

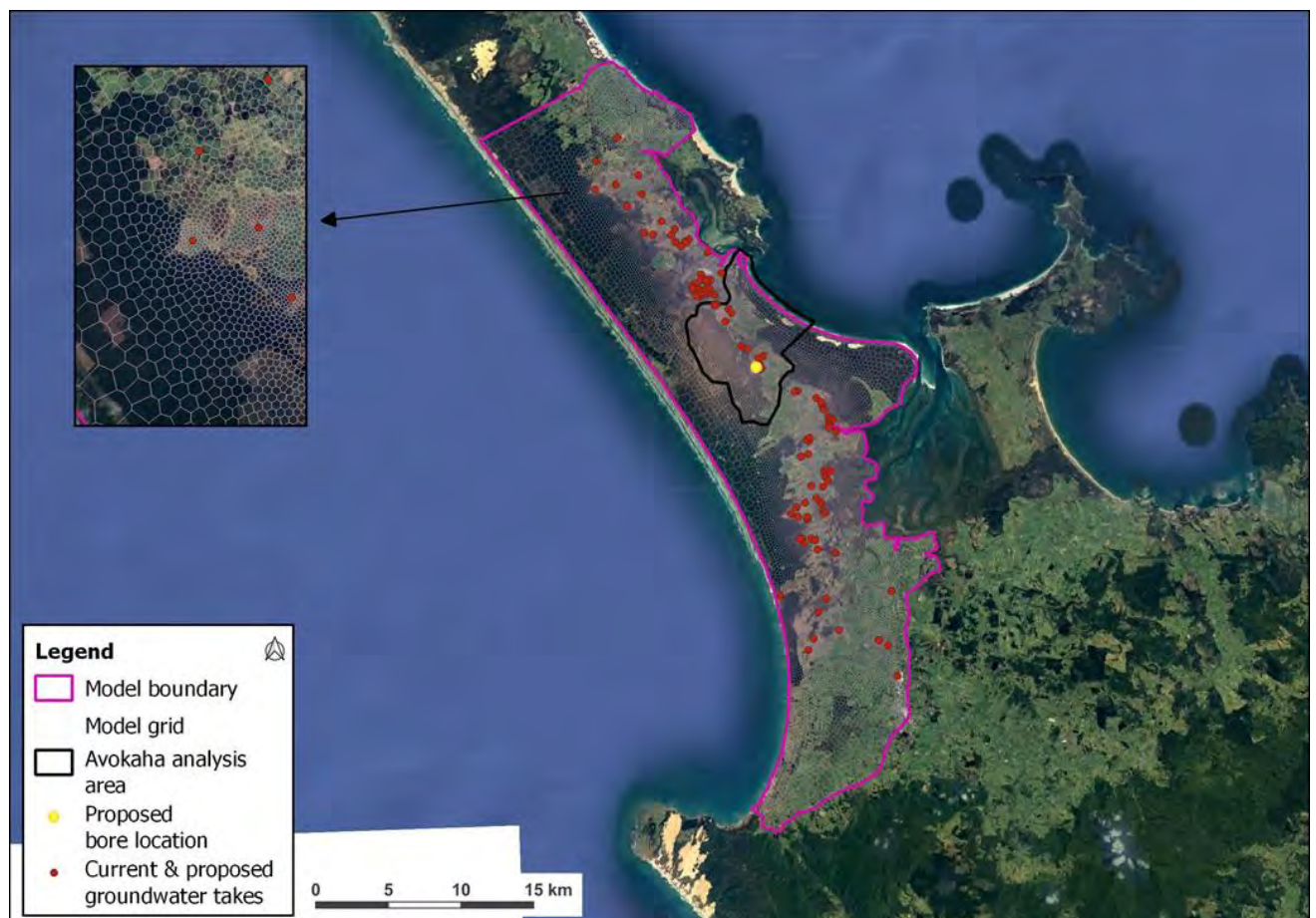
Irrigation Water Take Consent

Resource Consent Application & Assessment of Environmental Effects

AVOKAHA LIMITED

WWA0113| Rev. Final

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Irrigation Water Take Application

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1. Introduction

This document and attachments, prepared on behalf of Avokaha Limited (Avokaha) comprise a Resource Consent Application and an Assessment of Environmental Effects associated with a water take permit for irrigation of an 8-hectare Orchard at 70 Turk Valley Rd, Motutangi.

The background details of this application using Northland Regional Council's (NRC) "Application for Resource Consent" form is provided in **Appendix A**. Further details of various items where marked on the form are provided in the **Section 2**.

1.1 Report Structure

The report comprises:

- **Section 2** – a description of the proposed activity and suggested consent conditions;
- **Section 3** – background details of the application;
- **Section 4** – an assessment of environmental effects;
- **Section 5** – an assessment of cultural effects;
- **Section 6** – an assessment of statutory considerations;
- **Section 7** – a discussion of the notification process;
- **Section 8** – a discussion on consideration of consultation; and
- **Section 9** – summary and conclusions.

2. Description of Proposed Activity

2.1 Location

Figure 1 provides a map of the project area. The subject bore is located at the end of Turk Valley road, Motutangi (see **Appendix A**) and is registered in the NRC database as LOC.200236.

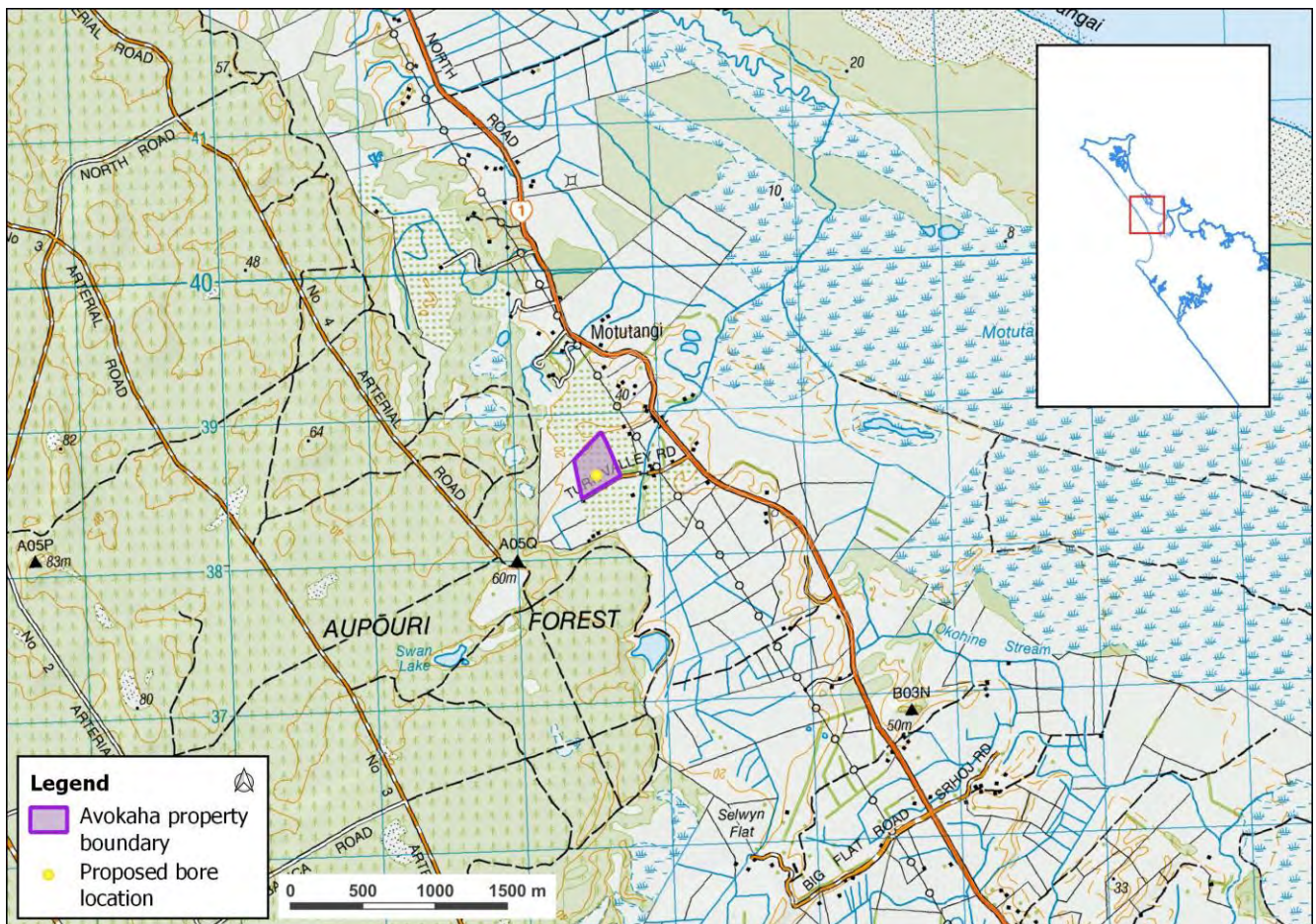


Figure 1. Project location map.

2.2 Description of Proposed Activity

The resource consent application for Avokaha Limited seeks to take and use groundwater from a current bore to develop and irrigate a new avocado orchard. The property, shown in **Figure 1**, has a Total Orchard Area (TOA) of 8.0 ha. The existing bore on the property will be used as the irrigation bore for the new avocado orchard. Bore details are shown in **Table 1**.

The property owners already hold an existing consent to take and use groundwater at a daily rate of up to 160 m³/d and an annual amount of up to 26,400 m³/year (AUT.008647.01.04). The property owners are seeking to increase their groundwater take consent volumes to 230 m³/d and 32,000 m³/year, comprising an increase of 70 m³/day and 4,800 m³/year. This amounts to 28.75 m³/day per hectare (ha) of TOA and 480 mm/year per canopy hectare. These values were determined from an independent analysis of irrigation requirements for the Avokaha orchard undertaken by AgWater Engineering Limited, attached as **Appendix B**.

Table 1. Bore details of the proposed application.

IRISID	Easting	Northing	Depth (m)	Diameter (mm)	Cased Interval (m)	Screened Interval (m)	Static Water Level (mBGL)	Aquifer
LOC.200236	1614554	6138575	116.2	100	unknown	unknown	6.1	Aupouri shellbed

The proposed groundwater take will be exercised from October to April, in accordance with the following total volumes:

- Maximum daily volume of 230 m³/day, an increase of 70 m³/day above the existing consent; and
- Maximum annual volume of 31,200 m³/year, an increase of 4,800 m³/year above the existing consent.

Irrigation requirements were based on an estimated canopy area of 6.5 ha which is 81% of the TOA. This irrigation requirement is adequate to meet up to a 1 in 10 years drought requirement (**3.1.4**). Further details of the calculations for irrigation requirements are provided in **Section 3.1.4** and **Appendix B**.

2.2.1 Pump Specification

The current bore is outfitted with a Franklin Electric Submersible D-54516 Typ 224 551 1916. The maximum pumping rate is 4 l/s. The pump is fitted with a meter to measure the amount of water that is taken. It is the intention of Avokaha Ltd to replace this pump with a model capable of delivering a higher flow rate.

2.2.2 Consent Duration, Lapse and Review

A consent duration of 30 years is sought subject to a lapse period of 5 years from commencement of consent, and review conditions have been proposed for the purposes laid out in **Section 2.3**.

2.3 Proposed Consent Conditions

This section contains the proposed conditions for the water permit sought by the Applicant.

Water Extraction Volumes

- The rate of take shall not exceed the limits set out as follows:
 - Maximum daily volume of 230 m³/day (being any 24 consecutive hours); and
 - Maximum annual volume of 31,200 m³/annum (being 1 July to 30 June).

Notification of Irrigation

- 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

- The Consent Holder shall install a meter to measure the volume of water taken, in cubic metres, from each production bore. Each meter shall:
 - Be able to provide data in a form suitable for electronic storage;
 - Be sealed and as tamper-proof as practicable;
 - 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 have an electronic datalogger for automatic logging of meter data. A copy of the electronic data records shall be forwarded to Council's assigned Monitoring Officer by the 7th of the following month, and immediately on written request from the assigned monitoring officer.
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 eight hours after cessation of pumping. The Consent Holder shall also monitor electrical conductivity at least once a month during any irrigation season when the bore is in use.
8. A copy of the records required to be kept by Conditions 5, 6 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 Compliance Manager 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 wellhead 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) that 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 the ISP required by Condition 10 has been certified by the Council's Compliance Manager.
12. The ISP certified 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 and the ISP described in Condition 10 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. A follow-up audit shall occur at five yearly intervals throughout the term of this consent, with a focus on the efficiency of water use.
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 this consent.

Review Condition

17. 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

18. This consent shall lapse on the **30 June 2024**, 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: 30 June 2049

3. Background Information

3.1 Site Conditions

3.1.1 Soils

There is no Landcare Research S-map soil data available for this site, however there is Fundamental Soil Layer information, pre-dating S-Map, which describes the soil around the property as having slow permeability densipan podzol¹, weakly developed sandy recent soils², brown soils³ which occur in places where summer drought is uncommon, and Mesic organic soils⁴ which is moderate decomposed peat. These soils display the following properties:

- **Physical properties** – Densipan podzol are commonly cemented or compacted B horizons which relates to the slow permeability of the soil and its limited root depth, there is extreme limitations for arable use. Sandy recent soils occur on young land surfaces generally having deep rooting and high plant – available water capacity. Brown soils are relatively stable topsoils with a well-developed structure. Mesic organic soils occur in areas of wetlands or under forests which produce acidic litter, with low bulk density, bearing strength and thermal conductivity but high total available – water capacity.
- **Chemical properties** - Densipan podzol are highly acidic which secondary clays and minerals strongly differentiated with depth. Densipan podzol have generally low natural fertility while sandy recent soils have high natural saturation with high base saturation. Brown soils have low to moderate base saturation. Part of Mesic organic soils have mineral material but is dominated by organic matter.
- **Biological properties** – Densipan podzol have generally low biological activity while sandy recent soils have a continuous cover of vascular plants. Brown soils are associated with high biological activity (earthworms are prominent). Organic soils have restricted biological activity of organisms due to the anaerobic conditions, leading to a slow decomposition rate.

3.1.2 Geology

Avokaha Limited bore is underlain by the Aupouri Aquifer, comprising an extensive sequence of fine-grained sands, interspersed with sporadic iron pan, peat, and silt near the surface and shellbed in the deep layer. This consists of Pleistocene and Holocene unconsolidated sedimentary materials deposited in beach and dune (abandoned shorelines and marine terraces) and associated alluvial, intertidal estuarine, shallow marine, lakebed and wetland environments.

With distance inland from the coast, the sand deposits become progressively older and have a higher degree of compaction and weathering compared to the younger foredune sands located at the coast.

With increasing depth, the occurrence of shellbed layers increases. The shellbeds comprise layers that typically range in composition from 30-90% medium to coarse shell and 10-70% fine sand. The shellbed aquifer typically resides from approximately 70 to 120 mBGL. Underlying the shellbed aquifer are basement rocks of the Mount Camel Terrain, which typically comprise hard grey to dark green / black igneous rocks described in Isaac (1996) as intercalated basalt and basaltic andesite lava, pillow lava, rhyolitic tuff, tuff-breccia, conglomerate, sandstone and mudstone.

3.1.3 Hydrogeological Interpretation

The sands deposited on the east and west coast are generally younger and more permeable than the weathered sand in the central area. The shell content in the sand increases with depth, and the shell-rich sand layer is the most prolific water yielding aquifer in the region and hence the target for irrigation bores.

¹ <https://soils.landcareresearch.co.nz/describing-soils/nzsc/soil-order/podzol-soils/>

² <https://soils.landcareresearch.co.nz/describing-soils/nzsc/soil-order/recent-soils/>

³ <https://soils.landcareresearch.co.nz/describing-soils/nzsc/soil-order/brown-soils/>

⁴ <https://soils.landcareresearch.co.nz/describing-soils/nzsc/soil-order/organic-soils/>

The aquifer system is unconfined at the surface but behaves in a manner that suggests a progressive degree of confinement with depth (leaky confinement). There is no well-defined regionally extensive confining layer but there are numerous low-permeability layers (e.g. iron pan, brown (organic) sand, silt, peat) that vary in depth and thickness, which over multiple occurrences collectively provide a degree of confinement that leads to the development of vertical pressure gradients

All the basement rocks in the area are known to be low permeability.

