Before the Independent Commissioners appointed by the Northland Regional Council (NRC)

In the Matter of	the Resource Management Act 1991
And	
In the Matter of	applications by members of the Motutangi-Waiharara Water Users Group for new groundwater takes from the Aupouri aquifer subzones: Houhora, Motutangi and Waiharara

Right Of Reply Evidence of

Jon Williamson

for the Motutangi-Waiharara Water User Group

Dated: 4 May 2018

Contents

1. Introduction

1. This document comprises a brief right of reply covering:

   (a) the Department of Conservation's evidence by four witnesses: Mr Jacob Williams (Planning), Ms Shona Myers (Wetland ecology), Mr Tim Baker (Groundwater) and Mr James Blyth (Wetland hydrology), which I received partway through the week prior to the hearing; and

   (b) Comments on the following aspects of the Groundwater Monitoring and Contingency Plan (GMCP):

      (i) An estimation of infrastructure and ongoing costs of implementation;

      (ii) Disagreement with the need for pesticide and some of the shallow groundwater monitoring suites; and

      (iii) DOC's submission on the GMCP with respect to i) baseline conditions; ii) alert levels; iii) monitoring bores in the wetland; and iv) priority for reductions.

2. Response to Department of Conservation Evidence

2.1. Summary of Disagreements with DOC Evidence

2. The evidence provided by experts for the Department of Conservation maintained a generic line of reasoning based on the technical understanding of Mr Baker and Mr Blyth that in my opinion was inaccurate because the evidence was lacking situational, temporal and spatial context. For example, the experts for DOC:

(a) talk extensively about the high natural values of the wetland but make no mention of the fact that not all parts of the wetland are highly valued for conservation or scientific purposes. This is important given the location of the orchards, and because the area of largest predicted drawdown is outside of the wetland areas that have high natural and scientific values;

(b) argue that iron pan is not pervasive in the wetland area, yet existence of the wetland in this geological terrain (sand tombolo) is dependent on iron pan or low permeability base – without which, water would drain vertically into the underlying sand aquifer and the wetland would not exist. The Commissioners heard from longterm local drain layer Mr Wagener, who confirmed form his 40 years' experience that iron pan is found everywhere in the area;

(c) argue that drawdowns of between 0.2 m and 0.6 m are relatively significant in terms of wetland systems, however this argument lacks situational context given that:

(i) DOC's own monitoring data shows natural seasonal oscillation of up to 0.65 m from just last year (which was not a remarkable drought year);

(ii) the predicted drawdown was from a conservative model scenario (leaky aquifer) at the end of the driest season in the 60-year historical climate simulation (i.e. not a permanent reduction);

(iii) the predicted maximum impact in the Scientific Reserve and Conservation Areas is less than 0.2 m in all area and for the majority of the area less than 0.1 m; and

(iv) calculations of drawdown in an aquifer overstate the drawdown in an overlying standing water body due to consideration of aquifer effective porosity (i.e. if a 0.5 m drawdown was calculated in an aquifer with an effective porosity or specific yield of 10%, the actual change in water level in a directly connected standing water body would be 0.05 m).

(d) argue that radon concentrations measured indicate strong potential for groundwater contribution into the wetland, but when the samples are placed in spatial context, the fact of the matter is that samples taken outside the wetland have concentrations exceeding 0.5 BqL^{-1} (the indicator level of some degree of groundwater contribution), whereas those taken from within or at the point of exit from the wetland all returned radon concentrations <0.5 BqL^{-1}.

3. The DOC experts seek “conclusiveness”, which I take means to eliminate any uncertainty before considering granting or exercising of the consent. In my opinion this is an unrealistic expectation because there is always going to be an element of uncertainty. The question is whether (given the information available) the uncertainty is acceptable in light of:

(a) the implications or magnitude of any manifestation from that uncertainty; and

(b) any conditions or mitigations provided.

2.2. Evidence of Ms Myers

4. In the main Ms Myers relies on the hydrological evidence of Mr Baker and Mr Blyth to form her conclusions regarding the impact on wetland hydrology (paragraph 10), which in my opinion renders her evidence not particularly useful to the Commissioners for the reasons set out in my response to Mr Baker and Mr Blyth’s evidence.

5. In paragraphs 39 and 44 Ms Myers makes the statement that the AEE and staff reports relies on an assumption that “the wetland is not connected, that the iron pan layer is continuous”. While this assumption is partly correct – i.e. the wetland is not directly connected in practice or in the field – the analysis I provided (as pointed out at length in my main evidence and again in **Section 2.1** above), was initially premised on the wetland and deep shellbed aquifer being connected via a leaky aquifer.

6. The impacts on the wetland Ms Myers quotes in paragraph 38 are from this “leaky aquifer” scenario. The impacts from the disconnected aquifer scenarios are significantly less than Ms Myers quotes (i.e. <0.2 m).

