BEFORE THE NORTHLAND REGIONAL COUNCIL

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

Reply Evidence of
David William West
for the Director-General of Conservation
4 June 2021

For the Director-General of Conservation:

Sarah Ongley
Barrister
PO Box 8213
NEW PLYMOUTH
Telephone: 0274 467 917
Email: sarah@ongley.co.nz
www.bankchambers.co.nz

Lisa Sutherland
Legal Counsel, DOC *Te Papa Atawhai*
PO Box 842
WHANGAREI 0140
Telephone: 0272 750 826
Email: lsutherland@doc.govt.nz

REPLY EVIDENCE OF DAVID WILLIAM WEST

QUALIFICATIONS AND EXPERIENCE

1 My full name is **David William West**. I am a Freshwater Science Advisor based in the Whangārei office of the Department of Conservation (DOC). My full qualifications and experience are set out in my Evidence in Chief (EIC) dated 21 August 2020.

CODE OF CONDUCT

2 I have read and agree to comply with the Code of Conduct for Expert Witnesses produced by the Environment Court 2014 and have prepared my evidence in accordance with those rules.

3 I confirm that the issues addressed in this brief of evidence are within my area of expertise.

4 I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed. I have specified where my opinion is based on limited or partial information and identified any assumptions I have made in forming my opinions.

SCOPE OF EVIDENCE

5 My EIC covered concerns regarding potential adverse effects on wetlands, ephemeral wetlands, springs, streams, lakes & ponds and threatened freshwater species. This included lack of identification and/or mapping of affected ecosystems and species.

6 Since the date of my EIC:

- I have participated in expert conferencing on:[1]

    i. Hydrogeology, freshwater & ecology on 27 Nov 2020 (JWS 2);

    ii. Shallow aquifer monitoring in relation to surface water impacts (JWS 3);

    iii. Potential wetlands risk analysis (JWS 5);

[1] Other Joint Witness Conferencing also occurred, with 6 Conferencing Statements:

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

iv. Threatened species (JWS 6);

and

- I have reviewed the Supplementary S42A Report drafts of the Groundwater Management and Contingency Plans (GMCP's) and make comments, particularly on the new proposed 'Wetland Delineation Framework'.

7 Further to the Commissioner's Directions, DOC requested certain 'tasks' be undertaken by the Applicant, on 16 October 2020. These requested tasks are attached to DOC's legal submissions in reply. Some tasks the Applicant has not agreed to carry out, as I explain in my evidence.

Wetlands

8 I, together with the other experts representing the Department, acknowledged that a pragmatic method for identification and monitoring of wetlands at risk of drawdown effects was needed. We contributed to conferencing on the selection of representative wetland Areas Of Interest (AOIs) in locations of higher drawdown and risk. The methodology for this task (Task 6) 'Potential Wetland Risk Analysis' was agreed between experts for DOC, the Applicant and NRC.

9 Using the areas mapped as high risk by the revised risk matrix the Applicant's hydrogeologist initiated a process whereby a larger number of AOIs were shortlisted down to those where wetlands were most likely to be present. The relevant JWS states:[2]

> *"For clarification the experts' final agreed list of AOIs is: Areas D, E, G, H, J, K M, N, P & Q, noting that circles shown on the maps are considered indicative guidelines and nearby sites that are identified as having significance as a wetland during the benchmarking exercise may be carried forward in the GMCPs."*

10 There were points of disagreement as to what DOC and NRC ecologists would do once AOIs were agreed.

11 As shown in the JWS, I was reluctant to specify what part of the eventual consenting framework the work should be undertaken in.[3] I had expected that it would have been part of an assessment of environmental effects of the Applicant's consent applications. I discuss this further under the "GMCP" heading below, along with a discussion on the mapping of wetlands within the 10 shortlisted wetland AOIs (D, E, G, H, J, K, M, N, P & Q), proposed as part of the GMCPs in the Supplementary s42A Report.

[2] JWS 5 at [6].
[3] JWS 2 – differences in the wording of our positions under Step B.

12 The Applicant's hydrogeologist and NRC's hydrogeologist[4] also constrained any further assessment of AOIs to only those areas defined as wetlands and not connected surface water streams/drains, springs and lakes.[5] In my EIC, I discussed reasons I consider it is important to consider effects on these other surface water bodies.

Surface waterbodies other than the identified wetlands

13 Tasks DOC sought during the adjournment, included:

- #1(d) Stream depletion effects/Lakes: site-specific investigations on potential stream flow depletion/lake water level for high risk areas (with highest known ecological values + hydraulic connection).

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

14 The Commissioners had requested an assessment of each application in terms of their "Hydraulic Connection Category" with respect to Policy H.5 of the pRPN.[6] This Policy determines whether, and the manner in which, groundwater takes are subject to minimum flows and water levels as set out in Policy H.4 pNRP. In Policy H.4, minimum "*levels"* are set for lakes and natural wetlands, and minimum "*flows*" are set for rivers and streams.

15 Mr Williamson provided a Hydraulic Connection Category Assessment in his Supplementary evidence dated 28 September 2020. Mr Williamson's modelling predicted stream depletion effects of between 0 – 25% using methodology outlined in that evidence. This evidence concluded that all the takes therefore fall into the "Other" category in Policy H.5, that is:

> "where the take is not classified as having a direct hydraulic connection and the calculated surface water depletion effect is less than 40% of the abstraction rate determined by the pumping schedule".

16 This would mean that the individual groundwater takes are not subject to the surface water 'allocation regime' e.g. surface water minimum flows.

17 There was some confusion during expert conferencing whether the application of Policy H.5 meant that consideration of potential adverse effects on surface waterbodies (other than wetlands) was

[4] JWS 2 at [20]: "In response to the differences between the experts, as subsequently described above, Brydon Hughes observed that his understanding was that the steps in paragraphs 18 & 19 (above) were restricted to areas defined as wetlands, rather than to surface water bodies that may be hydraulically connected to wetlands that are addressed via other areas of expert conferencing."
[5] Contrary to my position – record in JWS 2 under Step A, page 5.
[6] Minute #2.

wholly precluded from consideration. This was reflected in the expert conferencing as follows:

JWS 2:

- Mr Williamson and Mr Hughes took the view that further assessment on surface water effects was not required based upon Policy H.5 together with Mr Williamson's Supplementary Statement of Evidence.[7]

- Mr Williamson took the view that the "Other" category in Policy H.5 reflects that groundwater abstraction has negligible impact on the natural flow regime.[8]

- Mr Williamson advised he considered adequate monitoring was proposed in the GMCP conditions to safeguard against surface water depletion effects, including the shallow aquifer monitoring and wetland monitoring.[9]

- Dr Drinan and I requested further information on the proposed monitoring regime.