3.1.4 Irrigation Requirements

An independent assessment of irrigation requirements for Avokaha was performed by AgWater Engineering Ltd. Estimated irrigation requirements were based on a reference evapotranspiration rate of 5.4 mm/day and a crop coefficient of 0.65 for avocados. Based on these values, an evapotranspiration rate of 3.5 mm/day over the canopy area only, was used as the basis for calculating irrigation requirements for Avokaha orchard. The canopy area for the orchard was estimated to be 6.5 ha which comprises 81% of the orchard area.

These values produced an estimated demand of 226 m³/day, which was rounded up to 230 m³/day for the consent application.

The annual irrigation requirement was estimated to be 31,200 m³/year, based on a 480 mm/year requirement per canopy hectare.

The complete AgWater report is provided in **Appendix B**.

3.2 Neighbouring Bore Information

There are 29 bores registered within the NRC database within a 2 km radius of the Avokaha bore (**Figure 2**). Statistics on the 29 bores are as follows:

- 28 are active and one is pending;
- Bore depth is provided for 28 bores and ranges from 6 m to 120 m with an average of 84 m;
- 23 bores have information attached in terms of the purpose of the bores; among these bores:
 - Eight are for irrigation;
 - Five are for stock;
 - Five are for domestic and stock use;
 - One is for domestic;
 - Two are for domestic use and irrigation;
 - Two are for stock use and irrigation.

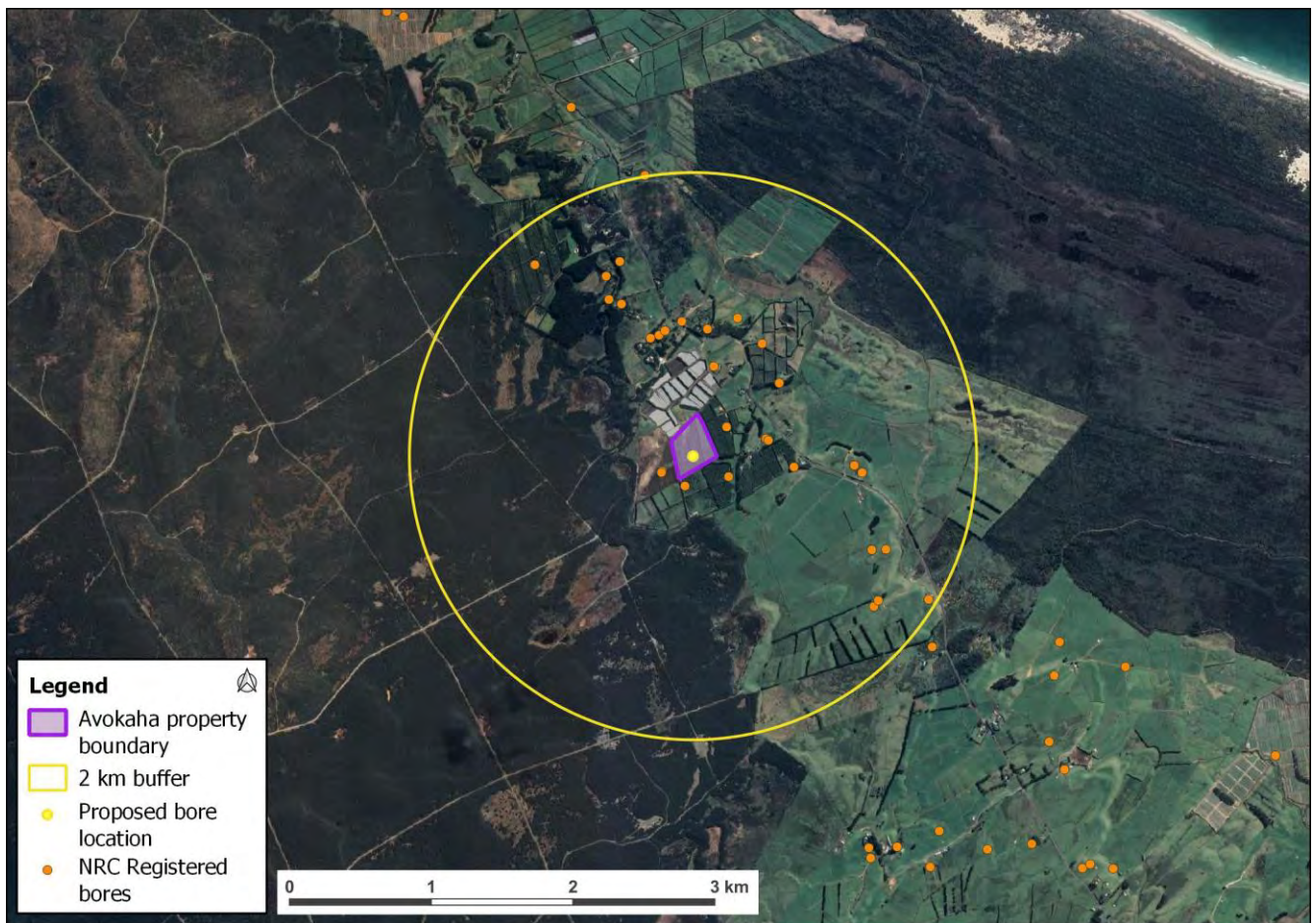


Figure 2. Neighbouring bores within 2 km radius.

3.3 Relevant Statutory Documents

3.3.1 Section 104(1)(b) of the RMA

Schedule 4 of the RMA requires that when applying for a resource consent for any activity an assessment of activities against the matters in any relevant provisions of a statutory document referred to in s104(1)(b) of the RMA must be provided. These matters are described below and **Section 6** provides an assessment against the relevant documents.

The documents referred to in Section 104(1)(b) of the RMA are:

- a national environmental standard;
- other regulations;
- a national policy statement;
- a New Zealand coastal policy statement;
- a regional policy statement or proposed regional policy statement;
- a plan or proposed plan;

The following section provides details of the relevant Regional Planning provisions, while assessment of which documents listed above are relevant is provided in Table 2.

Table 2. Summary of relevance of Section 104 statutes.

Statute	Relevance	Requirement of Statute
National Environmental Standards	There are no national environmental standards that are applicable to the proposed activity.	None
Resource Management (Measurement and Reporting of Water Takes) Regulations 2010	This regulation applies to a water permit that allows fresh water to be taken at a rate of 5 litres/second or more and is consumptive. Therefore, this regulation is relevant for this water take consent.	In summary, the regulations require permit holders to keep records that provide 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 of the volume of water taken each day (in cubic metres) or each week (if approved by the Regional Council), and must be in an appropriate format for auditing, and in a form suitable for electronic storage. The regulations also specify the required accuracy of any metering device (to within $\pm 5\%$ of the actual volume taken if from a full pipe (e.g. bore)).
National Policy Statement for Freshwater Management 2014	<p>The following objectives and policies of the NPS are relevant to this proposal:</p> <p><i>Water Quality</i></p> <ul style="list-style-type: none"> Objectives A1, A2, and A4. Policies A2, A3, and A7. <p><i>Water Quantity</i></p> <ul style="list-style-type: none"> Objective B2, B3 and B5. Policies B2 to B6. <p><i>Integrated Management</i></p> <ul style="list-style-type: none"> Objective C1. Policies C1 and C2. 	<p><i>Water Quality</i></p> <ul style="list-style-type: none"> Objective A1 seeks to safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the use and development of land, and of discharges of contaminants. Objective A2 requires that the overall quality of fresh water within a region is maintained or improved while improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated. Objective A4 seeks to enable communities to provide for their economic well-being, including productive economic opportunities. Policies A2, A3, and A7 are considered relevant to this application and give effect to Objectives A1, A2, A4. <p><i>Water Quantity</i></p> <ul style="list-style-type: none"> Objective B2 seeks to avoid any further over-allocation of fresh water and phase out existing over-allocation. Objective B3 seeks to improve and maximise the efficient allocation and efficient use of water. Objective B5 seeks to provide for communities' economic wellbeing within freshwater quantity limits. Policies B2 to B6 are considered relevant to this proposal. <p><i>Integrated Management</i></p> <ul style="list-style-type: none"> Objective C1 seeks to improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water,

Statute	Relevance	Requirement of Statute
		<p>land, associated ecosystems and the coastal environment.</p> <ul style="list-style-type: none"> • Policies C1 and C2 are relevant to this application and give effect to Objective C1.
Regional Policy Statement for Northland	<p>The Regional Policy Statement (RPS) was made operative on 9 May 2016. The RPS provides a broad direction and framework for managing Northland's natural and physical resources. These include land, water, air, soil, minerals, plants, animals and all built structures.</p> <p>The following Objectives are considered relevant to this proposal:</p> <ul style="list-style-type: none"> • Objective 3.2, 3.3, 3.5, and 3.10. <p>The following Policies give effect to the above Objectives, and therefore are considered relevant to this application:</p> <ul style="list-style-type: none"> • Policy 4.3.2, 4.3.3. 	<ul style="list-style-type: none"> • Objective 3.2 seeks to maintain and improve water quality for human use and ecological health. • Objective 3.3 seeks to safeguard the flows and flow variability required to maintain water's life-supporting capacity, for ecological processes, and to support indigenous species. • Objective 3.5 requires that the region's resources are sustainably managed in a way that is attractive for business and investment that will improve the economic wellbeing of the region and its communities. • Objective 3.10 requires efficient use and allocation of common natural resources with a particular focus on maximising the security and reliability of supply for users. • Policy 4.3.2 requires regulatory methods to avoid over-allocation of region-wide ecological flows and water levels. • Policy 4.3.3 requires the allocation and use of water efficiently within allocation limits.
Regional Plans	<p>The Proposed Regional Plan for Northland (pRPN) sets out policies and rules for how Northland's water, soil, air and coast are used and was publicly notified on 6 September 2017 and closed for submissions on 26 March 2018. The pRPN will replace the Regional Water and Soil Plan for Northland (RWSPN), which has been operative since 28 August 2004.</p> <p>At present, the rules in both these plans have legal effect, with weight given to whichever plan has the more restrictive rule for the same activity if there is a conflict between the two plans, or the later plan if no submissions were received on certain aspects.</p> <p>Both plans address groundwater abstractions that have the potential to adversely affect the environment. However, there are no specific aquifer allocation limits set in the RWSP.</p> <p>The following objectives and policies of the pRPN are considered relevant to this proposal:</p> <ul style="list-style-type: none"> • Objective F.0.1. • Policy D.2.2. • Policy D.2.5. • Policy D.4.5. • Policy D.4.13. • Policy D.4.17. • Policy D.4.18. • Policy D.4.20. 	<p>From the pRPN:</p> <ul style="list-style-type: none"> • Objective F.0.1 seeks to manage the use, development, and protection of Northland's natural and physical resources which enables people and communities to provide for their social, economic and cultural well-being while <ol style="list-style-type: none"> 1. sustaining the natural resources to meet the reasonable foreseeable needs of future generations, 2. safeguarding life-supporting capacities of water, and 3. avoiding, remedying, or mitigating adverse effects on the environment. • Policy D.2.2 requires that regard is had to the social, cultural, and economic benefits of the proposed activity when considering resource consents. • Policy D.2.5 requires an authority to have regard to community and tangata whenua values • Policy D.4.5 seeks to maintain overall water quality. • Policy D.4.13 seeks to achieving freshwater quantity related outcomes and in particular manage the taking, use, damming, and diversion of fresh water so that (with relevance to this application) saline intrusion in, and land subsidence above, aquifers is avoided (amongst other things).

Statute	Relevance	Requirement of Statute
	<ul style="list-style-type: none"> Policy D.4.23. <p>The following objectives and policies of the RWSPN are considered relevant to this proposal:</p> <ul style="list-style-type: none"> Objective 7.4. Objective 10.4.1. Policy 10.5.1. Policy 10.5.2. Policy 10.5.4. Policy 10.5.7. Policy 10.5.9 	<ul style="list-style-type: none"> Policy D.4.17 considers allocation limits for aquifers and requires rules and applications to meet allocation limits Policy D.4.18 concerns conjunctive surface water and groundwater management. Policy D.4.20 requires the reasonable and efficient use of water for irrigation and sets requirements for a resource consent application to take water for irrigation purposes. Policy D.4.23 <p>From the RWSPN:</p> <ul style="list-style-type: none"> Objective 7.4 requires the maintenance or enhancement of water quality of natural water bodies. Objective 10.4.1 maintains the sustainable use and development of the region's groundwater resources while avoiding, remedying, or mitigating actual and potential adverse effects on groundwater quantity and quality. Policy 10.5.1 seeks to ensure the sustainable use of resources by avoiding takes that exceed recharge. Saltwater intrusion, reduced groundwater quality, significant drawdown, and adverse effects on surface water resources can arise where takes exceed recharge. Policy 10.5.2 recognises that aquifers are at risk in certain circumstances and that adverse effects on water quality should be avoided. Policy 10.5.4 seeks that groundwater allocations take into account reduction in recharge that may occur in time. Policy 10.5.7 requires the Northland Regional Council to consider effects of a groundwater take and use on surface water bodies. Policy 10.5.9 seeks to avoid, remedy or mitigate any ground subsidence as a result of groundwater takes, use or diversion, where this is likely to cause adverse flooding, drainage problems, or building damage.

3.3.2 Activity Status

The activity status of the proposed activity under both the RWSPN and pRPN is considered a discretionary activity – details of this conclusion are summarised in **Table 3**.

Table 3. Summary of activity status against Regional Plan Provisions.

Plan	Relevant Rules	Comment
RWSPN	Rule 25.03.01 of the plan states that "The taking, use or diversion of groundwater from an aquifer, and any associated discharge of groundwater onto or into land or into water, which does not meet the requirements of the permitted, controlled or non-complying activity rules is a discretionary activity." In essence, the discretionary activity rule is for takes that are not for domestic or stock watering purposes (Rule 25(A)) and exceed the permitted activity thresholds (Rule 25.01.01) of a daily volume of 10 m ³ /d and instantaneous rate of 5 L/s per bore.	Under this plan and until such time as the equivalent provisions within the Proposed Regional Plan for Northland (pRPN) are no longer contested, the proposed activity would be considered Discretionary Activity.
pRPN	<p>Rule C.5.1.10 states that the taking and use of fresh water is a discretionary activity unless it is one of the following:</p> <ol style="list-style-type: none"> 1) a permitted activity under C.5.1.1 'Minor takes – permitted activity', or 2) a permitted activity under C.5.1.2 'Temporary take for road construction or maintenance – permitted activity', or 3) a permitted activity under C.5.1.3 'Water take from an off-stream dam – permitted activity', or 4) a permitted activity under C.5.1.4 'Water take from an artificial watercourse – permitted activity', or 5) a permitted activity under C.5.1.5 'Water take associated with bore development, bore testing or dewatering – permitted activity', or 6) a controlled activity under C.5.1.6 'Replacement water permits for registered drinking water supplies - controlled activity', or 7) a controlled activity under C.5.1.7 'Takes existing at the notification date of the plan - controlled activity', or 8) a restricted discretionary activity under C.5.1.8 'Supplementary allocation – restricted discretionary activity', or 9) a discretionary activity under C.5.1.9 'Takes existing at the notification date of this plan – discretionary activity', or 10) a non-complying activity under C.5.1.11 'Water take below a minimum flow or water level-non-complying activity', or 11) a non-complying activity under C.5.1.12 'Water take that will exceed an allocation limit - non-complying activity', or 12) a prohibited activity under C.5.1.13 'Water takes that will exceed an allocation limit - prohibited activity'. 	The proposed groundwater take does not conform to any of the activities listed in 1) to 10) in the left column, and as indicated in the following Section 3.3.3 does not exceed an allocation limit, therefore the proposed activity constitutes a Discretionary Activity under the pRPN.

3.3.3 Allocation Zones

The Aupouri Peninsula Aquifer is divided into different allocation zones for management purposes. The Avokaha Limited property sits within the Aupouri-Motutangi allocation zone. The allocation limit, current level of allocation and the level of allocation should this consent (along with other pending consents) be granted, are shown in **Table 4**.