7. Ms Myers and the other experts talk extensively about the high natural values of the wetland but make no mention that not all parts of the wetland are highly valued for conservation or scientific purposes. For example, the western part of the wetland, which is adjacent to the proposed takes on Norton Road and the largest predicted drawdown (albeit <0.6 m), have in the past (i.e. turn of the century c.1905) been subjected to hand-dug peat extraction operations, and numerous historic drainage lines are still present within this area, as can be seen on Google Earth. Additional mining operations were operational across parts of the site

in the 1980's and there is still a Crown Mining License 35156 for the extraction and processing of peat soils from these areas.

8. **Figure 3** provides a map generated in part from data provided in Ms Myers evidence, which delineates Public Conservation Land and Scientific Reserve (blue shading), from mined peat areas (red shading) that are adjacent to the takes at Norton Road.

9. In conclusion, it is important to consider any potential impacts on the wetland from the proposed abstractions in relation to the specific conservation or scientific value attached to the area, rather than generically as a whole.

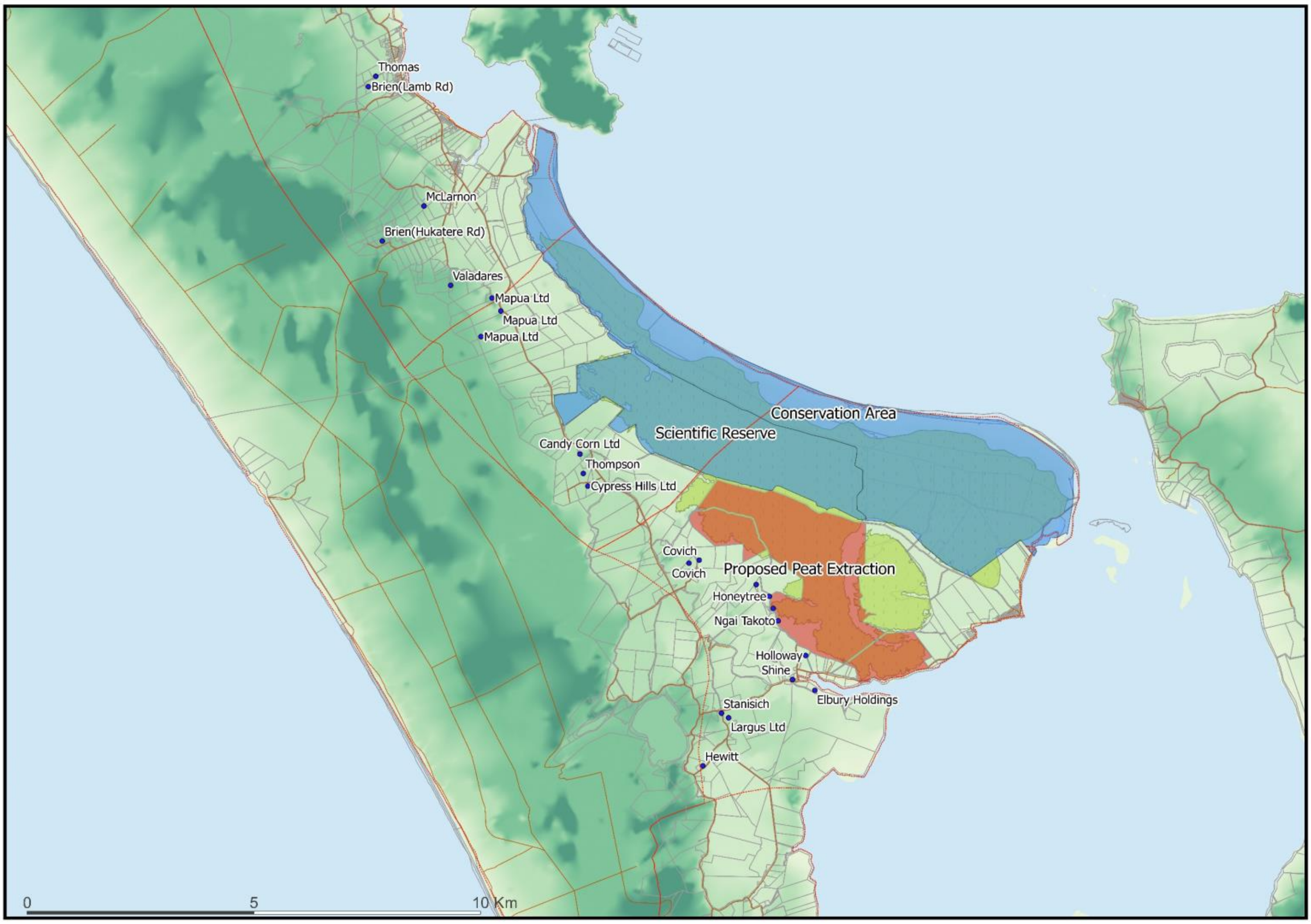

Figure 1. Map showing sub-divisions within the Kaimaumau Wetland.

2.3. Evidence of Mr Baker

Iron Pan

10. Mr Bakers key arguments against the applications is that there is a lack of drill hole investigations in the wetland and therefore no firm evidence to define the level of connectivity the wetland has with the underlying aquifer (paragraphs 11 and 19).

