitude of observed groundwater levels.

73. It is noted that the modelling report also identifies that some of the offset in measured and modelled groundwater levels in the test pumping bores may be associated with localised inaccuracies in the digital elevation model (DEM) used to reference groundwater levels to a common datum.

74. The model was used to simulate a range of predictive scenarios ranging from pumping at the existing consented volume to pumping at rates and volumes significantly higher than that proposed in the current application. Results of these scenarios are presented in terms modelled drawdown in shallow and deep water-bearing layers (both spatially and at specific existing bores), as well as in terms of changes to the aquifer water budget (including drain flows).

75. In response to review comments, potential uncertainties associated with the simplified conceptualisation of a complex geological environment (particularly with regard to vertical leakage) were addressed by re-running the pumping scenarios with assumed values of horizontal and vertical hydraulic conductivity in layer 2 reduced by one, two and three orders of magnitude (Scenario 4a, 4b and 4c respectively) to simulate the response of groundwater levels to varying degrees of hydraulic connection between the sand and shellbed aquifers.

76. Overall, the numerical model exhibits a reasonable ability to simulate both temporal and depth variation in groundwater levels across the model domain. The reporting officers consider that the modelled predictions of effects from the proposed water take provide a sufficient level of confidence to support decision making. However, it is acknowledged that the modelling undertaken represents a simplified representation of a complex geological and hydrogeological system so a degree of uncertainty is inherent in all model predictions. The reporting officers consider that any residual uncertainty regarding the magnitude and/or

timing of effects can be addressed through appropriate mitigation placed on conditions of consent, as discussed further in Section 6.

4.2 Demonstrated Need for Water

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Proposed Northland Regional Plan	Policy D.4.20: *Reasonable and efficient use of water – irrigation* *An application for a resource consent to take water for irrigation purposes must include an assessment using a field-validated water balance model that considers land use, crop water use requirements, on-site physical factors such as soil water holding capacity, and climate factors such as rainfall variability and potential evapotranspiration. The model must reliably predict annual irrigation volume within an accuracy of 15 percent. The annual volume calculated using the model must meet the following criteria:* *(a) an irrigation application efficiency of at least 80 percent, and* *(b) demand conditions that occur in nine out of 10 years.*
Northland Regional Water and Soil Plan	Assessment criteria 36.2.2: *The adequacy of information substantiating the applicant's need for water.*

Analysis

77. Although the applications were submitted prior to the notification of the proposed regional plan, Policy D.4.20 (as set out above) is still relevant for the assessment of the applications under section 104 of the RMA. It provides guidance as to the reasonable and efficient use and allocation of groundwater. The proposed rates and volumes of groundwater abstraction outlined in the AEE were calculated using the irrigation scheduling tool based on soil moisture modelling alone. Initial comparison of actual and modelled water use tended to suggest that the rates and volumes calculated based on soil moisture modelling alone may tend to over-estimate actual water requirements.

78. The AEE stated that the use requirements were typically calculated as 25 m³ per canopy ha per day. However, applying this rate to each application provides for a wide range of irrigation days per year (between 112 days for Kathy Valaderes and 298 days for Bernard Kim and Sheryl Dianne Shine). Further, the application depths vary between 279 mm/ha/year for Kathy Valadares and 745 mm/ha/year for Bernard Kim and Sheryl Dianne Shine (based on estimated canopy areas).

79. We note the submission from Stanisich which states that based on water use records for his existing avocado orchard of 2,090 to 3,049 m³ per hectare per year. This is based on actual use, with an average evapotranspiration with a crop factor for avocado of 0.6. This indicates that the volumes sought for some applications appear to be in excess of 200% of actual irrigation requirements for this submitter's orchard. The submission from Rouse and Madrid seeks a limit of 3,725 m³/ha/year (25 m³/ha/day allowing for 149 days irrigation).

80. NRC has therefore undertaken a further assessment and analysis based on actual water usage for avocado orchard irrigation in the region under a variety of soil types. This assessment is set out in Attachment 2 and was provided to the reporting officers to assist in this analysis.

81. The applicants have not provided further analysis or justification for application depths significantly in excess of 310 mm/year as indicated by NRC's SPASMO V1.2 model. Allowing for an irrigation efficiency of 80% as well as some variance in geological conditions, weather conditions and contingency, a volume of around 400 mm/year (equivalent of 160 irrigation days at 25 m³/ha/day average) is considered by the reporting officers to be around the upper limit for 'reasonable and efficient use'. This rate and volume of irrigation provides for a reliability of 90% (i.e. sufficient water to meet calculated crop water demand in nine out of ten years) which is consistent with Policy D.4.20 of the proposed regional plan.

82. Further, it is noted that a number of applications calculate water demand over non-canopy areas. Based on the policy framework, it is considered that efficient allocation and use of water requires allocation to be approved for canopy areas only.

83. Based on the available information, a reduction in the water volumes approved in some applications is recommended should the consents be approved. This is based on a maximum of 400 mm/year. Where lower annual application depths have been sought, these are recommended. Based on canopy areas, the following allocations are recommended.

TABLE 2: Application and Recommended Annual Allocation Volumes

			Application		Recommended
Application	Name	Canopy Area (ha)	Annual Volume (m³)	Seasonal Application Depth (mm)	Seasonal Allocation (Based on 400 mm/year for canopy area or application volume, whichever is the lesser)
APP.039244.01.01	Kevin & Dani Thomas	16	59,600	373	59,600
APP.039381.01.01	Johno and Carol Brien (Lamb Road)	4	14,900	373	14,900
APP.039345.01.01	Ongare Trust C/- Ian McLarnon & Jason McLarnon	6	29,800	497	23,370
APP.038732.01.01	Kathy Valadares	8	22,350	279	22,350
APP.038610.01.01	Mapua Avocados Limited, C/- Murray Forlong	53	248,333	469	208,000
Houhora	*Total*		*374,983*	*87*	*328,220*
APP.038610.01.01	Mapua Avocados Limited, C/- Murray Forlong	107	496,667	464	416,000
APP.039332.01.01	Candy Corn Limited, C/- Bryan Candy	20	80,000	400	80,000
APP.038589.01.01	Neil & Alma Violet Thompson and Steven & Josephine Suzanne Thompson	9	47,680	530	39,350
APP.038591.01.01	Cypress Hills Limited, C/- Alan Anderson & Carolyn Dawn Smith	9	41,720	464	41,720
Motutangi	*Total*		*666,067*		*577,070*
APP.038410.01.01	Georgina Tui & Mate Nickolas Covich	70	223,500	319	223,500

			Application		Recommended
Application	Name	Canopy Area (ha)	Annual Volume (m^3)	Seasonal Application Depth (mm)	Seasonal Allocation (Based on 400 mm/year for canopy area or application volume, whichever is the lesser)
APP.038471.01.01	Honeytree Farms Limited, C/- Tony Hayward	70	200,000	286	200,000
APP.038513.01.01	Te Rūnanga o Ngai Takoto, C/o Rangitane Marsden	60	193,700	323	193,700
APP.038380.01.01	Daimen & Katherine Holloway	4	14,900	373	14,900
APP.038328.01.01	Bernard Kim & Sheryl Dianne Shine	10	40,000	400	40,000
APP.038454.01.01	Elbury Holdings Limited, C/- Kevin & Fiona King	30	113,700	379	113,700
APP.038650.01.01	Tony & Diane Hewitt	10	40,230	402	40,230
APP.038420.01.01	Largus Orchard Limited Partnership	60	193,700	323	193,700
APP.027391.01.02	Ivan Anthony Stanisich	17	64,070	377	64,070
Waiparera	*Total*		*1,083,800*		*1,083,800*

84. The reporting officers consider the above recommended allocation provides an appropriate balance between ensuring sufficient water is allocated to meet the reasonable needs of the applicants, including providing security of supply to enable economic investment, while minimising the risk of inefficient allocation inconsistent with the statutory planning framework.

4.3 Water Conservation and Mitigation Measures (efficiency of use)

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
National Policy Statement for Freshwater Management 2014 (updated August 2017)	Objective B3 *To improve and maximise the efficient allocation and efficient use of water*
Northland Regional Policy Statement	Objective 3.10 Efficiently use and allocate common natural resources, with a particular focus on: (a) Situations where demand is greater than supply; (b) The use of freshwater and coastal water space; and (c) Maximising the security and reliability of supply of common natural resources for users.
Proposed Northland Regional Plan	Policy D.4.20 Reasonable and efficient use of water – irrigation *An application for a resource consent to take water for irrigation purposes must include an assessment using a field-validated water balance model that considers land use, crop water use requirements, on-site physical factors such as soil water holding capacity, and climate factors such as rainfall variability and potential evapotranspiration. The model must reliably predict annual irrigation volume within an accuracy of 15 percent. The annual volume calculated using the model must meet the following criteria:*

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
	(a) an irrigation application efficiency of at least 80 percent, and (b) *demand conditions that occur in nine out of 10 years.*
Northland Regional Water and Soil Plan	Assessment criteria 36.2.5: *The adequacy of any water conservation and mitigation measures for the proposed system.*

Analysis

85. The AEE states that it is imperative that consent holders efficiently irrigate the avocado orchards for the success of the crops. The AEE states that this is as avocado trees have shallow root systems and are particularly sensitive to root rot, which is the most common cause of avocado failure. Trees that receive too much water will drop fruit and excess water will leach nutrients from the soil around the roots, which is expensive for the grower to replace. Avocado growers therefore monitor soil moisture to ensure that the soil is not too wet or dry.

86. As discussed above, Policy D.4.20 of the proposed regional plan requires applications to take water for irrigation purposes to include an irrigation assessment. The proposed regional plan was notified after the applications were lodged. To ensure that water is being utilised efficiently, should consents be granted it is considered appropriate to require soil moisture monitoring records to be provided to NRC for review, and for irrigation application efficiency to be at least 80 percent as sought under this policy. This will ensure that losses of water are minimised to the extent practicable, consistent with the relevant policy framework.

87. The reporting officers consider that should consents be granted, it is appropriate for all consents to include conditions relating to irrigation management and efficiency. Recommended conditions 10-16 seek to ensure that water is efficiently utilised within each avocado orchard, consistent with the planning framework.

4.4 Effects in Relation to Long-term Aquifer Storage

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
National Policy Statement for Freshwater Management 2014 (updated August 2017)	Objective B2 *To avoid any further over-allocation of fresh water and phase out existing over-allocation.* Policy B5 *By every regional council ensuring that no decision will likely result in future over-allocation – including managing fresh water so that the aggregate of all amounts of fresh water in a freshwater management unit that are authorised to be taken, used, dammed or diverted does not over-allocate the water in the freshwater management unit.*
Proposed Northland Regional Plan	Policy D4.17 Allocation limits for aquifers *2. The quantities of fresh water that can be taken from aquifers must not exceed:*

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
	(a) for the Aupōuri aquifer, the catchment-specific allocation limits in Table 12 'Allocation limits for the Aupōuri aquifer management unit'
Northland Regional Water and Soil Plan	Objective 10.4.1: *The sustainable use and development of Northland's groundwater resources while avoiding, remedying or mitigating actual and potential adverse effects on groundwater quantity and quality.* Policy 10.5.1 *To ensure the sustainable use of groundwater resources, by avoiding groundwater takes that exceed recharge which result in any of the following:* *(a) Saltwater intrusion or reduced groundwater quality;* *(b) A lowering of the groundwater table below existing efficient bore takes;* *(c) A lowering of the temperature of geothermal waters in geothermal aquifers and springs;* *(d) Adverse effects on surface water resources in terms of Policy 10.05.07.*

Analysis

88. Section 3.2.3 of the AEE assesses the potential effect on the proposed abstraction on long-term aquifer storage. This assessment identifies that the proposed cumulative volume of groundwater abstraction (current + proposed, i.e. Scenario 2) represents approximately 1.8% of the total water budget within the groundwater system and concludes that potential effects of the proposed abstraction on groundwater storage are likely to be no more than minor.

89. The operative RWSP does not set specific groundwater allocation limits. However, Policy 10.5.1 refers to the sustainable use of groundwater resources by avoiding groundwater takes that exceed recharge which result in nominated adverse effects on the environment. With regard to the Aupōuri Aquifer, the proposed abstraction represent represents only a small proportion of the recharge to the whole aquifer system. However, given the spatial extent of the Aupōuri Aquifer, evaluation of the cumulative effects of groundwater abstraction long-term aquifer storage at a whole-aquifer scale fail to adequately account for potential constraints on abstraction that occur at a local scale (such as saline intrusion or effects on wetlands).

90. NRC's proposed regional plan approach is to manage allocation on the basis of sub-aquifer areas which represent subdivisions of the larger groundwater management unit representing the Aupōuri Peninsula. An allocation limit has been proposed for each sub-aquifer area based on recommendations in the Lincoln Agritech (2015) report which take into consideration estimated recharge volumes and specific environmental constraints identified for each area.