Currently there are three pending applications for new groundwater takes, Tuscany Avocados (36,000 m³/year), KSL Limited (3,600 m³/year), and Bryan Estate (160,000 m³/year).

The allocation limit is calculated as 15% of mean annual recharge, as recommended by the Northland Regional Council in paragraphs 111 to 118 of the Section 42 Hearing Report (Tait, 2018).

For the purposes of this section of the AEE we have only analysed the water take increase i.e. the increase of 70 m³/d and 4,800 m³/year.

Table 4 shows that the Aupouri-Motutangi zone is currently 58.7% allocated and granting the proposed Avokaha Limited groundwater take (an increase of 4,800 m³/year) will account for an additional 0.3% of the allocation limit. If the other current proposals are granted (Tuscany Avocados, KSL Limited, and Bryan Estate) the total allocation status for the Aupouri-Motutangi zone will increase to 71.5%.

Table 4. Aupouri Aquifer Limits⁵ and Allocation Status.

Sub-aquifer	Allocation Limit ^A		Allocation Status (Current) ^B		Allocation Status Including Proposed Groundwater Takes:	
					Avokaha Limited (4,800), Bryan Estate (160,000), KSL Limited (3,600), Tuscany Avocados (36,000)	
	m ³ /year	% mean annual recharge	m ³ /year	%	m ³ /year	%
Aupouri - Motutangi	1,604,487	15	941,457	58.7%	1,145,857	71.4%

Notes:

A. Recalculated from Lincoln AgriTech (2015).

B. Includes the recently granted (June 2018) MWWUG consents, which equated to 566,960 m³/year in the Motutangi zone. Also the already consented Avokaha take (26,400 m³/yr)

⁵ According to NRC's allocation maps at <http://gis.nrc.govt.nz/LocalMaps-Viewer/?map=895e0785f7054d47b10a72edc38022dc>

4. Assessment of Environmental Effects

The proposed increase of 4,800 m³/year groundwater take for the Avokaha Limited property was evaluated using the Aupouri Aquifer Groundwater Model (AAGWM), which is a numerical model covering the Aupouri shellbed aquifer from Ahipara to Ngataki. The model applied the MODFLOW Unstructured Grid (MODFLOW-USG) developed by the United States Geological Survey (USGS) applied within the GMS10.3 modelling platform to simulate regional groundwater flow.

The model comprises six layers that are used to represent the varying geology of the region with the shellbed aquifer, the primary source of groundwater, represented by the fourth and sixth model layers. Error! Reference source not found. provides a brief description of the geological units assigned to the layers in the model.

The development and calibration of the AAGWM is detailed in a standalone report on model development and calibration (WWA, 2019A). The model domain and locations of consented and proposed groundwater takes are shown in **Figure 3**.

Table 5. Geological units in the model conceptualisation.

Model Layer	Strat. Layer	Name	Description	Locality
1-3	1	Coastal sand	Loose coast sand, highly permeable	Western and eastern coastal strips.
	1	Weathered sand	Weathered dune sand, moderately compacted	Inland hilly or rolling country areas.
	1	Plain zone	Peaty and clayey sediments, low permeability	Inland low-lying plain areas.
4	2	Shellbed	Sand presented with shells, highly permeable	Throughout model, albeit thickness varies.
5	3	Fine sand	Old sand deposits, fine sand, moderately permeable	
6	4	Shellbed	Sand presented with more shells, highly permeable	

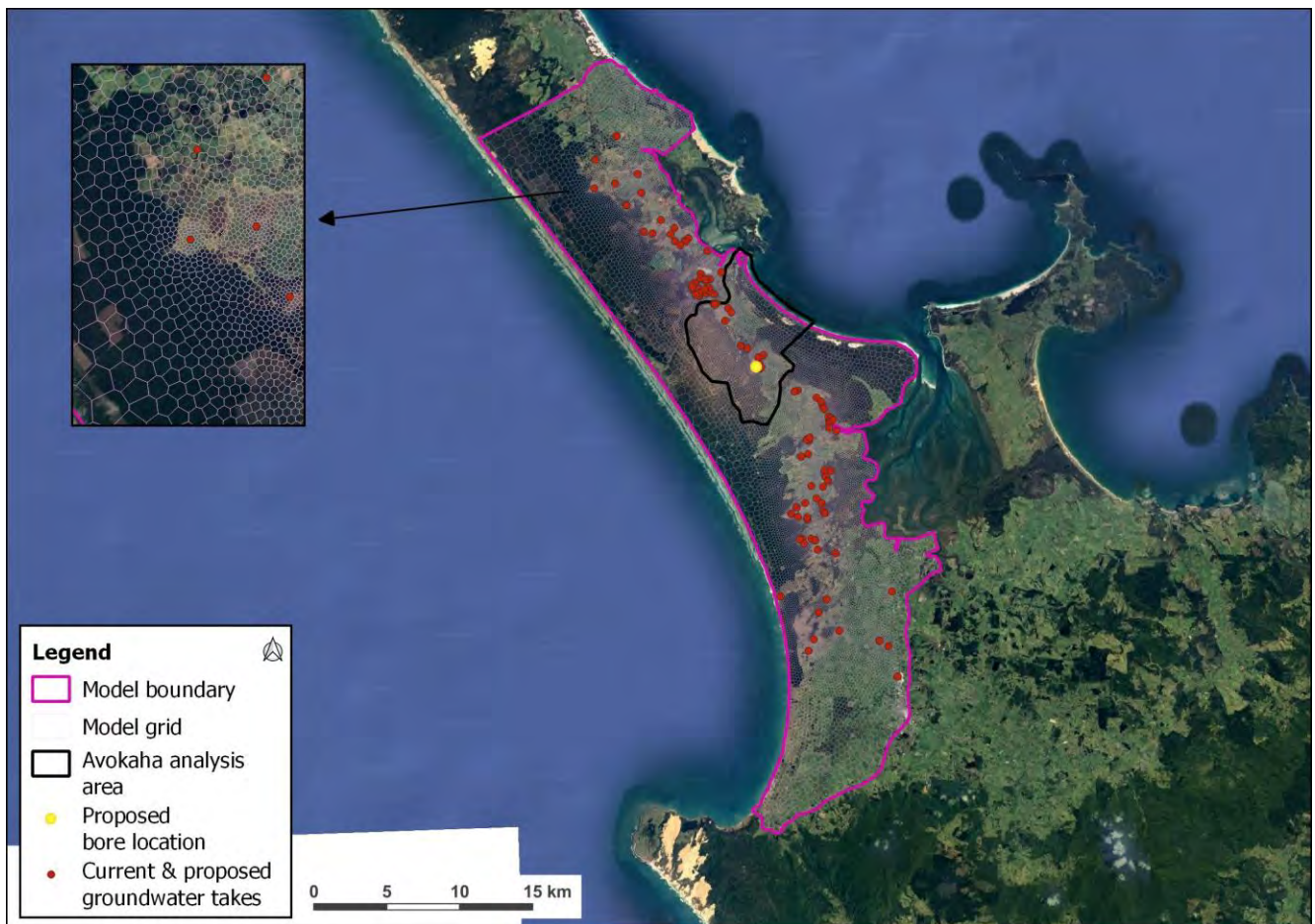


Figure 3. Aupouri Aquifer Groundwater Model domain

The Motutangi-Waiharara Groundwater Model (MWGWM), detailed in WWA (2017) is a previous numerical model that includes the area occupied by the proposed groundwater take.

The Base Case Scenario (Scenario 1) for evaluating the proposed groundwater take at the Avokaha bore applied the AAGWM with all currently consented groundwater takes and pending applications included. The Proposed Extraction Scenario (Scenario 2) was then developed by adding the proposed Avokaha groundwater take to the Base Case Scenario. The results of the two scenarios were compared to assess cumulative effect of the proposed groundwater take with regard to the AEE criteria. Simulation results were evaluated for the drainages within and around the Avokaha property in order to assess potential effects from proposed pumping in the area most likely to be impacted. This area is referred to in this report as the Avokaha Analysis Area and is shown in **Figure 3**.

This assessment also included a sensitivity analysis (Scenario 3) using the methods described in WWA (2017). In the sensitivity analysis connectivity between the surface conditions and the deep aquifer was significantly reduced while boundary and source/sink conditions remained the same as in the baseline model. The model was not calibrated to the conditions applied in Scenario 3, therefore Scenario 3 results are only referenced to illustrate relative (rather than absolute) changes in simulated groundwater levels.

The sensitivity analysis was undertaken because the calibrated groundwater model errs on the side of over simulation of vertical leakage. This was deliberately built into the model in the absence of a single well-defined low permeability horizon in the field, but rather a series of multi-layered and discontinuous iron pans and other low permeability horizons within the sedimentary sequence that in combination act as a flow barrier between the deeper groundwater system and the surface drains and wetlands. As a result, the model exaggerates the

effects of the proposed abstraction on the groundwater levels in the shallow aquifer and at the surface. Conversely, the model under-predicts the local-scale drawdown in the deeper aquifer.

The numerical simulation was run for a 58-year time period using historic climate records and groundwater pumping data. In effect, the climatic conditions of the last 58-years have been utilised to simulate conditions that may occur in the next 58-years.

The three predictive model scenarios can be summarised as follows:

- **Scenario 1: Base Case** – the calibration model including all groundwater takes that are currently consented or have been proposed prior this application.
- **Scenario 2: Proposed Extraction** – includes all current and proposed groundwater takes including the 4,800 m³/year proposed for this application.
- **Scenario 3: Low Permeability-Proposed Extraction** – Groundwater extraction is the same as in Scenario 2 with horizontal hydraulic conductivity of Layer 2 decreased to 1×10^{-7} m/s in both the coastal sands and weathered sand regions to simulate a hard pan extending over the model area.

From an assessment of effects perspective, it is important to focus on annual volumes. However, simulated pumping in the model is premised on peak daily rates (consented or proposed) pumped until the annual volume is reached (cap). Due to variable stress period length ranging from a minimum of 13 days to a maximum of 185 days, the average pumping rate reported from the model is always less than the peak rate due to days within the stress period where pumping was not required. Historical dates where the maximum annual volume (consented or proposed) was simulated included 1974, 1991, and 2010.

4.1 Surface Water Effects

An analysis of the impact on flows including discharge to both farm drains and wetlands was undertaken for low-flow situations. Scenario 2 was selected for this assessment because it represents a greater potential impact on surface drains compared to Scenario 3. The annual minima in daily flow was determined from the global flow budget for all combined drain cells within the potential area of impact. Annual minima flows were used to calculate annual recurrence intervals for each scenario, and the resulting data is presented in **Table 6** and **Figure 4**.

A comparison of the proposed groundwater extraction (Scenario 2) against the Base Case scenario indicates that the mean annual (1-year) low flow as a result of the combined groundwater extraction at the Avokaha bore is likely to be virtually unchanged as a result of the proposed activities. However, as stated in WWA (2017) the model errs on the side of exaggerating groundwater level reduction in the shallow aquifer and at the surface because of the lack of hard pans in the model. In this regard, this can be considered a conservative estimate.

Results also indicate that the variation in annual minimum discharge from groundwater to surface water over a range of drought severities (i.e. annual to 100-year recurrence interval) is likely to be, at most, a 0.02% reduction with the proposed groundwater extraction. The relative flow reduction increases slightly for the more infrequent events, e.g. the 0.06% reduction in annual low flow with proposed groundwater extraction relative the Base Case Scenario is predicted in the event of a 100-year drought. These predictions for reduced flow on the order of millilitres per second are below the resolution of the numerical model and can be taken to indicate that no measurable change in seasonal low flow will occur as a result of the proposed groundwater extraction at the Avokaha bore. Therefore, the impact on surface water resources due to proposed take will therefore be less than minor.

Table 6. Surface water low-flow reduction analysis. Total drain flows in the Avokaha analysis area.

Recurrence Interval	Scenario 1: Base Case	Scenario 2: Proposed GW Extraction	Relative Difference
(years)	(L/s)	(L/s)	(%)
1	171.50	171.47	-0.02%
2	102.63	102.59	-0.04%
5	82.71	82.69	-0.03%
10	72.62	72.59	-0.05%
25	70.06	70.03	-0.05%
50	68.97	68.93	-0.05%
100	63.33	63.29	-0.06%

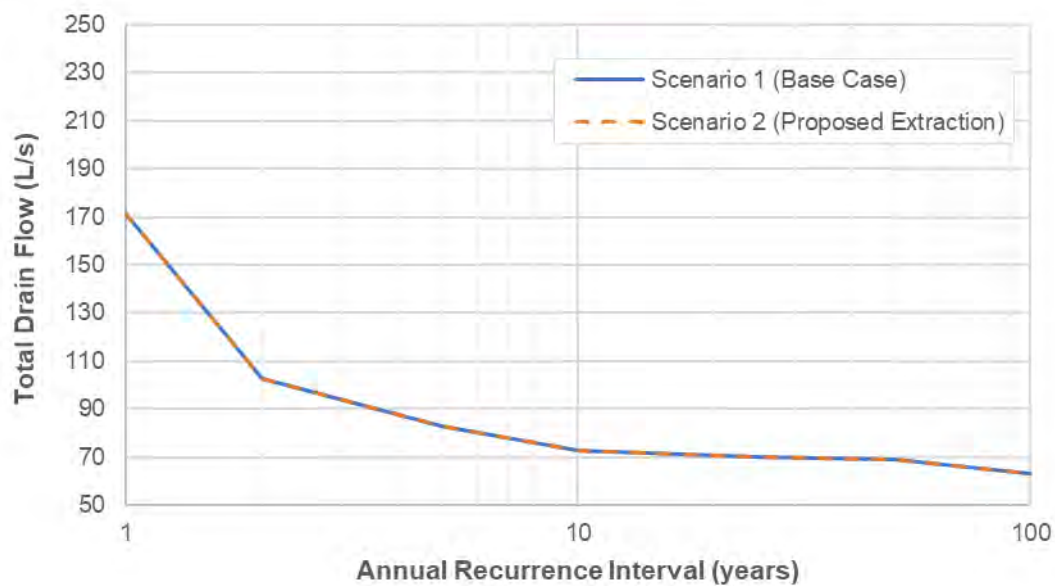


Figure 4. Surface drainage low flow analysis for model predictive scenarios.

4.2 Pumping Interference Effects

The end of the 2010 irrigation season (30 April 2010) was selected for impact analysis as this date represents the end time of the driest period within the historical record, and the greatest simulated seasonal irrigation pumping requirement. Simulation results were evaluated within and around the Avokaha property in order to assess potential effects from proposed pumping in the area most likely to be impacted.

Drawdown Effects

The simulated groundwater level for the end of 2010 irrigation season for Scenarios 2 and 3 were subtracted from the head simulated at the corresponding time from the Baseline Model in the case of Scenario 2, and a

revised version of the Baseline Model with low permeability in Layer 2 for Scenario 3, to produce regional drawdown maps (**Figure 5** and **Figure 6**). The resulting drawdown predictions are used to evaluate the magnitude and extent of potential impacts resulting from the proposed pumping on both the shallow and deep aquifers for both scenario conditions.

Deep aquifer

The predicted drawdown in the deep aquifer for Scenario 2 is shown in **Figure 5**. In Scenario 2 the maximum predicted drawdown was 0.022 m at the proposed Avokaha bore location. Significant drawdown is typically considered to be the 0.6 m therefore no significant drawdown was predicted as a result of the proposed groundwater take under scenario 2 conditions.

In Scenario 3, the low permeability of model Layer 2 limited leakage from the overlying layers thereby magnifying the impact of pumping on groundwater levels. The maximum drawdown predicted in Scenario 3 was 0.026 m at the pumping location (**Figure 6**). As was the case with Scenario 2, no significant drawdown was predicted with the proposed ground water take under Scenario 3 conditions.