11. The lack of boreholes in the wetland is acknowledged, but this limitation does not change the fact that the presence of the wetland in sand country is because the wetland water cannot drain effectively. The wetlands' presence and maintenance are supported by low permeability confining layers, including iron pan.

12. We need to remember that:

    (a) peat accumulation has occurred in sand dune swales over a long period of time (c. 30,000 years);

    (b) the sand dune system is and has been dynamic over this time, and there are multiple layers of peat and ironpans (as seen in numerous borelogs to the west of the current wetland);

    (c) peat has a significantly lower permeability than sand;

    (d) iron pan has a significantly lower permeability than sand (acknowledged by Mr Baker in paragraph 27 of his evidence);

    (e) iron pan has occurred as a result of redox state changes due to a lack of oxygen beneath the peat (acknowledged by Mr Baker in paragraph 27 of his evidence); and

    (f) flow within the wetland is lateral because vertical flow is restricted (acknowledged by Mr Baker in paragraph 30 of his evidence).

13. In paragraph 29 Mr Baker states "Unfortunately, the spatial extent and continuity of the pan has not been investigated or constrained by way of mapping." However, I contend that the "mapping" is the footprint of the wetlands that remain themselves. These wetlands would not be in existence without low permeability substrate, whether that be compacted peat at the base of the wetland, iron pan or silts. These low permeability sediments are seen in coastal exposure along Kaimaumau Road and in the vast majority of the borelogs in the shallow aquifer (except perhaps those bores in the younger sands on the eastern seaboard) typically to depths of around 45 m below ground level.

14. Furthermore, it came to my attention as late as 23 April 2018, that the NRC granted resource consent to Resin and Wax Holdings Ltd on 29 March (the day after this hearing adjourned) for commercial kauri resin and wax extraction from the area of the Kaimaumau wetland adjacent to Norton Road. The consent allows for advance dewatering and complete removal of peat to depths anticipated up to 6 m.

15. With respect to the spatial extent and continuity of the iron pan, it is interesting to note the following from the NRC's Section 113 RMA decision report:

    (a) This wetland area has formed due to the presence of a sandstone hardpan which prevents the movement of water into underlying sandstone material (2nd paragraph page 5);

    (b) The applicants built the case that NRC obviously agreed with (in granting of the consent) that the sand ridges are impervious and provide horizontal containment of water flows. "The applicant is not proposing to disturb the integrity of any sand ridges and has agreed to a condition to this effect. Therefore, the natural delineation of distinct surface water catchments will be preserved" (page 6).

16. The inference from this decision, is that a) the iron pan is pervasive; and (b) any shallow groundwater impact outside of the wetland area is unlikely to propagate horizontally through the wetland because of the presence of impervious sand ridges, which must be maintained by the mining consent.

Magnitude and Extent of Drawdown

17. Mr Baker states in paragraph 36 that drawdowns of between 0.2 m and 0.6 m are relatively significant in terms of wetland systems. I do not agree with this fully as I think the comment lacks context (as discussed below), but I would agree that drawdowns greater than 0.5 m over and above seasonal oscillation can be significant for wetland plants.

18. As alluded to above, it is important to place my model predictions in context:

    (a) the situational context is that as shown in the hydrographs in Figure 3 and 4 of Mr Blyth's evidence and the report by Hicks, et. al. (2001), the wetland plants seem to be adapted to reasonably significant (for wetland plants) seasonal oscillations, which were recorded by Mr Blyth at between 0.3-0.65 m over just the last year;

    (b) the predicted drawdown contour values were a temporal maximum reached at a single point in time at the end of the direst season in the 60-year historical climate simulation (i.e. not a permanent reduction);

(c) the simulation for the worst-case scenario assumed that the shallow aquifer and deep aquifer were connected (i.e. a leaky aquifer scenario with no contiguous iron pan), which we know is not the case;

(d) the predicted 0.6 m aquifer drawdown contour in the shallow aquifer was constrained to the western margin of the wetland/scrub, which is:

   (i) outside the Scientific Reserve and Conservation Area; and

   (ii) now understood to be subject of a recently granted peat mining consent.

(e) the maximum predicted aquifer drawdown within Scientific Reserve and Conservation Area is actually less than 0.2 m as shown in **Figure 3**, which is an update of Figure 3a of my EIC and Figure 30 of the Modelling Report showing additional contour lines for 0.1 and 0.05 m.