JWS 3:

- The objective of this conferencing was to discuss the adequacy of the monitoring proposed in the GMCPs for the protection of surface waters, and in particular using shallow aquifer groundwater level monitoring as a proxy for surface water impacts given that pumping occurs in the underlying deep aquifer.[10] At this conferencing session, we did not discuss the need for further analysis of potential effects on streams, given Mr Williamson's and Mr Hughes' stated positions on Policy H.5.

- Mr Williamson, Mr Hughes, Dr Drinan and I agreed that: *"shallow aquifer monitoring is a pragmatic means by which to establish potential effects of deep groundwater pumping on surface water bodies*".

---

[7] JWS 2 at [25] – [26].

[8] JWS 2 at [28]: "Jon Williamson responded (to the 2nd sentence in para 27 above) that surface waters naturally recede below their default minimum flow statistic, regardless of whether there is any groundwater abstraction or not. The Policy (H.5) (and others like it this throughout the country) are aimed at establishing the likely degree of additional effect on the natural flow regime due to groundwater abstraction. The "Other" category reflects that groundwater abstraction has negligible additional impact on the natural flow regime. Hence he disagreed on the relevance of Tom Drinan's comment in light of the Policy provision and others like it throughout NZ."

[9] JWS 2: Jon Williamson advised that he considered that adequate monitoring was proposed in the applications and the proposed GMCP conditions to safeguard against surface water depletion effects from the applicants' proposed activities, including the shallow aquifer monitoring and also the wetland monitoring (Task 6)."

[10] This Objective stated at [3] of JWS 3 and in the title: Expert Conferencing "*relating to shallow aquifer monitoring in relation to potential surface water impacts*".

18 I remain concerned, as I expressed at conferencing, that there could be adverse effects on surface water quantity and ecological effects regardless of whether the thresholds in Policy H.5 are met.[11] I agree with the following:[12]

> "Tom Drinan noted that surface water depletion (due to groundwater abstraction) could lead to a reduction in stream/river flows below their default minimum flows set for this river FMU (Coastal river minimum flow = 90% of 7-day MALF (Policy H.4.1), irrespective of these proposed groundwater takes being classified as 'Other' in terms of hydraulic connectivity (Policy H.5)."
>
> "[S]treamflow/water level (for lakes) reductions below these default minimum limits increases the risk of adverse ecological effects on these surface water ecosystems."

19 I remain of the view that adequate assessments of these potential adverse effects have not been carried out, particularly cumulative assessments that take into account the existing allocation status of relevant reaches.

20 I consider spatially explicit streamflow hydrological assessments are needed, whereby the Applicants' hydrogeological specialists would model both the individual and cumulative effects of the predicted drawdowns for each of the stream/river reaches shown on NRC's Water Allocation Tool.[13]

Lakes

21 As noted in my EIC, several of Northland's most significant dune lakes occur in the affected area and one of the most notable – Lake Rotoroa – is centrally located in highest predicted drawn-down area. No conferencing was undertaken on Lakes despite DOC's task request. Many Aupouri lakes have extensive wetlands around their margins and these are classified as lacustrine wetlands,[14] further emphasising the need to consider these waterbodies within a wider

---

[11] JWS 2 at [27]

[12] Above-cited.

[13] This Tool was developed by Northland Regional Council to fulfil its 'accounting' requirements under the NPSFM 2014. As described in the Evidence of S Osbaldiston for the Proposed Northland Regional Plan hearings (Water Quantity), [5.1] – [5.9], the tool uses a series of ArcGIS models and Python scripts. The tool takes data from various sources and provides the following key outputs:.

a. River catchment scale – source to sea and several sub-catchments
   i. Indicative level of allocation (estimated permitted and consented) compared with the water available in accordance with PRP H.4.3 at catchment scale.

b. River reach scale (based on DN1)
   i. Indicative level of consented allocation accumulated down the network compared with water available in accordance H.4.3.
   ii. Indicative level of consented allocation considering downstream allocation availability. For example, if the allocation of a reach is already at the limit then all reaches that contribute to the flow at that site are also at their limit, as any further takes upstream will result in exceedance of the limit at that site.
   iii. Indication of lesser minimum flow regimes set by existing consents conditions compared to H.4.1.

[14] Johnson, P., & Gerbeaux, P. (2004). Wetland types in New Zealand. Wellington, N.Z: Dept. of Conservation; Ministry for the Environment.

context. This was discussed in the Supplementary Evidence of T Drinan given for the PRPN hearing on Water Quantity/Allocation (Appendix 1 to my evidence), subsequently the Environment Court issued its Decision referred to in Ms Ongley's/Ms Sutherland's legal submissions. [15]

22 In the Environment Court's decision, Policy H.4.2 of the PRPN (Minimum levels for lakes and natural wetlands) was amended "*to provide that there can be no change to the levels of any dune lake*".[16] I understand that NRC had proposed this 'no change' requirement be limited to Lakes ranked of High or Outstanding value only.[17] This was extended to all lakes. The Court's reasons are set out in DOC's legal submissions. Dr Drinan's evidence was largely accepted, and included:

- Water-level fluctuations (WLFs) affect lake ecological processes and patterns in several ways, and are critical to biodiversity values, as they structure the distribution of organisms in most wetlands and lake littoral zones. For example, seasonal and interannual WLFs influence the survival of aquatic biota and functioning of lake marginal turf communities that contain many threatened plants, while high water levels and flooding help to release nutrients from riparian areas. In the case of macrophytes, the upper depth limit is set by disturbance, water level and wave action.[18]

- Considering that biota will have varying physiological responses to the dynamics of WLFs, different species will occupy different positions along the land-water interface, and several aspects of WLFs have been identified as important to defining these distributions.[19]

- Altering the natural WLFs of lakes (in terms of their extent, frequency or duration), will likely yield an ecological response (which will vary depending on lake type).[20] The extent of aquatic habitats and feeding/breeding grounds will change, as light, climate, and wave action characteristics are altered (to name but a few variables).[21] There are many