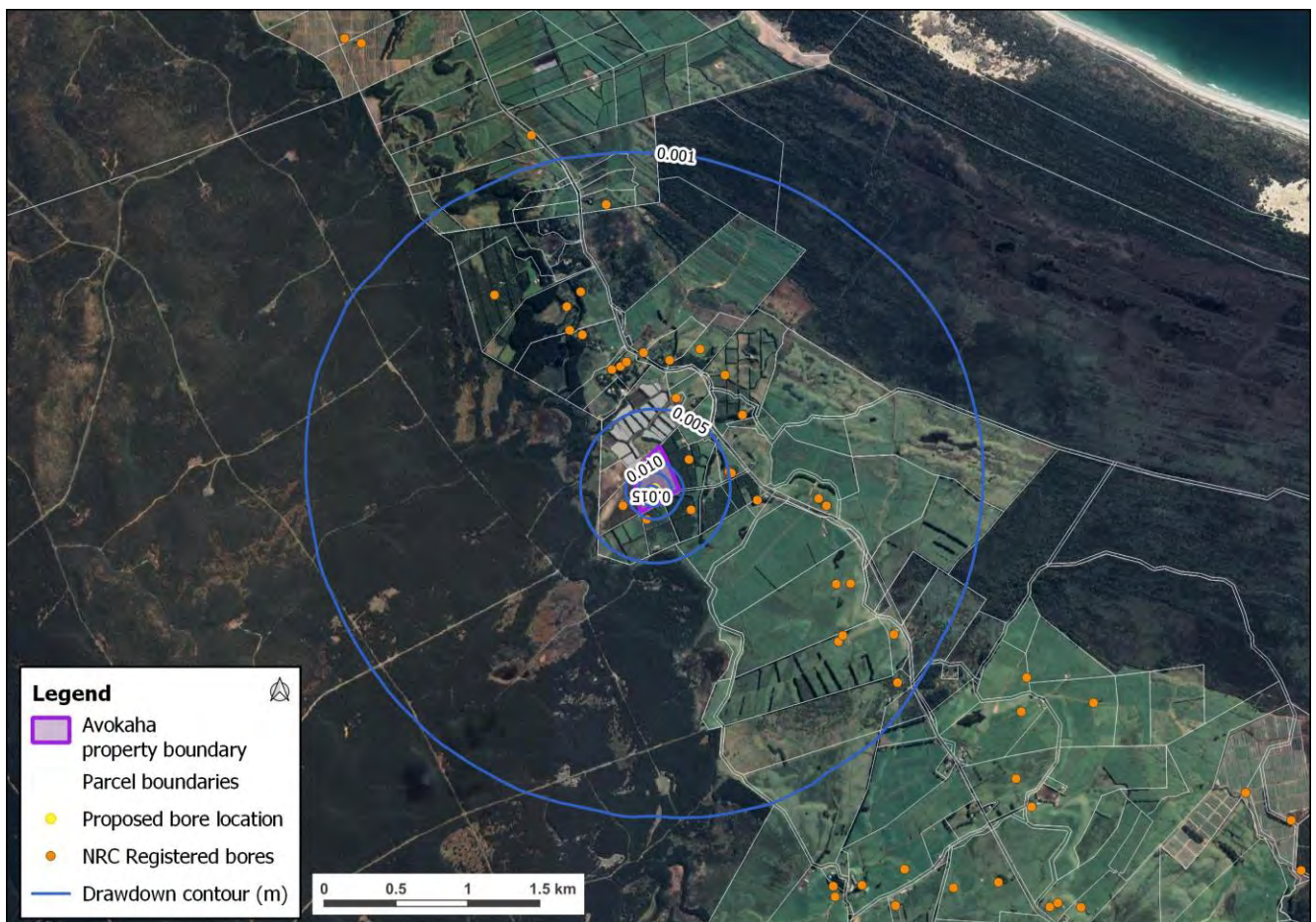


Figure 5. Simulated drawdown of deep aquifer (Scenario 2).

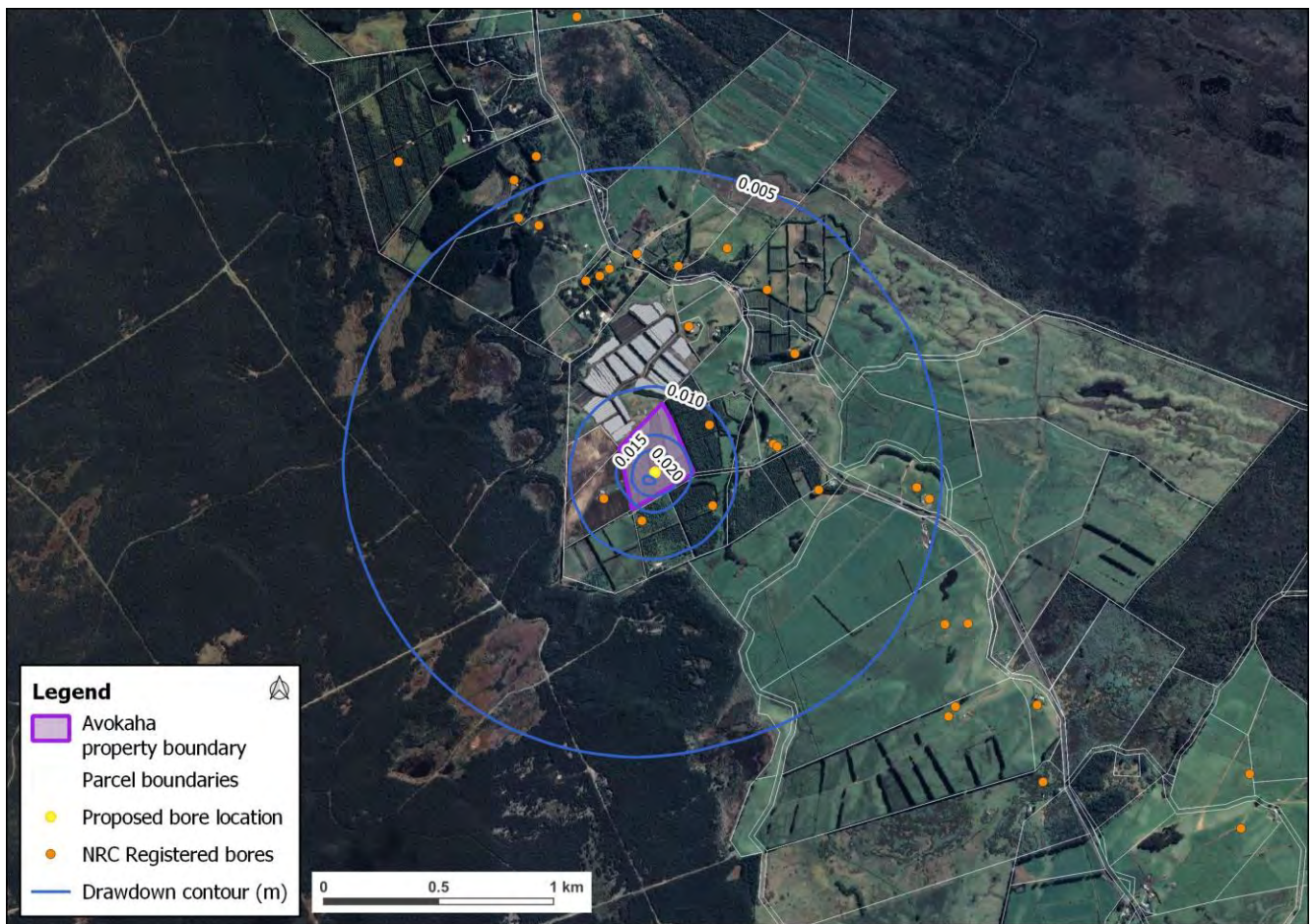


Figure 6. Simulated drawdown of deep aquifer (Scenario 3)

Shallow aquifer

The proposed groundwater take was predicted to cause negligible drawdown (0.003 m) in the shallow aquifer under Scenario 2 conditions (**Figure 7**). It was apparent in the assessment that the drawdown in the shallow aquifer was also influenced by the locations of agricultural drains. In Scenario 3, no shallow aquifer drawdown was predicted due to increased groundwater pumping because of the disconnection of the upper and lower portions of the aquifer.

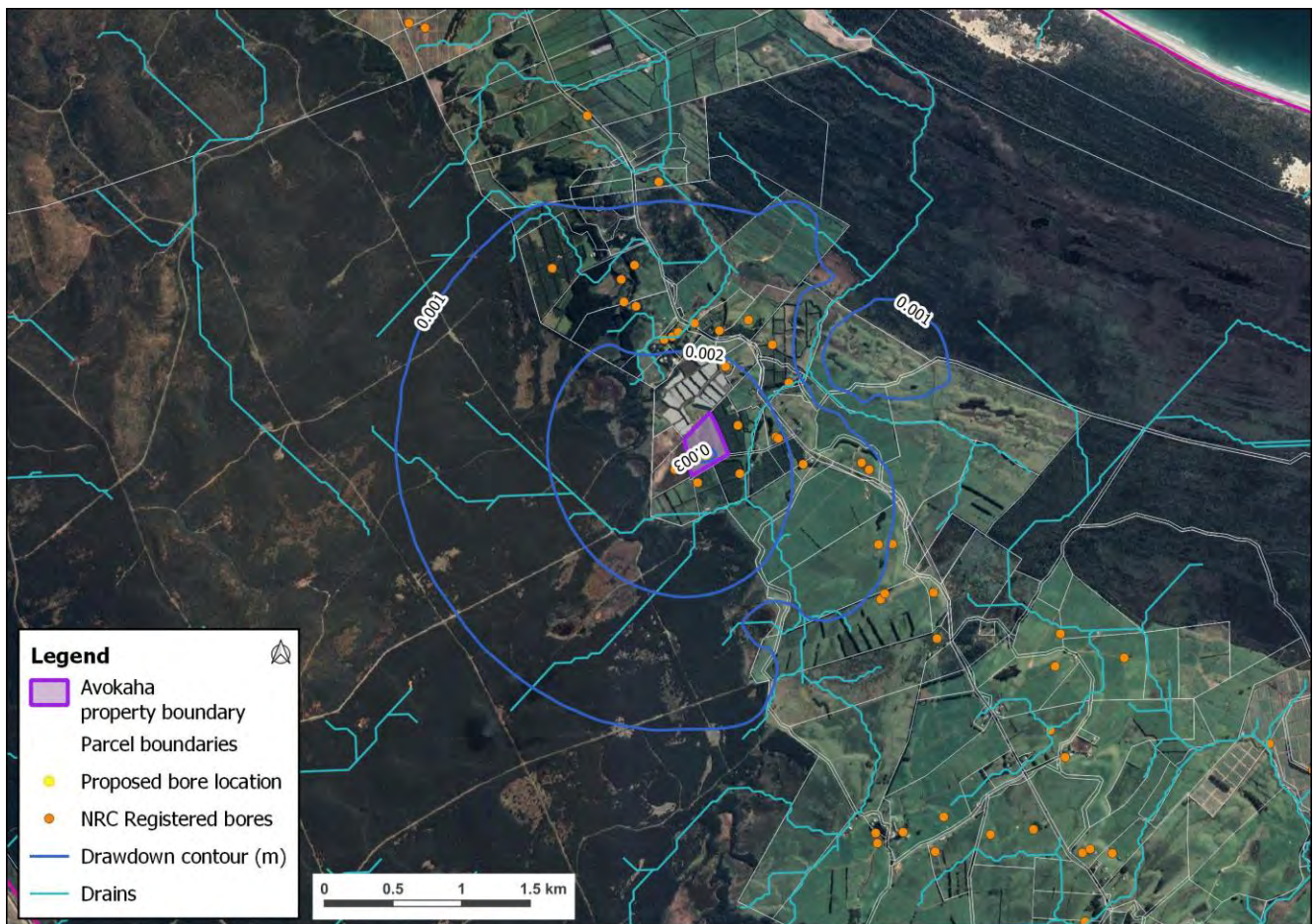


Figure 7. Simulated drawdown of shallow aquifer (Scenario 2).

Cumulative Effects

The cumulative impact of groundwater extraction on the deep aquifer, including the proposed pumping at Avokaha, is shown relative to a naturalised condition with no groundwater pumping under Scenario 2 conditions in **Figure 8** and under Scenario 3 conditions in **Figure 9**. The proposed Avokaha groundwater has a negligible influence on the cumulative drawdown in the deep aquifer.

The cumulative impact of all groundwater pumping relative to a naturalised condition is shown for the shallow aquifer under Scenario 2 conditions in **Figure 10**, where it is apparent that cumulative drawdown is influenced by the locations of agricultural drains but not impacted by the proposed groundwater take. Negligible drawdown is predicted in the shallow aquifer for Scenario 3.

Available drawdown for shellbed aquifer bores is typically 60 to 100 m, while maximum cumulative drawdown in the area where Avokaha is located averages 3 m for bores with consented groundwater takes in the more conservative low permeability model scenario (WWA 2019B).

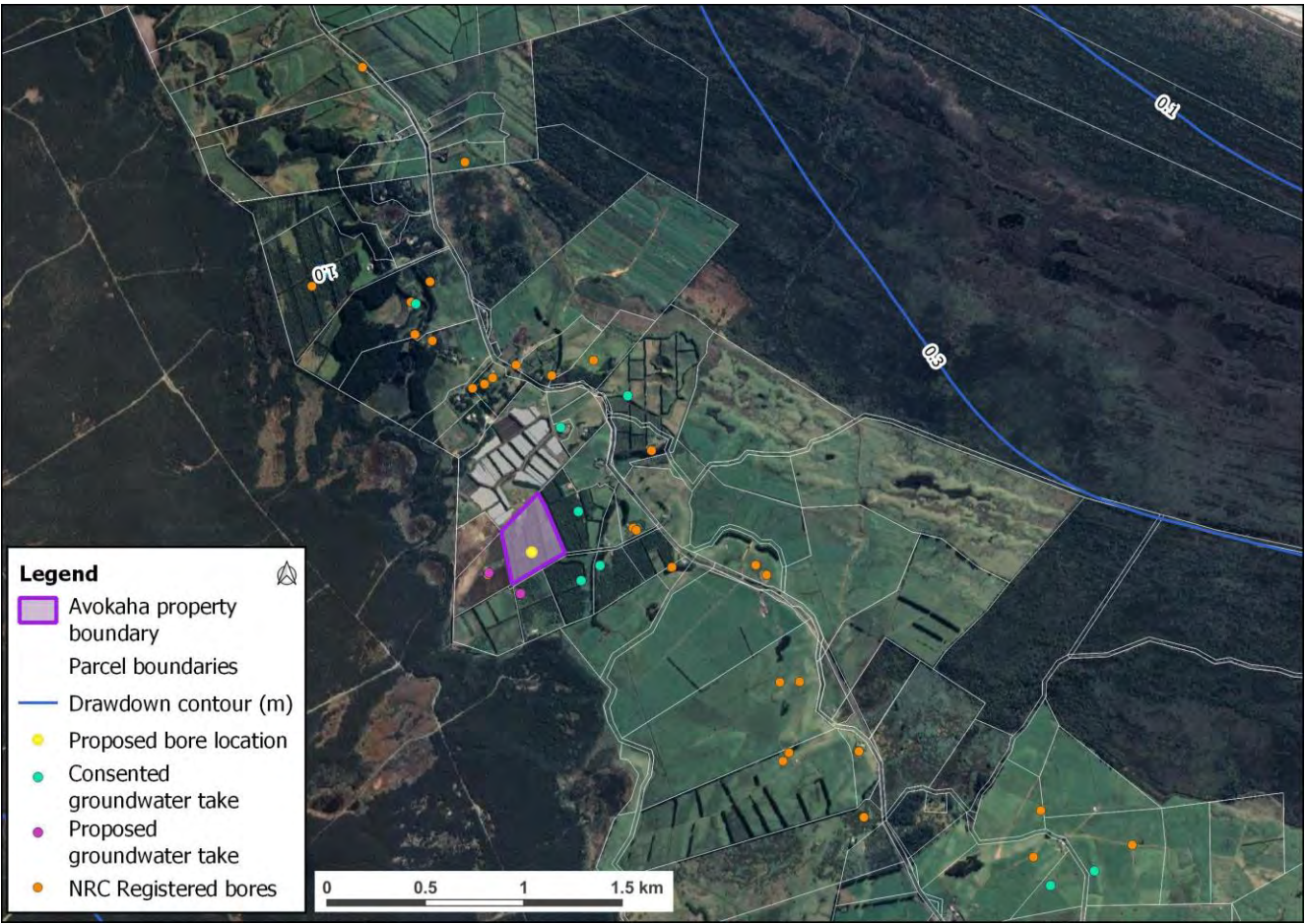


Figure 8. Cumulative drawdown (Scenario 2) in the deep aquifer relative to a naturalised condition for all consented and proposed bores.