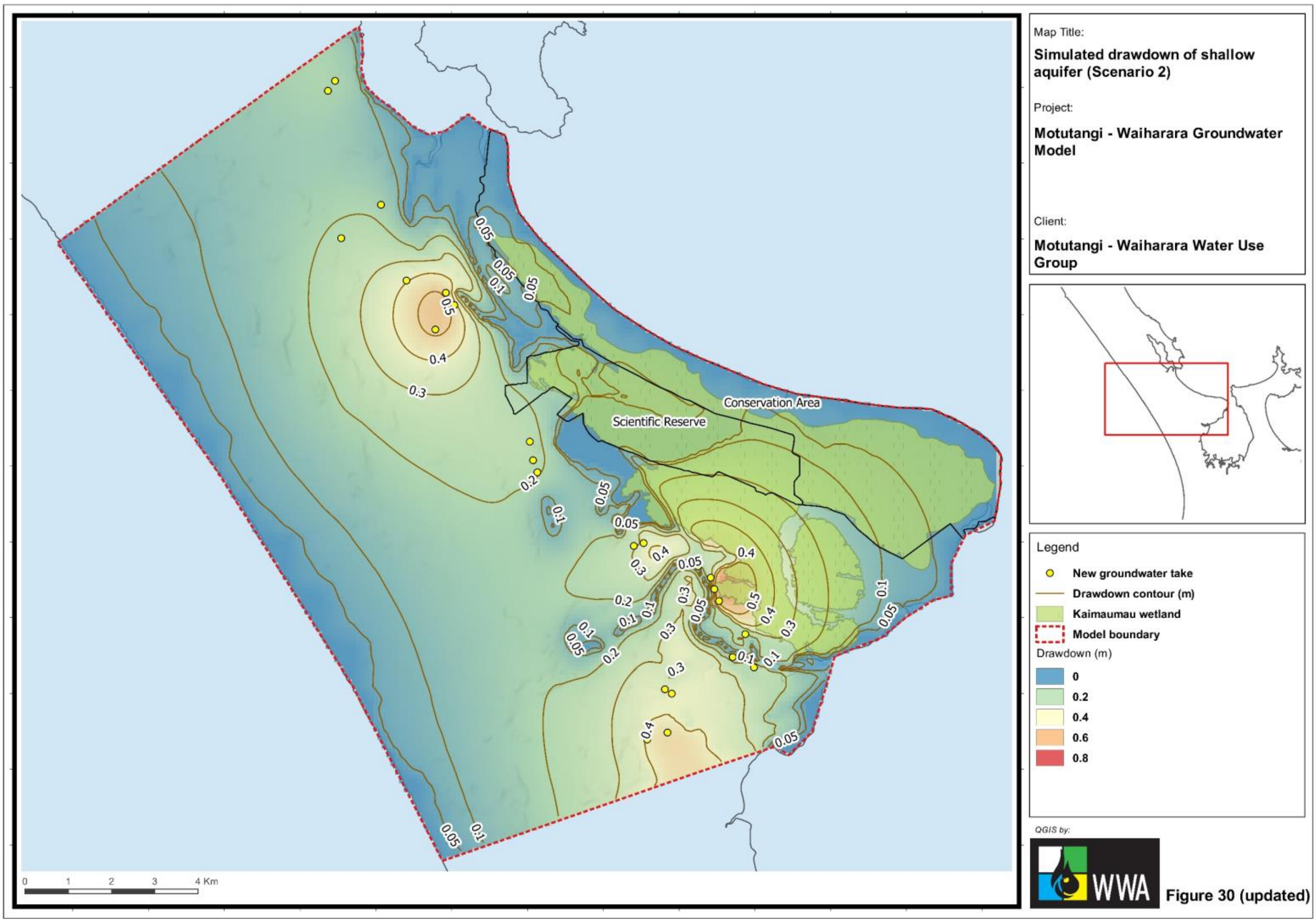

Figure 2. Drawdown in the shallow aquifer assuming leaky conditions at end of worst drought in 60-year historical record (updated Figure 30 from Modelling Report).

19. Furthermore, Mr Baker agreed with Commissioner Callander during the Hearing that if the maximum drawdown in the aquifer was 0.2 m, the change in a standing water level (i.e. water sitting at the surface of the wetland) would be an order of magnitude less (i.e. 0.02 m) due to the effect of porosity.

Water Level Control For Model Calibration

20. Paragraph 40 of Mr Bakers evidence says "There are no water level records in or around the Kaimaumau wetland, nor even in the southern half of the model domain". While, I acknowledge we have <u>better</u> data in the north, it is not correct to infer we had no water level data in the southern half of the model domain, as we used two of the NRC's long-term monitoring bores (Ogle Drive and Paparore) that are outside the model domain to the south to check the calibration in the southern part of the model, and we also used spot data from applicants' bores in Norton Road adjacent to the western boundary of the wetland. Furthermore, as discussed with the Commissioners on the first day at the hearing, the modelled heads in the wetland are near the ground surface. The point being, we can use the topographic surface data as groundwater level control in the wetland area.

Radon Analysis

21. Mr Baker provides commentary on the radon analysis undertaken and in paragraph 56 states that "the results actually indicate strong potential for groundwater contribution into the drains and/or surface channels of the wetland...". In paragraph 55 Mr Baker states "the Salles Stream samples indicate a groundwater contribution between the Salles Drain and the Salles Downstream sites, and both the Seymour Drain and Selwyn Drain also indicate groundwater contribution".

22. My concern with these statements is that they are too general and lack site-specific or spatial context with respect to the results obtained at each sampling location, which is important when interpreting the data. For example, the sampling undertaken in the streams/drains mentioned in Mr Baker's paragraph 55 (i.e. Salles Drain and Salles Downstream sites) are located outside the wetland, and the higher concentrations are due to inputs from the shallow aquifer either in the form of deep cut drains (Salles and Seymour Drain) and seepage from the base of the western sand dunes (Selwyn Drain). Samples taken from within or at the point of exit from the wetland all returned radon concentrations <0.5 BqL^{-1}[1], which is the indicator of some degree of groundwater contribution.