---

[15] *Minister of Conservation & Ors v Northland Regional Council* (Topic 3 and 4) NZEnvC 001 (Interim Decision) NZEnvC 033 (Final Decision).
[16] A note was also added to Policy H.4.2 to clarify how "No change" is to be measured given that lake levels are subject to natural fluctuations.
[17] As reflected in Council's planning witness, Mr Tait's, EIC at [6.45] "*I consider that given their importance, the minimum level for the outstanding and high ecological value lakes should be no change in their seasonal or annual range in water levels*."
[18] James MR, Mark A, Single M 2002. Lake Managers' Handbook: Lake Level Management. Prepared for the Ministry for the Environment. ME 443.
[19] For example Riis T, Hawes I 2002. Relationships between water level fluctuations and vegetation diversity in shallow water of New Zealand lakes. Aquatic Botany 74: 133–148.
[20] Evtimova VV, Donohue I 2016. Water-level fluctuations regulate the structure and functioning of natural lakes. Freshwater Biology 61: 251–264.
[21] Wantzen KM, Rothhaupt K-O, Mörtl MO, Cantonati M, G-Tóth L, Fischer P 2008. Ecological effects of water-level fluctuations in lakes: an urgent issue. Hydrobiologia 613: 1–4.

studies that have detailed adverse biotic responses (particularly vegetation) to altered WLFs.[22]

23 I am unable to adequately describe the full biodiversity values of the lakes present within the project area (assessment of values was not considered in any of the AEEs); however, in my opinion, many of these lakes are likely to provide habitat for *Threatened* and *At Risk* species.[23]

24 For example, a study comparing the littoral macroinvertebrate faunas of 17 Aupouri Peninsula lakes found that "*the littoral fauna of the Aupouri lakes is diverse and species-rich, and can be expected to have an important role in supporting the diverse fish and aquatic bird populations of the lakes*".[24]

25 Champion & de Winton (2012) specifically mention "*water level fluctuations, especially dropping lake levels*" as a key pressure affecting some dune lakes adjacent to plantation forests (see also Collier 1996; Stephens et al. 2018[25]). The authors further note that hydrological alteration "*appear*[s] *to be impacting the ecological health of the lake*(s)". [26]

26 Considering that there are predicted water level drawdowns for some identified lakes,[27] I consider that such assessments have not been carried out; thereby, risking potentially significant values of dune lakes within the project area.

---

[22] Leira M, Cantonati M 2008. Effects of water-level fluctuations on lakes: an annotated bibliography. Hydrobiologia 613: 171–184 and references therein.

[23] For example Collier KJ 1996. Potential impacts of plantation forestry on dune lakes in Northland, Prepared for the Department of Conservation. NIWA Consultancy Report DOC60204 and references therein. And Conning L, Holland W 2003. Natural areas of Aupouri Ecological District: Reconnaissance survey report for the Protected Natural Areas Programme. Published by the Department of Conservation.
See further reconnaissance survey reports for some of Northland's ecological districts: https://apc01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.doc.govt.nz%2Fabout-us%2Fscience-publications%2Fconservation-publications%2Fland-and-freshwater%2Fland%2Fnorthland-conservancy-ecological-districts-survey-reports%2F&data=04%7C01%7Clsutherland%40doc.govt.nz%7C5646ea25138241176a0a08d926e873e8%7Cf0cbb24fa2f6498fb5366eb9a13a357c%7C0%7C0%7C637583602078749370%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=XgNbfThOdADX1j%2FuZawm%2BcUZ61q9q2J%2F3sS%2FrSms7k0%3D&reserved=0.

[24] Ball OJ-P, Pohe SR, Winterbourn MJ 2009. The littoral macroinvertebrate fauna of 17 dune lakes on the Aupouri Peninsula, Northland. Unpublished report prepared by NorthTec (Environmental Sciences Department) for Northland Regional Council.

[25] See also Collier 1996 Supra Note 23 and Stephens T, Augustinus P, Rip B, Gadd P, Zawadski A 2018. Managing land-use effects on Northland dune lakes: lessons from the past. New Zealand Journal of Marine and Freshwater Research 52: 409–429.

[26] Champion P, de Winton M 2012. Northland lakes strategy. Prepared for Northland Regional Council. NIWA Client Report No: HAM2012-121.

[27] E.g. Elbury Holdings Ltd Consent Application, 0.105 m predicted drawdown for Lake Rotoroa predicted based on the August 2018 modelling.

Springs

27 As outlined in my EIC, springs are ecosystems where groundwater discharges to the surface therefore springs are likely to be one of the first surface water habitats to be impacted by declines in groundwater levels and pressure due to abstraction. Because many groundwaters are closely interconnected with surface waters, ecosystems above ground often rely on them, permanently or intermittently, to support biological communities and ecological function.

28 DOC requested a task to identify example spring(s) (in discussion with iwi/NRC/DOC) for which baseline data (water level monitoring) could be collected prior to any abstraction but this task was not accepted.

29 Springs are known to be of significant (disproportional to their extent) habitats for many rare and threatened freshwater species (e.g., over 40% of New Zealand's *Threatened* freshwater invertebrates inhabit these ecosystems, often exclusively as spring/seepage specialists). Therefore, I remain of the opinion that the lack of consideration for both their natural values and their relative sensitivities to the proposed groundwater abstraction place these habitats and species at high risk of adverse ecological effects.

Threatened species

30 While conferencing was undertaken on threatened species between NRC and DOC ecologists (myself), hydrogeologist for NRC and the hydrogeologist for the Applicants later stated "…*that if there were no hydrological impacts arising from the proposed activities, then there would be no adverse effects on Threatened Species*."

31 A review of freshwater-dependent species within the Aupouri aquifer extent was undertaken by me with assistance of NRC ecologists but was not included within JWS 6. I attach the outcome of this work in Appendix 2 to my evidence.

32 I note that the s42A-recommended GMCPs do provide for description of flora and fauna within wetland AOIs and, should consents be granted.

33 I would recommend that suitable surveys should be undertaken to capture-ID freshwater-dependent species.

GMCP's

34 All three GMCPs use the Wetland delineation protocols published by MfE in 2020. I note the Hydrology Tool in the American protocol was "*currently under development*" when the MfE protocol was developed and the protocol still has little detail on requisite hydrologic measurements that would be first to indicate effects of increased abstraction on wetlands. In my opinion there are additional improvements that should also be used in delineation

such as new lists of wetland plants[28] and Northland hydrological mapping.[29] Should the Applicant provide an ecological expert, I would be in a position to further discuss this with that person.