91. Policy D.4.17 of the proposed regional plan requires that "The quantities of fresh water that can be taken from aquifers must not exceed.." the catchment specific limits for the Aupōuri aquifer. It is noted that this policy is not yet operative and is subject to a number of submissions that have not yet been heard or determined. The policy can therefore be given limited statutory weight.

92. A summary of the current allocation, proposed allocation, and recommended allocation (as set out in Section 4.2 above), is as set out in Tables 4 and 5 below (all volumes m³/year):

TABLE 4: Application Allocations

Zone	pNRP Allocation Limit (m³)	Existing Allocation (m³)	Proposed Allocation (m³)	Total Allocation m³ (if granted)	% Allocation Limit
Houhora	2,141,300	1,124,884	374,983	1,499,867	70.0
Motutangi	1,069,600	389,692	666,067	1,055,759	98.7
Waiparera	2,312,200	327,949	1,083,800	1,411,749	61.1

TABLE 5: Reporting Officers Recommendation Allocation

Zone	pNRP Allocation Limit (m³)	Existing Allocation (m³)	Proposed Allocation (m³)	Total Allocation m³ (if granted)	% Allocation Limit
Houhora	2,141,300	1,124,884	328,220	1,453,104	67.9
Motutangi	1,069,600	389,692	577,070	966,762	90.4
Waiparera	2,312,200	327,949	1,083,800	1,411,749	61.1

93. It is noted that the Lincoln Agritech (2015) report states the recommended allocation limit for the Motutangi sub-aquifer area (subsequently incorporated in the Motutangi sub-aquifer area) is conservative due to the lack of information and data from that area (relatively few bores and abstractions) which resulted in large model uncertainties. The report acknowledged that a higher allocation limit might be feasible in the Motutangi sub-region if it was demonstrated to be sustainable by further work and information obtained in the area. However, it is noted that the recommended allocation is within the allocation limits proposed in the proposed regional plan. Any request for the allocation limits in the proposed regional plan to be increased can be addressed through the hearings on submissions received on the proposed regional plan.

94. While it is acknowledged that the proposed allocation is within the groundwater allocation limits specified in the proposed plan, there remains an element of uncertainty with regard to potential local-scale effects due to the overall heterogeneity of the groundwater system. In particular, it is noted that the sub-aquifer allocation zone boundaries represent arbitrary subdivision of a larger management unit (the *Aupōuri Aquifer*) for the purposes of resource management and therefore do not represent hydraulic boundaries. As a consequence, the potential for the effects of groundwater abstraction to propagate between the individual sub-aquifer areas has to be considered with regard to cumulative effects of abstraction.

95. Therefore, although the relevant policies will be met, an adaptive management approach and appropriate monitoring is recommended should consents be approved to ensure effects on long-term aquifer storage in the Aupōuri aquifer are no greater than assessed. This is further addressed in Section 6 of this report.

4.5 Effects on Other Users of the Resource

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Northland Regional Water and Soil Plan	Policy 10.5.1 Sustainable Use and Development *To ensure the sustainable use of groundwater resources, by avoiding groundwater takes that exceed recharge which result in any of the following:* *(b) A lowering of the groundwater table below existing efficient bore takes;* Assessment criteria 36.2.3: *The extent to which the taking of water from the proposed source will impact on the resource, and on other users, including any cumulative effects of the takes on the resource.*

Analysis

96. Potential drawdown effects on existing (consented) groundwater users were assessed in the AEE for a range of pumping scenarios ranging from the proposed abstraction (Scenario 2) to the proposed abstraction plus an additional 80,000 m³/day (Scenario 3c).

97. In response to a request by NRC for further information, additional analysis of Scenario 2 (Scenario 4a, 4b and 4c) was provided to enable assessment of the potential sensitivity of modelled drawdown to vertical hydraulic conductivity values one, two and three orders of magnitude lower than that assumed in the Scenario 2 modelling. The lower vertical hydraulic conductivity values scenarios reduce the rate of vertical flow simulated within the aquifer system, effectively increasing the amount of drawdown simulated in the shellbed aquifer and reducing the amount of drawdown occurring at shallow depths.

98. Given the significant spatial variability observed in effective aquitard conductance values calculated from aquifer tests undertaken in bores screened in the shellbed aquifer, it is considered that, in combination with Scenario 2, the lower leakage scenarios (4a, 4b and 4c) provide a reasonable indication of the potential range of drawdown likely to occur in response to the proposed abstraction from the shellbed aquifer.

99. Table 5 of the AEE outlines the drawdown calculated for wells associated with existing resource consents in the model domain assuming additional pumping at the proposed rates and volumes. The Scenario 2 assessment indicates a maximum well interference effect of 0.7 metres in response to the proposed abstraction. This magnitude of drawdown is assessed as minor given the available drawdown in bores screened in the shellbed layer (a minimum of 60 metres in bores in the Kaimaumau settlement area, increasing to >100 metres elsewhere).

100. The maximum drawdown anticipated in the shellbed aquifer under the lower leakage sensitivity scenarios (4a, 4b and 4c) is less than 2.1 metres. This figure represents a conservative assessment of potential cumulative drawdown effects in the shellbed aquifer in areas where the hydraulic connection between the shellbed and overlying sand aquifer is relatively low. However, even adopting the lowest vertical hydraulic conductivity the calculated drawdown in response to pumping is no more than minor, given an available drawdown exceeding 60 metres in the shellbed aquifer across the entire Aupōuri Peninsula.

101. Given the higher assumed rate of vertical leakage, the Scenario 2 assessment also provides an upper bound for the potential magnitude of drawdown in the shallow sand aquifer. As illustrated on Figure 30 of the modelling report, the maximum predicted in shallow groundwater levels of approximately 0.6 metres is limited to a small area to the east of Cox Road. Drawdown of shallow groundwater levels is calculated at less than 0.2 metres across a majority of the model domain. Given a nominal bore depth of 10 metres and a static water level of 2 metres, the maximum predicted drawdown in shallow groundwater in response to the proposed abstraction represents less than 10 percent of the available drawdown.

102. Overall, based on the modelling assessment provided, it is reasonable to conclude that the proposed abstraction is unlikely to adversely impact on the reliability of supply for existing groundwater users:

- For bores screened in the shellbed aquifer(s), the magnitude of drawdown estimated to result from the proposed abstraction is likely to represent a small proportion (<5%) of the available saturated thickness, even in areas where vertical hydraulic conductivity of the sand materials is restricted by the presence of lower permeability layers.
- For bores screened in the shallow sand aquifer, although available drawdown is significantly less than that in deeper bores screened in the shellbed aquifer, the magnitude of drawdown in response to the proposed abstraction is also reduced by the partial confinement of the shellbed aquifer. Assuming a nominal bore depth of 10 metres, modelled drawdown in the shallow sand aquifer represents than 10 percent of the available drawdown.

103. The reporting officers wish to clarify that the water rights of existing water takes must be protected. However, it is considered any bores potentially adversely impacted by the proposed abstraction are unlikely to meet requirements for “efficient bore takes” defined in the RWSP. An efficient bore take is defined as one where the bore fully penetrates the water bearing layer and takes groundwater from the base of the aquifer (refer Policy 10.5.1 of the RWSP).

104. In this case the water level in a bore, which is only partially penetrating an aquifer or is drawing water from the top of the aquifer, may be drawn below the bottom of that bore as a result of water being taken (at a sustainable rate) from another deeper bore. In this situation the user of the shallow bore has not lost his or her rights to take groundwater (assessment criteria 36.2.1(c) and 36.2.6(b) of the RWSP), rather, the method of extraction is no longer effective.

105. Given the relatively minor magnitude of calculated drawdown (in the context of available drawdown) it is considered that bores meeting the criteria for "efficient bore takes" are unlikely to be adversely impacted by the proposed abstraction.

106. Any remaining uncertainty about the ability of existing water users to obtain existing volumes will be addressed by appropriate conditions of consent, should consents be granted.

4.6 Likelihood of Saline Intrusion

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Proposed Northland Regional Plan	Policy D.4.13 Achieving freshwater quantity related outcomes *Manage the taking, use, damming, and diversion of fresh water so that:* *6. saline intrusion in, and land subsidence above, aquifers is avoided, and*
Northland Regional Water and Soil Plan	Policy 10.5.1 Sustainable Use and Development *To ensure the sustainable use of groundwater resources, by avoiding groundwater takes that exceed recharge which result in any of the following:* *(a) Saltwater intrusion or reduced groundwater quality;*

Analysis

107. Under natural conditions, recharge of groundwater in inland areas results in the formation of a hydraulic gradient which causes lateral seepage of fresh groundwater toward the coast. In shallow unconfined aquifers, mixing of fresh groundwater and sea water forms an interface where water quality transitions from fresh to brackish to saline close to, or offshore of, the costal margin. However, at greater depths, the location and geometry of the interface between fresh groundwater and the sea water is largely determined by the hydraulic gradients in the aquifer and the density difference between fresh and saline water (with groundwater typically becoming more brackish with depth).

108. Saline intrusion (i.e. displacement of freshwater by the inland movement of brackish/saline water) can result from two different processes as a result of groundwater abstraction. Firstly, a reduction in the head of freshwater in an aquifer can allow saline water at depth to move upwards in an aquifer (a process termed *upconing*). A reduction in groundwater head can also allow the saline interface at depth to migrate further inland (referred to as *lateral migration*).

109. Given the geometry and geology, the potential for saline intrusion is a significant constraint on sustainable groundwater allocation on the Aupōuri Peninsula. The Lincoln Agritech (2015) report recommended provisional allocation limits for various sub-aquifer areas across the peninsula based on the calculated volume of groundwater able to be abstracted without drawing groundwater levels below thresholds established at the coast to maintain the saline interface offshore (i.e. to prevent the migration of the saline interface inland of the coastal margin). As assessed above, the requested volumes do not exceed the recommended limits.

110. Section 5.2.6 of the modelling report provides an assessment of potential upconing of the saline interface resulting from the proposed abstraction based on the Ghyben-Herzberg relation. This relation essentially states that due to the density difference between fresh and saline water, for every metre of freshwater in an aquifer above sea level, there will be 40 metres of freshwater in the aquifer below sea level. The assessment of potential upconing calculated the depth of freshwater along a number of section lines across and along the Aupōuri Peninsula, based on modelled groundwater levels calculated from the various pumping scenarios. Results of this assessment show that sufficient head will be maintained in the aquifer to ensure the depth to the saline interface is in excess of 100 metres below the base of the shellbed aquifer across the entire model domain.

111. Given the geology of the basement rocks underlying the Quaternary sediments comprises low permeability sediments and volcanics (assumed to be a no flow boundary in the groundwater model) it is uncertain if upconing is a likely scenario for saltwater intrusion on the Aupōuri Peninsula. However, if the basement sediments were to sufficiently permeable and contain saline or brackish water, the analysis confirms that there is limited potential for depressurisation occurring in the shellbed and overlying sand aquifers to result in adverse effects on water quality within the overlying Quaternary sediments via this mechanism.

112. In the context of the Aupōuri Peninsula, lateral migration of the saline interface may potentially occur along permeable shellbed sediments overlying the basement contact. The potential for saline intrusion to occur via this mechanism is analysed in Section 5.2.6.2 of the modelling report. This assessment utilised the Ghyben-Herzberg relation to calculate the minimum head required to maintain the saline interface offshore, based on the estimated depth to basement rocks at 85 points distributed evenly around the coastal margin of the model domain.

113. Simulated groundwater levels were above the estimated levels required to maintain the saline interface offshore for the vast majority of the time for each pumping and sensitivity scenario. However, at the driest time in the 60 year run (April 1978) simulated groundwater levels came close to the trigger level at two points along the coast (Houhora Heads and East Beach to Kaimaumau) for the maximum pumping scenario (3c) (shown in Figure 43, and Table F1 and Table F2 in Appendix F of the Groundwater Modelling Report). These points represent locations where the land protrudes into the ocean (headlands) and is therefore naturally surrounded by sea water and potentially most sensitive to saline intrusion.

114. The modelling results indicate that it is unlikely that salt water would migrate inland along the interface of the shellbed and basement, even under much higher levels of abstraction than that sought in this consent (i.e. Scenarios 3a, 3b and 3c), and at the driest time in the 60 year model run. Therefore, the application concludes that prolonged saline intrusion effects of this consent application are considered unlikely and thus to be no more than minor.

115. However, given the complex geological and hydrogeological setting of the Aupōuri Peninsula, it is the view of the reporting officers that it is uncertain if the saline intrusion assessment provides adequate information to characterise the potential effect of the proposed abstraction, particularly in groundwater quality information that has recently become available.

116. In particular, NRC recently received information from a local driller regarding three separate bores drilled to differing depths on a single property in Kaimaumau settlement. Although no water quality samples were analysed from the two deeper bores (completed at depths in excess of 30 metres below ground level), reported electrical conductivity values greater than 40,000 µS/cm suggest the presence of strongly saline water.