23. To reiterate our findings with this spatial context, copied below are relevant paragraphs from Section 2.3.1 of the Groundwater Modelling Report:

[1] Becquerels per litre.

The Rn concentration in the groundwater sample collected from the shellbed aquifer in the Stanisich cow shed bore (6.3 BqL^{-1}) is significantly higher than the concentration in the surface water samples, which range between 0.1 BqL^{-1} and 2.6 BqL^{-1}, with a median value of 0.85 BqL^{-1}.

The sample collected at the Pirini Stream, which drains the southeast of Kaimaumau wetland, has a Rn concentration that is very low (close to the detection limit – 0.1 BqL^{-1}) indicating no interaction with groundwater at this location. Similarly, the Salles upstream and middle sampling sites, which drain from the southwestern side of the Kaimaumau swamp both have low values at 0.2 and 0.1 BqL-1 respectively, indicating it is unlikely the water coming from the swamp has a significant groundwater component. However, it is interesting to note that the drain appears to be picking up some shallow groundwater flow as it moves downstream into lower-lying areas towards the coast.

It would appear that the drains that cross farmland in the west of the Motutangi area and flow towards the northern end of the Kaimaumau wetland, particularly Selwyn and Seymour drains, potentially show some influence of groundwater given as their values are around 1 BqL^{-1}, which is consistent with anecdotal information from the locals, who indicated that the area is perennially wet and receives groundwater seepage from the base of the sand dunes.

Similarly, Okohine drain in the southwest, which drains low-lying farmland also appears to show a small amount of groundwater input given its Rn concentration of 1.7 BqL^{-1}.

In summary, the analysis shows that the deeper groundwater has a significantly different Rn signature than the surface water. Given the Rn information and the anecdotal and hydrogeological knowledge of the iron pans and other small confining layers, it is unlikely that the deep shellbed aquifer has a strong hydrological connection with the surface drains and wetlands.

2.4. Evidence of Mr Blyth

24. In paragraph 14 and again in paragraph 43 Mr Blyth passes comments consistent with paragraph 29 of Mr Baker's evidence, in reference to iron pan - that "its continuity has not been confirmed with field-based measurements". In response, I reiterate that iron pan is prevalent at varying depth and thicknesses across the eastern side of the peninsula, and the wetlands that remain would not be in existence without low permeability substrate such as compacted peat, iron pan and silts (as discussed in **paragraph 13** above).

25. Paragraph 38 of Mr Blyth's evidence states his opinion that "it is not appropriate to assess the degree of hydrological alternation as "low" based on the information the applicant has provided". With reference to this, I would like to reiterate that various scenarios were

simulated with the model, some of which were conservative with respect to wetland impacts (Scenario 2 – leaky aquifer) and to bore interference effects (Scenario 4 – lower degrees of leakiness). Under all scenarios the degree of impact on the wetland was no more than minor, even the most conservative scenario where the model is configured with no iron pan, which as discussed *ad nauseam* is not actually the case.

26. In paragraph 47 Mr Blyth suggests based on his "evidence presented above that is appears the wetland maybe connected to groundwater". However, there is no evidence supporting this. There is a statement in paragraph 30 that suggests two possibilities for the standing water over the wetland, being i) storage capacity of the wetland to hold rainfall, and ii) an additional source of water (groundwater). Mr Blyth then acknowledges that the additional source of water is "yet to be characterised by scientific studies", so paragraph 47 cannot be considered evidence of this.

27. In my opinion, the presence of standing water in this part of the wetland is purely due to the difference in topographic elevation. **Figure 3** clearly shows that topographic elevation is lower than surrounding wetland in the area of interest (marked with a cross) and further to the southeast of the area of interest.