35 JWS 2 contained the following agreement, as 'step B' for wetlands:[30]

> *"For all of the listed potential wetland areas, a report is to be prepared by suitably qualified, independent expert(s) to ground-truth the extent of the wetland area(s) and to carry out an ecological survey describing the existing flora and fauna. The report is to assess the importance of each wetland and the level of risk."*

36 As recorded in the JWS, I agreed that the ground-truthing could be a part of the GMCP as an adaptive management type clause, but I did not think it is appropriate for the technical experts to specify what part of the consenting framework the work should be undertaken in. I consider that this should be undertaken by planning experts.

37 Ground truthing should also evaluate why some wetland sites classified as high risk did not pick up nearby connected wetlands, which presumably could be due to discrepancies in the GIS-based approach (and groundwater modelling outputs). An example of this is in the document 'WWLA memo depression assessment 29092020'.pdf, Area of interest F (page 7) and K (page 14). This may highlight that there are unmapped wetlands of high risk which haven't been captured within AOI circles. It is unclear to me what the extent of AOIs and wetland delineation is, the GMCPs have polygons drawn on parts of oblique photos that may or may-not encompass the AOIs supplied as GIS files.

38 No spring mapping or monitoring is planned in GMCPs and as stated above this is a significant gap in my opinion.

39 The GMCPs and adaptive management regime being pursued by the Applicants rely on appropriate monitoring that is analysed and reported quickly and consistently. Specialists for DOC Dr Tom Drinan, James Blyth and I communicated to Mr Williamson and Mr Hughes our concerns over deficiencies in proposed monitoring in conferencing, summarised concerns and suggested ways they could be allayed in the attached Memorandum "*Concerns with monitoring as proposed*" 16 December 2020 (Appendix 3 to this evidence).

40 Inadequate surface water effects monitoring poses a significant risk that hydrologically mediated impacts on these ecosystems (and

---

[28] Clarkson, B. R., Champion, P. D., Forester, L., & Rance, B. D. (2021). New Zealand Wetland Plant List 2021 (Landcare Research Report LC3975).
[29] Rissmann, C. W. F., Pearson, L. K., Lindsay, J. L., & Couldrey, M. A. (2019). Mapping of Northland's Wetness Gradients utilising Radiometric and Satellite imagery – GIS Metadata (2019/38). Report for Northland Regional Council.
[30] JWS 2 second paragraph under Step B, page 6.

species they support) go entirely undetected and irreparably damage freshwater ecosystems and species. For this final point, I do acknowledge that the s42A Officer's recommendations now include telemetry. Mr Baker's evidence will comment further on the proposed monitoring regime.

4 June 2021

Appendices

1. T Drinan Supplementary evidence (freshwater ecology) 28 October 2020.

2. JWS Task 9(f) *"Aupouri records of threatened freshwater dependant species*" D West & K Hansen, 3 Dec 2020.

3. Memorandum Prepared by DOC experts – D West, T Drinan & J Blyth dated 16 December 2020 "*Concerns with monitoring as proposed*".

BEFORE THE ENVIRONMENT COURT
AT AUCKLAND

I MUA I TE KŌTI TAIAO O AOTEAROA
TAMAKI MAKAURAU ROHE

IN THE MATTER OF	the Resource Management Act 1991
AND	
IN THE MATTER OF	appeals under clause 14 of Schedule 1 of the Act
BETWEEN	MINISTER OF CONSERVATION (ENV-2019-AKL-000122) PUBLIC AND POPULATION HEALTH UNIT OF THE NORTHLAND DISTRICT HEALTH BOARD (ENV-2019-AKL-000126) NORTHPOWER LIMITED (ENV-2019-AKL-000123) ROYAL FOREST AND BIRD PROTECTION SOCIETY (ENV-2019-AKL-000127) FEDERATED FARMERS OF NEW ZEALAND (ENV-2019-AKL-000114) **Appellants**
AND	NORTHLAND REGIONAL COUNCIL **Respondent**

SUPPLEMENTARY EVIDENCE OF THOMAS JOSEPH DRINAN
On behalf of the MINISTER OF CONSERVATION
(Freshwater ecology)
Dated 28 October 2020

Department of Conservation
P O Box 10 420, WELLINGTON 6011

Counsel acting: S J Ongley Barrister / M Downing Solicitor
Tel: 0274 467 917 / 027 564 1428
email: sarah@ongley.co.nz / mdowning@doc.govt.nz

1. INTRODUCTION, QUALIFICATIONS AND EXPERIENCE

1.1 My name is Thomas Joseph Drinan. My qualifications and experience are set out in my evidence in chief, dated 2 October 2020. I am not a wetland ecologist; however, I have experience working across a range of wetland types, both in New Zealand and internationally.

2. CODE OF CONDUCT

2.1 I confirm that I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2014, and I stand by the commitments to that Code that I set out in my evidence-in-chief (EIC).

3. SCOPE OF EVIDENCE

3.1 This evidence is provided to assist the Court on the implications of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (Freshwater NES) and the National Policy Statement for Freshwater Management 2020 (NPS-FM), as these national policy documents relate to wetlands. Furthermore, I provide a brief description of wetlands associated with lake ecosystems.

4. DEFINITION OF WETLANDS

4.1 The Resource Management Act 1991 (RMA) (Section 2) defines wetlands as "…*permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions*".

4.2 This is used in the definition of 'natural wetland' in the NPS-FM (2020).

5. DEFINITION OF LAKES

5.1 The RMA (Section 2) defines a lake as "*a body of fresh water which is entirely or nearly surrounded by land*". However, a more commonly used (and cited) definition of lakes in New Zealand is "*closed bodies of fresh or brackish water, larger than 1 hectare in surface area*" (Schallenberg et al. 2013).

5.2 Furthermore, a lakebed is defined in the RMA (Section 2) as "t*he space of land which the waters of the lake cover at its highest level without exceeding its margin*".

5.3 Needless to say, standing water bodies less than 1 hectare in area (e.g., dune lakes, kettle lakes) could be referred to as lakes on the basis of depth, permanence, and those displaying typical lake processes such as stratification and wave-action (Johnson & Gerbeaux 2004).