117. In response to the reported presence of saline water, NRC undertook a survey of water quality in a total of 14 bores located around the margin of Rangaunu Harbour from east of Kaimaumau settlement to Norton Road in mid-February 2018. Of the bores sampled, two are less than 30 metres deep (including a bore on the property where the saline water was reported), two are between 30 and 60 metres deep, with the remaining bores greater than 60 metres.

118. Preliminary results of the survey indicate electrical conductivity values from the bores sampled were less than 500 µS/cm, with the single exception of a single bore in the Norton Road area which exhibited a value closer to 750 µS/cm. These results suggest that the presence of strongly saline water reported in Kaimau settlement is somewhat anomalous compared to other nearby bores. The results do, however, suggest slightly elevated salinity values compared to those observed in inland locations elsewhere on the Aupōuri Peninsula (Lincoln Agritech, 2015), possible reflecting proximity to the inland margin of the saline interface.

119. Based on the modelling results, the risk of saline intrusion as a result of the proposed abstraction is assessed as being minor. However, given the potential sensitivity to saline intrusion in the Motutangi and Waiparera sub-zones (particularly due to the flat hydraulic gradient in these areas), and results of recent water quality investigations, should the consents be approved, it is recommended that conditions are proposed to require:

- Monitoring of groundwater levels at key coastal locations, and/or,
- Monitoring of groundwater levels at locations further inland to validate drawdown predictions made using the numerical model; and/or,
- Monitoring of key water quality parameters at specified locations[10].

120. This will mitigate the risk of effects of low probability but high potential impact. Appropriate monitoring is discussed further in Section 7.

[10] For example, refer to: Pattle Delamore Partners, 2011; *New Zealand Guidelines for the Monitoring and Management of Sea Water Intrusion Risks on Groundwater*. Envirolink Project 420-NRLC50.

4.7 Other Water Quality Effects

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
National Policy Statement for Freshwater Management 2014 (updated August 2017)	Objective A1 *To safeguard:* *(a) the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; and* *(b) the health of people and communities, as affected by contact with fresh water; in sustainably managing the use and development of land, and of discharges of contaminants.* Objective A4 *To enable communities to provide for their economic well-being, including productive economic opportunities, in sustainably managing freshwater quality, within limits*
Northland Regional Policy Statement	Objective 3.2 *Improve the overall quality of Northland's fresh and coastal water with a particular focus on:* *(a) Reducing the overall Trophic Level Index status of the region's lakes;* *(b) Increasing the overall Macroinvertebrate Community Index status of the region's rivers and streams;* *(c) Reducing sedimentation rates in the region's estuaries and harbours;* *(d) Improving microbiological water quality at popular contact recreation sites, recreational and cultural shellfish gathering sites, and commercial shellfish growing areas to minimise risk to human health; and* *(e) Protecting the quality of registered drinking water supplies and the potable quality of other drinking water sources.*
Proposed Northland Regional Plan	Policy D.4.5 Maintaining overall water quality *An application for a resource consent that would allow a water quality standard or sediment quality standard to be exceeded or further exceeded will generally be declined. Resource consent may be granted if existing beneficial water quality dependent values of water are not adversely affected.*

Analysis

121. The AEE states that avocado orchardists in this area tend to apply fertiliser efficiently via fertigation as part of their irrigation water using a small dosage regular frequency approach, which is driven by both the soil conditions (i.e. high permeability and lacking in organic matter and nutrients) and economic considerations. Combined with efficient irrigation that avoids root rot as explained above, excessive leaching of fertiliser and plant nutrients is unlikely. Therefore, adverse effects on shallow water quality are not expected.

122. Of note with regard to potential nutrient losses is the observation by Lincoln Environmental (2015) that groundwaters in the Aupōuri Aquifer typically exhibit reducing (anoxic) geochemical conditions (illustrated by elevated concentrations of iron and manganese) due to the abundance of organic material (peat and lignite) within the sand deposits. Under these conditions there is an elevated potential for any losses of nitrogen to the saturated zone to be assimilated by denitrification occurring in shallow groundwater.

123. The reporting officers note that Section 3.5 of the AEE identifies significant fertiliser use (equivalent to $2,000/ha/year) may be associated with the use of irrigation water for establishment and operation of avocado orchards. It is recommended that should the applications be approved, appropriate water quality monitoring is required to ensure any potential contamination of the surface and groundwater resources is identified at an early stage, and remedial steps undertaken. It is, however, recommended that any such monitoring be subject to periodic review to determine the utility and value of continued monitoring, depending on results.

4.8 Ground Subsidence

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Northland Regional Water and Soil Plan	Objective 10.4.3: *The management of groundwater resources so that the potential adverse effects of land subsidence are avoided.* Policy 10.5.9 Ground Subsidence *To avoid, remedy or mitigate any ground subsidence as a result of groundwater takes, where this is likely to cause adverse flooding, drainage problems, or building damage.*

Analysis

124. In terms of land subsidence the AEE refers to a detailed geotechnical modelling study undertaken using a finite element model to assess potential deformation and land stability for a previous resource consent application (King Avocado Orchard) with similar geology and drawdown to that associated with the proposed abstraction. This study assumed a conservative uniform drawdown of 2 metres across the entire area and concluded that subsidence effects would be no more than minor, with a total subsidence of 50 mm assessed as unlikely to adversely impact on built structures or infrastructure in the rural environment.

125. Given the drawdown assumed in the previous assessment (2 metres) is close to the maximum calculated for Scenario 2a (proposed abstraction) and associated sensitivity analyses (Scenarios 4a, 4b and 4c) it is reasonable to conclude subsidence effects are likely to be no more than minor in a similar geological environment based on the previous assessment.

4.9 Social and Economic

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
National Policy Statement for Freshwater Management 2014 (updated August 2017)	Objective B5 *To enable communities to provide for their economic well-being, including productive economic opportunities, in sustainably managing fresh water quantity, within limits.*
Northland Regional Policy Statement (RPS)	Objective 3.5 *Northland's natural and physical resources are sustainably managed in a way that is attractive for business and investment that will improve the economic wellbeing of Northland and its communities.*
Pukenui/Houhora Community Development Plan	Objective 3.2 of the Pukenui/Houhora Community Development Plan (Appendix 1) seeks that "*aquifers will be conserved by minimising commercial exploitation; and the potential for contamination of shell aquifers in particular will be avoided. Deep aquifers will continue to be closely monitored for falling levels and quality. Long term planning will take into account the probable need for a reticulated water supply".*

Analysis

126. The application states proposed water takes will support approximately 670 ha of orchard development, it is expected that approximately 70 additional full time equivalent jobs (primarily seasonal work) will be created, along with spending in the district of approximately $2M per annum on orchard operations. This assertion has not been peer reviewed. However, based on the available information, it is considered that the scale of horticulture development proposed will positively impact the local economy.

127. A number of submitters raise concern regarding social values and community aspirations, including a potential reticulated water supply for the local community, as indicated in the Pukenui/Houhora Community Development Plan.

128. The sustainability of the Aupōuri aquifer is addressed in Section 4.4 above. With regards to a reticulated water supply, it is the understanding of the reporting officers that this currently does not form part of FNDC's plans (including Long Term Plan), and FNDC did not include reference to this in their submission on the proposed regional plan. Given the current statutory framework, there is currently no basis for declining the applications, or reducing their volumes, based on the community aspirations for a reticulated water supply in this area. It is further noted that the allocation volumes recommended by the reporting officers do not result in full allocation of the Aupōuri Aquifer to subzones based on the proposed regional plan limits, enabling further applications for other uses to be received and assessed by NRC.

4.10 Cultural Heritage and Archaeological

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
National Policy Statement for Freshwater Management 2014 (updated August 2017)	Objective AA1 *To consider and recognise Te Mana o te Wai in the management of fresh water.*

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
	Policy AA1 *By every regional council making or changing regional policy statements and plans to consider and recognise Te Mana o te Wai, noting that:* *(a) te Mana o te Wai recognises the connection between water and the broader environment – Te Hauora o te Taiao (the health of the environment), Te Hauora o te Wai (the health of the waterbody) and Te Hauora o te Tangata (the health of the people); and* *(b) values identified through engagement and discussion with the community, including tangata whenua, must inform the setting of freshwater objectives and limits.*
New Zealand Coastal Policy Statement (NZCPS)	Objective 3 *To take account of the principles of the Treaty of Waitangi, recognise the role of tangata whenua as kaitiaki and provide for tangata whenua involvement in management of the coastal environment by:* § *recognising the ongoing and enduring relationship of tangata whenua over their lands, rohe and resources;* § *promoting meaningful relationships and interactions between tangata whenua and persons exercising functions and powers under the Act;* § *incorporating mātauranga Māori into sustainable management practices; and* § *recognising and protecting characteristics of the coastal environment that are of special value to tangata whenua.*
Northland Regional Policy Statement (RPS)	Objective 3.12 *Tangata whenua kaitiaki role is recognised and provided for in decision-making over natural and physical resources.*
Proposed Northland Regional Plan	Policy D.4.13 Achieving freshwater quantity related outcomes *Manage the taking, use, damming, and diversion of fresh water so that:* *4. flows and water levels support sustainable mahinga kai, and*

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Northland Regional Water and Soil Plan	Objective 6.3.1: *The management of the natural and physical resources within the Northland region in a manner that recognises and provides for the traditional and cultural relationships of tangata whenua with the land and water.* Policy 6.4.1: *To recognise and, as far as practicable provide for the relationship of Maori and their culture and traditions with respect of the use, development and protection of natural and physical resources in the northland region.* Policy 10.5.8 Cultural Values *When allocating groundwater, to recognise, and as far as practical, provide for the cultural and spiritual values held by the tangata whenua for the groundwater resources and associated surface water resources.* Assessment criteria 36.2.8: *The extent to which amenity, cultural, recreational and social values and economic well-being are adversely affected.*

Analysis

129. The concept of "Te mana o te wai" is embedded as an objective in the NPS on Freshwater Management, and also throughout the operative and regional plan objectives and policies. Cultural values associated with the mauri of water recognise the interconnected physical and metaphysical values of water in relation to environmental and human health and wellbeing. Rather than taking a strictly technical approach to allocation of water and assessment of potential environmental effects the interconnectedness of water to social, environmental and cultural wellbeing is to be acknowledged and considered in the allocation of water. It is the view of the reporting officers that mana whenua are qualified to assess the effects of the applications on Te mana o te wai, including the mauri of the aquifer.

130. The reporting officers understand the NRC sought comments from local iwi and marae for each of the earlier applications (12 out of 17 of the applications). The relevant iwi and marae were determined as those who have formally lodged iwi/hapū management plans with the council, or that have treaty settlements, in the specific area where the application activity is proposed to occur and effects generated. The council is also guided by the Crown's database that provides information on who are the mandated iwi authorities in the potentially affected area for the purposes of the Resource Management Act.

131. The most recent five applications were not circulated as it was determined by that stage that the applications would be jointly notified and that it was appropriate for iwi/hapū/marae to assess the applications together on an integrated and comprehensive basis as part of that process. Iwi/hapū/marae with mana whenua over the conservative area of influence from the water take applications were given affected party status and formally notified through this process. These include mandated representatives from Te Aupōuri, Ngai Takoto, Ngāti Kuri, Te Rarawa, Ngāti Kahu, Te Potahi Marae, Kaimaumau Marae, Paparore Marae and Waiora Marae.

132. As noted in Section 3.1.3 above, the only submission received from the above listed parties was from Te Rūnanga Nui o Te Aupōuri Trust (C/- Mike Stevens).

133. Key concerns raised relate to:

- § Reliability of the modelling and assessment provided with the application.
- § Potential effects on all other users of the aquifer.
- § Opposition to the "first come first served" approach to water management.
- § Consider that NRC should manage the water more strategically.
- § Availability of water for other uses.

134. These matters have been addressed elsewhere in this report.

135. In relation to the earlier applications, responses were received from Waiora marae to both the Shine application, and also the Forlong application (Mapua). The marae did not oppose the applications on the basis that appropriate assessment and management of potential environmental effects would be undertaken.

136. In the absence of submissions from mandated mana whenua representatives, or earlier feedback on circulated applications, there is no evidence available to the reporting officers to indicate that the proposed water extractions will have significant adverse effects on Te mana o te wai.

137. Submissions have also been received from Mr Burgoyne, and Mr Awarau. The reporting officers have been advised by NRC that neither are considered to be mandated authorities to act on behalf of Ngāti Kuri and Ngai Takato respectively. Further, the mandated representatives of Ngāti Kuri and Ngai Takato also do not accept these submitters as representing the interests of the iwi/hapū. Matters relating to cultural values are also raised in the submission of Catherine Murupaenga-Ikenn.