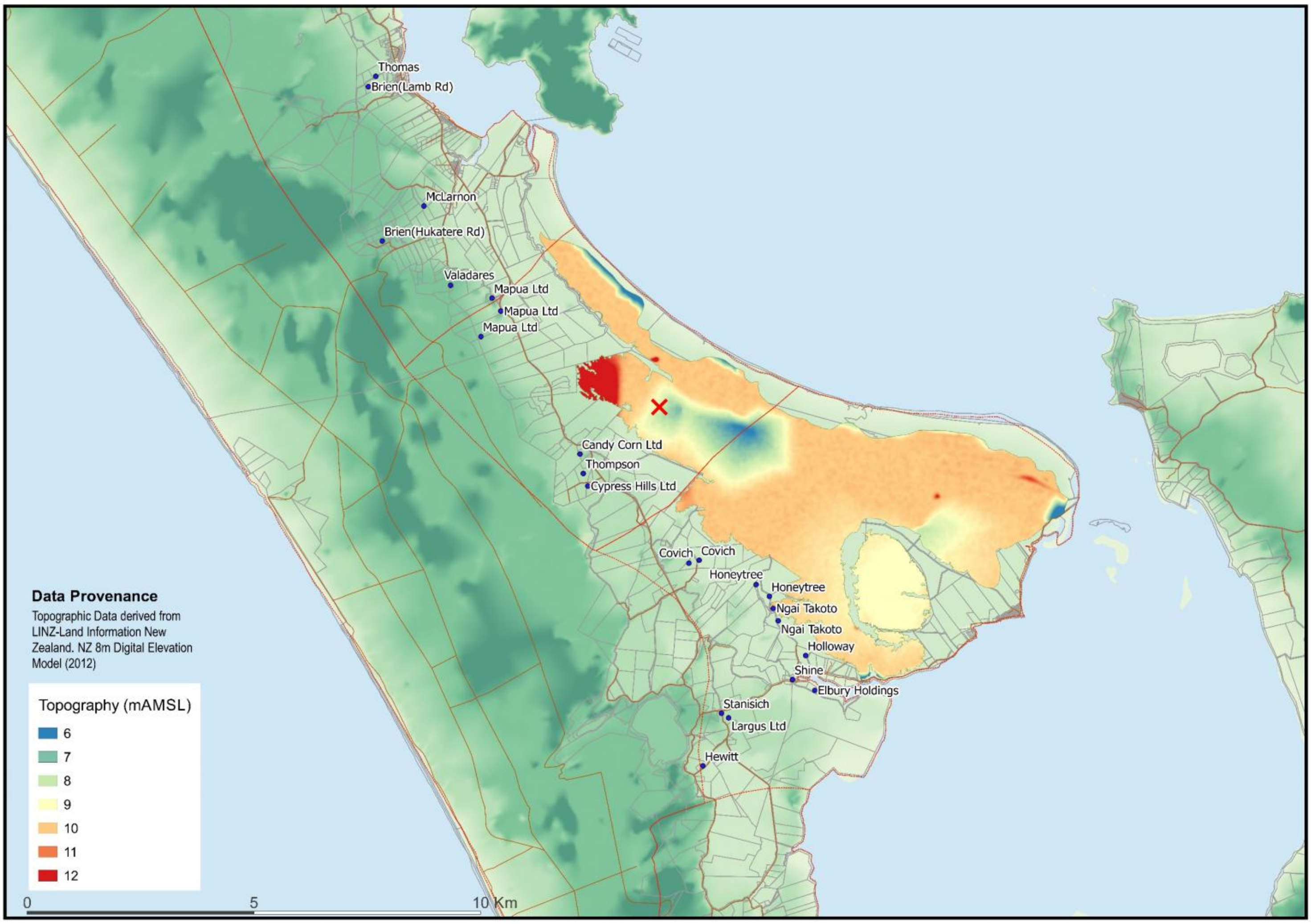

Figure 3. Map showing topographic elevation model within the Kaimaumau Wetland from LINZ 8 m DEM.

28. Furthermore, from my MSc Thesis in the Kopouatai Peat Bog in the Waikato[2], standing water over wide areas of a wetland (i.e. away from peripheral drains) is a common feature following prolonged rain due to i) high storage capacity of the peat; ii) low drainage characteristics (both horizontal and vertical), and iii) low topography.

29. Given that both the two radon samples WWA acquired from drains taking water from the wetland massif (Salles upstream and Pirini) had very low radon concentrations and significantly less than the 0.5 BqL^{-1} trigger for groundwater impact, the standing water in the wetland is more likely due to the high storage capacity and low drainage characteristics of the peat itself, rather than groundwater inputs.

[2] • Williamson JL (1995). Evaporation, Energy and Water Balance Studies from the Kopouatai Peat Dome, North Island, New Zealand. Unpublished MSc Thesis, University of Waikato.

2.5. Evidence of Mr Williams

30. Mr Williams states (para 10) "In my view the consent application does not adequately consider the importance of the Kaimaumau Wetland". The applicants are acutely aware of the importance of the Kaimaumau wetland. In fact, one of the applicants, the Iwi of NgaiTakoto who own the surrounding lands, have a conservation strategy for the wider area (which also involves partnering with DOC) to ensure that enhancement of the environment (Lands) and sustainability goals of the resource (Water) are achieved. Given the understanding of the wetland's importance, my team adapted the following tasks and approaches to ensure any impacts on the wetland would be sustainable:

    (a) The drain and stream survey using radon isotopes to determine the percentage of deep groundwater in the water courses that drain into and from the wetland. This study indicated a lack of deep groundwater in the surface water courses in and around the wetland;

    (b) The developmental approach of the modelling exercise was premised on the fact that if there was any significant impact on the wetland, gaining consent would be unlikely. Hence, we developed the model in the first instance (or set of scenarios) as a leaky aquifer to consider the worst case from a wetland impact perspective. The leaky aquifer scenario indicated that effects in the wetland would be no more than minor.

31. Mr Williams in paragraphs 16 and 20 uses the word "conclusive" in the context that the applicant has not conclusively demonstrated or shown that there will be no more than minor effects on the Kaimaumau wetland. However, in nature and science nothing is conclusive – take climate change for example. Conclusively is a nirvana that can be aimed for but is impossible to fully achieve given the complex interplays governing and dynamics of natural systems. RMA decision makers must deal with this residual uncertainty and make a balanced decision on the basis of probability, considering the evidence put to them and mitigation measures proposed.