6. WETLANDS ASSOCIATED WITH LAKES

6.1 Many lakes in New Zealand have associated (fringing) wetlands. Northland's dune lakes are no exception: Champion & de Winton (2012) note "*These Northland lakes and **their surrounding wetland margins** support a range of endemic endangered species providing the only known habitat, or the national strongholds for a range of biota*". [my emphasis]

6.2 In the well-known text 'Wetlands types in New Zealand', Johnson & Gerbeaux (2004) recognise lacustrine (hydrosystem[1]) wetlands as those "*associated with the waters, beds, and immediate margins of lakes and other bodies of open, predominantly freshwater which are large enough to be influenced by characteristic lake features and processes such as fluctuating water level, wave action, and usually permanent and often deep water that has nil or only slow flow*".

6.3 At a finer level of wetland classification, Johnson & Gerbeaux (2004) further recognise shallow water wetlands as "*Aquatic habitats, generally less than a few metres deep, having standing water for most of the time. This wetland class accommodates the margins of lakes, rivers, and estuary waters, in which case the term 'shallow open water' is sometimes used to acknowledge the presence of an open body of water further from the shore…In practice, the shallow water wetland class provides for habitats that 'land-based' wetland workers would meet with at land / water margins*" (Figure 1).

6.4 This wetland type (lacustrine wetlands) was also one of the eight wetland types used to rank Northland's wetlands (Wildland Consultants 2011 – common bundle, tab 12). That report ranked 31 lacustrine wetlands (for which there was data available), eight of which were in the top 50 (from a total of 304 ranked wetlands).

6.5 To note, for Policy H.4.2 regarding minimum levels for lakes, the Minister of Conservation is seeking (on the basis of my EIC) the same level of

[1] Defined by Johnson & Gerbeaux (2004) as a "*wetland ecosystem differentiated by broad landform and hydrological settings, and by water salinity, water chemistry, and temperature*".

protection for all dune lakes (as for natural wetlands), which is "*no change in their seasonal or annual range in water levels*".

Figure 1. Lake Ngatu, Northland: a dune lake with erect, emergent-aquatic sedges (*Baumea juncea* in foreground; *Eleocharis sphacelata* in deeper water beyond). These can be classified as reedlands in the wetland class of shallow water; lacustrine (source: Johnson & Gerbeaux 2004).

Thomas Joseph Drinan

28 October 2020

REFERENCES

Champion P, de Winton M 2012. Northland lakes strategy. Prepared for Northland Regional Council. NIWA Client Report No: HAM2012-121.

Johnson P, Gerbeaux P 2004. Wetland types in New Zealand. Department of Conservation.

Schallenberg M, de Winton M, Verburg P, Kelly D, Hamill K, Hamilton D 2013. Ecosystem services of lakes. In Dymond J (ed.): Ecosystem services in New Zealand – Conditions and trends. Lincoln, New Zealand: Manaaki Whenua Press.

Wildland Consultants 2011. Ranking of wetlands in the Northland region: Stage 4 – rankings for 304 wetlands. Prepared for Northland Regional Council. Contract Report No. 2489.

JWS Task 9(f):

Aupouri records of threatened freshwater dependant species

Dave West & Katrina Hansen. 3 Dec 2020.

Introduction

Task we were given from 27 Nov 2020 DRAFT JWS "Dave West would review any records DOC had of threatened species covered by NZCPS Policy 11/NPSFM 2020 to identify species and locations of interest.

Dave to circulate his report and locations of threatened species on this by 5pm Wednesday 2 December 2020 to Jon Williamson and NRC representative (it was acknowledged that Katrina might not be available and so another person in NRC would be sought. In this regard Lisa Forester was suggested by Dave. Dave to liaise with NRC on this matter. Katrina was not present for this part of the expert conference on 27 November 2020.)"

Methods

Records of threatened species that occur in freshwater habitats were targeted for mapping and presentation to experts. The extent used to extract records includes areas covered by NZCPS Policy 11/NPSFM 2020.

Freshwater fish

Records of freshwater fish classified as At Risk (Dunn et al. 2018) from a 2 Dec 2020 NZ Freshwater Fish Database download that occurred within the Aupouri aquifer extent were selected.

Freshwater invertebrates

Records of threatened freshwater invertebrates from Grainger et al. (2014) were mapped where they occur within the Aupouri aquifer extent.

Freshwater dependant birds

Locations that occurred within the Aupouri aquifer extent were selected from a spatial DOC dataset of Australasian bittern records since 1990.

Vascular plants

DOC Bioweb records for At Risk and Threatened plants that occur in freshwater habitats were examined for those that occurred within the Aupouri aquifer extent.

Zones of interest

A shapefile of Zones of Interest from expert conferencing Sept -27 Nov 2020 was received from Williamson Water Ltd. and shortlisted for zones agreed on 27 November.

Results

Freshwater fish

At Risk fish species found within the Aupouri aquifer extent are 61 records of the endemic black mudfish *Neochanna diversus* (AR – declining), 8 records of longfin eel *Anguilla dieffenbachii* (AR – declining) and 24 records of native inanga *Galaxias maculatus* (AR – declining) (Figure 1). Most of the southern Northland ecologically significant unit of black mudfish populations (Barrier 2003) occur within the extent of the aquifer.

Freshwater invertebrates

No threatened freshwater macro-invertebrate records were found within the aquifer extent. Note that records of freshwater crustacea or insects such as freshwater crabs and diving beetles are not readily available unless local ecologists or consultant ecologists have sampled the locality.

Freshwater dependant birds

There are 56 records of Australasian bittern *Botaurus poiciloptilus* (Wagler, 1827) (Nationally critical) within the Aupouri extent since 1990 (Figure 2).

Vascular plants

There are ~200 records of threatened plants (de Lange et al. 2018) that occur in freshwater habitats within the Aupouri extent (Figure 3). Many of the records are for rare species and New Zealand's most threatened plants (Table 1).

Table 1. Observations of Threatened and At Risk plant species within the Aupouri aquifer extent from a 10/09/2020 Bioweb extract.