138. The main concerns relating to cultural effects raised in submissions is that mana whenua were not sufficiently consulted or involved in the assessment of the applications, are therefore not able to exercise their kaitiaki. As discussed above, mandated mana whenua representatives were notified and had the opportunity to provide submissions. It is beyond the scope of the assessment of the current consent applications to assess or consider whether alternative policies of frameworks for managing the water resource are appropriate. The NPS on Freshwater management provides direction for the involvement of tangata whenua in plan preparation and the setting of allocation limits. However, this is a matter for the proposed regional plan process. The current applications must be assessed under the current statutory framework.

139. The reporting officers consider that the principles of whanaungatanga (partnership) and kaitiakitanga may be encouraged through the recommended condition to establish a Water User Liaison Group, which includes invited membership from representatives of the consent holders/groundwater users; mandated representatives from Te Aupōuri, Ngai Takoto, Ngāti Kuri, Te Rarawa, Ngāti Kahu, Te Potahi Marae, Kaimaumau Marae, Paparore Marae and Waiora Marae; the Department of Conservation; Far North District Council; and the NRC. The purpose of this group will be to share information on monitoring results, increases in groundwater abstraction (within the limits set

by the consent), and any issues identified by other members of the group in relation to the exercise of the consents.

140. Another key principle of the Treaty is the active protection of natural resources and Maori interests. Based on the assessment of environmental effects provided by the applicant and throughout this report, the reporting officers are of the view that natural resources including significant wetlands will continue to be protected. No specific cultural concerns have been raised during the submission process that would lead to consent being refused to the application.

141. Submitters with affected party status may present further detail and assessment of cultural matters to the Hearing Commissioners for their consideration in making a decision on this application.

4.11 Ecological (including recharge of Wetlands from Aquifer) and Natural Character

Relevant Provisions

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
National Policy Statement for Freshwater Management 2014 (updated August 2017)	Objective B1 *To safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the taking, using, damming, or diverting of fresh water.* Objective B4 *To protect significant values of wetlands and of outstanding freshwater bodies.*
New Zealand Coastal Policy Statement	Objective 1 *To safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by:* § *maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature;* § *protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and* § *maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.*
Northland Regional Policy Statement	Objective 3.3 *Maintain flows, flow variability and water levels necessary to safeguard the life supporting capacity, ecosystem processes, indigenous species and the associated ecosystems of freshwater.*

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
Proposed Northland Regional Plan	Policy D.4.13 Achieving freshwater quantity related outcomes *Manage the taking, use, damming, and diversion of fresh water so that:* *1. the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh and coastal water are safe-guarded, and* *2. the natural hydrological variation of outstanding freshwater bodies and natural wetlands are not altered, and* *3. rivers have sufficient flow variability to maintain habitat quality, including to flush rivers of deposited sediment and nuisance algae and macrophytes, and* Policy D.4.15 Minimum levels for lakes and wetlands *Apply the following minimum levels for Northland's lakes and natural wetlands, unless a lesser minimum level is approved under D.4.19 'Exceptions to minimum flows or levels':* *4. for natural wetlands, there is no change in their seasonal or annual range in water levels.* Policy D.4.27 Wetlands – requirements *Activities affecting a wetland must:* *(a) maintain the following important functions and values of wetlands:* *(b) water purification, and* *(c) contribution to maintaining stream flows during dry periods, and* *(d) peak stream flow reduction, and* *(e) habitat for indigenous flora and fauna, and* *(f) avoid, remedy, or mitigate effects, or provide biodiversity offsetting or environmental biodiversity compensation, so that residual adverse effects are no more than minor.*
Northland Regional Water and Soil Plan	Objective 10.4.2: *The sustainable management of groundwater resources in conjunction with the sustainable management of surface water resources.* Policy 10.5.1 Sustainable Use and Development *To ensure the sustainable use of groundwater resources, by avoiding groundwater takes that exceed recharge which result in any of the following:* *(d) Adverse effects on surface water resources in terms of Policy 10.05.07.* Policy 10.5.7 Effects on Surface Water Resources *To ensure the springflows to associated surface water bodies, and water levels in lakes and wetlands, which may be affected by groundwater takes, are sufficient to:* *(a) Maintain the life supporting capacity of the surface water resource;* *(b) Protect the natural character of the surface water body and the habitats of aquatic flora and fauna;*

Planning Document	Directly Relevant Objectives, Policies, Assessment Criteria
	(c) Maintain any associated or dependent values, such as amenity or recreational values; and Assessment criteria 36.2.7: *The extent to which the natural character of the environment is maintained.*

Analysis

Kaimaumau Wetland

142. The Kaimaumau wetland stretches some 11 km from the mouth of Rangaunu Harbour near Kaimaumau north-westwards to Motutangi, south of the Houhora Heads. It is flanked along its north-eastern margin by the young dunes of East Beach and rises in altitude from near sea level to 10 metres. Its sedge, rush and shrub vegetation is representative of acid low-fertility wetlands that were once more widespread on the sand country of the Aupōuri and Karikari Peninsulas. The low-lying wetlands and intervening drier ridges provide habitats for many species of native plants and animals. Up to 11 of these plants have been listed as threatened including a number of orchids. The land is the only remaining freshwater wetland in Northland that exceeds 1,000 ha and its outstanding conservation values have been partially protected by designation of 955 ha of the wetland as Scientific Reserve in 1984.

143. The potential effects of the proposed abstraction on the Kaimaumau Wetland have been assessed in two ways using data from the Scenario 2 assessment presented in the AEE:

- Firstly, potential effects on wetland drain flows were estimated from the annual minima daily wetland discharge were obtained from the flow budget for each model time step. These values were converted to specific discharge and the reduction in flow estimated by comparing changes in annual minima discharge calculated from the 70 year record for the different predictive scenarios. Results of this assessment indicate the proposed abstraction (i.e. Scenario 2) has the potential to reduce mean annual low-flow discharge by a maximum of 7%, and 5-year low-flow discharge by 11%.
- Secondly, potential effects on standing water levels in the wetland can be estimated from the magnitude of drawdown calculated in the shallow unconfined aquifer for the various predictive scenarios. Again, given Scenario 2 assumes the highest vertical hydraulic conductivity, results of this scenario present an upper bound on potential drawdown in the vicinity of the Kaimaumau Wetland. As illustrated in Figure 30 of the modelling report estimated drawdown this scenario is less than 0.2 metres across a majority of the wetland area, with only a relatively small area east of Srhoj Road calculated to experience drawdown in excess of 0.4 metres.

144. The assessment notes that the model does not capture the hydraulic separation between the shallow aquifer and the wetland by discontinuous iron pan. Therefore, the calculated effect on the Kaimaumau wetland is likely to represent a conservative upper estimate of the potential magnitude of effect. This observation is particularly relevant given the wetland is typically classified as being perched with recharge predominantly sourced from rainfall (Hicks

et.al., 2001[11])). The probability of the proposed abstraction resulting in a reduction on groundwater levels or drain flow of the magnitude calculated by Scenario 2 is therefore assessed as being low.

145. In addition to the modelling study, a field investigation and groundwater isotope study using Radon was been undertaken to address the connectivity between groundwater and the wetland (see Section 2.3.1 of the Groundwater Modelling Report). Results indicate that the deeper groundwater has a significantly different Radon signature than the surface water. This result was utilised to support the inference that the deep shellbed aquifer has a limited hydraulic connection with surface drains and wetlands in the Kaimaumau area. The reporting officers concur with this assessment.

146. The Draft Guidelines for Selection of Technical Methods which supports the proposed NES for ecological flows identifies that the potential risk of ecological change may be defined as low where there is less than 0.2 metre change in median water level; and, patterns of water level seasonality (summer vs winter levels) remain unchanged from the natural state (summer relative to winter). Given the assessment provided and the likeliness of limited hydraulic connectivity between the deep groundwater and the wetland, it is considered unlikely that the proposed extraction will result in this threshold being exceeded.

147. Monitoring and review is recommended, should consents be approved, to address any remaining uncertainty in this regard, based on the proposed NES thresholds. It is noted in the Hicks et al report that the Kaimaumau wetland that *"The wetland is generally thought by local residents to have become drier in recent years but whether this is the case is unclear."* Where water levels are identified through monitoring as decreasing compared with the baseline, the recommended conditions will require further investigation to be undertaken to determine the likely cause (i.e. whether the water level reduction is attributable to the groundwater extraction or some other cause such as a reduction in rainfall).

148. Further, it is the assessment of the reporting officers that changes in salinity in the wetland is unlikely, as the upconing and lateral migration associated with saline intrusion potential occurs at depth (>80 metres) and is therefore unlikely to affect surface water bodies.

149. Based on all available information, and the recommended monitoring and mitigation conditions, it is considered that effects on the integrity and resilience of the Kaimaumau wetland, including ecological values, will be less than minor.

Private Wetlands and Streams

150. Submitters have raised concern of the effect of the water extractions on privately owned wetlands within the area of influence (i.e. submissions from J Larson at Paparore Road and Spains Road; and for S Simpkin and H Exley at Waiharara).

[11] Options for managing the Kaimaumau wetland, Northland, New Zealand SCIENCE FOR CONSERVATION 155 D.L. Hicks, D.J. Campbell, and I.A.E. Atkinson 2007.

151. The conservative modelling outputs indicate a maximum 0.6 metres of drawdown in the shallow aquifer. In the vicinity of the submitters' sites, Scenario 2 (which assumed the greatest degree of vertical leakage and hence calculates the largest drawdown in the unconfined aquifer) predicts a drawdown of less than 0.2 metres at both locations. As noted in the preceding section, this model scenario is conservative (in terms of predicted drawdown in shallow groundwater), as it assumes a relatively high degree of hydraulic connection between the shellbed aquifer and overlying shallow groundwater. In terms of the NES, the potential risk of ecological change is therefore assessed as low, and any ecological and natural character effects will be less than minor.

Lake Waiparera

152. Lake Waiparera is perched above the regional aquifer, thus it is hydrologically disconnected from the groundwater system. No change is expected in the hydrological functionality of the lake due to the proposed abstraction from the deep shellbed aquifer.

4.12 The Effects of Climate Change

Relevant Provisions

Planning Document	Relevant Objectives, Policies, Assessment Criteria
Northland Regional Policy Statement (RPS)	Policy 6.1.2 *Adopt a precautionary approach towards the effects of climate change and introducing genetically modified plant organisms to the environment where they are scientifically uncertain, unknown, or little understood, but potentially significantly adverse.*

Analysis

153. In August 2006, the National Institute of Water and Atmospheric Research Ltd (NIWA) carried out a comprehensive assessment on the impact of climate change and climate variability on Northland's water resources based on all available literature. The assessment considered natural climate variability in the Northland region and the potential effects of predicted climate changes over the next 50 to 80 years.

154. The main points of the assessment were:

- § All predictions suggest an increase in temperature, particularly during the winter;
- § Overall annual rainfall may not change, although rainfall trends for the next 30 to 80 years are for increased dry periods (drought and low flows) and increased high intensity rainfall events (floods); and
- § The change in rainfall trends and temperature is likely to result in decreased recharge to groundwater resources, and increased potential for saltwater intrusion in coastal aquifers.

155. The NRC have identified that additional work is required to assess the potential effects of increased drought frequencies and extreme rainfall events on surface water flows i.e. low flows and environmental responses.

In terms of this consent application, climate change may affect:

- Recharge (and hence water availability) estimates.
- Likelihood of saline intrusion.

156. The effect of a reduction of recharge will mean that less water will be available for allocation. However, it is noted that the proposed allocation limits in the proposed regional plan allow for the effects of climate change.

157. The modelling did incorporate estimated sea level rise in the analysis of saline intrusion risk (and consequently recommended sustainable allocation volumes). As the proposed extractions do not exceed the allocation limits for the Aupōuri aquifer subzones, the allocation is considered to be sustainable over the duration of the consents sought.

158. The risk of saline intrusion to arise as a result of exercising the consent will increase as a result of anticipated climate change. The predictive model scenarios were simulated based on a climate data record from the last 60 years. In effect, the climatic conditions of the last 60 years have been utilised to simulate the next 60 years. The model therefore does not account for anticipated changes in climate, including increased dry periods.

159. In the absence of predicted groundwater levels under the effects of climate change, we propose saline intrusion monitoring for the duration of any consent that may be granted.

5. ALTERNATIVES

160. Under Schedule 4, clause 6(1)(a) of the RMA, an AEE should include *"if it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity"*. Consideration of alternatives is therefore only required where there are likely to be significant adverse effects. For example, in an appeal against the grant of resource consents for a proposal to establish and operate a rival supermarket, the appellant argued that an alternative site should be considered. The Court found that in the absence of credible evidence of any significant adverse effect on the environment arising from the proposal, the consideration of alternatives was irrelevant[12].

161. The reporting officers have not identified any credible evidence for a significant adverse effect on the environment. A full assessment of alternatives is therefore not required under Schedule 4.