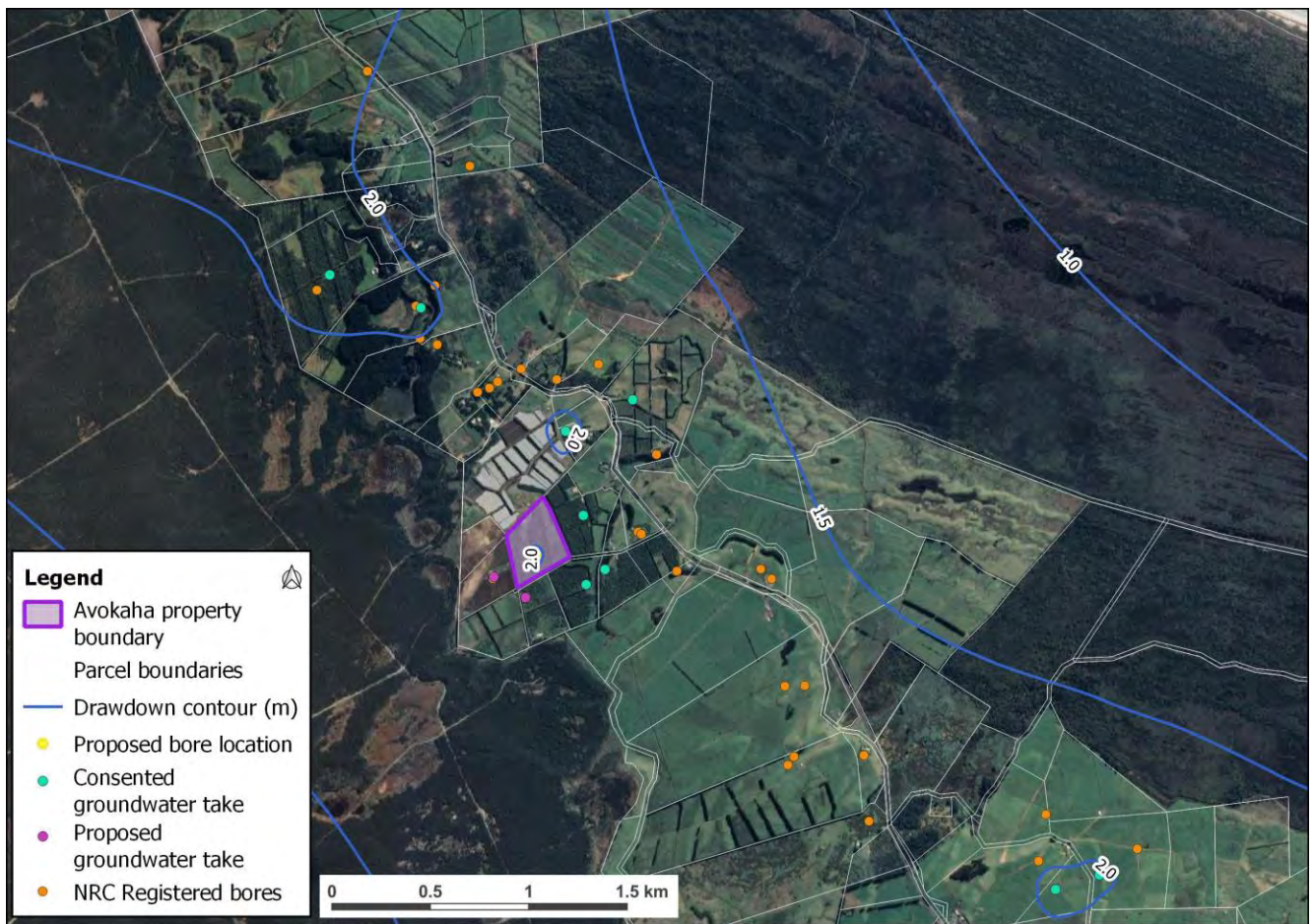
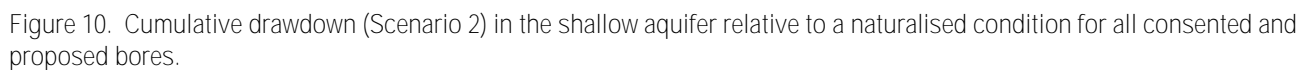


Figure 9. Cumulative drawdown (Scenario 3) in the deep aquifer relative to a naturalised condition for all consented and proposed bores.



The predicted groundwater drawdown for 30 April 2010 was used as the basis for predicting potential interference on existing groundwater users resulting from pumping at the proposed Avokaha bore. **Appendix C** provides a summary of predicted drawdown in Scenario 2 and Scenario 3 for bores within 2 km of the Avokaha bore with Scenario 3 having the greater drawdown between the two scenarios. Cumulative drawdown from all pumping bores in the model is also provided in **Appendix C** for the bores within two km of the Avokaha bore.

In all cases, predicted drawdown was insignificant in the context of available drawdown in this aquifer, which is between 70 – 100 m in most shellbed aquifer bores. Based on this assessment and the available drawdown in the aquifer the interference effects on existing groundwater users is considered less than minor.

4.3 Saline Intrusion

Model results from the Base Case (Scenario 1) and Proposed Extraction (Scenario 2) scenarios were used to evaluate the risk of the proposed groundwater takes inducing saltwater intrusion into the Aupouri aquifer. The Low Permeability Scenario (Scenario 3) was not considered for this analysis because it is not based on a calibrated version of the model, and therefore can only be used to assess relative drawdown rather absolute water levels as required for analysis of potential saline intrusion.

The most likely mechanism for saline intrusion under the hydrogeological conditions of the study area is lateral migration. The potential for lateral migration was evaluated using the Ghyben-Herzberg relation that states that for every meter of head above sea level in the freshwater aquifer there will be 40 m of freshwater in the aquifer below sea level.

The Avokaha property is situated approximately 4.3 km from the east coast and approximately 6.0 km from the west coast. The analysis for saline intrusion was performed for the east coast because it is closer to the Avokaha property and well beyond the extent of any predicted drawdown.

The bottom of the Aupouri aquifer along the portion of the east coast adjacent to the Avokaha property is approximately -89 m AMSL. Therefore 2.2 m of head are required to prevent inland migration of the saltwater interface. In the Base Case Scenario, the predicted head along this section of coastline at the time of maximum irrigation is 2.8 m, exceeding the required head to avert saline intrusion by 0.6 m.

The maximum predicted drawdown along the east coast, adjacent to the Avokaha property, is less than 1 mm in the Proposed Extraction Scenario (**Figure 5**). Based on the Ghyben-Herzberg principal and the elevation of the saltwater interface, this level of drawdown will not cause lateral migration of seawater into the Aupouri aquifer.

The impact on saltwater intrusion due to proposed take will therefore be less than minor.

4.4 Ground Settlement

Land subsidence due to groundwater extraction was calculated using the Bouwer (1977)⁶ equation:

$$S_u = (P_{i2} - P_{i1}) \frac{Z_1}{E}$$

where S_u = vertical subsidence (m)
 $P_{i2} - P_{i1}$ = Increase in intergranular pressure due to drop of the water table
 Z_1 = layer thickness
 E = modulus of elasticity of the soil

The following characteristics were assumed for the aquifer:

- Porosity = 0.30
- Unsaturated water content = 0.08
- Specific weight of aquifer material (consolidated silty sand) = 20 kN/m³ (Silty sand density ranges between 1,410 kg/m³ and 2,275 kg/m³ (http://structx.com/Soil_Properties_002.html), corresponding to specific weight of 14 kN/m³ and 22 kN/m³)
- Specific weight of water = 9.81 kN/m³.

The deep shellbed material is denser and less compressible compared to the mixture of sand, silt and peat overlying above. The subsidence analysis was conducted using three separate layers representing the

conceptual hydrogeological units of the sub-surface environment, and the parameter values used were based on Bouwer (1977).

The potential maximum ground settlement was estimated at the proposed bore on the Avokaha property based on the maximum simulated drawdown in the Base Case Scenario and low permeability scenarios. Predicted settlement at the bore location was less than 1 mm in both Scenario 2 (Base Case) and Scenario 3 (Low Permeability). These values would be impossible to measure under existing field conditions and can therefore be considered negligible.

In summary, the potential settlement effects are considered less than minor.

4.5 Water Quality

The potential risk to water quality from the leaching of fertilisers and pesticides that may be associated with horticulture is not a relevant consideration for a water take application under the current Northland Regional planning framework. With reference to the effects from horticultural sprays the Commissioners for the MWWUG water take applications stated in their Hearing Decision Report (June 2018) that:

“such are not matters that are directly engaged by the present applications for water abstraction. Accordingly, we have no present jurisdiction to consider those putative effects. If resource (or other) consent is subsequently required, then such will need to be applied for and considered at the appropriate time”.

Nevertheless, there are a range of factors that make the leaching of fertiliser and pesticides unlikely to impact water quality:

- In practice, orchardists in this area tend to apply fertiliser efficiently via fertigation as part of their irrigation water using a small dosage regularly, which is driven by both the soil conditions (i.e. high permeability and lacking in nutrients) and economic considerations.
- Inefficient irrigation practice will lead to root rot, thus because orchardists will actively avoid this, excessive leaching of nutrients is unlikely.
- Both fertiliser and approved pesticides are applied in accordance with permitted activity rules within the pRPN and rules needing to be met to become certified under the AvoGreen Assured program by the Avocado Industry Council Ltd. One of the key aims is “environmental sustainability by only using sprays when required”.
- Due to the presence of significant amounts of organic matter within the shallow sand deposits, shallow groundwater is likely to be reducing. Under such conditions, nitrate concentrations are likely to be low in groundwater (consistent with available groundwater quality data) due to denitrification within the aquifer system. The presence of organic matter is also likely to substantially decrease the mobility of any pesticide compounds prone to leaching.

4.6 Consideration of Alternatives

An AEE must include a description of alternative locations or methods for undertaking an activity, if it is likely that the activity will result in any significant adverse effect on the environment.

The effects of the proposed taking and using of groundwater were assessed above as being no more than minor on the environment and less than minor on other groundwater users. As such, no alternatives have been considered for this proposal.

5. Assessment of Cultural Effects

Northland Regional Council have an internal procedure where they circulate all applications to local Iwi and Maori Groups that have registered with the Council as having an interest in the area. Therefore, regardless of whether the local Iwi or Maori Groups are considered to be affected by the effects of the proposed activity, the Group will be notified by the Regional Council and therefore can be considered as part of the consultation process.

The applicant has not undertaken any personal consultation with Iwi or Maori Groups based on the understanding that physical effects of this application are less than minor, therefore any meta-physical (cultural and spiritual) effects would commensurately be less than minor (acknowledging cultural values are complex and effects upon them may manifest in unanticipated ways).

6. Assessment Of Statutory Considerations

Table 7 to Table 10 provide assessments of the relevant statutory documents as were identified in **Section 3.3**.

Overall, this resource consent application is consistent with the objectives and policies of the National Policy Statement for Freshwater Management 2014, incumbent regional plan (RWSPN) and proposed regional plan (pRPN).

Table 7. Assessment against relevant objectives and policies for the National Policy Statement for Freshwater Management 2014.

No.	Objective / Policy	Assessment
Water Quality		
Objective A1	<ul style="list-style-type: none">Seeks to safeguard the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems of fresh water, in sustainably managing the use and development of land, and of discharges of contaminants.	This proposal is consistent with these objectives and policies and either supports them or at the least maintains them.
Objective A2	<ul style="list-style-type: none">Required that the overall quality of fresh water within a region is maintained or improved while improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.	
Objective A4	<ul style="list-style-type: none">Seeks to enable communities to provide for their economic well-being, including productive economic opportunities.	
Policies A2, A3, and A7	<ul style="list-style-type: none">Give effect to Objectives A1, A2, A4	
Water Quality		
Objective B2	<ul style="list-style-type: none">Seeks to avoid any further over-allocation of fresh water and phase out existing over-allocation.	This proposal is consistent with these objectives and policies.
Objective B3	<ul style="list-style-type: none">Seeks to improve and maximise the efficient allocation and efficient use of water.	
Objective B5	<ul style="list-style-type: none">Seeks to provide for communities' economic wellbeing within freshwater quantity limits.	
Policies B2 to B6	<ul style="list-style-type: none">Give effect to Objectives B2 to B5.	

No.	Objective / Policy	Assessment
<i>Integrated Management</i>		
Objective C1	<ul style="list-style-type: none"> Seeks to improve integrated management of fresh water and the use and development of land in whole catchments, including the interactions between fresh water, land, associated ecosystems and the coastal environment. 	This proposal is consistent with these objective and policies.
Policies C1 and C2	<ul style="list-style-type: none"> Give effect to Objective C1. 	

Table 8. Assessment against relevant objectives and policies for the Regional Policy Statement for Northland.

No.	Objective / Policy	Comment
Objective 3.2	<ul style="list-style-type: none"> Seeks to maintain and improve water quality for human use and ecological health. 	This proposal is consistent with this objective as it will at the least maintain water quality.
Objective 3.3	<ul style="list-style-type: none"> Seeks to safeguard the flows and flow variability required to maintain water's life-supporting capacity, for ecological processes, and to support indigenous species. 	The proposal is consistent with this objective as it will have a no more than minor impact on surface water resources.
Objective 3.5	<ul style="list-style-type: none"> Requires that the region's resources are sustainably managed in a way that is attractive for business and investment that will improve the economic wellbeing of the region and its communities. 	The proposal is consistent with this objective as it will efficiently utilise a natural resource to facilitate development of economic wellbeing.
Objective 3.10	<ul style="list-style-type: none"> Requires efficient use and allocation of common natural resources with a particular focus on maximising the security and reliability of supply for users. 	The proposal is consistent with this objective.
Policy 4.3.2	<ul style="list-style-type: none"> Requires regulatory methods to avoid over-allocation of region-wide ecological flows and water levels. 	The proposal does not exceed allocation limits, hence is consistent with this policy.
Policy 4.3.3	<ul style="list-style-type: none"> Requires the allocation and use of water efficiently within allocation limits. 	The proposal will use water efficiently and will not exceed allocation limits, hence is consistent with this policy.

Table 9. Assessment against relevant objectives and policies for the Proposed Regional Plan for Northland.

No.	Objective / Policy	Comment
Objective F.0.1	<ul style="list-style-type: none"> Seeks to manage the use, development, and protection of Northland's natural and physical resources which enables people and communities to provide for their social, economic and cultural well-being while <ol style="list-style-type: none"> sustaining the natural resources to meet the reasonable foreseeable needs of future generations, safeguarding life-supporting capacities of water, and avoiding, remedying, or mitigating adverse effects on the environment. 	The proposal is consistent with this objective.
Policy D.2.2	<ul style="list-style-type: none"> Requires that regard is had to the social, cultural, and economic benefits of the proposed activity when considering resource consents. 	The proposal will facilitate the economic and social benefits of both the landowner, their employees and the wider community through flow on effects of purchases made to operate and maintain the orchard.
Policy D.2.5	<ul style="list-style-type: none"> Requires an authority to have regard to community and tangata whenua values 	The proposal is not inconsistent with either community values, as there has been conversion to market gardening and horticulture in the area that has benefitted the community and tangata whenua through employment opportunities.
Policies D.4.5	<ul style="list-style-type: none"> Seeks to maintain overall water quality 	This proposal is consistent with this policy as it will not impact water quality.
Policy D.4.13	<ul style="list-style-type: none"> Seeks to achieve freshwater quantity related outcomes and in particular manage the taking, use, damming, and diversion of fresh water so that (with relevance to this application) saline intrusion in, and land subsidence above, aquifers is avoided (amongst other things). 	This proposal is consistent with this policy as it will avoid the saline intrusion and subsidence impacts, as discussed in Section 4.3 and 4.4.
Policy D.4.17	<ul style="list-style-type: none"> Considers allocation limits for aquifers and requires rules and applications to meet allocation limits. 	This proposal is consistent with this policy as the proposed take will not exceed allocation limits within the Aupouri-Motutangi zone.
Policy D.4.18	<ul style="list-style-type: none"> Concerns conjunctive surface water and groundwater management. 	This application is not inconsistent with this policy, in that the groundwater take will not adversely impact on surface water through stream depletion.
Policy D.4.20	<ul style="list-style-type: none"> Requires the reasonable and efficient use of water for irrigation and sets requirements for a resource consent application to take water for irrigation purposes. 	This proposal is consistent with this policy as the daily irrigation rate and annual volume are considered efficient and just meet 10-year drought requirements, but provide reduced reliability for more severe droughts.