Species	**# of Records**	**Threat status**
Atriplex hollowayi	8	Nationally Critical
Centipeda minima subsp. minima	3	Nationally Endangered
Corybas carsei	2	Nationally Critical
Goebelobryum unguiculatum	1	Nationally Endangered
Juncus holoschoenus	1	Nationally Critical
Lobelia physaloides	32	Nationally Vulnerable
Lycopodiella serpentina	21	Nationally Vulnerable
Mazus novaezeelandiae subsp. impolitus f. hirtus	12	Nationally Critical
Metrosideros carminea	1	Nationally Vulnerable
Microlaena carsei	8	Nationally Endangered
Ophioglossum petiolatum	7	Nationally Critical
Pterostylis micromega	1	Nationally Endangered
Rorippa divaricata	2	Nationally Vulnerable
Tecomanthe speciosa	12	Nationally Critical
Todea barbara	30	Nationally Vulnerable
Trithuria inconspicua subsp. inconspicua	44	Nationally Critical
Utricularia australis	15	Nationally Critical
Botrychium australe	1	At Risk
Christella dentata	34	At Risk
Cyclosorus interruptus	54	At Risk

Drosera pygmaea	2	At Risk
Eleocharis neozelandica	14	At Risk
Fimbristylis velata	1	At Risk
Myriophyllum robustum	23	At Risk
Ranunculus urvilleanus	8	At Risk
Sporadanthus ferrugineus	1	At Risk
Thelypteris confluens	27	At Risk

Discussion

There are large numbers of records of threatened freshwater species within the extent of the Aupouri Aquifer. Areas of interest (at risk of effects from groundwater drawdown) do not have a high density of records but this could be due to several factors, primarily lack of survey given most of the areas of interest are outside protected areas where many of the surveys have occurred.

Not presented or readily available are groundwater dependant species or lower orders of biota from other freshwaters. Given groundwater abstractions being applied for, some knowledge of the threatened species in the Stygofauna (Fenwick et al. 2018) especially would be good but this fauna is rarely sampled or considered.

References

Barrier, R. 2003. New Zealand mudfish (Neochanna spp.) recovery plan 2003-13: Northland, black, brown, Canterbury and Chatham Island mudfish (51). DOC Wellington: https://www.doc.govt.nz/globalassets/documents/science-and-technical/tsrp51.pdf

de Lange, P. J., Rolfe, J., Barkla, J., Courtney, S. P., Champion, P. D., Perrie, L. R., . . . Ladley, K. 2018. Conservation status of New Zealand indigenous vascular plants, 2017 (22). DOC Wellington: http://www.doc.govt.nz/globalassets/documents/science-and-technical/nztcs22entire.pdf

Dunn, N. R., Allibone, R. M., Closs, G. P., Crow, S. K., David, B. O., Goodman, J. M., . . . Rolfe, J. R. 2018. Conservation status of New Zealand freshwater fishes, 2017 (24). DOC Wellington, New Zealand: https://www.doc.govt.nz/Documents/science-and-technical/nztcs24entire.pdf

Fenwick, G., Greenwood, M., Williams, E., Milne, J., & Watene-Rawiri, E. 2018. Groundwater Ecosystems: Functions, Values, Impacts and Management. (2018184CH). NIWA Envirolink report https://www.envirolink.govt.nz/assets/Envirolink/Reports/1838-HZLC143-Groundwater-Ecosystems-Functions-values-impacts-and-management.pdf

Grainger, N., Collier, K., Hitchmough, R., Harding, J., Smith, B., & Sutherland, D. 2014. Conservation status of New Zealand freshwater invertebrates, 2013. DOC Wellington, New Zealand: http://www.doc.govt.nz/Documents/science-and-technical/nztcs8entire.pdf