162. However, it is noted that assessment criteria in the RWSP require consideration of the adequacy of the assessment of any alternative water sources considered, or other water management strategies and the reasons for the proposed system.

12 *Progressive Enterprises Ltd v North Shore CC.*

163. In terms of alternative water sources, the AEE states that there are few streams in the Houhora-Motutangi to Waiharara area. Where farmers and orchardists have water takes from local drains and streams, the AEE states that the water quality within these water bodies is problematic during summer and also the yields can be unreliable. *"Hence, groundwater is strongly preferred over surface water because of the more reliable yield, better water quality, and also because in this area groundwater is almost guaranteed anywhere you choose to drill."*

164. As the reporting officers' concur that the effects of the proposed groundwater take are likely to be no more than minor, and the volume sought will be within the proposed allocation limits for the relevant Aupōuri aquifer sub-aquifer areas, we consider it appropriate that the aquifer could be used as the primary water source for the avocado farms. Based on the policy direction in the proposed regional plan for irrigation, allocation is to be based on the requirement for 9 out of 10 years. We therefore recommend a reduction in the volumes sought in some cases. Consent holders may seek other methods to minimise risk such as onsite storage.

165. We recommend that appropriate monitoring conditions are proposed to ensure effects are no greater than assessed under this consent.

6. MITIGATION MEASURES

6.1 Precautionary Principle and Adaptive Management

166. In terms of the precautionary principle; it is considered that the technical analysis and recommendation provided as part of this report has been undertaken based on the most current information and understanding of the nature of the groundwater resource in the area. However, it is the nature of groundwater resources that there is a degree of estimation or inferring involved with the assessment, and accordingly there is a degree of uncertainty involved with the current understanding of the resource. In light of this potential, conditions have been included, particularly with respect to monitoring and review that are considered to be sufficiently conservative to take account of the degree of uncertainty in the assumptions made at this stage. It is also acknowledged that the rate of extraction will be staged, and will increase over time, rather than the full volumes being extracted in the first irrigation season. This will allow for monitoring, reporting and analysis as extraction increases over time. Where effects are greater than anticipated for the volume of extraction undertaken, remedial measures will be required.

167. The Environment Court interim decision in relation to Crest Energy Kaipara Limited and Ors vs. Northland RC (paragraph [101]) sets out features of adaptive management which include:

(a) Proposed stages of development – this is not set out specifically in the recommended conditions, however, it is understood that the rate of extraction will increase over time as discussed above.

(b) Robust evaluation of existing environment (i.e. baseline monitoring).

(c) A monitoring, reporting and checking mechanism.

(d) Enforceable conditions requiring meeting with specific criteria before proceeding to next stage.

(e) Ability to remove all/some development that has occurred at that time if monitoring results warrant.

168. The intention of an adaptive management approach is to enable a responsive approach to addressing potential environmental effects as further information is obtained on an environmental system. Schedule 1 to the recommended conditions address requirements (b)–(e) above, ensuring that an adaptive management approach to management of the groundwater resource can be achieved.

6.2 Monitoring

169. Policy D.4.23 of the proposed regional plan sets out requirements for conditions for water permits.

Water permits must include conditions that:

(a) clearly define the take amount in instantaneous take rates and total volumes, including by reference to the temporal aspects of the take and use, and

(b) require that the water take is metered and information on rates and total volume of the take is provided electronically to the regional council, and

(c) for water permits for takes equal to or greater than 10 litres per second, require the water meter to be telemetered to the regional council, and

(d) clearly define when any restrictions and cessation of the water take must occur to ensure compliance with freshwater water quantity limits set in this plan, and

(e) require the use of a backflow prevention system to prevent the backflow of contaminants to surface water or ground water from irrigation systems used to apply animal effluent, agrichemical or nutrients, and

(f) specify when and under what circumstances the permit will be reviewed pursuant to Section 128(1) of the RMA, including by way of a common review date with other water permits in a catchment.

170. Having regard to the above policy, and the adaptive management approach proposed to address residual uncertainty associated with the complex geological environment, we have proposed a number of monitoring conditions relating to:

- Volume of water extraction;
- Saline Intrusion;
- Water levels, including in relation to the Kaimaumau Wetland; and
- Water Quality.

171. Conditions relating to adaptive management have been incorporated into consent conditions for the groundwater take to allow "cut-backs" to lower pumping volumes in the event that an unanticipated effect relating to the groundwater take is identified. The reporting officers' recommend additional monitoring above the applicant's conceptual proposal. This will partially meet the concerns raised by submitters' regarding the lack of monitoring initially proposed.

172. Further, as discussed earlier in this report, conditions are proposed in relation to irrigation management and water efficiency to ensure that groundwater abstracted from the Aupōuri aquifer is efficiently utilised for avocado farm irrigation.

7. ASSESSMENT OF PART II MATTERS

7.1 Purpose of the Resource Management Act

173. Section 5 of the Resource Management Act sets out that the purpose of the Act is *"to promote the sustainable management of natural and physical resources"*. It defines sustainable management as follows:

"sustainable management means the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural wellbeing and for their health and safety while:

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) avoiding, remedying or mitigating any adverse effects of activities on the environment."

174. In this case, approval of the application will help enable the applicants to irrigate avocado forms which will provide for the social and economic wellbeing of the applicants and the wider Northland economy.

175. The assessment provided in this report concludes that the water takes will not affect the ability for the wider rural community to provide for its future needs and well-being. The existing water rights from adjacent businesses and other water users will not be adversely affected.

176. Analysis has been undertaken to assess the total amount of water able to be taken from the Aupōuri aquifer Houhora, Motutangi and Waiparera subzones; to determine the needs of the existing development in the area in terms of the groundwater resource; and to determine whether the proposed water take will result in any adverse effects on the environment. The assessment concludes that the proposed water take will ensure the potential of the groundwater resource of the Aupōuri Aquifer will be sustained to meet the reasonably foreseeable needs of future generations and the life supporting capacity of these resources.

177. The proposed conditions on the resource consents will ensure adverse effects on the environment are avoided, remedied or mitigated.

7.2 Matters of National Importance

178. Section 6 of the Resource Management Act sets out matters of national importance that a consent authority must recognise and provide for as follows:

(a) the preservation of the natural character of the coastal environment, wetlands, lakes and rivers and their margins and the protection of them from inappropriate subdivision, use and development;

(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use and development;

(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna;

(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes and rivers;

(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other taonga;

(f) the protection of historic heritage from inappropriate subdivision, use and development;

(g) the protection of recognised customary activities.

179. Matters (b), (d) and (g) are not relevant in this case. There are wetlands and lakes within the surrounding environment, however, the assessment summarised in Section 4.11 concludes that the proposed groundwater take is unlikely to affect the natural character of these water bodies and their ecosystems.

In relation to (e), no issues regarding the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga have been raised by mandated iwi or marae representatives. Submissions provided by other parties raise concerns over the way in which water is managed in this area, but no specific effects in relation to section 6(e) matters. Further information may be provided by submitters at the hearing.

7.3 Other Matters

180. Section 7 of the Resource Management Act sets out other matters a consent authority must have particular regard to as follows:

§ kaitiakitanga (clause a);

§ the ethic of stewardship (clause aa);

§ the efficient use and development of natural and physical resources (clause b);

§ the efficiency of the end use of energy (clause ba);

§ the maintenance of amenity values (clause c);

§ the intrinsic values of ecosystems (clause d);

- § maintenance and enhancement of the quality of the environment (clause f);
- § any finite characteristics of natural and physical resources (clause g);
- § the protection of the habitat of trout and salmon (clause h);
- § the effects of climate change (clause i);
- § the benefits to be derived from the use and development of renewable energy (clause j).

181. Clauses (ba) and (j) are not relevant to these applications.

182. Section 2(1) of the Resource Management Act defines kaitiakitanga as follows:

"'Kaitiakitanga' means the exercise of guardianship by the tangata whenua of an area in accordance with tikanga Maori in relation to natural and physical resources; and includes the ethic of stewardship."

The reporting officers have recommended conditions requiring consent holders to invite mandated representatives of potentially affected iwi and marae to participate in the Water Liaison Group, including review of monitoring results and input into analysis. This provides an opportunity for mana whenua to have an active kaitiaki role in the management of the water resource within the current statutory framework.

183. Conditions of consent are recommended requiring efficient use of the water, and review of the actual water usage to enable the allocated abstraction volumes to be reduced.

184. The groundwater take will not have significant adverse effects on amenity values, the intrinsic value of ecosystems or the quality of the environment.

185. The finite characteristics of groundwater resources have been assessed, in particular the ongoing sustainability of abstractions from the Aupōuri Aquifer. The proposed water takes, should they be approved, would not result in unsustainable takes from the aquifers. An adaptive management monitoring framework is proposed to ensure that the water allocation can be decreased where adverse effects on the environment are greater than predicted and as assessed in this report.

186. The effects of climate change have been assessed in Section 4.12 of this report. The term of consent will allow any changes in recharge and water demand as a consequence of climate change to be assessed in any future application for replacement consents. Further, the GMCP allows for the reduction in water takes should the effects of the groundwater abstractions over the duration of the consent exceed what has been reasonably assessed in the application and this report.

7.4 Principles of the Treaty of Waitangi

187. Section 8 of the Resource Management Act requires a consent authority to take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi). The Treaty principle of whanaungatanga (partnership) will be encouraged through the recommended establishment of a water liaison group with mandated iwi and marae representatives invited to participate in monitoring and review of the consents.

188. Another key principle of the Treaty is the active protection of natural resources and Maori interests. The assessment of environmental effects provided in this report concludes that natural resources including significant wetlands will continue to be protected. No specific cultural concerns have been raised during the submission process.

7.5 Overall Assessment of Part 2 Matters

189. Overall, the proposal would serve the sustainable management of natural and physical resources as defined by the Resource Management Act. In particular, the groundwater resource in the area will continue to be able to meet the reasonable foreseeable needs of the existing residents and development in the area, and the extraction activity is able to be managed in a manner that will result in an efficient use of the finite groundwater resource and not result in adverse effects on the environment that are any more than minor.

8. CONCLUSION

8.1 Summary

190. The reporting officers' have considered the assessment of environmental effects provided by the applicants in support of their application. Overall, the proposed water take will not have any significant adverse effects on the environment. The recommended volume of water takes (including reductions from the volumes sought by some applicants) is considered appropriate having regard to generally accepted water usage calculations for avocado farm irrigation, actual water usage records for avocado farm irrigation in the region, SPASMO modelling for the application area, and allowance for a minimum 80% irrigation efficiency.

191. The cumulative drawdown has been predicated conservatively and the assessment indicates that groundwater takes meeting the criteria for "efficient bore takes" defined in the RWSP are unlikely to be adversely affected by the proposed abstraction. As a consequence, water rights for existing users of the groundwater resource will be protected.

192. However, as with any model, there is uncertainty with regard to the accuracy of the model due to the complexity and heterogeneity of the geological environment. It is not possible to fully and accurately determine the effects of the abstraction on the complex environmental system. Uncertainty can be managed and reduced over time by appropriate monitoring conditions as abstraction rates and volumes increase over time (known as an "adaptive management" framework) to ensure effects are consistent with those anticipated by the model. This includes requirements for a reduction or

cessation of abstraction where adverse effects, as monitored, are greater than assessed and anticipated through the processing of the resource consent applications.

193. The reporting officers therefore recommend grant of these applications and have provided recommended conditions for the Hearing Commissioners to consider. Given the similar nature in the use of water and the hydraulic system from which the abstractions are proposed, the reporting officers consider it is appropriate for a single set of conditions to apply to each consent. The wording of the conditions enables each consent to be exercised individually, or in combination with other consent holders.

Term of Consent

194. Both the RWSP (Section 37.5) and the PNRP (Section D.2.4) state that when considering the duration of a resource consent the NRC should have regard to matters such as the consistency of expiry dates in an area or catchment, the capital investment involved in the activity, the certainty of any likely environmental effects, the life of any structures involved, and the security of tenure for investment.

195. Consistency of expiry dates in an area or catchment enables a comprehensive review of all consents to be undertaken at the agreed time in the future.

196. The recommended duration for these consents, if granted, is 15 years. This proposed term equates to an expiry date in 2033, which is consistent with the expiry date of a number of other large horticultural irrigation consents in the Aupōuri aquifer.

197. This term is also considered an appropriate timeframe that will allow for the respective orchards to reach maturity so a greater level of certainty in regards to the actual water requirements will have been established. This will then allow appropriate changes to be made to the respective allocations if needed at that time, if it has not already occurred under the provisions of the review conditions of the consents. The data available from the required monitoring will enable a thorough review of the aquifer and environmental effects in the context of all groundwater water abstraction activities related to the respective subsections of the Aupōuri aquifer.