No.	Objective / Policy	Comment
Policy D.4.23	<ul style="list-style-type: none"> Requires conditions on water permits that <ol style="list-style-type: none"> 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 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 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 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 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 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. 	The proposal is only partially consistent with this policy, as the applicants are arguing that so long as pumping data is recorded electronically and available for the council upon request, telemetry is not required. All other provisions will be met.

Table 10. Assessment against relevant objectives and policies for the Regional Water and Soil Plan for Northland.

No.	Objective / Policy	Comment
Objective 7.4	<ul style="list-style-type: none"> Requires the maintenance or enhancement of water quality of natural water bodies. 	This proposal is consistent with this objective as the effects of the take and use of the water will have no more than minor impacts on the shallow aquifer and other surface water bodies, as discussed in Sections 4.1 and 4.2
Objective 10.4.1	<ul style="list-style-type: none"> Seeks to maintain the sustainable use and development of the region's groundwater resources while avoiding, remedying, or mitigating actual and potential adverse effects on groundwater quantity and quality. 	Ditto above.
Policy 10.5.1	<ul style="list-style-type: none"> Seeks to ensure the sustainable use of resources by avoiding takes that exceed recharge. Saltwater intrusion, reduced groundwater quality, significant drawdown, and adverse effects on surface water resources can arise where takes exceed recharge. 	This proposal is consistent with this policy as the cumulative allocation in this aquifer management zone is only 11% of mean annual recharge, which is a low limit on a national scale.
Policy 10.5.2	<ul style="list-style-type: none"> Recognises that aquifers are at risk in certain circumstances and that adverse effects on water quality should be avoided. 	This proposal is consistent with this policy in that current water quality will be maintained.

No.	Objective / Policy	Comment
Policy 10.5.4	<ul style="list-style-type: none"> Seeks that groundwater allocations take into account reduction in recharge that may occur in time. 	This proposal is consistent with this policy in that the analysis assumed no rainfall for the entire 96 days of pumping.
Policy 10.5.7	<ul style="list-style-type: none"> Requires the Northland Regional Council to consider effects of a groundwater take and use on surface water bodies. 	This proposal is consistent with this policy as the effects of the take and use of the water will have no more than minor impacts on the shallow aquifer and other surface water bodies, as discussed in Section 4.1
Policy 10.5.9	<ul style="list-style-type: none"> Seeks to avoid, remedy or mitigate any ground subsidence as a result of groundwater takes, use or diversion, where this is likely to cause adverse flooding, drainage problems, or building damage. 	This proposal is consistent with this policy as subsidence effects will be unmeasurable, as discussed in Section 4.4 .

7. Notification

Section 95 sets out the decision-making steps for the determining of public notification and limited notification of applications and the timeframe Councils have for making the notification decision.

A notification assessment has been carried out in accordance with the stepped process as documented in **Table 11**.

Table 11. RMA Section 95A public notification of consent applications assessment.

Step	Question	Assessment
Step 1: mandatory public notification in certain circumstances	a) The applicant has requested that the application be publicly notified	NO
	b) Public notification is required under section 95C	NO
	c) The application is made jointly with an application to exchange recreation reserve land under section 15AA of the Reserves Act 1977	NO
Step 2: if not required by step 1, public notification precluded in certain circumstances	a) The application is for a resource consent for 1 or more activities, and each activity is subject to a rule or national environmental standard that precludes public notification.	NO
	b) The application is for a resource consent for 1 or more of the following, but no other, activities: (i) a controlled activity; (ii) a restricted discretionary or discretionary activity, but only if the activity is a subdivision of land or a residential activity; (iii) a restricted discretionary, discretionary, or non-complying activity, but only if the activity is a boundary activity; (iv) a prescribed activity (see section 360H(1)(a)(i)).	NO
Step 3: if not precluded by step 2, public notification required in certain circumstances	a) The application is for a resource consent for 1 or more activities, and any of those activities is subject to a rule or national environmental standard that requires public notification.	NO
	b) The consent authority decides, in accordance with section 95D, that the activity will have or is likely to have adverse effects on the environment that are more than minor.	NO
Step 4: public notification in special circumstances	Determine whether special circumstances exist in relation to the application that warrant the application being publicly notified.	NO

Therefore, in accordance with s95A(9)(b) of RMA, the consent authority should not publicly notify this application but may determine whether to give limited notification under s95B.

8. Consultation

Schedule 4 of the RMA requires that an AEE should identify (amongst other things) the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted.

Potentially affected parties in relation to this application could include other groundwater users and occupiers of the land within the pumping induced groundwater cone of depression.

However, it should also be noted that while it is considered good practice and “neighbourly” to undertake consultation, under Section 36A of the RMA there is no requirement for an applicant or council to undertake any consultation with any person in regard to an application.

Written approval has been obtained from six land owners adjacent to the Avokaha property. Copies of these documents are provided in **Appendix D**. Additional consultation has not been undertaken with other water users and landowners because the assessment of effects and in particular the bore interference assessment provided in **Section 4.2** concludes that no other groundwater users are considered to be adversely affected by the granting of this application.

9. Summary and Conclusions

Avokaha Limited are seeking to increase an existing groundwater take to facilitate the development of a 8-ha orchard on a property located at 70 Turk Valley Road, Motutangi. The current groundwater take, AUT.008647.01.04, is for 26,400 m³/year and 160 m³/day. The increased volume being sought is intended to bring the irrigation capacity for the property up to 28.75 m³/day per ha of total orchard area and 480 mm/year of total canopy area. The additional groundwater take being sought in this application will be exercised from October to April, in accordance with the following volumes:

- Maximum daily volume of 70 m³/day; and
- Maximum annual volume of 4,800 m³/yr.

A consent duration of 30 years is sought, subject to a lapse period of 5 years.

If granted, this consent taken with other pending applications will increase the allocation status for the Aupouri-Motutangi sub-aquifer management zone to approximately 71.4% of full allocation. The activity status thus remains Discretionary.

The AEE has demonstrated that the potential adverse effects of the proposed water take and use on the environment will be less than minor, and the effects on persons will also be less than minor.

The proposal is also considered to be consistent with the relevant objectives and policies of the NPS, the RPS, the pRPN, the RWSPN, and Part 2 of the RMA. The applicant considers that in light of the less than minor effects of the application, the decision made following the recent hearing for the MWWUG consent applications, the consent should proceed without public notification and be granted on a non-notified basis.

10. References

Bouwer H, 1977. Land Subsidence and Cracking Due to Ground-Water Depletion. Agricultural Research Service-U.S. Department of Agriculture

Lincoln AgriTech, 2015. Aupouri Aquifer Groundwater Model. Consultancy report prepared for Northland Regional Council.

Tait, B., 2018. Allocation and use of water. Recommendations in response to submissions on the Proposed Regional Plan for Northland - Section 42A hearing report. Date: 3/07/2018. Author: Ben Tait. Version: Final.

Williamson Water Advisory, 2017. Motutangi-Waiharara Groundwater Model Factual Technical Report – Modelling. Consultancy report prepared for Motutangi-Waiharara Water Users Group.

Williamson Water and Land Advisory, 2019A. Aupouri Aquifer Groundwater Model-Factual Technical Report. Consultancy report *prepared for interested parties and the public*.

Williamson Water and Land Advisory, 2019B. Addendum to Assessment of Effects Reports Pertaining to Aupouri Aquifer Resource Consent Applications Compiled by WWLA *prepared for the Northland Regional Council*

Appendix A. Form A - Application for Resource Consent

APPLICATION FORM FOR RESOURCE CONSENT



Putting Northland first

Whāngārei Office	Phone: (09) 470 1200
	Fax: (09) 470 1202
Kaitiāia Office	Phone: (09) 408 6600
Ōpua Office	Phone: (09) 402 7516
Dargaville Office	Phone: (09) 439 3300
Free Phone	0800 002 004
E-mail	mailroom@nrc.govt.nz
Website	www.nrc.govt.nz

**This application is made under Section 88/127
of the Resource Management Act 1991**

To: Consents Department
Northland Regional Council
Private Bag 9021
Whāngārei Mail Centre
Whāngārei 0148

IMPORTANT NOTES TO APPLICANTS

- (a) Please read fully the notes below and the Information Brochures and Explanatory Notes available from the Council, before preparing your application and any supporting information.
- (b) The Resource Management Act 1991 sets out the information you must provide with your application for a resource consent. If you do not provide adequate information, your application cannot be received nor processed by the Council and will be returned to you. If you are unsure of what information should be included with your application, please contact the Council before submitting the application.
- (c) Applications require notification (public advertising calling for submissions) unless the Council is satisfied that the adverse effects on the environment of the activity for which consent is sought will be minor; and written approval has been obtained from every person who the Council is satisfied may be adversely affected by the granting of the consent. The Council also has available a form "Form 8A – Affected Person's Written Approval", to help you record such approvals for applications that may be processed without public notification.

PART A – GENERAL

APPLICANT	Full Names
(1) Full Name of Applicant(s): (in full e.g. Albert William Jones and Mary Anne Jones. For Companies, Trusts and other Organisations, commonly used name)	Avokaha Limited
	ATTN: Keith Patterson (Director)
Phone Number – Business:	Fax: +64 3 351 5645
Home:	Mobile: +64 21 897 479
E-mail:	paterson.verity@xtra.co.nz

For applications by a company, private trusts or other entity/organisations, the Directors; Trustees and Officers' full names must be supplied and Section (12) completed and signed.

(2) Postal Address: (in full)	55 Idris Road
	Fendalton
	Christchurch 8052
	New Zealand

(3) Residential Address: (if different from postal address)	

(4) Address for Service of Documents: (if different from postal address e.g. Consultant)	Jon Williamson (jon.williamson@wwa.kiwi)
	c/o Williamson Water & Land Advisory
	PO Box 314
	Kumeu, 0812
Auckland	

(5) Owner/Occupier of Land/ Water Body: (if different from the Applicant)	N/a

(6) Type(s) of Resource Consent sought from the Regional Council:	
You will need to fill in a separate Assessment of Environmental Effects Form for each activity. These forms can be obtained from the Northland Regional Council.	
Coastal Permit	
<input type="checkbox"/> Mooring	<input type="checkbox"/> Marine Farm
<input type="checkbox"/> Other (specify) _____	<input type="checkbox"/> Structure
	<input type="checkbox"/> Pipeline/Cable
Land Use Consent	
<input type="checkbox"/> Vegetation Clearance	<input type="checkbox"/> Quarry
<input type="checkbox"/> Earthworks	<input type="checkbox"/> Construct/Alter a Bore
<input type="checkbox"/> Other (specify) _____	<input type="checkbox"/> Structure in/over Watercourse
	<input type="checkbox"/> Dam Structure
Water Permit	
<input type="checkbox"/> Stream/Surface Take	<input type="checkbox"/> Damming
<input type="checkbox"/> Other (specify) _____	<input checked="" type="checkbox"/> Groundwater Take
	<input type="checkbox"/> Diverting Water
Discharge Permit	
<input type="checkbox"/> Domestic Effluent to Land	<input type="checkbox"/> General Discharge to Land
<input type="checkbox"/> Air	<input type="checkbox"/> Water
<input type="checkbox"/> Other (specify) _____	<input type="checkbox"/> Farm Dairy Effluent to Land/Water

(7) Other Resource Consents required from the District Council:	
Where other Resource Consents are required for the same activity, they must be applied for at the same time. Not doing so will delay the processing of this application.	
What other Resource Consents are required from the District Council?	
<input checked="" type="checkbox"/> None	<input type="checkbox"/> Land Use Consent
	<input type="checkbox"/> Subdivision Consent
Have the applications been made? <input type="checkbox"/> Yes <input type="checkbox"/> No	

(8) Description of the Activity:
Please briefly describe the activities and duration for which Consent(s) are being sought. It is important you fill this out correctly, as the Council cannot grant Consent for any activity you do not apply for.
The resource consent application for Avokaha Ltd. is seeking to take and use groundwater from the Aupouri aquifer for irrigation of a 6.5 canopy hectare orchard. This application comprises an increase to the existing groundwater take registered as AUT.008647.01.02. The existing consent is for 160 m³/day and 26,400 m³/year.
This application is seeking an increase in consented groundwater take volumes for the following amounts:
• 4,800 m³/yr (total with existing consent would be 31,200 m³/year)
• 70 m³/day (total with existing consent would be 230 m³/day)

(9) Location of Property/Waterbody to which Application relates:

Describe the location in a manner which will allow it to be readily identified, e.g. street address, legal description, harbour, bay, map reference etc. Attach appropriate plans and/or diagrams.

Property Address: 70 Turk Valley Road
(see rate demand)

Locality: Motutangi

Legal Description: Lot 3 DP178824

Blk: _____

SD: _____

Other Location Information: Bore coordinates: 1614553 E 6138575 N

PART B – ASSESSMENT OF EFFECTS ON THE ENVIRONMENT

You must include an assessment of the effects of your activity on the environment as part of your application.

The Resource Management Act 1991 requires that each application include an assessment of the actual and potential effects of the activity on the environment in accordance with the Fourth Schedule.

To assist you to supply this assessment of effects, the Council has prepared specific forms for various consent activities. For minor activities, all that will be required is for you to complete the specific form. Where the potential effects of the activity are more significant, we recommend you undertake a full assessment of effects, with professional assistance if necessary.

If you are unsure of what information to include with your application and the assessment of effects, please contact the Council before submitting your application. A pre-lodgement meeting with relevant Consent Staff is recommended.

PART C – GENERAL

(10) Renewal of an Existing Resource Consent:

☐ Yes ☐ No ☒ A change in conditions of a current Resource Consent

(11) Fee/Deposit Enclosed with Application(s):

Application to be processed as: ☐ Notified ☐ Limited Notified ☒ Non-notified

☐ Coastal Permit: \$ _____

☐ Land Use Consent: \$ _____

☒ Water Permit: \$ 896.50

☐ Discharge Permit: \$ _____

☐ Bore Permit: \$ _____

☐ Change Conditions: \$ _____

(12) Signature of Applicant(s) or Persons authorised to sign on behalf of Applicant(s):

IMPORTANT NOTES TO APPLICANTS

- (a) Your application must be accompanied by the minimum fee (deposit) as determined by the Council. A schedule of the fee/deposits for different consent applications is annexed. Please note that applications by private trusts and other group entities require the personal guarantees of the Trustees and/or Officers for the payment of costs to be submitted with the application.
- For complex applications, the Council may require an additional deposit pursuant to Section 36(3) of the Act, based on the estimated costs for processing such complex applications and may require progressive monthly payments during consent processing.
 - The final fee is based on actual and reasonable costs including disbursements and where this fee exceeds the fee/deposit, the additional fee is subject to objection and appeal.
- (b) All accounts are payable by the 20th of the month following the date of invoice. Any actual and reasonable costs, including but not limited to legal costs, debt collection fees or disbursements incurred as a result of any default in payment, shall be recoverable from the Applicant and is so notified in compliance with the Credit Contracts and Finance Act 2003. Submitting this Application authorises the Council to, if necessary, provide your personal information to a Credit Reporter in order to employ in its debt collection services in compliance with the Credit Reporting Privacy Code 2004, should payment default occur.
- (c) Resource Consents usually attract an annual fee to recover the reasonable costs of the Council's monitoring, supervision and administration of the Consent during its term.
- (d) The information you provide is official information. It will be used to process the application and, together with other official information, assist the management of the region's natural and physical resources. Access to information held by the Northland Regional Council is administered in accordance with the Local Government Official Information and Meetings Act 1987 and the Privacy Act 1993.