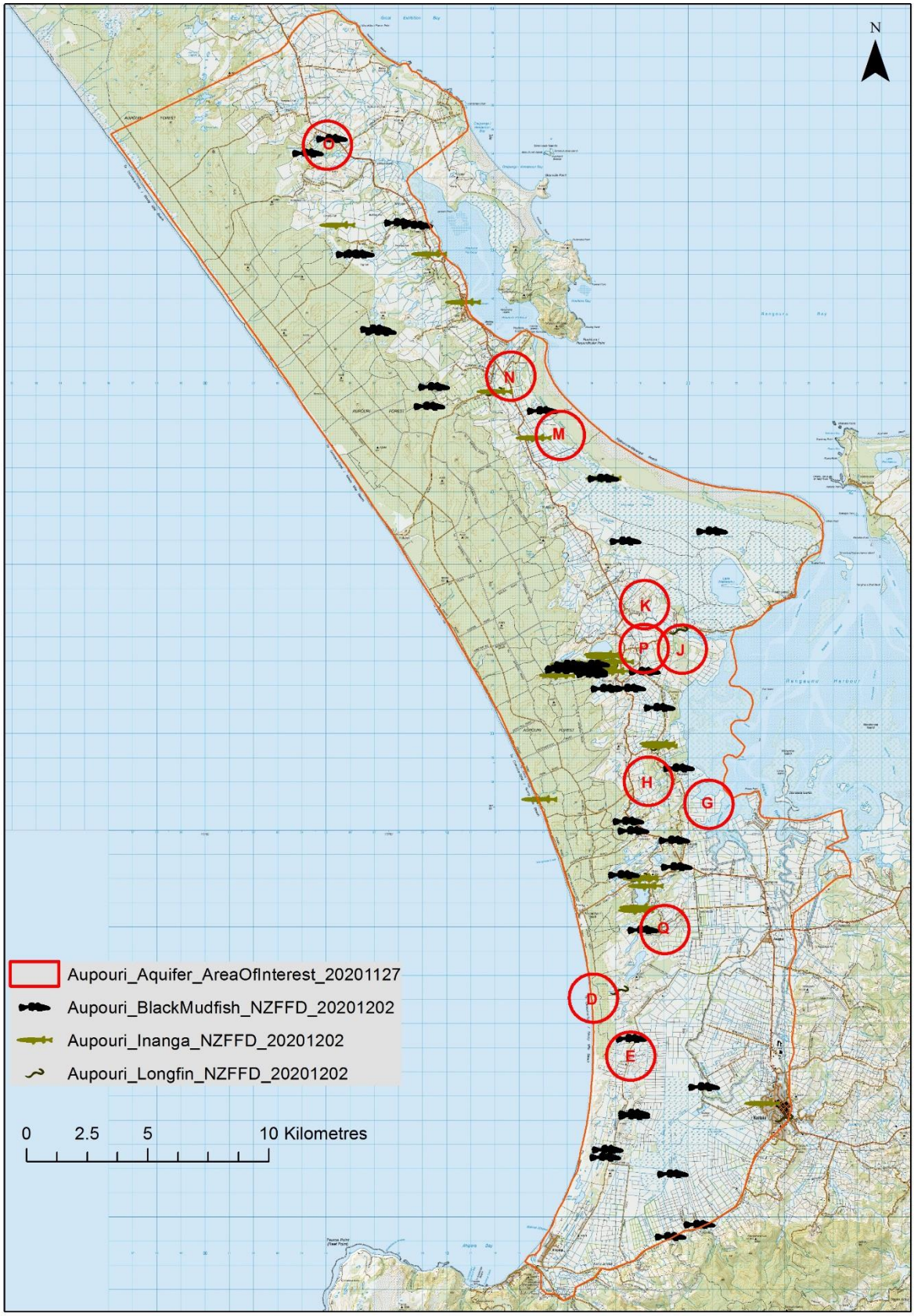

Figure 1. NZ Freshwater Fish Database Records (downloaded 2/12/2020) of At Risk (Dunn et al. 2018) freshwater fish within the Aupouri Aquifer extent. Fish records are shown for the endemic black mudfish and longfin eel, and inanga. Areas of interest IDed from expert conferencing.

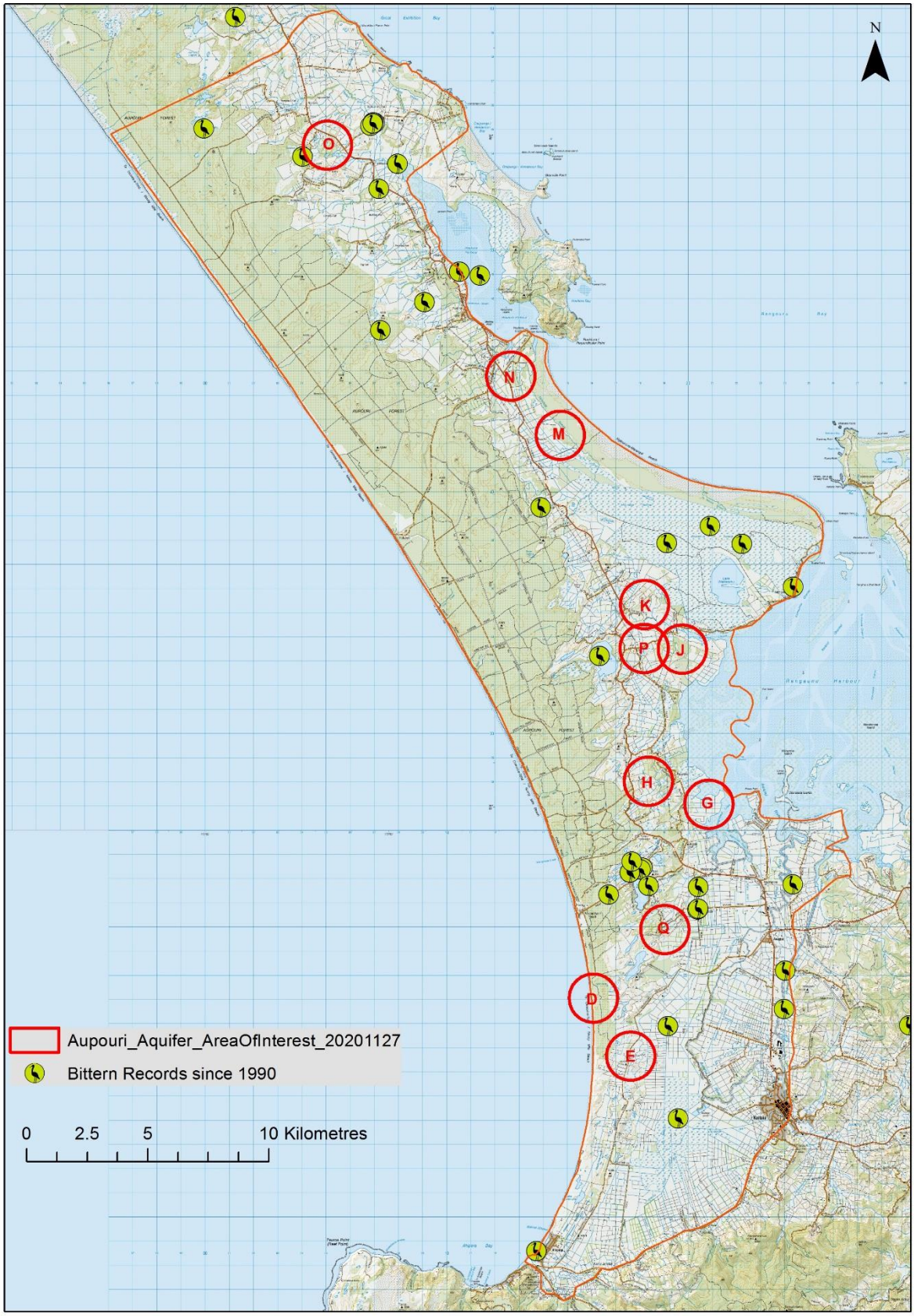

Figure 2. Records of bittern from spatial DOC dataset of bittern records since 1990.