198. The term is also considered adequate to allow for financial security of investment as the orchards can be developed to full capacity during the 15 year period. Any reduction in allocation at the time of consent renewal would only occur if the required monitoring of irrigation efficiency shows that the allocated amount was not being fully utilised.

199. It is noted that the adaptive management approach proposed for these consents, and incorporated in the conditions and the monitoring programme, in tandem with the provisions for review under Section 128 of the Act, allows for any changes to be made prior to the expiry date if required.

9. RECOMMENDATION

REQ-581172 Limited Notified New and change (Stanisich)

CONDITIONS APPLICABLE TO ALL CONSENTS:

To take groundwater on (for respective legal titles of individual applicant properties Refer Table 2 of "Groundwater Take Consent Application – Motutangai Waiharara Water User Group" dated 30 August 2017), for the purpose of horticultural irrigation on that property:

Water Extraction Volumes

1 The rate of taking shall not exceed the limits set out in the following table:

Consent	Holder	Annual Limit (m^3), being 1 July to 30 June:	Daily rate of taking (m^3/day), being any 24 consecutive hours:
APP.038328.01.01	Bernard Kim & Sheryl Dianne Shine	40,000	268
APP.039332.01.01	Candy Corn Ltd, C/- Bryan Candy	80,000	537
APP.038471.01.01	Honeytree Farms Limited, C/- Tony Hayward	200,000	2,200
APP.038589.01.01	Neil & Alma Violet Thompson and Steven & Josephine Suzanne Thompson	39,350	320
APP.039345.01.01	Ongare Trust, C/- Ian McLarnon & Jason McLarnon	23,370	200
APP.038610.01.01	Mapua Avocados Ltd, C/- Murray Forlong	624,000	5000
APP.038591.01.01	Cypress Hills Ltd, C/- Alan Anderson & Carolyn Dawn Smith	41,720	280
APP.038650.01.01	Tony and Diane Hewitt	40,230	270
APP.027391.01.02	Ivan Anthony Stanisich	64,070*	1150*
APP.038454.01.01	Elbury Holdings Limited, C/- Kevin and Fiona King	113,700	763
APP.038380.01.01	Daimen & Katherine Holloway	14,900	100
APP.039381.01.01	Johno and Carol Brien (Lamb Road)	14,900	100
APP.039244.01.01	Kevin and Dani Thomas	59,600	400
APP.038420.01.01	Largus Orchard Ltd Partnership, C/- Murray Forlong (Changed from Matijevich)	193,700	1,300
APP.038513.01.01	Te Rūnanga o Ngai Takoto, C/- Rangitane Marsden	193,700	1,300
APP.038410.01.01	Georgina Tui and Mate Nickolas Covich	223,500	1,500
APP.038732.01.01	Kathy Valadares	22,350	150

***Note to Commissioners** – *Stanisich application was for a change to an existing consented take to increase the existing authorized volume from 720 m^3/day to 1,150 m^3/d (a change of 430 m^3/day), while keeping the annual volume the same as existing (120,000 m^3/annum). The volumes expressed in the application documents for the annual equivalent reflect the implied annual change associated with the daily increase for the purposes of the model in the AEE assessment.*

Notification of Irrigation

2 The Consent Holder shall advise the council's assigned Monitoring Officer in writing when irrigation is to commence for the first time each season, at least five days beforehand.

Metering and Abstraction Reporting

3 The Consent Holder shall install a meter to measure the volume of water taken, in cubic metres, from each production bore. Each meter shall:

(a) Be able to provide data in a form suitable for electronic storage;

(b) Be sealed and as tamper-proof as practicable;

(c) Be installed at the location from which the water is taken; and

(d) Have an accuracy of +/-5%.

The Consent Holder shall, at all times, provide safe and easy access to each meter installed for the purposes of undertaking visual inspections and water take measurements.

4 The Consent Holder shall verify that the meter required by Condition 3 is accurate. This verification shall be undertaken prior to 30 June:

(a) following the first taking of water from each production bore; and

(b) at least once in every five years thereafter.

Each verification shall be undertaken by a person, who in the opinion of the council's Compliance Manager, is suitably qualified. Written verification of the accuracy shall be provided to the council's Assigned Monitoring Officer by 31 July following the date of each verification.

5 The Consent Holder shall, using the meter required by Condition 3, keep a record of the daily volume of water taken from each production bore in cubic metres, including all nil abstractions.

6 If the instantaneous rate of taking is equal to or greater than 10 litres per second, then the water meter required by Condition 3 shall be telemetered so that council can freely access the information at any point in time. The telemetry connection shall be agreed to by the council's Hydrology Manager.

7 The Consent Holder shall measure, and keep a record of, the static water level in each production bore at least once each month. This measurement shall be taken at least 12 hours after cessation of pumping.

8 A copy of the records required to be kept by Conditions 5 and 7 for the period 1 July to 30 June (inclusive) shall be forwarded each year to the council's assigned Monitoring Officer by the following 31 July. In addition, a copy of these records shall be forwarded immediately to the council's assigned Monitoring Officer on written request. The records shall be in an electronic format that has been agreed to by the council.

Advice Note: *If no water is taken during the period 1 July to 30 June (inclusive) then the Consent Holder is still required to notify the council's Monitoring Manager in writing of the nil abstraction. Water use record sheets in an electronic format are available from the council's website at www.nrc.govt.nz/wur.*

9 Easy access for a water level probe shall be provided and maintained at the production bore well head to enable the measurement of static water levels in the bore.

Water Use Efficiency

10 The Consent Holder shall prepare an Irrigation Scheduling Plan (ISP) which outlines how irrigation decisions will be made. The ISP shall be prepared by a suitably qualified and experienced person and submitted to the council's Compliance Manager for written approval. The ISP shall, as a minimum, address:

- § water balance and crop water requirements;
- § subsurface drainage; and
- § overall irrigation strategy.

For each irrigation area, the ISP should include:

(a) a description of how water requirement for each irrigation cycle is calculated;

(b) method(s) for assessing current soil moisture levels;

(c) method(s) for assessing potential evapotranspiration (PET) and rainfall to date;

(d) assessment of other inputs such as effluent irrigation and effect on irrigation requirement;

(e) soil moisture target to be maintained in each zone by irrigation;

(f) how measured data will be used to assess irrigation requirements over the next irrigation cycle; and

(g) a description of proposed method(s) for remaining within consent limits at each borehole or group of boreholes.

Advice Note: *The ISP seeks to ensure that an irrigation efficiency of a minimum 80% is achieved.*

11 The Consent Holder shall not exercise this consent until approval for the ISP required to be prepared in accordance with Condition 10 has been approved by the council's Compliance Manager.

12 The ISP approved in accordance with Condition 11 shall be implemented prior to the first irrigation season, unless a later date has been approved in writing by the council's Compliance Manager.

13 The Consent Holder shall, within six months of the first exercise of this consent, undertake an audit of the irrigation system using a suitably qualified and experienced person. The irrigation system audit shall be prepared in accordance with Irrigation New Zealand's "Irrigation Evaluation Code of Practice" (dated 12 April 2010), including recommendations on any improvements that should be made to the system to increase water efficiencies. The results of the audit and its recommendations shall be submitted in writing to the council's assigned Monitoring Officer within one month of the audit being undertaken.

14 The Consent Holder shall, within three months of notification in writing by the council's Compliance Manager, implement any recommendations of the audit referred to in Condition 13.

15 The reticulation system and components shall be maintained in good working order to minimise leakage and wastage of water.

16 There shall be no significant ponding of irrigated water within any irrigated area, or significant runoff from either surface or subsurface drainage to a water body, as a result of the exercise of these consents.

Monitoring and Contingency Measures

17 Prior to first exercise of this Consent, the Consent Holder shall submit a Groundwater Monitoring and Contingency Plan (GMCP) to the Northland Regional Council. The GCMP shall be prepared by a suitably qualified and experienced person and submitted to the council's Compliance Manager for written approval. The GCMP shall be generally in accordance with Schedule 1 of this consent and address the following matters:

- The location and physical details of individual monitoring sites.
- Specific details of monitoring to be undertaken at each site including the parameters to be measured and the frequency (and/or duration) of monitoring.
- Methods/procedures/standards to be adopted for the collection, management, archiving and reporting of monitoring results.
- Details of any arrangements in place for the collection, analysis and reporting of monitoring results by third parties.
- The form, content and frequency at which monitoring results will be reported to the council.
- Specific triggers for groundwater level and/or groundwater quality at each individual monitoring site. Multiple triggers may be specified for individual sites, each linked to a specific set of mitigation actions.
- Requirements for the reporting of trigger level exceedances to the council.
- Specific details of mitigation to be initiated in the event of a trigger level exceedance including:
  - Review/evaluation of monitoring data (particularly with respect to the magnitude of anticipated environmental effects).
  - Increases in the frequency and location of monitoring.
  - Changes to parameters being monitored.
  - Further hydrogeological, hydrological or water quality investigations to identify the potential causes of the trigger level exceedance.
  - Specific reductions in the rate/volume of groundwater abstraction.
- Development of strategies to avoid future trigger level exceedances.
- A process for reviewing and summarising monitoring results to support the staged development approach.
- A timeline and procedure for periodic review and updating of the GCMP to account for future water use, variations to prevailing environmental conditions and changes in access to monitoring sites.

Advice Note: *It is anticipated that a single GCMP will be prepared and submitted on behalf of all consent holders within the Motutangi-Waiharara Water Users Group.*

18 The exercise of this consent shall not prevent any other person who has consent to take groundwater, which was issued prior to 26 October 2017, from fully exercising that consent.

Advice Note: *The date specified in Condition 18 is the date that the application for this consent was notified.*

19 To prevent saline contamination, the council may require the Consent Holder to cease the exercise of this consent at all such times as the trigger levels specified in the approved GCMP are exceeded.

Community Liaison Group and Meetings

20 The Consent Holder shall, for the purpose of discussing matters relating to this consent, including the results of monitoring and input into any review of conditions, form and maintain (including providing all administrative support) a water user group (hereafter referred to as the Aupōuri Water User Liaison Group (AWULG). The AWULG shall invite representatives of consent holders/groundwater users; mandated representatives from Te Aupōuri, Ngai Takoto, Ngāti Kuri, Te Rarawa, Ngāti Kahu, Te Potahi Marae, Kaimaumau Marae, Paparore Marae and Waiora Marae; the Department of Conservation; Far North District Council; and the Northland Regional Council.

21 The Consent Holder shall hold a meeting of the AWULG not less than once every year in August. Prior to the meeting, the Consent Holder shall provide a copy of the Annual Monitoring Report required to be prepared in accordance with Condition 22 and a summary of the water use records and static water level monitoring result for the same period as the report to each representative of the group. The meeting shall be held at a time and venue convenient for the majority of the AWULG members.

Reporting

22 The Consent Holder shall prepare an Annual Monitoring Report (AMR) for the period 1 July to 30 June (inclusive) and forwarded a copy to the council's assigned monitoring officer by the following 31 July. The AMR shall include, but not be limited to, the results, update and summary report of the monitoring undertaken as required by the GCMP.

Advice Note: *It is anticipated that a single Annual Monitoring Report will be prepared and submitted on behalf of all consent holders within the Motutangi-Waiharara Water Users Group.*

Review Condition

23 The council may, in accordance with Section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions annually during the month of June for any one or more of the following purposes:

(a) To deal with any adverse effects on the environment that may arise from the exercise of the consent and which it is appropriate to deal with at a later stage; or

(b) To review the allocation of the resource.

The Consent Holder shall meet all reasonable costs of any such review.

Lapsing Condition

24 This consent shall lapse on the **30 April 2023**, unless before this date the consent has been given effect to.

Advice Note: *An application can be made to the council in accordance with Section 125 of the Act to extend the date after which the consent lapses. Such an application must be made before the consent lapses.*

EXPIRY DATE:	**ALL EXCEPT STANISICH**	**30 NOVEMBER 2033**
EXPIRY DATE:	**STANISICH**	**30 NOVEMBER 2025**

SCHEDULE 1: REQUIREMENTS FOR GROUNDWATER MANAGEMENT AND CONTINGENCY PLAN (CONDITION 17)

1. INTRODUCTION

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

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

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

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

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

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

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

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

The Groundwater Management Plan will also provide information as to the actual effects of the abstraction on the groundwater resource and enable validation of the numerical model by the Consent Holders for any replacement application of the consent to take groundwater.

This schedule sets out the requirements to be addressed in the GCMP required by Condition 17. Any deviation from this schedule must be in response to additional technical information provided to NRC by the consent holder, including baseline monitoring results. Additional information supporting any change to the recommendations in this schedule must be provided with the GCMP for approval by NRC under Condition 17 prior to the commencement of groundwater abstraction.

2. SENTINEL BORES

Sentinel bores will be utilised as the primary reference sites for regional groundwater levels and quality.

Sentinel bores will be continuously monitored for water levels and electrical conductivity in individual piezometers to provide an indication that water groundwater levels are approaching a threshold where the risk of saline intrusion is increased and identify any variation in water quality that could indicate the landward migration of the saline interface.