32. My opinion remains unchanged that the likely impacts are no more than minor, and while the residual uncertainty is also low, the conditions of consent and in particular the groundwater monitoring and contingency plan (GMCP) provides a robust tool to monitor and mitigate (make less severe and/or reduce to acceptable levels) any effects greater than those predicted in the Modelling Report and AEE.

3. Groundwater Monitoring and Contingency Plan

3.1. Estimated Capital and Operational Costs

33. The Commissioners asked for an estimate of the capital and operational costs of the GMCP, which I have provided in **Table 1** for year 1 only. It is anticipated that in the first-year costs will be approximately $90,000-$100,000 (+GST) allowing some contingency. In the second-year costs will likely be around $35,000 (+GST).

Table 1. Estimated cost breakdown for implementation of GMCP in year 1.

		No	Rate	Cost	Sub-Total	Notes
1	**Bore Drilling & Piezo Construction**				**56,500**	
1.1	Bore drilling permit	1	500	500		
1.2	Shallow Piezo (8 m with 3 m screen)	2	3,000	6,000		
1.3	Deep Piezo (90 m) with 9 m screen)	2	14,000	28,000		
1.4	Pressure & EC sensors	6	2,000	12,000		
1.5	Consultant - Organising, Management & Install	1	10,000	10,000		
2	**Year 1 Costs**				**34,000**	
2.1	Saline Intrusion (Quarterly)					
	Round 1 - Lab fees (Na, Cl, TSS)	8	150	1,200		8 bores
	Round 1 - Technician fees	10	100	1,000		1-day
	Round 2 - Lab fees (Na, Cl, TSS)	8	150	1,200		8 bores
	Round 2 - Technician fees	10	100	1,000		1-day
	Round 3 - Lab fees (Na, Cl, TSS)	8	150	1,200		8 bores
	Round 3 - Technician fees	10	100	1,000		1-day
	Round 4 - Lab fees (Na, Cl, TSS)	8	150	1,200		8 bores
	Round 4 - Technician fees	10	100	1,000		1-day
2.2	Water Quality (Bi-Annual)					
	Round 1 - Lab fees (nutrients & pesticide suites)	3	450	1,350		3 bores
	Round 1 - Technician fees	0	0	0		time covered in SI sampling
	Round 2 - Lab fees (nutrients & pesticide suites)	3	450	1,350		3 bores
	Round 2 - Technician fees	0	0	0		time covered in SI sampling
2.3	Groundwater Level					
	Production bores	0	0	0		Responsibility of each property
	Shallow groundwater	0	0	0		Data downloaded as part of the water quality sampling
2.4	Data Processing & Analysis					
	Consultant	80	125	10,000		
2.5	Environmental Monitoring Report					
	Consultant	60	125	7,500		
2.6	Setting of Trigger Levels					
	Consultant	40	125	5,000		
	TOTAL				**90,500**	

34. The approximate cost split per applicant in the first year on an annual volume prorate basis is shown in **Table 2**.

Table 2. Approximate cost split per applicant.

	Applicant	Vol (m^3/yr)	Cost ($)
	Total	*2,317,254*	*$100,000*
1	Mapua Avocados Limited	745,000	$32,150
2	Honeytree Farms Limited	380,000	$16,399
3	Covich	223,500	$9,645
4	Largus Orchard Partnership Ltd	193,700	$8,359
5	Candy Corn Ltd	80,000	$3,452
6	Elbury Holdings Limited	113,700	$4,907
7	Shine	50,184	$2,166
8	Stanisich	64,070	$2,765
9	Thompson	36,000	$1,554
10	Hewitt	40,000	$1,726
11	Cypress Hills Ltd	36,000	$1,554
12	McLarnon	24,000	$1,036
13	Valadares	48,000	$2,071
14	Huanui Avocados Ltd	14,900	$643
15	Brien (Lamb Road)	14,900	$643
16	Te Runanga o Ngai Takoto	193,700	$8,359
17	Thomas (Lamb Road)	59,600	$2,572

3.2. Disagreement with Monitoring Suites

Nutrients and Pesticide Monitoring

35. I am strongly opposed to water quality monitoring for nutrients and pesticides (as mentioned in the draft GMCP) because:

(a) from a planning perspective as covered by Ms Letica in her Supplementary Evidence, pesticide and nutrient use is a permitted activity under the proposed Regional Plan for Northland (pRPN) and hence considered part of the permitted activity environmental baseline;

(b) from a practical perspective, the presence of organic matter is likely to substantially reduce nitrogen and decrease the mobility of any pesticide compounds prone to leaching (noting not all pesticides are soluble), which means if anything was to be detected monitoring would need to occur on each individual property. The draft GMCP does not propose monitoring in close proximity to every orchard, which infers the current proposal would unlikely meet the intent for this particular aspect. Furthermore, given the very low level of risk with regard to pesticides and nutrients, monitoring at each orchard location in my opinion would be too onerous and impractical.