I/we declare that, to the best of my/our knowledge and belief, the information given in this Application and attached Assessment of Environmental Effects is true and correct. I/we unconditionally guarantee jointly and severally to pay the actual and reasonable costs of processing this Application as and when charges become due and payable. I/we acknowledge that I/we understand the consequences of sign

Signature: _____ pp.

Full Name (print): Jon Williamson

Date: 17/04/2019

Signature: _____

Full Name (print): _____

Date: _____

Continue with Trustees' and Authorised Officers' signatures below, as necessary.

Personal details and signatures of Trustees*, or Officers authorised to sign on behalf of and to bind Trusts, Societies and Unincorporated Entities. * Private and Family Trusts only

Full Name and Status:
(Trustee, Officer etc)

Full Residential Address:

Signature:

Full Name and Status:
(Trustee, Officer etc)

Full Residential Address:

Signature:

Full Name and Status:
(Trustee, Officer etc)

Full Residential Address:

Signature:

Full Name and Status:
(Trustee, Officer etc)

Full Residential Address:

Signature:

CHECKLIST – Have you remembered to...

- ☐ Complete all details set out in this Application Form
- ☐ Include an Assessment of Effects of the activity on the environment, set out in the attached form
- ☐ Sign and date the Application Form

- ☐ Include a Site Plan
- ☐ Include the appropriate fee as set out in the "Schedule of Minimum Estimated Initial Fees"
- ☐ Complete details of Trustees and/or Authorised Officers on this page

Appendix B. AgWater Engineering Irrigation Analysis

Reference: 19005

Date: 15th April 2019



Agricultural water solutions

Avokaha Orchard

Attention: Claudia Hermosilla

Email: peter@agwater.co.nz

Web: www.agwater.co.nz

Mobile: 027 7676761

Dear Claudia,

Re: Avokaha Avocado Orchard – Irrigation Services

We have inspected the installation at Avokaha Avocado Orchard and report as follows.

Overview

Avokaha orchard appears to be a mixture of mature, immature, and recently planted trees set among mature shelter belts. The blocks are arranged in irregular dimensions to fit the land and the stage of development.

There is no design or analysis for the irrigation system as it has been installed.

We understand the original irrigation system was set up for dripline but has been since upgraded to a micro sprinkler system.

Irrigation is supplied by a water bore set into the shelter belt between blocks 2 and 5. A submersible pump is set into the bore, depth, age and condition unknown.

A simple fertigation system injects fertigant into the irrigation water.

Irrigation water is distributed to the orchard through PVC pipework. Control valves located at the blocks admit water into LDPE 'alkathene' submains along the head of each block..

The valves and irrigation pump are controlled by a simple irrigation controller.

Water is taken from the submain into a new 19mm lateral pipe arranged along each row. New Netafim SuperNet LRD Sprinklers are located at each tree to provide irrigation. These are typically 40LPH. In some blocks there has been some interplanting of trees and in this case there is one sprinkler per two trees.

The work to the orchard blocks: laterals and sprinklers appears recent. The irrigation infrastructure is original with no work done to meet the changes to the irrigation systems in the blocks.

Frost Mitigation

Frost mitigation is not provided on this orchard. We consulted the previous owner who advised frost mitigation has not historically been required in this area.

Irrigation Requirements

We have based our calculations on the following Evapotranspiration and crop coefficient maxima.

Typical accepted Kc for avocados varies over the season according to the age of the tree and its fruiting growth cycle. Recommended values can vary from 0.5 to 0.85, NZ texts quote Kc=0.65. We have used a value of 0.65 in these calculations.

Eto = 5.4mm/day

Kc = 0.65

Etc = 3.5mm

We estimate the nominal daily maximum irrigation demand as follows:

Estimated canopy area	6.46	ha
Etc	3.5	mm/day
Irrigation demand, max	226	m3/day

We estimate the nominal annual irrigation demand:

Maximum take, pa	est. required		Consented	
Annual demand	480	mm	Not known	mm
Avokaha	31202	m3/pa	Not known	m3/pa

Resource Consent

The resource consent has not been sighted. The consent should allow as follows:

Maximum daily take: 230m3/day

Maximum Annual Take: 31,202m3

Water Bore

The water bore is a 4" PVC cased bore which appears to extend 100m into the shell bed aquifer of this region. The condition of the water bore is unknown but it appears to be producing good quality water with few contaminants.

Similar bores in this region were constructed to produce around 8m3/hr, but since then have been used to produce up to 15m3/hr as the orchards have been upgraded.

Bore Pump

The bore pump dates from the original orchard, age condition and model are unknown at this time. Labels on the pump control indicate the pump is 2HP or 1.5kW rating.

We calculate a submersible pump operating at 80% efficiency will produce around 7m3/hr at 6Bar (see following hydraulic analysis) pressure at a shaft power of 1.4kW.

We would normally design an irrigation system to operate over a 15 hour pumping day. Over a 15hour pumping day the orchard will require a minimum of 15m3/hr to meet maximum irrigation demand as identified above.

At a maximum 24hour pumping day the orchard will require at least 9.4m3/hr, pumping capacity.

Based on the above the existing pump is too small to meet the maximum irrigation demand.



We recommend as follows. In the first instance the bore capacity should be tested. A (step) pump test should be undertaken to determine if the bore can produce enough water each day without degradation. Some remediation of the bore may be required as the bore is reasonably old.

Ideally the existing bore pump can be upgraded and irrigation water can be supplied directly from the bore.

If the bore capacity is limited but the daily volumes can be achieved around a 24 hour period the water can be pumped to a storage tank/bladder and then irrigated at the required rate from the storage system using a surface pump.

If the bore capacity is sufficient a new bore pump will be required. We recommend the existing pump be replaced with a larger pump, such as a Pentair SC12, 3.0 or 4.0kW unit. See attached brochure.

A larger bore pump will provide the higher flows and pressures needed for an orchard of this size. A pump of this size can be installed with an MDPE riser instead of a steel pipe for economy and ease of service.

Pump head works

The pump discharges through a simple galvanised/PVC head works which includes:

- Pressure reducing/sustaining valve
- a water meter,
- Simple manual filter,
- pressure relief valve,
- take off for fertigation
- discharge into a DN40mm PVC pipework.

The headworks is functioning but of average to poor construction, supported on wooden blocks.

The PSRV valve needs to be serviced or replaced.

The water meter is >5 years old and will need to be replaced as it will not be reading accurately. The water meter installation is non-compliant as the pipework needs to be constructed with a straight piece 10x pipe diameters upstream and 5x pipe diameters downstream.

The Filter condition appears OK but is small for the duty required. The small filter can be re-purposed for tank and sprayer filling.

Fertigant is injected into the bore headworks using a displacement pump. Back flow prevention is required. If the irrigation control system shuts down the fertigation pump could be left running. Measures for the prevention of chemigant entering the aquifer needs to be installed.



Fertigation System

The fertigation system is a simple bulk injection type using an electric displacement type pump. The orchardist operates the pump manually while the irrigation system is running while watching the tank level until the required volume of fertigant has been delivered to the block(s).

The operator fills a stainless vat (estimated 2000liter) from the water bore. Chemicals are mixed in the tank using a standard Pentair pool pump (see photo) to mix the chemicals into solution. The Fertigant is injected into the irrigation water using an injection pump as each block is irrigated.

The fertigation process is entirely manual and requires the operator to be skilled, present and to actively operate the fertigation pump and manage the fertigation volumes injected into the water with the irrigation cycle.

The system can be operated as is. However the orchard manager is not in residence on site and will need to attend and remain continuously on the orchard to set up and operate every fertigation event to every block. The orchardist will need to remain on site each fertigation day – 15hours plus... Automation of fertigation will reduce the labour inputs to preparation of the fertigant and monitoring function.



Good condition mixing tank



Good quality dosing pump lying in the dirt.

We recommend the existing fertigation systems be replaced with a system that will allow mixing and storage of fertigant, and contolled proportional dosing into the orchard. This will greatly improve the reliability of the system and also reduce labour overheads required to operate the system.

The skilled labour unit will only be required to set up and intitiate the fertigation process to the entire orchard, and manage any alarm events.

The following minimum measures should be undertaken:

- remove trees overhead or cover the fertigation tank to stop debris entering the tank
- pour a concrete slab to the shed for chemical storage and preserve irrigation equipment
- install a decent filter to prevent debris and particles >240mcrons entering the irrigation water
- install back flow prevention to the water bore head works
- Tidy up the installation which is average to poor.

We further recommend the fertigation system be improved to reduce the labour overhead and potential for error in operating the system. The existing components can be re purposed for a cost saving. We recommend as follows:

- Replace the existing irrigation flow meter with a new meter with pulse output so irrigation flows can be measured by the controller
- Install a fertigation flow meter with pulse output and solenoid valve into the fertigation line so the controller can monitor and control the volume of fertigant entering the irrigation water.
- Install a new controller and electrical services for the following operation:
 - o Periodic mixing using the existing pool pump to mix fertigant when fertigating
 - o Programmed fertigation operation with
 - Monitor irrigation flow and
 - Proportionally dose fertigant by operating the solenoid vale and dosing pump while measuring dosed volumes using the fertigation flow meter.

Control System

The orchard irrigation system is controlled by a Rainbird 12-zone irrigation controller. The controller is functional and is fully populated (no spare outputs). The controller provides simple irrigation control only.



The condition of the wiring is unknown.

The condition of the valves is unknown. We understand they are all functioning. We spoke to the previous owner who was unable to advise us of their location. The valves are apparently buried underground. From other orchards of similar age it is likely that they are simple on/off plastic weir gate type and will need to be replaced in the near future. On installations of this age we have usually found the solenoids controlling the valve are failing.

We recommend as follows:

- Upgrade the controller to a Netafim NMC Pro Junior, or similar with comprehensive irrigation and fertigation control function.
- Replace the control valves and install them in a manifold above ground in the avocado tree rows.

- Replacement of the valves and field wiring should be planned with the timing of any replacement would be dependent on the condition of the valves and other factors (see following)

See brochure attached for NMC Pro Junior.

Irrigation Pipework.

Irrigation water is distributed to the orchard through PVC pipework, size and condition unknown but thought to be 40mm, more than 20 years old.

Control valves located at the blocks admit water into submains along the head of each block. The valves are buried underground and the location is uncertain. They are however in working condition.

It is thought the submains are 32mm diameter alkathene pipe – part of the original installation.

The main and submain pipework is too small and should be replaced at some time in the future to meet upcoming orchard demand. See following.

Block Irrigation Installation

Water is taken from the submain into a new 19mm lateral pipe arranged along each row.

New Netafim SuperNet LRD Sprinklers are installed with a 90cm microtube off the lateral, one per tree to provide irrigation. See attached brochure for sprinkler information.

The sprinklers are typically 40LPH. In some blocks there has been some inter-planting of trees and in this case there is one sprinkler per two trees. This configuration is causing some 'shadowing' of the sprinkler operation so that coverage of the tree subcanopy is not even.



Hydraulic Analysis

The fundamental requirement of any irrigation system is the ability to deliver adequate water to the crop for its health and productivity. For avocados the irrigation system should irrigate at least 70% of

the tree canopy to the soil moisture levels demanded of the tree given its age, fruiting cycle, condition and the time of the season.

The SuperNET sprinklers installed provide 40 liters per hour of water to a wetted diameter of 6.0m. They are a pressure compensating sprinkler and operate over a range of 1.5 to 4.5 Bar. Minimum recommended operating pressure is 1.8Bar (18m).

We created a simple schematic of the orchard for analysis purposes. See attached. From this we calculate as follows.

Block No.	1	2	3	4	5	6	7	8	9	10	11	12
canopy (ha)	0.66	0.56	0.61	0.59	0.67	0.62	0.67	0.37	0.41	0.19	0.7	0.41
Lat No.	4	8	9	4	10	9	10	7	9	4	11	8
Lat L (m)	144	84	84	184	88	88	88	105	58	60	130	72
Lat Total L (m)	781	704	762	736	849	775	848	496	498	238	504	500
row spacing	8	8	8	8	8	8	8	8	8	8	8	8
tree spacing	4	8	8	8	8	4	4	8	8	8	4	4
Trees	195	88	95	92	106	194	212	62	62	30	126	125
Sprinklers	195	88	95	92	106	194	212	62	62	30	126	125
Sprinkler (LPH)	40	40	40	40	40	40	40	40	40	40	40	40
Flow (m3/hr)	7.8	3.5	3.8	3.7	4.2	7.8	8.5	2.5	2.5	1.2	5.0	5.0
effective application rate (mm/hr)	1.2	0.6	0.6	0.6	0.6	1.3	1.3	0.7	0.6	0.6	0.7	1.2
Irrigation time, max (hrs)	3.0	5.6	5.6	5.6	5.5	2.8	2.8	5.2	5.8	5.6	4.9	2.9
effective coverage (%)	83.6%	44.4%	44.1%	44.1%	44.8%	88.3%	89.4%	47.4%	42.9%	44.2%	50.9%	86.2%

Please note that this does not account for the increased tree counts from recent interplanting.

From the above we identify as follows.

There is insufficient coverage: 40 to 50%, under the avocado trees in the widely spaced orchard blocks. On an 8x8m spacing the 40LPH sprinkler only covers 28m² of the 64m² tree canopy. In these widely spaced blocks a second sprinkler is required to increase the cover to >70%. Please note that this will also increase the block flow.

The application rate is too low resulting in a long pumping time required to meet maximum daily irrigation demand. The pump duty has been noted at 7m³/hr. Even if we combine blocks to maintain pumping at around 7m³/hr, the irrigation time for the maximum application depth of 3.5mm will be around 40hrs – much more than the 24hr period and much more than the desirable 15 to 18hour irrigation standard.

We recommend as follows:

- Add a second sprinkler per tree on the widely spaced planted blocks to increase coverage >70%, and increase the application rate to reduce irrigation time
- Increase the pump duty to 15m³/hr (see above) to bring the irrigation cycle time <18hrs

- On the closely planted blocks the 40LPH sprinkler per two trees should be replaced with one 20LPH sprinkler per tree. The 40LPH sprinklers can be installed into the wide spaced blocks.

We visited the orchard and ran the irrigation system. One block at a time was irrigated. The pressures at the end of the lateral pipes were measured. We found the pressures in the mature 8m x 8m planted blocks were just adequate – in the region of 1.5 to 2Bar. We found the pressures in the closer or more intensively planted blocks to be around 1Bar pressure. In these blocks some of the sprinklers did not have sufficient pressure to operate (rotor spin). This verified that the pump was unable to provide sufficient pressures at the required flow. It is highly likely the pump is operating beyond its specification (off the curve) to meet the irrigation flows created by the sprinkler installation.

The irrigation system needs to operate at around 15m³/hr to meet maximum irrigation demand. The higher flows will cause increased pressure losses in the pipelines. Based on the schematic attached and our understanding/ estimate of pipeline sizes and lengths we calculate the following pressure losses over the system:

Nominal pump discharge pressure	50	m
<i>Less pressure losses:</i>		
Main: PVC DN40, 150m, 15m ³ /hr	-24	
Submain: LDPE 32mm, 75m, 8m ³ /hr	-9	
Lateral 19mm, 90m, 1m ³ /hr	-2.5	
elevation	-2	
fittings, valves	-2	
	10.5	M
Pressure at last sprinkler	1	Bar

Based on the above we recommend that the main pipeline size be increased to a minimum PVC DN65, PN9 pipe size, or alternatively an MDPE DN75mm pipeline.

The submains should be upgraded to a LDPE 50mm pipeline as a minimum to meet irrigation standards.

The lateral pipelines are fit for purpose as installed.

Conclusion and recommendations

The resource consent needs to be examined and amended to meet any changes in requirements due to the recent upgrades to the orchard.

A pump test needs to be carried out. The orchard should be surveyed and an irrigation design should be prepared to verify and refine our findings in this report.

The orchard is in good condition and the recent work to the irrigation system in the orchard blocks is of reasonable quality and does not need replacing. Existing components such as sprinklers can be re-purposed as required.