Details of the location of the new sentinel bores as set out in Table 1 below will be required as part of the GCMP.

TABLE 1: Sentinel Monitoring Bores

Monitoring Bore/ Bore Number	Indicative Depth/ Piezometer ID	Parameter	Indicative Trigger level[3]
NRC Waterfront 200210	1	Water Level	2.0 m asl
	2	Water Level	2.0 m asl
	3	Water Level	1.5 m asl
	4	Water Level	1.5 m asl
NRC Kaimaumau	Shallow (<10 m) (LOC.315766)	Water Level Electrical Conductivity	1.0 m asl 60 mS/cm >x departure from baseline
	Deep (LOC.316222)	Water Level Electrical Conductivity	2.0 m asl 60 mS/cm >x departure from baseline
Motutangi[1]	Shallow (<10m)	Water Level Electrical Conductivity	1.0 m asl 60 mS/cm >x departure from baseline
	Deep (shellbed)	Water Level Electrical Conductivity	2.0 m asl 60 mS/cm >x departure from baseline
Norton Road[2]	Shallow (<10m)	Water Level Electrical Conductivity	1.5 m asl 60 mS/cm >x departure from baseline
	Deep (shellbed)	Water Level Electrical Conductivity	2.0 m asl 70 mS/cm >x departure from baseline

1 New sentinel monitoring bore comprising shallow (<10 metres) and deep (shellbed) piezometers, constructed in the Motutangi sub-area. The bore will be located:

- east of Far North Road
- as close to the margin of Kaimaumau wetland as practicable
- >1 kilometre from any existing/proposed groundwater abstraction

2 New sentinel monitoring bore comprising shallow (<10m) and deep (shellbed) piezometers, constructed in the Norton Road area:

- within 500 m of the coastal marine area
- as far as practicable from any existing/proposed abstraction

3 Groundwater level and electrical conductivity triggers for individual monitoring bores/piezometers will be established on the basis of an analysis of background values at each site and agreed with the NRC. Triggers may include numerical triggers for individual parameters as well as thresholds for departure from a reference baseline (expressed in terms of numerical values or x% of the baseline).

3. SALINE INTRUSION MONITORING

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

Proposed monitoring sites include:

- the existing Fishing Club bore at Houhora (monitored quarterly by NRC).
- the existing shallow and deep Kaimaumau sentinel bores (monitored quarterly by NRC).
- a new or existing bore in or near the Kaimaumau settlement accessing the shallow sand aquifer (<20 metres).
- a new or existing bore in or near the Kaimaumau settlement accessing the shellbed aquifer (>50 metres).
- proposed production bores in the Norton Road area located within 1 km of the coastal marine area.

Salinity indicators monitored shall include:

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

The GCMP shall specify additional monitoring and contingency measures to be undertaken in the event that any nominated trigger is exceeded in an individual monitoring bore/piezometer.

A recommended monitoring schedule is set out in Table 2 below. Any deviation from this schedule must be in response to additional technical information including baseline monitoring results, and provided with the GCMP for approval by NRC under Condition 17 prior to the commencement of groundwater abstraction.

TABLE 2: Proposed Monitoring Schedule – Saline Intrusion

Monitoring Bore	Area	Parameter	Frequency	Indicative Trigger Level[1]
Fishing Club (NRC)	Houhora	Salinity Indicators + major ions	Quarterly	§ EC > 60 mS/cm § Chloride >100 mg/L § Departure of any individual parameter >x from baseline
NRC Kaimaumau sentinel (shallow)	Kaimaumau	Salinity Indicators + major ions	Quarterly	
NRC Kaimaumau sentinel (shallow)	Kaimaumau	Salinity Indicators + major ions	Quarterly	
Kaimaumau Settlement - shallow (<20 metres)	Kaimaumau	Salinity Indicators	Quarterly	
Kaimaumau Settlement - deep (>50 metres)	Kaimaumau	Salinity Indicators	Quarterly	

Monitoring Bore	Area	Parameter	Frequency	Indicative Trigger Level[1]
APP.038328.01.01	Norton Road	Salinity Indicators	Quarterly	
APP.038380.01.01	Norton Road	Salinity Indicators	Quarterly	
APP.038454.01.01	Norton Road	Salinity Indicators	Quarterly	

[1] *Specific triggers for individual monitoring bores will be agreed with the NRC once baseline data is available to characterise water quality at each monitoring site*

4. WATER LEVEL MONITORING

Monthly water level monitoring is required in all MWWUG production bores during the winter months (nominally May to September) to provide information to identify any inter-annual variations in aquifer storage which may be anomalous compared to regional trends. No specific triggers will be established for this monitoring.

Water level monitoring is also required in a shallow observation bore adjacent to the APP.038471.01.01 production bore to quantify any localised drawdown effects in the shallow sand aquifer in the vicinity of a relatively large abstraction proximal to Kaimaumau Wetland. This monitoring information will enable comparison of shallow water levels in the vicinity of a significant concentration of abstraction (within the area of maximum in the shallow aquifer modelled in the AEE), with those recorded in the shallow piezometers in the four sentinel bores distributed across the wider Aupōuri Aquifer.

TABLE 3: Proposed Monitoring Schedule – Water Levels

Monitoring Bore	Area	Parameter	Frequency
All MWWUG production bores	Houhora, Motutangi, Waiparera	Water Level	Monthly
APP.038471.01.01 shallow observation bore	Motutangi	Water Level	Continuous

5. WATER QUALITY MONITORING

Water quality monitoring shall be established in shallow piezometers located down-gradient of representative orchard areas in the Motutangi and Waiparera sub-areas. Piezometers shall be sampled on a six-monthly basis for major ions and nutrient concentrations. It is also recommended that annual sampling is undertaken for any pesticides identified in the GCMP which exhibit characteristics which increase the potential to leach to groundwater (e.g. persistent, soluble, mobile).

It is recommended the GCMP include provision for periodic review of groundwater quality monitoring results as well as the nature and scope of continued monitoring.

TABLE 5: Proposed Monitoring Schedule – Water Quality

Sub-area	Location	Parameter	Frequency
Motutangi	Shallow piezometers down-gradient of two	- Electrical Conductivity - Major ions - Dissolved reactive phosphorus	Six monthly, with a review of monitoring results after five years

Sub-area	Location	Parameter	Frequency
Waiparera	representative planted areas	- Nitrate - Ammoniacal Nitrogen - Total Nitrogen - Annual pesticide screen (targeting any persistent, leachable compounds identified in the GCMP which are identified as being in widespread use)	(to assess value of continued monitoring)

6. IMPACT ON EXISTING USERS

In the event that there is a query or complaint as to potential effects of exercise of the consent, the Consent Holder and the council's Monitoring Manager shall be notified of the receipt of the complaint/query.

The complaint/query will be registered on the Northland Regional Council Incident Database and processed in accordance with the procedures set out in the "Northland Regional Council Incident Procedure Manual".

Staff of the Northland Regional Council will carry out an investigation as soon as is practicably possible to assess if the water level decline is likely to be attributable to the exercise of the consent.

This investigation will review the Consent Holder's monitoring records and the SOE monitoring results. If, in the opinion of the council's Monitoring Manager the water level decline may be attributable to the exercise of the consent, the Consent Holder will immediately initiate the Mitigation Plan as detailed in Section 7.

In accordance with Northland Regional Council policy, in the event that an investigation determines that the effects are attributable to the exercise of one or more of the consents held by members of the Water Users Group, the relevant Consent Holder(s) shall meet the actual and reasonable costs of the investigation.

7. MITIGATION PLAN

The GCMP shall set out a Mitigation Plan to be initiated immediately upon the relevant Consent Holder(s) receiving notification from the council's Monitoring Manager, and/or any of the trigger levels set out in the GCMP being exceeded.

Mitigation measures shall include:

- Review/evaluation of monitoring data (particularly with respect the magnitude of anticipated environmental effects).
- Increases in the frequency and location of monitoring.
- Changes to parameters being monitored.
- Further hydrogeological, hydrological or water quality investigations to identify the potential causes of the trigger level exceedance.
- Specific reductions in the rate/volume of groundwater abstraction.
- Development of strategies to avoid future trigger level exceedances.

ATTACHMENT 1

Attachment 1 - List of submitters		
Affected water users		
1	Wayne + Vicki Black	Oppose
2	Ivan Mark Buselich	Neutral
3	PS & MJ Byers & GA Carnaby. Buyers family trust.	Oppose
4	Kathleen Mary Cotching	Oppose
5	Philip & Vivien Cullen	Oppose
6	Antony Jon Delaney	Oppose
7	Robert Leslie Denison	Oppose
8	Robyn Lynette Denison	Oppose
9	Walter Edmund & Judith Ann Hilton-Jones	Oppose
10	Walter Edmund + Judith Ann Hilton-Jones	Oppose
11	Walter Edmund + Judith Ann Hilton-Jones	Oppose
12	Walter Edmund + Judith Ann Hilton-Jones	Oppose
13	KSL Ltd	Support
14	Diane Laurenson	Oppose
15	Deane Colin Moyle	Support
16	Pukenui Lodge Motel	Oppose
17	N. C. Rouse and CAH Madrid	Support
18	Sheryl Diane Shine	Support
19	George Joseph Stanisich	Oppose
20	Richard Sucich	Oppose
21	Te Taumata Kaumatua O Ngati Kuri Research Unit	Oppose
22	Jennine Marie Vandermey and others	Oppose
23	Jeff Wagener	Oppose
24	Wharemaru Farm Trust	Oppose
25	Donald Edward Woodcock	Oppose
26	Ljubo Bacica	Oppose
27	William Joseph Evans	Support
28	Croydon & Dianne Thompson	Support
29	Ada Hobson	Oppose
30	H Cook C/- A Thompson	Support
31	P & J D Matijevich	Support
32	N G Rouse and C A H Madrid	Support
33	Vernon and Rosie Ireland	Neutral
34	Vernon and Rosie Ireland and Paula Ireland	Neutral
35	Alan Gordon Nunns	Oppose
36	Judith Mary Wright	Oppose
37	Bainbridge	Neutral
38	Shane Bell	Support
39	Ivan Anthony Stanisch	Support
40	Katherine Valadares	Oppose
41	Far North Farms Ltd	Neutral
42	Far North Avos Ltd	Neutral

43	Ian Fulton	Oppose
44	Eric John Wagener	Oppose
45	Pfaendder	Oppose
46	Stted & Johnson	Oppose
47	Jeniffer Larson	Oppose
48	Alan Macrae and T Burkhardt	Oppose
49	Sandra Simpkin and Hadyn Exley	Oppose
50	Robert Cambell Family Trust	Neutral
51	Antony Charles and Angela Isobell Payton	Oppose
52	Gobox Limited	Oppose
53	Norman Ashley Bryan	Oppose
55	Croydon and Dianne Thompson	Support
56	A Burgoyne	Oppose
Department of Conservation		
57	Department of Conservation	Oppose
Mana whenua representatives		
58	Te Runanga Nui o Te Aupouri Trust (c/o Mike Stevens)	Oppose
Unaccepted submission referred to in report		
*59	Whiti Awarau (Ngai Takoto) - refer Section 3.1.3 of the hearing report	Oppose

ATTACHMENT 2

Water Use Assessment

Prepared by A D Stride, NRC Water & Wastes Management Officer
February 2018

Due to the disparity between the volumes requested by some applicants and the previously understood estimated water requirements for Avocado orchards and assertions that higher water requirements occur for orchards in the Aupōuri Peninsula, the council undertook a broad assessment of the water use records for five established orchards in the Aupōuri region that covered the areas where these new applications for the MWWUG group are located. The orchards were chosen for both their location, and their long-term (minimum 10-year) water use data and mature tree status.

Due to time constraints and a number of limitations associated with historic water use recording, its important to note that at this stage, the assessment was broad and not definitive, and is only to be used as a guide to inform the decision-making process, along with other known guidelines the council utilises to assess efficient water use.

The council uses a tool generated by Plant and Food Research for assessing reasonable water use for the northland region called SPASMO-IR (Soil Plant Atmosphere System Model – Irrigation), which calculates the irrigation requirements for a range of crops, in various locations in Northland using localised soil and meteorological data. The model estimates the water requirements for an area of land based on crop, soil, and meteorological conditions using climate data from locations around the region.

It is normal for the Regional Council to utilise the P10 value (a one in 10-year dry year event), with an extra allowance of 20% to provide an operational margin that accounts for application efficiency and variations in root depth or drought tolerance.

However, the council has determined some errors in its more advanced SPASMO software (version 2.1), such that it is considered unreliable for use at this time. An earlier version of the tool with more limited parameters may still be used as a broad guide, and has been included in this assessment.