Shallow Aquifer / Wetland Monitoring

36. I consider that the amount of shallow aquifer monitoring proposed for the protection of the wetland is bordering on being inconsistent with the: a) magnitude of effect, and b) location of effect given the distance from the production bores to the Scientific Reserve and Conservation Area. Hence, I am opposed to additional monitoring as proposed by DOC for the purpose of wetland water level monitoring.

37. The magnitude of the maximum aquifer drawdown effect in the Scientific Reserve and Conservation Area ranges from <0.05 to 0.2 m, which in the context of natural oscillation and influences of land drainage (up to 4 m adjacent to drains) is insignificant. Mr Hughes seems to share this view, where he states in Section 3.2.1 on page 6 of his letter dated 26 March 2018, "Due to the range of factors that may potentially impact on wetland condition (e.g. climate variability, land drainage, peat mining etc) it is suggested that wetland monitoring may be difficult to interpret in the context of anticipated environmental effects associated with the proposed abstraction (unless the magnitude of drawdown is significantly greater than anticipated)".

38. Given the location of the production bores and sentinel piezometers in relation to the wetland (see map in GMCP), any adverse effects would be identified in the monitoring piezometers before any discernible effect was to be experienced at the wetland.

3.3. Disagreement with DOC's GMCP Comments

39. In the DOC's comments on the draft GMCP a number of points were made, which are responded to below where significant disagreement resides.

Baseline Monitoring

40. DOC make the following recommendations in regard to baseline monitoring:

(a) that together with baseline water level monitoring there should be a programme of wetland vegetation condition monitoring established in the wetland;

(b) baseline ecological monitoring should be undertaken for at least 1 year prior to any abstraction;

(c) aerial photo monitoring of wetland to assess any changes in dominance of native vegetation and invasion by dryland exotic species;

(d) calculate a water balance of the wetland including a baseline water balance assessment that comprises flow gaugings, and additional radon surveys;

(e) there should be piezometers located within the wetland to measure water levels within the wetland – to gather baseline data as well as to measure adverse effects;

(f) a baseline of data (water levels and ecology) needs to be collected for the wetland – ideally this should be for at least 5 years (at minimum at least one year prior to abstraction).

41. The notion that five years of baseline data is required before any abstraction occurs is too onerous in the context that:

(a) there are other existing consents operating that equate to approximately 11,810 m^3/day;

(b) some of the orchards in the MWWUG are already existing; and

(c) the proposed adaptive management approach, in particular the staged implementation, will give adequate time over the period of 12-15 months to collect data on the basis of environmental conditions with limited abstraction by MWWUG consents.

42. A requirement for all this additional work (i.e. monitoring of at least three shallow piezometers in the wetland, vegetation surveys, aerial surveys, further stream flow and radon surveys, and water budget calculations) in my opinion is too onerous and inconsistent with:

(a) the scale of potential impact within the wetland areas of high scientific and conservation value (<0.05 to 0.2 m); and

(b) the fact that current water level oscillations in the wetland are typically three to twelve times greater than the maximum likely impact.

Alert Levels

43. DOC make two comments regarding alert levels, with both comments suggesting that if the annual average water level reduces by 0.1 m, a management response needs to be implemented.

44. I disagree with an alert level of 0.1 m as DOC's own monitoring from 2017 and that presented in the Hicks et. al. (2001) report show water levels receded across a number of sites by up to 0.65 m and 1.0 m, respectively. The monitoring plan has defined a suitably robust two-tiered trigger level approach that will provide adequate early warning of impacts in the shallow aquifer adjacent to the wetland. The inference being that alerts would be triggered in the

piezometers before manifesting in the wetland, given the piezometers are situated closer to the production bores.

Monitoring Bores in the Wetland

45. DOC comment that there is currently no provision for monitoring bores within the wetland, particularly in the zone of large standing water identified through the DOC statement of evidence. They recommend the addition of a minimum of 3 shallow monitoring piezometers located in/adjacent to areas of standing water within the wetland complex.

46. I am in disagreement with this because as inferred above, the proposed shallow aquifer monitoring in the draft GMCP will provide the data required to determine any effect in the wetland, given that alerts would be triggered in the piezometers before effects materialise in the wetland, due to the location of the piezometers being between the wetland and the production bores.

Priority for Reductions

47. DOC comment that Mapua, Covich and Honeytree collectively makeup 57% of the entire MWWUG groundwater abstraction. These are ranked as Priority 2 takes (only 25% reduction). However, these are also located close to the wetland and are likely to have a greater impact than bores with smaller takes.

48. The draft GMCP prioritises orchards for reduction in pumping based on their proximity to an area of wetland (defined by the sentinel monitoring bore). The priority has been developed with experienced judgement based on distance and likely impact of pumping in a particular area. For example, Honeytree Farms is Priority 1 if alerts where to occur in the Norton Road/Kaimaumau Road area but is Priority 2 for Motutangi and Houhora (Waterfront) sentinel piezometers.

J.L. Williamson

4 May 2018