The balance of the irrigation system: pump, fertigation, subsurface pipelines, and controls need to be upgraded if orchard productivity is to be optimised.

The orchard has newly planted blocks and at present the immature trees do not require as much water. This means that any upgrade can be made progressively, but should be made before the trees mature and start producing fruit if orchard productivity is to be maximised.

Labour savings can be achieved by making some changes to the existing fertigation system and upgrading the controller to semi automate irrigation and fertigation.

We make the following recommendations:

1. Check resource consent and amend as required
2. Carry out a full design of the orchard irrigation system
3. Conduct a pump test to confirm bore capacity. Outcome of this will determine final pumping configuration.
4. Upgrade the pumping system based on 2 above. Either a 3 or 4kW bore pump will be required, or a storage plus surface pump installation configured.
5. Electrical services will need to meet nominal 4kW pumping duty.
6. Replace the pump manifold
 - a. New water meter with pulse output
 - b. Construct a new bore pump manifold, in particular Install meter to council requirement
 - c. Install Back flow prevention
 - d. Filtration to meet new pump duty
 - e. New PRSV valve and pressure relief valve, isolation valves and accessories for spray and tank filling
7. Alter fertigation system
 - a. Cover to tank and/or remove trees
 - b. Install a filter
 - c. Level the tank and install new pipework with
 - d. take off for pod connection
 - e. Electrical work to the mixing pump so it can be operated by the irrigation controller.
 - f. Add a solenoid valve and fertigation meter with pulse output
 - g. Tidy up the installation
8. Upgrade the controller to a Netafim NMC Pro Jnr for improved fertigation control and labour saving
9. Design and replace the main pipeline. Nominal pipe size should be 65mm PVC
10. Replace the control valves and field cabling
11. replace the submains with LDPE 50mm pipe
12. Add a second 40LPH sprinkler to each tree for 8x8m plantings (can use sprinklers from '13')
13. Replace the 40LPH sprinklers per two closely planted trees with two 20LPH sprinklers
14. Provide As-Built information, verify water meter

Budget Estimate

Please note the following pricing is provided for budget estimate purposes and discussion only. It is not a quote or an accurate estimate of cost. We would need to provide a full design of the irrigation system to provide an accurate estimate of costs.

Pump Test, irrigation design	\$3,500.00
Bore Pump SC4-12, 4kW on MDPE riser	\$9,500.00
Electrical Services	\$1,500.00
New pump Manifold	\$4,000.00
New Controller	\$4,500.00

Alterations to fertigation system	\$3,000.00	
Replace field cable and control valves	\$7,000.00	
Sprinklers	\$3,000.00	
New main pipeline	\$12,000.00	
New submains	\$12,000.00	
		excl
Total Investment	\$60,000.00	GST

A storage plus surface pump system would add a further \$25k to the above cost.

Studies show that fertigation and irrigation provide a 30% contribution to an Avocado Orchards productivity. The current installation irrigates less than 50% of 8 out of 12 of the orchard blocks canopy. The irrigation system meets less than 50% of the irrigation daily maximum irrigation volume. Based on this we estimate that irrigation contribution is only 10%, with room for improvement of 20% productivity.

The orchard covers 6.5ha canopy. A nominal production of 3,000 trays per hectare at \$15/tray equates to an annual income of \$300k. 20% of this income equates to \$60k. With a cost of improvement of \$60k, the annual productivity gain to the orchard appears to be equivalent to our budget estimate cost of improving the orchard.

We would welcome the opportunity to meet and discuss this in greater detail.

We trust we have interpreted your requirements correctly. Please do not hesitate to contact the writer should you have any queries or require further information.

Regards,

Peter Robinson
Consulting Engineer

Appendix C. Impact on Neighbouring bores

Predicted drawdown on bores over 50 m deep that are included in the NRC database:

IRISID	X	Y	Purpose	Depth of Bore (m)	Scenario 3 Drawdown: Deep Aquifer (m)	Scenario 3 Cumulative Drawdown: Deep Aquifer (m)
LOC.200341	1614490	6138367	Irrigation	89	0.012	1.949
LOC.209585	1614328	6138468	Irrigation	114	0.012	1.990
LOC.209284	1614800	6138422	Irrigation	90	0.011	1.972
LOC.209280	1614798	6138773	Irrigation	88.5	0.011	1.988
LOC.210299	1615073	6138680	Domestic and Irrigation	90	0.008	1.782
LOC.200331	1615089	6138668	Irrigation	87.4	0.008	1.782
LOC.210378	1614723	6139203	Domestic	89.7	0.008	2.126
LOC.209326	1615263	6138474	Stock and Irrigation	106.5	0.007	1.697
LOC.209647	1615180	6139069	Domestic and Irrigation	97	0.007	1.746
LOC.200239	1614387	6139466	Stock	73	0.007	1.887
LOC.300999	1614283	6139417	Domestic and stock	120	0.007	1.889
LOC.210374	1614344	6139436	Domestic and stock	113.5	0.007	1.889
LOC.314463	1614508	6139527	Stock	110	0.006	1.871
LOC.312665	1615069	6139351	Not specified	Not specified	0.006	1.944
LOC.209031	1614902	6139537	Domestic and Stock	115.1	0.006	1.817
LOC.200328	1614087	6139665	Irrigation	88	0.006	1.937
LOC.200197	1615742	6138418	Stock	96	0.005	1.594
LOC.200321	1613986	6139865	Not specified	117	0.005	2.195
LOC.200190	1614086	6139965	Stock	76	0.005	1.991
LOC.200292	1613486	6139963	Not specified	117.25	0.004	2.189
LOC.209495	1615824	6137512	Stock and Irrigation	85.5	0.004	1.653
LOC.201512	1615792	6137471	Domestic and Stock	77.5	0.004	1.666
LOC.309604	1616179	6137507	Domestic and stock	100	0.003	1.640

Appendix D. Affected Persons Written Approval



TO: Northland Regional Council

Full name of person giving written approval:

MALCOLM OWEN BELLETTE

I am the owner / occupier (delete one) of the property located at:

101 TURK VALLEY ROAD, MOTUTANGI

(Give address of property)

I have authority to sign on behalf of all the other owners / occupiers (*select one*) of the above property. **Note:** If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority.

This is written approval to the following activity that is subject of a resource consent application:

Applicant's Name:

Avokaha Limited

Application Number (if known):

Description of Proposal:

TO TAKE AN EXTRA 60 CUBIC METERS PER DAY FOR IRRIGATING OUR AVOCADO ORCHARD

Location:

70 TURK VALLEY ROAD, MOTUTANGI

I have read the full application for resource consent, the Assessment of Environmental Effects (AEE), and any site plans as follows:

Document name and date: AEE AND SITE PLAN

Plan number(s) and date(s): 08/06/2018

In signing this written approval, I understand that the Northland Regional Council must decide that I am no longer an affected person, and the Northland Regional Council must not have regard to any adverse effects on me.

I understand that I may withdraw my written approval by giving written notice to the Northland Regional

Council before the hearing, if there is one, or, if there is not, before the application is determined.

M. O. Bellette 21/6/2018
Signature* of person giving written approval Date
(or person authorised to sign on behalf of person giving written approval)

Address for service of person giving written approval: _____

Telephone: 09-406-8551

Fax/Email: bellette1n@gmail.com

Contact person: MALCOLM BELLETTE
(name and designation, if applicable) _____

* A signature is not required if you give your written approval by electronic means.

- NOTES:**
- (1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, if you do not understand what this form is, or details about the application, then **DO NOT SIGN IT**.
 - (2) Conditional written approvals cannot be accepted.
 - (3) If this form is not signed, the application may need to be notified with an opportunity for submissions.

AFFECTED PERSONS WRITTEN APPROVAL FORM OCTOBER 2013 (REVISION 5)

GUIDELINES FOR AFFECTED PERSONS REQUEST FOR WRITTEN APPROVAL

Why is your written approval being sought?

If you have been asked to sign this form, it will be because someone is proposing an activity that requires a resource consent and you have been identified as a potentially affected person.

For a resource consent application to be processed without notification the applicant needs to:

1. Show that the proposed activity has no more than minor effects on the environment; and
2. Obtain the written approval of any person that the Council considers may be adversely affected.



TO: Northland Regional Council

Full name of person giving written approval:

CYPRESS HILLS Ltd
ALAN ANDERSON

I am the owner / occupier (*delete one*) of the property located at:

84 TURK VALLEY ROAD, MOTUTANGI

27

(Give address of property)

I have authority to sign on behalf of all the other owners / occupiers (*select one*) of the above property. **Note:** If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority.

This is written approval to the following activity that is subject of a resource consent application:

Applicant's Name: Avokaha Limited

Application Number (*if known*):

Description of Proposal: TO TAKE AN EXTRA 60 CUBIC METERS PER DAY FOR IRRIGATING OUR AVOCADO ORCHARD

Location: 70 TURK VALLEY ROAD, MOTUTANGI

I have read the full application for resource consent, the Assessment of Environmental Effects (AEE), and any site plans as follows:


Document name and date: AEE AND SITE PLAN

Plan number(s) and date(s): 08/06/2018

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I understand that I may withdraw my written approval by giving written notice to the Northland Regional

Council before the hearing, if there is one, or, if there is not, before the application is determined.



Signature of person giving written approval
(or person authorised to sign on behalf of person giving written approval)* *Date*

Address for service of person giving written approval: _____

Telephone:

0273195268

Fax/Email:

Cypresshillslimited@gmail.com

Contact person:
(name and designation, if applicable)

Alan Anderson

** A signature is not required if you give your written approval by electronic means.*

- NOTES:**
- (1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, if you do not understand what this form is, or details about the application, then **DO NOT SIGN IT**.
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TO: Northland Regional Council

Full name of person giving written approval: NEIL THOMPSON

I am the owner / occupier (delete one) of the property located at: 38 ~~84~~ TURK VALLEY ROAD, MOTUTANGI
(Give address of property)

I have authority to sign on behalf of all the other owners / occupiers (select one) of the above property. Note: If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority.

This is written approval to the following activity that is subject of a resource consent application:

Applicant's Name: Avokaha Limited

Application Number (if known): _____

Description of Proposal: TO TAKE AN EXTRA 60 CUBIC METERS PER DAY FOR IRRIGATING OUR AVOCADO ORCHARD

Location: 70 TURK VALLEY ROAD, MOTUTANGI

I have read the full application for resource consent, the Assessment of Environmental Effects (AEE), and any site plans as follows:


Document name and date: AEE AND SITE PLAN

Plan number(s) and date(s): 08/06/2018

In signing this written approval, I understand that the Northland Regional Council must decide that I am no longer an affected person, and the Northland Regional Council must not have regard to any adverse effects on me.

I understand that I may withdraw my written approval by giving written notice to the Northland Regional

Council before the hearing, if there is one, or, if there is not, before the application is determined.

 12.6.18
Signature* of person giving written approval Date
(or person authorised to sign on behalf of person giving written approval)

Address for service of person giving written approval: 38 TURK VALLEY ROAD, MOTULANGI, RD 4 KAITIAHUA

Telephone: 0940685918

Fax/Email: molulangi@xta.co.nz

Contact person: NEIL THOMSON
(name and designation, if applicable)

* A signature is not required if you give your written approval by electronic means.

- NOTES:**
- (1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, if you do not understand what this form is, or details about the application, then **DO NOT SIGN IT**.
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AFFECTED PERSONS WRITTEN APPROVAL FORM OCTOBER 2013 (REVISION 5)

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TO: Northland Regional Council

Full name of person giving written approval:

Jonathan Anders Jacobsen

I am the owner / ~~occupier~~ (delete one) of the property located at:

65-84 TURK VALLEY ROAD, MOTUTANGI
JAJ (Give address of property)

I have authority to sign on behalf of all the other owners / occupiers (select one) of the above property. **Note:** If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority.

This is written approval to the following activity that is subject of a resource consent application:

Applicant's Name: Avokaha Limited

Application Number (if known): _____

Description of Proposal: TO TAKE AN EXTRA 60 CUBIC METERS PER DAY FOR IRRIGATING OUR AVOCADO ORCHARD

Location: 70 TURK VALLEY ROAD, MOTUTANGI

I have read the full application for resource consent, the Assessment of Environmental Effects (AEE), and any site plans as follows:

Document name and date: AEE AND SITE PLAN

Plan number(s) and date(s): 08/06/2018

In signing this written approval, I understand that the Northland Regional Council must decide that I am no longer an affected person, and the Northland Regional Council must not have regard to any adverse effects on me.

I understand that I may withdraw my written approval by giving written notice to the Northland Regional

Council before the hearing, if there is one, or, if there is not, before the application is determined.

J. Jacobsen 13/6/18
Signature of person giving written approval* *Date*
(or person authorised to sign on behalf of person giving written approval)

Address for service of person giving written approval:

P.O. Box 151 Mangonui 0442

Telephone:

09 4060280

Fax/Email:

jake@jacobson.co.nz

Contact person:

(name and designation, if applicable)

Jake Jacobsen Director

* A signature is not required if you give your written approval by electronic means.

- NOTES:**
- (1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, if you do not understand what this form is, or details about the application, then **DO NOT SIGN IT**.
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TO: Northland Regional Council

Full name of person giving written approval:

Hogan King

I am the owner / occupier (delete one) of the property located at:

3167 Fox North Road, Motutangi
(Give address of property)

I have authority to sign on behalf of all the other owners / occupiers (select one) of the above property. **Note:** If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority.

This is written approval to the following activity that is subject of a resource consent application:

Applicant's Name: Avokaha Limited

Application Number (if known): _____

Description of Proposal: TO TAKE AN EXTRA 60 CUBIC METERS PER DAY FOR IRRIGATING OUR AVOCADO ORCHARD

Location: 70 TURK VALLEY ROAD, MOTUTANGI

I have read the full application for resource consent, the Assessment of Environmental Effects (AEE), and any site plans as follows:

Document name and date: AEE AND SITE PLAN

Plan number(s) and date(s): 08/06/2018

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Council before the hearing, if there is one, or, if there is not, before the application is determined.

[Signature] _____
Signature* of person giving written approval Date
(or person authorised to sign on behalf of person giving written approval)

Address for service of person giving written approval:

345 SH 11 RD 2 Kaitake

Telephone:

Fax/Email:

elby@extra.co.nz

Contact person:

(name and designation, if applicable)

Logan Krey

* A signature is not required if you give your written approval by electronic means.

NOTES:

- (1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, you do not understand what this form is, or details about the application, then **DO NOT SIGN IT**.
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AFFECTED PERSONS WRITTEN APPROVAL FORM OCTOBER 2013 (REVISION 5)

GUIDELINES FOR AFFECTED PERSONS REQUEST FOR WRITTEN APPROVAL

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TO: Northland Regional Council

Full name of person giving written approval:

Sheyl Shue

I am the owner / occupier (delete one) of the property located at:

84 TURK VALLEY ROAD, MOTUTANGI

(Give address of property)

I have authority to sign on behalf of all the other owners / occupiers (select one) of the above property. **Note:** If you are signing on behalf of a trust or company, please provide additional written evidence that you have signing authority.

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Application Number (if known): _____

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Location: 70 TURK VALLEY ROAD, MOTUTANGI

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Plan number(s) and date(s): 08/06/2018

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I understand that I may withdraw my written approval by giving written notice to the Northland Regional

Council before the hearing, if there is one, or, if there is not, before the application is determined.


Signature* of person giving written approval
(or person authorised to sign on behalf of person giving written approval)
Date 12/06/18

Address for service of person giving written approval:

23 Kaimanawa Road, Waiharara

Telephone:

09 406 8867

Fax/Email:

sheyl.shone@egmail.com

Contact person:

(name and designation, if applicable)

Sheyl Shone

* A signature is not required if you give your written approval by electronic means.

NOTES:

(1) There is no obligation for you to sign this form and no reasons need to be given. Therefore, you do not understand what this form is, or details about the application, then **DO NOT SIGN IT**.

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AFFECTED PERSONS WRITTEN APPROVAL FORM (OCTOBER 2013 (REVISION 5))

GUIDELINES FOR AFFECTED PERSONS REQUEST FOR WRITTEN APPROVAL

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