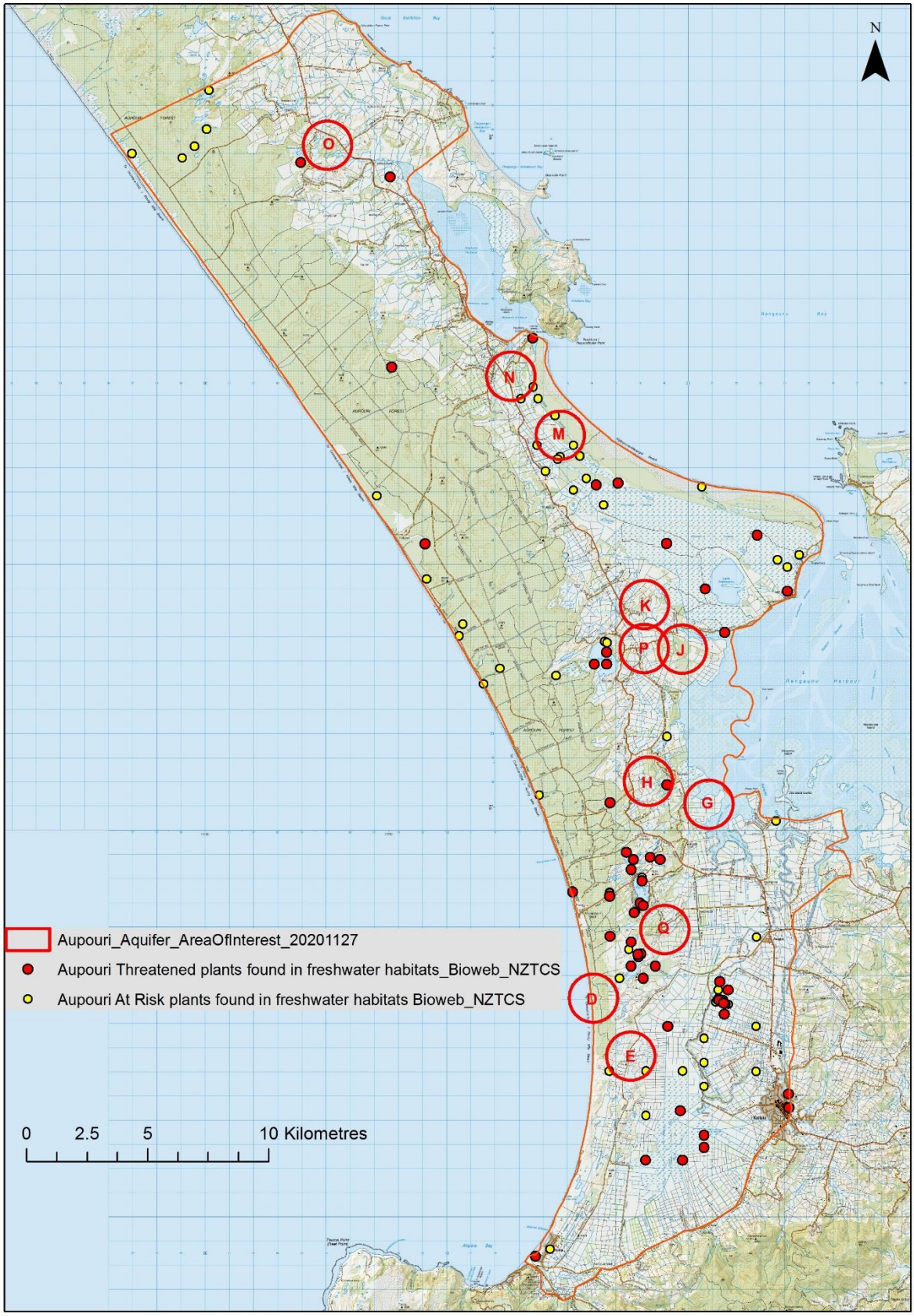

Figure 3. Locations of Threatened & At Risk native plants within the Aupouri aquifer extent from a 10/09/2020 Bioweb extract.

RE: Aupouri - 24 applications by the Aupouri Aquifer Water User group to the Northland Regional Council to take groundwater from the deep shell bed aquifer of the Aupouri Peninsula (REQ.596300).

Prepared by: DOC experts – Dave West, Tom Drinan & James Blyth

Date: 16 December 2020

Topic: Concerns with monitoring as proposed

1. Whilst stream depletion assessments have been conducted following NRC policies (H.5), we remain concerned that groundwater pumping-mediated reductions in streamflow/water levels (below their respective minimum limits) may have adverse ecological effects on surface water ecosystems and species within the overall area.

2. While we agree that shallow aquifer monitoring is a pragmatic means to indicate any signs of potential effects on surface waters we did not agree that existing and proposed shallow well coverage are adequate. The location of the proposed shallow aquifer monitoring wells appears to be largely focussed along the coastline to monitor saltwater intrusions. Very few of the limited number of the shallow aquifer wells proposed further inland and existing shallow aquifer wells inland occur in or near the areas of interest we have worked on with Jon, Brydon and Katrina. Many of the existing shallow aquifer wells are only monitored manually monthly.

3. NRC lake monitoring appears to be restricted to only 2 "outstanding" lakes of the 38 lakes (FENZ) including 19 dune lakes within the aquifer extent. Neither of these 2 "outstanding" lakes are within circles of Areas of Interest and are not included in wetland ground-truthing or assessment. Furthermore, water level monitoring is not proposed for any of the high value lakes (NRC are reducing their monitoring network to monitor Outstanding Lakes only). It is important to note that at the recent hearings (October 2020) for the Proposed Regional Plan for Northland, it was proposed by NRC that all 'Outstanding' and 'High' ecological value lakes be afforded a similar level of protection as natural wetlands with regards to their water levels – that is, no change to their seasonal or annual range in water levels (as per Policy H.4.2). Furthermore, DOC sought that **all dune lakes** be afforded this level of protection with regards to their water levels (i.e., same as natural wetlands).

4. **Outstanding value lakes**: Lakes Taharoa, Humuhumu, Waikere, Rotokawau (Pouto), Mokeno, Kai-Iwi, Ngatu, Wahakari, Kanono, Waiporohita, Waihopo and Morehurehu.

5. **High value lakes**: Lakes Kahuparere, Te Kahika, Te Werahi Lagoon, Karaka, Ngakapua, Te Paki Dune, Waiparera and Rotoroa.These shortfalls are compounded by reliance being placed upon monitoring in other task discussions we have had and GMCP proposed by the applicants.

6. Possible ways our concerns could be allayed

a) A wider monitoring network of the shallow aquifer occurs using transducers in dipwells, across a range of locations at risk from abstraction.
b) In two locations to be determined at high risk from drawdown, a transducer should be installed in a selected stream to capture stream water levels. These sites should be in close proximity to shallow groundwater monitoring bores.

c) Stage/water level monitoring should be incorporated for (a) any Outstanding or High value lake in an area of predicted shallow aquifer drawdown, and (b) for other lakes in areas of highest predicted shallow aquifer drawdown (i.e., greatest risk following the same water level risk table utilised for the wetland assessments).
d) Existing shallow monitoring bores under a GMCP should be upgraded from monthly manual dips to 15–30-minute water level measurements by installing transducers.
e) Ground-truthed surface water ecosystems, i.e. wetland types, threatened species habitats and connected streams at AOI schedule sites.
f) Effects monitoring plan for representative sub-sample of locations-springs and wetland types & threatened species i.e. at AOIs.
g) Conditions setting trigger points for further assessment of effects and adaptive management.
h) New monitoring sites should be incorporated within a revised version of a GMCP to assess change in water levels over time (should the consent be granted).