For the council's assessment of existing water use, data provided by the respective consent holders of established orchards was extracted from the files and entered into the council's database (Hilltop) and monthly and annual totals for each irrigation season between 2006-2007 and 2016-2017 were assessed. Annual and monthly totals and averages were determined for each year on the record, and also averaged over the entire record. In addition, maximum (drought year) daily, monthly, and annual totals were derived. The average and maximum m^3/ha/year, and m^3/ha/day volumes were calculated for each property.

To be consistent with normal council assessment, the drought year data was utilised in the water use assessment for comparison with each applicant's property, and to derive the estimated volumes required for each applicant's property. This is to ensure that the effect of the proposed water use under a worst case scenario is captured and assessed. This is considered a conservative approach to management of the aquifer, as it assumes a worst-case scenario that, in by definition will only occur once every five or 10. It ensures that during those drought years, the aquifer will not be over-allocated, and during non-drought years, water use will be lower. This approach also ensures that the volume allocated to each applicant is sufficient to cover drought years, and provides for better security of supply for the Consent Holder.

Review clauses included in all consents allow for a review of the water use and subsequent reduction in allocation if the water use records show consistent significant reduction in volume being utilised even in drought years.

To enable a level of comparison between the existing orchards, and the MWWUG applicants, the fundamental soils for each property from both the existing consents as well as for each applicant's property associated with the MWWUG group were extracted from the council's GIS maps and described for each property. Each applicant's requested water volume was then compared against the data for the existing orchard property(s) that most closely matched the soil type on the individual applicant's property, as well as an average of all five the existing orchard group combined, as well as the SPASMO-IR Ver 1.2 outputs for the nearest soil type(s) available in the software. All derived estimates, both from existing orchards consents data, as well as for SPASMO 1.2 data, include a 20% increase to provide an operational margin that accounts for application efficiency and variations in root depth or drought tolerance.

It is noted that some applicant's properties have some soil types that were not the same as the soils in the existing five representative orchards properties. For example, there were some clay based soils in properties near Waiparera Stream that were not found in any of the existing orchards analysed, so an average of the most appropriate existing orchards was used for their water use assessment, as well as various soil type options for SPASMO-IR version 1.2.

Table 1 shows the summary of the data from the existing orchards whose 10-year water use records were analysed. There was significant diversity in water demand between the established orchards studied, and the reason for this was difficult to identify from the limited information available, and the method of water use recording employed over the past 10 years, but could be due to soil type and localised climate variations, as well as irrigation and orchard practices for each individual property. But the sample is considered to cover the likely range of per ha water demand in the Aupōuri area, and thus provides a useful comparison range to determine likely water demand for the applicant properties, along with the SPASMO 1.2 tool.

The assessment of the existing orchard historical data clearly shows that in some of the soil types and conditions encountered in the Aupōuri aquifer, there appears to be justification for a higher application rate than the general "rule of thumb" of 25 m^3/ha/day, particularly around the Motutangi area, and Paparore east area. However, the unknown nature of the variables, the diversity of soil types on each property, and lack of robustness of the available water use data and information for the cases studied does not allow for definitive statements about the exact water use requirement for each property or soil type at this time, but indicates an appropriate range, which has been utilised in the estimates for the MWWUG properties.

Table 2 shows the summary outcomes of the assessment of water requirements and recommendations for the MWWUG group applications, and Table 3 shows the derived data for each applicant. Most of the requested volumes for each applicant were found to be generally consistent with, and within the range of, the estimated volume requirements for each property, based on the derived values from the existing orchard data and SPASMO 1.2 estimates, allowing for the aforementioned uncertainties and 20% efficiency factor.

However, a small number of applicants did appear to have requested application rates that did not seem to be justified in the context of the existing orchards water use assessment, as well as SPASMO estimates, and these were therefore recommended to be revised down to more appropriate rates and volumes. The applicant's that had recommended reduction in their water volume are shown in grey shading in Table 2 (including one applicant, Honeytree, who voluntarily requested a reduction in water volume and proposed area for irrigation).

Please note, however, that while the annual volumes for some applicants have been revised lower, the daily maximums in most cases have remained the same as applied for. This is to allow for the possible maximum daily requirements during an individual day during a drought scenario. So, while the setting of a higher maximum daily limit allows for a limited time of higher daily take to cover the highest water requirements during the driest month in a drought year, which may occur once every five years during the term of the consent, the average daily use for the season will be lower than the maximum daily rate, which is reflected in the annual allocation limit, and effectively prevents the use of the highest rate for the entire season.

TABLE 1: Summary of Data for Existing Orchards

Consent Name	Location	Total Annual Volume per (m³/ha)		Max season	Daily vols/ha in max season (m³/ha/d)		Soil type
		11-year average	max year		120 day season	151 day season	
Freeman	Hukatere Road	1257	2574	2009-2010	21.5	17	100% sand
Shirttail	Motutangi	2561	3643	2009-2010	30	24	80% peaty sand; 20% sand
Fulton	Norton Road, Kaimaumau	1603	2151	2012-2013	18	14	75% Peaty sand; 25% Sandy Loam
FNF	Paparore east	3481	4830	2012-2013	40	32	40% Sand; 40% sandy loam; 20% Peaty sandy loam
Valicic	Paparore west	1859	3032	2012-2013	25	20	55% Peaty sandy loam; 40% sand; 5% sand

TABLE 2: Volumes Requested by Applicant and NRC Recommended Volumes

Applicant	Application Number	Volumes and area applied for*			Soil Type	Volume Recommended by NRC	Comments
		Volume m³/day		Ha			
		m³/d	m³/year				
APP.038610.01.01	Mapua Avocados Limited C/- Murray Forlong	5,000	745,000	160	80% sand, 10% peaty sandy loam, 10% sandy loam	624,000 m³/annum 5000 m³/day (reduction)	Annual vol at 39 m³/ha/d too high. 31-32 m³/ha/d (incl 20% efficiency factor) based on WUR of existing consents in area. Daily max ok to cover driest day.
APP.038471.01.01	Honeytree Farms Limited C/- Tony Hayward	?	200,000	70	70% peaty sand, 10% sand, 15% loamy peat, 5% sandy loam	200,000 m³/annum 2200 m³/d	Applicant reduced irrigation area and requested reduced annual volume
APP.038410.01.01	Georgina Tui & Mate Nickolas Covich	1,500	223,500	70	40% peaty sand, 30 % sand, 15% peaty sandy loam and 15% loamy peat	As requested	
APP.038420.01.01	Largus Orchard Limited Partnership C/- Murray Forlong	1,300	193,700	60	70% fine sandy peat, 20% peat sandy loam, 5% sand, 5% clay	As requested	
APP.038513.01.01	Te Rūnanga o Ngāi Takoto C/- Rangitane Marsden	1,300	193,700	60	85% loamy peat, 10% peaty sand, 5% sandy loam	As requested	
APP.039332.01.01	Candy Corn Ltd C/- Logan King	537	80,000	20	100% sand	As requested	
APP.038454.01.01	Elbury Holdings Limited C/- Kevin & Fiona King	763	113,700	30	50% clay, 50% peaty sandy loam	As requested	
APP.038328.01.01	Bernard Kim & Sheryl Dianne Shine	268	40,000	10	95% clay, 5% Peaty silt loam	As requested	
APP.027391.01.02	Ivan Anthony Stanisich	430	64,070	17	50% sand, 30% clay, 20% peaty sandy loam	As requested	
APP.039244.01.01	Kevin & Dani Thomas	400	59,600	16	100% sand	As requested	
APP.038589.01.01	Neil & Alma Violet Thompson and Steven & Josephine Suzanne Thompson	320	47,680	9	80% peaty sandy loam, 20 % sand	39,350 m³/annum 320 m³/day (reduction annual)	44 m³/ha/d too high. Reduced to 36 m³/ha/d (incl 20%) based on WUR of existing consents in area
APP.038650.01.01	Tony and Diane Hewitt	270	40,230	10	100% peaty sandy loam	As requested	
APP.038591.01.01	Cypress Hills Limited C/- Alan Anderson & Carolyn Dawn Smith	280	41,720	9	50% sand, 50% peaty sandy loam	As requested	
APP.039345.01.01	Ongare Trust C/- Ian McLarnon & Jason McLarnon	200	29,800	6	100% sand	23,370 200 (reduction annual)	41 m³/ha/d too high 32 m³/ha/d (incl 20%) based on WUR of existing consents in area
APP.38732.01.01	Kathy Valadares	150	22350	8	100% sand or 90% peaty sandy loam; 10% sandy loam	As requested	
APP.038380.01.01	Darren & Katherine Holloway	100	14900	4	100% peaty sand	As requested	
APP.039381.01.01	Johno and Carol Brien (Lamb Road)	100	14900	4	100% sand	As requested	

APPENDIX 3-A

TABLE 3: **Table showing results of derived estimates for each applicant using SPASMO 1.2 and existing orchard data**
(SP=spasmo; Sh=Shirttail; FNF = Far North Farms, F = Fulton, V = Valicic; Fr = Freeman)

Applicant	Volume Requested					Soil Comparison (+20%)			
	Ha	Annual	Daily Max		(sp=spasmo)	Annual	Daily (120)		
Thomas	16	59600	400		SP-TK sand	59520	496		grant as requested
					Freeman	49416	412		
					avg all existing	62319	519		
Brien & Carr	4	14900	124		SP-TK sand	14880	124		grant as requested
					Freeman	12354	103		
					avg all existing	15580	130		
McLarnon	6	29800	238		SP-TK sand	22,320	186		reduce - applied for rate too high,
					Freeman	18531	154		
					avg all existing	23370	195		
Valadares	8	22350	150		SPASMO TK sand	29760	248		grant as requested
					SP OTP Peaty sandy loam	22080	184		
					Freeman	24708	206		
					Shirttail	34974	291		
					avg all existing	31160	260		
Mapua	160	745000	5000		SP - Tksand	595200	4960		reduce - annual too high rate
					Freeman	494160	4118		62400 5000
					avg all existing	623192	5193		
Candy Corn	20	80000	537		SP - Tksand	74400	620		grant as requested
					Freeman	61770	515		
					avg all existing	77899	649		

Applicant	Volume Requested					Soil Comparison (+20%)			
	Ha	Annual	Daily Max		(sp=spasmo)	Annual	Daily (120)		
Thompson	9	47680	320		SP-TK sand	33480	279		reduce annual too high rate
					SP-OTP Peaty sandy loam	24840	207		
					Shirttail	39346	328		39350 320
					avg all existing	35055	292		
Cypress Hills	9	41,720	280		SP-TK sand	33480	279		grant as requested
					SP- OTP psl	24840	207		
					Sh+FNF + Valicic	41416	345		
					avg all existing	35055	292		
Covich	70	223,500	1500		SP-TK sand	260400	2170		grant as requested
					SP- OTP psl	193200	1610		
					F+SH+V	247115	2059		
					avg all existing	257314	2144		
Honeytree	70	200000			SP-TK sand	260,400	2170		grant as requested
					SP- OTP psl	193200	1610		daily 2200
					Sh+F	254184	2118		
					avg all existing	284799	2373		
Ngai Takoto	60	193700	1300		SP-TK sand	223,300	1860		grant as requested
					SP- OTP psl	165600	1380		
					Valicic	218286	1819		
					avg all existing	233697	1947		
Holloway	4	14900	100		SP-TK sand	14,880	124		grant as requested
					SP- OTP psl	11040	92		
					F+SH	13905	116		
					avg all existing	15580	130		

Applicant	Volume Requested					Soil Comparison (+20%)			
	Ha	Annual	Daily Max		(sp=spasmo)	Annual	Daily (120)		
Shine	10	40,000	268		SP-TK sand	37200	310		grant as requested
					SP-Okaihau gravelly clay	38400	320		
					FNF+SH+V	46018	383		
					avg all existing	38949	325		
Elbury (king)	30	113700	763		SP-TK sand	111,600	930		grant as requested
					SP- OTP psl	82,800	690		
					SP-Okaihau gravelly clay	115,200	960		
					Sh+FNF+V	138055	1150		
					avg all existing	116,848	974		
Stanisich	17	64070	430		SP-TK sand	63240	527		grant as requested
					SP-Okaihau gravelly clay	65280	544		
					SP-Oakihau silty clay loam	63240	527		
					SP-OTP peaty sand	46920	391		
					FNF+V	80187	668		
					Avg all	66214	552		
Hewitt	10	40230	270		SP-TK sand	37200	310		grant as requested
					SP- OTP psl	27600	230		
					SP-Huk loam	31200	260		
					SP-Okaihau silty clay loam	37200	310		
					Valicic	36381	303		
					avg all existing	38949	325		
Largus	60	193700	1300		SP-TK sand	223200	1860		grant as requested
					SP-Okaihau silty clay loam	223200	1860		
					SP-Huk loam	187200	1560		
					SP- OTP psl	165600	1380		
					FNF+F+SH+Fr	237550	1980		
					avg all existing	233697	1947		